

Appendix A

Comments and Responses

A.1 Public Comments and Responses

Table A-1. Topics and Associated Codes.

[Comments received and the associated responses on the Draft Watershed Project Plan will be included in the Final Watershed Project Plan]

Table A-2. Responses to Comments Received During the Public Comment Period for Powder Valley Water Control District Watershed Plan-EA

[Comments received and the associated responses on the Draft Watershed Project Plan will be included in the Final Watershed Project Plan]

A.2 Correspondence to Support Required Consultation



Oregon
Tina Kotek, Governor

Parks and Recreation Department

Oregon Heritage/
State Historic Preservation Office
725 Summer St. NE, Suite C
Salem, OR 97301-1266
(503) 986-0690
Fax (503) 986-0793
oregonheritage.org



January 7, 2026

Ms. Rachel Gebauer
USDA-NRCS
1945 Main St. Ste 200
Klamath Falls, OR 97601

RE: SHPO Case No. 23-0892
NRCS Powder Valley Water Control District PL566 Canal Infrastructure Project
PL566 Canal Infrastructure
Not provided, Baker Union County

Dear Rachel Gebauer:

Thank you for submitting information for the undertaking referenced above. We concur with the determination that the cultural resources identified are not eligible for listing in the National Register of Historic Places. We concur that there will be no historic properties affected for this undertaking.

Our office has assigned the report SHPO biblio number 36422. Details will be available in the bibliographic database.

This concludes consultation with our office under Section 106 of the National Historic Preservation Act (per 36 CFR Part 800) and/or Oregon Revised State (ORS) 358.653. If you have not already done so, be sure to consult with all appropriate Native American tribes and interested parties regarding the proposed undertaking.

If the undertaking design or effect changes or if additional historic properties are identified, further consultation with our office will be necessary before proceeding with the proposed undertaking. Additional consultation regarding this case must be sent through Go Digital. In order to help us track the undertaking accurately, reference the SHPO case number above in all correspondence.

Please contact our office if you have any questions, comments or need additional assistance.

Sincerely,

Robert T. Olguin

Robert Olguin
Review and Compliance, Historian
(503) 602-2468
Robert.Olguin@opr.oregon.gov



State Historic Preservation Office
Oregon Parks and Recreation Department
Heritage Conservation Division
725 Summer St NE, Suite C
Salem, OR 97301

December 10, 2025

Subject: Cultural Resources Assessment for the Powder Valley Water Control District, SHPO Case No. 23-0892

Dear Jamie and Robert,

The Powder Valley Water Control District (PVWCD) is proposing an irrigation infrastructure modernization project (the project) through the Natural Resources Conservation Service's (NRCS) Watershed Protection and Flood Prevention Program, Public Law 83-566 (PL 83-566). NRCS is serving as the lead federal agency for the project under PL 83-566. As the lead federal agency, NRCS is responsible for compliance with the requirements of Section 106 of the National Historic Preservation Act (NHPA).

Consultation for this project was initiated with the Oregon State Historic Preservation Office on June 8, 2023 by Michael Petrozza for the Natural Resources Conservation Service. This letter accompanies the combined archaeological and built resources survey report including the **Determinations of Eligibility** for the Carnes Ditch, the Lone Pine Ditch and the Maharry Blevins Ditch and NRCS's **Findings of Effect** for the project.

The Powder Valley Water Control District (PVWCD) is proposing an irrigation infrastructure modernization project (the project) through the Natural Resources Conservation Service's (NRCS) Watershed Protection and Flood Prevention Program, Public Law 83-566 (PL 83-566). NRCS is serving as the lead federal agency for the project under PL 83-566. As the lead federal agency, NRCS is responsible for compliance with the requirements of Section 106 of the National Historic Preservation Act (NHPA).

Project activities include:

- piping 2.1 miles of an existing open segment of Ellis Ditch and installing a new 1.3-mile segment of the C-1 pipeline
- installation of a pressure reducing vault to hold two pressure reducing valves to depressurize the C-1 pipeline before the C-1 pipeline intersects the Lone Pine Ditch
- installation of a junction vault and trash rack to connect the C-1 pipeline with the Lone Pine Ditch outfall
- retirement of Lower Lone Pine Ditch (3.4 miles) and Maharry Blevins Ditch (1.6 miles), which would remain open
- retirement and filling of approximately 0.5 mile of the Redger Ditch; installation of fish screening and fish passage improvements at the Carnes Diversion adjacent to the confluence of North Fork Anthony Creek and Anthony Creek
- piping of Carnes Ditch from the Carnes Diversion to the Pilcher Creek Filling Channel (approximately 3.2 miles). Following construction, a dirt road approximately 10 feet wide would be maintained along the current ditch alignment, atop the buried pipeline, for District maintenance access.

Natural Resources Conservation Service
USDA is an equal opportunity provider, employer, and lender.

In 2024, Parametrix conducted an archaeological and built environment survey of the APE. Parametrix identified no archaeological resources and three historic built environment resources in the APE: the Carnes Ditch, Lone Pine Ditch, and Maharry Blevins Ditch.

The Carnes Ditch is not located in an existing historic district. In addition, other resources within the vicinity of the property do not sufficiently represent a significant concentration, linkage, or continuity of buildings or structures unified historically or aesthetically by plan or physical development to constitute the presence of a historic district. As such, the Carnes Ditch is recommended not eligible for listing in the NRHP as a contributor to a historic district under Criteria A, B, C, or D. Although the Carnes Ditch does retain the integrity of setting, it does not retain integrity of location, design, materials, workmanship, feeling, or association.

The Lone Pine Ditch is not located in an existing historic district. In addition, resources within the vicinity of the property do not sufficiently represent a significant concentration, linkage, or continuity of buildings or structures unified historically or aesthetically by plan or physical development to constitute the presence of a historic district. As such, the Lone Pine Ditch is recommended not eligible for listing in the NRHP as a contributor to a historic district under Criteria A, B, C, or D. The Lone Pine Ditch does not retain integrity of location, setting, design, materials, workmanship, feeling, or association.

The Maharry Blevins Ditch is not located in an existing historic district. In addition, resources within the vicinity of the property do not sufficiently represent a significant concentration, linkage, or continuity of buildings or structures unified historically or aesthetically by plan or physical development to constitute the presence of a historic district. As such, the Maharry Blevins Ditch is recommended not eligible for listing in the NRHP as a contributor to a historic district under Criteria A, B, C, or D. The Maharry Blevins Ditch does not retain integrity of location, setting, design, materials, workmanship, feeling, or association.

Parametrix recommends all three of these resources identified in the APE as **not eligible for individual listing** in the NRHP, and also **not eligible for listing in the NRHP as contributing resources** to a potential PVWCD historic district. As such, Parametrix recommends a finding of **no historic properties affected** for the project, pursuant to 36 CFR 800.5. The USDA-NRCS has reviewed and agrees with the evaluation of the project under the evaluation of historic significance and determination of eligibility at 36CFR 800.4 (c)(1)(2). NRCS does not recommend any of the identified ditches for listing, individually or as contributing resources to the NRHP. NRCS finds that the project will result in **no historic properties affected** (36CFR 800.4(d)(1).

Attached you will find the final survey report for built environment and archaeological resources, *Cultural Resources Assessment for the Powder Valley Water Control District Infrastructure Modernization Project, Union County, Oregon*. If you have any questions, please let me know and I will be happy to address them.

Sincerely,

Rachel LS Gebauer

Rachel Smith Gebauer, M.A., RPA
NRCS Oregon State Cultural Resources Specialist

cc. Gary Diridoni, NRCS ASTC for Watershed Resources

Natural Resources Conservation Service
USDA is an equal opportunity provider, employer, and lender.



Kirsten Lopez
Confederated Tribes of the Umatilla Indian Reservation
46411 Timine Way
Pendleton, OR 97801

December 16, 2025

Subject: Cultural Resources Assessment for the Powder Valley Water Control District

Dear Kirsten,

The **Powder Valley Water Control District (PVWCD)** is proposing an **irrigation infrastructure modernization project** (the project) through the Natural Resources Conservation Service's (NRCS) Watershed Protection and Flood Prevention Program, Public Law 83-566 (PL 83-566).

Consultation for this project was initiated with CTUIR on June 8, 2023 by Michael Petrozza for the Natural Resources Conservation Service. **This follow-up letter accompanies the combined archaeological and built resources survey report for your review.**

Project activities include:

1. Piping 2.1 miles of an existing open segment of **Ellis Ditch** and installing a new 1.3-mile segment of the C-1 pipeline;
2. Installation of a pressure reducing vault to hold two pressure reducing valves to depressurize the C-1 pipeline before the C-1 pipeline intersects the **Lone Pine Ditch**;
3. Installation of a junction vault and trash rack to connect the C-1 pipeline with the Lone Pine Ditch outfall. Retirement of Lower Lone Pine Ditch (3.4 miles) and **Maharry Blevins Ditch** (1.6 miles), which would remain open;
4. Retirement and filling of approximately 0.5 mile of the **Redger Ditch**;
5. **Installation of fish screening and fish passage improvements** at the Carnes Diversion adjacent to the confluence of North Fork Anthony Creek and Anthony Creek;
6. **Piping of Carnes Ditch** from the Carnes Diversion to the Pilcher Creek Filling Channel (approximately 3.2 miles), and following construction, **a dirt road approximately 10 feet wide** would be maintained along the current ditch alignment, atop the buried pipeline, for District maintenance access.

In 2024, Parametrix conducted an archaeological and built environment survey of the APE. Parametrix identified no archaeological resources and three historic built environment resources in the APE: the **Carnes Ditch, Lone Pine Ditch, and Maharry Blevins Ditch**. Parametrix recommends all three of these resources identified in the APE as **not eligible for individual listing in the NRHP**, and also not eligible for listing in the NRHP as contributing resources to a potential PVWCD historic district. As such, **Parametrix recommends a finding of no historic properties affected** for the project, pursuant to 36 CFR 800.5.

Attached you will find the final survey report, with maps, for built environment and archaeological resources,

Natural Resources Conservation Service
USDA is an equal opportunity provider, employer, and

Cultural Resources Assessment for the Powder Valley Water Control District Infrastructure Modernization Project, Union County, Oregon.

If you have any questions, additional information to share, or specific concerns about the proposed project or the area of potential effect, please contact me and I will be happy to address them.

Sincerely,

Rachel LS Gebauer

Rachel Smith Gebauer, M.A., RPA
NRCS Oregon State Cultural Resources Specialist

cc. Gary Diridoni, NRCS ASTC for Watershed Resources

Natural Resources Conservation Service
USDA is an equal opportunity provider, employer, and



Keith Baird, THPO
Nez Perce Tribe
P.O. Box 365
Lapwai, ID 83540

December 16, 2025

Subject: Cultural Resources Assessment for the Powder Valley Water Control District

Dear Mr. Baird,

The **Powder Valley Water Control District (PVWCD)** is proposing an **irrigation infrastructure modernization project** (the project) through the Natural Resources Conservation Service's (NRCS) Watershed Protection and Flood Prevention Program, Public Law 83-566 (PL 83-566).

Consultation for this project was initiated with the Nez Perce Tribe on June 8, 2023 by Michael Petrozza for the Natural Resources Conservation Service. **This follow-up letter accompanies the combined archaeological and built resources survey report for your review.**

Project activities include:

1. Piping 2.1 miles of an existing open segment of **Ellis Ditch** and installing a new 1.3-mile segment of the C-1 pipeline;
2. Installation of a pressure reducing vault to hold two pressure reducing valves to depressurize the C-1 pipeline before the C-1 pipeline intersects the **Lone Pine Ditch**;
3. Installation of a junction vault and trash rack to connect the C-1 pipeline with the Lone Pine Ditch outfall. Retirement of Lower Lone Pine Ditch (3.4 miles) and **Maharry Blevins Ditch** (1.6 miles), which would remain open;
4. Retirement and filling of approximately 0.5 mile of the **Redger Ditch**;
5. **Installation of fish screening and fish passage improvements** at the Carnes Diversion adjacent to the confluence of North Fork Anthony Creek and Anthony Creek;
6. **Piping of Carnes Ditch** from the Carnes Diversion to the Pilcher Creek Filling Channel (approximately 3.2 miles), and following construction, **a dirt road approximately 10 feet wide** would be maintained along the current ditch alignment, atop the buried pipeline, for District maintenance access.

In 2024, Parametrix conducted an archaeological and built environment survey of the APE. Parametrix identified no archaeological resources and three historic built environment resources in the APE: the **Carnes Ditch, Lone Pine Ditch, and Maharry Blevins Ditch**. Parametrix recommends all three of these resources identified in the APE as **not eligible for individual listing in the NRHP**, and also not eligible for listing in the NRHP as contributing resources to a potential PVWCD historic district. As such, **Parametrix recommends a finding of no historic properties affected** for the project, pursuant to 36 CFR 800.5.

Attached you will find the final survey report, with maps, for built environment and archaeological resources,

Natural Resources Conservation Service
USDA is an equal opportunity provider, employer, and

Cultural Resources Assessment for the Powder Valley Water Control District Infrastructure Modernization Project, Union County, Oregon.

If you have any questions, additional information to share, or specific concerns about the proposed project or the area of potential effect, please contact me and I will be happy to address them.

Sincerely,

Rachel LS Gebauer

Rachel Smith Gebauer, M.A., RPA
NRCS Oregon State Cultural Resources Specialist

cc. Gary Diridoni, NRCS ASTC for Watershed Resources

Natural Resources Conservation Service
USDA is an equal opportunity provider, employer, and



R & C Team
Burns Paiute Tribe
100 Pasigo Street
Burns, OR 97720

December 16, 2025

Subject: Cultural Resources Assessment for the Powder Valley Water Control District

Dear Reviewer,

The **Powder Valley Water Control District (PVWCD)** is proposing an **irrigation infrastructure modernization project** (the project) through the Natural Resources Conservation Service's (NRCS) Watershed Protection and Flood Prevention Program, Public Law 83-566 (PL 83-566).

Consultation for this project was initiated with the Burns Paiute Tribe on June 8, 2023 by Michael Petrozza for the Natural Resources Conservation Service. **This follow-up letter accompanies the combined archaeological and built resources survey report for your review.**

Project activities include:

1. Piping 2.1 miles of an existing open segment of **Ellis Ditch** and installing a new 1.3-mile segment of the C-1 pipeline;
2. Installation of a pressure reducing vault to hold two pressure reducing valves to depressurize the C-1 pipeline before the C-1 pipeline intersects the **Lone Pine Ditch**;
3. Installation of a junction vault and trash rack to connect the C-1 pipeline with the Lone Pine Ditch outfall. Retirement of Lower Lone Pine Ditch (3.4 miles) and **Maharry Blevins Ditch** (1.6 miles), which would remain open;
4. Retirement and filling of approximately 0.5 mile of the **Redger Ditch**;
5. **Installation of fish screening and fish passage improvements** at the Carnes Diversion adjacent to the confluence of North Fork Anthony Creek and Anthony Creek;
6. **Piping of Carnes Ditch** from the Carnes Diversion to the Pilcher Creek Filling Channel (approximately 3.2 miles), and following construction, a **dirt road approximately 10 feet wide** would be maintained along the current ditch alignment, atop the buried pipeline, for District maintenance access.

In 2024, Parametrix conducted an archaeological and built environment survey of the APE. Parametrix identified no archaeological resources and three historic built environment resources in the APE: the **Carnes Ditch, Lone Pine Ditch, and Maharry Blevins Ditch**. Parametrix recommends all three of these resources identified in the APE as **not eligible for individual listing in the NRHP**, and also not eligible for listing in the NRHP as contributing resources to a potential PVWCD historic district. As such, **Parametrix recommends a finding of no historic properties affected** for the project, pursuant to 36 CFR 800.5.

Attached you will find the final survey report, with maps, for built environment and archaeological resources,

Natural Resources Conservation Service
USDA is an equal opportunity provider, employer, and

Cultural Resources Assessment for the Powder Valley Water Control District Infrastructure Modernization Project, Union County, Oregon.

If you have any questions, additional information to share, or specific concerns about the proposed project or the area of potential effect, please contact me and I will be happy to address them.

Sincerely,

Rachel LS Gebauer

Rachel Smith Gebauer, M.A., RPA
NRCS Oregon State Cultural Resources Specialist

cc. Gary Diridoni, NRCS ASTC for Watershed Resources

Natural Resources Conservation Service
USDA is an equal opportunity provider, employer, and



Lawrence Squiemphen, THPO
Confederated Tribes of the Warm Springs Reservation of Oregon
1233 Veterans Way, PO Box C
Warm Springs, OR 97761

December 16, 2025

Subject: Cultural Resources Assessment for the Powder Valley Water Control District

Dear Mr. Squiemphen,

The **Powder Valley Water Control District (PVWCD)** is proposing an **irrigation infrastructure modernization project** (the project) through the Natural Resources Conservation Service's (NRCS) Watershed Protection and Flood Prevention Program, Public Law 83-566 (PL 83-566).

Consultation for this project was initiated with CTWSRO on June 8, 2023 by Michael Petrozza for the Natural Resources Conservation Service. **This follow-up letter accompanies the combined archaeological and built resources survey report for your review.**

Project activities include:

1. Piping 2.1 miles of an existing open segment of **Ellis Ditch** and installing a new 1.3-mile segment of the C-1 pipeline;
2. Installation of a pressure reducing vault to hold two pressure reducing valves to depressurize the C-1 pipeline before the C-1 pipeline intersects the **Lone Pine Ditch**;
3. Installation of a junction vault and trash rack to connect the C-1 pipeline with the Lone Pine Ditch outfall. Retirement of Lower Lone Pine Ditch (3.4 miles) and **Maharry Blevins Ditch** (1.6 miles), which would remain open;
4. Retirement and filling of approximately 0.5 mile of the **Redger Ditch**;
5. **Installation of fish screening and fish passage improvements** at the Carnes Diversion adjacent to the confluence of North Fork Anthony Creek and Anthony Creek;
6. **Piping of Carnes Ditch** from the Carnes Diversion to the Pilcher Creek Filling Channel (approximately 3.2 miles), and following construction, **a dirt road approximately 10 feet wide** would be maintained along the current ditch alignment, atop the buried pipeline, for District maintenance access.

In 2024, Parametrix conducted an archaeological and built environment survey of the APE. Parametrix identified no archaeological resources and three historic built environment resources in the APE: the **Carnes Ditch, Lone Pine Ditch, and Maharry Blevins Ditch**. Parametrix recommends all three of these resources identified in the APE as **not eligible for individual listing in the NRHP**, and also not eligible for listing in the NRHP as contributing resources to a potential PVWCD historic district. As such, **Parametrix recommends a finding of no historic properties affected** for the project, pursuant to 36 CFR 800.5.

Attached you will find the final survey report, with maps, for built environment and archaeological resources,

Natural Resources Conservation Service
USDA is an equal opportunity provider, employer, and

Cultural Resources Assessment for the Powder Valley Water Control District Infrastructure Modernization Project, Union County, Oregon.

If you have any questions, additional information to share, or specific concerns about the proposed project or the area of potential effect, please contact me and I will be happy to address them.

Sincerely,

Rachel LS Gebauer

Rachel Smith Gebauer, M.A., RPA
NRCS Oregon State Cultural Resources Specialist

cc. Gary Diridoni, NRCS ASTC for Watershed Resources

Natural Resources Conservation Service
USDA is an equal opportunity provider, employer, and



June 26, 2025

Shane DeForest,
Bureau of Land Management, Vale District Manager
100 Oregon St,
Vale, OR 97918

Jeremy Aujero
Forest Service, District Ranger Wallowa-Whitman National Forest
1550 Dewey Avenue
Suite A
Baker City, OR 97814

RE: Request for Lead Agency Status on the Watershed Plan-Environmental Assessment for Powder Valley Water Control District Modernization Project

Dear Jeremy and Shane,

In accordance with the National Historic Preservation Act (NHPA) regulations for Section 106 at 36CFR §800.2(a)(2), the Natural Resources Conservation Service is formally requesting that your agency designate NRCS as the Lead Federal Agency in the development of the Watershed Plan-EA for the Powder Valley Water Control District (PVWCD) Modernization Project. This request is being made because your agency has land management authority over lands which PVWCD maintains their water delivery ditches and canal infrastructure.

Powder Valley WCD is seeking federal funds to address necessary upgrades to the district through the Natural Resources Conservation Service's (NRCS) Watershed Protection and Flood Prevention Program (Public Law (PL) 83-566), as well as technical assistance from NRCS. An authorized Watershed Plan-Environmental Assessment (Plan-EA) is required. NRCS and PVWCD are developing the Plan-EA with assistance from Farmers Conservation Alliance (FCA). After the plan is authorized, PVWCD will seek implementation funding through PL83-566 to modernize parts of PVWCD's infrastructure identified in the plan.

As your agency may have NHPA and NEPA compliance responsibilities concerning this project, the Plan-EA should also assist in fulfilling these requirements with the intent of reducing duplication and delay between agencies.

We are requesting confirmation from you that NRCS will take Lead Agency for the Powder Valley Water Control District's Modernization Project.

Natural Resources Conservation Service
1201 NE Lloyd Blvd., Suite 900
Portland, OR 97232

USDA is an equal opportunity provider, employer, and lender.

Sincerely,

GARY
DIRIDONI

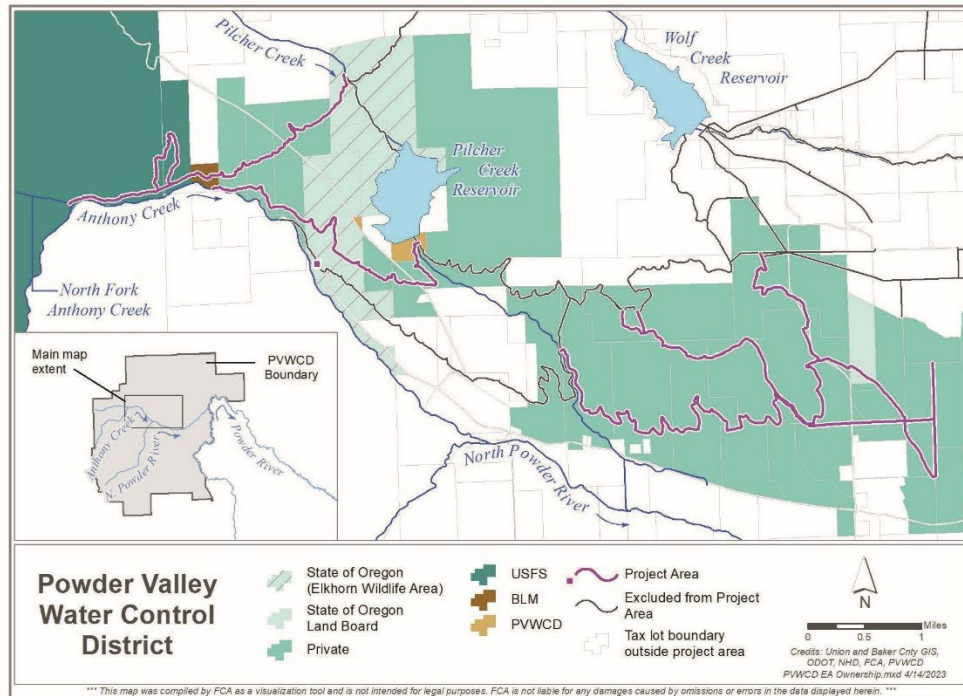
Digitally signed by
GARY DIRIDONI
Date: 2025.06.26
14:24:44 -07'00'

Gary Diridoni
NRCS Assistant State Conservationist Water Resources and Planning
1201 NE Lloyd Blvd
Suite 901
Portland, OR 97232

Cc:
Jacob Arnzen, BLM Vale District Archaeologist
Kate Fent, WWNF Special Use Program Manager
Rachel Gebauer, NRCS OR State Cultural Resources Specialist

Natural Resources Conservation Service
1201 NE Lloyd Blvd., Suite 900
Portland, OR 97232

USDA is an equal opportunity provider, employer, and lender.



The APE maps were sent with all of the Section 106 invitation letters, but are included below only once to limit pages.



Natural
Resources
Conservation
Service

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

08 JUNE 2023

SHPO Compliance
State Historic Preservation Office
725 Summer Street, NE, Suite C
Salem, Oregon 97301-1226

Subject: Initiate the §106 Process, Powder Valley Water Control District

In accordance with 36 CFR §800.3(c), The United States Department of Agriculture's Natural Resources Conservation Service (USDA-NRCS) is formally initiating the §106 consultation process for the Powder Valley Water Control District (PVWCD). USDA-NRCS is cooperating with PVWCD, on an infrastructure improvement effort in accordance with The Watershed Protection and Flood Prevention Act of 1954 (PL-566) by providing financial and technical assistance.

Under the proposed plan, modernization of PVWCD's water delivery infrastructure would occur in two project groups over the course of 3 years. Construction would occur during the non-irrigation season (October to April) and could begin as early as fall 2024 (Figure 1). The proposed Carnes Pipeline project would convert 3.9 miles of open Carnes Ditch to closed pipeline (Figures 2 and 3). The pipeline would include 788 feet of new alignment where a siphon would be installed at a crossing beneath Dutch Creek. A pump and 0.7 miles of pipe would be installed in the segment of Upper Coughanour Ditch closest to the Pilcher Creek Reservoir outlet. The Upper Coughanour Ditch and Carnes Ditch would be retired (3.9 miles total), and the Coughanour Diversion on Anthony Creek would be removed. Fish passage improvements and fish screening would also be installed at the Carnes Diversion. Implementation of the C-1 pipeline project would install 3.4 miles of pipeline (Figures 4 and 5). The project would include piping 2.1 miles of the Ellis Ditch and an additional 1.3 miles that would follow a new alignment. The Lower Lone Pine and Maharry Blevins ditches would be retired and remain open (9.6 miles). An additional 0.3 miles of the Redger Ditch would be retired and filled.

PL-566 watershed projects introduce locally led solutions to natural and human resource problems in watersheds up to 250,000 acres (less than 400 square miles). Projects can include flood prevention and damage reduction, development of rural water supply sources, erosion and sediment control, fish and wildlife habitat enhancement, wetland creation and restoration, and increased recreational opportunities.

We are currently in the NEPA scoping phase of this project and invite you to submit your written comments. The details provided here are subject to change as we receive feedback from project scoping, engineering, and design. As the proposed project progresses, we will update you with project specifics including maps, details of work, and consult on the Area of Potential Effect (APE).

USDA is an equal opportunity provider, employer, and lender.

Sincerely,

Michael Petrozza

Michael Petrozza, M.A. **RPA**
USDA-NRCS Oregon State Cultural Resources Specialist
(503) 414-3212
Michael.Petrozza@usda.gov

cc: Amy Hendershot, USDA-NRCS Oregon State Resource Conservationist
Gary Diridoni, USDA-NRCS Oregon Watershed Conservationist

USDA is an equal opportunity provider, employer, and lender.

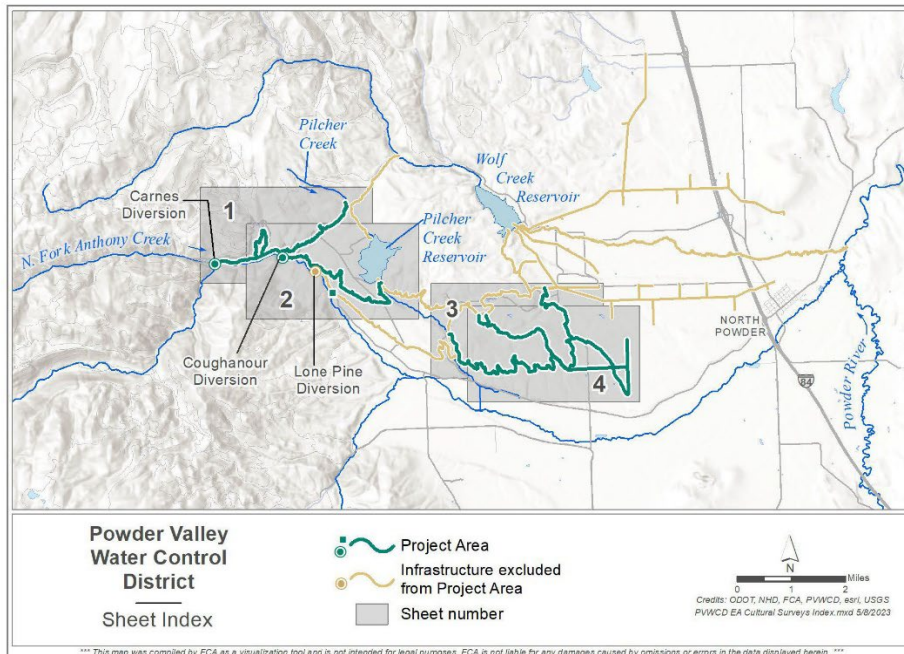


Figure 1. Complete Project Proposal Overview

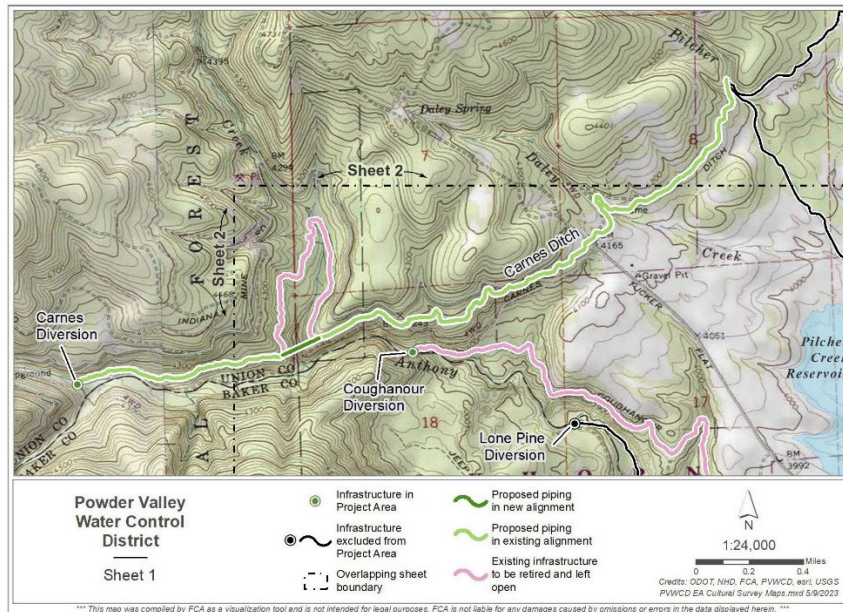


Figure 2. Carnes Project APE

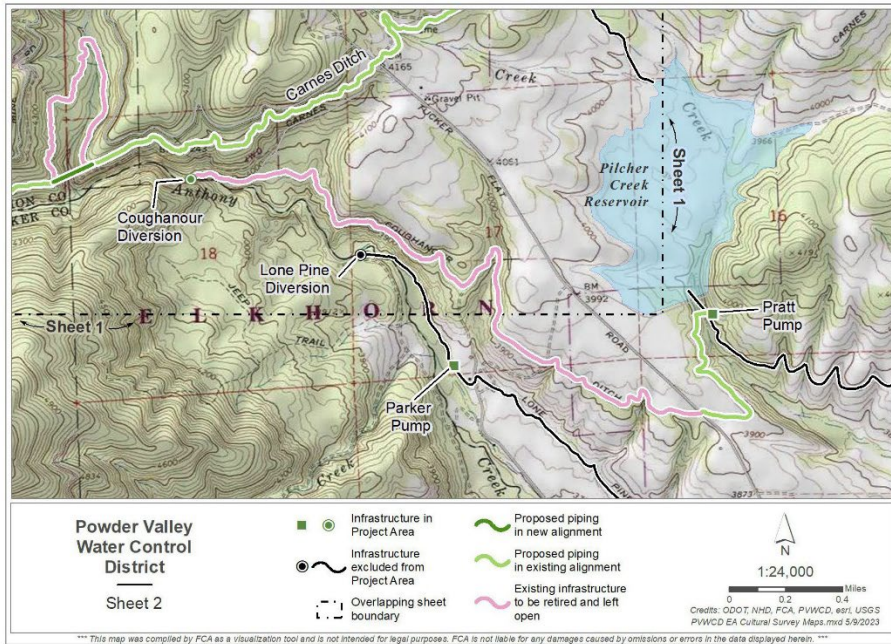


Figure 3. Carnes Project APE cont.

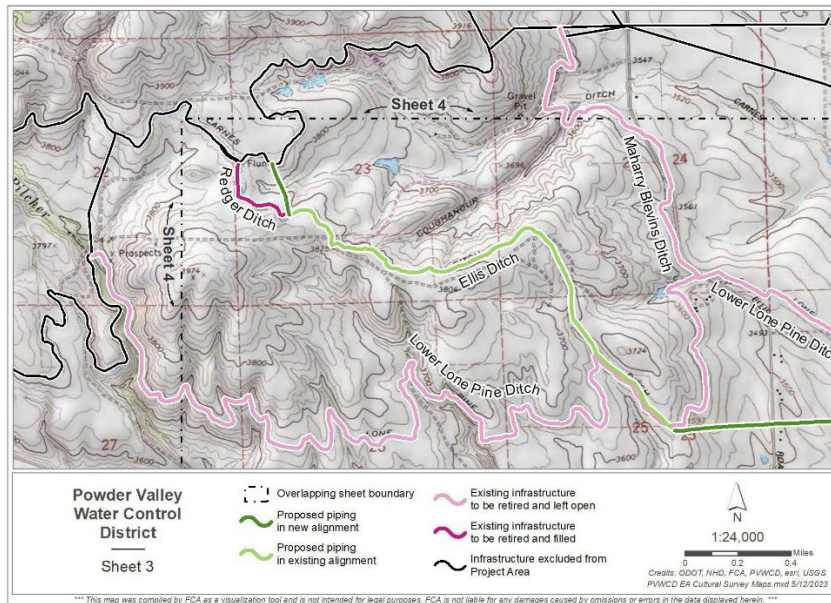


Figure 4. C-1 Project APE

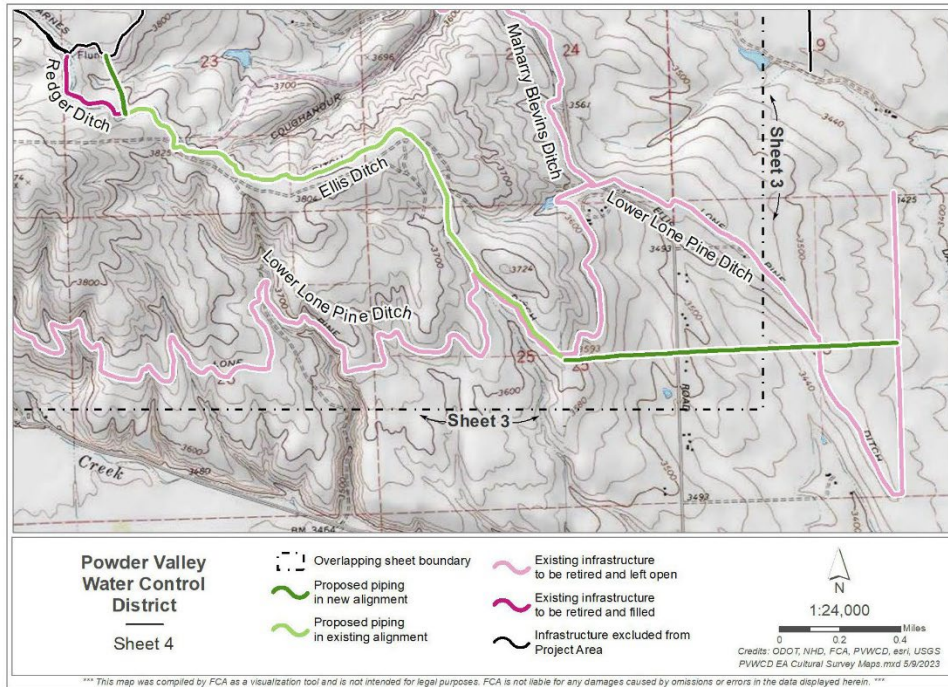
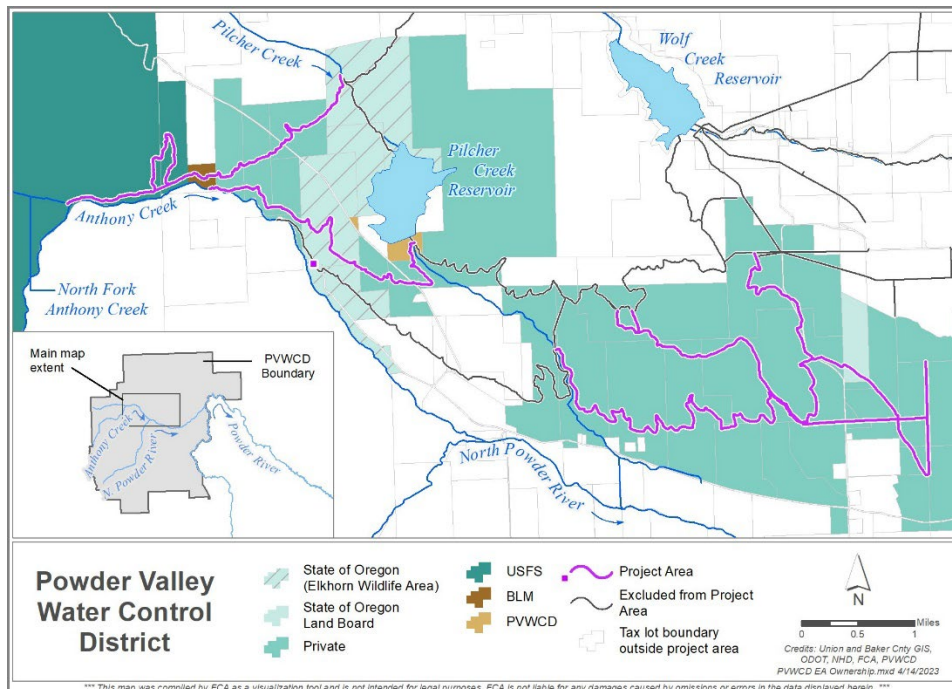


Figure 5. C-1 Project APE cont.





08 JUNE 2023

Natural
Resources
Conservation
Service

Confederated Tribes of the Colville Reservation
21 Colville Street
Nespelem, WA 99155

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

Subject: Invitation to the §106 Process, Powder Valley Water Control District

In accordance with 36 CFR §800.3(c), The United States Department of Agriculture’s Natural Resources Conservation Service (USDA-NRCS) is formally inviting you to participate in the §106 consultation process for the Powder Valley Water Control District (PVWCD). USDA-NRCS is cooperating with PVWCD, on an infrastructure improvement effort in accordance with The Watershed Protection and Flood Prevention Act of 1954 (PL-566) by providing financial and technical assistance.

Under the proposed plan, modernization of PVWCD’s water delivery infrastructure would occur in two project groups over the course of 3 years. Construction would occur during the non-irrigation season (October to April) and could begin as early as fall 2024 (Figure 1). The proposed Carnes Pipeline project would convert 3.9 miles of open Carnes Ditch to closed pipeline (Figures 2 and 3). The pipeline would include 788 feet of new alignment where a siphon would be installed at a crossing beneath Dutch Creek. A pump and 0.7 miles of pipe would be installed in the segment of Upper Coughanour Ditch closest to the Pilcher Creek Reservoir outlet. The Upper Coughanour Ditch and Carnes Ditch would be retired (3.9 miles total), and the Coughanour Diversion on Anthony Creek would be removed. Fish passage improvements and fish screening would also be installed at the Carnes Diversion. Implementation of the C-1 pipeline project would install 3.4 miles of pipeline (Figures 4 and 5). The project would include piping 2.1 miles of the Ellis Ditch and an additional 1.3 miles that would follow a new alignment. The Lower Lone Pine and Maharry Blevins ditches would be retired and remain open (9.6 miles). An additional 0.3 miles of the Redger Ditch would be retired and filled.

PL-566 watershed projects introduce locally led solutions to natural and human resource problems in watersheds up to 250,000 acres (less than 400 square miles). Projects can include flood prevention and damage reduction, development of rural water supply sources, erosion and sediment control, fish and wildlife habitat enhancement, wetland creation and restoration, and increased recreational opportunities.

We are currently in the NEPA scoping phase of this project and invite you to submit your written comments. The details provided here are subject to change as we receive feedback from project scoping, engineering, and design. As the proposed project progresses, we will update you with project specifics including maps, details of work, and consult on the Area of Potential Effect (APE).

USDA is an equal opportunity provider, employer, and lender.

Sincerely,

Michael Petrozza

Michael Petrozza, M.A. **RPA**
USDA-NRCS Oregon State Cultural Resources Specialist
(503) 414-3212
Michael.Petrozza@usda.gov

cc: Amy Hendershot, USDA-NRCS Oregon State Resource Conservationist
Gary Diridoni, USDA-NRCS Oregon Watershed Conservationist

USDA is an equal opportunity provider, employer, and lender.



08 JUNE 2023

Natural
Resources
Conservation
Service

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

Confederated Tribes of the Warm Springs Reservation of Oregon
1233 Veterans Way
P.O. Box C
Warm Springs, OR 97761

Subject: Invitation to the §106 Process, Powder Valley Water Control District

In accordance with 36 CFR §800.3(c), The United States Department of Agriculture's Natural Resources Conservation Service (USDA-NRCS) is formally inviting you to participate in the §106 consultation process for the Powder Valley Water Control District (PVWCD). USDA-NRCS is cooperating with PVWCD, on an infrastructure improvement effort in accordance with The Watershed Protection and Flood Prevention Act of 1954 (PL-566) by providing financial and technical assistance.

Under the proposed plan, modernization of PVWCD's water delivery infrastructure would occur in two project groups over the course of 3 years. Construction would occur during the non-irrigation season (October to April) and could begin as early as fall 2024 (Figure 1). The proposed Carnes Pipeline project would convert 3.9 miles of open Carnes Ditch to closed pipeline (Figures 2 and 3). The pipeline would include 788 feet of new alignment where a siphon would be installed at a crossing beneath Dutch Creek. A pump and 0.7 miles of pipe would be installed in the segment of Upper Coughanour Ditch closest to the Pilcher Creek Reservoir outlet. The Upper Coughanour Ditch and Carnes Ditch would be retired (3.9 miles total), and the Coughanour Diversion on Anthony Creek would be removed. Fish passage improvements and fish screening would also be installed at the Carnes Diversion. Implementation of the C-1 pipeline project would install 3.4 miles of pipeline (Figures 4 and 5). The project would include piping 2.1 miles of the Ellis Ditch and an additional 1.3 miles that would follow a new alignment. The Lower Lone Pine and Maharry Blevins ditches would be retired and remain open (9.6 miles). An additional 0.3 miles of the Redger Ditch would be retired and filled.

PL-566 watershed projects introduce locally led solutions to natural and human resource problems in watersheds up to 250,000 acres (less than 400 square miles). Projects can include flood prevention and damage reduction, development of rural water supply sources, erosion and sediment control, fish and wildlife habitat enhancement, wetland creation and restoration, and increased recreational opportunities.

We are currently in the NEPA scoping phase of this project and invite you to submit your written comments. The details provided here are subject to change as we receive feedback from project scoping, engineering, and design. As the proposed project progresses, we will update you with project specifics including maps, details of work, and consult on the Area of Potential Effect (APE).

USDA is an equal opportunity provider, employer, and lender.

Sincerely,

Michael Petrozza

Michael Petrozza, M.A. **RPA**
USDA-NRCS Oregon State Cultural Resources Specialist
(503) 414-3212
Michael.Petrozza@usda.gov

cc: Amy Hendershot, USDA-NRCS Oregon State Resource Conservationist
Gary Diridoni, USDA-NRCS Oregon Watershed Conservationist

USDA is an equal opportunity provider, employer, and lender.



United States Department of Agriculture

Natural
Resources
Conservation
Service

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

08 JUNE 2023

Nez Perce Tribe
P.O. Box 365
Lapwai, ID 83540

Subject: Invitation to the §106 Process, Powder Valley Water Control District

In accordance with 36 CFR §800.3(c), The United States Department of Agriculture's Natural Resources Conservation Service (USDA-NRCS) is formally inviting you to participate in the §106 consultation process for the Powder Valley Water Control District (PVWCD). USDA-NRCS is cooperating with PVWCD, on an infrastructure improvement effort in accordance with The Watershed Protection and Flood Prevention Act of 1954 (PL-566) by providing financial and technical assistance.

Under the proposed plan, modernization of PVWCD's water delivery infrastructure would occur in two project groups over the course of 3 years. Construction would occur during the non-irrigation season (October to April) and could begin as early as fall 2024 (Figure 1). The proposed Carnes Pipeline project would convert 3.9 miles of open Carnes Ditch to closed pipeline (Figures 2 and 3). The pipeline would include 788 feet of new alignment where a siphon would be installed at a crossing beneath Dutch Creek. A pump and 0.7 miles of pipe would be installed in the segment of Upper Coughanour Ditch closest to the Pilcher Creek Reservoir outlet. The Upper Coughanour Ditch and Carnes Ditch would be retired (3.9 miles total), and the Coughanour Diversion on Anthony Creek would be removed. Fish passage improvements and fish screening would also be installed at the Carnes Diversion. Implementation of the C-1 pipeline project would install 3.4 miles of pipeline (Figures 4 and 5). The project would include piping 2.1 miles of the Ellis Ditch and an additional 1.3 miles that would follow a new alignment. The Lower Lone Pine and Maharry Blevins ditches would be retired and remain open (9.6 miles). An additional 0.3 miles of the Redger Ditch would be retired and filled.

PL-566 watershed projects introduce locally led solutions to natural and human resource problems in watersheds up to 250,000 acres (less than 400 square miles). Projects can include flood prevention and damage reduction, development of rural water supply sources, erosion and sediment control, fish and wildlife habitat enhancement, wetland creation and restoration, and increased recreational opportunities.

We are currently in the NEPA scoping phase of this project and invite you to submit your written comments. The details provided here are subject to change as we receive feedback from project scoping, engineering, and design. As the proposed project progresses, we will update you with project specifics including maps, details of work, and consult on the Area of Potential Effect (APE).

USDA is an equal opportunity provider, employer, and lender.

Sincerely,

Michael Petrozza

Michael Petrozza, M.A. **RPA**
USDA-NRCS Oregon State Cultural Resources Specialist
(503) 414-3212
Michael.Petrozza@usda.gov

cc: Amy Hendershot, USDA-NRCS Oregon State Resource Conservationist
Gary Diridoni, USDA-NRCS Oregon Watershed Conservationist

USDA is an equal opportunity provider, employer, and lender.



United States Department of Agriculture

08 JUNE 2023

Natural
Resources
Conservation
Service

Confederated Tribes of the Umatilla Indian Reservation
46411 Ti'mine Way
Pendleton, OR 97801

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

Subject: Invitation to the §106 Process, Powder Valley Water Control District

In accordance with 36 CFR §800.3(c), The United States Department of Agriculture's Natural Resources Conservation Service (USDA-NRCS) is formally inviting you to participate in the §106 consultation process for the Powder Valley Water Control District (PVWCD). USDA-NRCS is cooperating with PVWCD, on an infrastructure improvement effort in accordance with The Watershed Protection and Flood Prevention Act of 1954 (PL-566) by providing financial and technical assistance.

Under the proposed plan, modernization of PVWCD's water delivery infrastructure would occur in two project groups over the course of 3 years. Construction would occur during the non-irrigation season (October to April) and could begin as early as fall 2024 (Figure 1). The proposed Carnes Pipeline project would convert 3.9 miles of open Carnes Ditch to closed pipeline (Figures 2 and 3). The pipeline would include 788 feet of new alignment where a siphon would be installed at a crossing beneath Dutch Creek. A pump and 0.7 miles of pipe would be installed in the segment of Upper Coughanour Ditch closest to the Pilcher Creek Reservoir outlet. The Upper Coughanour Ditch and Carnes Ditch would be retired (3.9 miles total), and the Coughanour Diversion on Anthony Creek would be removed. Fish passage improvements and fish screening would also be installed at the Carnes Diversion. Implementation of the C-1 pipeline project would install 3.4 miles of pipeline (Figures 4 and 5). The project would include piping 2.1 miles of the Ellis Ditch and an additional 1.3 miles that would follow a new alignment. The Lower Lone Pine and Maharry Blevins ditches would be retired and remain open (9.6 miles). An additional 0.3 miles of the Redger Ditch would be retired and filled.

PL-566 watershed projects introduce locally led solutions to natural and human resource problems in watersheds up to 250,000 acres (less than 400 square miles). Projects can include flood prevention and damage reduction, development of rural water supply sources, erosion and sediment control, fish and wildlife habitat enhancement, wetland creation and restoration, and increased recreational opportunities.

We are currently in the NEPA scoping phase of this project and invite you to submit your written comments. The details provided here are subject to change as we receive feedback from project scoping, engineering, and design. As the proposed project progresses, we will update you with project specifics including maps, details of work, and consult on the Area of Potential Effect (APE).

USDA is an equal opportunity provider, employer, and lender.

Sincerely,

Michael Petrozza

Michael Petrozza, M.A. **RPA**
USDA-NRCS Oregon State Cultural Resources Specialist
(503) 414-3212
Michael.Petrozza@usda.gov

cc: Amy Hendershot, USDA-NRCS Oregon State Resource Conservationist
Gary Diridoni, USDA-NRCS Oregon Watershed Conservationist

USDA is an equal opportunity provider, employer, and lender.



United States Department of Agriculture

Natural
Resources
Conservation
Service

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

08 JUNE 2023

Burns Paiute Tribe
100 Pasigo Street
Burns, OR 97720

Subject: Invitation to the §106 Process, Powder Valley Water Control District

In accordance with 36 CFR §800.3(c), The United States Department of Agriculture’s Natural Resources Conservation Service (USDA-NRCS) is formally inviting you to participate in the §106 consultation process for the Powder Valley Water Control District (PVWCD). USDA-NRCS is cooperating with PVWCD, on an infrastructure improvement effort in accordance with The Watershed Protection and Flood Prevention Act of 1954 (PL-566) by providing financial and technical assistance.

Under the proposed plan, modernization of PVWCD’s water delivery infrastructure would occur in two project groups over the course of 3 years. Construction would occur during the non-irrigation season (October to April) and could begin as early as fall 2024 (Figure 1). The proposed Carnes Pipeline project would convert 3.9 miles of open Carnes Ditch to closed pipeline (Figures 2 and 3). The pipeline would include 788 feet of new alignment where a siphon would be installed at a crossing beneath Dutch Creek. A pump and 0.7 miles of pipe would be installed in the segment of Upper Coughanour Ditch closest to the Pilcher Creek Reservoir outlet. The Upper Coughanour Ditch and Carnes Ditch would be retired (3.9 miles total), and the Coughanour Diversion on Anthony Creek would be removed. Fish passage improvements and fish screening would also be installed at the Carnes Diversion. Implementation of the C-1 pipeline project would install 3.4 miles of pipeline (Figures 4 and 5). The project would include piping 2.1 miles of the Ellis Ditch and an additional 1.3 miles that would follow a new alignment. The Lower Lone Pine and Maharry Blevins ditches would be retired and remain open (9.6 miles). An additional 0.3 miles of the Redger Ditch would be retired and filled.

PL-566 watershed projects introduce locally led solutions to natural and human resource problems in watersheds up to 250,000 acres (less than 400 square miles). Projects can include flood prevention and damage reduction, development of rural water supply sources, erosion and sediment control, fish and wildlife habitat enhancement, wetland creation and restoration, and increased recreational opportunities.

We are currently in the NEPA scoping phase of this project and invite you to submit your written comments. The details provided here are subject to change as we receive feedback from project scoping, engineering, and design. As the proposed project progresses, we will update you with project specifics including maps, details of work, and consult on the Area of Potential Effect (APE).

USDA is an equal opportunity provider, employer, and lender.

Sincerely,

Michael Petrozza

Michael Petrozza, M.A. **RPA**
USDA-NRCS Oregon State Cultural Resources Specialist
(503) 414-3212
Michael.Petrozza@usda.gov

cc: Amy Hendershot, USDA-NRCS Oregon State Resource Conservationist
Gary Diridoni, USDA-NRCS Oregon Watershed Conservationist

USDA is an equal opportunity provider, employer, and lender.



Natural
Resources
Conservation
Service

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

September 22, 2022

Craig Rowland
Acting State Supervisor, Oregon Fish and Wildlife Office
U.S. Fish and Wildlife Service
2600 SE 98th Avenue
Portland, Oregon 97266

Subject: Notice of Online Public Scoping Meeting October 5, 2022, for Powder Valley Water Control District Infrastructure Modernization Project Watershed Plan-Environmental Assessment and Watershed Protection and Flood Prevention Act of 1954, Section 12, Consultation Request

Dear Mr. Rowland:

The United States Department of Agriculture Natural Resources Conservation Service (NRCS), in cooperation with Powder Valley Water Control District (PVWCD) as the Sponsoring Local Organizations, is proposing to partially fund through the Watershed Protection and Flood Prevention Act of 1954 (PL83-566), improvements to irrigation infrastructure modernization actions within Union and Baker Counties, Oregon, such as addressing water loss, water delivery reliability, and operation inefficiencies in District and Ditch Company infrastructure. Current operation inefficiencies include maintaining open canals, particularly those in remote locations, infrastructure breaches, and excessive wear on District and Ditch Company-owned infrastructure due to sedimentation. A watershed plan will be developed that will help irrigators conserve water and increase delivery efficiency.

The proposed project would allow the District and Ditch Company to improve Agricultural Water Management by reducing water losses, increasing water use efficiency on District and Ditch operated infrastructure, and reduce risk to public safety in the project area by improving said infrastructure. This project is needed to address water loss, and water delivery and operations inefficiencies in District and Ditch Company infrastructure.

The Watershed Protection and Flood Prevention Act of 1954 (often referred to as P.L.83-566 or PL 566) authorizes the NRCS to assist state and local agencies in the development of water resources development projects in watersheds of 250,000 acres or less. NRCS provides technical, financial, and credit assistance to local sponsors in the development of projects for purposes including watershed protection, flood prevention, agricultural water management, ground water recharge, water quality management, and municipal and domestic water supply.

As part of this planning effort, NRCS, PVWCD and the County announced on September 20th, 2022, that we are hosting a meeting, in an open house format, where tribe, agency personnel and the public have been invited to discuss proposed irrigation system improvements and collect input from the community, stakeholders, and agencies.

An Equal Opportunity Provider and Employer

At this meeting, participants will have an opportunity to learn more about the proposed project and submit comments, ideas, and concerns. We would like to invite you to the Online Public Scoping Meeting for the Powder Valley Water Control District Infrastructure Modernization Project.

