



Draft Watershed Plan and Environmental Impact Statement for the Wellsville Canyon Watershed Project

Wellsville Canyon Watershed Cache County, Utah



PREPARED BY



IN COOPERATION WITH
Sponsoring Local Organization (SLO):
Cache Water District

Co-Sponsoring Local Organizations:
Wellsville City
Mendon City
Cache County
Wellsville-Mendon Conservation District
Wellsville City Irrigation Company
Mendon North Irrigation Company
Mendon Central Irrigation Company
Mendon South Irrigation Company
Mendon Second North Irrigation Company
Greater Mendon Irrigation Company
Wellsville East Field Irrigation & Canal Company

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Sponsoring Local Organization (SLO): Cache Water District (CWD)

Co-Sponsoring Local Organization(s): Wellsville City, Mendon City, Wellsville-Mendon Conservation District, Wellsville City Irrigation Company, Cache County, Mendon North Irrigation Company, Mendon Central Irrigation Company, Mendon South Irrigation Company, Mendon Second North Irrigation Company, Greater Mendon Irrigation Company

Authority: This Watershed Project Plan and Environmental Impact Statement (Plan-EIS) has been prepared under the authority of NRCS Watershed Protection and Flood Prevention Act (16 U.S.C. Section 1001 et seq.) 1954; (Public Law 83-566) as amended and in accordance with Section 102(2)(C) of the National Environmental Policy Act of 1969 (NEPA), PL 91-190, as amended, and in accordance with the Guidance for Conducting Analyses Under the Principles, Requirements, and Guidelines for Water and Land Related Resources implementation Studies and Federal Water Resource Investments (DM 9500-013) also known as PR&G.

This environmental document was initiated using the 40 CFR 1500-1508 (2020) and 7 CFR 650 regulations, Notice of Intent (91 FR 17062 [April 3, 2026]). These regulations have recently been rescinded and replaced with USDA regulations found under 7 CFR 1b. However, in a good-faith effort to fulfill NEPA’s requirements, including Congressional timeline and considerations of fiscal restraints, the agency decided to continue to use 40 CFR 1500-1508 (2020) and 7 CFR 650. This is permissible per the USDA policy guidance issued in the Final Rule’s preamble. The Federal Register notice said: *“If the NOI for an EIS published more than 90 days prior to the publication of this final rule, the USDA subcomponent has discretion to continue applying the versions of NEPA regulations being applied before publication of the NOI or to switch to applying 7 CFR 1b as published in this final rule”*.

Abstract: The purpose of the project is to address the problems of flooding, agricultural water management, and public recreation in Wellsville, Mendon, and parts of unincorporated Cache County, Utah. The study area is located at the base of the Wellsville mountains, and the current flood control infrastructure is not sufficient to protect residents from high runoff flood events. Earthen canal irrigation distribution systems in the area experience significant seepage losses. There is a current lack of recreational opportunities in Wellsville and Mendon as well. The No Action Alternative, Action Alternative 1 – Piping Alternative, and Action Alternative 2 --- Lining & Buyouts were analyzed in this Plan-EIS. Action Alternative 1 – Piping Alternative is the Preferred Alternative. This alternative would consist of management measures that sufficiently address the problems and opportunities in the watershed including, (1) pressure piping the Wellsville-Mendon and Wellsville East Field Canals, (2) installing various flood control measures including channel improvements, culverts (not funded by PL 83-566), and pipelines (pressure piping and gravity piping), (3) construction of new secondary water systems in Wellsville and Mendon cities, and (4) the installation of new public recreation facilities at Wellsville Reservoir and at Mendon City Cemetery.

The cost (environmental, design, and construction) for the Preferred Alternative is \$140,636,000. NRCS has completed this Draft Plan-EIS in accordance with the NEPA and NRCS guidelines and standards. Reviewers should provide their comments to NRCS during the allotted Draft Plan-EIS review period. Comments need to be submitted by June 29, 2026, to become part of the Administrative Record. Please send comments to:

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Ancestral Land Acknowledgement: NRCS, through the review of the NPS Native American Graves Protection and Repatriation Act Native American Consultation Database (NACD), the U.S. Department of Housing and Urban Development Tribal Directory Assessment Tool (TDAT), the BIA website, and the Utah Division of Indian Affairs (UDIA) website, and previous NEPA & NHPA consultations, identified four Federally Recognized Tribes (Eastern Shoshone Tribe of the Wind River Reservation, Northwest Band of the Shoshone Nation, Shoshone-Bannock Tribes of the Fort Hall Reservation, and the Ute Indian Tribe of the Uintah & Ouray Reservation) with ancestral land, traditional use, and/ or traditional cultural property claims within the project area and the immediate vicinities. Consultation with these five entities continued throughout this plan's development, refer to Appendix A for that correspondence.

(Include copies of signed **watershed agreements**

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Summary: Office of Management and Budget Fact Sheet

S.1 Title of Proposed Action

Wellsville-Canyon Watershed Plan and Environmental Impact Statement (Plan-EIS)

S.2 Location

S.2.1 County, State

Cache County, Utah

S.2.2 Congressional District

First Congressional District

S.3 Organizations & Agencies

S.3.1 Sponsoring Local Organizations (SLOs)

Cache Water District is the SLO for this project. The following comprise the co-sponsors for the project; Wellsville City, Mendon City, Wellsville-Mendon Conservation District (WMCD), Wellsville City Irrigation Co., Cache County, Mendon North Irrigation Co., Mendon South Irrigation Co., Mendon Central Irrigation Co., Mendon Second North Irrigation Co., Greater Mendon Irrigation Co., and the Wellsville East Field Irrigation & Canal Co.

S.3.2 Cooperating Agency/Agencies

The cooperating agencies for this project are the Environmental Protection Agency (EPA) and the U.S. Bureau of Reclamation (USBR).

S.4 Authority

This Watershed Plan and Environmental Impact Statement (Plan-EIS) has been prepared under the authority of the Natural Resources Conservation Service (NRCS) Watershed Protection and Flood Prevention Act (16 U.S.C. Section 1001 et Seq.) 1954; (Public Law 83-566), as amended and in accordance with Section 102(2)(c) of the National Environmental Policy Act of 1969 (NEPA), PL 91-190, as amended. The purposes for which the project is planned include flood prevention, agricultural water management, and public recreation.

This environmental document was initiated using the 40 CFR 1500-1508 (2020) and 7 CFR 650 regulations, Notice of Intent (91 FR 17062 [April 3, 2026]). These regulations have recently been rescinded and replaced with USDA regulations found under 7 CFR 1b. However, in a good-faith effort to fulfill NEPA's requirements, including Congressional timeline and considerations of fiscal restraints, the agency decided to continue to use 40 CFR 1500-1508 (2020) and 7 CFR 650. This is permissible per the USDA policy guidance issued in the Final Rule's preamble. The Federal Register notice said: *"If the NOI for an EIS published more than 90 days prior to the publication of this final rule, the USDA subcomponent has discretion to continue applying the versions of NEPA regulations being applied before publication of the NOI or to switch to applying 7 CFR 1b as published in this final rule"*.