During the online meeting, project partners will provide background information on the proposed project, the National Environmental Policy Act including scoping and the Environmental Impact Statement process, NRCS-specific regulations, and public involvement activities.

Date and Time: Wednesday, October 5, 2022, 6 PM to 7 PM

Meeting: Register for the meeting at oregonwatershedplans.org.

Location: North Powder Fire Department
320 E St., North Powder, OR 97867

Submitting comments is the most effective way to make your voice heard. Please feel free to send comments at any time during the process starting September 20, 2022, and ending on October 25, 2022.

Comments may be:

Emailed to: powdervalley.wcd.comments@gmail.com

Submitted online at oregonwatershedplans.org

Submitted via phone at (541) 716-6085

Mailed to: Farmers Conservation Alliance, 102 State Street, Hood River, OR 97031

This project is not covered by the consultation provisions of the Fish and Wildlife Coordination Act of 1934, as amended (FWCA). However, consultation is required under Section 12 of P.L.83-566, which was added to P.L.83-566 by the 1958 amendments to the FWCA. Section 12 was added in recognition of the need for evaluation of fish and wildlife resources impacts and opportunities at P.L.83-566 projects in a manner similar to that required for other construction projects under the FWCA.

Section 12 provides that, in preparing project plans, the Department of Agriculture must consult with the Fish and Wildlife Service (FWS) with regard to the conservation and development of fish and wildlife resources and provide the FWS with the opportunity to participate in project planning. The FWS is to be afforded the opportunity to make surveys and investigations and prepare reports with recommendations on the conservation and development of fish and wildlife. The Department of Agriculture must give full consideration to the recommendations contained in FWS reports and include features that are determined to be feasible and that are acceptable to the Department of Agriculture and the local project sponsor. FWS reports are to be included in project reports prepared by the Department of Agriculture. No funds are provided by the Department of Agriculture for FWS involvement in P.L.83-566 projects; funds for such work must come from those appropriated for FWS work in project planning.

An Equal Opportunity Provider and Employer

3

This letter is being sent to you to invite you to participate in the scoping process for Powder Valley Water Control District Infrastructure Modernization Project and to request consultation under the provisions of Section 12 of P.L.83-566 which provides for consultation similar to that required under the FWCA.

Please provide any information, comments, or concerns to Gary Diridoni, Assistant State Conservationist for Watershed Resources and Planning, by phone at 503-414-3092, email at gary.diridoni@usda.gov, or mail at the letterhead address provided above.

Sincerely,



JASON JEANS
Acting State Conservationist

An Equal Opportunity Provider and Employer

Appendix B

Project Maps

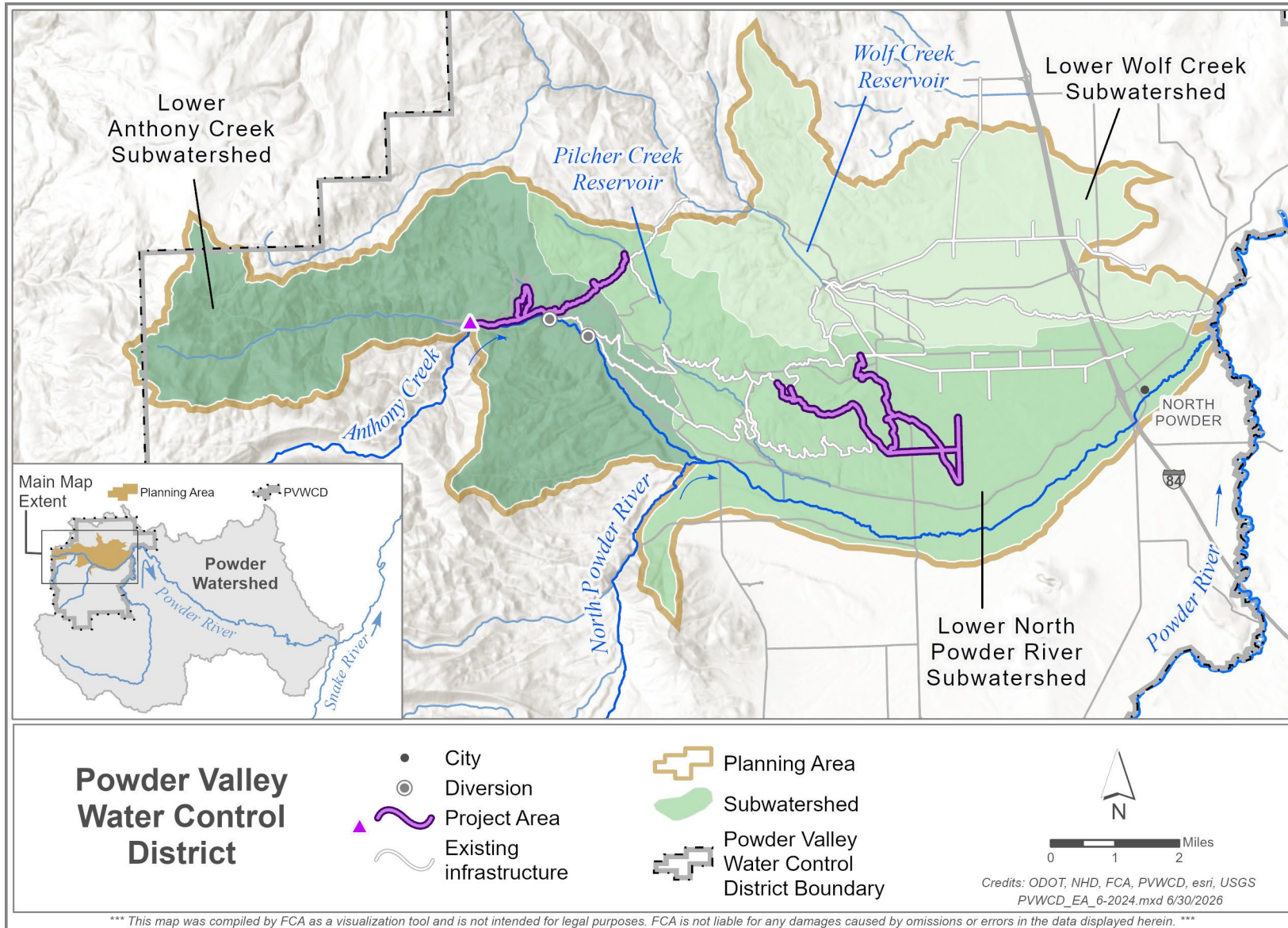


Figure B-1. PVWCD planning area and subwatersheds.

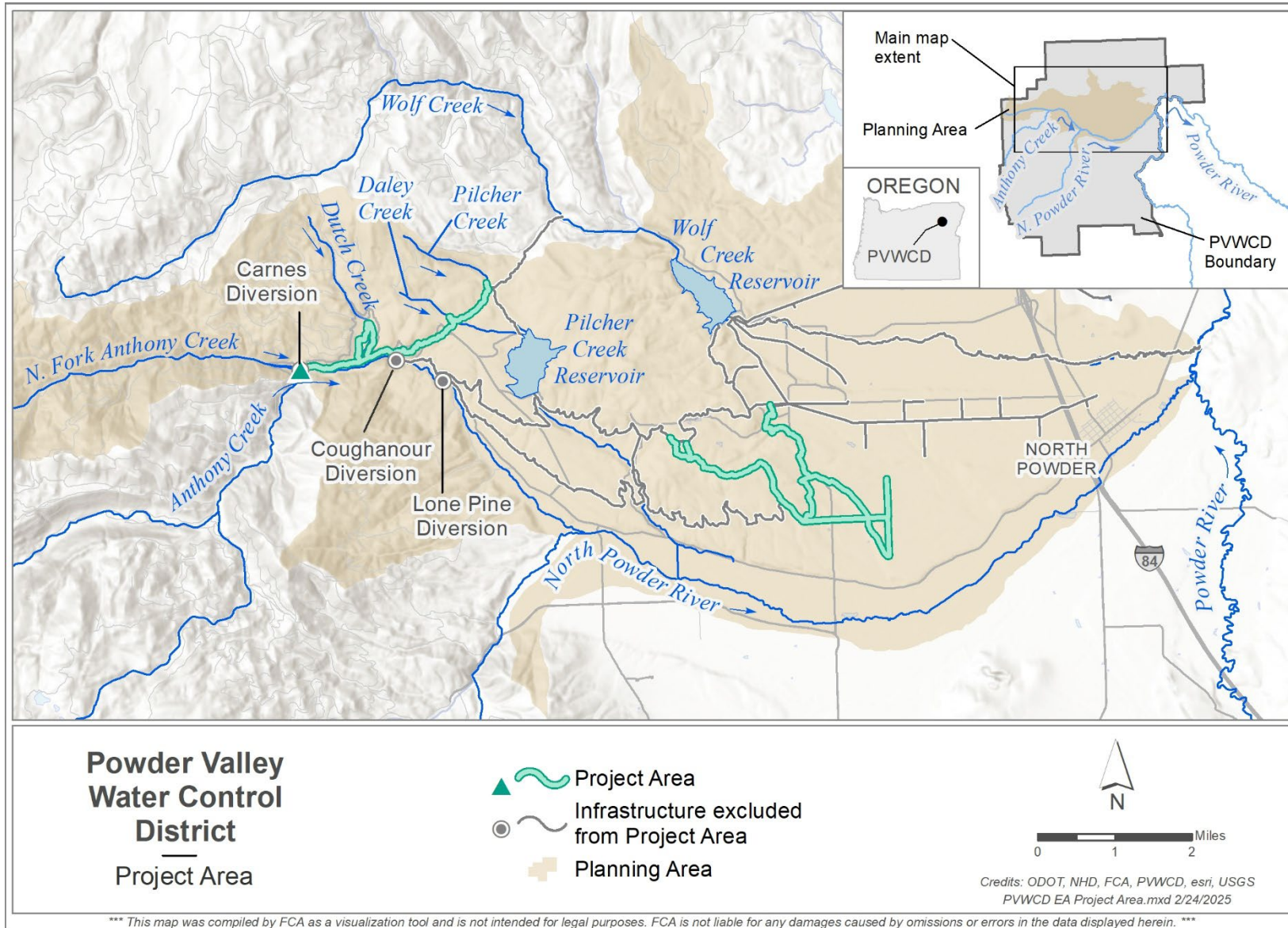


Figure B-2. PVWCD project area.

Appendix B: Project Maps

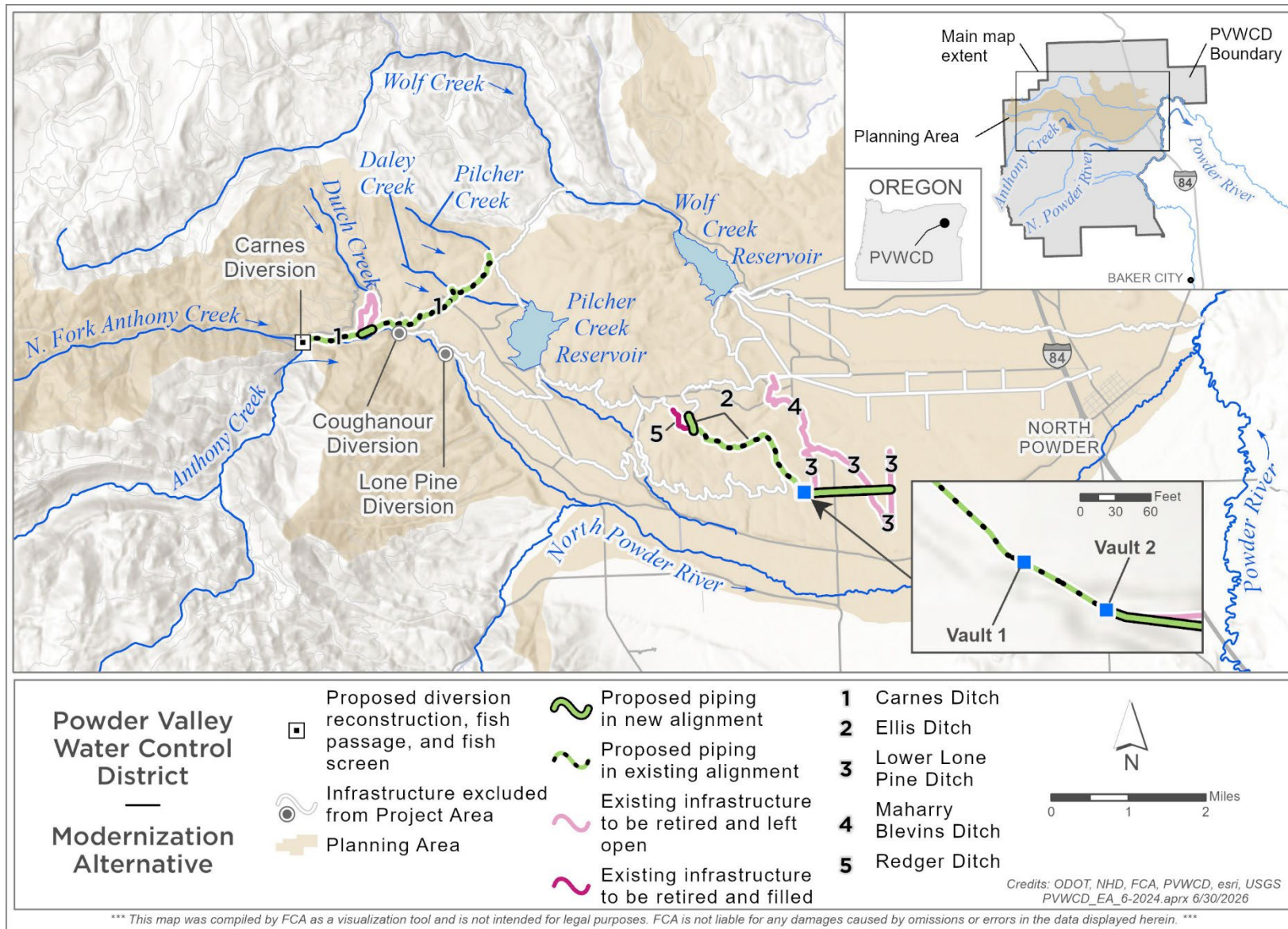


Figure B-3. Overview of the Modernization Alternative.

Appendix C

Supporting Maps and Tables

Table C-1. Powder Valley Water Control District Planning Area.

Subwatershed Name	12-Digit Hydrologic Unit Code	Subwatershed Size (acres)
Lower Anthony Creek	170502030504	12,476.9
Lower N. Powder River	170502030505	16,643
Lower Wolf Creek	170502030602	12,765.1
All Subwatersheds	Total	41,885

Appendix C: Supporting Maps

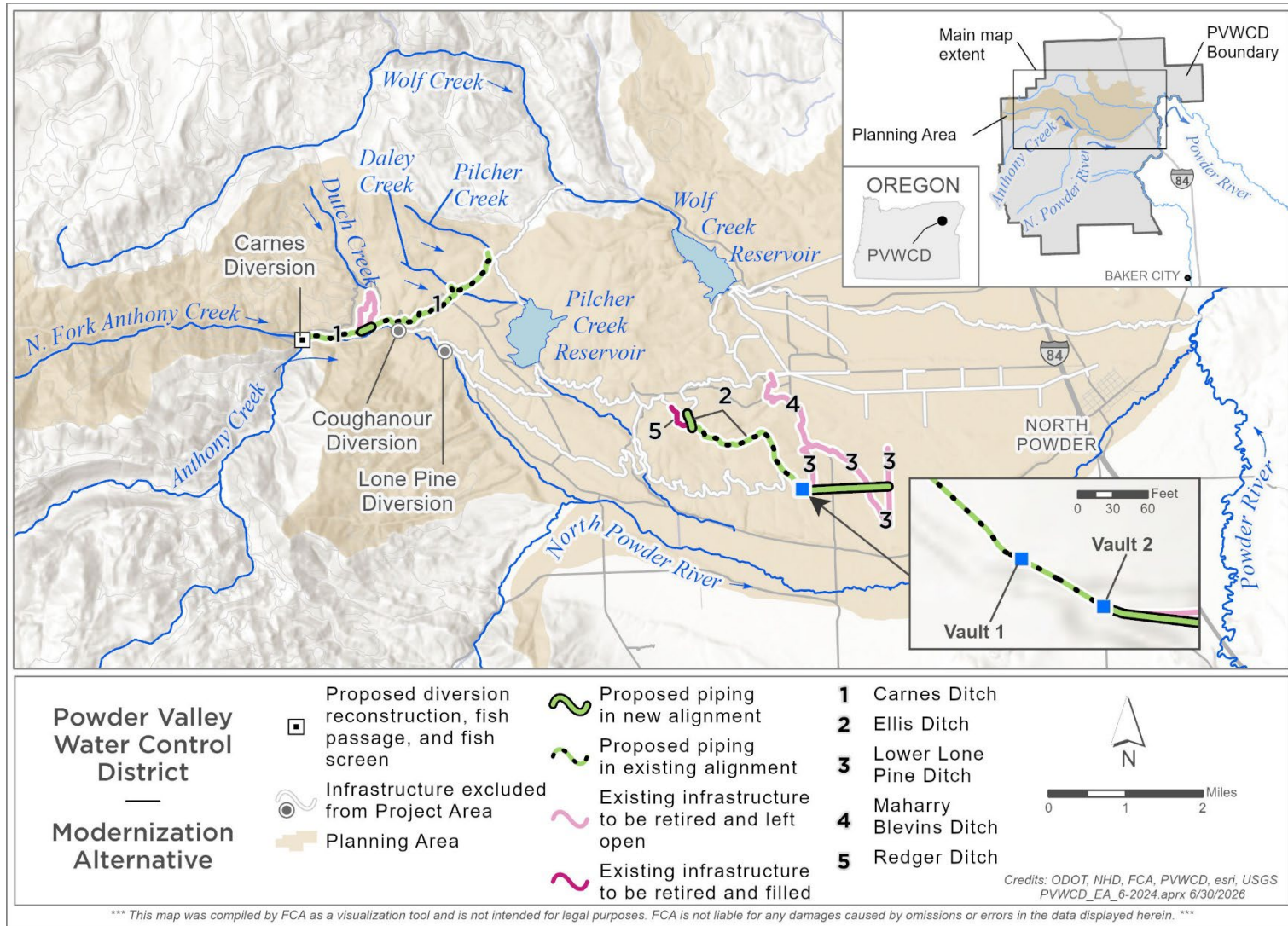


Figure C-1. PVWCD Existing Infrastructure.

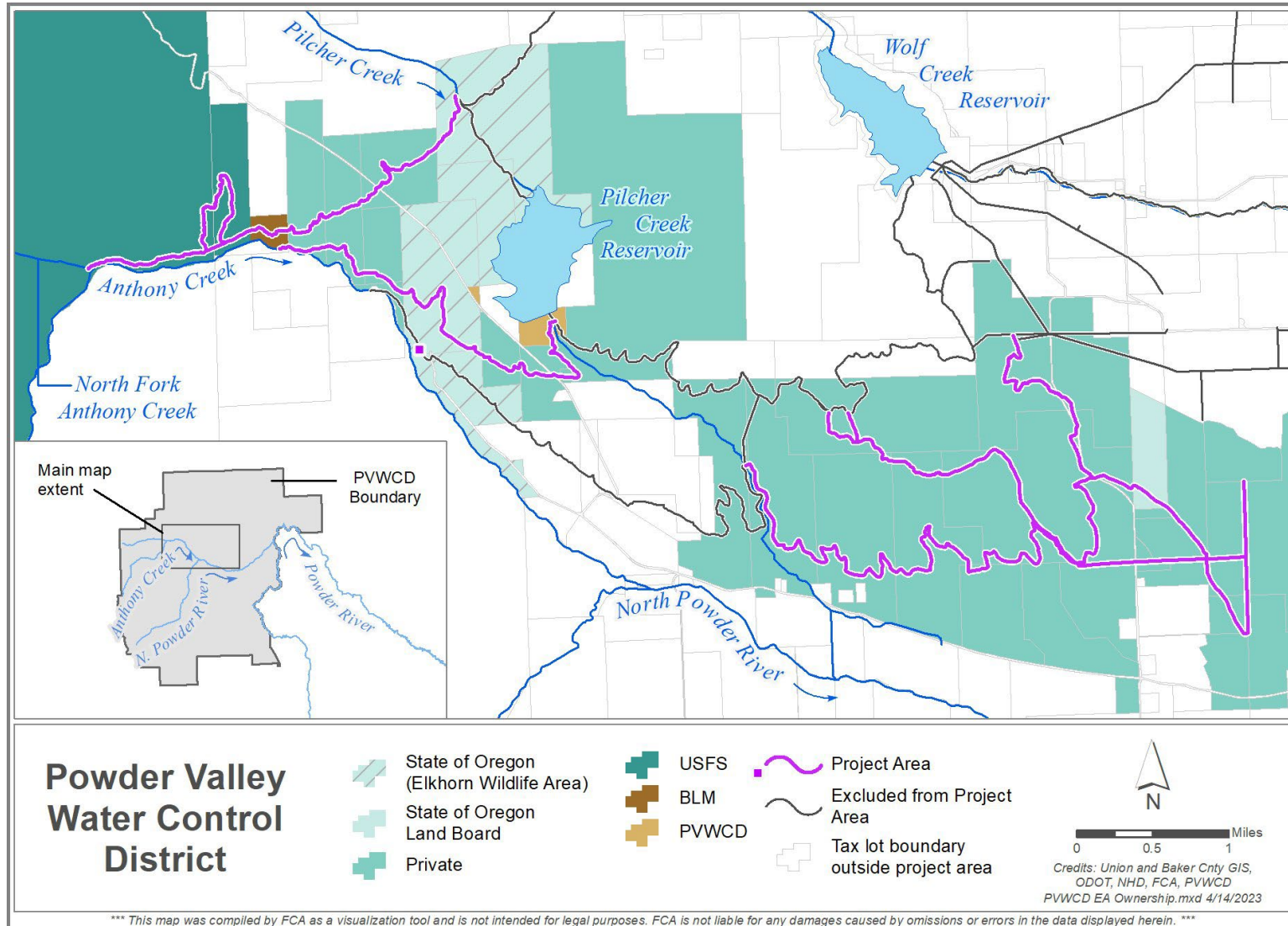


Figure C-2. PVWCD Land Ownership Map.

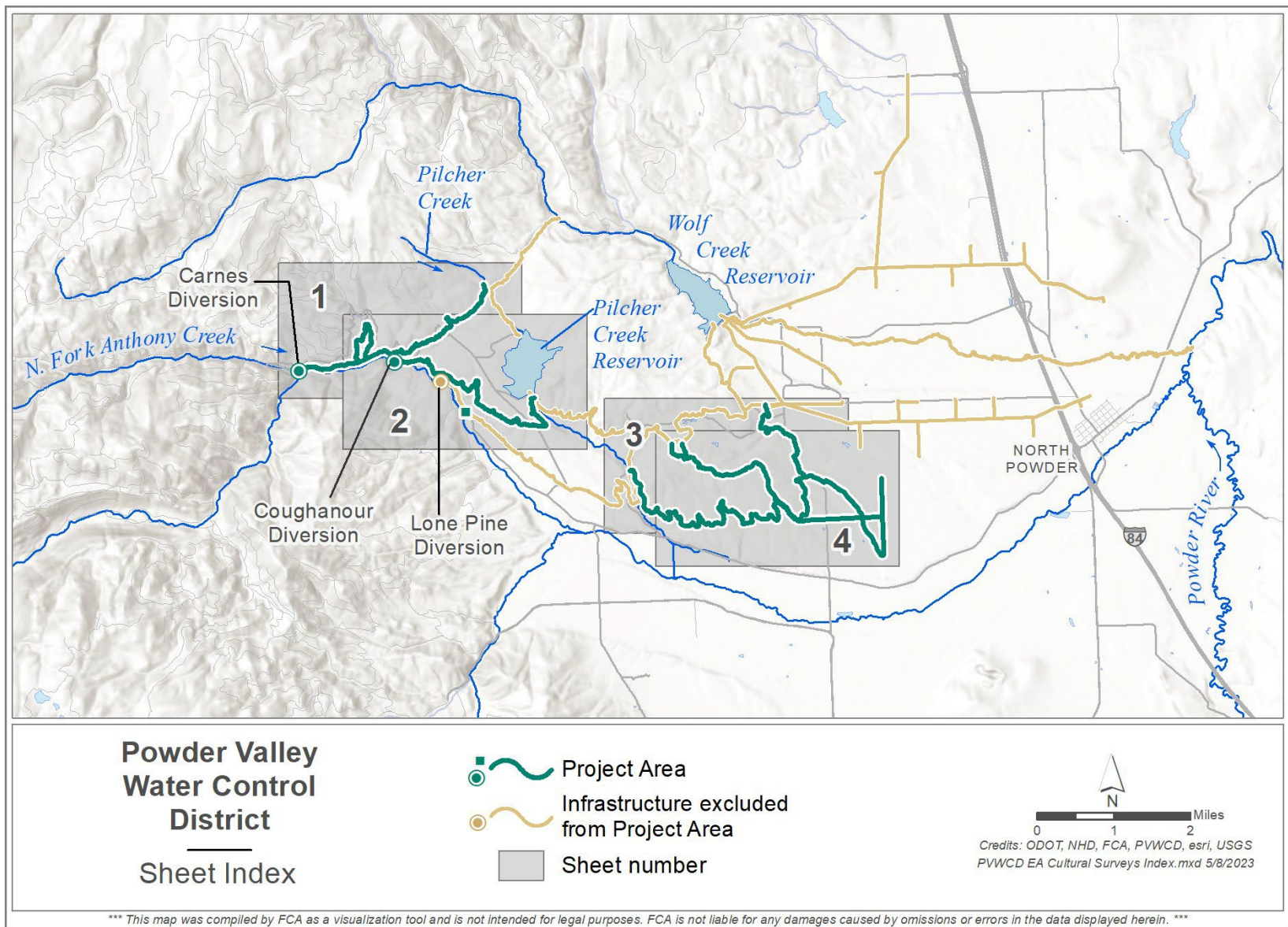


Figure C-3. PVWCD Area of Potential Effect Index Map.

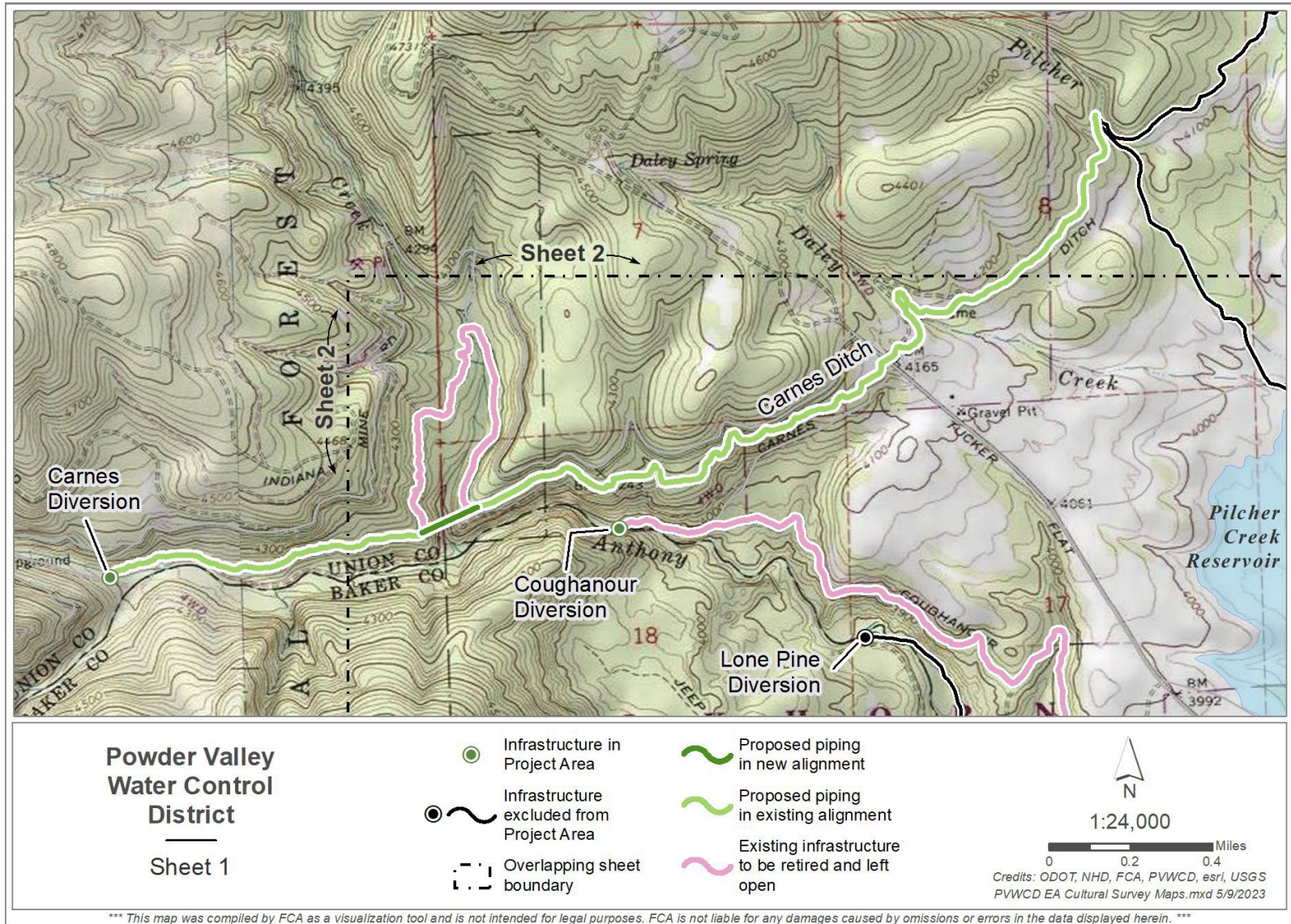


Figure C-4. PVWCD Area of Potential Effect Map 1.

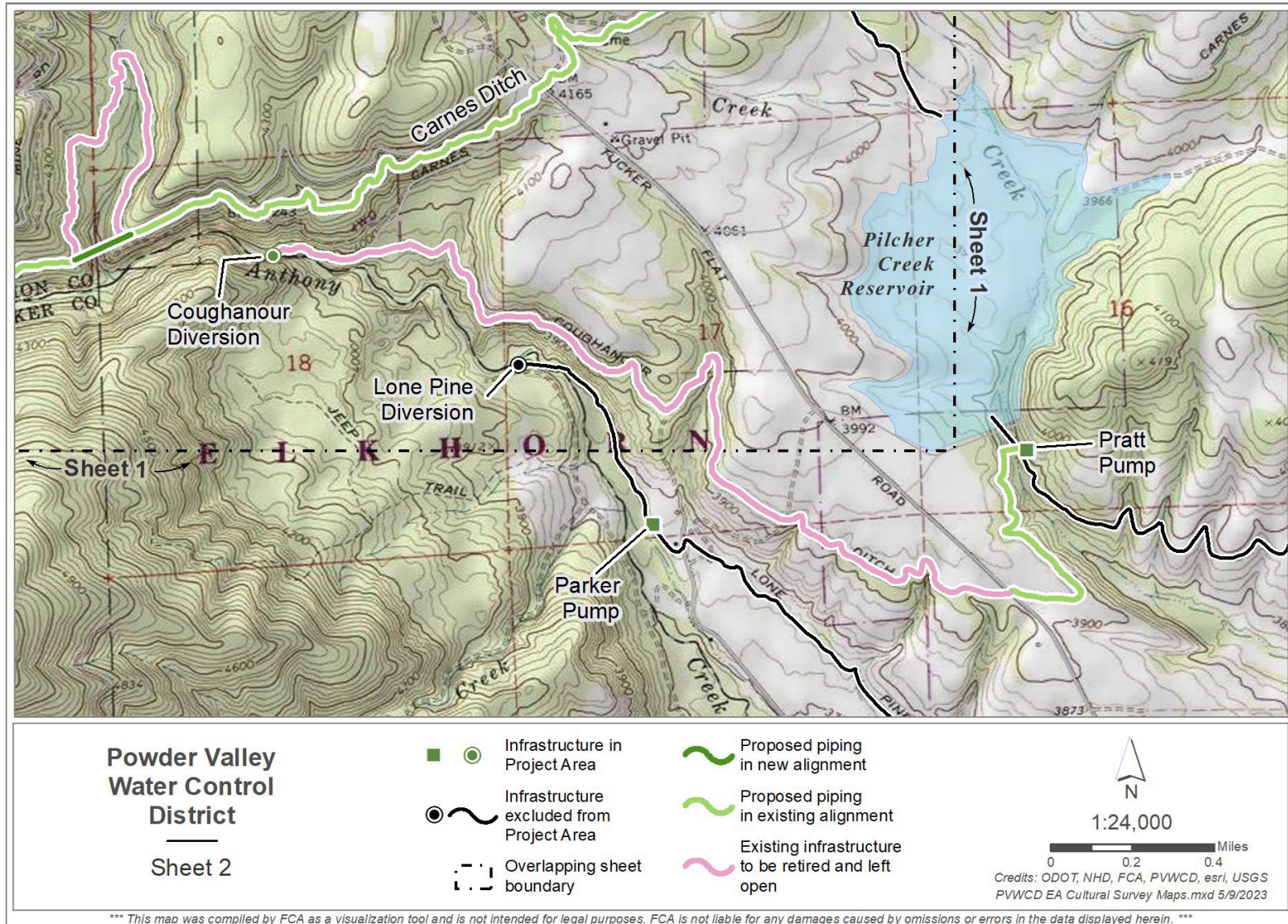


Figure C-5. PVWCD Area of Potential Effect Map 2.

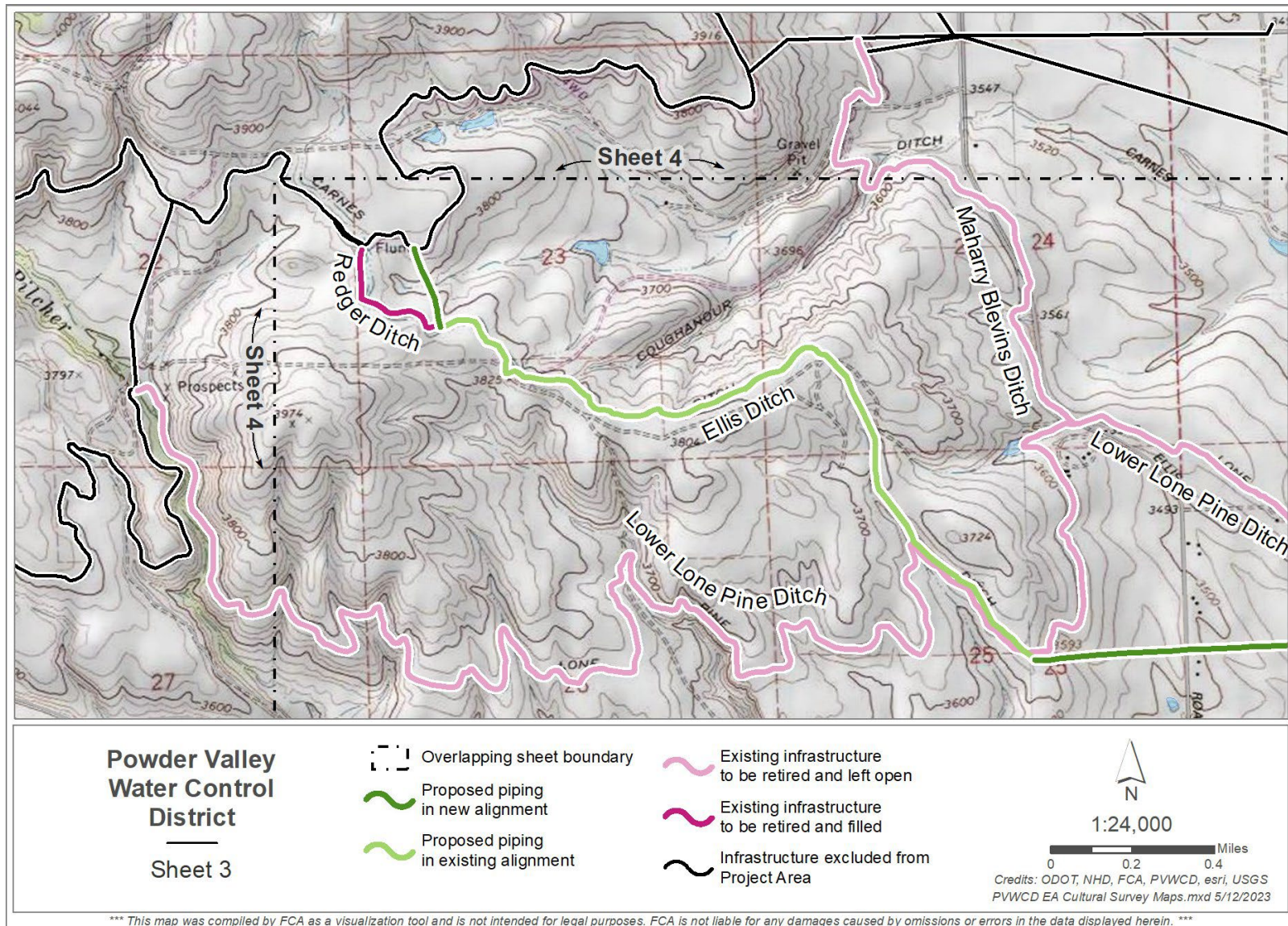


Figure C-6. PVWCD Area of Potential Effect Map 3.

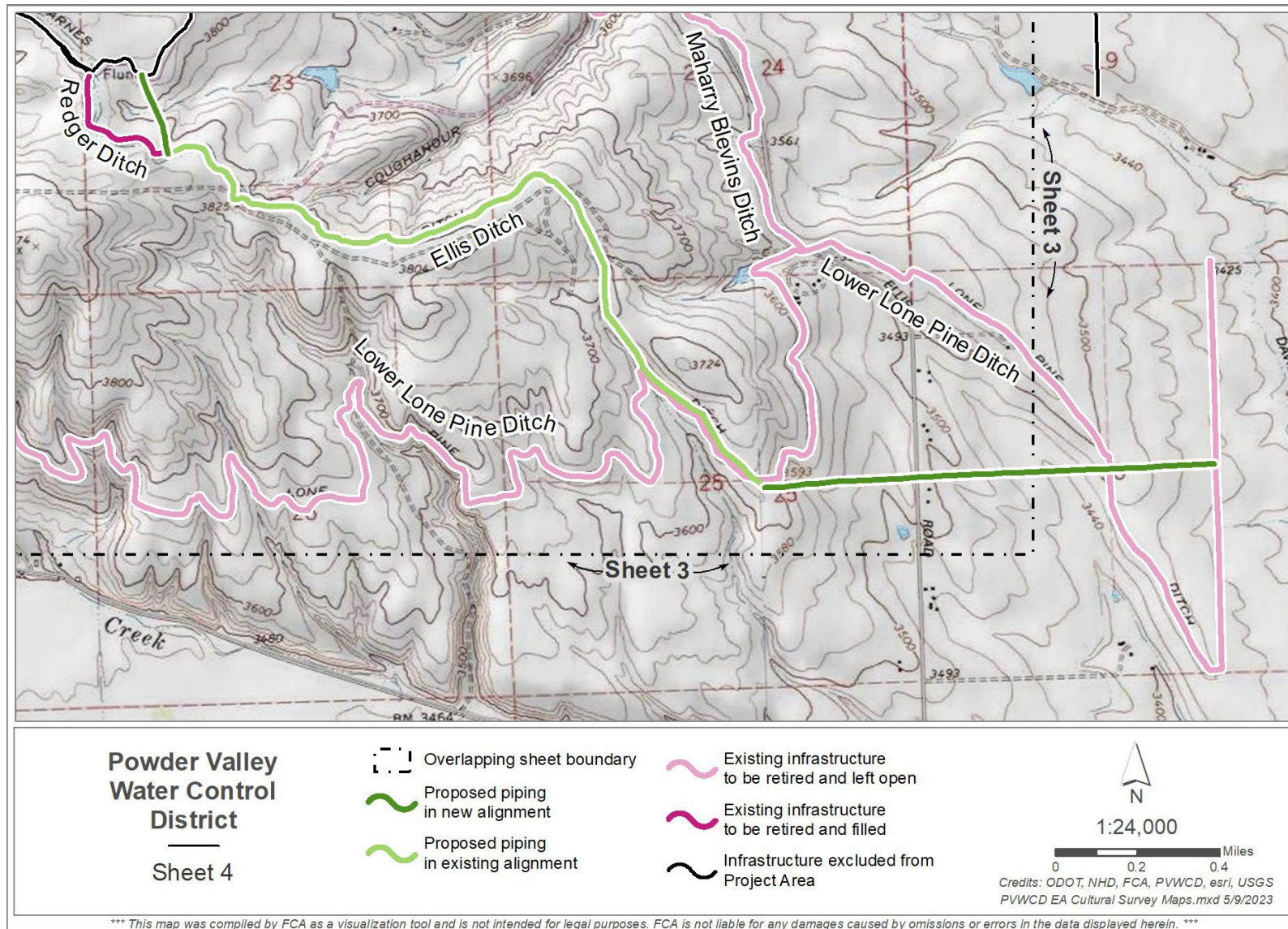


Figure C-7. PVWCD Area of Potential Effect Map 4.

Appendix D

Investigation and Analyses Report

D.1.1 Introduction

This appendix provides a National Economic Efficiency (NEE) analysis that evaluates the costs and benefits of the Modernization Alternative for the Powder Valley Water Control District (PVWCD, or “District”) Infrastructure Modernization Project (“Project”). The analysis uses Natural Resources Conservation Service (NRCS) guidelines for evaluating public benefits¹ as outlined in the NRCS Natural Resources Economics Handbook and the U.S. Department of Agriculture’s (USDA) Guidance for Conducting Analyses Under the Principles, Requirements, and Guidelines (PR&Gs) for Water and Land Related Resources Implementation Studies and Federal Water Resource Investments (DM 9500-013).

The Modernization Alternative represents the potential future with federal funding through P.L. 83-566. This NEE analysis is divided into two sections. The first section describes the analysis parameters. The second section identifies the costs and benefits of the Modernization Alternative compared to conditions in the Future Without Federal Investment (“No Action Alternative”).

D.1.2 Project Location

PVWCD is located in the Powder Basin of northeast Oregon near the towns of North Powder and Haines. The District provides water to a service area of approximately 15,915 acres of farmland in Union and Baker counties, although the Project area lies completely in Union County (Farmers Conservation Alliance, 2022). Farmland in the district primarily produces alfalfa hay and pasture. PVWCD diverts water from the North Powder River, Pilcher Creek, Wolf Creek, Anthony Creek, and the North and South Forks of Anthony Creek. Diverted water is stored in the Pilcher Creek and Wolf Creek Reservoirs. The reservoirs are connected by the Lower Coughanour Ditch and are managed in concert to store and distribute water to District patrons. The District has 11,100 acre-feet (AF) of total storage in Wolf Creek Reservoir (of which 10,350 AF are designated for irrigation purposes and 750 AF are reserved for minimum pool storage) and 5,910 AF in Pilcher Creek Reservoir for irrigation, water storage, and recreation.

The Planning Area is defined as the subwatersheds traversed by the proposed Project, which consist of Lower Anthony Creek, the Lower North Power River, and the Lower Wolf Creek subwatersheds (see map in Appendix B). The Project area, making up only a portion of the District’s total system, consists of the District infrastructure to be modernized and areas where new infrastructure would be constructed, areas where existing infrastructure would be retired, and area where construction would take place. This would occur at and around the Carnes Ditch, the Ellis Ditch, Maharry Blevins Ditch, Redger Ditch, and the Lower Lone Pine Ditch (see Figure 5-1 in the Plan-EA).

D.1.3 Existing Conditions & Challenges

The District currently maintains and operates roughly 41 miles of open ditches and 22 miles of pipe. The District’s Carnes and Ellis ditches are open and unlined. As a result, there are water losses in these ditches from seepage and evaporation that total an estimated 2,364 AF during the irrigation season. Water losses due to inefficient conveyance systems reduce the District’s ability to deliver water to its irrigators at the full rate and duty associated with each water right. Based on data from 2001 to 2024, under existing conditions there are water shortages in approximately one-third of water years that result in reduced yields and reduced agricultural income in the District. Currently, data from the District and public sources indicate that water shortages reduce pasture yields by 28

¹ Public benefits may be environmental, economic, and social in nature and include monetary and nonmonetary effects.

percent in roughly one-third of years and reduce alfalfa and pasture yields by around 35 percent in about 21 percent of years.

Since 1990, annual precipitation in the area has averaged 8.9 inches (National Atmospheric and Oceanic Administration, 2024). Much of the precipitation falls as snow in the mountains, which then provides runoff for irrigation in the spring and summer. The highest flows occur in May, followed by low flows from summer through fall. On average, more than half the annual precipitation falls outside the primary crop growing season. In general, crops grown in the region require at least 20 inches of water to meet their evapotranspiration (ET) needs in an average year (Bureau of Reclamation, 2015). Given the low level of rainfall during the growing season, irrigation plays a critical role in crop production in the study area.

The District has identified that replacing open ditches with piped conveyance is a high priority to both conserve water and improve operational efficiencies. The District's aging system conveys water inefficiently. Open ditches make it difficult to manage water throughout the system and deliver the correct amount of water to patrons' points of delivery. The District must also pass excess water to ensure that adequate water reaches all points of delivery when required by patrons. Many of the District's open ditches are in remote locations, making it difficult to maintain and repair them when failures occur. This leads to higher operations and maintenance (O&M) costs than if the ditches were piped. Ditch failures result in water supply interruptions, which reduce crop yields. District patrons also incur higher O&M costs from the ditch system, which requires daily maintenance during the irrigation season to ensure proper operation, and in some cases, patrons incur higher power costs to move water from ditches onto fields.

In addition to water quantity issues, there are water quality impairments in the watershed. Within the Powder River basin where the planning area is located, the Oregon Department of Environmental Quality has identified water flow and quality problems in Anthony Creek and the North Powder River. Both waterbodies are included in Oregon's Integrated Report (previously Oregon's 303(d) list) for year-round failures to meet state water quality standards for temperature, making them unsuitable for fish spawning and rearing (Oregon Department of Environmental Quality, 2024).

Because there is no fish screen at the District's Carnes Diversion on North Fork Anthony Creek, fish, including federally-listed bull trout, may enter the District's irrigation conveyance system and become trapped. In addition, Carnes Diversion is a partial barrier to fish passage and has been identified as a priority for removal by the Oregon Department of Fish and Wildlife (ODFW).

D.1.3.1 Future Conditions in the Study Area

If left unaddressed, the District's conveyance problems will continue or worsen. Open ditches will continue to lose water to seepage and evaporation, further contributing to water shortages in the District. Future increases in the frequency of droughts will likely exacerbate water shortages and water quality concerns, as lower summertime flows negatively impact water quality and water availability for agriculture, livestock, and fisheries. Water shortages will continue to negatively impact crop yields, reducing agricultural production in the District. Lack of fish screening and passage at the Carnes Diversion will continue to serve as a potential detriment to fish.

The District and its patrons would continue to incur costs from an inefficient and unreliable conveyance system. Both patrons and the District would continue to experience high O&M costs associated with the ditch system. Water delivery reliability for farmers would not improve (and may worsen with continued drought and reduced streamflow), nor would streamflow and habitat conditions for fish and aquatic species improve. Open ditches would continue to fail, which would

require costly repairs, and result in water supply interruptions to irrigators, harming agricultural production.

D.1.3.2 Project Area Challenges and Opportunities

Modernizing PVWCD's water delivery infrastructure provides an opportunity to address the District's challenges related to inefficient water conveyance, water shortages, risks to fish, and high O&M costs. It also offers an opportunity to increase the amount of water available for irrigation and instream flows to reduce agricultural crop damages and enhance habitat, and improve fish passage and screening. These opportunities are constrained by the District's limited ability under its existing rate structure to finance conveyance system upgrades.

D.1.4 Project Purpose and Need

The purpose of the proposed Project is Agricultural Water Management through improved water delivery reliability and efficiency along District infrastructure. Federal assistance is needed to alleviate inefficient conveyance and unreliable access to irrigation water which causes agricultural damages for PVWCD farmers. Current operation inefficiencies include water loss in open ditches, high labor and material costs to maintain open ditches (particularly in remote locations), and ditch breaches from aging infrastructure.

D.1.5 Project Overview

The PVWCD Infrastructure Modernization Project is an agricultural water conveyance efficiency project. The Project would include three project groups: the C-1 Project (Project Group (PG)1), the Carnes Pipeline (PG2), and the Fish Screen and Passage (PG3).

The C-1 Project would include the following actions:

- Pipe the Ellis Ditch (approximately 2.1 miles) and install approximately 1.3 miles of pipeline within a new alignment.
- Install a pressure reducing vault and a junction vault between the C-1 Project pipeline and the Lower Lone Pine Ditch.
- Retire and leave open the end of the Lower Lone Pine Ditch and all the Maharry Blevins Ditch (approximately 5.0 miles total).
- Retire and fill the Redger Ditch (approximately 0.5 miles).

The Carnes Pipeline would include the following actions:

- Pipe the Carnes Ditch from the Carnes Diversion to the Pilcher Creek Filling Channel (approximately 3.2 miles).
- Install an approximately 0.1-mile-long siphon below Dutch Creek along the Carnes Ditch.
- Retire approximately 1.2 miles of the Carnes Ditch that makes a loop along Dutch Creek. This section of ditch would remain open following the Project.
- Remove the existing headgate infrastructure where Carnes Ditch currently intercepts Dutch Creek at the northernmost extent of the Carnes Ditch loop. Restore the Dutch Creek stream channel to natural conditions at this site and reconnect portions of the stream channel upslope and downslope of the current ditch location.

The Fish Screen and Passage would install fish screening and improve fish passage at the Carnes Diversion.

D.1.6 Watershed Plan-EA Alternatives

D.1.6.1 Future Without Federal Investment (No Action) Alternative

Under the Future Without Federal Investment Alternative (hereafter referred to as the No Action Alternative), federal funding through P.L. 83-566 would not be available to implement the Project. The District would continue to operate and maintain infrastructure consistent with past and current operations. In the No Action Alternative, modernization of the District's system to meet the purpose and need of the Project would not be reasonably certain to occur. Because of this, the No Action Alternative would not address the purpose and need of the Project.

D.1.6.2 Modernization Alternative

Under this alternative, federal funding through P.L. 83-566 would be available. The District would use this funding to complete the following projects:

- PG1 C-1 Project: Pipe the Ellis Ditch (partially a new alignment), install a pressure reducing vault and a junction vault, retire and leave open the Maharry Blevins Ditch, and retire and fill the Redger Ditch.
- PG2 Carnes Pipeline: Pipe the Carnes Ditch, install a siphon, retire and leave open part of the Carnes Ditch, remove the headgate at the Dutch Creek intercept, and restore and reconnect Dutch Creek upslope and downslope of the ditch.
- PG3 Fish Screen & Passage: Install fish screening and improve fish passage at the Carnes Diversion.

D.1.7 Analysis Parameters

All economic values are presented in 2024 dollars rounded to the nearest \$1,000. Unless otherwise noted, all NEE values are presented in average annual values (following the approach described in the NRCS Water Resources Handbook for Economics) using the 3.25-percent federal discount rate for federal water projects for fiscal year 2026 (Bureau of Reclamation, 2024). Under this method, all costs and benefits are evaluated at the 2024 price level for all years in the study period, then converted to a present value over the entire analysis period using the 3.25-percent federal discount rate.² Finally, each present value is amortized to average annual values over the evaluation period using the 3.25-percent rate.³

D.1.7.1 Funding

Under the Modernization Alternative, P.L. 83-566 funding would be awarded. P.L. 83-566 funds would cover \$22,798,000 (75 percent) of the total Project installation/construction cost, and the remaining \$7,563,000 (25 percent) would be funded by PVWCD (through their own funds or other outside funding sources).

² As directed in DM 9500-13 (Section 9a and 9f(5)), the National Resource Economics Handbook (Part 611 Water Resources Handbook for Economics, Section 611.0103), the Principles and Guidelines (Sections 1.4.11, 1.7.1(h), 2.1.3, 2.4.11, 2.4.14, and 8), and in Chapter III of the Principles, Guidelines, and Recommendations (Section v).

³ As directed in DM 9500-13 (Section 9a and 9f(5)), the National Resource Economics Handbook (Part 611 Water Resources Handbook for Economics, Section 611.0103), the Principles and Guidelines (1.7.1(h), 2.1.3, and 2.4.14), and in Chapter III of the Principles, Guidelines, and Recommendations (Section v).

D.1.7.2 Evaluation Unit

The proposed Project consists of three project groups, which are the evaluation units for this analysis. While the project groups are described more fully in Section 1.5.1 above, they are listed here for quick reference:

1. PG1 C-1 Project
2. PG2 Carnes Pipeline
3. PG3 Fish Screen & Passage

The design and cost/benefit of each project group is independent of the number of project groups included and the order in which they are installed.

D.1.7.3 Project Implementation Timeline

Under the Modernization Alternative, District staff predict that if P.L. 83-566 funds are made available, construction of the three project groups would likely be completed over approximately five years. For each project group, this analysis assumes that full benefits would be realized the year after construction is completed (e.g., for PG1 C-1 Project, which would be constructed in Year 1, full benefits would be realized in Year 2). This information is summarized in Table D-1 below.

D.1.7.4 Period of Analysis

The period of analysis is defined as 105 years, which includes five years of Project installation and 100 years of Project life, based on the expected life of high-density polyethylene pipe (during which time it is expected to have significant beneficial effects). Accordingly, the analysis period extends from Year 1 (construction start) to Year 105 (last year of potential useful life for the Project). The anticipated installation timing, as well as the life of each project group, is summarized in Table D-1 below.

Table D-2. Construction Timeline and Project Life for the Modernization Alternative, Powder Valley Watershed, Oregon

Works of Improvement	Construction Start Year	Construction End Year	Project Life Start Year	Project Life End Year
PG1 C-1 Project	1	1	2	101
PG2 Carnes Pipeline	4	5	6	105
PG3 Fish Screen & Passage	4	4	5	104

D.2 Modernization Alternative

This section describes the costs and benefits of the Modernization Alternative above the Future Without Federal Investment (No Action) Alternative.

D.2.1 Costs of the Modernization Alternative

The costs of the Modernization Alternative include the initial installation costs of each project group, as well as O&M costs. All costs are presented in 2024 dollars and converted to present value in 2024 (and not the construction year), so no inflation of construction costs was included.

D.2.1.1 Installation Costs

In the case of PG1 C-1 Project, the project installation costs include piping roughly 2.1 miles of the Ellis Ditch and installing about 1.3 miles of pipeline in a new alignment, installing a pressure reducing vault, installing a junction vault, and retiring and filling approximately 0.5 miles of the Redger ditch. For PG2 Carnes Pipeline, project installation costs include the cost of installing roughly 3.3 miles of pipe in the Carnes ditch and installing a siphon. PG3 Fish Screen & Passage would install a fish screen at the Carnes Diversion and improve fish passage near the diversion.

The total cost of installation/construction of the Modernization Alternative is estimated at \$30,361,000. This includes the costs of materials and installation; engineering, construction management, and survey costs (estimated at 10 percent of construction costs); contractor markup (estimated at 14 percent of construction costs); and contingency costs (estimated at roughly 30 percent of the subtotal of other cost components).

The total costs of the Project also include project administration costs for PVWCD and NRCS (7 percent of the subtotal of previously mentioned cost components; split 75 percent NRCS and 25 percent PVWCD), and technical assistance from NRCS (estimated at 8 percent of the subtotal of previously mentioned cost components). Permitting costs are estimated at 3 percent of total construction and engineering costs. Easement costs are estimated to total \$100,000. There are no anticipated mitigation costs or other costs. The installation costs of the Modernization Alternative are summarized in Table 8-2 and Table 8-3 in the Plan-EA.

D.2.1.2 Operations, Maintenance, and Replacement Costs

Under the Modernization Alternative, PG1 C-1 Project would require additional O&M to maintain Project components. Maintaining the flow meters and radio systems would require an estimated \$2,000 per year, and the vault would require about six hours of manager time for winterization and season preparation, costing roughly \$300 per year. Accordingly, we estimate \$2,300 in O&M costs per year during the PG1 C-1 Project life. When discounted and annualized, the O&M costs of PG1 C-1 Project are approximately \$2,000, as shown in Table D-2. PG2 Carnes Pipeline is expected to require a minimal amount of O&M under the Modernization Alternative compared to the No Action, expected to be less than \$1,000 annualized. Since all values in this analysis are rounded to the nearest \$1,000, there are no O&M costs for PG2 Carnes Pipeline in the table below.

PG3 Fish Screen & Passage is not expected to require any additional annual maintenance compared to the No Action Alternative, which consists of inspecting the diversion and removing any debris present as part of routine checks of the District's system. However, certain components of PG3 Fish Screen & Passage would require replacement during the Project life. The screen brush would be replaced approximately every seven years at a cost of roughly \$300 per replacement, and the screen gearbox would be replaced roughly every 15 years at a cost of \$5,000 per replacement. When discounted and annualized, these replacement costs are less than \$300, and since all values in this analysis are rounded to the nearest \$1,000, the replacement costs do not appear in the table below. In total, the average annualized operations, maintenance, and replacement (OMR) costs are estimated at \$2,000.

Table D-2. Operations and Maintenance Costs of the Modernization Alternative, Powder River Watershed, Oregon, 2024 dollars¹

Project Group	Annual O&M Costs	Replacement Costs	Annualized OMR Costs
PG1 C-1 Project	\$2,300	\$0	\$2,000
PG2 Carnes Pipeline	\$0	\$0	\$0
PG3 Fish Screen & Passage	\$0	\$0	\$0
Total	\$2,300	\$0	\$2,000

Note: Totals may not sum due to rounding.

Prepared June 2026

1/ Price Base: 2024 dollars amortized over 100 years at a discount rate of 3.25 percent.

2/ Some costs do not appear in the table above since they are expected to be less than \$1,000 annualized.

D.2.1.3 Summary of Costs Under Modernization Alternative

The total costs of the Modernization Alternative include the annualized installation/construction costs and OMR costs, which total \$933,000, are provided in Table D-3 below (NWPM 506.18 Economic Table 4).

Table D-3. Economic Table 4 – Estimated Average Annual National Economic Development Costs, Powder River Watershed, Oregon, 2024\$.¹

Works of Improvement	Project Outlays (Amortization of Installation Cost)	Operation, Maintenance, and Repair Costs of the Modernization Alternative over the No Action Alternative	Total Average Annual Costs
PG1 C-1 Project	\$355,000	\$2,000	\$357,000
PG2 Carnes Pipeline	\$465,000	\$0	\$465,000
PG3 Fish Screen & Passage	\$111,000	\$0	\$111,000
Total Costs	\$931,000	\$2,000	\$933,000

Note: Totals may not sum due to rounding.

Prepared June 2026

1/ Price Base: 2024 dollars amortized over 100 years at a discount rate of 3.25 percent.

D.2.2 Benefits of the Modernization Alternative

This section presents on-site damage reduction benefits that would accrue to agricultural and the local rural community, including reduced agricultural damages, avoided damages from ditch failure, and reduced District and patron O&M costs. It also presents off-site quantified benefits, which consist of the value of supporting aquatic habitat through augmented streamflow from conserved water. Other benefits not included in the analysis that may result indirectly from the Modernization Alternative include support to recreation from higher reservoir levels for longer during summer months (due to conserved water) and reduced air emissions from reduced power consumption.

D.2.2.1 Benefits Considered and Included in the Analysis

As noted in the Water Resources Handbook for Economics, “The national economic development (NED) benefits are the value of increases in the agricultural output of the Nation and the cost savings in maintaining a given level of output. The benefits include reductions in production and in associated costs; reductions in damage costs from floods, erosion, sedimentation, inadequate drainage, or inadequate water supply; the value of increased production of crops; and the economic efficiency of increasing production of crops in the project area.” (Natural Resources Conservation Service, 1998). The Modernization Alternative results in several of these types of agricultural benefits, both of which are categorized in the Water Resources Handbook as agricultural damage reduction benefits related to increased net income. This section describes these agricultural damage benefits, which include: 1) cost savings in maintaining a given level of output (i.e., efficiency gains from reduced production costs to deliver water in the District) and 2) reduced agricultural damages from inadequate water supply.

D.2.2.1.1 District Efficiency Gains in Water Delivery

Under the Modernization Alternative, the District would experience efficiency gains by experiencing cost savings in delivering water to patrons relative to the No Action Alternative. Piping the District’s ditches would increase efficiency by eliminating the need to operate and maintain ditches, avoid the costs of repairing ditch failures, and avoid the cost of replacing ditch bridges and headgates. This section estimates these efficiency benefits of the Modernization Alternative.

By piping its ditches, the District would increase efficiency associated with inspecting and maintaining open ditches. The cost savings associated with these activities include labor to conduct inspections, clean ditches, and conduct road repairs; vehicle and fuel used for travel to the inspections; and contractors to maintain and repair the ditches. The District estimates these costs total roughly \$13,600 and \$10,400 annually for ditches replaced by PG1 C-1 Project and PG2 Carnes Pipeline, respectively. Additionally, the Carnes Ditch requires cleaning approximately every 12 years at an expense of roughly \$20,000 (Birdsall, 2023-2025). The Lone Pine Ditch Company conducts its own inspections of the Lower Lone Pine Ditch (replaced by PG1 C-1 Project), with associated costs of about \$1,080 per year, and conducts maintenance totaling \$26,000 per year (Wilson, 2024).⁴

In the absence of the Project, the District expects that manager time for O&M will increase in the future. Manager time dedicated to ditch O&M has risen 17 percent in the last five years, and it is expected to continue to increase at a rate of 10 percent every five years due to increasing O&M requirements for the open ditches (or the equivalent of 2.1 percent annually) (Birdsall, 2023-2025). Accordingly, this analysis increases the O&M costs associated with manager time by 2.1 percent annually.

Piping ditches would also increase efficiency by avoiding the cost of repairing the ditch after a failure. The Lone Pine Ditch Company repairs about one ditch failure per year at an average cost of approximately \$14,000 (including labor and repairs) (Wilson, 2024). PG1 C-1 Project would avoid an estimated 30 to 60 percent of these failures (Wilson, 2024). Accordingly, we model a failure reduction of 45 percent (the midpoint of the estimated range), equating to an annual average benefit of roughly \$6,400 under the Modernization Alternative. When combined with the other annual

⁴ The cost to hire two people for an average of 2.5 days per year, working 10 hours per day, at a wage rate of \$18 per hour (Wilson, 2024). We increase the wage costs by 20 percent to account for non-wage employment costs, such as health care and insurance. This is roughly the average proportion of non-wage labor costs for all private, part-time workers in the U.S. in December 2018 (Bureau of Labor Statistics, 2018).

O&M costs described above (\$10,400 for PVWCD and \$27,080 for the Lone Pine Ditch Company), PG1 C-1 Project is expected to reduce O&M by roughly \$44,000 in Year 2.⁵

Between 2011 and 2022, the District experienced three ditch failures of the Carnes Ditch, with average repair costs of roughly \$27,000 per incident (Birdsall, 2023-2025). This equates to an average annual cost of approximately \$6,700. Under the Modernization Alternative, this risk would be avoided, so we include \$6,700 as an annual benefit of avoided ditch repairs for PG2 Carnes Pipeline. When combined with the other annual O&M costs described above (\$13,600), PG2 Carnes Pipeline is expected to reduce O&M by roughly \$20,000 per year in Year 6.⁶

Installation of the Project would eliminate the need to replace some District infrastructure, including a headgate and three all-terrain vehicle (ATV) bridges in PG2 Carnes Pipeline, which the District expects would be replaced in Year 35 under the No Action Alternative. Replacing the headgate would cost an estimated \$40,000 and replacing each bridge would cost approximately \$5,000. The replaced headgate would have an expected useful life of 100 years, and the bridges would have expected useful lives of 50 years (Birdsall, 2023-2025). Because these replacement costs would be avoided under the Modernization Alternative, we include them as benefits to PG2 Carnes Pipeline. Accordingly, this analysis models a benefit of \$55,000 in Year 35 (when the bridges and headgate are replaced), and a benefit of \$15,000 in Year 85 when the bridges are replaced a second time.

Table D-4 below summarizes the OMR savings under the Modernization Alternative. In total, the discounted and annualized OMR benefits are estimated at \$72,000.

Table D-4. District OMR Savings of the Modernization Alternative, Powder River Watershed, Oregon, 2024 dollars¹

Project Group	Reduced Annual O&M in Year 5	Cost per Replacement	Replacement Years	Discounted Annual OMR Savings
PG1 C-1 Project	\$45,000	N/A	N/A	\$52,000
PG2 Carnes Pipeline	\$21,000	Headgate: \$40,000 Bridges: \$15,000	Headgate: 35 Bridges: 35, 85	\$20,000
PG3 Fish Screen & Passage	\$0	N/A	N/A	\$0
Total	\$66,000	N/A	N/A	\$72,000

Note: Totals may not sum due to rounding.

Prepared June 2026

1/ Price Base: 2024 dollars amortized over 100 years at a discount rate of 3.25 percent.

D.2.2.1.2 Avoided O&M Costs to PVWCD Patrons

The Modernization Alternative would reduce PVWCD patron O&M costs by reducing energy associated with pumping water onto fields and eliminating patron maintenance of turnout screens. The Modernization Alternative would provide partial gravity pressurization of the C-1 system. Currently, patrons served by C-1 ditches commonly rely on pumps to transport water from their turnouts to their fields, which increases patron energy costs. Farmers Conservation Alliance (FCA) estimates that energy use equating to 502,747 kilowatt-hours (kWh) per year would be avoided as a

⁵ Due to the expected annual increase in manager time, the avoided O&M cost for PG1 C-1 Project is projected to increase to nearly \$106,000 at the end of the project life in Year 100.

⁶ Due to the expected annual increase in manager time, the avoided O&M cost for PG2 Carnes Pipeline is projected to increase to roughly \$31,000 at the end of the project life in Year 102.

result of piping under PG1 C-1 Project. To estimate the value of these energy savings, we use Oregon Trail Electric Cooperative's tariff for small irrigation in the area: \$0.0515 per kWh (Oregon Trail Electric Cooperative, 2024). At this rate, the energy savings would be worth roughly \$26,000 per year, which is the annual energy benefit we attribute to PG1 C-1 Project under the Modernization Alternative.

Currently, PVWCD patrons rely on turnout screens to filter moss and other debris before transporting the water onto their fields. Checking and clearing these screens is a significant labor demand for patrons. One patron estimates that his screen requires checking twice per day most of the season and at least three times per day for a one-month period when moss grows the quickest. At 30 minutes per check and \$20 per hour for labor and vehicle costs, the cost per season to check the screen costs this patron approximately \$3,900 (Bingham, 2024). This patron operates about 650 acres, which results in an average cost of \$6 per acre (\$3,900 divided by 650 acres). Applying this cost to the entire area served by PG1 C-1 Project (2,030 acres) results in an estimated total annual cost of just over \$12,000. Accordingly, we estimate \$12,000 as annual patron O&M benefits of PG1 C-1 Project. The total discounted and annualized O&M benefits to PVWCD patrons are shown in Table D-5 below.

Table D-5. Avoided O&M Costs to Patrons Under the Modernization Alternative, Powder River Watershed, Oregon, 2024 dollars¹

Project Group	Annual Energy Savings (kWh/year)	Undiscounted Annual Energy Cost Savings	Annual Maintenance Savings	Discounted Annualized Benefits
PG1 C-1 Project	502,747	\$26,000	\$12,000	\$37,000
PG2 Carnes Pipeline	0	\$0	\$0	\$0
PG3 Fish Screen & Passage	0	\$0	\$0	\$0
Total	502,747	\$26,000	\$12,000	\$37,000

Note: Totals may not sum due to rounding.

Prepared June 2026

1/ Price Base: 2024 dollars amortized over 100 years at a discount rate of 3.25 percent.

D.2.2.1.3 Support to Instream Flow

Implementing the Modernization Alternative would result in water savings by eliminating seepage and evaporation from ditches. In this way, the Project would conserve an estimated 2,364 AFY per year (AFY). During years with no irrigation water shortages (approximately two-thirds of years), the District would leave all of the 2,364 AFY of water saved instream in Anthony Creek. During years with irrigation water shortages (approximately one-third of years, as described in detail below in Section 2.2.1.4), PVWCD would leave 490 AFY instream in Anthony Creek and dedicate 1,874 AFY to fulfill existing irrigation water rights. On average, over the 105-year project life, 1,739 AFY would increase instream flow in Anthony Creek. This section examines the value of this additional instream flow. The Project would also support additional instream flow in Dutch Creek, which is considered but not included in this analysis (see Section D.2.2.2.4).

The Oregon Department of Environmental Quality has identified water flow and quality challenges in several waterbodies in the Project area, including Anthony Creek and the North Powder River. Both of these waterbodies are included in Oregon's Integrated Report (previously Oregon's 303(d) list) for failing year-round to meet state water quality standards for temperature, making them

unsuitable for fish spawning and rearing (Oregon Department of Environmental Quality, 2024). Bull trout, a federally-listed threatened and state-listed sensitive species, have been found in Anthony Creek and the North Powder River, and both waterbodies are designated critical habitat for the species (Howell, 2017; U.S. Fish and Wildlife Service, 2010). Additional instream flow made possible by the Modernization Alternative could enhance habitat for bull trout and other aquatic species by increasing instream flow and reducing temperature impairment.

This section provides several types of information on the value of instream flow. First, the section presents available water market data for values paid by environmental or governmental groups to purchase water rights for instream flow. These values represent the cost of increasing instream flow and may significantly underestimate the full value of instream flow augmentation. While these values are in fact costs rather than a measurement of benefit, the amounts paid to enhance instream flow represent the minimum value to the funding entities of enhanced instream flow (benefits as perceived by funding entities are expected to at least equal costs, or funding would not be provided) and represent value only to funding entities and not all beneficiaries.

Data on water right transactions in the Powder River 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 data on the value of water rights to PVWCD irrigators, as this indicates the potential cost of purchasing water rights from these irrigators to augment instream flows in the Project area.

Taking into account the available data on the value of water transactions and the value of water to irrigators provided in the following discussion, we estimate that the economic benefit of instream flow augmentation would be at least \$80 per AFY. As discussed above, on average, the increase in instream flow from the Modernization Alternative is expected to be 1,739 AFY. Accordingly, the expected value of enhanced instream flow is estimated to be approximately \$139,000 per year (1,739 AFY multiplied by \$80 per AFY) once the Project is complete under the Modernization Alternative (\$124,000 when discounted and annualized). 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. The degree to which each of these benefits to the public is captured by the water right transaction data is not known as this would require understanding the purpose and intent of the purchaser in each water right transaction. However, given that one organization typically is the purchasing entity, and that organization may not be considering the full welfare benefits to all in society of instream flow augmentation, we expect that the full economic benefits of instream flow would exceed those estimated in this section. These additional benefits are described in Section D.2.2.2 below.

Values published in the economic literature are often quite high for enhancements to trout and other fish and wildlife populations (see Table D-6), such as those that would benefit from the instream flows provided by the Modernization Alternative. As quantitative information on how instream flows would improve fish and wildlife populations in the Project Area 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 for environmental water in the western United States. Table D-7 shows the estimated average annual benefits of enhanced instream flow for the Modernization Alternative.

Table D-6. Example Studies and Values of Fish Enhancement in the western United States.

Author(s)	Study Year	Original Value Per Household (Dollar Year)	Value Per Household Adjusted to 2024 dollars	Enhancement Location	Fish Enhancement	Survey Respondents
Layton, Brown, & Plummer	1999	\$171 - \$186 (1998\$)	\$305 - \$331	Eastern WA and Columbia River; Western WA and Puget Sound	Annual WTP per household to increase freshwater fish populations by 50%	Households in WA state
Loomis	2006	\$36 - \$149 (2004\$)	\$57 - \$235	Snake River in ID and WY	Mean net WTP per angler-day to double the number of fish caught or increase catch size by 25%	Anglers in southeastern ID and southwestern WY
Dalton, Bastian, Jacobs, & Wesche	2011	\$64 - \$227 (1998\$)	\$114 - \$404	Unidentified streams in WY	Consumer surplus per day for resident and tourist anglers for increasing the trout population or doubling the chance of catching a large trout	Anglers fishing in WY streams

Sources: (Loomis J. , 2006); (Layton, Brown, & Plummer, 1999); (Dalton, Bastian, Jacobs, & Wesche, 1998)

Prepared June 2026

Table D-7. Estimated Instream Flow Value of the Modernization Alternative, Powder River Watershed, Oregon, 2024 dollars¹

Project Group	Dedicated Instream Flow (AFY)	Average Annual Other Flow (AFY)²	Average Annual Additional Instream Flow (AFY)	Undiscounted Annual Benefit of Additional Instream Flow	Discounted Annualized Benefit of Instream Flow
PG1 C-1 Project	490	109	599	\$48,000	\$46,000
PG2 Carnes Pipeline	0	1,141	1,141	\$91,000	\$78,000
PG3 Fish Screen & Passage	0	0	0	\$0	\$0
Total	490	1,250	1,739	\$139,000	\$124,000

Note: Totals may not sum due to rounding.

Prepared June 2026

1/ Price Base: 2024 dollars amortized over 100 years at a discount rate of 3.25 percent.

2/ Represents the Project water dedicated to agriculture (1,874 AF) that is put instream in years PVWCD does not experience a water shortage (estimated to be two-thirds of years).

This value of \$80 per AF per year is based on the following information (see Table D-8):

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 \$1,970 per AF per year, with an average permanent sale transaction price of \$269 per AF per year. Among the 51 permanent water right purchases with the sales price and volume recorded in a water transaction database published by the UC Santa Barbara Bren School, the permanent sales price value in 29 transactions (57 percent of transactions) was above \$80 per AF per year. As discussed in detail below, these values are expected to provide a low range estimate of instream flow value to society.
2. *Value of water to irrigators in the Powder River Basin.* Low-value crop irrigators are likely the first to sell water for environmental purposes, which makes the value of water to low-value crop irrigators a key factor determining water sales and lease prices to environmental buyers in the Project area (i.e., the value of water to agriculture determines the willingness of the agricultural sellers to accept a price for water). As analyzed in detail in the following section, the marginal value of water (the value of each additional AF of water) to irrigators in PVWCD is estimated to range from approximately \$81 (marginal value of water to pasture) to \$280 per AFY (marginal value of water to alfalfa). However, the average value of water is estimated to range from approximately \$30 to \$120. These values are 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 value of water to agriculture determines the willingness of the agricultural sellers to accept a price for water), and because conserved water avoids potential future reductions in PVWCD deliveries.

Table D-8. Value per AF per Year of Water (Market Prices and Value to Agriculture), Powder River Watershed, Oregon, 2024 dollars

Type of Value	Low Value	High Value	Median Value	Average Value	Marginal Value
Permanent water right transaction in western U.S., 2000 to 2009 (<i>Converted to Annual Values</i>)	~\$0	\$1,970	~\$80	\$269	N/A
Marginal value of water to Powder River Basin hay and pasture irrigators (<i>Income Capitalization Approach</i>)	\$81	\$280	N/A	N/A	~\$150
Average value of water to Powder River Basin hay and pasture irrigators (<i>Income Capitalization Approach</i>)	\$30	\$130	N/A	~\$80	N/A

D.2.2.1.3.1 Past Costs Paid as a Proxy for Value

Water rights can be purchased or leased in Oregon. It is important to note that the value paid per AF 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.

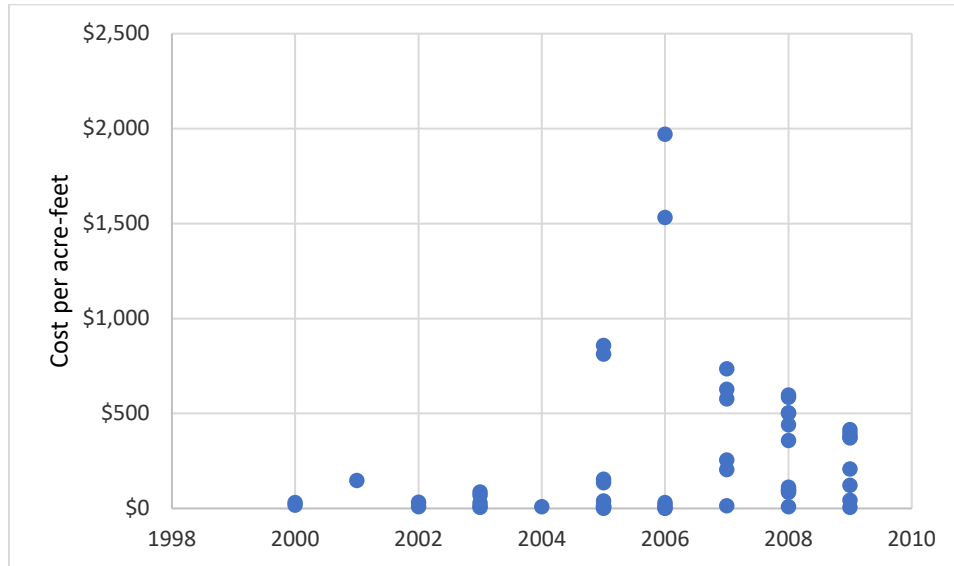
Water right leases and purchases for environmental purposes across the Western United States were analyzed in a 2003 paper (Loomis, Quattlebaum, Brown, & Alexander, 2003). During the period between 1995 and 1999, five water right purchases averaged \$427 per AF in Oregon, while six water right leases averaged \$200 per AFY.⁷ The paper also shows lease and purchase price by environmental use, including for riparian areas, wetlands, recreation, and instream flow. For instream flows in the Western U.S., the average purchase price across 18 transactions per AF was \$1,323, while across 35 lease transactions the annual price was \$80 per AF.

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 Figure D-1 and Figure D-2 show more recent (from 2000 to 2009) sales and leases of water rights by environmental buyers on a price per AF 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 \$300 per year while one-year leases typically fall below \$800 per AFY (with several transactions showing prices rising over a \$4,000 per AFY). Among the 51 permanent water right purchases with the sales price and volume recorded in the database, the sales price value in 29 transactions (57 percent) was above \$80 per AFY. However,

⁷ Values were adjusted from 1999 dollars to 2024 dollars using the GDPIPD.

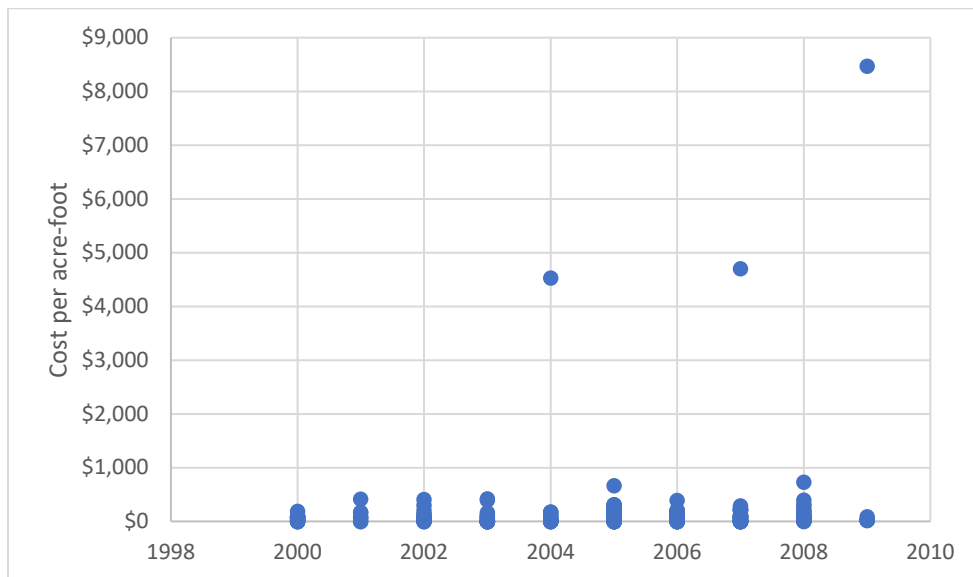
it is also important to note that the amount paid per AF tends to decline with an increase in water volume traded; weighting the purchase price by the water volume sold decreases the average permanent sale transaction price to \$24 per AFY.

Figure D-1. Western water right purchases for environmental purposes, 2000 to 2009, price paid per acre-foot per year, 2024 dollars



Note: Purchase prices were adjusted to 2024 dollars using the GDPIPD and then amortized using a 3.25-percent interest rate and a 100-year period to derive dollar per AFY values.

Figure D-2. One-year water leases for environmental purposes, price paid per acre-foot in Western United States, 2024 dollars



Note: Purchase prices were adjusted to 2024 dollars using the GDPIPD.

D.2.2.1.4 Agricultural Damage Reduction Benefits

As explained in Section 2.2.1.4 above, the Modernization Alternative is expected to conserve roughly 2,364 AFY, of which the District plans to dedicate 1,874 AFY to augment the supply of

irrigation water available to the District. Historically, PVWCD has experienced years in which water supply is less than total crop water demand in the district, resulting in reduced crop yields and agricultural damages. Our analysis (further explained below) indicates that water shortages reduce crop yields in roughly one-third of years (in the other two-thirds of years, conserved water would increase instream flows and is valued in the next section). As such, on average, approximately 625 AFY (one-third of 1,874 AFY) of conserved water on average would enhance irrigation water supply and reduce agricultural damages. The rest of this section describes the economic benefit of the conserved water to PVWCD farms in reducing crop damages.

This analysis estimates the economic benefit of additional water to PVWCD by modeling the benefits of increased alfalfa hay and pasture production, which make up the majority of irrigated lands within PVWCD (approximately 72 percent). District patrons cultivate a limited acreage of higher-value crops, such as potatoes (3 percent), which could suffer greater economic damage than hay or pasture if impacted by water shortages. Because this analysis focuses on the impacts only to hay and pasture and does not include potential impacts to higher value crops grown in PVWCD, the benefits presented in this section may underestimate the benefits of additional water to PVWCD. In other words, if future PVWCD water shortages reduce acreage or yields of higher-value crops, the value of additional water to PVWCD would be higher than is presented here.

We adapted published university crop budgets and customized the budgets based on local conditions to model the costs and revenues of producing alfalfa and pasture in PVWCD with and without the Modernization Alternative. The difference in net income with additional water is used to estimate the marginal value of conserved water. The alfalfa budget is based on a budget published by the University of Idaho (UI) and the pasture budget is based on a budget published by the University of California, Davis. From these source budgets, we developed crop budgets to model the net returns to alfalfa hay and pasture under the No Action and Modernization Alternatives. These budgets are provided in Section 4 beginning on page D-81. Section 4 also has a detailed explanation of the methods used to update revenues and costs to 2024-dollar values.

To estimate the frequency and severity of water shortages, we combine District records of water supplies (see data and analysis presented in NEE Appendix Section 4.4) and public data on crop evapotranspiration (ET) requirements and precipitation. This analysis is summarized in Table D-9. As shown in the table, in recent years (2001 to 2024) water shortages have resulted in reduced pasture yields in roughly one-third of years, during which the average water supply was 28 percent lower than a full water supply. Alfalfa, which has a lower irrigation requirement than pasture due to more efficient irrigation methods, is also affected by water shortages in an estimated 21 percent of years, during which the average water supply is 35 percent lower than a full water supply. This analysis assumes that future hydrology and the frequency and severity of water shortages is like the hydrology experienced in recent years (2001 to 2024). To the extent that the region experiences more drought, this assumption would cause the analysis to underestimate economic benefits of the Modernization Alternative. If the region experiences less drought, the assumption would cause an overestimation of economic benefits of the Project.

Table D-9. Summary of Crop Water Requirements and Historic Water Shortages by Crop, Powder River Watershed, Oregon, 2024 dollars

Variable/ Calculation	Metric	Pasture	Alfalfa
A	Evapotranspiration needs of crop (in acre-feet per acre) ¹	2.0	2.5
B	Average precipitation during the irrigation season (in feet) ²	0.4	0.4
C=A-B	Remaining consumptive water need (in acre-feet per acre) ³	1.6	2.1
D	Irrigation efficiency ⁴	50%	75%
E=C/D	Applied water demand (in acre-feet per acre) ⁵	3.2	2.8
F=% of Years Water Supply is <E	Percent of years PVWCD has a water shortage impacting crop, and conserved water would go to crop ⁶	33%	21%
G	Average historic water supply in water-short years when crop is impacted (in acre-feet per acre)	2.3	1.8
H=1- G/E	Average historic percent water supply shortage when crop is impacted	28%	35%

1/ Source: (Bureau of Reclamation, 2015)

Prepared June 2026

2/ Average between April and September from 1990 to 2024. Source: (National Oceanic and Atmospheric Administration, 2024)

3/ Equal to total ET requirement minus the water provided by precipitation

4/ Most pasture in the District is flood irrigated (which has a general efficiency of 40% to 60%) while most alfalfa in the District is sprinkler irrigated (which is roughly 75% efficient) (Birdsall, 2023-2025).

5/ Equal to the remaining consumptive need divided by the irrigation efficiency.

6/ The frequency that the District water supply per acre is less than applied crop water demand, based on District records of water supplies from 2001 to 2024 (Birdsall, 2023-2025).

Using the data from Table D-8, we model the impacts of water shortages on crop yields and associated revenues under both the No Action and Modernization alternatives. The difference between these two scenarios represents the benefit of the conserved water to agriculture of the Modernization Alternative. Under the Modernization Alternative, in approximately one-third of years, 1,874 AF of saved water would help mitigate the impact of water shortages. This amount of water, spread evenly across the roughly 12,649 acres served by the Project area, would represent an increase of about 0.15 AF per acre. We use this increase in water to model the increase in crop yields, based on an estimated linear, proportional crop-yield response (e.g., a 10% increase in water supply results in a 10% increase in yield).⁸ Some growers may also concentrate the increased water supply on a portion of their acreage (i.e., instead of applying 0.15 AF per acre on every acre, growers may apply 1 AF on 15 percent of acres); since we model yields as proportional to water application, the net benefits of this on-farm strategy would be approximately equal to the benefits modeled in this analysis.

The analysis in Section 4 (NEE Appendix) describes the crop budget method used to estimate the net revenues under both the No Action and Modernization alternatives. The results of this analysis are summarized in Table D-10. As the table shows, in water shortage years, the Project is expected to increase net returns per acre for pasture from \$92 to \$104 (an increase of \$12 per acre). This translates to a marginal value of water of \$81 per AFY for pasture (\$12 divided by 0.15 AF per acre). For alfalfa, in water short years, the Project is expected to increase net returns per acre for alfalfa

⁸ This follows the guidance of an OSU Extension agent (Bohle, 2018) and publications on alfalfa yield response to water, including (UN Food and Agricultural Organization, 2012).

from \$106 to \$147 (an increase of \$41 per acre in each water short year). This translates to a marginal value of \$280 per AFY for alfalfa (\$41 divided by 0.15 AFY). Note that this is the expected increased value of additional irrigation water; this marginal value of water is much higher than the average value of applied water (\$30 to \$130 per AFY depending on crop and water year type).

Table D-10. Summary of Crop Budget Method Results, Powder River Watershed, Oregon, 2024 dollars

Metric	No Action Alternative Pasture	No Action Alternative Alfalfa	Modernization Alternative Pasture	Modernization Alternative Alfalfa
Net returns per acre per year ¹	\$92	\$106	\$104	\$147
Marginal net returns (\$/acre/year)	N/A	N/A	\$12	\$41
Additional water under Project (AF/acre)	N/A	N/A	0.15	0.15
Marginal returns to water (\$/AFY)	N/A	N/A	\$81	\$280

1/ Based on Highland Economics analysis summarized in Section 4.

Prepared June 2026

To estimate an average value of conserved water used to reduce agricultural damages in water short years, we weight the marginal values of water to alfalfa and pasture by the amount of water going to each crop and the frequency (i.e., percentage of years) the water is applied to each crop in water short years. Under the No Action Alternative, in roughly 12 percent of all years, only pasture yields will be impacted by water shortages, and in about 21 percent of all years, alfalfa and pasture yields will both be impacted (as described above). This means that, in years with water shortages that impact crop yields (i.e., the years when water is going to agriculture and not to augment instream flows), pasture yields will be affected in 36 percent of water-short years, during which alfalfa yields will not be impacted. In these years, water conserved under the Modernization Alternative would generate an estimated value of approximately \$81 per AF (the marginal value to pasture).

For 21 percent of all years under the Modernization Alternative and 64 percent of water-short, crop-affected years, the saved water would enhance both alfalfa and pasture yields. USDA CropScape data indicates the Project area consists of roughly 51 percent alfalfa, 37 percent pasture, and the remainder being other crops.⁹ Using these percentages and the need for on-farm irrigation, we estimate that about 55 percent of the saved water would go to alfalfa and 45 percent would go to pasture in the years where both crops are impacted by water shortages. Accordingly, 55 percent of the water would generate benefits of \$280 per AF (for alfalfa) and 45 percent of the water would generate benefits of \$81 per AF (for pasture). This results in a weighted average value of water of \$190 per AF in the years when both alfalfa and pasture yields are impacted by water shortages.

To summarize, in years when crop yields are impacted by water shortages, the saved water will provide benefits of \$81 per AF in about 36 percent of these years, and in the other 64 percent, the water will generate average benefits of roughly \$190 per AF. Based on these values, the weighted average value of saved water in years when crop yields are impacted is \$150 per AF. We use this amount to represent the value of saved water to agriculture under the Modernization Alternative in the one-third of years when water shortages reduce crop yields (Table D-11).

⁹ Based on Highland Economics' analysis of CropScape data in the Project area (USDA National Agricultural Statistics Service, 2024).

Table D-11. Value of Conserved Water Applied to Crops, Powder River Watershed, Oregon, 2024 dollars

Variable	Pasture-Only Impacts - Pasture	Pasture-Only Impacts - Alfalfa	Pasture & Alfalfa Impacts - Pasture	Pasture & Alfalfa Impacts - Alfalfa
Marginal value of water by Crop Type (\$/AF)	\$81	\$280	\$81	\$280
Percentage of conserved water allocated to each crop ¹	100%	0%	45%	55%
Weighted average, marginal value of conserved water (\$/AF) ²	\$81	\$81	\$190	\$190
In crop-impacted water years, likelihood of which crops impacted ³	36%	36%	64%	64%
Weighted average, marginal value of conserved water applied to crops in crop-impacted years (\$/AF) ⁴	\$150	\$150	\$150	\$150

Prepared June 2026

1/ Only pasture yields are impacted under a 28% water shortage. Water allocations under a 35% water shortage are allocated based on the estimated relative acreages in the Project area crop mix and the irrigation need of each crop.

2/ Weighted by the allocation of water between crops shown in the row above.

3/ Pasture yield is reduced by water shortages in 33% of water years, while alfalfa and pasture yields both are reduced in 21% of water years. As such, in years when crops are impacted by water shortages, 64% of the time (21% divided by 33%) both crops are affected, and in the remaining 36% of the time, only pasture is affected.

4/ Weighted by the frequency of each water shortage shown in the row above.

While the District plans to allocate 1,874 AF to augment the supply of irrigation water under the Modernization Alternative, according to the above analysis, this water would contribute to crop yields in roughly one-third of years. As a result, the average annual water use contributing to crop yield would be 625 AF (1,874 multiplied by 1/3). At a value of \$150 per AFY, each year of Project life would bring expected annual benefits of roughly \$93,000 (\$150 per AFY multiplied by 625 AFY). When discounted and annualized over the period of analysis, the agricultural damage reduction benefits of the Modernization Alternative would be \$81,000, as shown in Table D-12.

Table D-12. Avoided Damages to Crop Yields Under the Modernization Alternative by Project Group, Powder River Watershed, Oregon, 2024 dollars¹

Project Group	Conserved Water Available for Irrigation (AFY)	Average Annual Water Contributing to Yields (AFY) ²	Undiscounted Average Annual Benefit	Annualized Average Net Benefits
PG1 C-1 Project	163	54	\$8,000	\$8,000
PG2 Carnes Pipeline	1,711	570	\$85,000	\$73,000
PG3 Fish Screen & Passage	0	0	\$0	\$0
Total	1,874	625	\$93,000	\$81,000

Note: Totals may not sum due to rounding.

Prepared June 2026

1/ Price base: 2024 dollars amortized over 100 years at a discount rate of 3.25 percent.

2/ The saved water dedicated to irrigation would contribute to crop yields in an estimated 33% of years.

In addition to enhancing crop yields, the Modernization Alternative would help reduce agricultural damages by eliminating water interruptions during ditch failures. When District ditches fail, the water supply to irrigators can be interrupted, which can harm agricultural production. This occurs regularly on an annual basis; a three-day water supply interruption every year is typical in the area served by PG1 C-1 Project. Every two to three years, a large ditch failure results in a 7- to 12-day water supply interruption (Wilson, 2024). We estimate the value of avoiding these interruptions by estimating the value of pasture production lost due to the interruptions. Given the frequency of interruptions described above, the average annual water supply interruption is approximately 5.7 days. In an irrigation season that lasts approximately 169 days (from April 15th to October 1st), the average 5.7-day interruption would represent approximately 3 percent of the total season's irrigation.

To value the effect of irrigation water interruption on pasture production, we estimated the equivalent amount of hay that would be needed to replace the pasture as cattle feed. One animal-unit month (AUM) is approximately equivalent to 750 pounds (0.375 tons) of hay (Stam, Scasta, & Thacker, 2018). We estimate the yield of pasture under full irrigation in PVWCD based on data from the NRCS Web Soil Survey and USDA's CropScape (USDA National Agricultural Statistics Service, 2024; Natural Resources Conservation Service, 2024), which indicates that irrigated pasture in the Project area had an average potential yield of 12.2 AUM per acre. We apply a 25 percent utilization rate to this potential yield to account for the amount consumed by the cattle. Given these data, we estimate that approximately 1.14 tons of hay would be required to replace the feed produced by an acre of pasture (12.2 AUM multiplied by 25 percent, multiplied by 0.375 tons per AUM). The yield lost as a result of the average water interruption (5.7 days comprising 3-percent of the season's total irrigation deliveries), would be approximately 0.04 tons per acre (1.14 multiplied by 0.03).

To value this amount of hay, we use a modified NRCS method to calculate the normalized average price of all hay in Oregon, which resulted in an estimated price of \$265 per ton.¹⁰ At this price, 0.04 tons of hay would cost about \$10. We use this cost (\$10 per acre) to represent the value of pasture production lost during the average water interruption. This may be an underestimate, as pasture is a low-value crop, and PG1 C-1 Project also serves higher-value crops than pasture that may lose greater economic value under a water interruption; it may also be an overestimate if soil moisture

¹⁰ We use the NRCS's method of calculating the normalized price of hay at the state level using data from 2019 to 2023 and adjusting prices for inflation prior to averaging. Prices were taken from the USDA National Agricultural Statistics Service's (NASS) Quickstats database (USDA National Agricultural Statistics Service, 2024).

can be maintained throughout the supply interruption based on timing of prior irrigations or precipitation.

PG1 C-1 Project serves 2,030 acres, indicating that up to 2,030 acres could potentially suffer from water interruptions. At a cost of \$10 per acre (assuming 5.7 days), a water interruption on the C-1 could cause up to \$20,800 in damages if the entire area were cut off during the interruption. Less damage would occur if service were disrupted to only part of the acres served by PG1 C-1 Project.

The Modernization Alternative is expected to reduce water interruptions by between 30 and 60 percent (Wilson, 2024).¹¹ Using an average reduction of 45 percent, and assuming that, on average, an interruption impacts half of the C-1 area,¹² the average annual benefit of avoiding damages from a complete water supply interruption would be just under \$5,000 (\$20,800 multiplied by 45 percent multiplied by 50 percent). We include this amount as the annual benefit of PG1 C-1 Project.¹³

The Carnes ditch also experiences failures that interrupt the supply of water to PVWCD. Because the Carnes ditch only serves one agricultural producer, and because the length and frequency of interruptions results in an estimated loss to the producer that averages less than \$300 per year, we do not model these damages in this analysis. However, because the Carnes ditch conveys water to the reservoirs that supply the District, past failures have resulted in water losses that reduce the District's total water supply. Between 2019 and 2023, the average annual water loss from Carnes ditch failures was roughly 111 AFY.¹⁴ We use this rate to model the average annual future water lost due to Carnes ditch failures under the No Action Alternative.

According to District records from 2001 to 2024, PVWCD experienced a less than full water supply in approximately 42 percent of years (Birdsall, 2023-2025).¹⁵ We use this rate to model the frequency of water shortages under the No Action Alternative. During water-short years, the loss of water resulting from a Carnes ditch failure would exacerbate water shortages and contribute to yield losses. We estimate the damage to agricultural yield using the rate derived above and shown in Table D-11: \$150 per AF. At this rate, the loss of 111 AFY would cause total damages of approximately \$16,600 in water-short years.

Because PG2 Carnes Pipeline would eliminate Carnes ditch failures, the avoided agricultural damage is considered a benefit of the Modernization Alternative. Given that damages of roughly \$16,600 would be avoided in approximately 42 percent of years (i.e., only years with shortages), the average annual benefit of avoiding water supply losses would be around \$7,000 for PG2 Carnes Pipeline. The value of avoiding water supply interruptions for the Modernization Alternative is summarized in Table D-13.

¹¹ Some ditches in the C-1 Project area would not be piped under the Modernization Alternative, and therefore could still experience failures and cause water interruptions under the Modernization Alternative (Wilson, 2024).

¹² A roughly equal probability of failure at any point in the ditch would result in roughly half the service area experiencing an interrupted water supply (Wilson, 2024).

¹³ If the water supply interruptions impact more than half the total area served by PG1 C-1 Project, the damages would be more than those estimated and less if the area affected was less than half the service area.

¹⁴ One failure in 2022 resulted in a loss of 50 cfs lasting five days (for an equivalent of 496 AF) and a failure in 2023 resulted in a loss of 10 cfs for approximately three days (for an equivalent of 60 cfs) (Birdsall, 2023-2025). There were other failures of the Carnes ditch from 2019 to 2023 that resulted in lost water, but the amount is likely much less than the two examples provided, so they are not considered in this analysis.

¹⁵ See Section 4.4 in the Appendix.

Table D-13. Avoided Agricultural Damage from Ditch Failure, Powder River Watershed, Oregon, 2024 dollars¹

Project Group	Undiscounted Average Annual Value of Avoided Damages	Discounted and Annualized Value of Avoided Damages
PG1 C-1 Project	\$5,000	\$5,000
PG2 Carnes Pipeline	\$7,000	\$6,000
PG3 Fish Screen & Passage	\$0	\$0
Total	\$12,000	\$11,000

Note: Totals may not sum due to rounding.

Prepared June 2026

1/ Price Base: 2024 dollars amortized over 100 years at a discount rate of 3.25 percent.

D.2.2.2 Benefits Considered but Not Included in the Analysis

D.2.2.2.1 Recreational Benefits

The Modernization Alternative would conserve approximately 2,364 acre-feet (AF) of water per year through reduced seepage and evaporation from open ditches. Minimizing water loss within the District's water conveyance system would lead to a greater volume of water reaching Pilcher Creek and Wolf Creek reservoirs during water-short years and more efficient allocation of water from these storage facilities. Overall, the reservoirs would be expected to fill earlier in the season and there would be an increased likelihood of having more water in the reservoirs at the end of the irrigation season, resulting in an overall increase in stored volume throughout the irrigation season compared to those under the No Action Alternative. Both reservoirs have boat ramps that require sufficient water levels to be accessible. When water levels are not high enough to reach the boat ramps, water-based recreation at the reservoirs is limited. Because the Project's conserved water would keep water levels in the reservoirs higher for longer periods, the Project has the potential to increase the amount of time the boat ramps are usable, thereby increasing recreation access and associated value at the reservoirs.

Popular recreational activities at Pilcher Creek and Wolf Creek reservoirs include relaxing, observing nature, camping, hunting, and fishing (Union County, 2023; Union County, 2023). Both reservoirs feature stocked trout and black crappie (Oregon Department of Fish & Wildlife, 2023). Motorized water activities, such as jet skiing and water skiing, are popular at Wolf Creek, while non-motorized activities, such as kayaking, canoeing, and paddleboarding, are more popular at Pilcher Creek due to a five-mile-per-hour speed limit. By expanding the amount of time the boat ramp is usable, the Modernization Alternative would expand recreational opportunities for ramp-dependent recreation.

Under the Modernization Alternative, the 2,364 AF of water conserved by the Project would increase the total amount of water stored in the reservoirs compared to water-short years under the No Action Alternative. According to the District, the conserved water from the Project would likely be stored roughly evenly between Wolf Creek and Pilcher Creek reservoirs, potentially adding 1,182 AF to each reservoir in some years (Birdsall, 2023-2025). The addition of conserved water would cause the reservoirs to fill more quickly and empty more slowly during the year. To calculate a change in water levels over the course of the season, we used reservoir records from the District for two normal years (fall 2010 to fall 2011 and fall 2019 to fall 2020) and two dry years (fall 2006 to fall 2007 and winter to fall 2015). These records included a time-based accounting of the water level elevation, the total storage remaining in the reservoir, and the water level necessary to enable use of the boat ramps.

We calculated post-Project water levels by adding half of 2,364 AF to each reservoir in each water year type and determined when the storage level would drop below what is necessary to meet the boat ramp. When the water drops below the boat ramp, it is not possible to launch a boat. While some recreation is possible without use of the boat ramps (such as camping and hiking), the use of boat ramps is a primary recreational attraction of the reservoirs according to local recreation managers, and therefore recreation is likely to decrease drastically when the water levels are lower than the ramps (Ford, 2023; Wright, 2023).

According to District data, the water level at Pilcher Creek Reservoir reaches the bottom of the boat ramp at 3,930 feet of elevation, or 684.5 AF of water stored. At Wolf Creek Reservoir, the water reaches the bottom of the boat ramp at 3,645 feet of elevation and 2,804 AF of water stored. Input from recreation managers indicates that recreation tends to decrease significantly around Labor Day, aligning with dropping water levels and cooler weather. Based on this guidance, we used Labor Day as the end of the peak recreation season and calculated the potential number of days that the Project would extend the recreation season.

In normal water years for which there were data (2010-2011 and 2019-2020), water levels at Pilcher Creek Reservoir remained above the boat ramps well past Labor Day, and until at least after October 3rd (in 2011) and October 19th (in 2020), after which there are no data.¹⁶ Because the data are incomplete, it is unclear if water levels ever dropped below the boat ramp during these normal water years. Based on these data, the Project is not expected to impact recreation in Pilcher Creek Reservoir during normal water years.

At Wolf Creek Reservoir in 2010-2011, water levels remained above the boat ramp until at least October 3rd, after which there are no data.¹⁷ In 2019-2020, the water dropped below the bottom of the boat ramp sometime between September 21st and 28th. In both seasons, the water levels fell below the ramp after the peak season, and therefore the additional Project water would not have impacted recreational access during the peak season. Based on the data, it is unclear whether the Project water would have allowed for ramp access in the 2010-2011 shoulder season; but in 2019-2020, the additional water from the Project would have increased shoulder season ramp access by at least 35 days.

In the dry water season of 2006-2007, Pilcher Creek Reservoir water levels fell below the bottom of the boat ramp by October 1, 2006, at the latest, and again on August 14, 2007. We expect that Project water would have expanded shoulder season access to the boat ramp by at least 31 days in fall 2006, expanded peak season access by about 20 days in fall 2007, and expanded shoulder season access by about one week in fall 2007. In 2015 (another dry water year), water levels at Pilcher Creek Reservoir fell below the boat ramp between August 31st and October 7th. Water from the Project would have kept water levels above the boat ramp until at least November 3rd, expanding recreational access in the shoulder season by at least 27 days and possibly adding up to one week of access to the peak season.

At Wolf Creek Reservoir in 2007, the water was below the bottom of the boat ramp between February 1st and 26th. Access to the boat ramp was possible after February 26th through at least mid-June. Water levels again fell below the boat ramp between June 20th and 29th, eliminating access

¹⁶ The dates related to each gage reading cannot be conclusively established because dates were recorded sporadically in the water storage tables.

¹⁷ The dates related to each gage reading cannot be conclusively established because dates were recorded sporadically in the water storage tables.

through at least August 6th (and likely through the remainder of the peak season, although the data are incomplete). With the Project conserved water, shoulder season ramp access would have been expanded by at least seven days, and peak season access would have been expanded by at least 11 days in the summer. In 2015, the Wolf Creek Reservoir boat ramp was inaccessible by June 13th. Had the Project water been available, we estimate that access to the ramp would have been possible for an additional 28 days during the peak recreation season.

In summary, based on the data available, saved water from the Project is not expected to impact recreation in Pilcher Creek Reservoir during normal water years, but could enable additional ramp access at Wolf Creek Reservoir in the shoulder season. In dry water years, Project water could potentially expand peak season access to the Pilcher Creek Reservoir boat ramp by up to seven to 20 days (depending on the timing and release of conserved water) and shoulder season access by one week to a month. Recreational activities benefited by Project water in Pilcher Creek Reservoir could include kayaking, canoeing, and paddleboarding; however, these activities could be launched from locations other than the boat ramps. In Wolf Creek Reservoir in dry years, Project water could expand boat ramp recreation by just under a month in the peak season and by one week in the shoulder season, based on the available data. Recreational activities benefited by Project water in Wolf Creek Reservoir could include boat fishing, tubing, jet skiing, and water skiing.

Quantifying recreation benefits would require estimates of recreation activity participation at the reservoirs over the course of the year. However, the reservoirs' recreation managers do not collect visitation data and were unable to provide approximate visitation estimates for the reservoirs (Ford, 2023; Wright, 2023). Based on similar recreational sites in Oregon and Washington, annual visitation at Wolf Creek and Pilcher Creek reservoirs may be between 10,000 and 40,000 visitors per year. Due to the lack of visitation data specific to Wolf Creek and Pilcher Creek reservoirs, uncertainty regarding the effects of changes in reservoir levels on recreation visitation and value, and the relatively few days of increased boat access during the peak recreation season, we do not quantitatively estimate the economic value of the enhanced recreation access made possible by the Project.

D.2.2.2.2 Ecological Benefits of the Fish Screen

PG3 Fish Screen & Passage would install a fish screen and new diversion structure at the Carnes Diversion on the North Fork of Anthony Creek. This would prevent fish from becoming entrained in the Carnes Ditch and provide fish passage in North Fork Anthony Creek at the Carnes Diversion, thereby helping to protect fish populations. Removal of the fish passage barrier in North Fork Anthony Creek would enhance connectivity, allowing fish to better access critical habitats needed for each stage of their life history. The North Fork of Anthony Creek is designated critical habitat for bull trout, a federally-listed threatened and state-listed sensitive species (Howell, 2017; U.S. Fish and Wildlife Service, 2010). The Carnes Diversion dam has been identified as a priority barrier for removal by ODFW, and passage improvements would have significant benefits to local populations of bull trout, Columbia River redband trout, and important game fish. During agency coordination, ODFW and USFWS were strong proponents of the fish screen and passage improvements at Carnes Diversion due to its benefits to local fish populations. PG3 Fish Screen & Passage could eliminate entrainment risk, thereby increasing the survival of bull trout and other fish species and generating moderate long-term benefit on resident fish species.

This analysis does not quantify the ecological benefits of PG3 Fish Screen & Passage for two reasons: 1) lack of data regarding local fish populations, and 2) uncertainty regarding the likely number of fish saved by the fish screen. While bull and brook trout have been observed in the

North Fork of Anthony Creek, there do not appear to be estimates of their population (or the population of other fish species). This makes it difficult to determine the magnitude of impact the fish screen and passage may have on protecting fish populations. Because there are other diversions downstream (some belonging to PVWCD and some owned by other entities), it is uncertain how effective the screen would be in preventing the total number of fish entrained. The screen may prevent entrainment upstream, but the surviving fish may become entrained at downstream diversions. Given the lack of data and uncertain benefits, we do not attempt to quantify the ecological benefits of PG3 Fish Screen & Passage.

D.2.2.2.3 Avoided Costs of Air Emissions

By reducing electricity use, the Modernization Alternative would reduce harmful air emissions. As described in Section 2.2.1.2, the PG1 C-1 Project is expected to decrease annual energy use by almost 503,000 kWh, or 503 megawatt-hours (MWh). Assuming the energy source for the electricity generation is fossil fuels, the decrease in energy use under the Modernization Alternative would result in less fossil fuels being burned to produce energy than would be burned under the No Action Alternative. This would, in turn, reduce air emissions harmful to human health and wellbeing produced during combustion of the fuels. However, more than 94 percent of the power Oregon Trail Electric Cooperative receives from Bonneville Power Administration is generated from renewable sources (Oregon Trail Electric Cooperative, 2025), so it is not clear how much air emissions would be reduced by the Modernization Alternative. Due to this uncertainty and the relatively small magnitude of MWh reduced by the project, we do not quantify the value of air emission reductions in this analysis.