S.5 Purpose & Need for Action

The purpose of this project is to improve flood prevention capabilities; to provide more reliable management of agricultural water in the area; and to increase opportunities for public recreation in Wellsville, Mendon, and other unincorporated areas of Cache County, Utah.

There is a need to provide reliable and capable floodwater conveyance infrastructure in order to reduce flood risk and improve public safety in the project area. The project is also needed to conserve water and improve agricultural management, reduce watershed erosion that results in high sediment and nutrient loading to the Little Bear River, and to improve recreational facilities in the watershed.

S.6 Description of the Preferred Alternative

The Preferred Alternative would address flooding through a combination of channel improvements, culvert upgrades (construction not funded by PL-566), conduits, overflow systems, swales, and flood control pipelines. This would include the installation of new flood control infrastructure at several locations in the watershed. The Wellsville-Mendon Lower Canal would be enclosed and pressure piped for agricultural water management and a portion of the Wellsville Eastfield Canal would be enclosed and gravity piped as well. The alternative would completely pressurize Wellsville and Mendon Cities' secondary systems and would install regulating ponds to stabilize peak demands on the pressurized irrigation systems. A new access ramp limited to non-motorized personal watercraft would be built at Wellsville Reservoir for Public Recreation and a reflecting pond installed at Mendon City Cemetery.

S.7 Resource Information

Table S-1 identifies relevant resource information for the project area.

Table S-1: Existing Resource Information

Resource	Description
Latitude/Longitude	Wellsville: 41°38'17.67" N / 111°56'01.53" W Mendon: 41°42'35.10" N / 111°58'39.92" W Source: Google Earth
Elevation	Elevation from valley to peak ranges from 4489 feet to 9372 feet
Hydrologic Unit Code (HUC-12)	Fourmile Creek HUC: 160102030405 Deep Canyon HUC: 160102030403 Wellsville Canyon HUC: 160102030401 Spring Creek HUC: 160102030402
Climate	Summer average high: 89 degrees F Winter average low: 12 degrees F
Topography	Wellsville Mountains and Cache Valley
Annual Precipitation	An average of 35 inches of precipitation in the mountains and 21.8 inches in the valley.
Watershed Area	70,848 acres

Land Use	Agricultural (22,213.5 Acres), Urban/Residential (3,880.5 Acres), Riparian (856.2 Acres), Water (154.6 Acres), Other (3,986.5 Acres)
Land Ownership	Federal (0.09%), State (0.11%), Private (99.8%)
Population (U.S. Census 2020)	Wellsville: 4,280 (2020) Mendon: 1,375 (2020) Cache County: 133,154 (2020)
Demographics (U.S. Census 2020)	Wellsville / Mendon White: 94.84% / 98.76% African American: 0.53% / 0.00% American Indian: 1.04% / 0.00% Asian: 0.32% / 0.00% Native Hawaiian/Pacific Islander: 0.11% / 0.00% Two or More Races: 3.17% / 1.24%

S.8 Alternative Plans Considered

Alternatives that were analyzed in detail include the No Action Alternative (FWOFI), and two Action Alternatives namely, Action Alternative 1 – Piping Alternative and Action Alternative 2 – Lining & Buyouts Alternative. The No Action Alternative maintains existing conditions without improvements. The Piping Alternative includes irrigation piping, flood conveyance improvements, system pressurization, and recreation features. The Lining & Buyouts Alternative includes canal lining, voluntary buyouts, irrigation system pressurization, and recreation features. The Piping Alternative is the Locally Preferred Alternative, Environmentally Preferred Alternative (from NEPA), and Economically Preferred Alternative (Nationally Economically Efficient [NEE]). The Lining and Buyouts Alternative is a nonstructural-structural combination alternative as described in DM 9500-013(4)(f)(2)(1)(c). Mitigation measures were identified for potential impacts under the Preferred Alternative. The Proposed Action Alternatives were created from many considered management measures to create the Preferred Alternative based on a matrix consisting of the requirements of the Watershed and Flood Prevention Operations Program (PL 83-566), NEPA, and the Guiding Principles of the PR&G using an ecosystem services framework.

S.9 Project Costs and Funding Source

The estimated cost for the proposed project is summarized in Table S-2.

Table S-2: Estimate Project Costs

Item	NRCS PL83-566 Funds	Other Funds*	Total
Construction	\$92,858,000	\$25,891,000	\$118,749,000
Engineering	\$19,007,000	\$0	\$19,007,000
Land Rights	\$0	\$0	\$0
Mitigation	\$37,500	\$12,500	\$50,000
Permits	\$0	\$175,000	\$175,000

Project Admin. Costs	\$1,195,000	\$0	\$1,195,000
Total	\$113,097,500	\$26,078,500	\$139,176,000

S.10 Net Economic Benefits

The estimated average annual economic benefits for the Preferred Alternative are summarized in Table S-3. The Preferred Alternative is also the NED Alternative for the project, per Sections 505.2 and 505.35.B (1) (iv) of the National Watershed Program Manual (NWPM).

Table S-3: Estimate Project Net Benefits

Total Annual Benefits	Total Annual Costs	Benefit-Cost Ratio	Net Economic Benefits
\$14,756,305	\$6,007,158	2.46	\$8,749,147

Net economic benefits do not include O&M benefits listed in Table S-4

Table S-4: Summary of Benefits

Category	Piping Alternative	Lining & Buyouts Alternative
Public Recreation		
Increment 1. Wellsville Reservoir Boat Ramp	\$7,305	\$7,305
Increment 2. Mendon Cemetery Pond	\$4,658	\$4,658
Agricultural Water Management		
Increment 3. Wellsville Eastfield Piping	\$913,850	\$913,850
Increment 4. Wellsville Secondary Water System	\$1,752,366	\$1,752,366
Increment 5. Mendon Secondary Water System	\$756,924	\$756,924
Increment 6. WMCD Lower Canal Piping	\$4,493,400	n/a
Increment 7. WMCD Lower Canal Lining	n/a	\$3,029,426
Canal O&M		
Increment 3. Wellsville Eastfield Piping O&M	\$3,750	\$3,750
Increment 6/7. Lower Canal Piping/Lining O&M	\$11,000	\$11,000
Culinary O&M		
Increment 4. Wellsville Secondary System O&M	\$372,100	\$372,100
Increment 5. Mendon Secondary System O&M	\$153,410	\$153,410
Flood Prevention		
Increment 8. Structure, Contents, & Vehicles	\$6,827,802	\$0
Increment 9. Buyouts/Relocations	\$0	\$7,312,493

There are about 6,000 direct beneficiaries that live in the communities of Wellsville and Mendon, Utah, adjacent to the project area. The Preferred Alternative protects about 316 residences and 1 commercial structure in 100-year floodplain. The roadways and crossing downstream have minimal flood concerns within the 500-year inundation zone.

S.11 Period of Analysis & Funding Schedule

The period of analysis is 55 years. This includes a 5-year installation period, and a 50-year evaluated life. A funding schedule is presented in Table S-5 below.

Table S-5: Funding Schedule

Fiscal Year	PL 83-566	Other Funds	Total
2026	\$9,761,250	\$93,750	\$9,855,000
2027	\$9,761,250	\$93,750	\$9,855,000
2028	\$31,191,667	\$8,630,334	\$39,822,001
2029	\$31,191,666	\$8,630,333	\$39,821,999
2030	\$31,191,666	\$8,630,333	\$39,821,999

FY 2026 & 2027 include costs for design/engineering, permitting, and mitigation. Subsequent years focus on construction/installation of the project. Project administration costs are distributed across all 5 years

S.12 Project Life

The life of the project is estimated to be 50 years following 5 years of construction.

S.13 Environmental Impacts

Table S-4 identifies the resources of concern and potential environmental impacts associated with implementation of the Preferred Alternative. Resources not impacted by the project are not listed in this table.

Table S-6: Summary of Resource Concerns and Potential Environmental Impacts

Resource of Concern	Summary of Concern/Affect	Anticipated Environmental Effects Summary
Air Quality	Temporary Direct Impact during Construction	Temporary impacts to air quality may occur due to emissions and dust from construction equipment and excavation activities
Cultural and Historic Resources	Direct Permanent Impact	Historic properties within the project area would be treated in compliance with NHPA. Coordination with the Northwest Band of the Shoshone immediately on the discovery of any Native American artifacts discovered. Consultation with Tribes/THPOs/SHPO occurred for this project. The Preferred Alternative would result in <i>adverse effects</i> to two NRHP eligible properties (two canals). In accordance with 36 CFR 800.5(d)(2), NRCS initiated consultation to resolve these adverse effects pursuant to 36 CFR

Resource of Concern	Summary of Concern/Affect	Anticipated Environmental Effects Summary
		800.6. Resolution measures have been developed through preparation of a Memorandum of Agreement (MOA), provided in Appendix A.
Dam Safety	No Impact	No Impact
Ecosystem Services	Direct Permanent Benefits	The alternative will improve provisioning, regulating, and cultural ecosystem services in the watershed. More detail is found in Chapter 4 of the Plan-EIS.
Fish and Wildlife	Temporary Direct Impact during Construction	The project may have temporary impacts to fish and wildlife communities from construction activities including noise. No long-term impacts.
Floodplain Management	Direct Permanent Benefit	Project measures would provide a more reliable network of flood control structures to convey flood waters.
Geology	No Impacts	No Impacts
Great Salt Lake	No Impact	No Impact
Invasive Species	Potential for Direct Impact During Construction. BMPs will be used.	Due to construction activities, there is potential for the spread of invasive plant species.
Land Use	Direct Permanent Benefit.	The project will improve recreational opportunities around the Wellsville reservoir.
Migratory Birds & Bald/Golden Eagles	Temporary Direct Impact during Construction.	There are migratory birds within the project area which may be temporarily affected due to construction activities including noise. No long-term impacts.
Prime and Unique Farmlands	Indirect Permanent Benefit	Farmland quality would be improved as a result of flood control & ag. Water management actions.
Public Health and Safety	Direct Permanent Benefit And Temporary Direct Impact	Temporary dust and emissions from construction activities could temporarily affect public health. Removes risk of drowning in Canal and improves access to transportation routes for emergency services.
Riparian Areas	Direct Temporary Impact during Construction	The stream banks within the project area would be temporarily affected due to project activities and the removal of vegetation along the channel banks.
Socioeconomics	No Impact	No Impact
Scenic Beauty	Direct Temporary Impact during Construction	The presence of construction equipment as well as the project activities would temporarily affect the beauty of the surrounding area.

Resource of Concern	Summary of Concern/Affect	Anticipated Environmental Effects Summary
Soils Resources	Potential for Direct Temporary Impact during Construction.	Temporary impact on soils during construction but would not impact soil composition. Some excavated soil may need to be transported and dumped off-site. Short-term stream bank erosion may occur due to disturbance of soil along the channels. These could lead to increased sedimentation during construction.
Threatened & Endangered Plant and Animal Species	No Effect (NO EFFECT)	The project would have no effect on federally listed species or critical habitats.
Upland Erosion & Sedimentation	Indirect Permanent Benefit	Nutrient loading to the Little Bear River would be significantly decreased as a result of flood control actions, improving aquatic ecosystems and water quality.
Transportation	Temporary Direct Impact during Construction And Direct Permanent Benefit	Temporary impacts to highways and other roads in the project area will occur during construction. However, routes for emergency services will be more available following flood control actions.
Water Quality	Indirect Permanent Benefit	Surface water quality may be affected short-term due to soil disturbance which may result in erosion and sedimentation. Long-term benefits would occur due to reduce nutrient loading to the Little Bear River.
Wetlands	Temporary Direct Impact during Construction.	Temporary impacts to wetlands may occur during construction
Water Resources	Temporary Direct Impact during Construction and Direct Permanent Benefit	Temporary impacts to culinary and secondary water during construction. More access to secondary water, water savings, and culinary water as a result of project actions.

S.14 Major Conclusions

The implementation of the Preferred Alternative, although having some adverse temporary and permanent impacts to resource concerns, would provide far more permanent benefits to the natural, economic, and human environment. Major improvements to flood control capabilities would be made, providing protection to the watershed from severe flood events. Additional improvements would be made to irrigation water conveyance and access, reducing seepage and demands on the local aquifer. Additionally, new public recreational facilities would be installed in the watershed and would offer a new set of cultural services to local residents.

S.15 Areas of Controversy

No significant issues or controversy are anticipated resulting from implementation of the Preferred Alternative. This has been confirmed through reasonable and good faith consultation efforts with SHPOs, Tribes, and Cooperating Agencies. During scoping, comments were received in the following categories; flooding concerns, agricultural water management, flood study, wildlife, recreation, water quality, water resources, wetlands, air quality, mitigation measures, and financial

impacts. Full summaries of the comments received is documented in the Scoping Report in Appendix A.

S.16 Issues to Be Resolved

The following issues would be resolved for the implementation of the Preferred Alternative:

- (i) Securing easements on private property for project measures
- (ii) Coordinating with city/county/state on roadway crossings
- (iii) Formalizing agreements between the irrigation companies and towns related to the pressurized irrigation systems for operations and maintenance.
- (iv) Completing final permitting including:
 - a. Section 404 permitting wetland disturbance
 - b. Stream Alteration permits
 - c. UPDES permits
 - d. Railroad permits

S.17 Evidence of Unusual Congressional or Local Interest

There is no evidence of unusual congressional or local interest.

S.18 In Compliance

This Plan-EIS is in full compliance with all public laws, statutes, and Executive Orders governing the development of water resource projects.

1.0 Watershed Planning Background

1.1 Authority

This Watershed Plan-Environmental Impact Statement (Plan-EIS) has been prepared under the authority of the Watershed Protection and Flood Prevention Act of 1954, Public Law (PL) 83-566, as amended (16 USC Section 1001 et. seq); in accordance with Section 102(2)(c) of the National Environmental Policy Act of 1969 (NEPA), PL 91-190, as amended (42 USC 4321 et seq); and in accordance with the Principles, Requirements, and Guidelines for Water and Land-Related Resource Implementation Studies and Federal Water Resource Investments (PR&G), DM 9500-013.