D.2.2.2.4 Support to Dutch Creek Instream Flow

As a result of the project, water from Dutch Creek would no longer be diverted into Carnes Ditch. The previously diverted water, estimated at up to 2.8 cfs based on measurements taken during one year in the month of May, would increase flows within Dutch Creek downslope of Carnes Ditch and in Anthony Creek (below RM 4) and North Powder River (below RM 9.7) during May and June in all years. Due to the limited measurements quantifying the amount of water that would be added to Dutch Creek and relatively short timespan of benefit (i.e., only May and June), we do not quantify the value of additional water instream flow in this analysis.

D.2.2.3 Summary of NEE Benefits

Table D-14 summarizes the quantified benefits of the Modernization Alternative over the No Action Alternative (NWPM 506.20, Economic Table 5a).

Table D-14. Economic Table 5a – Estimated Average Annual Watershed Protection Damage-Reduction Benefits, Powder Valley Water Control District Watershed Plan, Powder River Basin Watershed.

Project Group 1 (C-1 project) On-Site Damage Reduction Benefits	Agricultural- Related	Non-Agricultural Related
Agricultural Yield Enhancement	\$13,000	\$0
Other – Reduced Patron O&M	\$37,000	\$0
Other – Reduced District OMR	\$52,000	\$0

Appendix D: Investigation and Analyses Report

On-site Subtotal	\$102,000	\$0
Project Group 1 (C-1 project) Off-Site Damage Reduction Benefits	Agricultural- Related	Non-Agricultural Related
Instream Flow Value	\$0	\$46,000
Off-site Quantified Subtotal	\$0	\$46,000
Total Quantified Benefits	\$102,000	\$46,000
Project Group 2 (Carnes Pipeline) On-Site Damage Reduction Benefits	Agricultural- Related	Non-Agricultural Related
Agricultural Yield Enhancement	\$79,000	\$0
Other – Reduced Patron O&M	\$0	\$0
Other – Reduced District OMR	\$20,000	\$0
On-site Subtotal	\$99,000	\$0
Project Group 2 (Carnes Pipeline) Off-Site Damage Reduction Benefits	Agricultural- Related	Non-Agricultural Related
Instream Flow Value	\$0	\$78,000
Off-site Quantified Subtotal	\$0	\$78,000
Total Quantified Benefits	\$99,000	\$78,000
Project Group 3 (Carnes Fish Screen and Passage) On-Site Damage Reduction Benefits	Agricultural- Related	Non-Agricultural Related
Agricultural Yield Enhancement	\$0	\$0
Other – Reduced Patron O&M	\$0	\$0
Other – Reduced District OMR	\$0	\$0
On-site Subtotal	\$0	\$0
Project Group 3 (Carnes Fish Screen and Passage) Off-Site Damage Reduction Benefits	Agricultural- Related	Non-Agricultural Related
Instream Flow Value	\$0	\$0
Off-site Quantified Subtotal	\$0	\$0
Total Quantified Benefits	\$0	\$0

Note: Totals may not sum due to rounding.

Prepared June 2026

^{1/} Price base: 2024 dollars amortized over 100 years at a discount rate of 3.25 percent.

D.2.3 NEE Benefits Compared to Costs

This section compares the benefits and costs of the Modernization Alternative to the No Action Alternative, which equate to the NEE benefits and costs of the Modernization Alternative. Across all project groups, the Modernization Alternative would provide annual average benefits of approximately \$325,000 at an annual average cost of \$933,000. The result is net average annual NEE benefits of -\$608,000. The NEE costs and benefits are summarized in Table D-15, which corresponds to NWPM 506.21 Economic Table 6.

Table D-15. Economic Table 6 – Comparison of Average Annual National Economic Development Costs and Benefits, Powder Valley Water Control District Watershed Plan, Powder River Basin Watershed, Oregon, 2024\$.¹

Works of Improvement	Agriculture-Related Agricultural Benefits	Agriculture-Related Reduced Patron O&M	Agriculture-Related Reduced District OM&R	Non-Agricultural Instream Flow Value	Average Annual Benefits	Average Annual Cost ²	Benefit Cost Ratio
PG1 C-1 project	\$13,000	\$37,000	\$52,000	\$46,000	\$148,000	\$357,000	0.41
PG2 Carnes Pipeline	\$79,000	\$0	\$20,000	\$78,000	\$177,000	\$465,000	0.38
PG3 Carnes Fish Screen and Passage	\$0	\$0	\$0	\$0	\$0	\$111,000	0.00
Total	\$92,000	\$37,000	\$72,000	\$124,000	\$325,000	\$933,000	0.35

Notes:

^{1/} Price base: 2024 dollars amortized over 100 years at a discount rate of 3.25 percent.

O&M = operation and maintenance

OM&R = operation, maintenance, and replacement

^{2/} From Economic Table 4

Prepared: June 2025

D.2.4 Incremental Analysis

The Modernization Alternative is evaluated using an incremental analysis, which identifies how total costs and benefits change as project groups are added (or removed). The design and cost/benefit of each project group is independent of the number of project groups included and the order in which they are installed. Table D-16 presents the incremental costs and benefits of the Modernization Alternative.

Table D-16. Incremental Analysis of Annual NEE Costs and Benefits Under the Modernization Alternative, Powder Valley, Oregon, 2024 dollars¹

Project Groups	Total Costs	Incremental Costs	Total Quantified Benefits	Incremental Benefits	Net Benefits
1	\$357,000	N/A	\$148,000	N/A	-\$209,000
1, 2	\$822,000	\$465,000	\$325,000	\$177,000	-\$497,000
1, 2, 3	\$933,000	\$111,000	\$325,000	Positive, Not Quantified	-\$608,000

1/ Price Based: 2024 dollars

Prepared June 2026

D.2.5 Preferred Alternative

NRCS and the District agree that the Modernization Alternative is the Preferred Alternative. NRCS has selected the Modernization Alternative based on its ability to meet the purpose and need for the project, best address the Federal Objective and Guiding Principles, and provide the most beneficial effects on environmental, social, and economic resources. The Preferred Alternative would have annual average benefits of approximately \$325,000 and an annual average cost of \$933,000, with a benefit cost ratio of 0.32. The net average annual benefits would be -\$608,000.

D.3 References

- Bingham, J. (2024, October 14). PVWCD patron. (W. Oakley, Interviewer)
- Birdsall, D. (2023-2025). Manager, Powder Valley Water Control District. (W. Oakley, Interviewer)
- Bohle, M. (2018, February 20). OSU Extension Agent. (W. Oakley, Interviewer)
- Bren School of Environmental Science & Management, University of California, Santa Barbara. (2017, February 22). Water Transfer Data. Retrieved from http://www.bren.ucsb.edu/news/water_transfers.htm
- Bureau of Labor Statistics. (2018, December). Table 11. Private industry, by occupational group and full-time and part-time status. *Economic News Release*. Retrieved from <https://www.bls.gov/news.release/ecec.t11.htm>
- Bureau of Reclamation. (2015). *AgriMet - Evapotranspiration Totals and Averages (BKVO - Baker Valley, Oregon)*. Retrieved from <https://www.usbr.gov/pn/agrimet/ETtotals.html>
- Bureau of Reclamation. (2024, December 12). Change in Discount Rate for Water Resources Planning. *Federal Register*. Retrieved from <https://www.federalregister.gov/documents/2024/12/12/2024-29263/change-in-discount-rate-for-water-resources-planning>
- Dalton, R., Bastian, C., Jacobs, J., & Wesche, T. (1998, November). Estimating the Economic Value of Improved Trout Fishing on Wyoming Streams. *North American Journal of Fisheries Management*, 18(4), pp. 786-797.
- Eborn, B. (2019). *2019 Costs and Returns Estimate, Southwestern Idaho, Alfalfa Hay*. University of Idaho Extension. Retrieved from Crop Budgets: <https://www.uidaho.edu/-/media/uidaho-responsive/files/cals/programs/idaho-agbiz/crop-budgets/southwest/sw-ah-19.pdf?la=en&rev=985a2dd0c77e433d9ba3090804183f04>
- Farmers Conservation Alliance. (2022, September 19). *Scoping Document for the Powder Valley Water Control District Infrastructure Modernization Project*. Retrieved from Watershed Plans: https://img1.wsimg.com/blobby/go/4c8b915d-c9c0-4a10-86d6-3ac6eb749f65/downloads/PVWCD_Scoping_Document_FINAL_2022.09.19.pdf?ver=1700508962665
- Ford, J. (2023, October 26). MERA/Parks Coordinator, Union County. (R. Pearce-Smith, Interviewer)
- Forero, L., Ingram, R., Davy, J., Nader, G., Klonsky, K., & Stewart, D. (2015). *Sample Costs to Establish or Reestablish and Produce Pasture, Sacramento Valley, Flood Irrigation*. University of California Cooperative Extension. Retrieved from https://coststudyfiles.ucdavis.edu/uploads/cs_public/b2/a9/b2a91349-8ef5-4ed3-8b99-37eccbbdd272/pastureep_sv_2015.pdf
- Howell, P. (2017). Changes in native bull trout and non-native distributions in the upper Powder River basin after 20 years, relationships to water temperature and implications of climate change. *Ecology of Freshwater Fish*, 1-10.
- Layton, D., Brown, G., & Plummer, M. (1999). *Valuing Multiple Programs to Improve Fish Populations*. Washington State Department of Ecology. Retrieved from https://www.researchgate.net/profile/John_Loomis3/publication/228364633_Use_of_Survey_Dat

- [a_to_Estimate_Economic_Value_and_Regional_Economic_Effects_of_Fishery_Improvements/links/552d16ef0cf2e089a3ad2da9.pdf](https://www.researchgate.net/profile/John_Loomis3/publication/228364633_Use_of_Survey_Data_to_Estimate_Economic_Value_and_Regional_Economic_Effects_of_Fishery_Improvements/links/552d16ef0cf2e089a3ad2da9.pdf)
- Loomis, J. (2006, May). Use of Survey Data to Estimate Economic Value and Regional Economic Effects of Fishery Improvements. *North American Journal of Fisheries Management*, 26, 301-307. Retrieved from https://www.researchgate.net/profile/John_Loomis3/publication/228364633_Use_of_Survey_Data_to_Estimate_Economic_Value_and_Regional_Economic_Effects_of_Fishery_Improvements/links/552d16ef0cf2e089a3ad2da9.pdf
- Loomis, J., Quattlebaum, K., Brown, T., & Alexander, S. (2003). *Expanding Institutional Arrangements for Acquiring Water for Environmental Purposes: Transactions Evidence for the Western United States*. USDA Forest Service, Faculty Publications 291. Retrieved from <http://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1290&context=usdafsfacpub>
- National Atmospheric and Oceanic Administration. (2024). NOWData - NOAA Online Weather Data. Baker City, OR. Retrieved from <https://nowdata.rcc-acis.org/boi/>
- National Oceanic and Atmospheric Administration. (2024). NOWData - NOAA Online Weather Data, Monthly Total Precipitation for Baker City Area, OR. Retrieved from <https://www.weather.gov/wrh/Climate?wfo=boi>
- Natural Resources Conservation Service. (2024). Web Soil Survey. Retrieved from <https://websoilsurvey.nrcs.usda.gov/app/>
- Oregon Department of Environmental Quality. (2024). DEQ WQ Standards & Assessment Tool. Retrieved from <https://hdcgcx2.deq.state.or.us/Html5Viewer211/?viewer=wqsa>
- Oregon Department of Fish & Wildlife. (2023, November 29). *Recreation Report: Southeast Zone*. Retrieved from Oregon Department of Fish & Wildlife: <https://myodfw.com/recreation-report/fishing-report/southeast-zone>
- Oregon Trail Electric Cooperative. (2024). *OTEC Tariff No. 1*. Retrieved from <https://www.otec.coop/sites/default/files/Tariff%20rev.%202012-18-2023%20effective%203-15-2024-updated.pdf>
- Oregon Trail Electric Cooperative. (2025). *Hydropower*. Retrieved from <https://www.otec.coop/oregons-hydropower>
- Stam, B., Scasta, J. D., & Thacker, E. (2018). *Animal Unit Month (AUM) Concepts and Applications for Grazing Rangelands*. University of Wyoming Extension. Retrieved from <https://wyoextension.org/publications/html/B1320/>
- U.S. Bureau of Labor Statistics. (2023, May). *May 2023 Metropolitan and Nonmetropolitan Area Occupational Employment and Wage Estimates*. Retrieved from Occupational Employment and Wage Statistics: https://www.bls.gov/oes/current/oes_4100008.htm
- U.S. Fish and Wildlife Service. (2010, October 18). Endangered and Threatened Wildlife and Plants; Revised Designation of Critical Habitat for Bull Trout in the Coterminous United States. *Federal Register*, 75(200), pp. 63898-64070. Retrieved from <https://www.govinfo.gov/link/fr/75/63898?link-type=pdf>

- UN Food and Agricultural Organization. (2012). *Yield response to water: The original FAO water production function*. Retrieved from UN Food and Agricultural Organization: <https://www.fao.org/4/i2800e/i2800e02.pdf>
- Union County. (2023, September 19). *Pilcher Creek Reservoir*. Retrieved from Union County: <https://union-county.org/public-works/parks/pilcher-creek-reservoir/>
- Union County. (2023, September 19). *Wolf Creek Reservoir*. Retrieved from Union County: <https://union-county.org/public-works/parks/wolf-creek-reservoir/>
- USDA National Agricultural Statistics Service. (2024). CropScape. Retrieved from <https://nassgeodata.gmu.edu/CropScape/>
- USDA National Agricultural Statistics Service. (2024). *Producer Price Indices (PPI)*. Retrieved from Quickstats: <https://quickstats.nass.usda.gov/>
- USDA National Agricultural Statistics Service. (2024). Quickstats. Retrieved from <https://quickstats.nass.usda.gov/>
- Walenta, D. (2023, October 16). Associate Professor and Union County Extension Service Agent, Oregon State University. (R. Pearce-Smith, Interviewer)
- Wilson, Z. (2024, August 26). Wilson Cattle Company. (W. Oakley, Interviewer)
- Wright, D. (2023, October 26). Union County Public Works and Airport Director. (R. Pearce-Smith, Interviewer)

D.4 NEE Appendix

D.4.1 Crop Enterprise Budgets

This appendix presents the crop enterprise budgets used to estimate the benefits of agricultural damage reduction under the Modernization Alternative (described in Section 2.2.1.4). The analysis uses a total of four crop budgets:

Table D-17. Summary of Crop Budgets

Crop	Scenario	Budget Table
Pasture	Modernization Alternative	Table D-18
Pasture	No Action Alternative	Table D-19
Alfalfa	Modernization Alternative	Table D-20
Alfalfa	No Action Alternative	Table D-21

We estimate the costs and benefits of agricultural production using enterprise budgets that represent typical costs and returns of producing crops in the Powder Valley of Northeast Oregon. Enterprise budgets aim to reflect common practices and relevant costs for production in the region, but do not necessarily represent the conditions of any particular farm. As a starting point for the crop budgets in this analysis, we used a crop budget for alfalfa hay developed by the University of Idaho (UI) and a crop budget for pasture developed by the University of California Cooperative Extension (UCCE). We adjusted values in the budgets to account for changes in prices through time and local conditions in PVWCD. The following sections outline the data and assumptions used in adjusting the budget.

D.4.2 Pasture Enterprise Budgets

The pasture enterprise budgets were based on a 2015 budget developed by UCCE for establishing and producing irrigated pasture in the Sacramento Valley, California (Forero, et al., 2015). We selected this budget as the basis for PVWCD crop production costs because it is the most recent crop budget developed for producing irrigated pasture in the Western US.

D.4.2.1 Modeled Farm

The modeled farm is 45 acres, of which 40 acres are dedicated to pasture production and five acres are non-arable land. The pasture is tilled, and flood irrigation is used. The stand life is 20 years.

D.4.2.2 Input Costs

Pasture growers in PVWCD typically do not use fertilizer and use very little herbicides (Wilson, 2024). For this reason, we do not include costs to fertilize and model herbicides costs at \$3 per acre, following the guidance of a major landowner in PG1 C-1 Project (Wilson, 2024).

All prices are adjusted from the original values in the UCCE budget. We used area-specific values for fuel prices, land rental rates, and irrigation water assessments. For all other costs, 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 (USDA National Agricultural Statistics Service, 2024). For example, there are price indices for fertilizer, herbicides, custom work, as well as one for the farm sector in general. The PPI cost adjustments range from a 17-percent increase in the Farm Sector prices to a 59-percent increase in Interest costs.

For land costs, we use NASS data on rental rates for pasture in Union County for a normalized average value of \$9.47 per acre (USDA National Agricultural Statistics Service, 2024).¹⁸ For irrigation assessment costs, we divide the total PVWCD charges to patrons in 2023/2024 (\$378,866) by the number of acres in the District (15,915), resulting in an average fee of roughly \$24 per acre.

D.4.2.3 Labor Costs

All production activities are done through custom hire. We adjusted the cost of custom work using the “Ag Services, Custom Rates” PPI.

D.4.2.4 Revenues

Pasture in PVWCD is used for grazing cattle or, in some cases, harvested hay that is later fed to cattle during the winter months (Bingham, 2024; Wilson, 2024). As a result, pasture typically does not generate direct revenue for PVWCD growers but is used as the most cost-effective means of producing feed for cattle. Without the pasture, PVWCD growers would need to purchase feed from other sources. In this way, the benefit of pasture is the avoided cost of purchasing other sources of cattle feed. To capture this benefit, we estimate the avoided cost of purchasing hay and use this avoided cost as the “revenue” generated by each acre of pasture.

According to our analysis of USDA CropScape and NRCS Web Soil Survey data, the average potential yield of irrigated pasture in the Project area is about 12.2 animal unit months (AUM).¹⁹ Given that each AUM roughly equals 750 pounds of dry forage and only about 25 percent of the yield is consumed by cattle (Stam, Scasta, & Thacker, 2018), on average, each acre of pasture can grow the equivalent of about 1.1 tons of hay feed. We use this amount as the yield of pasture under full irrigation.

Under the No Action Alternative, pasture yields are impacted by an average shortage of 28 percent in one-third of all years (as explained in Section 2.2.1.4). This results in an estimated yield equivalent of 0.82 tons per acre (28 percent less than the full yield of 1.1 tons). Under the Modernization Alternative, an additional 0.15 AF per acre would be applied, increasing the yield equivalent to an estimated 0.87 tons per acre.²⁰

We use a modified NRCS method to calculate the normalized average price of all non-alfalfa hay in Oregon, which resulted in an estimated price of \$247 per ton.²¹ We use this price to represent the cost of buying hay for feed. At \$247 per ton, each acre of pasture avoids feed purchases equal to roughly \$203 under the No Action Alternative and \$215 under the Modernization Alternative.

¹⁸ We use prices from 2014 to 2023 where data was available. We adjusted all prices for inflation using the IPDGDP prior to averaging. Calculating the normalized average involves dropping the minimum and maximum values and taking the mean of the remaining values.

¹⁹ This is based on a geographic information systems (GIS) analysis of pasture acres and soils in PVWCD. We used USDA CropScape data to map the pasture area in the Project area (USDA National Agricultural Statistics Service, 2024). We used NRCS Web Soil Survey data to map the yield of irrigated pasture by soil type (Natural Resources Conservation Service, 2024). By overlaying these two maps, we generated a table of pasture acres by yield. The weighted average yield in the District is 12.2 AUM per acre (weighted based on the number of acres).

²⁰ The additional water increases the application rate from 2.5 AF/acre (which is 28% less than the full application rate of 3.5 AF/acre) to 2.7 AF/acre, an increase of about 5.7%. Accordingly, we estimate that yield would also increase by 5.7%, or about 0.05 tons per acre.

²¹ We use the NRCS’s method of calculating the normalized price of hay at the state level using data from 2019 to 2023 and adjusting prices for inflation prior to averaging. Prices were taken from the USDA National Agricultural Statistics Service’s (NASS) Quickstats database (USDA National Agricultural Statistics Service, 2024).

D.4.2.5 Pasture Enterprise Budget Tables

The tables below present enterprise budgets used to estimate the costs and returns of pasture in PVWCD.

Table D-18. Pasture Crop Budget Under the Modernization Alternative, Powder Valley, Oregon, 2024 dollars

Description	Quantity	Unit	\$/Unit	Total
REVENUES				
Purchased hay equivalent	0.87	ton	\$246.69	\$215.03
OPERATING COSTS				
Custom - ground application	0.2	ac	\$13.26	\$2.65
Herbicide - roundup	1	ac	\$3.00	\$3.00
Irrigation water	1	ac	\$23.81	\$23.81
Interest on operating capital	1	ac	\$0.72	\$0.72
<i>Total operating costs</i>				<i>\$30.18</i>
CASH OVERHEAD				
Office expense	1	ac	\$23.35	\$23.35
Liability insurance	1	ac	\$18.68	\$18.68
Land lease	1	ac	\$9.47	\$9.47
Property taxes	1	ac	\$2.94	\$2.94
<i>Total cash overhead costs</i>				<i>\$54.44</i>
NON-CASH OVERHEAD				
Establishment costs	1	ac	\$26.26	\$26.26
<i>Total overhead costs</i>				<i>\$110.88</i>
Net revenues				\$104.16

Table D-19. Pasture Crop Budget Under the No Action Alternative, Powder Valley, Oregon, 2024 dollars

Description	Quantity	Unit	\$/Unit	Total
REVENUES				
Purchased hay equivalent	0.82	ton	\$246.69	\$203.30
OPERATING COSTS				
Custom - ground application	0.2	ac	\$13.26	\$2.65
Herbicide - roundup	1	ac	\$3.00	\$3.00
Irrigation water	1	ac	\$23.81	\$23.81
Interest on operating capital	1	ac	\$0.72	\$0.72
<i>Total operating costs</i>				<i>\$30.18</i>
CASH OVERHEAD				
Office expense	1	ac	\$23.35	\$23.35
Liability insurance	1	ac	\$18.68	\$18.68
Land lease	1	ac	\$9.47	\$9.47
Property taxes	1	ac	\$2.94	\$2.94
<i>Total cash overhead costs</i>				<i>\$54.44</i>
NON-CASH OVERHEAD				
Establishment costs	1	ac	\$26.26	\$26.26
<i>Total overhead costs</i>				<i>\$110.88</i>
Net revenues				\$92.42

D.4.3 Alfalfa Enterprise Budgets

The alfalfa hay enterprise budgets were based on a 2019 budget developed by UI for establishing and producing alfalfa hay in southwest Idaho (Eborn, 2019). We selected this budget as the basis for PVWCD crop production costs because it is the most recent crop budget developed for producing alfalfa hay in an area that is close to the Powder River Basin.

D.4.3.1 Modeled Farm

The modeled farm is 1,200 acres, of which 150 acres are dedicated to alfalfa production and 30 acres are under alfalfa establishment. Irrigation is delivered by concrete ditch and siphon tube irrigation system. The stand life is six years.

D.4.3.2 Input Costs

For fertilizers, we adjust the amount used proportionally according to differences in yield from the original budget. For example, the original budget calls for 15 pounds (lbs) of dry nitrogen to produce 7.5 tons of hay per acre; we model a yield of 3.5 tons per acre (46 percent of the original yield), so we decrease the amount of nitrogen to 6.9 lbs (46 percent of 15 lbs).

All prices are adjusted from the original values in the UI budget. We used area-specific values for fuel prices, land rent, and irrigation charges. For all other costs, we adjusted the value in the original budget using the national Producer Price Indices (PPI) produced, as described above in Section 4.2.2.

For land costs, we use NASS data on rental rates for irrigated cropland in Union County for a normalized average value of \$194 per acre (USDA National Agricultural Statistics Service, 2024).²² We used the same irrigation assessment charges (\$24 per acre) and fuel prices as described for pasture (Section 4.2.2). For fuel prices, we used observations of local prices from GasBuddy.com.

D.4.3.3 Labor Costs

All production activities are done through custom hire except for irrigation and some equipment operation, which are done through on-farm hired labor. On-farm hired labor is categorized as either equipment operator labor or general labor. For the cost of equipment operator labor, we use the median hourly wage rate for the agricultural equipment operators in the region in 2023 and adjust to 2024 dollars using IPDGDP.²³ We further increase this wage rate by 20 percent to account for non-wage employment costs, such as health care and insurance.²⁴ This results in total costs of \$23.87 per hour for equipment operator labor. For general farm labor, we use the wage for farmworkers in the region and make the same adjustments for inflation and non-wage costs, which results in a total cost of \$17.87 per hour.²⁵ We adjusted the cost of custom work using the “Ag Services, Custom Rates” PPI.

D.4.3.4 Revenues

To estimate the gross revenues of alfalfa hay, we used a modified NRCS method for calculating normalized prices for alfalfa hay in Oregon.²⁶ For state-level data, we use prices from 2021 to 2023, and for national-level data, prices from 2019 to 2023. This method results in an average price of \$276.36 per ton.

We estimate full alfalfa yields in PVWCD to be roughly 5.0 tons per acre, which generally aligns with full yields observed by one hay grower in PVWCD and is on the lower end of a range provided by an Oregon State University Extension agent working in the region (Walenta, 2023). This value is higher than the average of yields in Union and Baker Counties from 2009 to 2018 according to NASS data (USDA National Agricultural Statistics Service, 2024); however, these data would include both irrigated and non-irrigated alfalfa yields, as well as deficit-irrigated yields during periods of water shortages, so the average of the NASS data would naturally be lower than the typical yield under full irrigation.²⁷

Under the No Action Alternative, alfalfa in PVWCD would experience water shortages averaging about 35 percent in roughly 21 percent of all years (as explained in Section 2.2.1.5). A water shortage

²² We use prices from 2014 to 2023 where data was available. We adjusted all prices for inflation using the IPDGDP prior to averaging. Calculating the normalized average involves dropping the minimum and maximum values and taking the mean of the remaining values.

²³ Based on the average wage for Agricultural Equipment Operators (occupation code 45-2091) in the Eastern Oregon nonmetropolitan area of Oregon according to the Bureau of Labor Statistics’ Occupational Employment and Wage Estimates data in May 2023 (U.S. Bureau of Labor Statistics, 2023).

²⁴ This is roughly the average proportion of non-wage labor costs for all private, part-time workers in the U.S. in December 2018 (Bureau of Labor Statistics, 2018).

²⁵ Based on the average wage for Farmworkers and Laborers, Crop, Nursery, and Greenhouse (occupation code 45-2092) in the Eastern Oregon nonmetropolitan area according to the Bureau of Labor Statistics’ Occupational Employment and Wage Estimates data in May 2023.

²⁶ The modified method differs from the NRCS method by using more recent price data, using price data specific to alfalfa, and adjust all prices to 2024 dollars prior to averaging using the IPDGDP.

²⁷ Calculating the normalized average involves dropping the minimum and maximum values and taking the mean of the remaining values.

of 35 percent would reduce the full yield to roughly 3.2 tons per acre (35 percent less than 5 tons). Under the Modernization Alternative, application rates would increase by 0.15 AF per acre, an increase of roughly 6.4 percent. Accordingly, we increase the yield by 6.4 percent to 3.5 tons per acre.

At \$276 per ton, the No Action Alternative would generate gross revenues of \$898 per acre, while the Modernization Alternative would generate gross revenues of \$956 per acre.

D.4.3.5 Alfalfa Enterprise Budget Tables

Table D-20 and Table D-21 present enterprise budgets used to estimate the costs and returns of alfalfa in PVWCD.

D.4.4 District Water Supply Data

Table D-22 summarizes data from the District on reservoir storage and associated estimated water shortage for the years 2001 to 2024. As shown in the table, the District experiences shortages in years when reservoirs do not fill completely, with the shortage equal to the percent of storage not filled (i.e., if only 94 percent of the reservoir is filled, then the shortage to the District is 6 percent). The District's full allocation of water is 3.5 AFY per acre; this exceeds the pasture and alfalfa applied water demand of 3.2 and just under 2.8 AFY, respectively. As such, we estimate that pasture is adversely affected by shortages in excess of 9 percent (as full irrigation of 3.2 AFY is 91% of the 3.5 AFY full allocation) and alfalfa is adversely affected by shortages in excess of 21 percent (as just under 2.8 AFY is 79% of the 3.5 AFY full allocation). As such, the final rows of Table D-22 summarize the historic proportion of years when storage is less than 91 percent (when pasture yields begin to be adversely affected by shortages) and when it is less than 79 percent (when alfalfa yields are also adversely affected by shortages). The table also summarizes the average historic level of shortage that is experienced in these types of years.

Table D-20. Alfalfa Hay Crop Budget Under the Modernization Alternative, Powder Valley, Oregon, 2024 dollars

Description	Quantity	Unit	\$/Unit	Total
REVENUES				
Alfalfa Hay	3.5	ton	\$276.36	\$955.61
VARIABLE COSTS				
Fertilizer - dry nitrogen	6.9	lb	\$0.61	\$4.22
Fertilizer - dry P2O5	34.6	lb	\$0.63	\$21.94
Fertilizer - K2O	36.9	lb	\$0.46	\$17.01
Fertilizer - sulfur	18.4	lb	\$0.33	\$6.03
Pesticide - Metribuzin 75DF	1.0	lb	\$18.27	\$18.27
Pesticide - Warrior II w/ Zeon Tech	3.0	fl oz	\$2.00	\$6.00
Custom - fertilize	1.0	acre	\$8.94	\$8.94
Custom - swath & rake	2.0	acre	\$35.78	\$71.55
Custom - bale (1 ton)	3.5	ton	\$21.47	\$74.23
Custom - haul & stack (1 ton)	3.5	ton	\$5.96	\$20.62
Irrigation - water assessment	1.0	acre	\$23.81	\$23.81
Irrigation - repairs	1.0	acre	\$5.15	\$5.15
Machinery - fuel, gas	1.3	gal	\$4.27	\$5.47
Machinery - fuel, diesel	1.7	gal	\$4.90	\$8.09
Machinery - fuel, road diesel	0.6	gal	\$4.90	\$3.09
Machinery - lube	1.0	acre	\$1.87	\$1.87
Machinery - repairs	1.0	acre	\$3.09	\$3.09
Labor - equipment operator	1.2	hrs	\$23.87	\$28.64
Labor - irrigation	4.9	hrs	\$17.87	\$87.58
Interest on operating capital (7%)	1.0	acre	\$18.65	\$18.65
<i>Total operating costs</i>				<i>\$434.23</i>
FIXED COSTS				
General overhead	1	acre	\$10.86	\$10.86
Land rent	1	acre	\$193.99	\$193.99
Management fee	1	acre	\$38.53	\$38.53
Property insurance	1	acre	\$1.87	\$1.87
Capital recovery - equipment	1	acre	\$31.06	\$31.06
Alfalfa establishment - estimated amortized costs	1	acre	\$98.55	\$98.55
<i>Total ownership costs</i>				<i>\$374.86</i>
<i>Total costs</i>				<i>\$809.09</i>
Net revenues				\$146.52

Table D-21. Alfalfa Hay Crop Budget Under the No Action Alternative, Powder Valley, Oregon, 2024 dollars

Description	Quantity	Unit	\$/Unit	Total
REVENUES				
Alfalfa Hay	3.3	ton	\$276.36	\$898.17
VARIABLE COSTS				
Fertilizer - dry nitrogen	6.5	lb	\$0.61	\$3.97
Fertilizer - dry P2O5	32.5	lb	\$0.63	\$20.62
Fertilizer - K2O	34.7	lb	\$0.46	\$15.99
Fertilizer - sulfur	17.3	lb	\$0.33	\$5.67
Pesticide - Metribuzin 75DF	1.0	lb	\$18.27	\$18.27
Pesticide - Warrior II w/ Zeon Tech	3.0	fl oz	\$2.00	\$6.00
Custom - fertilize	1.0	acre	\$8.94	\$8.94
Custom - swath & rake	2.0	acre	\$35.78	\$71.55
Custom - bale (1 ton)	3.3	ton	\$21.47	\$69.77
Custom - haul & stack (1 ton)	3.3	ton	\$5.96	\$19.38
Irrigation - water assessment	1.0	acre	\$23.81	\$23.81
Irrigation - repairs	0.9	acre	\$5.15	\$4.84
Machinery - fuel, gas	1.3	gal	\$4.27	\$5.47
Machinery - fuel, diesel	1.7	gal	\$4.90	\$8.09
Machinery - fuel, road diesel	0.6	gal	\$4.90	\$3.09
Machinery - lube	1.0	acre	\$1.87	\$1.87
Machinery - repairs	1.0	acre	\$3.09	\$3.09
Labor - equipment operator	1.2	hrs	\$23.87	\$28.64
Labor - irrigation	4.6	hrs	\$17.87	\$82.32
Interest on operating capital (7%)	0.9	acre	\$18.01	\$16.93
<i>Total operating costs</i>				<i>\$418.28</i>
FIXED COSTS				
General overhead	1	acre	\$10.86	\$10.86
Land rent	1	acre	\$193.99	\$193.99
Management fee	1	acre	\$37.73	\$37.73
Property insurance	1	acre	\$1.87	\$1.87
Capital recovery - equipment	1	acre	\$31.06	\$31.06
Alfalfa establishment - estimated amortized costs	1	acre	\$98.55	\$98.55
<i>Total ownership costs</i>				<i>\$374.06</i>
<i>Total costs</i>				<i>\$792.34</i>
Net revenues				\$105.83

Table D-22. District Stored Water Records and Associated Water Supply Shortages

Year	% Reservoir Storage Filled	Estimated Shortage
2024	100%	0%
2023	100%	0%
2022	96%	4%
2021	71%	29%
2020	100%	0%
2019	100%	0%
2018	80%	20%
2017	100%	0%
2016	82%	18%
2015	61%	39%
2014	94%	6%
2013	73%	27%
2012	100%	0%
2011	100%	0%
2010	100%	0%
2009	100%	0%
2008	100%	0%
2007	62%	38%
2006	100%	0%
2005	100%	0%
2004	100%	0%
2003	100%	0%
2002	89%	11%
2001	57%	43%
Years with Reservoir Less than 100% Full	42%	24%
Years with Reservoir Less than 91% Full (Pasture Deficit Irrigated)	33%	28%
Years with Reservoir Less than 88% Full (Alfalfa and Pasture Deficit Irrigated)	21%	35%

Source: District records of water supplies from 2001 to 2024 (Birdsall, 2023-2025).

D.5 Project Formulation – Alternatives Considered

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 (PR&G) (Table D-23). According to NEPA, “agencies shall rigorously explore and objectively evaluate all reasonable alternatives” (7 CFR Part 1b). According to the PR&G DM9500-013, alternatives should reflect a range of scales and management measures and be evaluated against the Federal Objective and Guiding Principles; against the extent to which they address the problems and opportunities identified in the purpose and need; and against the criteria of completeness, effectiveness, efficiency, and acceptability:

1. Completeness is the extent to which an alternative provides and accounts for all features, investments, and/or other actions necessary to realize the planned effects, including any necessary actions by others. It does not necessarily mean that alternative actions need to be large in scope or scale.
2. Effectiveness is the extent to which an alternative alleviates the specified problems and achieves the specified opportunities.
3. Efficiency is the extent to which an alternative alleviates the specified problems and realizes the specified opportunities at the least cost.
4. Acceptability is the viability and appropriateness of an alternative from the perspective of the Nation’s general public and consistency with existing Federal laws, authorities, and public policies. It does not include local or regional preferences for particular solutions or political expediency.

Alternatives eliminated during formulation are shown in Table D-23 and discussed below.

Alternatives selected for further evaluation are discussed in the Plan-EA.

Table D-23. Alternatives Considered During the Formulation Phase and Criteria in PR&G Achieved.

Alternative	Does the alternative achieve the PR&G Criteria: Completeness	Does the alternative achieve the PR&G Criteria: Effectiveness	Does the alternative achieve the PR&G Criteria: Efficiency	Does the alternative achieve the PR&G Criteria: Acceptability	Selected for Further Evaluation
Conversion to Dryland Farming	No	No	Yes	No	No
Market-based Approaches to include Voluntary Duty Reduction	No	No	No	No	No
Ditch Lining Carnes and Upper Coughanour Ditches	Yes	Yes	No	Yes	Yes

Appendix D: Investigation and Analyses Report

Piping Mansfield and Bulger ditches	No	No	No	Yes	No
Modernization with Piping Upper Coughanour Ditch	Yes	Yes	No	Yes	No
No Action (Future without Federal Investment)	No	No	Yes	No	Yes
Modernization Alternative without Carnes fish screening and passage improvements ○ Implement C-1 Project ○ Pipe Carnes Ditch	Yes	Yes	Yes	No	No
Modernization Alternative with Carnes fish screening and passage improvements ○ Implement C-1 Project ○ Pipe Carnes Ditch ○ Carnes Diversion fish screening and passage improvements	Yes	Yes	Yes	Yes	Yes

D.5.1 Dryland Farming

Dryland farming is a nonstructural alternative. This method of farming uses no irrigation and incorporates drought-resistant crops and practices to conserve moisture. The Dryland Farming Alternative would include voluntary conversion by PVWCD patrons to dryland farming. Crop rotations would likely change from an annual production to a winter crop-summer fallow rotation, where only one crop is produced in 2 years. If sufficient annual precipitation exists (12 to 18 inches annually), rotations may change to a 3-year winter crop-based rotation, where crops are grown in 2 out of every 3 years.²⁸ New equipment purchases or changes to the specific types of crops grown could potentially be required in order to implement different water-conservation tillage practices.

²⁸ Washington State University. 2017. Advances in Dryland Farming in the Inland Pacific Northwest.

Economic losses would be incurred as a result of keeping prime farmland in a fallow state for extended time periods.

Dryland farming was eliminated for further study for multiple reasons. Project sponsors must have the legal authority and resources to carry out, operate, and maintain works of improvement (Pub. Law No. 83-566). Because PVWCD lacks the statutory authority or responsibility to carry out, operate, and maintain dryland farming by PVWCD patrons, conversion to dryland farming is not within the scope of actions that PVWCD can entertain as project sponsor.

Dryland farming would not meet the project's purpose and need; its effectiveness would be uncertain since conversion to dryland farming would be voluntary; it would not be acceptable because it is inconsistent with public policy supporting and maintaining existing agricultural land use; and it would not achieve the Federal Objective and Guiding Principles.

D.5.2 Market-based Approaches to include Voluntary Duty Reduction

Market-Based Approaches refers to patrons voluntarily accepting less than their full water delivery rate from PVWCD, or to patrons temporarily or permanently moving water or water rights from their lands to streams. This is a nonstructural alternative. A reduction in duty by a patron could mean that PVWCD diverts less water, which would leave more water instream.

Because PVWCD is obligated to provide a certain amount of water to patrons to meet associated rights, this alternative would be voluntary and at the discretion of individual patrons. For this reason, there would be no assurance that water would be conserved. Additionally, because the system has open ditches, subject to certain operating inefficiencies, PVWCD would still need to divert enough water, accounting for seepage and evaporation, to ensure those deliveries.

Currently, PVWCD lacks the statutory authority or responsibility to carry out, operate, and maintain voluntary duty reduction and the transfer of patron water instream. Without a change in the framework of current lawful authorities on the part of PVWCD, incorporating market-based incentives into the proposed action is not within PVWCD's ability or capacity to undertake as the project sponsor under Pub. Law No. 83-566 and is not logistically or technically feasible. Incorporating market-based approaches into the proposed action is not a sufficiently developed approach for consideration as an alternative at this time.

In consideration of the above, market-based approaches were eliminated from further evaluation as an alternative. This approach would not meet the project purpose; its effectiveness would be uncertain since duty reduction by patrons would be voluntary; PVWCD lacks the statutory authority and ability to carry out patron duty reductions; and such an approach would not achieve the Federal Objective and Guiding Principles.

D.5.3 Piping Mansfield and Bulger Ditches

The Mansfield and Bulger Ditch Company is a sub district located within the PVWCD. Piping and consolidating the Mansfield and Bulger ditches was initially explored in scoping. After further consideration, the Mansfield and Bulger Ditch Company and PVWCD decided to remove these actions from the Plan-EA and pursue separate funding.

D.5.4 Modernization with Piping Upper Coughanour Ditch

This alternative would be the same as the Modernization Alternative except the Upper Coughanour Ditch would be piped. This alternative would meet the project purposes of conserving water and improving water delivery reliability and operation efficiencies, as it would eliminate water loss from

evaporation and seepage and resolve operational inefficiencies associated with maintaining open irrigation ditches.

The estimated capital costs for piping the Upper Coughanour Ditch are \$26,278,500 (2024 dollars). As compared with the Modernization Alternative, the Modernization Alternative plus Piping Upper Coughanour Ditch would have 2 times greater costs and limited additional benefits. This alternative was eliminated from further evaluation because it would not be efficient.

D.5.5 Modernization without Carnes Diversion Fish Screening and Passage

This alternative would be the same as the Modernization Alternative except there would be no fish screening and passage at the Carnes Diversion. This alternative would meet the project purposes of conserving water and improving water delivery reliability and operation efficiencies. Without a fish screen, bull trout and other native fish will continue to be at risk of entrainment into Carnes Diversion, resulting in continued excess mortality. The diversion dam at Carnes Diversion will continue to be a partial barrier to fish passage and will prevent individuals from accessing necessary habitats within the watershed.

NRCS conducted extensive coordination with USFWS to explore the potential of this alternative. Because NRCS would provide implementation funding, NRCS would be required to do Section 7 consultation until the project is completed. USFWS indicated during coordination meetings that a project alternative without a fish screen would require annual fish monitoring. If annual monitoring was required, NRCS would be required to confirm monitoring was occurring and, if fish were being killed (i.e. take was occurring), NRCS would have to address it. This would necessitate long-term involvement by NRCS. Under Pub. Law No. 83-566, NRCS does not have the legal authority to maintain long-term engagement in the project. Therefore, this alternative is not feasible or acceptable and was eliminated from further evaluation.

D.6 Capital Costs

D.6.1 Modernization Alternative Costs

This section presents capital costs for the Modernization Alternative (Table D-24). Costs shown in Table D-24 differ from elsewhere in the Plan-EA because they do not include project administration costs. Table D-25 includes capital costs and project administration.

A wide variety of materials are available for piping; availability of piping materials, prices, and new products change over time. Piping materials that could be used for the Modernization Alternative include, but are not limited to polyvinyl chloride, steel, high-density polyethylene (HDPE), bar-wrapped concrete cylinder, fiberglass, and ductile iron. The Modernization Alternative was priced using HDPE pipe, which at the time of this analysis was considered to be the most effective material.

At the time of project implementation, the specific piping material would be selected based on a number of considerations: the cost of the project would meet NEE requirements; meet construction requirements; be appropriate based on local conditions and risk factors; and result in minor or no changes to project effects described in Section 6 of the Plan-EA, as determined through the tiered decision framework approach outline in Section 1.4 of the Plan-EA. The NRCS State Conservationist and the Sponsoring Local Organization would possess the final discretion to select the appropriate piping material.

Table D-24. Modernization Alternative Capital Costs.

Project Name	Item	Quantity	Units	Nominal Diameter	Construction Cost	Engineering, Construction Management, Survey	Construction Manager/ General Contractor	Contingency Costs	Total Costs
PG1 C-1 Project	Turnout	10	each	N/A	\$140,000	\$14,000	\$19,600	\$52,100	\$225,700
PG1 C-1 Project	Pipe	6,672	ft	42	\$2,412,600	\$241,300	\$337,800	\$897,500	\$3,889,100
PG1 C-1 Project	Pipe	2,764	ft	30	\$632,300	\$63,200	\$88,500	\$235,200	\$1,019,200
PG1 C-1 Project	Pipe	2,704	ft	36	\$1,091,200	\$109,100	\$152,800	\$405,900	\$1,759,000
PG1 C-1 Project	Pipe	2,278	ft	36	\$605,300	\$60,500	\$84,700	\$225,200	\$975,700
PG1 C-1 Project	Pipe	1,374	ft	24	\$295,700	\$29,600	\$41,400	\$110,000	\$476,800
PG1 C-1 Project	Pipe	1,350	ft	26	\$284,200	\$28,400	\$39,800	\$105,700	\$458,100
PG1 C-1 Project	Pipe	398	ft	28	\$97,100	\$9,700	\$13,600	\$36,100	\$156,500
PG1 C-1 Project	Pipe	52	ft	30	\$9,500	\$1,000	\$1,300	\$3,500	\$15,300
PG1 C-1 Project	Vault	2	each	18x10x8	\$74,400	\$7,400	\$10,400	\$27,700	\$119,900
PG1 C-1 Project	Vault headgate	2	each	20	\$70,000	\$7,000	\$9,800	\$26,000	\$112,800
PG1 C-1 Project	Trash rack	1	each	N/A	\$77,000	\$7,700	\$10,800	\$28,600	\$124,100
PG1 C-1 Project	Easements								\$20,000

Appendix D: Investigation and Analyses Report

PG2 Carnes Pipeline	Turnout	2	each	0	\$28,000	\$2,800	\$3,900	\$10,400	\$45,100
PG2 Carnes Pipeline	Pipe	16,854	ft	66	\$7,792,100	\$779,200	\$1,090,900	\$2,898,600	\$12,560,700
PG2 Carnes Pipeline	Pipe	788	ft	63	\$635,600	\$63,600	\$89,000	\$236,500	\$1,024,700
PG3 Fish Screen and Passage	Fish Screening and Passage	1	each	N/A	\$1,994,800	\$199,500	\$279,300	\$742,100	\$3,215,700
PG2 Carnes Pipeline	Easements								\$80,000
Total					\$16,239,800	\$1,624,000	\$2,273,600	\$6,041,100	\$26,278,400¹

Notes:

Prepared May 2025

N/A = not applicable.

Totals rounded to nearest \$100 and may not sum.

¹ Total cost differs from elsewhere in the Plan-EA because it does not include project administration costs.

Table D-25. Proposed Components of the Preferred Alternative within Powder Valley Water Control District, 2024\$.

Type	Project Group	Quantity	Construction Subtotal ^{1,2}
Pipeline	PG1 C-1 Project	17,592 feet	\$8,749,700
Turnout	PG1 C-1 Project	10	\$225,700
Pressure Reducing Vault	PG1 C-1 Project	2	\$356,800
Pipeline and siphon	PG2 Carnes Pipeline	17,642 feet	\$13,585,400
Turnout	PG2 Carnes Pipeline	2	\$45,100
Fish Screen and Fish Passage	PG3 Fish Screen and Passage	2 fish screens and fish passage improvements	\$3,215,700
Type	Project Component	Quantity	Subtotal ¹
Subtotal	Construction	N/A	\$24,286,000²
Subtotal	Engineering (Financial Assistance)	N/A	\$1,054,000
Subtotal	Project Admin and Technical Assistance	N/A	\$3,447,000
Subtotal	Permitting	N/A	\$761,000
Subtotal	Real Property Rights	N/A	\$100,000
Total	All Projects and Costs		\$29,648,000

¹Totals are rounded to nearest \$1,000.

² Construction subtotal includes cost of materials; construction contingency and management; contractor markup; and survey costs. See Appendix D.6 for individual material costs.

D.7 Ecosystem Service Multi-Criteria Decision Analysis

Using a Companion Analysis to Better Capture the Value of Irrigation Infrastructure Modernization

D.7.1 Summary

Benefit-cost analysis, which incorporates the monetary value of ecosystem services, is a widely used approach by decisionmakers to evaluate the merits of federal investment in land and water resource projects. This framework offers a valuable decision tool, one that is effective in communicating the benefits that ecological goods and services provide to human well-being (Ferraro et al., 2025; Olander et al., 2015). More recently, however, a growing number of researchers are challenging the ecosystem service framework suggesting that commodification of nature only reflects nature's value when it is viewed as providing a service or benefit to humans, and that the framework omits other values such as the meaningful relationships between people and nature and the value of nature independent of human benefit (Pascual et al., 2023; Ferraro et al., 2025; IPBES 2022). To better capture and evaluate values that a federal investment may have, but which were not previously captured, NRCS-Oregon is developing an Ecosystem Service Multi-Criteria Decision Analysis framework (NRCS 2024, Appendix B(3)). This analysis will act as a companion to the benefit-cost analysis already within the PL 83-566 Watershed Planning process and will more fully incorporate stakeholder preferences and critical nonmonetary benefits into decision making.

D.7.2 Ecosystem Services in Policy

Ecosystem services are defined as the benefits people obtain from natural systems—grouped into provisioning services (e.g. food, water, fiber), regulating services (e.g. water purification, flood control, erosion prevention), cultural services (e.g. recreation, spiritual and aesthetic values), and supporting services (e.g. nutrient cycling, soil formation). Since the concept gained prominence in the late 1990s, the use of ecosystem services has offered a powerful political rationale for conservation investment by translating ecological value into economic terms that decisionmakers recognize. Olander et al. (2015) documented the federal embrace of ecosystem services to make causal connections between proposed actions and “outcomes valued by people”, as an important step in embedding ecological considerations in agency planning processes where they have previously been absent.

This approach was formalized in the Departmental Memo (DM) 9500-013, and USDA applied the analysis to NRCS Watershed Assistance Programs (USDA 2017). In Watershed Project Plans ecosystem services are used to compare alternatives, conduct tradeoff analyses, and account for both monetized and nonmonetized benefits. This framework has meaningfully advanced NRCS's ability to demonstrate conservation value for more informed decision making, in particular for investments where ecosystem service benefits can be monetized.

D.7.3 Limitations of the Ecosystem Service Framework

D.7.3.1 Monetization Excludes Nonmonetizable Values

A limitation of the ecosystem services framework is its reliance on monetization as the primary measure of value. Placing a dollar figure on nature was championed as a way to make conservation easily accessible to decisionmakers, but many now argue that this strategy has not delivered the conservation outcomes its proponents hoped for (Lewton 2026). Researchers argue that putting ecosystem services into an anthropocentric, economic framework oversimplifies the complexity of ecological systems. They suggest that the approach favors services which are readily monetized but

excludes ecosystem processes and species for which direct economic value is difficult to assign (Ferraro et al., 2025). The result is that decisionmaker priorities may be skewed toward projects with market-valued services and away from projects that may be critical, but which lack demonstrable monetary value (Ferraro et al., 2025).

While current ecosystem service frameworks can capture the monetizable aspects of nature which contribute to human well-being (instrumental values), they struggle to capture relational values, those meaningful relationships between people and nature (Pascual et al., 2023; Ferraro et al., 2025; Kenter et al., 2025; IPBES 2022 and 2024). For rural communities whose identities, livelihoods, and social bonds are tied to working landscapes and shared water systems, relational values are often what motivate conservation action. However, due to the inherent limits in monetizing these values, projects that strongly support relational values risk not moving forward.

Capturing intrinsic value in ecosystem service frameworks, that of nature's value independent of human benefit, presents a similar challenge. Ecosystem services, by definition, positions humans to receive benefits from nature. This perspective of servitude limits the ability of the ecosystem service framework to recognize ecosystems as complex and interdependent with value beyond what is derived by humans. If a project will restore aquatic habitat, for example, but there are few or no known federally listed or species of concern, and no known species or ecosystem functions that provide a service to humans, the ecosystem service framework will likely assign little to no value to the habitat restoration aspect of the project. Yet the absence of a measurable human benefit does not diminish the ecological importance, or intrinsic value, of the habitat being restored and the species that interact with the habitat. Ferraro et al. (2025) caution that framing conservation exclusively in terms of human utility risks "exacerbating biodiversity loss by placing emphasis on short-term human benefits rather than long-term ecological resilience."

D.7.3.2 Rapid Changes in Project Costs and Monetized Ecosystem Service Benefits May Affect the Perceived Value of Projects

Project costs and ecosystem service benefits are both vulnerable to market volatility and political priorities, but not always in the same way. Construction costs generally respond sharply and immediately to market changes. For example, construction costs for irrigation infrastructure modernization projects have risen dramatically and rapidly in recent years due to supply chain disruptions, labor costs, and materials inflation. For these same projects, the change in monetary values for the ecosystem service benefits has generally been more temperate. This is expected because the methods used to calculate ecosystem service monetary values are typically derived from rigorous, peer-reviewed studies which, by their nature, reflect historical conditions. Geopolitical priorities, however, can rapidly influence the monetary value of an ecosystem service, as has occurred with the social cost of carbon and the associated monetary ecosystem benefit of carbon sequestration (e.g. Kerns et al., 2025). The result of this incongruity is that the monetized benefits of projects with well-documented community and ecological value may not exceed the project's cost. In the report *Monetary Valuation of Ecosystem Services and Assets for Ecosystem Accounting* (NCAVES and MAIA 2022), the authors identify that "...monetary values will not fully reflect the importance of ecosystems for people and the economy. Assessing the importance of ecosystems will therefore require consideration of a wide range of information beyond data on the monetary value of ecosystems and their services. This will include data on the biophysical characteristics of ecosystems, data on the characteristics of the people, businesses and communities that are dependent on them."

D.7.4 NRCS-Oregon's Approach

The scientific community has moved toward incorporating frameworks that more fully recognize the extent of nature's value. Instrumental, relational, and intrinsic values are all legitimate and consequential dimensions of how communities relate to nature, but evaluating projects based on instrumental values alone may produce incomplete outcomes (Pascual et al., 2023; Lewton 2026).

In Oregon, irrigated agriculture touches all three of these values through simultaneously shaping water availability, agricultural viability, ecological connectivity, and community resilience. The state's annual \$6.8 billion-dollar agricultural industry contributing to the generation of \$42 billion annual economic impact is built on family-owned and operated farms. Of the more than 35,000 farms in the state, 96% are family-owned and operated and about 90% are under 500 acres. These small and mid-size farms contribute to one-third of the state's agricultural output, sustaining local economies and rural communities. The remaining 10% of farms are large. By producing two-thirds of the state's agricultural output, these large farms and the large-scale production processes they support, Oregon-grown products help meet domestic and global food demands (OR Ag Board 2025).

While incorporating economic numbers into a benefit-cost analysis is relatively straightforward, incorporating the beliefs and value that Oregonians hold about agriculture and natural resources is more challenging. A 2023 state-wide survey by the Oregon Values and Beliefs Center found that 94% of Oregonians surveyed felt that small scale farms and locally grown food close to markets and customers were very or somewhat important. 95% of responders felt that protecting soil, water, and air quality was very important (Oregon Values and Beliefs Center 2023). Despite the high value Oregonians place on the agricultural industry and associated natural resources, irrigation infrastructure projects identified by communities and supported by experts often result in benefit-cost ratios below the threshold to merit federal investment. To address this gap, NRCS-Oregon is developing a Multi-Criteria Decision Analysis (MCDA) for ecosystem services to better account for relational and intrinsic values. NRCS-OR anticipates that using this new framework will complement the benefit-cost analysis required under the PL 83-566 Watershed Planning process to form a more complete assessment of a project's value.