This environmental document was initiated using the 40 CFR 1500-1508 (2020) and 7 CFR 650 regulations, Notice of Intent (91 FR 17062 [April 3, 2026]). These regulations have recently been rescinded and replaced with USDA regulations found under 7 CFR 1b. However, in a good-faith effort to fulfill NEPA's requirements, including Congressional timeline and considerations of fiscal restraints, the agency decided to continue to use 40 CFR 1500-1508 (2020) and 7 CFR 650. This is permissible per the USDA policy guidance issued in the Final Rule's preamble. The Federal Register notice said: *"If the NOI for an EIS published more than 90 days prior to the publication of this final rule, the USDA subcomponent has discretion to continue applying the versions of NEPA regulations being applied before publication of the NOI or to switch to applying 7 CFR 1b as published in this final rule"*.

1.2 Sponsor

The non-federal Sponsoring Local Organization (SLO) for this Plan-EIS is Cache Water District (CWD), located in Cache County, Utah. The following non-federal entities comprise the project's co-sponsoring local organizations: Wellsville City, Mendon City, Cache County, Wellsville-Mendon Conservation District (WMCD), Wellsville City Irrigation Company, Mendon North Irrigation Company, Mendon Central Irrigation Company, Mendon South Irrigation Company, Mendon Second North Irrigation Company, Greater Mendon Irrigation Company, and the Wellsville East Field Irrigation & Canal Company. These sponsors meet the relevant SLO responsibilities as outlined in 390 National Watershed Program Manual (NWPM) section 500.11.

1.3 Cooperating Agencies

The NRCS sent requests to the following state and federal agencies requesting to be a cooperating agency under NEPA on this project. Table 1-1 summarizes the responses of the contacted agencies. Because this project was initiated as a Plan-Environmental Assessment (Plan-EA) and then later transitioned to a Plan-EIS, the responses of the initial requests under the Plan-EA are summarized as well. The Utah Department of Transportation (UDOT) declined to remain a cooperating agency following the project's transition to a Plan-EIS.

Table 1-1: Cooperating Agency Outreach

Agency	Response (Plan-EA)	Response (Plan-EIS/Current)
Environmental Protection Agency (EPA)	Yes	Yes

U.S. Bureau of Reclamation (USBR)	Yes	Yes
Utah Department of Transportation (UDOT)	Yes	No
U.S. Army Corps of Engineers (USACE)	No	No
U.S. Forest Service (USFS)	No	No
U.S. Fish & Wildlife Service (USFWS)	No	No
Bureau of Land Management (BLM)	No	No

1.4 Planning Area

1.4.1 Selected Watershed

The project is being planned for areas within the Wellsville Canyon watershed, located in Cache County, Utah, in the first congressional district. The planning area overview map (Figure 1-1) identifies the target watershed in its surrounding context.

The watershed planning area is comprised of four Hydrologic Unit Codes (HUCs): Spring Creek HUC (160102030402), Fourmile Creek HUC (160102030405), Deep Canyon HUC (160102030403), and the Wellsville Canyon HUC (160102030401). The watershed map (Figure 1-2) identifies the project area within the relevant HUCs.

1.4.2 Study Area

The project study area, also known as the project footprint or project area, is the boundary within which the proposed project would be installed. Figure 1-3 is a map of the study area.

1.4.3 Area(s) of Potential Effects for NHPA Section 106 Compliance

Section 106 of the National Historic Preservation Act of 1966 (NHPA), as amended, mandates that the potential effects of a proposed federal undertaking on historic properties be considered. As part of the Section 106 process, the Area of Potential Effects (APE) must first be defined.

The APE is defined as “the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist. The area of potential effects is influenced by the scale and nature of an undertaking and may be different for different kinds of effects caused by the undertaking” (36 CFR, 800.16(d)). At the start of the watershed planning process, the direct APE was defined as 847.60 acres and the indirect APE (which consists of the current 100-year event flood inundation zone, which encompasses the area currently subject to flooding and the entire area that would benefit as a result of the proposed undertaking) as 24,422 acres (the indirect APE was not surveyed).

The direct APE is smaller than the surveyed study area and includes all proposed ground disturbance, including access roads and staging areas under alternatives. The surveyed area consisted of 921 acres of private land, 5 acres of USFS, and 49 acres within USBR Rights-of-Ways (975 acres total). The NRCS assumed the role of lead Federal agency.

A visual or viewshed APE was also analyzed to assess the visual properties that may change as a result of the undertaking. The visual APE was defined as 660 feet from each bank of the channels (see the redacted cultural resource inventory report in Appendix E).

Figure 1-4 delineates the direct APE that will be used to evaluate effects to historic properties . The APE(s) were defined by the NRCS in consultation with the Utah SHPO, Tribes, cooperating agencies (USBR and USFS), and other NHPA consulting parties.

A figure showing the Indirect APE is included in Appendix B and in the Cultural Resources Inventory Report in Appendix E.

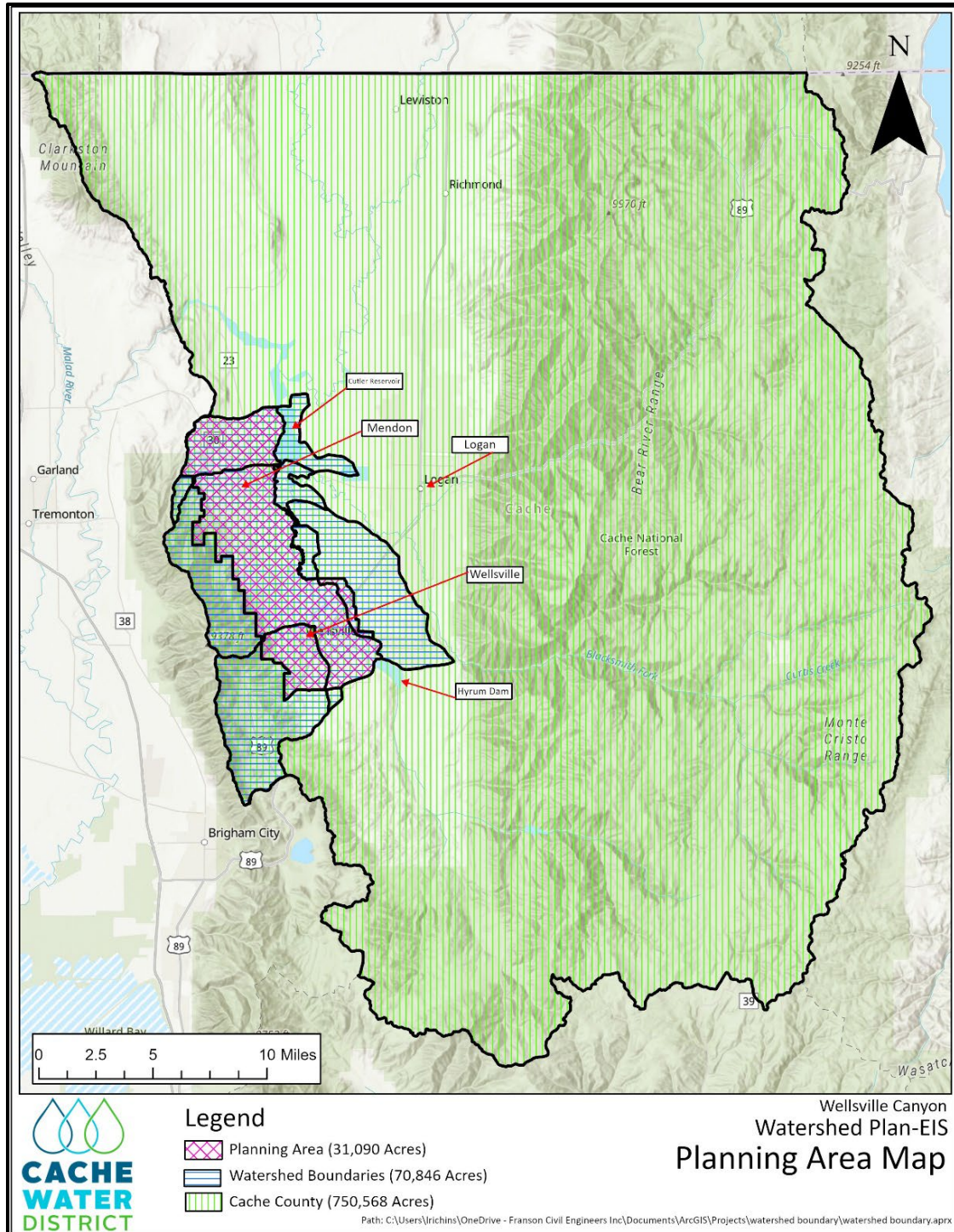


Figure 1-1: Planning Area Overview Map

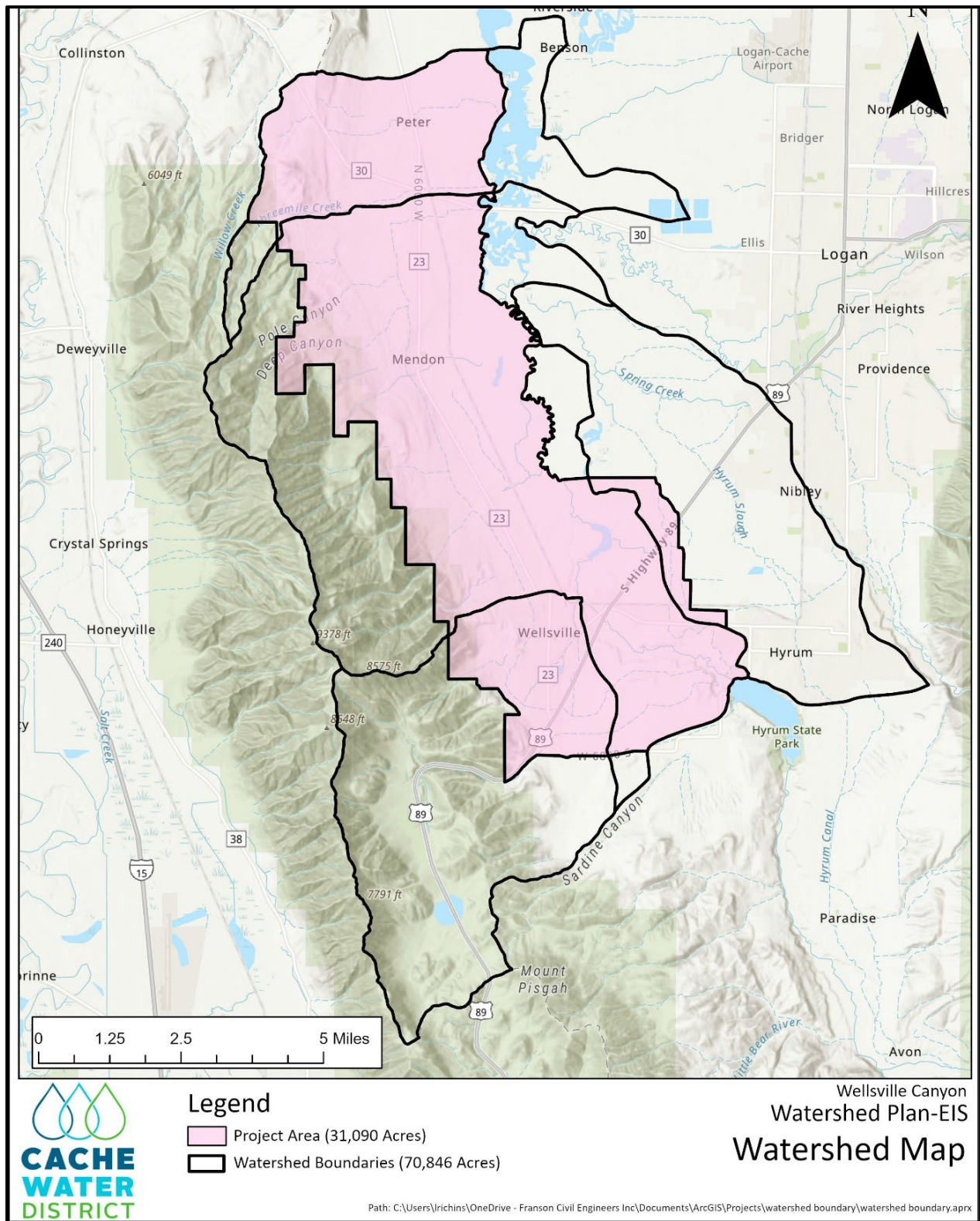
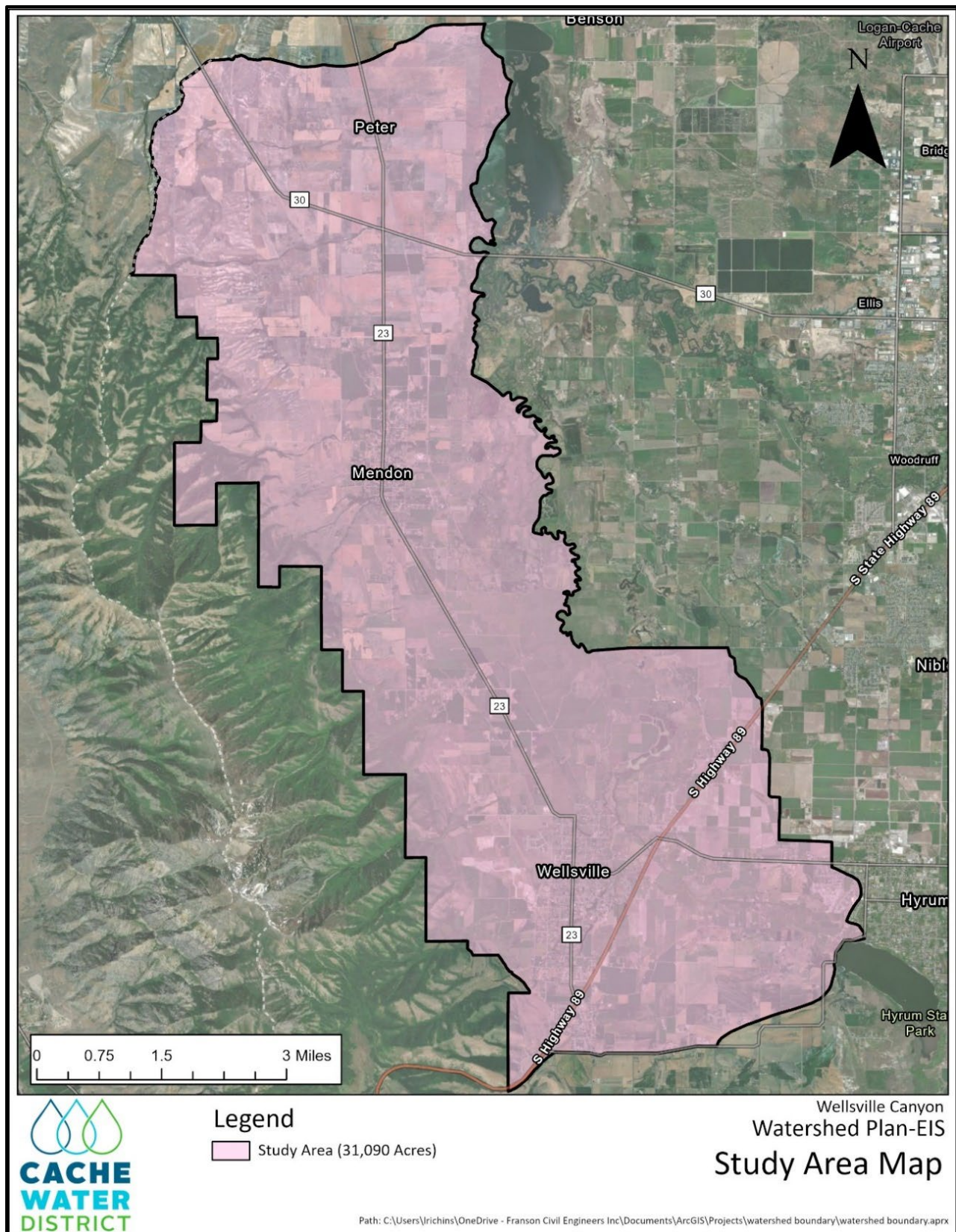