D.7.4.1 Scoring

The Ecosystem Service MCDA evaluates project value across three categories: economic, environmental, and sociocultural through questions that create an opportunity for a Sponsoring Local Organization (SLO) to build a coherent, community-grounded account of why a project matters. Within each category, a SLO responds to structured questions aimed at identifying project values that may otherwise be difficult to incorporate, for example, the role of modernized irrigation system infrastructure in sustaining multigenerational family farms or the ecosystems that working landscapes support.

NRCS-OR will then review the responses, consider the watershed problems, opportunities, resource concerns, and project objectives and constraints, and assign a score to each question. Possible scores range from -7 to +7 points, reflecting the project's negative impact or positive benefit on the resource or value being addressed. A question with a score of -7 points reflects a project that is expected to have an extremely negative impact, 0 points reflects a project that has no benefit, and positive 7 points reflects a project expected to have an exceptional benefit. If a question was not applicable to or explored in the Plan, the question would be removed from scoring. After each question has been scored, NRCS will total the points in each category.

Under the current framework, each category is given equal weight. When combined, if a project's total exceeds 50% of the points available, NRCS would determine that the project has demonstrated substantive benefits. Taken alongside the benefit-cost ratio quantitative analysis, the Ecosystem Service MCDA would provide NRCS with a more comprehensive understanding of the project's value and an additional evaluation tool for NRCS when considering the merit of federal investment.

D.7.5 References

- Ferraro, K.M., Ferraro, A.L., Lundgren, E., & Sommer, N.R. (2025). The use and abuse of ecosystem service concepts and terms. *Biological Conservation*, 308, 111218. <https://doi.org/10.1016/j.biocon.2025.111218>
- IPBES (2022). Summary for Policymakers of the Methodological Assessment Report on the Diverse Values and Valuation of Nature of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. Pascual, U., Balvanera, P., Christie, M., Baptiste, B., González-Jiménez, D., Anderson, C.B., Athayde, S., Barton, D.N., Chaplin Kramer, R., Jacobs, S., Kelemen, E., Kumar, R., Lazos, E., Martin, A., Mwampamba, T.H., Nakangu, B., O'Farrell, P., Raymond, C.M., Subramanian, S.M., Termansen, M., Van Noordwijk, M., and Vatn, A. (eds.). IPBES secretariat, Bonn, Germany. <https://doi.org/10.5281/zenodo.6522392>
- IPBES (2024). Summary for Policymakers of the Thematic Assessment Report on the Interlinkages among Biodiversity, Water, Food and Health of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. McElwee, P. D., Harrison, P. A., van Huysen, T. L., Alonso Roldan, V., Barrios, E., Dasgupta, P., DeClerck, F., Harmčkov, Z. V., Hayman, D. T. S., Herrero, M., Kumar, R., Ley, D., Mangalagiu, D., McFarlane, R. A., Paukert, C., Pengue, W. A., Prist, P. R., Ricketts, T. H., Rounsevell, M. D. A., Saito, O., Selomane, O., Seppelt, R., Singh, P. K., Sitas, N., Smith, P., Vause, J., Molua, E. L., Zambrana-Torrel, C., and Obura, D. (eds.). IPBES secretariat, Bonn, Germany. DOI: <https://doi.org/10.5281/zenodo.13850289>
- Kenter, J.O., Carmenta, R., Christie, M., Griffiths, H., Ihemezie, E., Martin, A., Teresa Gomez-Osorio, M., Pascual, U., Raymond, C., and Waters, R. (2025). Toward a relational biodiversity economics: Embedding plural values for sustainability transformation. *PNAS*, 122(40), e2314586122. <https://doi.org/10.1073/pnas.2314586122>
- Kerns, K., White, M., Camacho, M., McGlathery, K., Patrick, C. (2025). Valuation of blue carbon and ecological co-benefits in temperate seagrass meadows in the Atlantic Virginia Coast Reserve. *Ecosystem Services*, 76(101779). <https://doi.org/10.1016/j.ecoser.2025.101779>
- Lewton, T. (2026, February 11). Putting a price tag on nature failed. Can radical tactics save it? *New Scientist*. <https://www.newscientist.com/article/2513274>
- NCAVES and MAIA (2022). Monetary valuation of ecosystem services and ecosystem assets for ecosystem accounting: Interim Version 1st edition. United Nations Department of Economic and Social Affairs, Statistics Division, New York.
- Olander, L., Johnston, R.J., Tallis, H., Kagan, J., Maguire, L., Polasky, S., Urban, D., Boyd, J., Wainger, L., and Palmer, M., 2015. "Best Practices for Integrating Ecosystem Services into Federal Decision Making." Durham: National Ecosystem Services Partnership, Duke University. doi:10.13016/M2CH07

Oregon State Board of Agriculture (OR Ag Board) (2025). Oregon State Board of Agriculture 2025 Report. Retrieved from:
<https://www.oregon.gov/ODA/Documents/Publications/Administration/BoardReport.pdf>.
Accessed on: March 19, 2026.

Oregon Values and Beliefs Center. (2023, May–June). *Farming and agriculture: Annotated questionnaire* [Survey instrument]. <https://oregonvbc.org/wp-content/uploads/2023/07/OVBC-May-June-Survey-Annotated-Questionnaire-Agriculture1.pdf> accessed: March 19, 2026.

Pascual, U., Balvanera, P., Christie, M., et al. (2023). Diverse values of nature for sustainability. *Nature*, 620, 813–823. <https://doi.org/10.1038/s41586-023-06406-9>

U.S. Department of Agriculture (USDA). (2017). *Guidance for conducting analyses under the Principles, Requirements, and Guidelines for water and land related resources implementation studies and Federal water resource investments* (Departmental Manual DM 9500-013). Natural Resources and Environment.

USDA Natural Resources Conservation Service (NRCS). (2024). National Watershed Program Manual, Title 390, Part 501, Subpart D: Evaluation of Alternatives through the Ecosystem Services Tradeoff Analysis (5th ed., amended June 2024).

D.7.6 Scoring Scale Used in Evaluation of Public Benefits

Each of the questions will be scored according to the scale described below.

Exceptional public benefit: +7 points

- The project is likely to achieve benefits of an exceptionally high standard or quality.
- The outcomes are very substantial and/or represent a key or critical advancement.
- The response includes supporting information and evidence describing the anticipated change in conditions as a result of the project.
- The response includes all necessary information to document a high likelihood of success in achieving the public benefit.

High public benefit: +5 points

- The project is likely to achieve public benefits meeting a high standard or quality.
- The outcomes represent an important advancement.
- The response includes supporting information and evidence describing the anticipated change in conditions as a result of the project.
- The response includes sufficient information to support the achievement of the anticipated public benefit.

Medium public benefit: +3 points

- The project is likely to achieve moderate public benefit.
- The outcomes are likely to achieve an improvement in conditions.
- The response includes supporting information and evidence describing the anticipated change in conditions as a result of the project.

Minor public benefit: +1 point

- The project may achieve minor public benefits.
- Supporting information or evidence may be limited or incomplete.

No benefit: 0 points

- The project is not likely to achieve a public benefit.
- The claims of public benefit are unsupported.
- No positive or negative impact related to the public benefit. No change.

Minor negative impact or detriment: -1 point

- The project may have a minor negative effect or impact in this category.
- Any negative outcomes are limited in scope or scale.

Medium negative impact or detriment: -3 points

- The project is likely to cause moderate harm and have a negative impact in this category.
- Negative outcomes are demonstrable and affect a defined group, area, or resource.

High negative impact or detriment: -5 points

- The project is likely to cause significant harm and have a substantial negative impact in this category.
- Negative outcomes are well-supported by evidence and affect a broader community, region, or resource.

Extreme negative impact or detriment: -7 points

- The project is likely to cause severe or irreversible harm in this category.

- Negative outcomes are very substantial and/or represent a critical deterioration in conditions.
- The response includes information and evidence documenting the anticipated negative change in conditions as a result of the project.

D.7.7 General Question Guidance

This section provides an overview of the question format, how the NRCS review team will score the public benefits, and provides recommendations for how or what information should be included in the question response and Watershed Plan to facilitate public benefit scoring.

General guidance:

- The SLO is encouraged to use the responses to questions in each of the benefit categories to help build a community-grounded narrative for why a project matters. The questions are developed to provide an opportunity for the SLO to identify project values that may otherwise be difficult to monetize and incorporate in the National Economic Development (NED) benefit-cost analysis, for example, the role of modernized irrigation system infrastructure in sustaining multigenerational family farms or the ecosystems that working landscapes support.
- For questions that draw on specific metrics that may appear in the NED, for example, consider the metric, but develop the response to describe what the metrics may mean for the community or region. The purpose of this Ecosystem Service MCDA is to provide an opportunity to identify additional community, regional, or watershed context for the project.
- Where applicable, the responder should identify relevant sections in the Watershed Plan and Appendices where the topics discussed in the responses below can be found.
- Responders may reference responses to other questions if specific metrics or aspects from other responses apply.
- A word limit has not been defined; however, responders should strive to keep responses concise and refer to the Watershed Plan and Appendices, as applicable, to help maintain brevity.
- For some questions, the short-term effects of project implementation may be different than the long-term effects. For the purposes of this analysis, focus on the long-term effects, as short-term effects can often be mitigated unless there are special circumstances.
- For each question, the responder is encouraged to briefly summarize the applicable current conditions. Identifying the current conditions may allow the responder to better contextualize the project benefits and may allow NRCS to better assess the project's public benefit.

D.7.8 Questions and PVWCD Answers

Economic Public Benefits

1. Does the project have an economic effect that is important to the community through job creation, job retention, or increased economic activity?
 - The \$30.4 million in construction expenditure is expected to support \$2.8 million in average income over the 5-year construction period.
 - Additionally, the water conserved by the project would result in a permanent, long-term economic impact of \$100,000 in labor income annually in all sectors of the local economy.
 - Agricultural production and associated economic activity are central to the local economy in the PVWCD area, where irrigated hay and pasture support farm income, agricultural services, and downstream economic activity in a rural region with limited economic diversification.
 - See Plan Sections 4.4, 6.4; Appendix D 5.6

2. Does the project result in increases in efficiency and/or innovation in the area?
 - Much of the District currently relies on open, unlined conveyance systems, resulting in operational inefficiencies, water losses, and limited system control. The project would address these constraints by installing approximately 6.7 miles of piped infrastructure, representing a substantial improvement in water delivery efficiency and innovation.
 - The project increases water delivery efficiency by converting open ditches to piped conveyance, conserving an estimated 2,229 acre feet per year of water and improving the ability to deliver water at the correct rate and timing to patrons. Saved water would increase instream flow and augment irrigation during years with water shortages.
 - The project would provide partial gravity pressurization to PVWCD patrons, reducing patrons' pumping and improving overall energy efficiency. The project would save an estimated 502,747 kilowatt-hours per year of energy, equating to roughly \$26,000 per year of savings.
 - Utilizing flow meters to increase water measurement accuracy will facilitate the adoption of advanced levels of on-farm irrigation water management which supports long term sustainable agriculture.
 - Fish screening and improved passage at the Carnes Diversion represent an innovative integration of agricultural water management and aquatic habitat protection, aligning efficient infrastructure upgrades with ecological performance improvements.
 - See Plan Sections 6.7.2.2, 6.8.2

3. Compared to the baseline conditions, would the project result in Operations and Maintenance (O&M) effort savings?
 - PVWCD's existing system relies on extensive open-ditch infrastructure that requires ongoing inspection, cleaning, vegetation management, repairs after ditch failures, and increasing staff

time; District manager time devoted to O&M has increased by approximately 17 percent over the past five years and is projected to continue rising as infrastructure ages.

- The project would result in O&M savings for both PVWCD and their patrons. By piping its ditches, PVWCD would experience savings by reducing the costs of O&M, avoiding the cost of repairing ditch failures, and eliminating the need to replace some District infrastructure. In total, PVWCD would save \$72,000 per year in avoided O&M costs during the 105-year project life. These savings would be particularly significant for PVWCD which has a limited operating budget and small staff, where avoided costs and reduced labor demands represent a substantial operational benefit over the project lifespan.
- Currently, PVWCD patrons rely on turnout screens to filter moss and other debris before transporting the water onto their fields. Checking and clearing these screens is a significant labor demand for patrons. The project would also save an estimated 502,747 kilowatt-hours per year of energy with reduced patron pumping. In total, the project would save an estimated \$37,000 per year in patron O&M benefits during the 105-year project life.
- Overall, the project shifts District resources away from reactive maintenance of aging infrastructure toward predictable, lower-cost operation of modernized facilities, improving financial sustainability for PVWCD over the life of the project.
- See Plan Section 2.1.2; Appendix D.2.2.1.2

4. Does the project result in enhancement of infrastructure, farmland, public resource lands, industrial lands, commercial lands or lands having other key uses?

- Long-term benefits would result from piping open ditches because water savings would support irrigated agriculture on soils classified as Prime Farmland if Irrigated and Farmland of Statewide Importance.
- Utilizing flow meters to increase water measurement accuracy would facilitate the adoption of advanced levels of on-farm irrigation water management which supports long term sustainable agriculture. In addition, increases in pressure will allow patrons to shift from flood irrigation to sprinkler systems, reducing water use and eliminating adverse effects to soils from flood irrigation systems.
- The project would improve irrigation infrastructure and water conveyance efficiency, saving an estimated 2,364 AF of water annually. This would result in increased water levels in Pilcher Creek and Wolf Creek reservoirs, improving stored water supply, which would benefit all PVWCD patrons and approximately 19,000 irrigated acres.
- Water conserved from the project would enhance irrigation water supply and avoid damages to crop yields from lack of water, resulting in \$92,000 per year in avoided agricultural damages.

5. Does the project result in enhancement of the economic value associated with tourism, recreation, fishing (recreational or commercial), or other?

- Recreational use in the Powder Valley watershed is closely tied to water availability and aquatic conditions, including recreational fishing, wildlife viewing, and boating associated

with streams and reservoirs; low summer flows limit instream habitat quality and reduce the reliability of these recreation opportunities.

- The project enhances recreational fishing opportunities by increasing instream flows from conserved water and improving aquatic habitat conditions that support native fish species.
- Installation of the Carnes fish screen and passage improves fish protection and connectivity, supporting healthier fish populations and long-term recreational fishing value.
- The 2,364 AF of water conserved by the project would increase water stored in Pilcher Creek and Wolf Creek reservoirs. The addition of conserved water would cause the reservoirs to fill more quickly and empty more slowly during the year. In dry water years, the project could expand peak season access to the Pilcher Creek Reservoir boat ramp by up to seven to 20 days (depending on the timing and release of conserved water) and shoulder season access by one week to a month. Recreational activities benefited could include boat fishing, kayaking, canoeing, paddleboarding, tubing, jet skiing, and water skiing.
- See Plan Sections 4.3, 4.8.4, 6.3.2; Appendix D.2.2.2.1

6. Does the project result in increases in agricultural-related economic value or productivity of farmland?

- PVWCD serves a predominantly irrigated agricultural landscape in Union County where reliable irrigation is essential due to low annual precipitation. Crops grown in the District are primarily pasture/range (approximately 40 percent), hay (32 percent), wheat (15 percent), corn (8 percent), potatoes (3 percent), and other crops (2 percent), all of which depend on consistent water delivery to remain productive.
- The project directly increases agricultural productivity by improving the reliability and timing of water deliveries, enabling producers to meet crop water demands more consistently throughout the growing season.
- Reduced water loss from piping allows more diverted water to reach fields, supporting healthier crops, improved yields, and more stable forage and feed supplies for livestock operations.
- Water conserved from the project would enhance irrigation water supply and avoid damages to crop yields from lack of water, resulting in \$92,000 per year in avoided agricultural damages. The project would support irrigated agriculture on soils classified as Prime Farmland if Irrigated and Farmland of Statewide Importance.
- Improved delivery reliability reduces the risk of crop stress during critical growth periods, helping prevent loss of productive acreage and supporting the continued economic viability of irrigated farmland within the District.
- The project helps sustain the agricultural rural way of life in the Powder Valley by supporting multigenerational farming operations, preserving working lands, and reinforcing agriculture's role as the foundation of the local economy and community identity.
- See Plan Sections 4.2.2, 4.5.1, 6.2.2.3, 6.5.2; Appendix D 2.2.1.4

Environmental Public Benefits

7. Does the project improve degraded land, reduce processes that drive land degradation or desertification, and/or support soil health?
 - Irrigated farmland within PVWCD experiences water shortages during dry and drought years due to conveyance losses and unreliable delivery, which can force producers to reduce irrigated acreage or leave fields fallow.
 - Reduced irrigation availability constrains forage production, affects livestock operations, and increases the risk of soil exposure and land degradation.
 - The project improves water efficiency by reducing conveyance losses, increasing the effective amount of water available for irrigation without increasing diversions.
 - Increased water availability during drought years allows more acreage to remain irrigated and productive rather than being fallowed.
 - Maintaining irrigated pasture and hay, PVWCD's most abundant crops, supports soil cover, reduces erosion risk, and sustains soil structure and long-term land productivity.
 - By helping keep forage-producing lands in production during dry years, the project supports agricultural viability and responsible land stewardship.
 - See Plan Section 2.1.4, Appendix D.2.2.1.4

8. Does the project result in an improvement to surface water quantity?
 - The project results in measurable improvements to surface water quantity through increased conveyance efficiency and improved water management.
 - Anthony Creek and the North Powder River experience low summer flows that reduce aquatic habitat (Plan Section 4.7).
 - The project conserves approximately 2,229 acre-feet of water per year by eliminating seepage and evaporation losses from open, unlined ditches. On average, 1,615 acre-feet per year of conserved water is dedicated to instream flow in Anthony Creek and the North Powder River. In these flow-limited systems, this water would increase streamflow in non-water shortages years (2/3 of years) by an estimated 12 to 25 percent during the summer and 16 to 23 percent during the winter.
 - Increased instream flows help improve aquatic habitat conditions for many species, including critical habitat for federally listed bull trout.
 - See Plan Sections 4.7, 6.7.2, 6.8.2; Appendix D.2.2.1.3, E.5

9. Does the project result in an improvement to surface water quality?
 - The project results in measurable improvements to surface water quantity and improvements to surface water quality
 - Anthony Creek and the North Powder River experience low summer flows and are listed as impaired for temperature, failing to meet state water quality standards year-round (Plan Section 4.7). Low flows during the irrigation season reduce aquatic habitat and contribute to elevated stream temperatures.

- The project conserves approximately 2,229 acre-feet of water per year by eliminating seepage and evaporation losses from open, unlined ditches. On average, 1,615 acre-feet per year of conserved water is dedicated to instream flow in Anthony Creek and the North Powder River. In these flow-limited systems, this water would increase streamflow in non-water shortages years (2/3 of years) by an estimated 12 to 25 percent during the summer and 16 to 23 percent during the winter.
- Increased instream flows help moderate elevated stream temperatures, directly addressing a primary water quality impairment in the project watershed and improving aquatic habitat conditions for many species, including critical habitat for federally listed bull trout.
- The project also eliminates open ditches and limits unintended return flows associated with seepage and flood irrigation (where patrons convert from flood to sprinkler), consistent with the objectives of the Powder River Basin *E. coli* TMDL Implementation Plan.
- See Plan Sections 4.7, 6.7.2, 6.8.2; Appendix D.2.2.1.3, E.5

10. Does the project result in an improvement to groundwater quantity?

- The project would have minor long-term effects on groundwater with reduced seepage from piped ditches. However, the reduction in groundwater seepage would be offset by increased water stored in Pilcher Creek and Wolf Creek reservoirs and increased flows in Anthony Creek, North Power River, and Dutch Creek.
- See Plan Section 6.7.2.4.

11. Does the project result in an improvement to groundwater quality?

- The project would have minor long-term effects on groundwater with reduced seepage from piped ditches. However, the reduction in groundwater seepage would be offset by increased water stored in Pilcher Creek and Wolf Creek reservoirs and increased flows in Anthony Creek, North Power River, and Dutch Creek.
- See Plan Section 6.7.2.4.

12. Does the project improve habitat for species?

- The project improves aquatic habitat and provides benefits to riparian-associated terrestrial habitat by increasing instream flows, improving fish passage, and restoring more natural hydrologic conditions.
- Anthony Creek and the North Powder River experience low summer flows and elevated stream temperatures, which limit habitat suitability for cold-water aquatic species. The Carnes Diversion functions as a partial barrier to fish passage and lacks screening, creating entrainment risk for fish, including federally listed bull trout.
- The project conserves approximately 2,229 acre-feet per year of water by reducing conveyance losses, with an average of 1,615 acre-feet per year dedicated to instream flow in Anthony Creek and the North Powder River. Increased instream flows improve habitat availability, depth, and connectivity, particularly during critical summer low-flow periods.

- Installation of fish screening and passage improvements at the Carnes Diversion eliminates entrainment risk and improves longitudinal connectivity in North Fork Anthony Creek. These improvements benefit bull trout, a federally threatened species, as well as other native fish species present in the watershed.
- As described in the Plan, these actions would result in moderate long-term benefits to ESA-listed bull trout, including improved migration conditions, expanded access to habitat, reduced entrainment risk, and enhanced water quality (temperature and dissolved oxygen).
- Improved streamflow and habitat conditions support riparian vegetation health, which provides habitat and movement corridors for terrestrial wildlife.
- See Plan Sections 2.1.5, 2.1.7, 6.7.2, 6.8.2; Appendix D.2.2.1.3

13. Does the project provide energy benefits?

- Under existing conditions, PVWCD patrons along the C-1 system rely on electrically powered pumps to move water from open ditches to their fields. Energy costs represent a significant and recurring operating expense for agricultural producers along the C-1 system.
- A primary motivation for PVWCD to pipe the C-1 system is to generate pressure that enables producers to modernize on-farm irrigation systems. Piping and pressurizing the C-1 system reduces the need for on-farm pumping and is estimated to reduce electricity use by approximately 502,747 kilowatt-hours per year.
- Permanent energy savings for producers along the C-1 would reduce exposure to electricity price variability and infrastructure-related disruptions, supporting more stable agricultural water management over time.
- Reduced irrigation-related electricity demand leaves additional capacity available on the local electric grid for other residential, municipal, and commercial users. Eastern Oregon faces rapidly rising energy demand driven primarily by massive data centers.
- Reduced pumping requirements allow the same agricultural water deliveries to be achieved with less energy input, increasing overall energy efficiency of the irrigation system. Energy savings are sustained over the 100-year project life because they are tied to permanent conveyance improvements.
- A pressurized, piped conveyance may allow for future installation of in-conduit hydropower, creating opportunities to generate renewable energy from existing water deliveries if conditions allow.
- See Appendix D.2.2.1.2

14. Does the project result in an improvement to air quality?

- Not evaluated in the Plan-EA.

15. Does the project improve the ability of ecosystems to maintain their function during climatic variability?

- The project area experiences high interannual variability in snowpack, runoff timing, and summer streamflow, with increasing risk of drought and reduced late-season water availability. Low summer flows and elevated stream temperatures reduce resilience of aquatic ecosystems to drought and warming conditions.

- The project increases ecosystem resiliency to climatic variability by improving water management efficiency, increasing instream flows during low-flow periods, and reducing vulnerability to drought-related stressors in the watershed.
 - The project would increase reservoir carryover volumes, enhancing the District's ability to store water across years and respond more effectively to future drought conditions. This improved storage capacity supports more consistent water availability during periods of climatic variability, strengthening both agricultural and ecological resilience by buffering against reduced snowpack, altered runoff timing, and prolonged dry conditions.
 - Reduced diversion rates from the Carnes and Lone Pine diversions and reconnection of Dutch Creek would improve streamflow in Anthony Creek and the North Powder River in non-water shortage years (2/3 of all years) by an average of 3.5 cfs October to April and up to 8.5 cfs in May and June, particularly benefiting summer low-flow periods when climate stress is greatest.
 - Based on historical flow data, during non-water shortage years, flows in Anthony Creek and North Powder River could increase by up to 16 to 23% during the winter and by up to 12 to 25% during the summer. During water shortage years, flows in Anthony Creek and North Powder River would not change during the winter but would still increase by up to 9 to 19% during the summer.
 - Improved flow and temperature conditions enhance the resilience of aquatic habitat designated as critical habitat for federally listed bull trout, increasing the ability of populations to withstand climate-driven stressors.
 - By relying on efficiency improvements rather than increased diversions, the project reduces dependence on favorable hydrologic conditions and lowers vulnerability to future climate variability.
 - See Plan Sections 2.1, 6.7.2, 6.8.2; Appendix D.2.2.1.3, E.5
16. Does the project result in improvements that address one or more limiting ecological factors in the project watershed?
17. Low summer streamflow and elevated stream temperatures are primary limiting ecological factors in Anthony Creek and the North Powder River, reducing aquatic habitat availability and suitability for cold-water species. Fish passage barriers and entrainment risk at the Carnes Diversion further limit connectivity and survival of native fish species.
- The project results in improvements to limiting ecological factors by addressing low summer streamflow, elevated water temperatures, and barriers to aquatic connectivity that constrain ecosystem function in the watershed.
 - An average of 1,615 acre-feet per year of conserved water is allocated to instream flows, directly addressing low-flow conditions during critical summer periods.
 - Increased instream flows improve thermal buffering capacity in temperature-impaired streams, reducing the severity and duration of elevated water temperatures.

- Fish screening and passage improvements at the Carnes Diversion eliminate entrainment risk and improve longitudinal connectivity in North Fork Anthony Creek.
- See Plan Sections 4.7.2, 4.7.3, 6.7.2.2, 6.7.2.3; Appendix D.2.2.1.3, D.2.2.2.2

18. Does the project support crop diversity?

- Agricultural lands within the PVWCD service area are predominantly used for irrigated pasture and hay.
- Increased operating pressure in the C-1 system will allow producers to upgrade on-farm irrigation systems, such as converting from flood irrigation to sprinklers or other pressurized systems.
- By reducing conveyance losses and improving operational reliability, the project lowers production risk for existing agricultural operations in PVWCD. Reduced risk and improved predictability support long-term agricultural viability in the district.
- See Plan Sections 2.1.4, 8.1

Socio-Cultural Public Benefits

19. Does the project support public health and/or public safety?

- Not evaluated in the Plan-EA.

20. Does the project support local food systems and the vitality of the local communities?

- The project supports local food systems and community resiliency by improving the reliability and efficiency of irrigation water supplies that underpin existing agricultural production in the community.
- The project area is characterized by irrigated agricultural lands, primarily pasture and hay, which contribute to the local agricultural economy and support regional food and livestock systems. Continued agricultural viability is an important component of rural community stability in the Powder Valley area.
- The project reduces conveyance losses and improves delivery reliability by piping open ditches and modernizing infrastructure. Conserving approximately 2,229 acre-feet of water per year increases system reliability, particularly during dry years, reducing the risk of irrigation shortfalls that could disrupt agricultural production.
- Improved water management efficiency reduces vulnerability of agricultural operations to drought and hydrologic variability, supporting long-term economic and social resilience for PVWCD patrons.
- Supporting the long-term resilience of irrigation-dependent farms helps sustain local food systems and rural communities in the Powder Valley area, which is especially important given broader statewide pressures on agricultural viability, where Oregon continues to lose about one farm per day and faces ongoing challenges to farm economic stability.
- See Plan Sections 5.3.2.2, 8.1; Appendix D.2.2.1.4

21. Does the project support the intrinsic value or inherent worth of something independent of human benefit?
- The project supports the intrinsic value and inherent worth of other-than-human entities by restoring ecological processes, improving habitat conditions, and enabling the persistence of native aquatic species independent of direct human use.
 - Increased instream flows in Dutch Creek, Anthony Creek, and the North Powder River restore ecological functions such as natural flow regimes, thermal buffering, and habitat availability that allow aquatic ecosystems to function as living systems in their own right.
 - Reduced diversion rates and improved hydrologic conditions decrease chronic stress on riparian corridors, supporting ecological processes such as nutrient cycling, bank stability, and habitat connectivity.
 - Fish screening and passage improvements at the Carnes Diversion eliminate entrainment risk and restore longitudinal connectivity, allowing native fish species to move, spawn, and persist as self-sustaining populations rather than as managed or compromised resources.
 - Improved riparian vegetation condition supports soils by maintaining soil moisture, reducing disturbance from ditch maintenance, and sustaining biological soil function, recognizing soil as a foundational living component of the ecosystem.
 - Healthier riparian plant communities provide habitat and forage for native pollinators and invertebrates, supporting biodiversity and ecosystem complexity independent of agricultural production goals.
 - The project reflects a stewardship approach that balances human use with protection of ecological systems, supporting the value of non-human life beyond instrumental benefits.
22. Does the project result in improvements in conditions for underrepresented or underserved communities?
- The federally threatened bull trout and state listed Columbia River redband trout have cultural significance to the Warm Springs, Umatilla, Burns Paiute, and Nez Perce Tribes. These fish species would benefit from the project due to increases in habitat availability and water quality improvements.
 - Irrigated agriculture is a primary economic activity in the Powder Valley area, and agricultural income contributes to household stability in communities experiencing economic constraints. The project provides support to the area's economically distressed rural communities, including populations affected by lower income and higher poverty rates, by improving irrigation reliability that underpins local agricultural livelihoods.
23. Does the project support identity, livelihood, or sense of place values of people or communities in the area?
- The project supports the livelihood and sense of place values in the Powder Valley area by sustaining irrigated agriculture and water management practices that are central to local identity, land use, and community.

- Agricultural livelihoods in the district are closely tied to reliable surface water delivery systems that have shaped settlement patterns, land ownership, and community relationships over generations. By improving conveyance efficiency and water reliability, the project supports continuation of existing agricultural operations, helping maintain livelihoods and cultural continuity associated with working agricultural landscapes.
- Increased instream flows and improved fish passage support native fish populations and stream conditions that contribute to the ecological character of the watershed, reinforcing place-based values tied to healthy local waterways.
- The project modernizes infrastructure while maintaining the overall agricultural land use pattern, thereby supporting sense of place without introducing major land use conversion or community displacement.

24. Does the project support state or local priorities?

- The project aligns closely with Oregon state and local priorities for water quality standards, native fish recovery, and balanced water management by improving instream flows, restoring connectivity, and enhancing habitat for priority species.
- The project improves instream flows and temperature conditions in Anthony Creek and the North Powder River, directly addressing Oregon Department of Environmental Quality temperature impairments, which are a statewide water quality priority.
- Increased flows and reduced thermal stress support habitat designated as critical habitat for federally listed bull trout, aligning with Oregon Department of Fish and Wildlife priorities for native fish conservation and recovery in the Powder River Basin. Bull trout also have cultural significance to Indian tribes (see question 22).
- Fish passage and screening improvements at the Carnes Diversion are consistent with Oregon Department of Fish and Wildlife and local watershed priorities to eliminate entrainment and improve longitudinal connectivity for native fish species.
- The project aligns with Oregon priorities to balance agricultural water use with instream ecological needs through efficiency improvements rather than increased diversion, supporting collaborative approaches to water resource management.

25. Does the project support recreation and/or scenic values?

- The project promotes recreation and scenic values by increasing instream flows, improving aquatic habitat, and increasing the reliability of water retained in reservoirs, which together support recreational fishing, boating, wildlife viewing, and scenic quality.
- Anthony Creek, the North Powder River, and Pilcher Creek and Wolf Creek reservoirs contribute to local scenic character and provide opportunities for recreation such as fishing, boating and wildlife observation. Aquatic habitat quality and recreational value are limited under baseline conditions by low summer flows, elevated stream temperatures, and reduced late-season reservoir water levels.

- By reducing conveyance losses, the project conserves approximately 2,229 acre-feet of water per year, improving overall system efficiency and increasing streamflow and the reliability of water available for storage in reservoirs during some years.
- Improved reservoir storage reliability supports recreational uses that depend on adequate water levels, such as fishing and non-motorized boating, particularly during late summer periods.
- Increased instream flows resulting from conserved water improve habitat conditions for native fish species, supporting recreational fishing opportunities over time. Restoring more natural flow regimes in Anthony Creek, the North Powder River, and Dutch Creek improves visual and ecological stream conditions that contribute to scenic values.
- Fish passage and screening improvements at the Carnes Diversion enhance fish population connectivity, which supports long-term recreational fisheries.

26. Does the project support traditional cultural places, sacred areas, or archaeologically sensitive sites?

- No.

D.7.9 Scoring Table

Benefit Category	Question Number	Question	Preliminary Score	NRCS-OR Final Score
Economic	1	Does the project have an economic effect that is important to the community through job creation, job retention, or increased economic activity?	5	5
Economic	2	Does the project result in increases in efficiency and/or innovation in the area?	5	5
Economic	3	Compared to the baseline conditions, would the project result in Operations and Maintenance (O&M) effort savings?	7	7
Economic	4	Does the project result in enhancement of infrastructure, farmland, public resource lands, industrial lands, commercial lands or lands having other key uses?	5	5
Economic	5	Does the project result in enhancement of the economic value associated with tourism, recreation, fishing (recreational or commercial), or other?	3	3
Economic	6	Does the project result in increases in agricultural-related economic value or productivity of farmland?	7	7
		Total Economic Score		32
Environmental	7	Does the project improve degraded land, reduce processes that drive land degradation or desertification, and/or support soil health?	5	5
Environmental	8	Does the project result in an improvement to surface water quantity?	7	7
Environmental	9	Does the project result in an improvement to surface water quality?	5	5
Environmental	10	Does the project result in an improvement to groundwater quantity?	0	0
Environmental	11	Does the project result in an improvement to groundwater quality?	0	0
Environmental	12	Does the project improve habitat for species?	7	7
Environmental	13	Does the project provide energy benefits?	7	7
Environmental	14	Does the project result in an improvement to air quality?	Not explored	Not explored

Appendix D: Investigation and Analyses Report

Benefit Category	Question Number	Scoring Questions and Summary	Preliminary Score	NRCS-OR Final Score
Environmental	15	Does the project improve the ability of ecosystems to maintain their function during climatic variability?	3	5
Environmental	16	Does the project result in improvements that address one or more limiting ecological factors in the project watershed?	7	7
Environmental	17	Does the project support crop diversity?	1	1
		Total Environmental Score		44
Socio-cultural	18	Does the project support public health and/or public safety?	Not explored	Not explored
Socio-cultural	19	Does the project support local food systems and the vitality of the local communities?	5	5
Socio-cultural	20	Does the project support the intrinsic value or inherent worth of something independent of human benefit?	5	5
Socio-cultural	21	Does the project result in improvements in conditions for underrepresented or underserved communities?	3	3
Socio-cultural	22	Does the project support identity, livelihood, or sense of place values of people or communities in the area?	5	5
Socio-cultural	23	Does the project support state or local priorities?	7	7
Socio-cultural	24	Does the project support recreation and/or scenic values?	5	5
Socio-cultural	25	Does the project support traditional cultural places, sacred areas, or archaeologically sensitive sites?	0	0
		Total Socio-cultural Score		30
		Total MCDA Score		106
		Total MCDA Points Available		161
		Overall Percentage Score		66%

D.7.10 Detailed Question Guidance and Scoring Criteria

D.7.10.1 Category: Economic Public Benefits

Question 1: Does the project have an economic effect that is important to the community through job creation, job retention, or increased economic activity?

Economic effects include job impacts and broader economic activity associated with goods and services. When evaluating economic effects, consider values the project generates, including those that cannot be easily monetized or captured through conventional market-based indicators. Job creation means the project would result in new jobs, while retention means the project would prevent the loss of existing jobs. Include direct (project) and indirect (supply chain/support) effects. Note any ripple effects in the local, regional, or national economy. Specify if jobs are temporary or permanent (permanent are weighted more).

Increased economic activity includes growth in production, sales, or revenue post-project. Also consider new firms, contracts, or orders that may be possible because of the project. Include broader benefits e.g., food/water security, avoided costs, and support for agricultural systems and community livelihoods. Consider both direct and indirect economic impacts.

Tip: Briefly summarize the applicable current conditions to contextualize the benefit(s). This will help NRCS appropriately evaluate the project's benefit(s). In the Watershed Plan, if applicable, quantify and describe jobs created/retained, and reference supporting economic plans or activities. In this response, indicate the location in the Watershed Plan location where these details are identified, but focus on what the jobs or increase in economic activity mean to the community and local, regional, and/or national economy. Note potential decline without the project (if applicable).

Exceptional: 7 pts	Exceptional or critical economic benefit to the community or region. Jobs are permanent and substantial, and/or economic activity increases significantly across multiple sectors with broad direct and indirect effects. Strong supporting evidence demonstrates a high likelihood of success.
High: 5 pts	High economic benefit to the community or region. Jobs are largely permanent, and/or economic activity increases across one or more businesses or sectors with meaningful direct and indirect effects. Supporting evidence is provided.
Medium: 3 pts	Moderate economic benefit. Jobs or economic activity is limited in scale or certainty. Some supporting evidence is provided.
Minor: 1 pt	Minor economic benefits. Jobs created may be few or temporary, and economic activity increases are limited. Supporting evidence is limited.
No benefit: 0 pts	The project is not likely to create jobs or increase economic activity, or claims are unsupported.
Minor detriment: -1 pt	Minor detrimental economic effects may occur (e.g., minor job losses or reduced economic activity with limited scope or duration).
Medium detriment: -3 pts	Moderately detrimental economic effect (e.g., moderate job losses, reduced economic activity, or supply chain disruption).
High detriment: -5 pts	Substantial and wide-reaching economic harm is expected (e.g., high job losses, major economic activity reduction, or disruption to agricultural systems or community livelihoods), with supporting evidence.
Extreme detriment: -7 pts	Severe or irreversible economic harm is expected (e.g., critical job losses, sector collapse, or long-term livelihood damage).

Question 2: Does the project result in increases in efficiency and/or innovation in the area?

Increase in efficiency means the project would make improvements in performance or functionality resulting in less effort or waste. Increase in innovation means that new, creative solutions and ideas would be implemented. Examples of increases in efficiency and innovation include water system efficiencies such as system redundancy (back-up, inter-ties), eliminating leakage, water flow monitoring systems (e.g. SCADA), recycled water, hydro production, innovative production techniques, energy savings (e.g., the energy required to move, treat, or heat water), and/or time savings.

Tip: Briefly summarize the applicable current conditions to contextualize project benefit(s). Consider the project not only in terms of on-site operational improvements, but also in the broader area context, such as how the efficiency or innovation gains may benefit neighboring water users, regional infrastructure networks, or the wider agricultural community. Indicate the location(s) in the Watershed Plan where supporting details about efficiency gains or innovative practices implemented are located. In this response, focus on what the improvements mean for the district, watershed, or region. Note potential decline in system performance without the project, if applicable.

Exceptional: 7 pts	Exceptional or transformative increases in efficiency and/or innovation at a district, watershed, or regional scale. Improvements are extensive, long-term, and well-documented. Strong supporting evidence demonstrates a high likelihood of success and wide-reaching benefit.
High: 5 pts	Increases in efficiency or innovation are highly likely and well-supported. The magnitude, scale, or certainty of improvement are considerable. Meaningful benefits may extend beyond the immediate project area.
Medium: 3 pts	Moderate increases in efficiency or innovation. Benefits may be localized, incremental, or focused on specific components of the system. Improvements are real but limited in scope, scale, or certainty.
Minor: 1 pt	Minor increases in efficiency or innovation. Benefits are real but minimal in scale or impact. Supporting evidence is limited.
No benefit: 0 pts	No expected increase in efficiency or innovation. Evidence is insufficient or claims unsupported. System performance, resource use, or operational practices remain unchanged.
Minor detriment: -1 pt	A minor reduction in efficiency or innovation may occur. Effects are limited in scale or scope and are unlikely to have lasting consequences.
Medium detriment: -3 pts	A moderate reduction in efficiency or innovation is expected. Effects are meaningful, may affect multiple system components or users, and may warrant concern.
High detriment: -5 pts	Significant reductions in efficiency or innovation may occur with wide-reaching effects on system performance or operational capacity.
Extreme detriment: -7 pts	The project is likely to cause severe or irreversible reductions in efficiency or innovation, including potential collapse of system functionality or long-term degradation of infrastructure performance.

Question 3: Compared to the baseline conditions, would the project result in Operations and Maintenance (O&M) effort savings?

Avoided operations and maintenance (O&M) efforts are defined here as O&M expenses or time saved by implementing a project compared to the baseline conditions. Examples of O&M savings may include avoiding the time and cost of replacing or repairing infrastructure by a project sponsor or their patrons, reduced regulatory compliance costs, reduced labor hours, or reduced cost of herbicide or insecticide application.

Tip: Briefly summarize the applicable current conditions to contextualize project benefit(s). When describing saved O&M effort, consider discussing if the savings is a large or small portion of the sponsor's overall budget and contextualize how these savings would affect the irrigation community. For example, if installing SLO infrastructure would save producers 20 hours of work a month, how would those producers use their extra time and what would that mean for the community? If saved effort is monetized and captured in the National Economic Development analysis, please briefly summarize the savings so that NRCS can complete a review based on the response information.

Exceptional: 7 pts	Exceptional or critical reduction in annual O&M costs or effort. Savings are well-documented, may affect a considerable portion of the sponsor's overall O&M budget, and/or have meaningful positive effects on the irrigation community. Strong supporting evidence demonstrates a high likelihood of sustained savings.
High: 5 pts	Major reduction in annual O&M costs or effort. Savings are notable and well-supported, with meaningful benefits to the sponsor and/or patrons. Supporting evidence is provided.
Medium: 3 pts	Moderate reduction in annual O&M costs or effort. Savings may be limited in scale, scope, or certainty, but are real and beneficial. Some supporting evidence is provided.
Minor: 1 pt	Minor reduction in annual O&M costs or effort. Benefits are real but minimal. Supporting evidence may be limited.
No benefit: 0 pts	The project is not likely to result in avoidance of O&M costs or effort for the project sponsor(s) or patrons, or benefit claims are unsupported.
Minor detriment: -1 pt	Minor increase in annual O&M costs or effort may occur, likely in the short term. Effects are limited in scale or scope and are unlikely to have lasting consequences.
Medium detriment: -3 pts	Moderate increase in annual O&M costs or effort over the long term. Effects are meaningful and may affect the sponsor's operational capacity or patron burden.
High detriment: -5 pts	Substantial and sustained increase in O&M costs or effort is expected, placing considerable strain on the sponsor's budget or operations, with supporting evidence.
Extreme detriment: -7 pts	Severe or irreversible increase in O&M costs or effort is likely, potentially threatening the financial viability of the sponsor or long-term operability of the system.

Question 4: Does the project result in enhancement of infrastructure, farmland, public resource lands, industrial lands, commercial lands or lands having other key uses?

Enhancement of infrastructure, including municipal infrastructure, farmland, public resource lands, industrial lands, commercial lands and other lands means that the value, effectiveness, or reliability of such infrastructure or lands would increase as a result of project implementation. This may include an increase in the re-sale or rental value of the land or improvements. Example projects may result in, maintained, repaired, or upgraded infrastructure; maintained or buffered riparian areas; and maintained or improved soils.

Tip: *The Farmland Protection Policy Act (FPPA) aims to minimize the extent to which Federal programs contribute to the unnecessary and irreversible conversion of farmland to nonagricultural uses. Identify if the project supports FPPA’s aims by enhancing farmland, which includes prime farmland, unique farmland, and land of statewide or local importance, or by reducing the potential conversion of farmland to nonagricultural use. Farmland does not have to be currently used for cropland; farmland can be forest land, pastureland, cropland, or other land, but not water or urban built-up land. Summarize the applicable current conditions to contextualize project benefit(s).*

Exceptional: 7 pts	Exceptional or critical enhancement of infrastructure or land. Improvements are extensive, well-documented, and have meaningful positive effects on the community or region. Strong supporting evidence demonstrates a high likelihood of sustained benefit.
High: 5 pts	Substantial enhancement of infrastructure or land. Improvements are notable and well-supported, with meaningful benefits to the sponsor, patrons, or broader community. Supporting evidence is provided.
Medium: 3 pts	Moderate enhancement of infrastructure or land. Improvements may be limited in scale, scope, or certainty, but are real and beneficial. Some supporting evidence is provided.
Minor: 1 pt	Minor enhancement of infrastructure or land. Benefits are real but minimal. Supporting evidence is limited.
No benefit: 0 pts	Enhancements are not likely, or benefit claims are unsupported.
Minor detriment: -1 pt	Minor degradation of infrastructure or land, or minor removal from productive use may occur. Effects are limited in scale or scope and are unlikely to have lasting consequences.
Medium detriment: -3 pts	Moderate degradation of infrastructure or land, or removal from productive use is likely. Effects are meaningful and may warrant concern.
High detriment: -5 pts	Substantial degradation of infrastructure or land is expected, with significant removal from productive use and wide-reaching effects, with supporting evidence.
Extreme detriment: -7 pts	Severe or irreversible degradation of infrastructure or land is likely, including potential permanent loss of farmland, critical infrastructure, or productive lands.

Question 5: Does the project result in enhancement of the economic value associated with tourism, recreation, fishing (recreational or commercial), or other?

Enhancement of the economic value associated with tourism, recreation, and fishing (recreational or commercial) means that the attractiveness, accessibility, or productivity of these activities would increase because of project implementation. Examples include increases in daily park fees, tour guide revenues, boat or gear rentals, fishing licenses, or hospitality and lodging revenue. Also consider broader indirect effects, such as increased visitor spending in local businesses, growth in outfitter or guide services, and improvements to fisheries that support recreational or commercial harvests. Projects that restore or improve water quantity, quality, or timing may enhance downstream recreational and commercial opportunities even if those effects occur beyond the immediate project boundary.

Tip: Briefly summarize the applicable current conditions to contextualize the benefit(s). Consider both direct economic effects (e.g., fishing license revenue, lodging stays) and indirect effects (e.g., local spending by visitors, supply chain support for outfitters). Identify the locations where these effects are described in detail in the Watershed Plan and summarize in this response. Focus on considering the project in the broader regional context, for example, how improvements to irrigation infrastructure may affect streamflow timing or water temperatures in ways that benefit or detract from recreational and commercial fishing opportunities. Note potential decline in tourism, recreations, or fishing activity without the project, if applicable.

Exceptional: 7 pts	Exceptional enhancement of the economic value of tourism, recreation, or fishing. Benefits are well-documented, extend across multiple sectors or user groups, and have meaningful positive effects on the local or regional economy. Strong supporting evidence demonstrates a high likelihood of sustained benefit.
High: 5 pts	Substantial enhancement. Benefits are notable and well-supported by evidence, with meaningful effects on the community or region.
Medium: 3 pts	Moderate enhancement. Benefits may be limited in scale, scope, or certainty, but are real and beneficial. Some supporting evidence is provided.
Minor: 1 pt	Minor enhancement. Benefits are real but minimal. Supporting evidence is limited.
No benefit: 0 pts	Enhanced values are not likely, or benefit claims are unsupported.
Minor detriment: -1 pt	Minor decrease in the economic value of tourism, recreation, or fishing may occur. Effects are limited in scale or scope and are unlikely to have lasting consequences.
Medium detriment: -3 pts	Moderate decrease in economic value is likely. Effects are meaningful and may warrant concern.
High detriment: -5 pts	Substantial decrease in economic value is expected, with wide-reaching effects on the local or regional economy, with supporting evidence.
Extreme detriment: -7 pts	Severe or irreversible decrease in the economic value is expected. This may include the potential collapse of fisheries or long-term loss of recreation-dependent livelihoods.

Question 6: Does the project result in increases in agricultural-related economic value or productivity of farmland?

Farmland relates to areas of prime farmland, unique farmland, and land of statewide or local importance, which may include irrigated agricultural lands, non-irrigated agricultural lands, or other productive lands. For example, farmland can be forest land, pastureland, cropland, or other land, but not water or urban built-up land.

Increases in agricultural economic value or farmland productivity can be **direct** (e.g., increased crop yields, improved crop quality, or lands returning to production due to improved water supply) or **indirect** (e.g., improved water delivery reliability, reduced erosion, or producer cost savings that enable conversion to higher-value crops). Indirect benefits may also extend to adjacent industries and employment.

Tip: Briefly summarize the applicable current conditions to contextualize the benefit(s). Where applicable, identify the sections in the Watershed Plan that highlight changes to farmland or financial performance. Describe whether the anticipated increase in value or productivity is direct, indirect, or both, and explain what that means for the area's agricultural community. Where applicable, cite articles, reports, studies, or grower interviews. Note if a decline in agricultural viability is anticipated without the project.

Exceptional: 7 pts	Exceptional increase in agricultural economic value or farmland productivity. Benefits are well-documented and have meaningful positive effects on sponsor operations and the broader agricultural community. Strong supporting evidence demonstrates a high likelihood of sustained benefit.
High: 5 pts	Substantial increase in agricultural economic value or farmland productivity. Benefits are notable and well-supported with meaningful effects on, for example, farm revenues, operational viability, or risk reduction. Supporting evidence is provided.
Medium: 3 pts	Moderate increase in agricultural economic value or farmland productivity. Benefits may be limited in scale, scope, or certainty, but are real and beneficial. Some supporting evidence is provided.
Minor: 1 pt	Minor increase in agricultural economic value or farmland productivity. Benefits are real but minimal. Supporting evidence is limited.
No benefit: 0 pts	Increased value or productivity is not likely, or benefit claims are unsupported.
Minor detriment: -1 pt	Minor decrease in agricultural economic value or farmland productivity may occur. Effects are limited in scale or scope and are unlikely to have lasting consequences.
Medium detriment: -3 pts	Moderate decrease in agricultural economic value or farmland productivity is likely. Effects are meaningful and may affect farm revenues, operational viability, or land in production.
High detriment: -5 pts	Substantial decrease in agricultural economic value or farmland productivity is expected, with wide-reaching effects on sponsor operations or the broader agricultural community, with supporting evidence.
Extreme detriment: -7 pts	Severe or irreversible decrease in agricultural economic value or farmland productivity is likely, including potential permanent loss of productive farmland or long-term collapse of agricultural viability in the project area.

D.7.10.2 Category: Environmental Public Benefits**Question 7: Does the project improve degraded land, reduce processes that drive land degradation or desertification, and/or support soil health?**

Land degradation refers to the “many processes that drive the decline or loss in biodiversity, ecosystem functions or services, and includes the degradation of freshwater and coastal ecosystems that are closely interconnected with terrestrial ecosystems.”²⁹

Degraded land means “a state of land which results from the persistent decline or loss in biodiversity ecosystem functions or services that cannot fully recover unaided within decadal time scales.”²⁹

Desertification means “the degradation of land and vegetation, soil erosion and the loss of topsoil and fertile land in arid, semi-arid, and dry sub-humid areas, caused primarily by human activities and climate variations”.³⁰

Soil health is the ability of soil to function as a living system that supports plants, animals, people, and ecosystem services now and into the future. A healthy soil cycles nutrients; holds and filters water; supports diverse biological communities; and contributes to crop productivity, environmental quality, and resilience.³¹

Tip: Briefly summarize the applicable current conditions in the area to contextualize the benefit(s). When describing whether the project improves degraded land, reduces drivers of degradation or desertification, and/or supports soil health, explain what those improvements mean for the agricultural community (local, regional, or national), watershed, or broader landscape. If applicable, note the potential for continued or accelerated degradation without the project.

Exceptional: 7 pts	Exceptional improvement to land health. Benefits are well-documented, durable, and have meaningful positive effects at the farm, watershed, or landscape scale. Strong supporting evidence demonstrates a high likelihood of sustained benefit.
High: 5 pts	Substantial improvement to land health. Benefits are notable and well-supported, with meaningful effects on ecosystem function, productivity, or resilience. Supporting evidence is provided.
Medium: 3 pts	Moderate improvement to land health. Benefits may be limited in scale, scope, or certainty, but are real and beneficial. Some supporting evidence is provided.
Minor: 1 pt	Minor improvement to land health. Benefits are real but minimal. Supporting evidence is limited.
No benefit: 0 pts	Improvement to land health is not likely, or benefit claims are unsupported.
Minor detriment: -1 pt	Minor decrease in land health may occur. Effects are limited in scale or scope and are unlikely to have lasting consequences.
Medium detriment: -3 pts	Moderate decrease in land health is likely. Effects are meaningful and may affect ecosystem function, productivity, or long-term land viability.

²⁹ Fisher, J., Montanarella, L., and Scholes, R. Chapter 1: Benefits to people from avoiding land degradation and restoring degraded land. In IPBES (2018): The IPBES assessment report on land degradation and restoration. Montanarella, L., Scholes, R., and Bräinich, A. (eds.). Secretariat of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, Bonn, Germany, pp.1-51.

³⁰ United Nations Convention to Combat Desertification. <https://www.unccd.int/land-and-life/desertification/overview>

³¹ <https://www.farmers.gov/conservation/concerns-tool/soil>

Appendix D: Investigation and Analyses Report

High detriment: -5 pts	Substantial decrease in land health is expected, with wide-reaching effects on the farm, watershed, or landscape, with supporting evidence.
Extreme detriment: -7 pts	Severe or irreversible decrease in land health is likely, potentially resulting in permanent loss of productive capacity or ecosystem function.

Question 8: Does the project result in an improvement to surface water quantity?

Improvement in surface water quantity refers to a project's ability to increase the availability, reliability, or beneficial use of surface water resources (e.g. streams, rivers, reservoirs, wetlands). Increased water quantity supports a wide range of ecosystem processes including regulation of water flows, reduction of flood and drought risks, maintenance of aquatic habitats, etc. Improvements may result from changes in watershed hydrology, water management, infrastructure efficiency, or land stewardship practices, for example.

Tip: Briefly describe the current surface water conditions affected by the project. Be sure to reference appropriate sections in the Watershed Plan. Describe the expected ecological benefits, such as enhanced aquatic habitat, improved stream temperature regulation, etc. Where applicable, cite reports, studies, or grower interviews that support the environmental expectations.

Exceptional: 7 pts	Exceptional improvement in surface water quantity with substantial benefits to ecological systems and water availability. Benefits are well-documented, durable, and meaningful at the watershed or regional scale. Strong supporting evidence demonstrates a high likelihood of sustained benefit.
High: 5 pts	Substantial improvement in surface water quantity that meaningfully benefits ecological processes and water availability. Benefits are well-supported but may be somewhat more limited in extent, magnitude, or certainty than Exceptional. Supporting evidence is provided.
Medium: 3 pts	Moderate or localized improvement in surface water quantity. Benefits may be limited in scope, magnitude, or certainty, but are real and supported by reasonable evidence.
Minor: 1 pt	Minor or incidental improvement in surface water quantity. Benefits are possible but minimal, and evidence may be limited.
No benefit: 0 pts	Improvement in surface water quantity is not likely, or benefit claims are unsupported.
Minor detriment: -1 pt	Minor decrease in surface water quantity may occur. Effects are limited in scale or scope and are unlikely to have lasting consequences.
Medium detriment: -3 pts	Moderate decrease in surface water quantity is likely. Effects are meaningful and substantial enough to warrant concern over the long term.
High detriment: -5 pts	Substantial decrease in surface water quantity is expected, with wide-reaching effects on ecological systems and water availability, with supporting evidence.
Extreme detriment: -7 pts	Severe or irreversible decrease in surface water quantity is likely, potentially resulting in permanent loss of aquatic habitat, water availability, or watershed function.