Figure 1-2: Watershed Map

**Figure 1-3: Study Area Map**

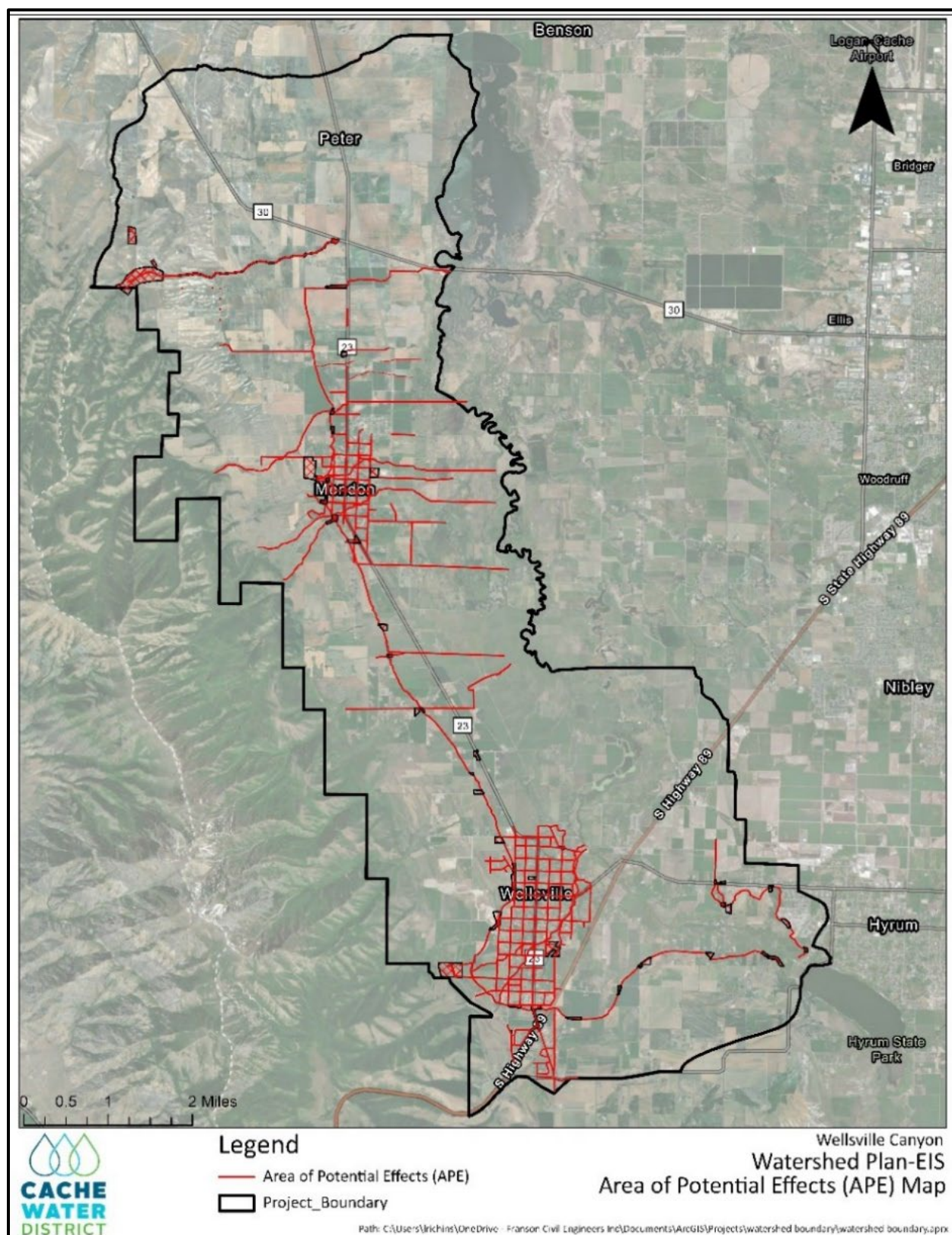


Figure 1-4: Area of Potential Effects (APE) Map

1.5 Planning Process and Study Scope

1.5.1 Stepwise Planning Process

Watershed Plans are voluntary, comprehensive plans for a watershed or other large geographic area. NRCS areawide conservation planning policy requires consideration of all natural and cultural resources within a planning area, as well as social and economic considerations. Watershed Plans are developed through a voluntary locally led effort to achieve the following:

1. Assess natural resource conditions and needs
2. Set goals
3. Identify programs
4. Alternative actions and other resources to solve those needs
5. Develop proposals and recommendations to solve those needs
6. Implement solutions
7. Measure success

The NRCS conservation planning process consists of nine steps, divided into three phases, which cover development, implementation, and evaluation of an Areawide Conservation Plan. The three phases and nine steps are identified below:

Phase 1 – Collection and Analysis

Step 1 – Identify Problems and Opportunities

Step 2 – Determine Objectives

Step 3 – Inventory Resources

Step 4 – Analyze Resource Data

Phase 2 – Decision Support

Step 5 – Formulate Alternatives

Step 6 – Evaluate Alternatives

Step 7 – Make Decisions

Phase 3 – Application and Evaluation

Step 8 – Implement the Plan

Step 9 – Monitor the Plan

The Watershed Plan also adheres to other stepwise planning processes such as those outlined in NEPA and the NHPA, which help to facilitate environmental and cultural resource compliance throughout the planning process.