Question 9: Does the project result in an improvement to surface water quality?

Improvement in surface water quality refers to a project's ability to reduce pollutants, sediment, nutrients, or other impairments in streams, rivers, reservoirs, or wetlands. Improved water quality supports a wide range of ecosystem processes, including aquatic habitat function, drinking water safety, and the reduction of harmful algal blooms.

Tip: Briefly describe the current surface water quality parameters affected by the project. Reference appropriate sections in the Watershed Plan. Describe the expected ecological benefits, such as reduced sediment or nutrient loading, enhanced aquatic habitat, reduced algal blooms, etc. Where applicable, cite reports, studies, or grower interviews that support the environmental expectations.

Exceptional: 7 pts	Exceptional improvement in surface water quality with substantial benefits to ecological systems and water resources. Benefits are well-documented, durable, and meaningful at the watershed or regional scale. Supporting evidence demonstrates a high likelihood of sustained benefit.
High: 5 pts	Substantial improvement in surface water quality that meaningfully benefits ecological processes and water resources. Benefits are well-supported but may be somewhat more limited in extent, magnitude, or certainty than Exceptional. Supporting evidence is provided.
Medium: 3 pts	Moderate or localized improvement in surface water quality. Benefits may be limited in scope, magnitude, or certainty, but are real and supported by reasonable evidence.
Minor: 1 pt	Minor or incidental improvement in surface water quality. Benefits are possible but minimal, and evidence may be limited.
No benefit: 0 pts	Improvement in surface water quality is not likely, or benefit claims are unsupported.
Minor detriment: -1 pt	Minor decrease in surface water quality may occur. Effects are limited in scale or scope and are unlikely to have lasting consequences.
Medium detriment: -3 pts	Moderate decrease in surface water quality is likely. Effects are meaningful and substantial enough to warrant concern over the long term.
High detriment: -5 pts	Substantial decrease in surface water quality is expected, with wide-reaching effects on ecological systems and water resources, with supporting evidence.
Extreme detriment: -7 pts	Severe or irreversible decrease in surface water quality is likely, potentially resulting in permanent impairment of aquatic habitat, drinking water sources, or downstream water resources.

Question 10: Does the project result in an improvement to groundwater quantity?

An improvement in groundwater quantity means the project enhances groundwater storage, recharge, aquifer levels, or availability. These changes may, for example, reduce risk of land subsidence or strengthen water-related ecosystem processes, such as drought buffering and baseflow support for streams.

Examples of ways that projects may improve groundwater are increasing groundwater recharge, reducing groundwater pumping, restoring hydrologic function, supporting sustainable groundwater management.

Tip: Briefly describe the current groundwater quantity conditions to contextualize the project benefit(s). Reference appropriate sections in the Watershed Plan. Describe any expected ecological benefits, such as enhanced aquatic habitat or improved surface and groundwater connection. Where applicable, cite reports, or studies that support the environmental expectations.

Exceptional: 7 pts	Exceptional improvement in groundwater quantity. Benefits are well-documented, durable, and meaningful at the watershed or regional scale. Strong supporting evidence demonstrates a high likelihood of sustained benefit.
High: 5 pts	Significant improvement in groundwater quantity that meaningfully benefits ecological systems or water users. Benefits are well-supported but may be somewhat less extensive or certain than Exceptional. Supporting evidence is provided.
Medium: 3 pts	Moderate or localized improvement in groundwater quantity. Benefits may be limited in scope, affected area, or certainty, but are real and supported by reasonable evidence.
Minor: 1 pt	Minor or incidental improvement in groundwater quantity. Benefits are possible but minimal, and evidence may be limited.
No benefit: 0 pts	Improvement in groundwater quantity is not likely, or benefit claims are unsupported.
Minor detriment: -1 pt	Minor decrease in groundwater quantity may occur. Effects are limited in scale or scope and are unlikely to have lasting consequences.
Medium detriment: -3 pts	Moderate decrease in groundwater quantity is likely. Effects are meaningful and substantial enough to warrant concern over the long term.
High detriment: -5 pts	Substantial decrease in groundwater quantity is expected, with wide-reaching effects on aquifer storage, recharge, or dependent ecological systems, with supporting evidence.
Extreme detriment: -7 pts	Severe or irreversible decrease in groundwater quantity is likely, potentially resulting in permanent aquifer depletion, loss of baseflow support, or long-term impairment of groundwater-dependent ecosystems or water users.

Question 11: Does the project result in an improvement to groundwater quality?

An improvement in groundwater quality means the project reduces contamination, salinity, nutrient loading, or other pollutants that impair groundwater for drinking water, irrigation supply, ecosystem support, or community uses. Improved groundwater quality supports water purification, protection of sole source aquifers, and the health of groundwater-dependent ecosystems and communities.

Improvements may result from reduced agricultural chemical inputs, changes in irrigation management, infrastructure upgrades that prevent leaching or seepage, or land stewardship practices that reduce pollutant infiltration.

Tip: Briefly describe the current groundwater quality conditions to contextualize the project benefit(s), including any known contaminants, impairments, or regulatory concerns. Reference appropriate sections in the Watershed Plan. Describe expected water quality benefits and consider both on-site and down-gradient effects on water users and ecosystems. Where applicable, cite reports, or studies that support the environmental expectations. Note the potential for continued or worsening impairment without the project, if applicable.

Exceptional: 7 pts	Exceptional improvement in groundwater quality with substantial benefits to water users, ecosystems, and community water supplies. Benefits are well-documented, durable, and meaningful at the watershed or regional scale. Strong supporting evidence demonstrates a high likelihood of sustained benefit.
High: 5 pts	Significant improvement in groundwater quality that meaningfully benefits water users or dependent ecosystems. Benefits are well-supported but may be somewhat less extensive or certain than Exceptional. Supporting evidence is provided.
Medium: 3 pts	Moderate or localized improvement in groundwater quality. Benefits may be limited in scope, affected area, or certainty, but are real and supported by reasonable evidence.
Minor: 1 pt	Minor or incidental improvement in groundwater quality. Benefits are possible but minimal, and evidence may be limited.
No benefit: 0 pts	Improvement in groundwater quality is not likely, or benefit claims are unsupported.
Minor detriment: -1 pt	Minor decrease in groundwater quality may occur. Effects are limited in scale or scope and are unlikely to have lasting consequences.
Medium detriment: -3 pts	Moderate decrease in groundwater quality is likely. Effects are meaningful and substantial enough to warrant concern over the long term.
High detriment: -5 pts	Substantial decrease in groundwater quality is expected, with wide-reaching effects on water users, dependent ecosystems, or community water supplies, with supporting evidence.
Extreme detriment: -7 pts	Severe or irreversible decrease in groundwater quality is likely, potentially resulting in permanent impairment of drinking water sources, sole source aquifers, or groundwater-dependent ecosystems.

Question 12: Does the project improve habitat for species?

Improved habitat for species means the project enhances the quantity, quality, condition, or connectivity of natural or managed habitats that support wildlife, fish, invertebrates, plants, or other organisms. Habitat improvement may occur through changes in hydrology, vegetation, water quality, soil condition, or physical structure of ecosystems that increase suitability for species' survival, reproduction, migration, or long-term population viability.

Increasing habitat area, complexity, carrying capacity, or connectivity are some examples of ways that improving habitat for species may be realized.

Tip: Briefly describe the current habitat conditions or limiting factors of concern for species or ecological communities and identify the ecological processes that may be affected by the project. Be sure to reference appropriate sections in the Watershed Plan. Describe any expected habitat benefits and how these benefits would support terrestrial or aquatic species. Where applicable, cite scientific articles, reports, or studies that support the environmental expectations.

Exceptional: 7 pts	Exceptional, well-documented, and long-term improvements in habitat quantity, quality, condition, or connectivity for species. Benefits are ecologically meaningful at the watershed or landscape scale and may include habitat for species listed under the Endangered Species Act or species of concern. Strong supporting evidence demonstrates a high likelihood of sustained benefit.
High: 5 pts	Significant improvement in habitat quantity, quality, condition, or connectivity. Benefits are ecologically meaningful and well-supported, though somewhat less in extent, magnitude, or certainty than Exceptional. Supporting evidence is provided.
Medium: 3 pts	Moderate or localized improvement in habitat conditions. Benefits may be limited in scope, affected area, or certainty, but are real and supported by reasonable evidence.
Minor: 1 pt	Minor or incidental improvement in habitat conditions for terrestrial or aquatic species. Benefits are real but minimal.
No benefit: 0 pts	Habitat improvement is not likely, or benefit claims are unsupported.
Minor detriment: -1 pt	Minor detriment to habitat conditions for terrestrial or aquatic species may occur. Effects are limited in scale or scope and are unlikely to have lasting consequences.
Medium detriment: -3 pts	Moderate detriment to habitat conditions is likely. Effects are meaningful and substantial enough to warrant concern over the long term.
High detriment: -5 pts	Substantial detriment to habitat quantity, quality, condition, or connectivity is expected, with wide-reaching effects on terrestrial or aquatic species, with supporting evidence.
Extreme detriment: -7 pts	Severe or irreversible detriment to habitat conditions is likely, potentially resulting in permanent loss of critical habitat, displacement of ESA-listed or species of concern, or long-term collapse of ecological communities.

Question 13: Does the project provide energy benefits?

An energy benefit means the project reduces energy demand or increases energy-use efficiency in support of agricultural, ecological, or community water management activities. Examples of projects that may result in energy benefits include transitions to lower-energy delivery systems, gravity-fed infrastructure, pump upgrades, reduced groundwater pumping, etc. These improvements can produce co-benefits for water quality, food security, and climate variability mitigation by reducing reliance on fossil fuels and lowering the carbon footprint of water management operations.

Tip: Briefly describe the current energy use conditions to contextualize the project benefit(s). Identify the specific project components expected to reduce energy demand or increase energy-use efficiency, and reference appropriate sections in the Watershed Plan if expected savings have been quantified. Consider how energy benefits that result from a project may affect local or regional energy demands. If applicable, discuss how energy benefits may affect other ecological processes. Cite reports or studies that support the benefit expectations.

Exceptional: 7 pts	Exceptional, well-documented, and long-term improvement in energy use. Benefits are large in magnitude and meaningful at the local, regional, or national scale. Strong supporting evidence demonstrates a high likelihood of sustained benefit.
High: 5 pts	Significant reduction in energy demand or increase in energy-use efficiency. Benefits are notable and well-supported, with meaningful effects, though somewhat less in extent, magnitude, or certainty than Exceptional. Supporting evidence is provided.
Medium: 3 pts	Moderate or localized reduction in energy demand or increase in energy-use efficiency. Benefits may apply to specific system components or carry greater uncertainty but are real and supported by reasonable evidence.
Minor: 1 pt	Minor or incidental reduction in energy demand or increase in energy-use efficiency. Expected benefits are limited in scale or evidence.
No benefit: 0 pts	Reduction in energy demand or increase in energy-use efficiency is not likely, or benefit claims are unsupported.
Minor detriment: -1 pt	Minor increase in energy demand or decrease in energy-use efficiency may occur. Effects are limited in scale and are unlikely to have lasting consequences.
Medium detriment: -3 pts	Moderate increase in energy demand or decrease in energy-use efficiency is likely. Effects are meaningful and may affect operational costs or the environmental footprint of the system over the long term.
High detriment: -5 pts	Substantial increase in energy demand or decrease in energy-use efficiency is expected, with wide-reaching effects on operational costs or system sustainability, with supporting evidence.
Extreme detriment: -7 pts	Severe or irreversible increase in energy demand is likely, potentially resulting in long-term financial strain on the sponsor or fundamental impairment of system viability.

Question 14: Does the project result in an improvement to air quality?

An improvement in air quality means that the project reduces emissions, pollutants, particulates, odors, or atmospheric contaminants associated with land use, water management, vegetation condition, or agricultural operations. For example, improvements may result from changes that reduce dust, volatile compounds, exhaust from machinery, greenhouse gas emissions, or ozone-forming pollutants. Air quality benefits may occur directly through reduced emissions or indirectly through improved soil, vegetation, water, and land management processes.

Some examples of projects that may improve air quality are those that reduce dust and particulates through soil health practices, erosion reduction, or improved surface moisture; those that reduce wildfire risk or severity through improved hydrologic or vegetation management; etc.

Tip: Briefly describe the air-quality concerns or pollutant sources and how the project is expected to reduce emissions, particulates, odors, etc. Contextualize the project benefits to the community or region. If applicable, describe any links between improvement in air quality and supporting ecological process and/or species. Cite reports, or studies that support the environmental expectations.

Exceptional: 7 pts	Exceptional, well-documented, and long-term improvement in air quality. Benefits are considerable in magnitude, extend across the community or region, and may produce meaningful co-benefits for ecological processes or public health. Strong supporting evidence demonstrates a high likelihood of sustained benefit.
High: 5 pts	Substantial improvement in air quality that is meaningful and well-supported. Benefits are notable in extent, magnitude, or certainty, though somewhat less than Exceptional. Supporting evidence is provided.
Medium: 3 pts	Moderate or localized improvement in air quality. Benefits may be limited in scope, affected area, or certainty, but are real and supported by reasonable evidence.
Minor: 1 pt	Minor or incidental improvement in air quality. Benefits are real but minimal, and evidence may be limited.
No benefit: 0 pts	Improvement in air quality is not likely, or benefit claims are unsupported.
Minor detriment: -1 pt	Minor detriment to air quality may occur. Effects are limited in scale or scope and are unlikely to have lasting consequences.
Medium detriment: -3 pts	Moderate detriment to air quality is likely. Effects are meaningful and substantial enough to warrant concern over the long term.
High detriment: -5 pts	Substantial detriment to air quality is expected, with wide-reaching effects on the community, region, or dependent ecological processes, with supporting evidence.
Extreme detriment: -7 pts	Severe or irreversible detriment to air quality is likely, potentially resulting in long-term public health impacts, significant increases in atmospheric pollutants, or permanent degradation of air quality conditions in the project area.

Question 15: Does the project improve the ability of ecosystems to maintain their function during climatic variability?

Maintaining ecosystem function during climatic variability means that the project improves the ability of ecosystems—terrestrial, aquatic, riparian, etc.—to absorb, adapt to, and recover from climate-related stressors such as drought, extreme precipitation, flooding, heatwaves, shifting snowpack or runoff patterns, increased evapotranspiration, high-intensity storms, and disturbance events (erosion, wildfire, pest outbreaks). This may occur through projects that restore ecological functions such as water retention, nutrient cycling, soil formation, and biodiversity. Examples may include those projects that improve water availability, improve water management infrastructure, reduce wildfire or erosion risk, or enhance landscape connectivity.

Tip: Briefly describe the current ecosystem conditions and the climate-related stressors or vulnerabilities of concern (e.g., drought frequency, flood risk, erosion, shifting runoff patterns, wildfire risk), to contextualize the project benefit(s). Consider how the project is expected to improve the ability of ecosystems to absorb, adapt to, or recover from these stressors both locally and in the wider region, if applicable. Consider how the project supports ecological functions. Reference appropriate sections in the Watershed Plan, and cite reports, or studies that support the environmental expectations. Note the potential for continued or worsening ecological vulnerability without the project, if applicable.

Exceptional: 7 pts	Exceptional, well-documented, and long-term improvement in the ability of ecosystems to maintain their function during climatic variability. Benefits are considerable in magnitude, extend across the watershed or landscape, and strengthen key ecological processes. Strong supporting evidence demonstrates a high likelihood of sustained benefit.
High: 5 pts	Significant improvement in ecosystem functional capacity during climatic variability. Benefits are ecologically meaningful and well-supported, though somewhat less in extent, magnitude, or certainty than Exceptional. Supporting evidence is provided.
Medium: 3 pts	Moderate or localized improvement. Benefits may be limited in scope, affected area, or certainty, but are real and supported by reasonable evidence.
Minor: 1 pt	Minor or incidental improvement. Benefits are real but minimal, and evidence may be limited.
No benefit: 0 pts	Improvement in ecosystem functional capacity during climatic variability is not likely, or benefit claims are unsupported.
Minor detriment: -1 pt	Minor reduction. Effects are limited in scale or scope and are unlikely to have lasting consequences.
Medium detriment: -3 pts	Moderate reduction is likely. Effects are meaningful and substantial enough to warrant concern over the long term.
High detriment: -5 pts	Substantial reduction is expected, with wide-reaching effects on ecological processes and the ability of terrestrial, aquatic, or riparian systems to recover from disturbance. Supporting evidence is provided.
Extreme detriment: -7 pts	Severe or irreversible reduction in ecosystem functional capacity during climatic variability is likely, potentially resulting in permanent degradation of ecological processes, loss of landscape-scale resilience, or transition to a fundamentally degraded ecological state.

Question 16: Does the project result in improvements that address one or more limiting ecological factors in the project watershed?

A limiting ecological factor is any resource or condition that restricts the health, productivity, distribution, or resilience of species, habitats, or ecosystems. Limiting factors may be physical, chemical, biological, or hydrological in nature, and often interact in ways that compound their effects on ecological communities. Projects that address limiting factors may include those that improve hydrologic function, water quality or quantity, habitat connectivity, riparian condition, sediment dynamics, water temperature, or reduce barriers to species movement.

Tip: Briefly describe the current ecological conditions and identify the specific limiting factor(s) of concern in the project watershed. If a project is expected to reduce or remove those limitations, describe the ecological processes or species communities most likely to benefit. Consider whether benefits are localized or extend across the broader watershed and the what the benefits may mean to the area or community. Reference appropriate sections in the Watershed Plan and cite reports, or studies that support the environmental expectations, if applicable.

Exceptional: 7 pts	Exceptional, well-documented, and long-term improvement to one or more limiting ecological factors. Benefits are considerable in magnitude, extend across the watershed or landscape, and are expected to produce meaningful recovery of ecological function, habitat, or species communities. Strong supporting evidence demonstrates a high likelihood of sustained benefit.
High: 5 pts	Significant improvement to one or more limiting ecological factors. Benefits are ecologically meaningful and well-supported, though somewhat less in extent, magnitude, or certainty than Exceptional. Supporting evidence is provided.
Medium: 3 pts	Moderate or localized improvement to one or more limiting ecological factors. Benefits may be limited in scope, affected area, or certainty, but are real and supported by reasonable evidence.
Minor: 1 pt	Minor or incidental improvement to one or more limiting ecological factors. Benefits are real but minimal, and evidence may be limited.
No benefit: 0 pts	Improvement to limiting ecological factors is not likely, or benefit claims are unsupported.
Minor detriment: -1 pt	Minor detriment to one or more limiting ecological factors may occur. Effects are limited in scale or scope and are unlikely to have lasting consequences.
Medium detriment: -3 pts	Moderate detriment to one or more limiting ecological factors is likely. Effects are meaningful and substantial enough to warrant concern over the long term.
High detriment: -5 pts	Substantial detriment to one or more limiting ecological factors is expected, with wide-reaching effects on species, habitats, or watershed-scale ecological processes, with supporting evidence.
Extreme detriment: -7 pts	Severe or irreversible detriment to one or more limiting ecological factors is likely, potentially resulting in permanent degradation of ecological function or the long-term loss of species or habitat viability in the watershed.

Question 17: Does the project support crop diversity?

Crop diversity may include genetic, species, functional, or temporal diversity in agricultural production, which affect ecological function and stability through soil health and microbiome function, pollination and pest regulation, among others. Projects that support crop diversity may include, for example, those that enable new crop choices through improved delivery systems, more flexibility in water timing, or improved soil health. Projects that support crop diversity may do so by enabling new crop choices through improved water delivery reliability, more flexible water timing, improved soil health, or reduced water stress.

Tip: Briefly describe the current cropping systems and the conditions that may limit crop diversity in the project area, such as water delivery constraints, soil health limitations, or inflexible irrigation timing. Consider how the project is expected to enable or support greater crop diversity, and consider benefits from the perspective of local agriculture, the local community, soil health, and associated biodiversity such as pollinators and pest-regulating species. Where applicable, note any connections between increased crop diversity and food security, nutritional outcomes, or market opportunities. Cite reports, articles, or grower interviews that support the benefit expectations.

Exceptional: 7 pts	Exceptional, well-documented, and long-term support for crop diversity. Benefits are considerable in magnitude, extend across multiple dimensions of diversity, and produce meaningful benefits for ecosystem function. Strong supporting evidence demonstrates a high likelihood of sustained benefit.
High: 5 pts	Substantial support for crop diversity that is meaningful and well-supported. Benefits are notable in extent, magnitude, or certainty, though somewhat less than Exceptional. Supporting evidence is provided.
Medium: 3 pts	Moderate or localized support for crop diversity. Benefits may be limited in scope, affected area, or certainty, but are real and supported by reasonable evidence.
Minor: 1 pt	Minor or incidental support for crop diversity. Benefits are real but minimal, and evidence may be limited.
No benefit: 0 pts	Support for crop diversity is not likely, or benefit claims are unsupported.
Minor detriment: -1 pt	Minor reduction in crop diversity may occur. Effects are limited in scale or scope and are unlikely to have lasting consequences.
Medium detriment: -3 pts	Moderate reduction in crop diversity is likely. Effects are meaningful and may affect ecosystem function over the long-term.
High detriment: -5 pts	Substantial reduction in crop diversity is expected, with wide-reaching effects on agricultural resilience and ecosystem function with supporting evidence.
Extreme detriment: -7 pts	Severe or irreversible reduction in crop diversity is likely, potentially resulting in permanent loss of agrobiodiversity, long-term degradation of soil health, or collapse of diversified farming systems in the project area.

D.7.10.3 Category: Socio-Cultural Public Benefits**Question 18: Does the project support public health and/or public safety?**

Public health refers to the protection and improvement of community health and well-being through prevention, environmental quality, and reduced exposure to health risks. Public health can be strongly influenced by nature's contributions to people. Examples may include clean drinking water and reduced waterborne diseases, improved air quality and reduced respiratory illness, reduced exposure to toxic substances, climate regulation that moderates heat and other extreme events, mental and cultural well-being associated with healthy landscapes.

Public safety refers to the protection of people, communities, and property from hazards, accidents, disasters, and other threats that can cause injury, loss of life, or damage. Public safety emphasizes risk reduction, hazard mitigation, and resilience, particularly in relation to environmental, infrastructural, and climate conditions. Examples may include projects that offer protection from environmental and natural hazards (e.g., floods, wildfires, landslides, drought impacts); improve infrastructure reliability and safety (e.g. dams, canals, water systems), accident and injury prevention (e.g. infrastructure use), and emergency preparedness and response (e.g. fish consumption advisories, water contact advisories); and support resilience to climate variability.

Tip: Briefly describe the current public health and/or public safety conditions or risks relevant to the project, such as water quality impairments, flood or wildfire hazards, infrastructure vulnerabilities, or exposure to toxic substances. Describe how the project is expected to reduce those risks or improve health and safety outcomes and identify the population or communities most likely to benefit. Where applicable, note connections between ecological improvements and public health outcomes. Reference appropriate sections in the Watershed Plan and cite reports, or studies that support the expected benefits.

Exceptional: 7 pts	Exceptional, well-documented, and durable improvements to public health and/or safety. Benefits address major risks or hazards, benefit a considerable portion of the community or watershed, and are expected to be long-lasting. Strong supporting evidence demonstrates a high likelihood of sustained benefit.
High: 5 pts	Significant improvements to public health and/or safety. Benefits are meaningful and well-supported, though somewhat less in magnitude, geographic extent, or certainty than Exceptional. Supporting evidence is provided.
Medium: 3 pts	Moderate or localized improvements to public health and/or safety. Benefits are real and meaningful but limited in scope, affected population, or certainty. Some supporting evidence is provided.
Minor: 1 pt	Minor or incidental improvements to public health and/or safety. Benefits are real but minimal, and evidence may be limited.
No benefit: 0 pts	Benefits to public health and/or safety are not likely, or benefit claims are unsupported.
Minor detriment: -1 pt	Minor detrimental effects to public health and/or safety may occur. Effects are limited in scale or scope, likely mitigable, and are unlikely to have lasting consequences.
Medium detriment: -3 pts	Moderate detrimental effects to public health and/or safety are likely. Effects may be long-term, broad in geographic extent, and/or difficult to mitigate.
High detriment: -5 pts	Substantial detrimental effects to public health and/or safety are expected, with wide-reaching consequences for community health, hazard exposure, or infrastructure reliability, with supporting evidence.

Extreme detriment: -7 pts	Severe or irreversible detrimental effects to public health and/or safety are likely, potentially resulting in long-term harm to community well-being, permanent increases in hazard exposure, or critical impairment of public water or safety infrastructure.
---------------------------	---

Question 19: Does the project support local food systems and the vitality of the local communities?

Supporting local food systems and the vitality of local communities means that self-reliant and resilient food networks connect food producers and food consumers in the same geographic region. The project may strengthen the capacity of local agricultural systems, producers, processors, and communities to produce, access, distribute, and sustain food over time, particularly in the face of environmental, economic, and climate-related stressors. Strong food systems may provide support cultural identity, social cohesion, and relational values tied to the area. Examples of project outcomes that may support local food systems and community vitality are improving water availability, reliability, or quality for local agricultural production; enhancing soil health; supporting crop diversity and diversified production systems; enhancing pollinator habitat; and reducing energy and operational costs.

Tip: Briefly describe the current local food systems and local communities to contextualize the project benefit(s). Describe how the project's outcomes would support local food systems and community via, for example, production capacity, food access, and the long-term viability of the agricultural community. Note any connections between food systems and the cultural values they support. Cite articles, reports, grower interviews, or community input that support the expected benefits.

Exceptional: 7 pts	Exceptional, well-supported, and long-term benefits to local food systems and community vitality are expected. Benefits are widespread, durable, and transformative.
High: 5 pts	Significant benefits to local food systems and/or community vitality. Benefits are meaningful and well-supported, though somewhat less in magnitude, extent, or certainty than Exceptional. Supporting evidence is provided.
Medium: 3 pts	Moderate or localized benefits to local food systems or community vitality. Benefits are real but limited in scale, scope, or certainty. Some supporting evidence is provided.
Minor: 1 pt	Minor or incidental benefits to local food systems or community vitality. Benefits are real but minimal, and evidence may be limited.
No benefit: 0 pts	Support for local food systems or community is not likely, or benefit claims are unsupported.
Minor detriment: -1 pt	Minor negative effects to local food systems or community vitality may occur. Effects are limited in scale or scope, likely mitigable, and are unlikely to have lasting consequences.
Medium detriment: -3 pts	Moderate negative impacts to local food systems or community vitality are likely. Effects are meaningful and may affect food production capacity, community food access, or the cultural and relational values tied to local food systems.
High detriment: -5 pts	Substantial negative impacts to local food systems or community vitality are expected, with wide-reaching effects on food production, community resilience, or cultural and social dimensions of local food identity, with supporting evidence.
Extreme detriment: -7 pts	Severe or irreversible negative impacts to local food systems or community vitality are likely, potentially resulting in long-term loss of food production capacity, collapse of local agricultural systems, or permanent disruption of the cultural and relational values that underpin community food identity and vitality.

Question 20: Does the project support the intrinsic value or inherent worth of something independent of human benefit?

The intrinsic value or inherent worth means that the value of ecosystems, species, habitats, or ecological processes is recognized and supported for their own sake, independent of their usefulness or benefits to people. Intrinsic value reflects the ethical position that non-human life and ecological systems have worth as ends in and of themselves, not merely as means to human wellbeing.

Tip: Describe how the project recognizes or supports the intrinsic value of non-human entities beyond their usefulness to people. Consider: (1) which species, habitats, or ecological processes are valued for their own sake; (2) how the project design, outcomes, or planning process reflects recognition of intrinsic value — for example, through avoidance of harm, restoration of ecological integrity, or explicit consideration of the rights or agency of non-human entities; and (3) how the project actions and outcomes may avoid, reduce, or reverse harm to non-human entities over the long term. Reference the Watershed Plan and other sources where applicable.

Exceptional: 7 pts	Strong and long-term support for the intrinsic value of ecosystems, species, or ecological processes. Intrinsic value may have played a large role in project's design and outcome. Supporting evidence is well-documented.
High: 5 pts	Substantial support for intrinsic value. Though intrinsic value considerations may not be the sole or primary driver of the project's design and outcomes, intrinsic value is clearly present and meaningfully supported.
Medium: 3 pts	Moderate or localized support for intrinsic value. Support is real but limited in scope or emphasis.
Minor: 1 pt	Minor or incidental support for intrinsic value.
No benefit: 0 pts	The project is not likely to support intrinsic value, or support is not documented.
Minor detriment: -1 pt	Minor harm to species, habitats, or ecological processes is expected. Effects are limited in scale or scope and are unlikely to have lasting consequences.
Medium detriment: -3 pts	Moderate harm to species, habitats, or ecological processes is expected. Effects are meaningful, may affect ecological integrity or species of concern, and warrant consideration.
High detriment: -5 pts	Substantial harm to species, habitats, or ecological processes, with wide-reaching or long-term consequences for ecological integrity is expected.
Extreme detriment: -7 pts	The project is likely to cause severe or irreversible harm to species, habitats, or ecological processes, potentially resulting in permanent loss of ecological entities or processes.

Question 21: Does the project result in improvements in conditions for underrepresented or underserved communities?

Improving conditions for underrepresented or underserved communities means that the project and/or public planning process reduces existing disparities, improves environmental or socio-economic conditions, or increases access to resources, decision-making, or benefits for communities that have historically experienced disproportionate environmental burdens. Underrepresented or underserved communities include people who are minority or low-income, economically distressed rural communities, tribal communities or other communities traditionally underrepresented in public processes.

Tip: *Identify which of the communities above would benefit from the project and in what way.*

Demonstrate that project-siting decisions have been examined and affected landowners or communities have been engaged. Identify public engagement methods. Consider how project outcomes would benefit these communities. Reference the Watershed Plan and other sources where applicable.

Exceptional: 7 pts	Exceptional and long-term improvements in conditions for one or more underrepresented or underserved communities. Equity considerations are meaningfully reflected in project design and outcomes. Benefits address significant disparities in environmental quality, resource access, or socioeconomic conditions, and are well-documented and likely to be durable. Strong supporting evidence demonstrates a high likelihood of sustained benefit.
High: 5 pts	Substantial improvements in conditions for underrepresented or underserved communities. Benefits are meaningful and well-supported, though somewhat less in magnitude, scale, or certainty than Exceptional. Equity considerations are present and documented. Supporting evidence is provided.
Medium: 3 pts	Moderate or localized improvements in conditions for underrepresented or underserved communities. Benefits are real but limited in scale, scope, or certainty. Some supporting evidence is provided.
Minor: 1 pt	Minor or incidental improvements in conditions for underrepresented or underserved communities. Benefits are real but minimal, and evidence may be limited.
No benefit: 0 pts	Improvements in conditions for underrepresented communities are not likely, or equity considerations were not documented.
Minor detriment: -1 pt	Minor negative effects on underrepresented or underserved communities may occur. Effects are limited in scale or scope, likely mitigable, and are unlikely to have lasting consequences.
Medium detriment: -3 pts	Moderate negative effects on underrepresented or underserved communities are likely. Effects are meaningful, may exacerbate existing disparities in environmental quality or resource access, and are substantial enough to warrant concern.
High detriment: -5 pts	Substantial negative effects on underrepresented or underserved communities are expected, with wide-reaching consequences for environmental conditions, resource access, or socioeconomic equity, with supporting evidence.
Extreme detriment: -7 pts	Severe or irreversible negative effects on underrepresented or underserved communities are likely, potentially resulting in long-term harm to community well-being, permanent worsening of existing disparities, or critical loss of access to resources, decision-making, or environmental quality for historically marginalized groups.

Question 22: Does the project support identity, livelihood, or sense of place values of people or communities in the area?

Supporting identity, livelihood, or sense of place values means the project helps sustain, strengthen, or restore the cultural identities, place-based livelihoods, practices, meanings, and relationships that people and communities associate with their landscapes and ecosystems. These values reflect how people understand who they are, how they make a living, and how they relate to specific places over time. Examples may include sustaining or enhancing place-based practices (e.g. agriculture, ranching, fishing, or land stewardship); maintaining or restoring landscape features that communities identify (e.g. working lands, riparian corridors, or floodplains); reducing disruptions that threaten identity (e.g. water insecurity, land degradations); supporting cultural practices and traditions (e.g. Indigenous or local knowledge systems).

Tip: Describe how identity, livelihood, or sense of place values are present in the communities affected by the project and how the project is expected to sustain, strengthen, or restore them. Consider values held by farmers, ranchers, fishers, Indigenous communities, and others whose identities and livelihoods are tied to the land, water, and working landscapes of the watershed. Be attentive to the ways that projects can both support and disrupt relational values. Reference the Watershed Plan and other sources where applicable.

Exceptional: 7 pts	Exceptional and long-term support for identity, livelihood, or sense of place values. Support strengthens the connections between people and the landscapes, practices, and traditions that define their identity and way of life. Strong supporting evidence is provided.
High: 5 pts	Substantial support. Benefits are meaningful, with notable positive effects, though somewhat less in magnitude, scale, or certainty than Exceptional. Supporting evidence is provided.
Medium: 3 pts	Moderate or localized support. Benefits are real but limited in scope, depth, or certainty. Some supporting evidence or community input is provided.
Minor: 1 pt	Minor or incidental support. Benefits are real but minimal, and documentation or community engagement is limited.
No benefit: 0 pts	Support for identity, livelihood, or sense of place values is not likely, or such values are not considered or documented.
Minor detriment: -1 pt	Minor negative effects may occur. Effects are limited in scale or scope and are unlikely to have lasting consequences for community-nature relationships.
Medium detriment: -3 pts	Moderate negative effects are likely. Effects are meaningful, may disrupt place-based practices or cultural relationships with the landscape, and are substantial enough to warrant concern.
High detriment: -5 pts	Substantial negative effects are expected. Effects may significantly disrupt community-nature relationships, undermine place-based livelihoods, or erode cultural identity tied to the landscape, with supporting evidence.
Extreme detriment: -7 pts	Severe or irreversible negative effects are likely, potentially resulting in permanent disruption of place-based practices, loss of cultural identity tied to the land or water, or long-term erosion of the relational values that sustain community well-being and connection to the landscape.

Question 23: Does the project support state or local priorities?

A state or local priority is one that is identified in a plan, strategy, or study. These include documents such as state and local water quality plans, species and habitat conservation or recovery plans, local economic development plans, regional planning efforts, collaborative basin planning efforts, state or local hazard mitigation plans, etc., or strategies such as restoration and protection of native fish species of cultural significance to Indian tribes.

Tip: *Identify the specific state or local priority or priorities that the project supports and cite the plan, strategy, or study in which the priority is documented. Describe how the project's outcomes align with or advance the stated goals of that priority and explain how central or significant the project's role is in achieving those goals. Where the project supports multiple priorities, note this and describe the breadth of alignment. Where relevant, reference tribal strategies or collaborative planning processes, including those addressing native fish species of cultural significance to Indian tribes. Reference appropriate sections in the Watershed Plan where applicable.*

Exceptional: 7 pts	Exceptional role in supporting one or more state or local priorities. The project directly and substantially advances the stated goals of a formally identified priority, is well-documented, and may be central to the priority's achievement. The project may support multiple priorities simultaneously. Strong supporting evidence is provided.
High: 5 pts	Substantial role in supporting one or more state or local priorities. The project meaningfully advances a formally identified priority and is well-supported, though its role may be somewhat less central or comprehensive than Exceptional. Supporting evidence is provided.
Medium: 3 pts	Moderate role in supporting one or more state or local priorities. The project contributes to a formally identified priority but may be limited in its scope, certainty, or directness of contribution. Some supporting evidence is provided.
Minor: 1 pt	Minor role in supporting a state or local priority. The connection to a formally identified priority is real but limited or incidental. Supporting evidence is limited.
No benefit: 0 pts	No meaningful promotion of state or local priorities, or benefit claims are unsupported.
Minor detriment: -1 pt	The project may be mildly counter to one or more state or local priorities. Effects are limited in scope and are unlikely to significantly impede priority achievement.
Medium detriment: -3 pts	The project runs counter to one or more state or local priorities in a meaningful way. Effects are substantial enough to warrant concern and may impede progress toward formally identified goals.
High detriment: -5 pts	The project substantially conflicts with one or more state or local priorities, with wide-reaching implications for priority achievement, with supporting evidence.
Extreme detriment: -7 pts	The project severely or irreversibly conflicts with one or more state or local priorities, potentially undermining or setting back formally identified goals in a lasting or transformative way.

Question 24: Does the project support recreation and/or scenic values?

Supporting recreation means the project enhances the quality, accessibility, safety, or experience of outdoor recreation opportunities. Supporting scenic values means the project improves the visual, aesthetic, and experiential qualities of landscapes and waterscapes valued by communities and visitors. These values include both use-based recreation (e.g. fishing, hunting, hiking, boating, wildlife viewing, etc.) and non-use scenic or aesthetic values (e.g. viewsheds, landscape character, tranquility, etc.).

Tip: Briefly describe the current recreation and/or scenic conditions in the project area and identify how the project is expected to enhance them. Consider both use-based recreation (e.g., fishing, hunting, hiking, boating, wildlife viewing) and non-use scenic or aesthetic values (e.g., viewsheds, landscape character, tranquility). Describe who benefits — local community members, visitors, or both — and whether benefits are localized or extend across the broader watershed or region. Note whether recreation or scenic values were identified through community input, stakeholder engagement, or planning documents, and whether the project may support or conflict with existing recreation plans or access agreements. Reference the Watershed Plan and other sources where applicable.

Exceptional: 7 pts	Widespread, exceptional, and long-term support for recreation and/or scenic values. Benefits are well-documented, extend across a considerable portion of the community or region, and may reflect meaningful integration of recreation or scenic values into project design and outcomes. Strong supporting evidence demonstrates a high likelihood of sustained benefit.
High: 5 pts	Substantial support for recreation and/or scenic values. Benefits are meaningful and well-supported, with notable positive effects on recreation quality, accessibility, or scenic character, though somewhat less in magnitude, geographic extent, or certainty than Exceptional. Supporting evidence is provided.
Medium: 3 pts	Moderate or localized support for recreation and/or scenic values. Benefits are real but limited in scope, affected area, or certainty. Some supporting evidence is provided.
Minor: 1 pt	Minor or incidental support for recreation and/or scenic values. Benefits are real but minimal, and evidence may be limited.
No benefit: 0 pts	Support for recreation or scenic values is not likely, or benefit claims are unsupported.
Minor detriment: -1 pt	Minor detriment to recreation or scenic values may occur. Effects are limited in scale or scope, likely mitigable, and are unlikely to have lasting consequences.
Medium detriment: -3 pts	Moderate detriment to recreation or scenic values is likely. Effects are meaningful, may reduce the quality, accessibility, or character of recreation or scenic resources, and are substantial enough to warrant concern.
High detriment: -5 pts	Substantial detriment to recreation or scenic values is expected, with wide-reaching effects on recreation opportunities or landscape character, with supporting evidence.
Extreme detriment: -7 pts	Severe or irreversible detriment to recreation or scenic values is likely, potentially resulting in permanent loss of recreation access, significant degradation of landscape character, or long-term impairment of the aesthetic and experiential qualities valued by communities and visitors.

Question 25: Does the project support traditional cultural places, sacred areas, or archaeologically sensitive sites?

Supporting traditional cultural places (TCP), sacred areas, or archaeologically sensitive sites means the project avoids, minimizes, or reverses harm to places that hold deep cultural, spiritual, historical, or archaeological significance for Indigenous peoples, local communities, or other groups with long-standing connections to the landscape. These places may include ceremonial sites, ancestral territories, fishing and gathering areas of cultural significance, burial grounds, irrigation or land management features of historical importance, or landscapes recognized under the National Historic Preservation Act (NHPA), the National Register of Historic Places, or tribal cultural resource management plans.

Tip: *Identify whether traditional cultural places, sacred areas, or archaeologically sensitive sites are present in or near the project area. Reference the Watershed Plan, cultural resource surveys, tribal consultation records, or other sources where applicable. Briefly identify the current conditions and describe the nature and significance of those places to the communities. Describe any project design and siting decisions associated with the planning process. Where the project actively supports access to, restoration of, or protection of these places, describe how and for whom.*

Exceptional: 7 pts	Exceptional and long-term support for TCPs, sacred areas, or archaeologically sensitive sites. The project actively protects, restores, or improves access to such places, and cultural or tribal values played a meaningful role in project design. Meaningful tribal consultation or community engagement has been conducted and documented. Strong supporting evidence demonstrates a high likelihood of sustained benefit.
High: 5 pts	Substantial support. The project takes deliberate steps to avoid harm and may benefit culturally significant places or access to them. Tribal consultation or community engagement has been conducted.
Medium: 3 pts	Moderate support. The project avoids known impacts and demonstrates reasonable consideration of cultural resource values, though the depth of engagement, or benefit may be limited.
Minor: 1 pt	Minor or incidental support. The project does not knowingly harm such places, but consideration of cultural resource values is limited or not well-documented.
No benefit: 0 pts	The project is not likely to support TCPs, sacred areas, or archaeologically sensitive sites. Such areas may not be located near the project, or such values are not considered or documented.
Minor detriment: -1 pt	Minor detrimental impacts. Effects are limited in scale or scope, or likely mitigable.
Medium detriment: -3 pts	Moderate impacts are expected. Effects are meaningfully detrimental, may affect community access or the integrity of culturally significant resources, and warrant concern.
High detriment: -5 pts	Substantial impacts are expected with wide-reaching consequences for cultural integrity, community access, or the preservation of irreplaceable resources, with supporting evidence.
Extreme detriment: -7 pts	The project is likely to cause severe or irreversible harm, potentially resulting in permanent loss of or damage to places of deep cultural, spiritual, or historical significance to Indigenous peoples or local communities.

Appendix E

Other Supporting Information

E.1 Supporting Information for Scoping

Table E-1. Public Scoping Comment Summary.

Comment Topic	Section Where Topic is Discussed
Will the effects from the Project of seepage loss and changed diversion points on surface water be addressed in the Plan-EA?	Section 6.8.2
Request to analyze the Project effect on streamflows and subsequent effects to fish, fish habitat, and water quality.	Section 6.8.2, Section 6.9.2
Request to analyze Project effects on groundwater.	Section 6.8.2
District should use Oregon Conserved Water statute to permanently protect conserved water instream.	Section 6.8.2
Request for piping/lining the Carnes and Coughanour Ditches in the existing alignment to be analyzed.	Section 5.3

Table E-2. Summary of Resource Concerns for the Powder Valley Water Control District Infrastructure Modernization Project.

Resource	Relevant to the proposed action (Yes/No)	Justification
Air Quality	No	Oregon Department of Environmental Quality (ODEQ) air quality data indicates that the entire project area is in attainment for all criteria pollutants. Emissions from equipment associated with construction activities would occur; however, such emissions are considered negligible when compared to background levels and the application of best management practices (BMPs).
Coastal Zones	No	The project area and vicinity does not contain, intersect, or lie adjacent to any coastal zones.
Coral Reefs	No	There are no coral reefs within, intersected by, or adjacent to the project area or its vicinity.

Appendix E: Other Supporting Information

Resource	Relevant to the proposed action (Yes/No)	Justification
Cultural and Historic Resources	Yes	Consultation with the SHPO, THPO, and other consulting parties including affiliated tribes is required for compliance with Section 106 of the NHPA.
Ecologically Critical Areas	No	The project area does not cross through any ecologically critical areas.
Endangered or Threatened Species	Yes	ESA-listed threatened bull trout and its designated critical habitat has been identified in Anthony Creek, North Fork Anthony Creek, Wolf Creek, and North Powder River, which could be affected by the project.
Essential Fish Habitat (EFH)	No	A query of the Planning Area on NOAA Fisheries Essential Fish Habitat Mapper did not identify any EFH in or around the project area. Since the project would not adversely affect EFH, consultation under the Magnuson Stevens Act is not expected to be required.
Fish and Fish Habitat	Yes	The proposed action could affect fish habitat within waterbodies associated with District operations and infrastructure.
Floodplain Management	No	Construction and operation of the proposed project would not occur in the 100-year floodplain.
Forest Resources	Yes	A portion of the project area exists within the Wallowa-Whitman National Forest and construction and operation of the project could affect forest resources.
General Wildlife and Wildlife Habitat	Yes	Construction and operation of project components could affect wildlife near District operations.
Geology	No	There are no active fault lines around the project area.
Invasive Species/Noxious Weeds	No	Invasive species/noxious weeds occur within the project area.
Invasive Animal Species	No	No invasive animal species are present in the project area or vicinity.
Land Use	Yes	Construction and operation of the project could affect land use.
Migratory Birds and Eagles	Yes	Migratory birds and eagles could occur within the project area.

Appendix E: Other Supporting Information

Resource	Relevant to the proposed action (Yes/No)	Justification
Natural Areas	Yes	The project area crosses the Elkhorn Wildlife Area and could be affected by project construction.
National Economic Development (NED)	Yes	A NED analysis has been completed as required by the Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies.
National Parks, Monuments, and Parklands	No	None occurs in the project area or would be affected by the project.
Noise	Yes	Construction of the project could impact noise.
Prime Farmlands	Yes	Construction and implementation of the proposed project could affect prime farmlands.
Public Safety	Yes	Drowning risk in the open ditches could be reduced.
Recreation	Yes	A portion of the project area is located within the Elkhorn Wildlife Area and may temporarily affect various recreation sites. There is also potential the project could beneficially affect recreation on the District's reservoirs.
Regional Water Resource Plans	No	The proposed project would not affect any regional water resource plans.
Riparian Areas and Wetlands	Yes	Wetlands and riparian areas could be affected by project construction activities or changes in water levels.
Scenic Beauty and Visual Resources	No	Visual resources were not identified during scoping. Additionally, the project is in a rural setting and few people would be able to see the project.
Scientific Resources	No	The proposed action is located in a heavily disturbed area. No significant scientific resources are known to occur within the area vicinity.
Soils	Yes	Construction and operation of the proposed project could affect soils.
Socioeconomics	Yes	The proposed project would involve an expenditure of public funds that could affect the local and regional economy. An evaluation of the effects of providing NRCS funding is included.

Appendix E: Other Supporting Information

Resource	Relevant to the proposed action (Yes/No)	Justification
Water: Groundwater Quantity, Aquifer Recharge	Yes	Construction and operation of the project could affect groundwater and aquifer recharge.
Water: Surface Water Quantity	Yes	The project could improve surface water quantity.
Water: Surface Water Quality	Yes	Operation of the proposed project could benefit surface water quality.
Water: Water Rights	Yes	The proposed project could affect certain water rights.
Waters of the United States	Yes	Construction and operation of the project could affect waters of the United States.
Wild and Scenic Rivers	No	No relevant impact. The North Powder River, from its headwaters in the Elkhorn Mountains to the Wallowa-Whitman National Forest boundary, was designated as scenic in 1988 (National Wild and Scenic River System 2023). This portion of the North Powder River lies upstream and outside of the project area. No rivers included in the nationwide rivers inventory are in the project area or area of effect.

BMP = best management practice; EFH = Essential Fish Habitat; EO = Executive Order; NED = National Economic Development; NHPA = National Historic Preservation Act; ODEQ = Oregon Department of Environmental Quality; SHPO = State Historic Preservation Office

E.2 Supporting Information for Cultural Resources

E.2.1 Cultural Resources Assessment Report Excerpt

Cultural Resources Assessment for the Powder Valley Water Control District Infrastructure Modernization Project, Union County, Oregon

Prepared for

Farmers Conservation Alliance



December 5, 2025

Parametrix

Cultural Resources Assessment for the Powder Valley Water Control District Infrastructure Modernization Project, Union County, Oregon

Prepared for

Farmers Conservation Alliance
102 State Street
Hood River, Oregon 97031

Prepared by

Corey Lentz, Stephanie O'Brien, Mathew Sisneros, J. Tait Elder, Kelly Yeates, and January Tavel
Parametrix
5 SE Martin Luther King Jr. Boulevard, Suite 400
Portland, OR 97214
T. 503.233.2400 F. 1.206.649.6353
www.parametrix.com

Lead Government Agency: United States Department of Agriculture, Natural Resources Conservation Service

Contracting Sponsor: Powder Valley Water Control District

Permit Number: BLM permit: OR-51125; ARPA Authorization ID: Heritage 24-10

Parametrix Project Number: 273-8767-001

December 5, 2025

Citation

Corey Lentz, Stephanie O'Brien, Mathew Sisneros, J. Tait Elder, and January Tavel. 2025. *Cultural Resources Assessment for the Powder Valley Water Control District Infrastructure Modernization Project, Union County, Oregon*. Prepared for Farmers Conservation Alliance by Parametrix, Portland, Oregon. December 2025.

Contents

1. Introduction	1-1
1.1 Project Description	1-1
1.2 Project Location	1-2
1.2.1 Area of Potential Effects	1-2
1.3 Personnel	1-3
2. Regulatory Context	2-1
2.1 Federal	2-1
2.1.1 National Historic Preservation Act	2-1
2.1.2 Other Relevant Federal Laws	2-2
2.2 State	2-2
2.3 Local	2-2
3. Research and Survey Methodology	3-1
3.1 Background Research	3-1
3.2 Survey Methodology	3-1
3.2.1 Archaeological Survey	3-1
3.2.2 Historic Built Environment Survey and Evaluation	3-2
4. Environmental Context	4-1
4.1 Geography and Geology	4-1
4.2 Flora and Fauna	4-2
5. Cultural Context	5-1
5.1 Precontact Context	5-1
5.1.1 Paleoindian Period (16,000 to around 11,500 years ago).....	5-1
5.1.2 Period I (11,500 to 6,000 years ago).....	5-2
5.1.3 Period II (6,000 to around 3,900 years ago).....	5-2
5.1.4 Period III (3,900 to around 300 years ago).....	5-3
5.2 Ethnographic Context.....	5-3
5.2.1 Ethnographically Named Places	5-4
5.3 Historic Context.....	5-4
5.3.1 South Union County and Powder River Valley Historic Settlement and Development.....	5-4

*Cultural Resources Assessment for the Powder Valley Water Control District Infrastructure
Modernization Project, Union County, Oregon*
Farmers Conservation Alliance

Contents (Continued)

5.3.2	Reclamation and Irrigation Development.....	5-6
5.3.3	Powder Valley Water Control District.....	5-10
6.	Records Review.....	6-1
6.1	Cultural Resource Survey.....	6-1
6.2	Archaeological Resources.....	6-2
6.2.1	Buried Site Sensitivity Analysis.....	6-3
6.3	Historic Built Environment Resources.....	6-4
7.	Results.....	7-1
7.1	Archaeological Survey.....	7-1
7.1.1	Pedestrian Survey.....	7-1
7.1.2	Shovel Probe Survey.....	7-1
7.2	Historic Built Environment Survey.....	7-7
7.2.1	Carnes Ditch.....	7-7
7.2.2	Lone Pine Ditch.....	7-13
7.2.3	Maharry Blevins Ditch.....	7-18
8.	Effects Analysis.....	8-1
9.	Conclusion and Recommendations.....	9-1
9.1	Conclusions.....	9-1
9.2	Recommendations.....	9-1
10.	Bibliography.....	10-1

FIGURES

Figure 1-1.	Project Location	1-4
Figure 1-2.1.	Project Area of Potential Effects - Overview	1-5
Figure 1-2.2.	Project Area of Potential Effects - Northwest	1-6
Figure 1-2.3.	Project Area of Potential Effects - Central	1-7
Figure 1-2.4.	Project Area of Potential Effects - East	1-8
Figure 7-1.1.	APE and Shovel Probe Locations - Overview	7-3
Figure 7-1.2.	APE and Shovel Probe Locations - Northwest	7-4

December 2025 | 273-8767-001

*Cultural Resources Assessment for the Powder Valley Water Control District Infrastructure
Modernization Project, Union County, Oregon*
Farmers Conservation Alliance

Contents (Continued)

Figure 7-1.3. APE and Shovel Probe Locations - Central	7-5
Figure 7-1.4. APE and Shovel Probe Locations - East	7-6
Figure 7-2. Overview Map Carnes Ditch Alignments	7-12
Figure 7-3. Overview Map Lone Pine Ditch Alignment	7-17
Figure 7-4. Overview Map Maharry Blevins Ditch Alignment	7-22

TABLES

Table 5-1. Ethnographically Named Places in APE Vicinity.....	5-4
Table 6-1. Previous Conducted Cultural Resource Surveys in or Within 1 Mile of the APE.....	6-1
Table 6-2. Previously Recorded Archaeological Resources Within 1 Mile of the APE.....	6-2

APPENDICES

- A Photographs
- B Shovel Probe and Scrape Results
- C Section 106 Documentation Forms

1. Introduction

The Powder Valley Water Control District (PVWCD) is proposing an irrigation infrastructure modernization project (the project) through the Natural Resources Conservation Service's (NRCS) Watershed Protection and Flood Prevention Program, Public Law 83-566 (PL 83-566). NRCS is serving as the lead federal agency for the project under PL 83-566. As the lead federal agency, NRCS is responsible for compliance with the requirements of Section 106 of the National Historic Preservation Act (NHPA).

The Farmers Conservation Alliance (FCA) retained Parametrix on behalf of the PVWCD to prepare a cultural resources assessment for the project to satisfy the requirements of Section 106 of the NHPA. This assessment includes the delineation of a project area of potential effects (APE), identification of archaeological and historic built environment resources in the APE, evaluation of these resources for eligibility for listing in the National Register of Historic Places (NRHP), and an assessment of effects to these resources from the project.

As part of this work, Parametrix conducted an archaeological and built environment survey of the APE, identifying no archaeological resources and three historic built environment resources in the APE: the Carnes Ditch, Lone Pine Ditch, and Maharry Blevins Ditch. Parametrix evaluated the NRHP-eligibility of these resources, recommending all of them as not eligible for individual listing in the NRHP, and also not eligible for listing in the NRHP as contributing resources to a potential PVWCD historic district. Based on the findings summarized above, Parametrix recommends a finding of no historic properties affected for the project, pursuant to Code of Federal Regulations (CFR) Title 36 Section 800.5, and Parametrix has no further recommendations for the project with respect to cultural resources.