1.5.2 Ecosystem Services Framework

In addition to the planning processes listed in the previous subsection, this Plan-EIS also complies with the Principles, Requirements, and Guidelines for Water and Land Related Resources Implementation Studies and Federal Water Resource Investments (PR&G) as outlined in the USDA DM 9500-013. The PR&G utilizes its own 8-step planning process that mirrors the processes in NEPA and of the NRCS 9-step process.

An important part of the PR&G planning process is the use of an ecosystem services framework. This framework was developed to describe the benefits that people receive from nature and can be

characterized as the goods and services provided by a healthy, functioning environment. Commonly, the ecosystem services framework is organized into four service categories:

- **Provisioning Services:** Services that provide tangible goods for direct human use or consumption.
- **Regulating Services:** Services that maintain a world in which it is possible for people to live and provide critical benefits that buffer against environmental catastrophe or disaster either locally, regionally, or on a larger scale.
- **Supporting Services:** Services that support the underlying processes for maintaining conditions for life on Earth such as nutrient cycling, soil formation, and primary production (photosynthesis).
- **Cultural Services:** Services that make the World a place in which we want to live in such as recreational, spiritual, aesthetic viewsheds, Tribal, or other cultural and community values.

1.5.3 Period of Analysis

The NWPM defines the period of analysis as “the time required for implementation (design and construction) plus the evaluated life of the project” (NWPM 501.12(C)). The manual further defines the evaluated life as “the time over which an alternative will have significant beneficial or adverse effects when the work(s) of improvement function successfully with prescribed operation, maintenance, and replacement” (NWPM 501.12(C)).

The period of analysis for this Plan-EIS is 55 years. This includes a 5-year construction period, and a 50-year evaluated life.

1.5.4 Project Scope

This Watershed Plan-EIS is being conducted via the NRCS Watershed Protection and Flood Prevention Operations Program (WFPO), authorized by PL 83-566. This program seeks to provide technical and financial assistance to States, local governments, and Tribes to plan and implement authorized watershed project plans for various purposes.

There are eight authorized purposes for initiating a WFPO project. A Watershed Plan document, which is required for the WFPO project planning process, provides the required information and analysis for the selected authorized purpose(s). The eight authorized purposes include:

- Flood Prevention
- Watershed Protection
- Public Recreation
- Public Fish & Wildlife
- Agricultural Water Management
- Municipal & Industrial Water Supply
- Water Quality Management
- Watershed Structure Rehabilitation (this purpose is managed by a separate program)

The Wellsville Canyon Watershed Plan-EIS has been prepared with the PL 83-566 authorized purposes of Flood Prevention (primary), Agricultural Water Management, and Public Recreation.

1.5.5 External Scoping

An external scoping process was completed to gather pertinent resource information and to initiate important planning, consultation, and coordination efforts. The scoping process conducted before the project transitioned to a Plan-EIS was used for the EIS as well. Additional comment periods were held following the transition to a Plan-EIS. A virtual project kickoff meeting including NRCS, the project SLO, project co-sponsors, and consultants was held on April 14, 2021, at 9:30 a.m. More information about this meeting and subsequent external scoping efforts summarized in this section can be found in Appendix A.

A 30-day scoping period was conducted from April 27, 2021, to May 27, 2021, to provide an opportunity for the public, SLO, agencies, Tribes, and other entities to express specific concerns related to the project.

Ten comments were received during the open comment period. These comments have been considered in the development of this Plan-EIS. A scoping report was prepared summarizing the scoping process and is included in Appendix A.

During the 30-day comment period, both an agency scoping meeting—May 10, 2021 (virtual)—and public scoping meeting—May 11, 2021 (in-person)—were held to present the overall project and Plan-EIS process and to provide attendees with the opportunity to express specific concerns and their relevance to the Proposed Action.

Scoping letters for NEPA were sent to Tribes/THPOs in April 2021, requesting information on historic properties or places of religious and cultural importance near the proposed project area that should be considered as part of the analysis. No responses were received.

Tribe/THPOs were sent letters in May 2024 informing them of the publication of the Notice of Intent (NOI) to the Federal Register.

The following Tribes were contacted:

- Eastern Shoshone Tribe of the Wind River Reservation, Wyoming
- Northwest Band of the Shoshone Nation, Utah
- Shoshone-Bannock Tribes of the Fort Hall Reservation, Idaho
- Ute Indian Tribe of the Uintah & Ouray Reservation, Utah

A 30-day public comment period was initiated upon the publication of the NOI. Comments received during this comment period were also considered and incorporated in the Plan-EIS. Documentation of the comments received during the NOI 30-day public comment period are also available in Appendix A.

1.6 Related Projects and Studies

“In defining the scope of issues to be addressed in the watershed project plan, detail and attention must be focused on connected...actions associated with the proposed action” (NWPM 501.39(F)). Thus, a list of relevant related projects/studies that have occurred, are occurring, or are likely to occur within the watershed is detailed in Table 1-2.

Table 1-2: Related Projects and Studies

Related Project/Study Name	Status of Project/Study
Farm Bill Programs/Projects (EQIP, CSP, ACEP, and RCPP)	Construction Phase
Logan River Watershed Plan-EIS	In Development/Planning
North Cache Valley Watershed Plan-EIS	In Development/Planning
Logan River Second Dam Project	Completed
Logan River Third Dam Project	Construction Phase
Trapper Park Lower Logan River Restoration Project	Construction Phase

These related projects and studies and their reasonably foreseeable effects to this project, as defined by NEPA, are discussed further in section 5.3.27.

2.0 Purpose and Need

2.1 Purpose

The purpose of this project is to prevent or reduce damages caused by floodwater in Wellsville, Mendon, and other unincorporated areas of Cache County, Utah; to provide more reliable management of agricultural water in the area; and to increase opportunities for public recreation in the watershed.

2.1.1 Federal Objective

The Federal Objective, as defined in the PR&G (DM 9500-013) states:

“Water resources investments shall reflect national priorities, encourage economic development, and protect the environment by:

- seeking to maximize sustainable economic development.
- seeking to avoid the unwise use of floodplains and flood-prone areas and minimizing adverse impacts and vulnerabilities in any case in which a floodplain or flood-prone area must be used; and
- protecting and restoring the functions of natural systems and mitigating any unavoidable damage to natural systems.”