1.1 Project Description

The infrastructure modernization improvements are proposed to be implemented for the purpose of Agricultural Water Management, an Authorized Purpose defined in 290-National Watershed Program Manual, Part 500, Subpart A, Section 500.3B. Project activities include the following:

- Piping 2.1 miles of an existing open segment of Ellis Ditch and installing a new 1.3-mile segment of the C-1 pipeline.
- Installation of a pressure reducing vault to hold two pressure reducing valves to depressurize the C-1 pipeline before the C-1 pipeline intersects the Lone Pine Ditch.
- Installation of a junction vault and trash rack to connect the C-1 pipeline with the Lone Pine Ditch outfall.
- Retirement of Lower Lone Pine Ditch (3.4 miles) and Maharry Blevins Ditch (1.6 miles), which would remain open.
- Retirement and filling of approximately 0.5 mile of the Redger Ditch.
- Installation of fish screening and fish passage improvements at the Carnes Diversion adjacent to the confluence of North Fork Anthony Creek and Anthony Creek.
- Piping of Carnes Ditch from the Carnes Diversion to the Pilcher Creek Filling Channel (approximately 3.2 miles). Following construction, a dirt road approximately 10 feet wide would be maintained along the current ditch alignment, atop the buried pipeline, for District maintenance access.

*Cultural Resources Assessment for the Powder Valley Water Control District Infrastructure
Modernization Project, Union County, Oregon*
Farmers Conservation Alliance

- Installation of a new siphon, approximately 0.1-mile long, to carry the piped Carnes Ditch water beneath Dutch Creek, bypassing the existing approximately 1.2-mile section of Carnes Ditch that makes a loop along Dutch Creek.
- Retirement of the 1.2-mile Carnes Ditch loop along Dutch Creek.
- Removal of existing headgate infrastructure where Carnes Ditch currently intercepts Dutch Creek at the northernmost extent of the Carnes Ditch loop, restoration of the Dutch Creek stream channel to natural conditions at this site and reconnecting portions of the stream channel upslope and downslope of the existing ditch and headgate.
- Installation of the Carnes Ditch pipeline beneath the Daley Creek stream channel where Carnes Ditch currently intercepts Daley Creek, restoration of the Daley Creek stream channel to natural conditions, and reconnecting portions of the stream channel upslope and downslope of the current ditch location.

1.2 Project Location

The project is within the PVWCD, a water control district in southeastern Union County, Oregon, west of North Powder, Oregon, and organized under the provisions of Oregon Revised Statute (ORS) Chapter 553. The project would occur in: Sections 12 and 13 (Protracted Blocks 44 and 45) of Township 06 South, Range 37 East; Sections 7, 8, 18, 23, 24, and 25 of Township 06 South, Range 38 East; and Section 30 of Township 06 South, Range 39 East. The project follows sections of the Carnes Ditch, C-1 Ditch, the Lone Pine Ditch, the Maharry Blevins Ditch, as well as newly developed irrigation areas. The project location is shown in Figure 1-1.

1.2.1 Area of Potential Effects

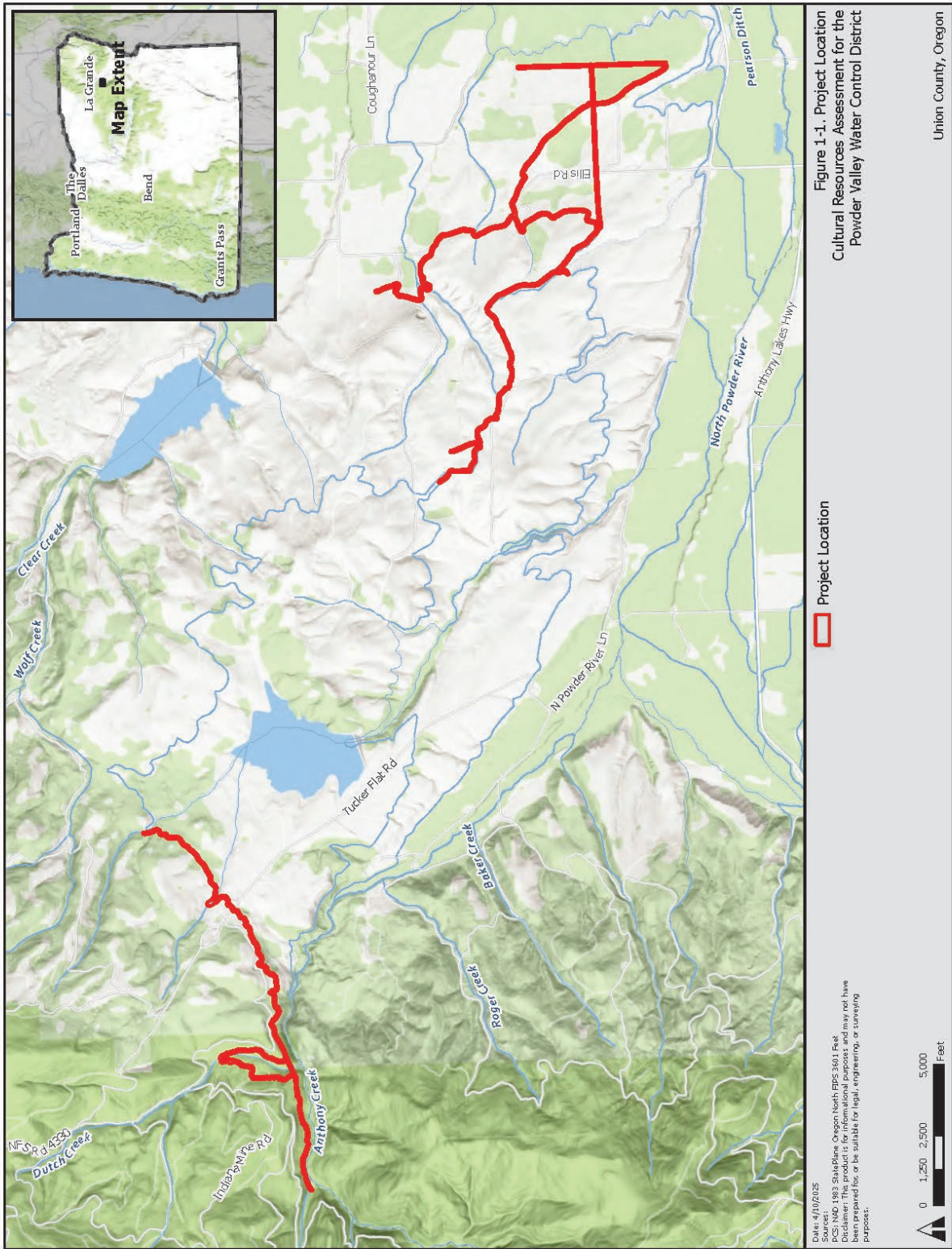
A project APE is defined in Section 106 of the NHPA as “geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties” (36 CFR 800.16.c). Effects may be direct or indirect, with the former including any type of effect (i.e., physical, visual, auditory, etc.) resulting from an “undertaking at the same time and place with no intervening cause,” and the latter including any type of effect “caused by the undertaking that is later in time or farther in distance but are still reasonably foreseeable” (Advisory Council on Historic Preservation 2019).

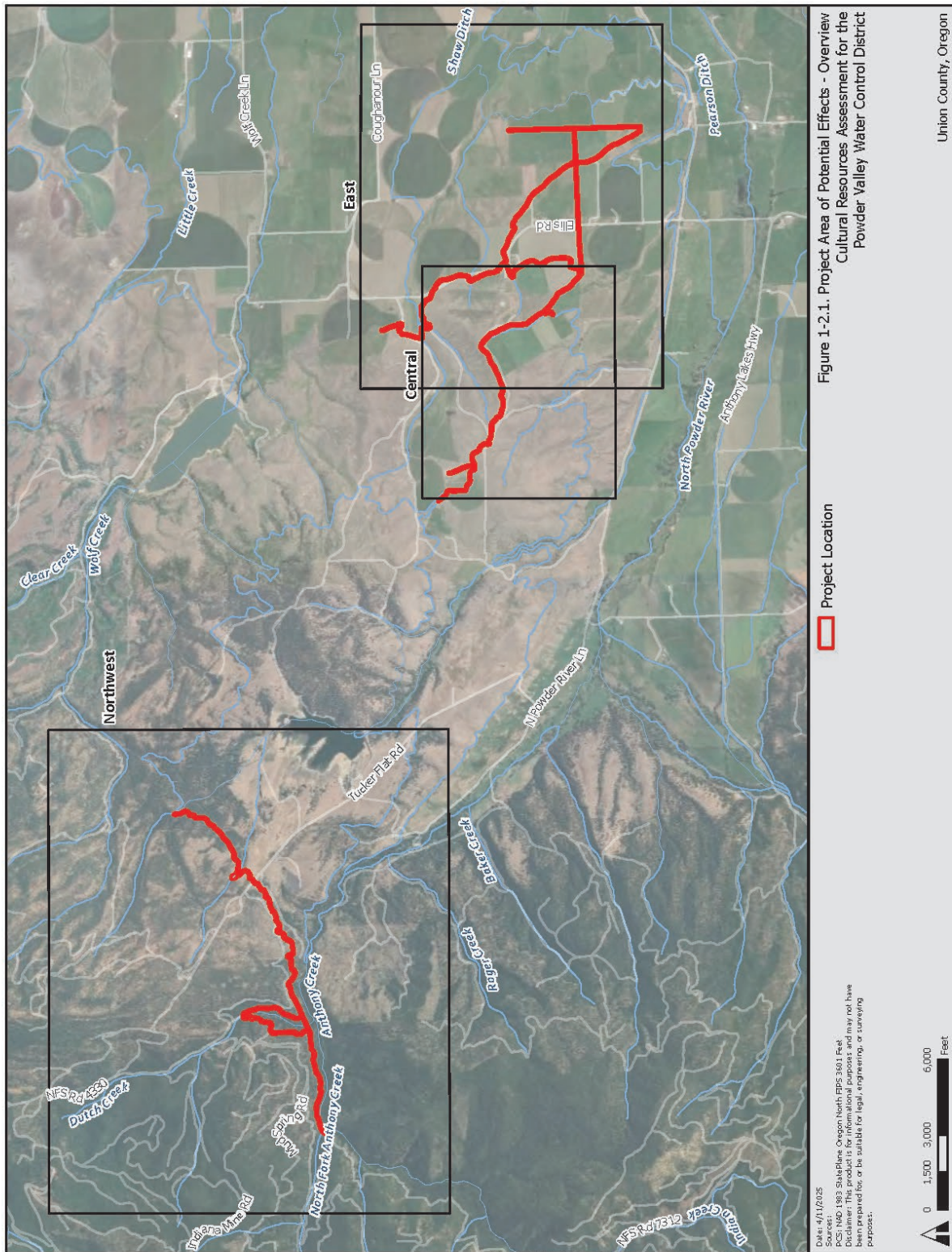
As delineated, the project APE considers direct effects that are long-term or permanent, including physical and visual effects, as well as effects from construction that are anticipated to be minor and temporary, such as vibration, noise, and fugitive dust. The horizontal extent of the APE includes the footprint of the areas and/or structures where the proposed project activities will occur. These limits of construction include areas where new pipeline alignments and the Dutch Creek siphon will be installed, as well as within Carnes Ditch (including both the northern Carnes Ditch segment from its head at Anthony Creek to the Pilcher Creek Spillway and the southern Carnes Ditch Segment, known as the C-1 Ditch), the Lone Pine Ditch, and the Maharry Blevins Ditch. The APE also includes a 100-foot buffer around the limits of construction to account for potential visual effects to significant viewsheds of historic properties resulting from alterations to components of the PVWCD. The vertical extent of the APE is defined as the maximum depth of project-related ground-disturbing activities as well as the height of project features in the areas where project-related ground disturbance is proposed. The maximum depth of ground disturbance is anticipated to be 6.5 feet. Reasonably foreseeable effects from the undertaking with the potential to occur at a later time or farther distance are not anticipated to occur outside the limits of construction or 100-foot buffer. As such, the APE as delineated also considers the potential for indirect effects. The APE is shown in Figure 1-2.1 through 1-2.4.

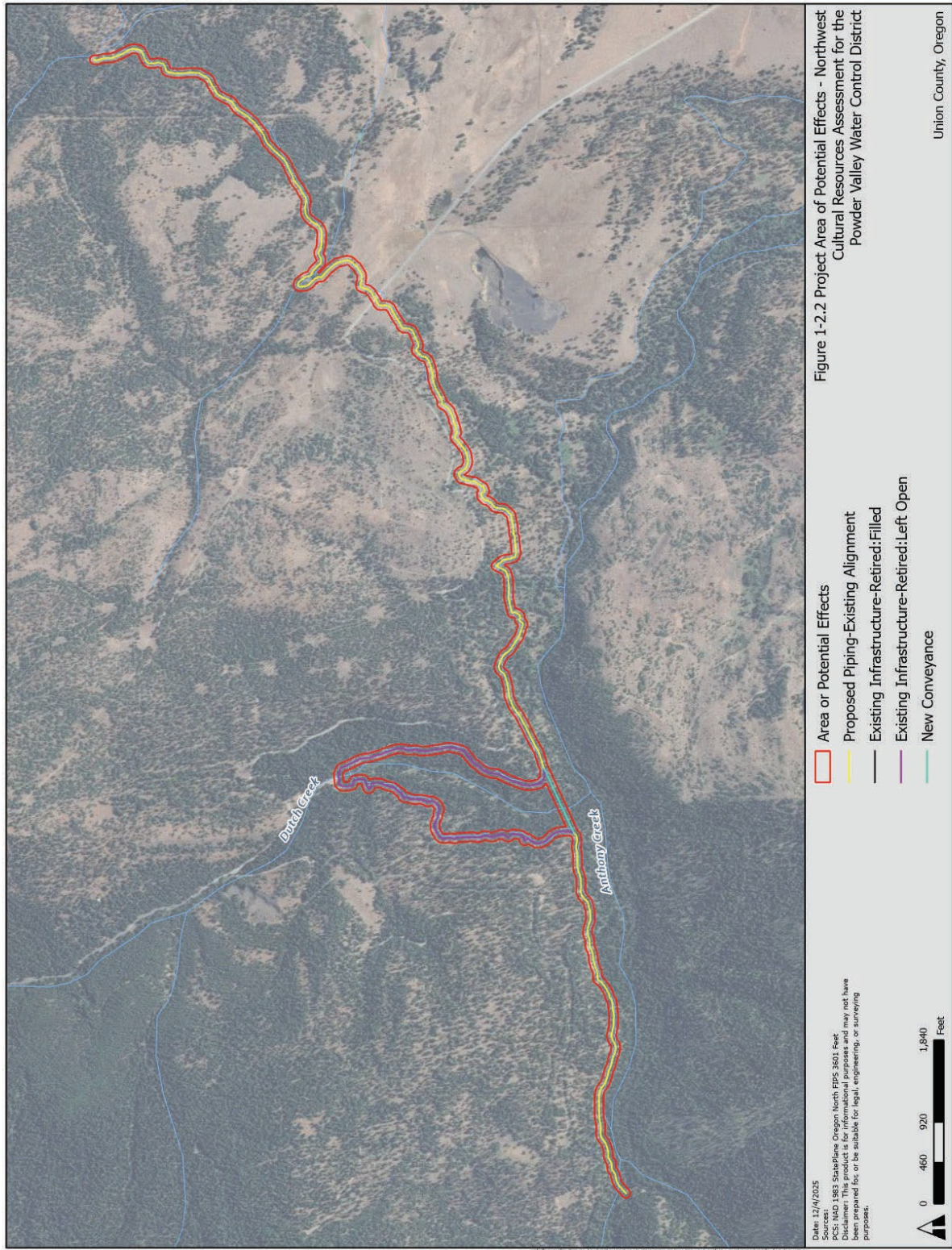
*Cultural Resources Assessment for the Powder Valley Water Control District Infrastructure
Modernization Project, Union County, Oregon*
Farmers Conservation Alliance

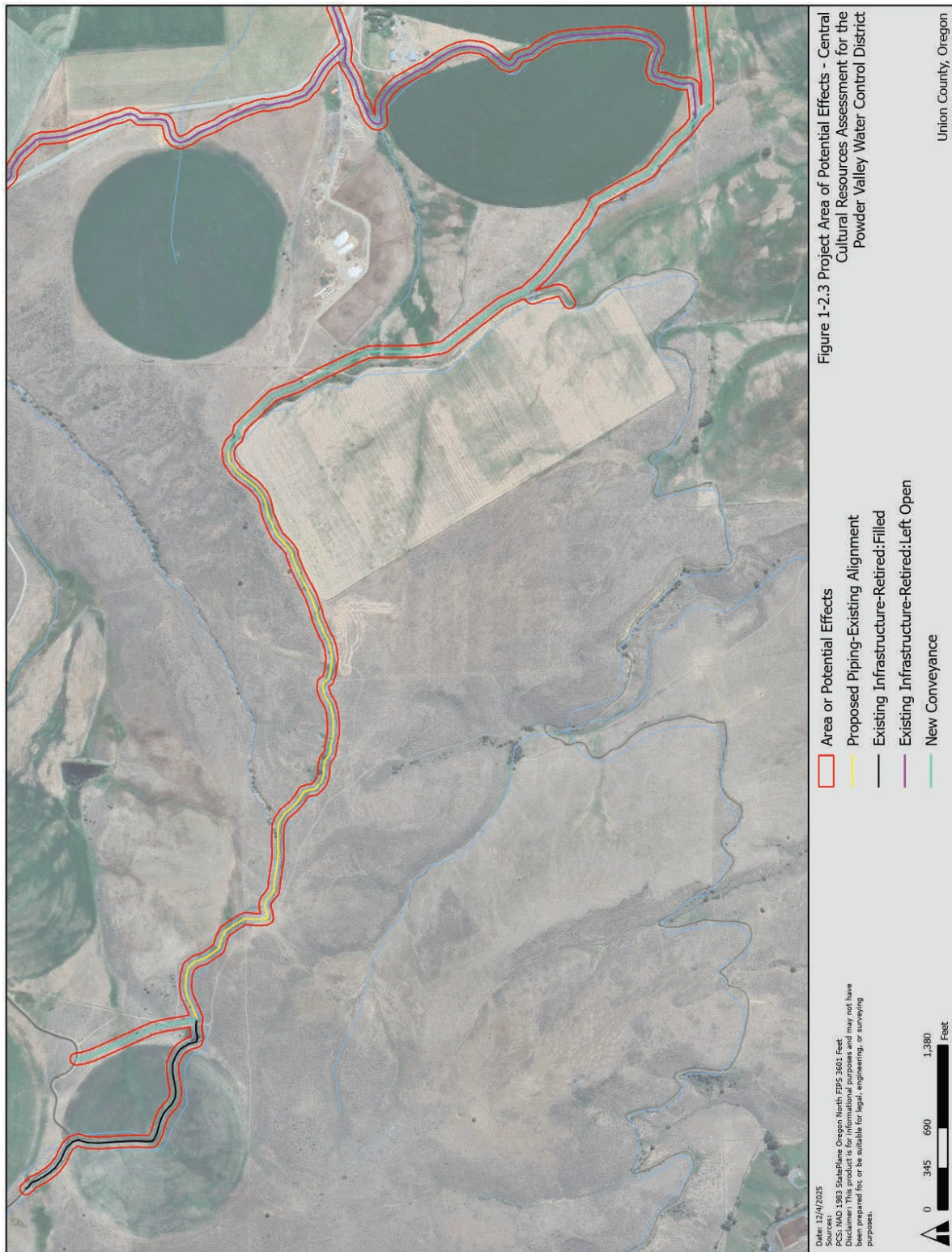
1.3 Personnel

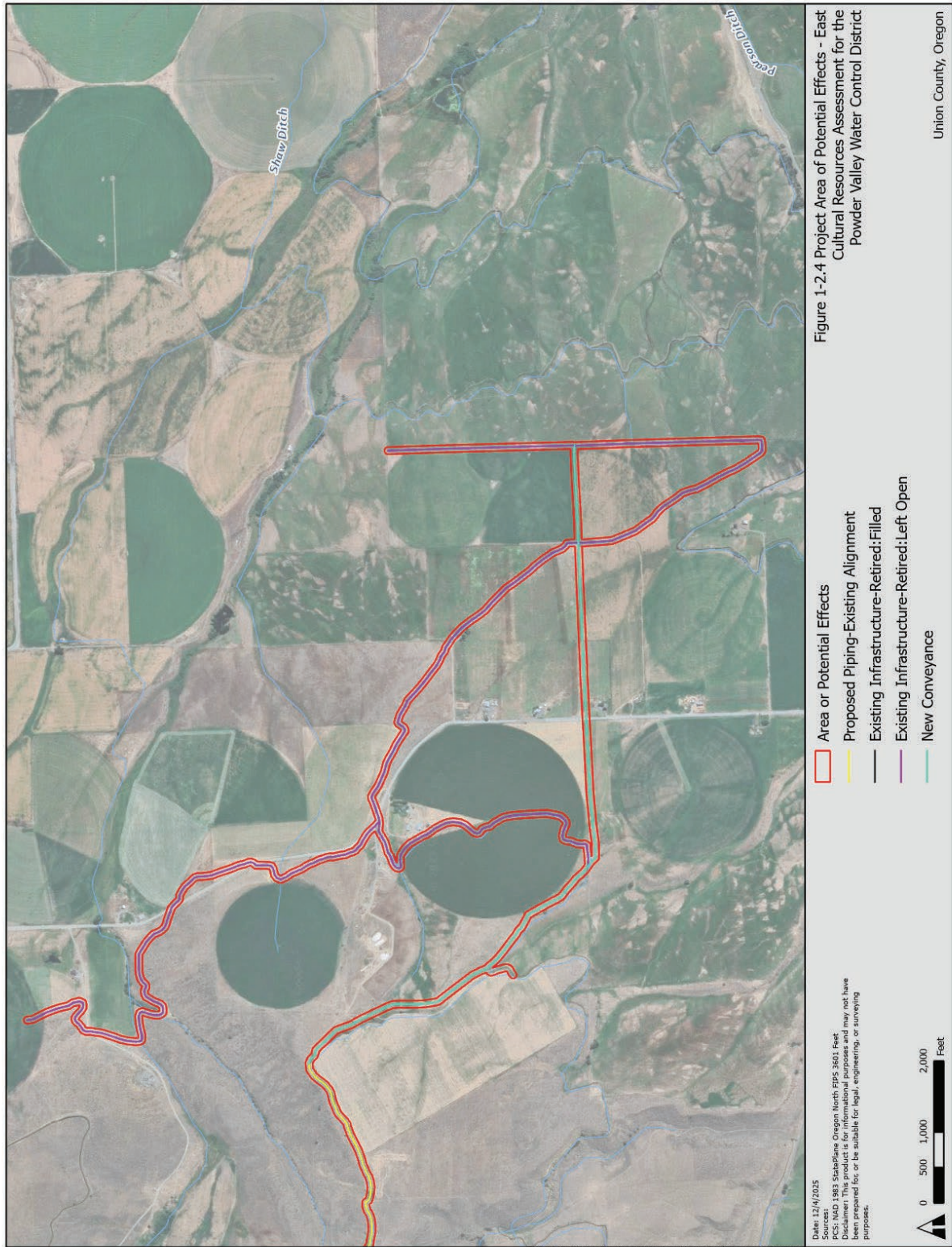
This report was prepared by Corey Lentz, MS, a Secretary of the Interior- (SOI-) Qualified Architectural Historian; Stephanie O'Brien, RPA, an SOI-Qualified Archaeologist; J. Tait Elder, RPA, an SOI-Qualified Archaeologist and Principal Investigator, and January Tavel, MHP, an SOI-Qualified Architectural Historian. Built environment field survey was conducted by Corey Lentz and Eliot Heath, MS, an SOI-Qualified Architectural Historian; archaeological field survey was conducted by Kainoa Little, BA, Lauren Collins, BA, and Nathan Benson, BA. Jacob Gray, MS, contributed figures for the report.











3. Research and Survey Methodology

This chapter outlines background research sources and the methodology of the archaeological and built environment resource surveys conducted as part of this study.

3.1 Background Research

Parametrix personnel conducted background research through review of online resources and Oregon Heritage (Oregon State Historic Preservation Office [SHPO]) and National Park Service (NPS) cultural resource databases. The following databases and online archival collections were reviewed:

- Oregon Archaeological Records Remote Access (OARRA) – A Geographic Information System-based database of previously recorded archaeological resources and archaeological survey reports.
- Oregon Historic Sites Database (OHSD) – Contains the Oregon Statewide Inventory, the public database of previously recorded built environment properties for which Oregon SHPO has collected physical and/or historical information.
- NPS NRHP NPGallery Database – Contains digital records for historic properties listed in the NRHP, held on file by the National Archives and Records Administration.
- Nationwide Environmental Title Research (NETR) Historic Aerials – A digital mapping tool for historic aerial photographs, available at <https://www.historicaerials.com/>.
- U.S. Geological Survey (USGS) Topographic Map Database – A digital collection of USGS topographic maps, available at <https://ngmdb.usgs.gov/topoview/viewer>.

3.2 Survey Methodology

The APE includes private, state, Bureau of Land Management, and U.S. Forest Service land (BLM permit OR-51125; ARPA Authorization ID: Heritage 24-10). The cultural resources survey included pedestrian (surface) and shovel probe (subsurface) archaeological surveys and a built environment survey.

3.2.1 Archaeological Survey

3.2.1.1 Pedestrian Survey

Parametrix conducted an archaeological pedestrian survey across the entirety of the APE. Pedestrian survey methods consisted of archaeologists walking side-by-side, approximately 15 meters apart, across the entire APE in a systematic fashion while carefully inspecting the ground surface. The ground surface was inspected for indicators of human activity such as midden soil, lithic artifacts, or concentrations of historic-era artifacts. Locations where the subsurface was exposed by rodent burrows, road cuts, or vegetation, were examined for artifacts or archaeological features.

Parametrix archaeologists documented field conditions, ground surface visibility, topography and visible geologic features, indicators of ground disturbance, and archaeological deposits in field notes and photographs.

3.2.1.2 Shovel Probes and Scrapes

Parametrix archaeologists excavated shovel probes at locations where project-related ground disturbance is anticipated to result in subsurface ground disturbance greater than 10 centimeters

below surface (cmbs). Shovel probes were excavated at intervals of 20 meters, in linear transects. Shovel probes were approximately 45 centimeters in diameter and excavated to the maximum anticipated depth of ground disturbance, or until Pleistocene-aged or older deposits or impassible conditions were encountered.

All excavated sediments were screened through 0.25-inch wire mesh. Upon completion, information relating to each shovel probe's sediments and stratigraphy, contents, and any other relevant observations were collected in field notes. Each shovel probe was photographed and mapped using a global positioning system unit. The shovel probe was then backfilled.

Due to the large size of the APE and the previously disturbed state of areas where pipelines would be placed in existing canals, shovel probing efforts were concentrated in areas where ground disturbance was proposed outside of the existing alignment and/or where the potential to yield archaeological sites was higher based on proximity to natural water sources. Soil probe data was also used to determine the presence of landforms which could yield subsurface archaeological deposits based on geologic age (see additional discussion in section 6.2.1 Buried Site Sensitivity Analysis). To this end, shovel scrapes were also implemented to verify that sediment patterns observed in the shovel probes extended beyond the area where shovel probes were placed. Shovel scrapes were created by scraping a roughly 50-centimeter by 50-centimeter area with a shovel to remove all vegetation and debris and expose the uppermost layer of sediments. Information about the scraped area was then collected in the same manner as the shovel probe, as noted above.

3.2.2 Historic Built Environment Survey and Evaluation

3.2.2.1 Historic Built Environment Survey

Historic built environment survey was designed and conducted in accordance with the Oregon SHPO's *Guidance for Historic Resource Surveys in Oregon* and *Guidance for Recording and Evaluating Linear Cultural Resources*, including specific guidance for the documentation of irrigation systems (Oregon Heritage 2011, 2013b). A Reconnaissance-Level Survey, consisting of photography and field notes, was conducted to identify and document historic built environment components of the PVWCD, focusing on the principal water conveyance structures and their related irrigation features within the APE. Documented historic built environment components of the PVWCD are summarized in Section 7.2, Historic Built Environment Survey.

3.2.2.2 Historic Built Environment Evaluation Methodology

Components of the PVWCD were evaluated for listing in the NRHP based on Oregon SHPO's *Guidance for Recording and Evaluating Linear Cultural Resources* (OR Heritage 2013b), which identifies irrigation systems as a type of linear resource. Secondly, the registration requirements established for individual components of irrigation systems in *Carey and Reclamation Acts Irrigation Projects in Oregon, 1901-1978 Multiple Property Documentation Form* (Hetzel 2016) informed the evaluation of PVWCD components for listing in the NRHP either individually or as contributing resources to a potential historic district.

Oregon SHPO guidance indicates that irrigation systems can be considered significant under NRHP Criterion A if they demonstrate that agricultural land use in a discreet area was made possible by the development of the irrigation system or that the system's development improved agricultural land use to a degree that would not otherwise have occurred. Additionally, this increase in agricultural land use should be demonstrated to have influenced historic patterns of settlement, social organization, and/or the appearance of the landscape in the vicinity of the irrigation system (Oregon Heritage 2013b:9).

*Cultural Resources Assessment for the Powder Valley Water Control District Infrastructure
Modernization Project, Union County, Oregon*
Farmers Conservation Alliance

Irrigation systems may be considered significant under NRHP Criterion B if their development substantially involved individuals significant for activities related to irrigation advocacy, land development, commercial irrigation development, or politics. However, the significance of this individual must be demonstrated to have a direct association with the development of a particular irrigation system and should consider whether other properties may better demonstrate this association. Importantly, if an individual's significance is associated primarily with the design or construction of an irrigation system, this association should be evaluated under NRHP Criterion C (Oregon Heritage 2013b:9).

Irrigation systems may be considered significant under NRHP Criterion C as an intact collection of engineered components constructed within a defined period that represent either a design approach to overcome an extraordinary environmental challenge or that consist of unusual or innovative design elements or aesthetic features. Large-scale federal projects may also be considered significant due to the sheer size of the project and the scale of mobilization required for its construction (Oregon Heritage 2013b:9-10).

Irrigation systems may be considered significant under NRHP Criterion D in cases where the system itself "serves as its own primary source of information," is considered to be an "artifact of primary importance," and this information is not otherwise available from documentary sources. As such, the application of this criterion is uncommon and must substantially rely on the physical elements of the system and its integrity (Oregon Heritage 2013b:10).

7. Results

Parametrix archaeologists Jillian Martin and Niki Nickoloff performed a pedestrian survey of the APE from August 11 to 13, 2024, and Parametrix archaeologists Kainoa Little, Lauren Collins, and Nathan Benson performed pedestrian and shovel probe archaeological surveys of the APE from September 30 to October 4, 2024. Parametrix architectural historians Corey Lentz and Eliot Heath performed a historic built environment survey of the APE from September 30 to October 4, 2024. Results of the surveys are presented below.

7.1 Archaeological Survey

7.1.1 Pedestrian Survey

The APE generally slopes from west to east, with the westernmost portion within the forested foothills of the Elkhorn Mountains exhibiting steeper terrain and heavier vegetation than the remainder of the APE. The ground surface in this westernmost portion of the APE was covered in thick pine needle duff, which resulted in poor to moderate ground visibility for surface artifacts, though ground features were still recognizable. The central and east portions of the APE consist of flatter terrain on the Powder River Valley floor. The ground in these areas is scarred from natural seasonal runoffs, agricultural fields, and irrigation ditches, with ground surface exhibiting sparse vegetation in the form of grass and sage brush, providing good to moderate ground visibility (see Appendix A for overview photos of APE). No archaeological artifacts or features were identified during the pedestrian survey. Three historic-age irrigation canals were identified and are evaluated for NRHP-eligibility below.

7.1.2 Shovel Probe Survey

A total of 22 shovel probes were excavated in portions of the APE where project ground-disturbing activities are proposed (see Figures 7-1.1 through 7-1.4 for locations and Appendix A for representative shovel probe photos and Appendix B for a full description of all probes). Six distinct sediment strata were observed in the shovel probes.

- Stratum 1– Brownish-gray silt with angular and subrounded gravels. Due to the presence of angular gravels and surrounding steep slopes where it was identified, it is likely a colluvial deposit. Found only on the surface and up to 60 cmbs in the westernmost portion of the APE, within the foothills of the Elkhorn Mountains.
- Stratum 2– A compact sandy silt ranging in color from brown to gray and containing rounded gravels. Found on the surface and below Stratum 1 up to 100 cmbs. It is likely alluvial, deposited from the Carnes and Lone Pine Ditches.
- Stratum 3 – A moderately compacted light brownish-gray sandy silt with angular and subangular gravels. Found on the surface up to 100 cmbs. Similar to Stratum 1, though in the central portion of the APE, away from slopes and significant channels in the Baker Valley, and more uniform in color. This stratum is likely a loess.
- Stratum 4 – A very compacted pale grayish-brown sandy silt with some rounded gravels and undecomposed organics. Found below Strata 2 and 3 in the central and east portions of the APE up to 100 cmbs. The undecomposed organics suggest an anoxic environment, indicating a previously inundated state; as such, this stratum is likely lacustrine.
- Stratum 5– A very fine white and brownish-gray powdery silt with no gravels found in only two shovel probes in the westernmost portion of the APE between 25 and 95 cmbs. Consistent

*Cultural Resources Assessment for the Powder Valley Water Control District Infrastructure
Modernization Project, Union County, Oregon*
Farmers Conservation Alliance

with volcanoclastic ash flows from the Eocene-Oligocene (33.9 to 33.4 million years ago) previously identified within portions of the APE (Ferns et al. 2001).

- Stratum 6 – A heavily compacted, blocky, brown and gray sand and silt with abundant subangular and subrounded gravels and cobbles throughout. Found below Strata 1, 2, and 5, suggesting an age of more than 33.9 million years.

The younger-aged Strata 1, 2, and 3 contain potential for buried archaeological resources, while the older Stratum 4 deposits contain limited potential. Strata 5 and 6 predate the presence of humans in the Americas and, therefore, have little to no potential for buried archaeological resources.

Shovel scrapes were also utilized to verify that the observed sediments extended beyond the area where SPs were placed. Shovel scrapes showed that the upper stratum in the SPs was consistent through these areas. Additional information on the shovel scrapes can be found in Appendix B.

No archaeological artifacts or features were identified during the shovel probe and shovel scrape survey.

*Cultural Resources Assessment for the Powder Valley Water Control District Infrastructure
Modernization Project, Union County, Oregon*
Farmers Conservation Alliance

8. Effects Analysis

Parametrix identified no archaeological resources and three historic built environment resources in the APE: the Carnes Ditch, Lone Pine Ditch, and Maharry Blevins Ditch. Parametrix recommends all three of these resources identified in the APE as not eligible for individual listing in the NRHP, and also not eligible for listing in the NRHP as contributing resources to a potential PWCD historic district. As such, Parametrix recommends a finding of no historic properties affected for the project, pursuant to 36 CFR 800.5.

*Cultural Resources Assessment for the Powder Valley Water Control District Infrastructure
Modernization Project, Union County, Oregon*
Farmers Conservation Alliance

9. Conclusion and Recommendations

9.1 Conclusions

Through background research, archaeological pedestrian and shovel probe survey, and built environment survey, three cultural resources, all historic built environment resources, were identified in the APE: the Carnes Ditch, Lone Pine Ditch, and Maharry Blevins Ditch. Parametrix evaluated the NRHP-eligibility of these resources, recommending all three as not eligible for individual listing in the NRHP, and also not eligible for listing in the NRHP as contributing resources to a potential PVWCD historic district. Based on the findings summarized above, Parametrix recommends a finding of no historic properties affected under Section 106 of the NHPA, pursuant to 36 CFR 800.5.

9.2 Recommendations

Based on the results of the current study, Parametrix does not foresee the need for any further archaeological or historic built environment work for the project as part of review under Section 106. However, in the unlikely event that archaeological deposits or human remains are encountered during project-related construction, Parametrix recommends the development of an inadvertent discovery plan to guide the treatment of inadvertent discoveries in accordance with state and federal laws.

E.2.2 Inadvertent Discovery Plan

Archaeological and Human Remains Inadvertent Discovery Plan (IDP)

PVWCD Modernization Project

Doug Birdsell, Powder Valley Water Control District, District Manager, September 2025

SHPO Case #23-0892

This document outlines procedures and protocols to be followed if archaeological objects or features, or human remains are encountered in the course of work. These procedures are intended for circumstances where there is not an expectation or anticipation of encountering cultural resources or human remains.

This is not a replacement for due diligence, robust project design, and consultation with appropriate Native American Tribes.³² Prior to undertaking project work, an assessment of the likelihood for disturbance to cultural resources and tribal heritage should be completed. All personnel will be briefed on all procedures and reporting structures before the start of any work.

Contents of this document

- A. Procedures for archaeological features and materials
 - B. Procedures for human remains, burials, funerary objects, sacred objects, and objects of cultural patrimony
 - C. Roles and responsibilities
 - D. Contact information
 - E. Confidentiality statement
 - F. Procedure flow chart
 - G. Visual reference guide for archaeology and tribal heritage items
-

Procedures for Inadvertent Discovery of Archaeological Features and Materials

(DOES NOT INCLUDE HUMAN REMAINS, BURLALS, FUNERARY OBJECTS, OBJECTS OF CULTURAL PATRIMONY, OR SPIRITUAL OBJECTS)

It is expected that ALL artifacts, features, structural elements, and other cultural items that are identified will be reported to required project, agency, and Tribal contacts, and accounted for as soon as possible. It is understood that there will be a single project point of contact to coordinate with the project archaeologist, SHPO, LCIS, and appropriate Native American Tribes.

Step 1. Stop work (immediately after discovery)

³² Appropriate Native American Tribes will be identified by LCIS

If any person believes that they have located an archaeological object³³ or site³⁴, all work must stop immediately.

Discovery made in field _____(date/time)_____ (initials of discoverer)

Step 2. Secure and protect the area (within first hour after discovery)

Establish a **minimum** 30 meter/100-foot area of protection, or more as necessary, around the find(s). Exclude all vehicle traffic and non-essential foot traffic. Non-ground-disturbing work may continue outside of the area of protection with caution until the situation is assessed by a qualified archaeologist.³⁵

Buffer established _____ (time) _____ (initials of person responsible)

Step 3. Notify (within first hour after discovery)

Notify the project manager, agency official (if applicable), and project archaeologist. If there is not an archaeologist on-site, or on retainer for the project, the project manager will contact an Oregon Qualified Archaeologist (which include agency and Tribal archaeologists) to assess the find.

Project Manager contacted _____ (time) _____ (initials of contactor)

Agency Official contacted _____ (time) _____ (initials of contactor)

Project Archaeologist contacted _____ (time) _____ (initials of contactor)

Step 4. Identify and Follow Guidance (timeline variable, as soon as possible)

If the archaeologist determines the find is an archaeological feature or object, or other cultural item or feature, OR if no qualified archaeologist can be contacted within the first hour of discovery, the **State Historic Preservation Office (SHPO) and appropriate Native American Tribes must be contacted**, and their guidance must be followed. SHPO, Native American Tribes, and project and agency personnel will determine in consultation how or if work may continue at the site. If the discovery is determined to *not* be archaeological or a cultural item, you may continue work. This determination should be confirmed in writing to the project manager and agency official.

SHPO contacted _____ (time) _____ (initials of contactor)

Appropriate Native American Tribes³⁶ _____ (time)_____ (initials of contactor)

Procedures for Inadvertent Discovery of Human Remains

³³ “Archaeological object” means an object that is at least 75 years old (or 50 years if there is a federal nexus), is part of the physical record of an indigenous or other culture found in the state or waters of the state, and is material remains of past human life or activity that are of archaeological significance including, but not limited to, monuments, symbols, tools, facilities, technological by-products and dietary by-products (ORS 358.905).

³⁴ “Archaeological site” means a geographic locality in Oregon that contains archaeological objects and the contextual associations of the archaeological objects with each other or biotic or geological remains or deposits (ORS 358.905).

³⁵ Ground-disturbing work on different landforms distant from the find and outside of the buffer may continue.

³⁶ ALL Tribes designated by LCIS must be notified. Contacting one or some of the Tribes does not fulfill the obligation to notify.

Appendix E: Other Supporting Information

(INCLUDES HUMAN REMAINS, BURLALS, FUNERARY OBJECTS, OBJECTS OF CULTURAL PATRIMONY, AND SPIRITUAL OBJECTS)

It is expected that ALL potential human remains, burials, funerary objects, or objects of cultural patrimony that are identified will be reported and accounted for within 3 hours of discovery.³⁷ It is understood that there will be a single project point of contact to coordinate with the project archaeologist, SHPO, LCIS, OSP and appropriate Native American Tribes.

Step 1: Stop work (immediately after discovery)

If any person believes that they have located human remains³⁸, ALL work will stop immediately. Any human remains, regardless of antiquity or ethnic origin, will always be treated with dignity and respect.

Step 2. Secure and protect the area (as soon as possible, within c. 10 min)

Secure and protect the area of inadvertent discovery with a **minimum** of 100 meter/300 foot buffer, or more as necessary. The location and other information about the find should be treated as confidential and shared on a **need to know basis only**. Prevent all vehicle traffic and unauthorized foot traffic from entry. Block remains from view and protect them from damage or exposure without touching or disturbing the remains, and leave them in place.

Do not take photographs unless approved by the appropriate Native American Tribes and Oregon Legislative Commission on Indian Services (LCIS), and only for the purpose of identification.

Do not speak to the media or public or post any information about the find on social media. Non-ground-disturbing work may continue outside of the buffer with caution.³⁹

Buffer established _____ (time) _____ (initials of person responsible)

Step 3. Notify (within first hour after discovery) – see contact list below (section D)

- 1. Project Manager _____ (time) _____ (initials)
- 2. Agency Official _____ (time) _____ (initials)
- 3. Oregon State Police⁴⁰ **DO NOT CALL 911**⁴¹ _____ (time) _____ (initials)
- 4. State Historic Preservation Office (SHPO) _____ (time) _____ (initials)
- 5. Commission on Indian Services (LCIS) _____ (time) _____ (initials)
- 6. Appropriate Native American Tribes⁴² _____ (time) _____ (initials)

Name of Tribe(s) Contacted and Individual(s) contacted:

³⁷ Modifications to reporting timelines can be made in consultation with SHPO and Tribes.

³⁸ Bone may be fragmented, weathered, or otherwise modified to make it difficult to identify, so when in doubt, stop work and call it in.

³⁹ Ground-disturbing work on different landforms distant from the find and outside of the buffer may continue.

⁴⁰ OSP will be responsible for contacting the county or state medical examiner’s office as appropriate.

⁴¹ **Unless remains are clearly modern.**

⁴² ALL Tribes designated by LCIS must be notified. Contacting one or some of the Tribes does not fulfill the obligation to notify.

Step 4. Follow guidance (timeline variable, may be up to several days or more)

If the site is determined not to be a crime scene by the Oregon State Police, **do not move anything!** The remains will continue to be *secured in place* along with any associated funerary objects, and protected from weather, water runoff, and shielded from view. Follow all guidance provided by OSP, LCIS, SHPO, and appropriate Native American Tribes.

Continue to maintain the work stoppage within the buffer until a plan is developed and carried out between the Oregon State Police, SHPO, LCIS, and appropriate Native American Tribes and you are directed in writing by the project manager that work may proceed.

Roles and Responsibilities

Person Responsible	Responsibility
Person Responsible will...	Notify the Project Manager [Doug Birdsall]: [541-898-2366]
Person Responsible will...	Notify the Agency Official [Greg Becker]: [503-414-3201]
Person Responsible will...	Notify the Agency Archaeologist [Rachel Gebauer]: [541-887-3511]
Person Responsible will...	Notify the State Agencies (OSP, LCIS, SHPO)
Person Responsible will...	Notify the Native American Tribes identified by LCIS
Person Responsible will...	Enforce the work stoppage and buffer

Contact Information⁴³

Agency	Position/Contact	Contact Information
Project Manager	Doug Birdsall, District Manager, Powder Valley Water Control District	541-898-2366

⁴³ Contact information should be regularly updated for all individuals. Up to date contacts for LCIS, OSP, SHPO, and Native American Tribes can be found on the LCIS cultural resources page: [Commission on Indian Services archaeology \(oregonlegislature.gov\)](http://commissiononindianservicesarchaeology.oregonlegislature.gov)

Appendix E: Other Supporting Information

USDA-NRCS Official	Greg Becker, State Conservationist	503-414-3201
USDA-NRCS Archaeologist	Rachel Gebauer, NRCS State Archaeologist	541-887-3511
Legislative Commission on Indian Services (LCIS)	Primary Contact: Dr. Elissa Bullion, State Physical Anthropologist	971-707-1372
Legislative Commission on Indian Services (LCIS)	Secondary Contact: LCIS Office	503-986-1067
Oregon State Police (OSP)	Primary Contact: Sgt. Ryan Tague	541-576-4393
Oregon State Police (OSP)	Secondary Contact: Dispatch, northern command ⁴⁴	800-442-0776
Oregon State Police (OSP)	Secondary Contact: Dispatch, southern command ⁴⁵	800-442-2068
State Historic Preservation Office (SHPO)	Primary Contact: John Pouley, State Archaeologist	503-480-9164
State Historic Preservation Office (SHPO)	Secondary Contact: Jamie French, Asst. State Archaeologist	503-979-7580
Native American Tribes	Confederated Tribes of the Umatilla Indian Reservation	541-429-7234
Native American Tribes	Burns Paiute	541-573-8096
Native American Tribes	Confederated Tribes of the Warm Springs Reservation	541-553-2026
Native American Tribes	Nez Perce	208-621-3851

Confidentiality

Powder Valley Water Control District and employees shall make their best efforts, in accordance with federal and state law, to ensure that its personnel and contractors keep the discovery confidential. The media, or any third-party member or members of the public are not to be contacted or have information regarding the discovery, and any public or media inquiry is to be reported to USDA-NRCS. Photos shall not be taken except for when authorized by LCIS, SHPO, and Native American Tribes for identification purposes, and no photos will be circulated publicly or

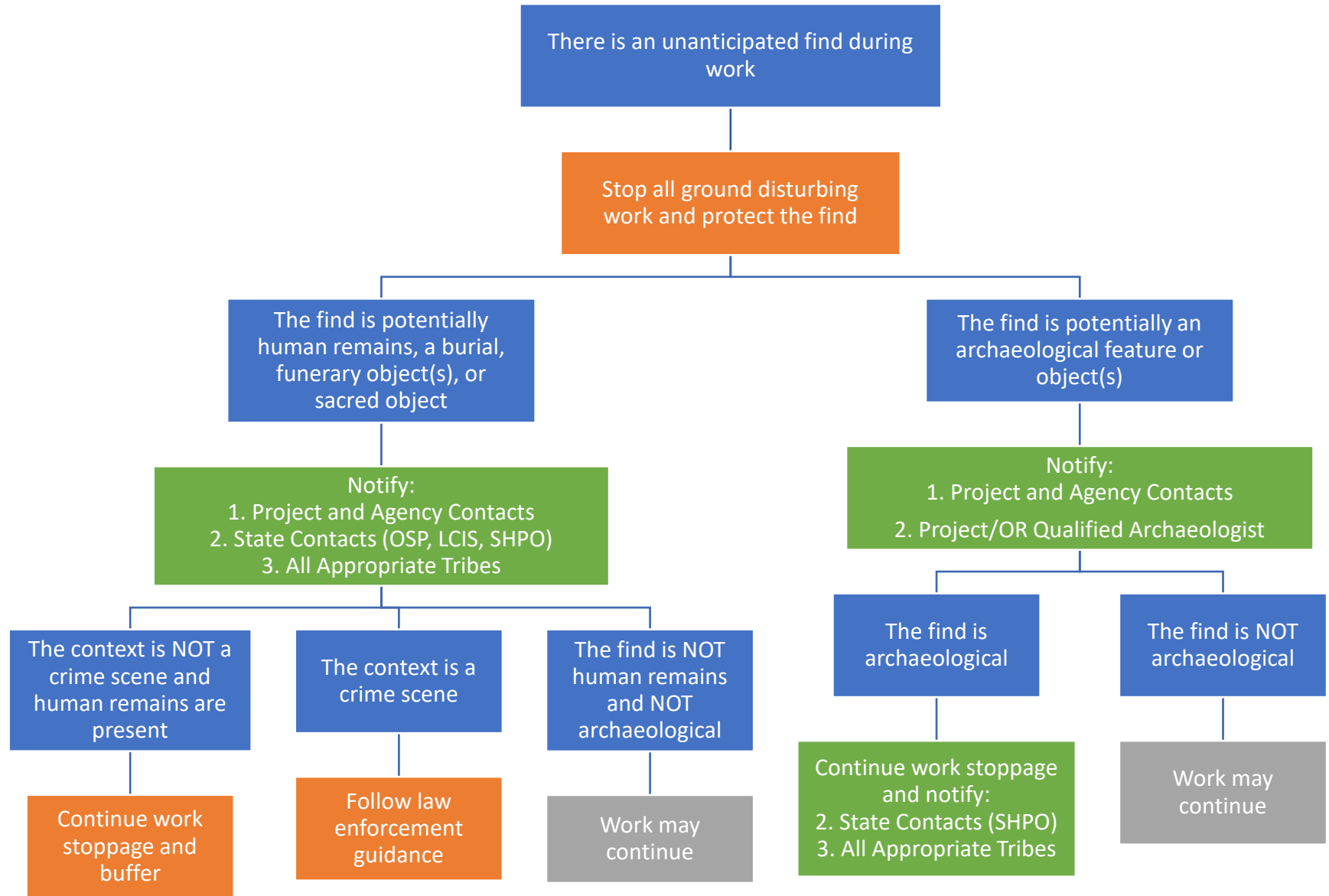
⁴⁴ Northern command: Benton, Clackamas, Clatsop, Columbia, Crook, Deschutes, Gilliam, Hood River, Jefferson, Klamath, Lane, Lincoln, Linn, Marion, Multnomah, Polk, Sherman, Tillamook, Wasco, Washington, Wheeler, Yamhill

⁴⁵ Southern command: Baker, Coos, Curry, Douglas, Grant, Harney, Jackson, Josephine, parts of Klamath, Lake, Malheur, Morrow, Umatilla, Union, and Wallowa

on social media. Prior to any release, the responsible agencies and Tribes shall concur on the amount of information, if any, to be released to the public.

To protect fragile, vulnerable, or threatened sites, the National Historic Preservation Act, as amended (Section 304 [16 U.S.C. 470s-3]), and Oregon State law (ORS 192.345(11)) establishes that the location of archaeological sites, both on land and underwater, shall be confidential.

Procedure Flow Chart



A. Visual Reference Guide for Archaeology in Oregon (Modify based on region/context)

Lithics and stone tools



Figure 1. Stone flakes



Figure 2. Stone projectile points

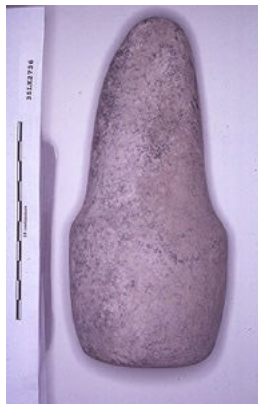


Figure 3. Ground stone tools: (left) pestle, (right) net weights,

Basketry/Cordage



Figure 4. Open diagonal twine basket fragments from Fort Rock Cave (UOMNCH).



Figure 5. Three-strand braid, sagebrush bark from Paisley Caves (UOMNCH).

Shell Middens



Figure 6. Cross section of shell midden.

Beads



Figure 7. Dentalium shell beads (UOMNCH).

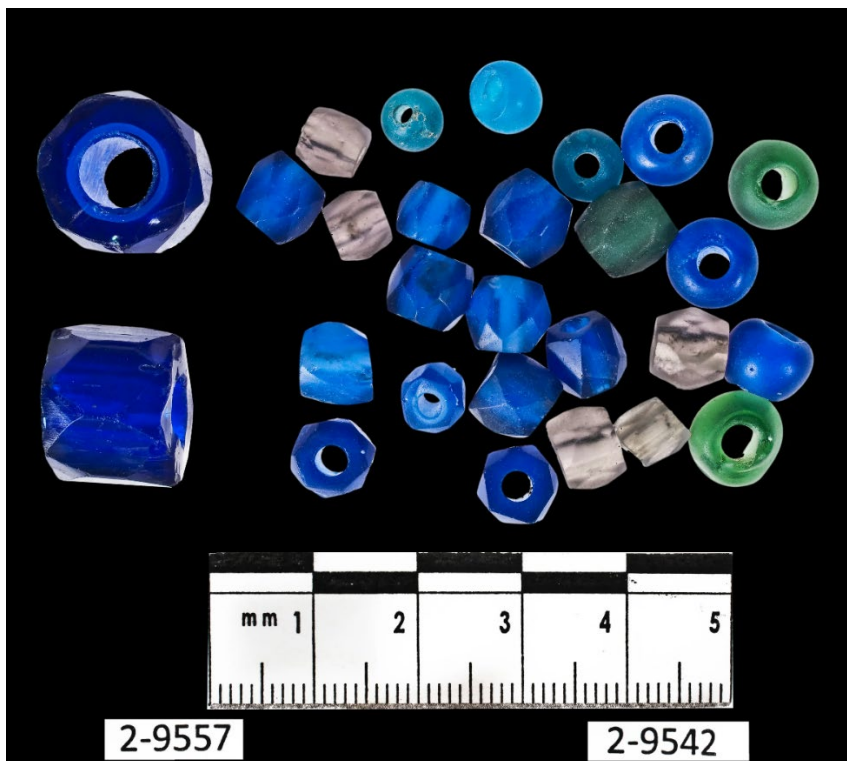


Figure 8. Glass trade beads, Upper Columbia River (UOMNCH).

Fish Weirs



Figure 9. Wooden fish weir



Figure 10. Fishing weir.



Figure 11. Close up of fishing weir.
Culturally Modified Trees



Figure 12. Example of peeled pine.



Figure 13. Arborglyph on aspen tree

Historic Artifacts



Figure 14. Historical glass



Figure 15. Historical metal artifacts

E.3 Supporting Information for Socioeconomic Resources

Table E-3. Population Characteristics

Area	Population 2018	Population 2023	Percent Change 2018–2023
Union County	26,028	26,192	+0.6%
North Powder, Oregon	490	669	+36.5%

Source: U.S. Census Bureau, 2023.

Table E-4. Labor Force Characteristics

Indicator	Union County	North Powder	Oregon
Labor Force Participation Rate	59.0%	57.7%	62.3%
Employment/Population Ratio	55.5%	55.7%	58.9%
Unemployment Rate	5.6%	3.5%	5.4%

Source: U.S. Census Bureau, 2023.

Table E-5. Income and Poverty

Indicator	Union County	North Powder	Oregon
Median Household Income	\$64,212	\$70,682	\$80,426
Poverty Rate	15.8%	12.6%	11.9%

Source: U.S. Census Bureau, 2023.

Table E-6. Crops Grown in Union County.

Crops Grown in Union County	Acreage in Union County
Forage (hay)	36,316
Wheat for grain	17,788
Field/grass seed crops	6,064
Vegetables harvested (all)	1,332
Potatoes	481
Mint for oil, all	1,176
Barley for grain	1,935
Corn for silage or greenchop	644
Sunflower Seed	840
Total	66,576

Source: USDA-NASS 2022

E.4 Supporting Information for Vegetation Resources



Figure E-1. Representative view of an uncultivated valley hillside with arid upland vegetation (FCA, November 29, 2022)



Figure E-2. Representative view of Carnes Ditch with arid upland vegetation along the banks and berms (FCA, November 29, 2022).



Figure E-3. View of the inlet to Pilcher Creek Reservoir (at 18 percent capacity) with a wetland fringe meadow and uplands (FCA, November 29, 2022).

Table E-7. Plant Species Potentially Occurring within the Planning Area.

Plant Species	Scientific Name
Arrowleaf balsamroot	<i>Balsamorhiza sagittata</i>
Basin wildrye	<i>Leymus cinereus</i>
Big sagebrush	<i>Artemisia tridentata</i>
Black cottonwood	<i>Populus balsamifera</i>
Bluebunch wheatgrass	<i>Pseudoroegneria spicata</i>
Carelessweed	<i>Amaranthus palmeri</i>
Cheatgrass	<i>Bromus tectorum</i>
Common yarrow	<i>Achillea millefolium</i>
Douglas fir	<i>Pseudotsuga menziesii</i>
Herb sophia	<i>Descurainia sophia</i>
Idaho fescue	<i>Festuca idahoensis</i>

Appendix E: Other Supporting Information

Plant Species	Scientific Name
Indian ricegrass	<i>Achnatherum hymenoides</i>
Kings fescue	<i>Leucopoa kingii</i>
Low sagebrush	<i>Artemisia arbuscula</i>
Mouse barley	<i>Hordeum murinum</i>
Muttongrass	<i>Poa fendleriana</i>
Needle-and-thread grass	<i>Hesperostipa comata</i>
Northern bedstraw	<i>Galium boreale</i>
Owl's-claws	<i>Hymenoxys hoopesii</i>
Prairie junegrass	<i>Koeleria macrantha</i>
Prairie smoke	<i>Geum triflorum</i>
Perennial pepperweed	<i>Lepidium latifolium</i>
Poison hemlock	<i>Conium maculatum</i>
Ponderosa pine	<i>Pinus ponderosa</i>
Prickly lettuce	<i>Lactuca serriola</i>
Purple loosestrife	<i>Lythrum salicaria</i>
Quackgrass	<i>Elymus repens</i>
Reed canary grass	<i>Phalaris arundinacea</i>
Richardson's needlegrass	<i>Achnatherum richardsonii</i>
Rosy Pussytoes	<i>Antennaria rosea</i>
Rough fescue	<i>Festuca campestris</i>
Rubber rabbitbrush	<i>Ericameria nauseosa</i>
Russian knapweed	<i>Acroptilon repens</i>
Russian thistle	<i>Salsola tragus</i>
Rye brome	<i>Bromus secalinus</i>

Appendix E: Other Supporting Information

Plant Species	Scientific Name
Sandberg bluegrass	<i>Poa sandbergii</i>
Silvery lupine	<i>Lupinus argenteus</i>
Silver sagebrush	<i>Artemisia cana</i>
Slender wheatgrass	<i>Elymus trachycaulus</i>
Stinging nettle	<i>Urtica dioica ssp. holosericea</i>
Sulphurflower buckwheat	<i>Eriogonum umbellatum</i>
Tall annual willowherb	<i>Epilobium brachycarpum</i>
Tall hedge-mustard	<i>Sisymbrium altissimum</i>
Teasel	<i>Dipsacus sp.</i>
Threadleaf sedge	<i>Carex filifolia</i>
Thurber's fescue	<i>Festuca thurberi</i>
Western juniper	<i>Juniperus occidentalis</i>
Western needlegrass	<i>Achnatherum occidentale</i>
Western wheatgrass	<i>Pascopyrum smithii</i>
White fir	<i>Abies concolor</i>
White sagebrush	<i>Artemisia ludoviciana</i>
Wild mint	<i>Mentha arvensis</i>
Yellow rabbitbrush	<i>Chrysothamnus viscidiflorus</i>

Sources: Oregon Explorer, 2022 and MacLean, 2022.

Table E-8. Noxious Weeds Potentially Occurring within the Planning Area.

Common Name	Scientific Name	Oregon State Designation	Union County Designation
Bull thistle	<i>Cirsium vulgare</i>	List B	-
Canada thistle	<i>Cirsium arvense</i>	List B	Class B
Common St. John's wort	<i>Hypericum perforatum</i>	List B	-
Cutleaf teasel	<i>Dipsacus laciniatus</i>	List B	-
Cheatgrass	<i>Bromus tectorum</i>	-	-
Dalmatian toadflax	<i>Linaria dalmatica</i> ssp. <i>dalmatica</i> (= <i>Linaria genistifolia</i> ssp. <i>dalmatica</i>)	List B (I)	Class B
Diffuse knapweed	<i>Centaurea diffusa</i>	List B	Class B
Hoary Alyssum	<i>Berteroa incana</i>	List A	Class A
Houndstongue	<i>Cynoglossum officinale</i>	List B	Class B
Jointed goatgrass	<i>Aegilops cylindrica</i>	List B	Class B
Leafy spurge	<i>Euphorbia virgata</i> (= <i>Euphorbia esula</i>)	List B (I)	Class A
Mediterranean sage	<i>Salvia aethiopsis</i>	List B	Class A
Medusahead	<i>Elymus caput-medusae</i> (= <i>Taeniatherum caput-medusae</i>)	List B	Class B
Perennial pepperweed	<i>Lepidium latifolium</i>	List B	Class A
Poison-hemlock	<i>Conium maculatum</i>	List B	Class B
Puncture vine	<i>Tribulus terrestris</i>	List B	Class B
Purple loosestrife	<i>Lythrum salicaria</i>	List B	Class B
Rush skeletonweed	<i>Chondrilla juncea</i>	List B (I)	Class A
Russian knapweed	<i>Acroptilon repens</i>	List B	Class A
Russian-thistle	<i>Salsola tragus</i>	-	-
Sulfur cinquefoil	<i>Potentilla recta</i>	List B	Class B
Scotch thistle	<i>Onopordum acanthium</i>	List B	Class B

Appendix E: Other Supporting Information

Common Name	Scientific Name	Oregon State Designation	Union County Designation
Spotted knapweed	<i>Centaurea stoebe ssp. micranthos</i> (= <i>Centaurea maculosa</i>)	List B	Class B
Tansy ragwort	<i>Senecio jacobaea</i>	List B (T)	Class A
Whitetop (hoary cress)	<i>Lepidium draba</i> (= <i>Cardaria draba</i>)	List B	Class A
Yellow starthistle	<i>Centaurea solstitialis</i>	List B	Class A
Yellowflag iris	<i>Iris pseudacorus</i>	List B	Class B

Source: ODA WeedMapper (2023)

E.5 Supporting Information for Water Resources**Table E-9. District Water Rights Associated with the Project Area.**

Certificate (Permit Application)	Priority Date	Beneficial Uses	Max Diversion Rates (cubic feet per second)	Max Volume (acre- feet)	Primary Irrigated Lands (acres)	Supplemental Irrigated Lands (acres)
(R-5776)	10/31/1963	Irrigation, Recreation	--	11,000	--	--
(R-8353)	10/31/1963	Irrigation, Storage	--	5,910	--	--
(S-35791)	10/31/1963	Irrigation, Supplemental Irrigation, Recreation	140 (Anthony Creek) 30 (Wolf Creek)	11,100	3,351.4	7,489.9
(S-42690)	4/25/1977	Irrigation, Supplemental Irrigation	144.8	--	2,716.4	3,078.1
(S-50717)	10/13/1983	Irrigation, Supplemental Irrigation	300 (Anthony Fork) 26.5 (North Powder River) 50 (Pilcher Creek)	--	2,465.6	15,185.3
83303	12/13/1908	Irrigation	1	--	38	--
83312	12/31/1889	Irrigation	7.5	--	499.5	--
83314	12/31/1885	Domestic, Livestock, Supplemental Irrigation	1	--	--	38
83744	12/31/1898	Irrigation, Livestock	9.6	--	623.8	--
83777	12/31/1898	Irrigation, Supplemental Irrigation	7.5 (Anthony Creek) 7.5 (North and South Fork Anthony Creek)	--	204.7	375.5

Appendix E: Other Supporting Information

83781	12/13/1903	Irrigation, Domestic, Livestock	19.4	--	883	--
83788	12/31/1898	Irrigation, Domestic, Livestock	5.7	--	263.5	--

Source: PVWCD 2020

Table E-10. Monthly Instream Water Rights Associated with District Operations.

Stream	Description	Certificate	Priority Date	Oct. (cfs)	Nov. (cfs)	Dec. (cfs)	Jan. (cfs)	Feb. (cfs)	Mar. (cfs)	Apr. (cfs)	May (cfs)	June (cfs)	July (cfs)	Aug. (cfs)	Sep. (cfs)
Anthony Fork	Anthony Lake to Indian Creek	73325	1/29/92	8.0	8.0	7.5	4.6	6.0	6.0	10.6	20.0	20.0	15.0	8.0	8.0
Anthony Fork	Indian Creek to Mouth	73326	1/29/92	10.0	10.0	10.0	10.0	10.0	22.3	25.0	25.0	25.0	18.0	10.0	10.0
North Fork Anthony Creek	Headwaters to Mouth	73334	1/29/92	2.6	3.0	2.4	2.6	2.5	3.6	9.6	12.0	12.0	4.3	2.4	2.3
North Powder River	RM 22.2 12.9	73321	6/7/91	8.0	8.0	8.0	8.0	8.0	20.0	25.0	25.0	25.0	15.0	8.0	8.0

Source: PBWC 2004, cfs = cubic feet per second

Table E-11. Waterbodies Associated with District Operations and Infrastructure.

Name	Associated River Miles	Size	Tributary to	Project Nexus
North Fork Anthony Creek	District's Carnes Diversion (RM 0.1) to confluence with Anthony Creek	N/A	Anthony Creek	District diverts water from North Fork Anthony Creek into Carnes Ditch, which conveys water to Pilcher Creek Reservoir.
Anthony Creek	North Fork and South Fork Anthony Creek confluence (RM 4.7) to confluence with North Powder River	N/A	North Powder River	District diverts water from Anthony Creek into Upper Coughanour Ditch.
Dutch Creek	Interception of Dutch Creek and Carnes Ditch (RM 0.6) to confluence with Anthony Creek	N/A	Anthony Creek	Dutch Creek flows into Carnes Ditch. A headgate releases water from Carnes Ditch at the site where Dutch Creek is intercepted by the ditch to allow flows to continue moving downstream within the Dutch Creek channel.
Daley Creek	Interception of Daley Creek and Carnes Ditch (RM 1) to confluence with Pilcher Creek	N/A	Pilcher Creek	Daley Creek flows into Carnes Ditch. Flows within the Daley Creek stream channel downslope of the ditch appear to be attributable to groundwater discharge that is augmented by ditch seepage during the irrigation season.
North Powder River	Anthony Creek confluence (RM 9.7) downstream to Powder River confluence	25 miles	Powder River	Water diverted from North Fork Anthony Creek and Anthony Creek by District results in lower flows to North Powder River.
Powder River	Confluence North Powder River to Thief Valley Dam	N/A	Snake River	District diversions result in lower flows to Powder River.
Pilcher Creek	Conveyance from Carnes Ditch (RM 0.9) to Pilcher Creek Reservoir	N/A	North Powder River	District conveys water from North Fork Anthony Creek into Pilcher Creek and Pilcher Creek Reservoir.

Appendix E: Other Supporting Information

Name	Associated River Miles	Size	Tributary to	Project Nexus
Wolf Creek	Wolf Creek Reservoir Dam (RM 6.5) to confluence with North Powder River	N/A	Powder River	Wolf Creek flow is determined from Wolf Creek Reservoir outfall.
Pilcher Creek Reservoir	N/A	5,910 acre-feet	Pilcher Creek	PVWCD holds 5,910 acre-feet of storage in the reservoir.
Wolf Creek Reservoir	N/A	11,100 acre-feet	Wolf Creek	PVWCD holds 11,100 acre-feet of storage in the reservoir.

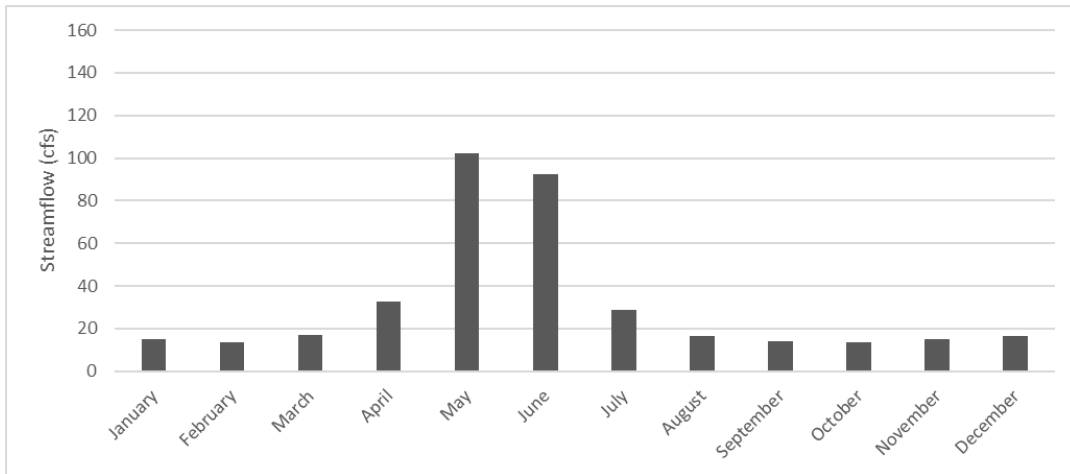


Figure E-4. Average daily streamflow by month from 1962 to 1978, Anthony Creek, Oregon Station ID #13282400 (OWRD, 2023a)

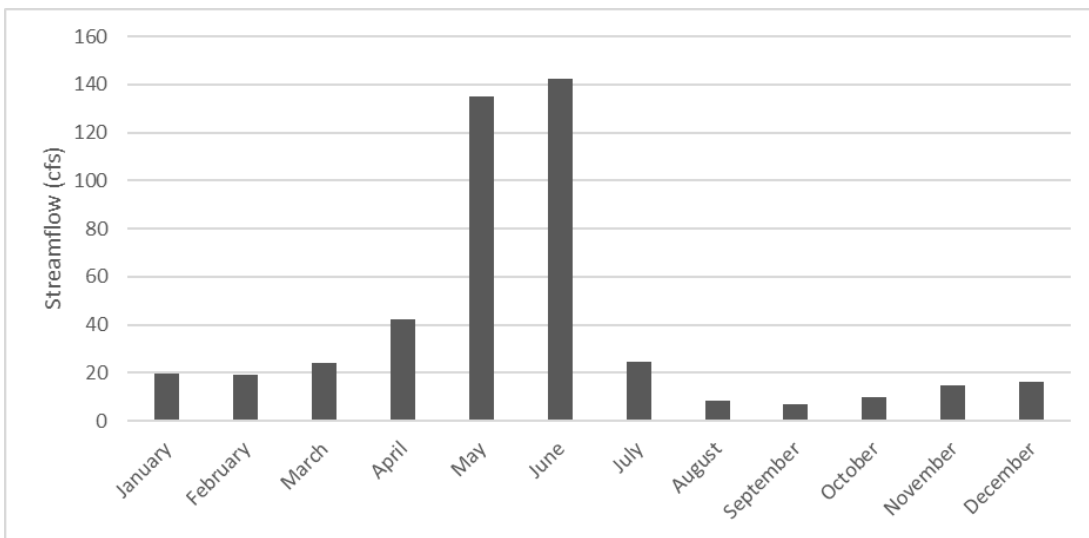


Figure E-5. Average daily streamflow by month from 1999-2014, North Powder River, Oregon Station ID #1328550 (OWRD, 2023a)

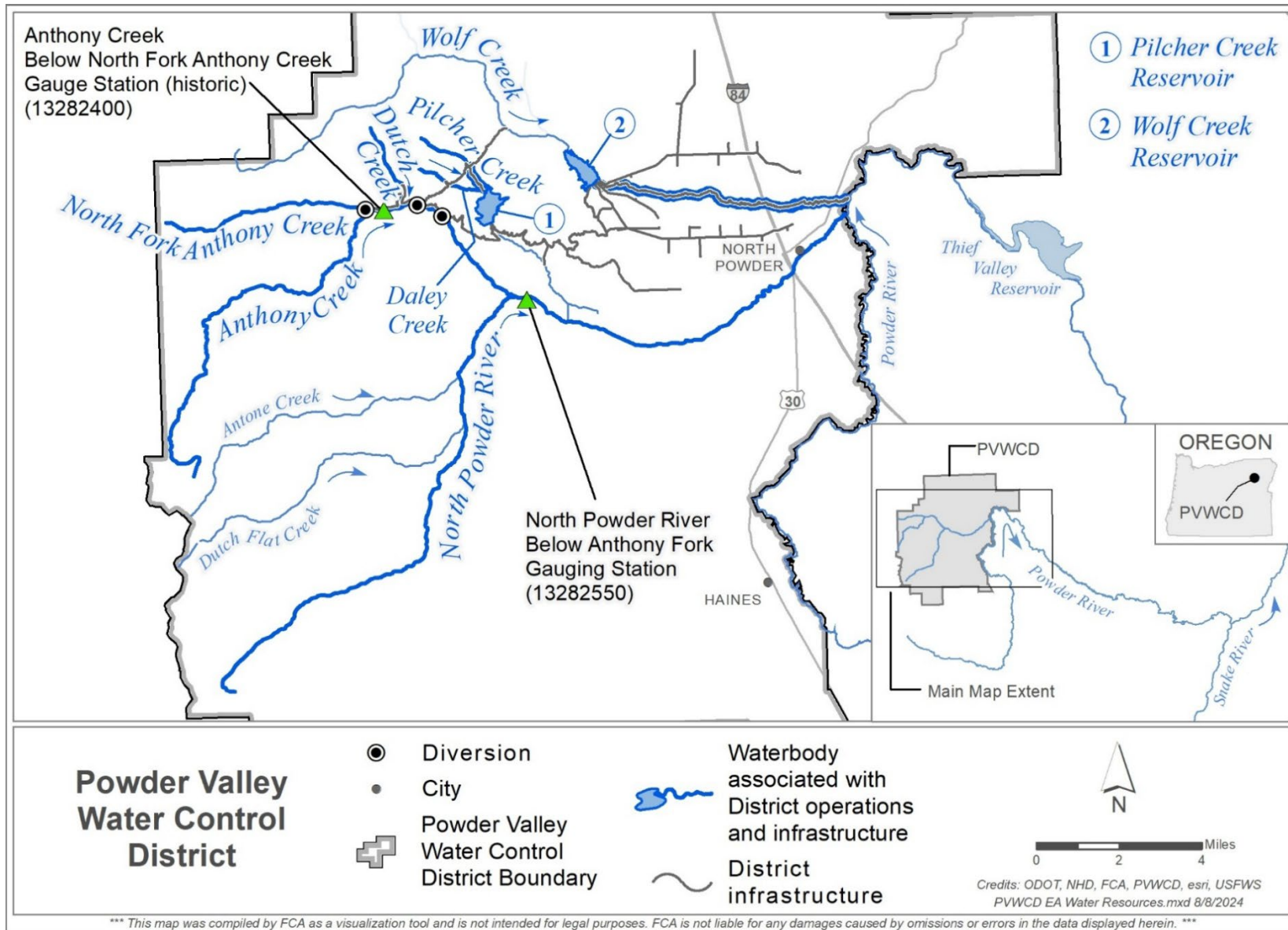


Figure E-6. Waterbodies and gauging stations associated with District operations

Table E-12. Impaired Waterbodies Associated with District Operations and Infrastructure.

Name	Listed Reach	Parameters Included on the Oregon 303(d) List
North Fork Anthony Creek	Entirety	Temperature year-round
Anthony Creek	Entirety: Temperature RM 0–7: <i>E. coli</i>	Temperature and <i>E. coli</i> year-round
North Powder River	RM 0–10	Temperature and <i>E. coli</i> year-round
Wolf Creek	RM 0–6.5 and 1.5 miles upstream of Wolf Creek Reservoir Remainder of Wolf Creek watershed is impaired for temperature	Temperature and dissolved oxygen (year-round, spawning), and pH (summer)

Source: ODEQ, 2022a.

RM = river mile

Table E-13. Estimated Changes in Hydrology for Dutch Creek, North Fork Anthony Creek, Anthony Creek, and North Powder River¹

Waterbody	Associated River Miles	Change in Hydrology during Non-Water Shortage Years (cfs) ¹ (October thru April)	Change in Hydrology during Non-Water Shortage Years (cfs) ¹ (May thru June)	Change in Hydrology during Non-Water Shortage Years (cfs) ¹ (July thru September)	Change in Hydrology during Water Shortage Years (cfs) ¹ (May thru June)	Change in Hydrology during Water Shortage Years (cfs) ¹ (July thru September)
North Fork Anthony Creek	RM 0.1 to 0	3.2	3.2	0	0	0
Dutch Creek	RM 0.6 to 0	0	2.8	0	2.8	0
Anthony Creek	RM 4.7 to 4	3.2	3.2	0	0	0
Anthony Creek	RM 4 to 2.8	3.2	6.0	0	2.8	0
Anthony Creek	RM 2.8 to 0	3.2	8.2	2.2	4.4	1.6

Appendix E: Other Supporting Information

North Powder River	RM 9.7 to 0	3.2	8.2	2.2	4.4	1.6
--------------------	-------------	-----	-----	-----	-----	-----

¹ Changes in hydrology were estimated by allocating water savings across the entire length of a typical diversion season for each diversion (i.e., October through June for the Carnes Diversion and May through September for the Lone Pine Diversion). After project construction PVWCD will work with OWRD to determine rates and timing of water instream. Changes in hydrology may differ from what is shown in the table if saved water is restored instream over a different time period.

E.6 Supporting Information for Fish and Aquatic Resources

Table E-14. Fish Species Potentially Occurring within the Planning Area.

Fish Species	Scientific Name	Nativity
Black crappie	<i>Pomoxis nigromaculatus</i>	non-native
Brook trout	<i>Salvelinus fontinalis</i>	non-native
Brown bullhead	<i>Ameiurus nebulosus</i>	non-native
Bull trout	<i>Salvelinus confluentus</i>	native
Chinook salmon	<i>Oncorhynchus tshawytscha</i>	native - extirpated
Chiselmouth minnow	<i>Acrocheilus alutaceus</i>	native
Northern pikeminnow	<i>Ptychocheilus oregonensis</i>	native
Columbia River redband trout	<i>Oncorhynchus mykiss gairdnerii</i>	native
Redside shiner	<i>Richardsonius balteatus</i>	native

Sources: ODFW, 2024; ORBIC, 2023; USFWS, 2025.

Note: Anadromous salmonids such as chinook salmon (*Oncorhynchus tshawytscha*) and steelhead (*Oncorhynchus mykiss*) historically inhabited the basin until 1932 with the construction of Thief Valley Dam which prevented upstream travel from the Snake River (ODEQ 2013).

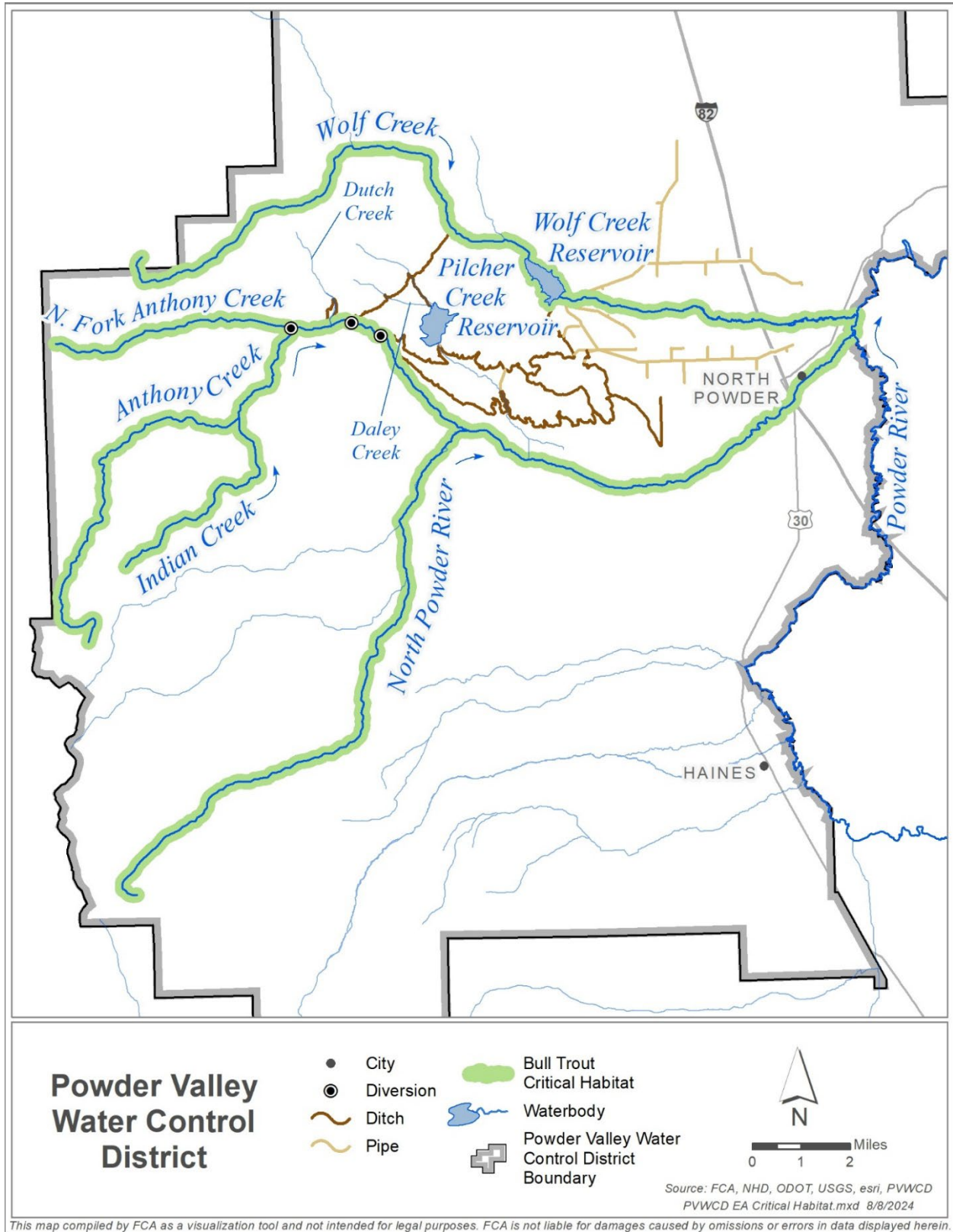
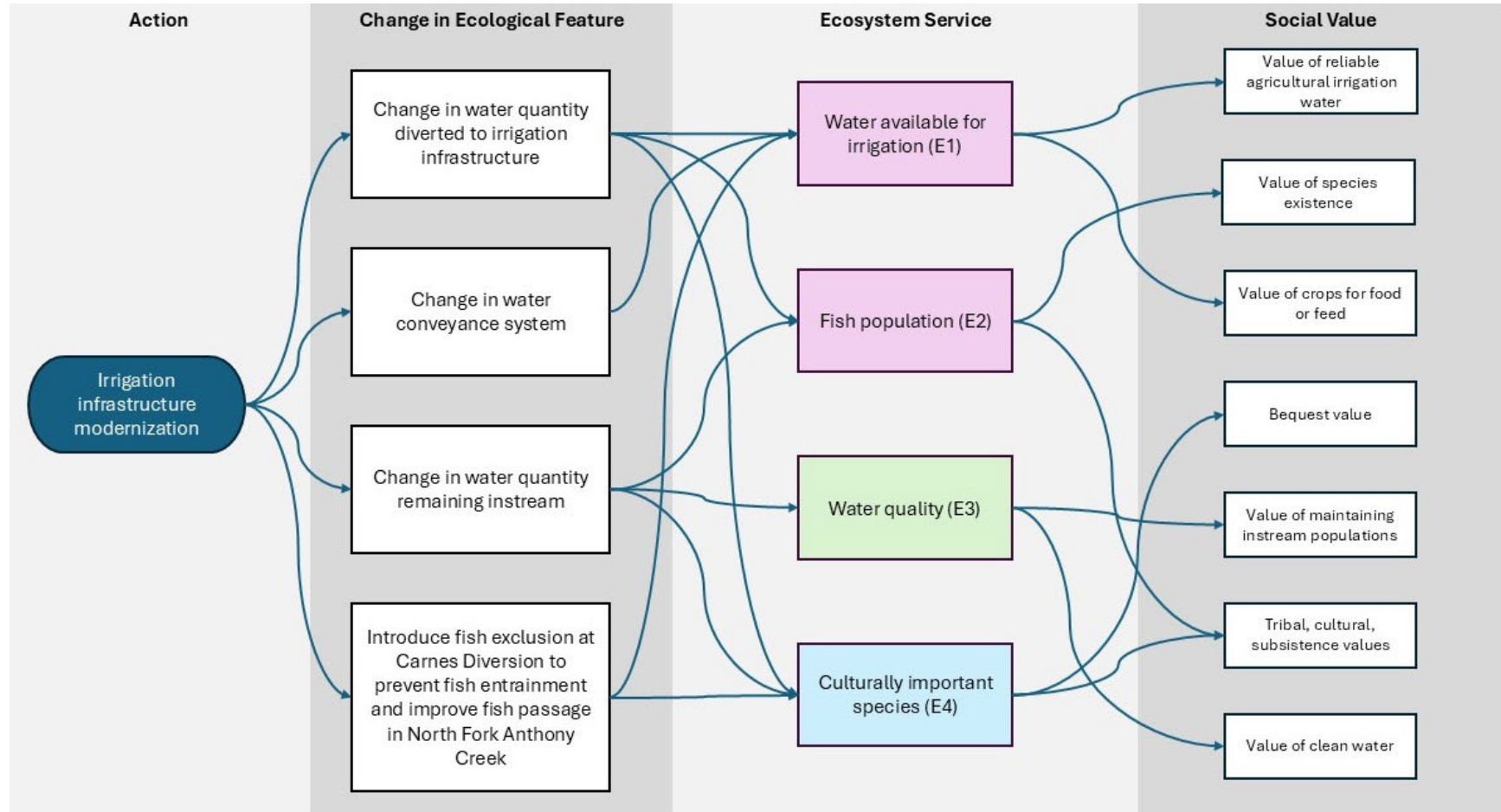


Figure E-7. Bull Trout Critical Habitat within District boundaries.

E.7 Supporting Information for Ecosystem Services



¹ E1 through E4 refer to ecosystem services 1 through 4. These services are referenced and their relevance to potentially affected resources is explained in more detail throughout Sections 4 and 6.

² Ecosystem services concept diagram developed by Farmers Conservation Alliance

Figure E-8. Ecosystem services concept diagram for the Powder Valley Water Control District Infrastructure Modernization Project.

E.8 Supporting Information for Wetland and Riparian Areas

The USACE administers Section 404 of the CWA with the oversight of the EPA. This law regulates the dredge or fill of wetlands over which the USACE has jurisdiction. The USACE and EPA define wetlands as “those areas inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.”

The Oregon Department of State Lands (DSL) implements the Removal-Fill Law (ORS 196.800-990), which regulates the removal or fill of material in wetlands or waterways, requiring any person who plans to remove or fill material within waters of the state to obtain a permit from DSL. Additionally, per the Oregon Removal-Fill statute OAR 141-085-0515(9), an irrigation ditch is not jurisdictional under Oregon Removal-Fill permitting if it meets both of the following:

1. The ditch is operated and maintained for the primary purpose of conveying water for irrigation; and
2. The ditch is dewatered outside the irrigation season except for incidentally retained in isolated low areas.

A ditch is considered by DSL to be dewatered if the source of irrigation water is turned off or diverted from the irrigation ditch. A ditch that is dewatered outside the irrigation season may be used for temporary flows associated with stormwater collection, stock water runs, or fire suppression.

On July 24, 2020, the USACE and EPA signed a memorandum providing a clear, consistent approach regarding the application of exemptions from regulation under Section 404(f)(1)(C) of the CWA for construction or maintenance of irrigation ditches and the maintenance of drainage ditches. As defined in this memorandum, an “irrigation ditch” is a ditch that either conveys water to an ultimate irrigation use or place of use or that moves and/or conveys irrigation water away from irrigated lands. Further, the construction and maintenance of irrigation ditches is considered an exempt activity under Section 404 of the CWA. However, if construction or maintenance of irrigation ditches “represents a *new use*, and the activity would result in a *reduction in reach or impairment of flow or circulation of* jurisdictional waters, including wetlands,” the activity does not meet this exemption.

E.9 Supporting Information for Wildlife Resources

Table E-15. Wildlife Species Potentially Occurring within the Planning Area.

Wildlife Species	Scientific Name
Bat	<i>Vespertilionidae</i> spp.
Belding's ground squirrel	<i>Urocitellus beldingi</i>
Black bear	<i>Ursus americanus</i>
Bobcat	<i>Lynx rufus</i>
Columbian ground squirrel	<i>Urocitellus columbianus</i>
Coyote	<i>Canis latrans</i>
Gray wolf	<i>Canis lupus</i>
Mule deer	<i>Odocoileus hemionus</i>
Raccoon	<i>Procyon lotor</i>
Rocky Mountain elk	<i>Cervus canadensis nelsoni</i>
Snowshoe hare	<i>Lepus americanus</i>
Whitetail deer	<i>Odocoileus virginianus</i>
Western gray squirrel	<i>Sciurus griseus</i>
Western rattlesnake	<i>Crotalus viridis</i>
Western skink	<i>Eumeces skiltonianus</i>
Yellow pine chipmunk	<i>Eutamias amoenus</i>

Source: ODFW, 2006. ORBIC, 2023.

Table E-16. Summary of Federally and State-listed and Sensitive Wildlife Species in the Project Area and its Vicinity

Mammal Common Name (<i>Scientific Name</i>)	Federal Listing	State Listing
North American wolverine (<i>Gulo gulo luscus</i>)	Threatened	Oregon – Threatened
Bird Common Name (<i>Scientific Name</i>)	Federal Listing	State Listing
Northern goshawk (<i>Strix occidentalis caurina</i>)	No status	Oregon – Sensitive
Ferruginous hawk (<i>Buteo regalis</i>)	Species of Concern	Oregon – Sensitive-Critical/Sensitive
Swainson’s hawk (<i>Buteo swainsoni</i>)	No status	Oregon – Sensitive
California Condor (<i>Gymnogyps californianus</i>)	Proposed Threatened (Non-Essential Experimental Population)	Oregon – Not Listed
Insect Common Name (<i>Scientific Name</i>)	Federal Listing	State Listing
Monarch butterfly (<i>Danaus plexippus</i>)	Proposed Threatened	Oregon – Not Listed
Suckley’s cuckoo bumble bee (<i>Bombus suckleyi</i>)	Proposed Threatened	Oregon – Not Listed

Source: USFWS, 2025; ORBIC, 2023.

Table E-17. Migratory Bird Treaty Act / Bald and Golden Eagle Protection Act Species Potentially Occurring within the Planning Area.

Migratory Bird Treaty Act / Bald and Golden Eagle Protection Act Species	Scientific Name
American robin	<i>Turdus migratorius</i>
Bald eagle	<i>Haliaeetus leucocephalus</i>
Barn swallow	<i>Hirundo rustica</i>
Black-bellied plover	<i>Pluvialis squatarola</i>
Black-capped chickadee	<i>Poecile atricapillus</i>
Black-necked stilt	<i>Himantopus mexicanus</i>
Blue-winged teal	<i>Spatula discors</i>
Bobolink	<i>Dolichonyx oryzivorus</i>
Bohemian waxwing	<i>Bombycilla garrulus</i>
Bushtit	<i>Psaltriparus minimus</i>
California gull	<i>Larus californicus</i>
California quail	<i>Callipepla californica</i>
Canada goose	<i>Branta canadensis</i>
Cassin's finch	<i>Carpodacus cassinii</i>
Clark's Nutcracker	<i>Nucifraga columbiana</i>
Common goldeneye	<i>Bucephala clangula</i>
Common merganser	<i>Mergus merganser</i>
Dark-eyed junco	<i>Junco hyemalis</i>
Eastern kingbird	<i>Tyrannus tyrannus</i>
Evening grosbeak	<i>Coccothraustes vespertinus</i>
Franklin's gull	<i>Leucophaeus pipixcan</i>
Gadwall	<i>Mareca strepera</i>
Golden eagle	<i>Aquila chrysaetos</i>
Great blue heron	<i>Ardea herodias</i>
Green-winged teal	<i>Anas crecca</i>
House finch	<i>Haemorhous mexicanus</i>
Killdeer	<i>Charadrius vociferus</i>

Appendix E: Other Supporting Information

Least sandpiper	<i>Calidris minutilla</i>
Lesser scaup	<i>Aythya affinis</i>
Lesser yellowlegs	<i>Tringa flavipes</i>
Lewis's woodpecker	<i>Melanerpes lewis</i>
Mourning dove	<i>Zenaidura macroura</i>
Northern flicker	<i>Colaptes auratus</i>
Northern harrier	<i>Circus hudsonius</i>
Northern pintail	<i>Anas acuta</i>
Northern rough-winged swallow	<i>Stelgidopteryx serripennis</i>
Northern shoveler	<i>Spatula chrypeata</i>
Olive-sided flycatcher	<i>Contopus cooperi</i>
Orange-crowned warbler	<i>Leiothlypis celata</i>
Osprey	<i>Pandion haliaetus</i>
Red-tailed hawk	<i>Buteo jamaicensis</i>
Ring-necked duck	<i>Aythya collaris</i>
Rough-legged hawk	<i>Buteo lagopus</i>
Ruffed grouse	<i>Bonasa umbellus</i>
Rufous hummingbird	<i>Selasphorus rufus</i>
Sandhill crane	<i>Antigone canadensis</i>
Snow goose	<i>Anser caerulescens</i>
Snowy egret	<i>Egretta thula</i>
Trumpeter swan	<i>Cygnus buccinator</i>
Tundra swan	<i>Cygnus columbianus</i>
Turkey vulture	<i>Cathartes aura</i>
Western grebe	<i>Aechmophorus occidentalis</i>
White-crowned sparrow	<i>Zonotrichia leucophrys</i>
White-winged crossbill	<i>Loxia leucoptera</i>
Wood Duck	<i>Aix sponsa</i>

Sources: USFWS, 2025; eBird, 2023.

E.10 Potential Local, State, and Federal Permit and Compliance Requirements for the Preferred Alternative

Table E-18. Potentially Required Permits.

Union County Regulation or Permit Type	Reviewing Agency	Applicability
Land Use Compatibility Statement (LUCS)	Union County Planning Department	The LUCS is required supporting documentation for obtaining various State permits from ODEQ (1200-C permit) and DSL (Removal-Fill permit). A LUCS would be submitted for County approval prior to construction.
Planning Director Land Use Decision	Union County Planning Department	Irrigation reservoirs, canals, delivery lines and those structures and accessory operational facilities, not including parks or other recreational structures and facilities, associated with a district may be established in an A-1 Zone (Exclusive Farm Use). The land use decision would be obtained prior to construction.
Utility Right-of-Way Permit	Union County Public Works Department	Required for crossing Tucker Flat Road (Carnes Ditch) and Ellis Road (Lower Lone Pine Ditch bypass) as described in the Modernization Alternative. This permit would be obtained prior to constructing these road crossings.
State of Oregon Regulation or Permit Type	Reviewing Agency	Applicability
Oregon Removal and Fill Permit	Oregon Department of State Lands	Required for removal or fill within waters of the State, including wetlands, streams, and estuaries. To be obtained prior to constructing water crossings and/or construction of fish screen and passage improvements.
CWA Section 401 Water Quality Certification	Oregon Department of Environmental Quality	Required for fill within waters of the United States and prior to issuance of Section 404 CWA permit from Corps of Engineers. It

Appendix E: Other Supporting Information

		would be obtained following submittal of the Section 404 permit application and prior to initiation of construction.
Oregon Construction Stormwater Permit - 1200-C	Oregon Department of Environmental Quality	Required for construction sites disturbing one acre or more. Would be obtained prior to initiation of construction.
Oregon State Endangered Species Act	Oregon Department of Fish and Wildlife	Voluntary incentives, encouraging appropriate species management, coordinated planning, habitat protection and restoration, and other means as appropriate and consistent with state law. To be addressed during fish screen and fish passage design development and final design reviews.
Federal Regulation or Permit Type	Reviewing Agency	Applicability
Clean Water Act (CWA) Section 404 Permit	U.S. Army Corps of Engineers	Required for fill within waters of the United States, including wetlands, streams, and estuaries. If less than ½ acre of impact, project can generally be permitted under various Nationwide Permits (streamlined process), otherwise would require an individual permit. Prior to construction activities, coordination and consultation with USACE would occur and measures would be taken as required to identify and mitigate effects to potential jurisdictional wetlands and Waters of the United States.
Endangered Species Act Section 7 Consultation	U.S. Fish and Wildlife Service and National Marine Fisheries Service	Required when a federal action (federal funding or a permit) may affect an ESA-listed species or designated critical habitat. NRCS ESA Section 7 obligations for potential impacts to bull trout would be met by adhering to the ORWAC Programmatic Consultation. No other ESA listed species are anticipated to be

Appendix E: Other Supporting Information

		impacted Coordination with USFWS and NMFS is ongoing.
Bald and Golden Eagle Protection Act	U.S. Fish and Wildlife Service	Required when known active nests of bald or golden eagles are within vicinity. Coordination with USFWS is ongoing. Pre-clearance surveys would occur prior to construction to verify the presence or absence of bald and golden eagles in the area. Should nesting sites be discovered, the requirements of the BGEPA would be implemented appropriately.
Migratory Bird Treaty Act	U.S. Fish and Wildlife Service	Requires that all entities refrain from actions to pursue, hunt, take, kill, sell, purchase, transport, or receive any migratory birds (including parts, nests, eggs, or other products, manufactured or not). This includes destruction of active nests during vegetation clearing or other construction activities. Nests may be present in natural areas or associated with structures or other built features. Vegetation clearing and grubbing outside of the nesting season is allowable (August 1 – January 31).
Special Use Permit	U.S. Forest Service	Required since the Carnes Pipeline Project crosses USFS land.
Standard Form 299	Bureau of Land Management	Required since the Carnes Pipeline Project crosses BLM land.
Section 106 National Historic Preservation Act	Oregon State Historic Preservation Office	Requires federal agencies that fund or provide permit approvals for projects to assess effects on historic properties and includes coordination with tribes that may attach religious or cultural importance to them. Consultation with SHPO to fulfill Section 106 obligations would be completed for the project prior to implementation.

E.10.1 Local and County

Union County Planning Department – Under OAR Chapter 340, Division 18, a Land Use Compatibility Statement would be submitted for County approval prior to construction. The Land Use Compatibility Statement is required supporting documentation for various State permits from DEQ (1200-C) and DSL (Removal-Fill).

Irrigation reservoirs, canals, delivery lines and those structures and accessory operational facilities associated with a district (as defined in ORS 540.505), not including parks or other recreational structures and facilities may be established in an A-1 (Exclusive Farm Use) Zone by a Planning Director's land use decision. This decision is subject to the review process identified in Section 24.02 (Planning Director Land Use Decision) of the Union County Zoning, Partition, and Subdivision Ordinance.

Union County Public Works Department – A right-of-way work permit is required for crossing Union County roads including Tucker Flat Road (Carnes Ditch piping) and Ellis Road (Lower Lone Pine Ditch bypass).

E.10.2 State

Department of Environmental Quality – The National Pollutant Discharge Elimination System program, implemented by DEQ, would require a permit for construction activities including clearing, grading, excavation, dewatering, and materials and equipment staging and stockpiling that would disturb one acre or more of land and have the potential to discharge into a public waterbody. The proposed project would meet these conditions; therefore, prior to project construction, as appropriate, a 1200-CA permit would be applied for.

Applicants receiving a Section 404 permit from USACE are required to obtain a Section 401 water quality certification from DEQ through a joint application process. The District would prepare a joint permit application for this project, which would be reviewed by USACE, DSL, and DEQ. The District would not begin construction until after the application is approved by both regulatory authorities.

Department of State Lands – Prior to project implementation, consultation with DSL would occur to perform wetland determinations for sites throughout the project area, as well as to determine exemption applicability to ditches in the project area. Removal-fill permits may be required for in-water work related to diversion removal and installation of fish passage and screening.

Oregon Fish Passage Law – Since August 2001, the owner or operator of an artificial obstruction located in waters in which native migratory fish are currently or were historically present must address fish passage requirements prior to certain trigger events such as the construction, installation, replacement, extension, or repair of culverts, roads, or any other hydraulic facilities. Laws regarding fish passage are found in ORS 509.580 through ORS 509.910 and in OAR 635, Division 412. Functioning fish screens are not present at the District's irrigation diversions, and some of the diversions have hindered fish passage in Anthony Creek, a tributary to the North Powder River and habitat for bull trout. In addition, existing District infrastructure where Carnes Ditch currently intercepts Dutch Creek, a fish-bearing tributary of Anthony Creek, creates a total fish passage barrier at that location. The Preferred Alternative would be required to meet Oregon fish passage requirements at all applicable locations.

Oregon State Endangered Species Act - Under State law (ORS 496.171-496.192) the Oregon Fish and Wildlife Commission through ODFW maintains the list of native wildlife species in Oregon that have been determined to be either “threatened” or “endangered” according to criteria set forth by rule (OAR 635-100-0105). Voluntary incentives, encouraging appropriate species management, coordinated planning, habitat protection and restoration, and other means as appropriate and in a manner consistent with the provisions of ORS 496.182(1) would be addressed during fish screen and fish passage final design for the project.

E.10.3 Federal

National Historic Preservation Act Section 106 – Pursuant to 36 C.F.R. 800 of NHPA (1966, as amended in 2000) and the regulations of the Advisory Council on Historic Preservation implementing Section 106 of the NHPA (54 U.S.C. 306108), federal agencies must take into account the potential effect of an undertaking on “historic properties,” which refers to cultural resources listed in or eligible for listing in the National Register of Historic Places. Consultation with SHPO to fulfill Section 106 obligations would be completed for the project prior to implementation.

Clean Water Act Section 404 – Under Section 404(f)(1)(C) of the CWA, discharges of dredged or fill material associated with construction or maintenance of irrigation ditches, or with the maintenance (but not construction) of drainage ditches, are not prohibited by or otherwise subject to regulation under Section 404. Discharges of dredged or fill material associated with siphons, pumps, headgates, wingwalls, weirs, diversion structures, and such other facilities as are appurtenant to and functionally related to irrigation ditches are included in the exemption for irrigation ditches. Under 33 C.F.R. 323.4(a)(1)(iii)(C)(1)(i), “construction and maintenance of upland (dryland) facilities such as ditching and tiling, incidental to the planting, cultivating, protecting, or harvesting of crops, involve no discharge of dredged or fill material into waters of the U.S., and as such never require a Section 404 permit.”

The construction and maintenance of irrigation ditches and maintenance of drainage ditches may require the construction and/or maintenance of a farm road. Subsection 404(f)(1)(E) exempts discharges of dredged or fill material associated with the construction or maintenance of farm roads where such related farm roads are constructed and maintained in accordance with BMPs. However, in 33 C.F.R. 323.4(a)(6) and 40 C.F.R. 232.3(c)(6), there must be assurance that flow and circulation patterns and chemical and biological characteristics of Waters of the U.S. are not impaired, that the reach of the Waters of the U.S. is not reduced, and that any adverse effect on the aquatic environment would be otherwise minimized.

Prior to construction activities, coordination and consultation with USACE would occur and measures would be taken as required to identify and mitigate impacts to potential jurisdictional wetlands and Waters of the U.S., including in-water work related to diversion removal and fish passage/screening improvements at Anthony Creek and North Fork Anthony Creek.

Farmland Protection Policy Act – The Farmland Protection Policy Act (7 U.S.C. 4201 et seq.) directs federal agencies to identify and quantify adverse impacts of federal programs to farmlands. The Act’s purpose is to minimize the number of federal programs that contribute to the unnecessary and irreversible conversion of agricultural land to nonagricultural uses. The proposed project would occur primarily in Exclusive Farm Use zones; however, all work would be done within existing and new easement agreements. The proposed project would support agricultural production and the intention of the Act.

Endangered Species Act – The ESA establishes a national program for the conservation of threatened and endangered species and the preservation of the ecosystems on which they depend. The ESA is administered by USFWS for wildlife and freshwater species and by NMFS for marine and anadromous species. The ESA defines procedures for listing species, designating critical habitat for listed species, and preparing recovery plans. It also specifies prohibited actions and exceptions. Section 7 of the Act, called Interagency Cooperation, is the mechanism by which federal agencies ensure the actions they take, including those they fund or authorize, do not jeopardize the existence of any listed species. Under Section 7, federal agencies must consult with USFWS when any action the agency carries out, funds, or authorizes (such as through a permit) may affect a listed endangered or threatened species.

Improved water conveyance would result in higher quality water within some of District’s waterbodies and increase the available habitat for the species. In addition, the installation of a fish screen and removal of a partial barrier would prevent bull trout entrainment into the irrigation system and increase habitat availability for the species. Short-term impacts to water quality during construction are unlikely to adversely affect bull trout. Coordination with USFWS and NMFS regarding ESA-listed fish species is ongoing, and informal Section 7 consultation under the ESA as amended would be initiated following the public review period.

Magnuson Stevens Act – The Magnuson-Stevens Act requires including Essential Fish Habitat (EFH) descriptions in federal fishery management plans, and it requires federal agencies to consult with NMFS on activities that may adversely affect EFH (P.L. 104-297). EFH can include all streams, lakes, ponds, wetlands, and other viable waterbodies, as well as most of the habitat historically accessible to salmon necessary for spawning, breeding, feeding or growth to maturity. As the project would not affect EFH, consultation under the Magnuson Stevens Act is not required.

Safe Drinking Water Act – Since the project would have no direct or indirect discharge to groundwater, permitting under the Safe Drinking Water Act is not required.

Migratory Bird Treaty Act – The MBTA implements various treaties and conventions between the United States and other countries including Canada, Japan, Mexico, and the former Soviet Union for the protection of migratory birds (16 U.S.C. 703–712). Under the Act, taking, killing, or possessing migratory birds, or taking, destroying, or possessing their eggs or nests, is unlawful. The Act classifies most species of birds as migratory except for upland and nonnative birds such as pheasant, chukar, gray partridge, house sparrow, European starling, and rock dove.

Bald and Golden Eagle Protection Act – The BGEPA prohibits the taking or possessing of and commerce in bald and golden eagles, with limited exceptions (16 U.S.C. 668–668d). The Act covers intentional acts or acts in “wanton disregard” of the safety of bald or golden eagles. The proposed project is proximal to known nesting sites, but the nearest nest is 1.5 miles from the proposed Carnes Pipeline and approximately 2 miles from the C-1 Project. No direct impacts are anticipated.

National Wild and Scenic Rivers Act – The designation of a river and river segments under the Wild and Scenic Rivers Act provides legal protections from adverse development and provides a mechanism for management of the river’s resources. No wild and scenic rivers occur within the proposed project area.

E.11 Additional Photo Documentation



Figure E-9. Representative view of Lower Lone Pine Ditch (FCA, June 9, 2021).



Figure E-10. Representative view of irrigated pasture vegetation and wheat field (FCA, November 29, 2022).



Figure E-11. Dense riparian vegetation along Lower Lone Pine Ditch (FCA, June 9, 2021).



Figure E-12. Representative view of Ellis Ditch (FCA, June 9, 2021).



Figure E-13. Wolf Creek Reservoir (Wikipedia, July 6, 2021).



Figure E-14. Carnes Ditch before being Pilcher Creek Filling Channel (FCA, May 2018).

E.12 References

- eBird. (2023, March 7). *eBird*. Cornell Lab of Ornithology, Ithaca, New York. <http://www.ebird.org>.
- MacLean, Taya. (2022). Parametrix site visit. November 29, 2022.
- Oregon Biodiversity Information Center. (ORBIC) (2023). *Oregon Biodiversity Information Center*. Oregon State University Institute for Natural Resources and Portland State University. <https://inr.oregonstate.edu/orbic>
- Oregon Department of Environmental Quality. (ODEQ). *Powder Basin Status Report and Action Plan*. Retrieved from <https://www.oregon.gov/deq/FilterDocs/BasinPowderSRAP.pdf>. Oregon Department of Fish and Wildlife. (ODFW). 2006. Elkhorn Wildlife Area Management Plan. Available at: https://www.dfw.state.or.us/wildlife/management_plans/wildlife_areas/docs/elkhorn.pdf
- ODFW. (2024). *Oregon Fish Habitat Distribution and Barriers*. https://nrmp.dfw.state.or.us/FHD_FPB_Viewer/index.html
- Oregon Explorer. (2022). Shrub and Grassland Habitats: Northern Rocky Mountain Lower Montane, Foothill and Valley Grassland, Inter-Mountain Basins Montane Sagebrush Steppe. Available at: <https://oregonexplorer.info/content/shrub-and-grassland-habitats?topic=185&ptopic=179>
- Oregon Water Resources Department. (OWRD). (2023). *ANTHONY CR BL N FK NR N POWDER, OR*. Hydrographics Data Access and Summary Statistics. https://apps.wrd.state.or.us/apps/sw/hydro_report/gage_data_request.aspx?station_nbr=13282400
- Powder Valley Water Control District (PVWCD). (2020). *Powder Valley Water Control District system improvement plan*.
- U.S. Department of Agriculture (USDA). Natural Resources Conservation Service. (NRCS) (2020) Oregon & Washington Guide for Conservation Seedings and Plantings, Portland, Oregon: USDA–NRCS, April 2000.
- U. S. Fish and Wildlife Service.(USFWS) (2025). *Powder Valley Water Control District Infrastructure Modernization Project Official Species List*. 4/24/2025. Project Code: 2024-0120997. Obtained from: <https://ipac.ecosphere.fws.gov/>