2.1.2 Project Objectives

The project objectives are to solve the problems identified in section 2.2.1 by using the opportunities described in section 2.2.2. Objectives for this project include:

- **Objective 1:** Address flood control infrastructure problems in Wellsville, Mendon, and unincorporated Cache County to effectively manage high flows from flood events and prevent damage to homes, businesses, and agricultural fields through the year 2130.
- **Objective 2:** Address the problem of water efficiency and reliability of the Lower Canal and Wellsville East Field Canal systems to reduce water losses and increase agricultural water availability in the Wellsville and Mendon areas through the year 2080.
- **Objective 3:** Develop and implement a solution to improve access to secondary water within the watershed to reduce culinary water demand for irrigation and enhance water conservation practices through the year 2080.
- **Objective 4:** Expand recreational opportunities and improve public access to nature and cultural services in the watershed through the year 2130.

2.1.3 Constraints and Considerations

In any planning process, there are certain restrictions that limit the extent to which the implementation of a project will achieve the project objectives. The constraints and considerations for the Wellsville Canyon Watershed project include:

- **Constraint 1:** Minimize disruptions to existing residential and commercial properties during the construction of the project in Wellsville, Mendon, and parts of unincorporated Cache County, Utah.
- **Constraint 2:** Minimize adverse impacts to cultural and historic resources in the watershed to the maximum extent possible.

- **Constraint 3:** Minimize impacts to existing transportation infrastructure, including roads and bridges, to ensure continued access for emergency services and residents.
- **Constraint 4:** Minimize disruptions to the ability of farmers to access their water supply during the irrigation season.
- **Constraint 5:** Minimize soil loss and the degradation of the surrounding landscapes, including wetlands, during project implementation.
- **Constraint 6:** Minimize water pollution and sedimentation of waterways during construction activities to protect aquatic ecosystems in the Little Bear River and its tributaries.
- **Constraint 7:** Minimize impacts that would directly adversely impact or degrade potential habitat for any federally listed species that may be present in the watershed.

2.2 Need

There is a need to provide reliable and capable floodwater conveyance infrastructure in order to reduce flood risk and improve public safety in the project area. The project is also needed to conserve water and improve agricultural management, reduce watershed erosion that results in high sediment and nutrient loading to the Little Bear River, and to improve recreational facilities in the watershed.

2.2.1 Problems

The Wellsville and Mendon areas are at risk of significant flooding due to inadequate infrastructure that fails to manage high flows from late winter to early spring rain-on-snow flooding events, leading to recurring flood damage and public safety concerns.

The Wellsville and Mendon areas also face challenges in agricultural water management due to insufficient infrastructure in the Lower Canal and Wellsville East Field Canal, affecting efficient irrigation and water distribution.

There is also a problem of access to secondary water for irrigation and a subsequent high reliance on culinary water for irrigation needs in Wellsville and Mendon cities.

The watershed also lacks sufficient public recreational opportunities, limiting the benefits available to local residents.

The large-scale stressors in the project area have been created by large-scale drivers such as biological resource use, human intrusion and disturbance, and resource extraction, among others. Additionally, more localized stressors/drives have caused these negative issues in the watershed. They are discussed in detail in the following section.

2.2.1.1 Flooding in Wellsville and Mendon

In most typical flood evaluations based on the National Engineering Handbook (NEH), flooding is usually associated with summer thunderstorms or spring snowmelt events. However, in Cache Valley, late winter to early spring rain-on-



Figure 2-1: Flooding on SR-23 in Mendon (2016-17)

snow events, as shown in Figure 2-1, are the cause of the most serious flooding events not associated with main river flows.

In the project area, rain-on-snow on the lower elevations between late February to late April historically causes the large-scale flood events in Wellsville, Mendon, and this portion of unincorporated Cache County.



Figure 2-2: Flood Damage in Mendon (2012)

Flood control infrastructure in the project area, while typically adequate for summer rainstorms and typical snowmelt events, cannot handle the high flows of rain-on-snow or frozen ground and pass them to the Little Bear River, causing significant damage. Flooding causes damage to crops, roads, homes, and businesses, and delays access to agricultural fields, reducing crop yields.

The flooding events described above typically consist of rain in the valley and part way up the mountain slope, with precipitation being snow above

6,500 feet on average (see Appendix D for additional information). These events typically create sheet flow that converges to erode rills and gullies through the foothill agricultural lands until entering natural drainage channels. However, with the development of agricultural irrigation channels, leveling for irrigation, grading for dryland farming, construction of roads over the last 150 years, and residential development, these natural channels have been choked, blocked, and constricted. Flood damage has been documented in the watershed and the surrounding area during major flood events in the past, with major events occurring in 2005, 2012, 2015, 2017, and 2023 as shown in Figure 2-2, Figure 2-3, and Figure 2-4.



Figure 2-3: May 2015, Flooding at the Cooper Home, Wellsville, Utah (HJ News)



Figure 2-4: Flooding on Agricultural Fields, Wellsville (2023)

There are three main canals that supply the area with irrigation water: the Wellsville Canal, Hyrum-Mendon Canal (also known as the Upper and Lower Canals, respectively, which are managed by the Wellsville-Mendon Conservation District), and the Wellsville East Field Canal which is managed by Wellsville East Field Irrigation & Canal Company. This project will focus on the Lower Canal and Wellsville East Field Canal. A map showing the location of these canals is shown in Figure 2-5.

The water for the Lower Canal is supplied from the Little Bear River through Hyrum Reservoir storage and Little Bear River instream flows. Hyrum Dam was completed

in 1935 by the United States Bureau of Reclamation (USBR). The operation of Hyrum Reservoir is for agricultural water storage and is managed by the South Cache Water Users. A full history of the USBR Hyrum Project may be found in the Administrative Record.

Several springs exist throughout the area which are diverted into various ditches and used for irrigation of lawns, gardens, agricultural fields, and pastures. These are particularly important in the areas around Wellsville and Mendon where Wellsville City Irrigation and Mendon City Irrigation distribute water in and around the cities through a combination of open ditches and pipes to individual property owners.

These ditches and pipes traverse the valley below the Upper and Lower Canals. As a result, the ditches also act as flood water collectors, often helping convey floodwater out of the communities and down to the Little Bear River.

2.2.1.2 Wellsville-Mendon Conservation District (WMCD)

The Wellsville-Mendon Conservation District (WMCD) was formed on June 5, 1933. They manage an agricultural water distribution system composed mainly of earthen canals to a service area of approximately 6,800 acres (USBR.gov/project/Hyrum Project). Their system is described below.

Wellsville Canal (Upper Canal)

The earthen Upper Canal crosses the watershed and intercepts runoff during precipitation events. However, due to the small capacity (maximum of 15 cfs), the canal quickly overtops and spills. This canal also suffers from high seepage losses (approximately 580 acre-feet per year) as documented in Appendix D.

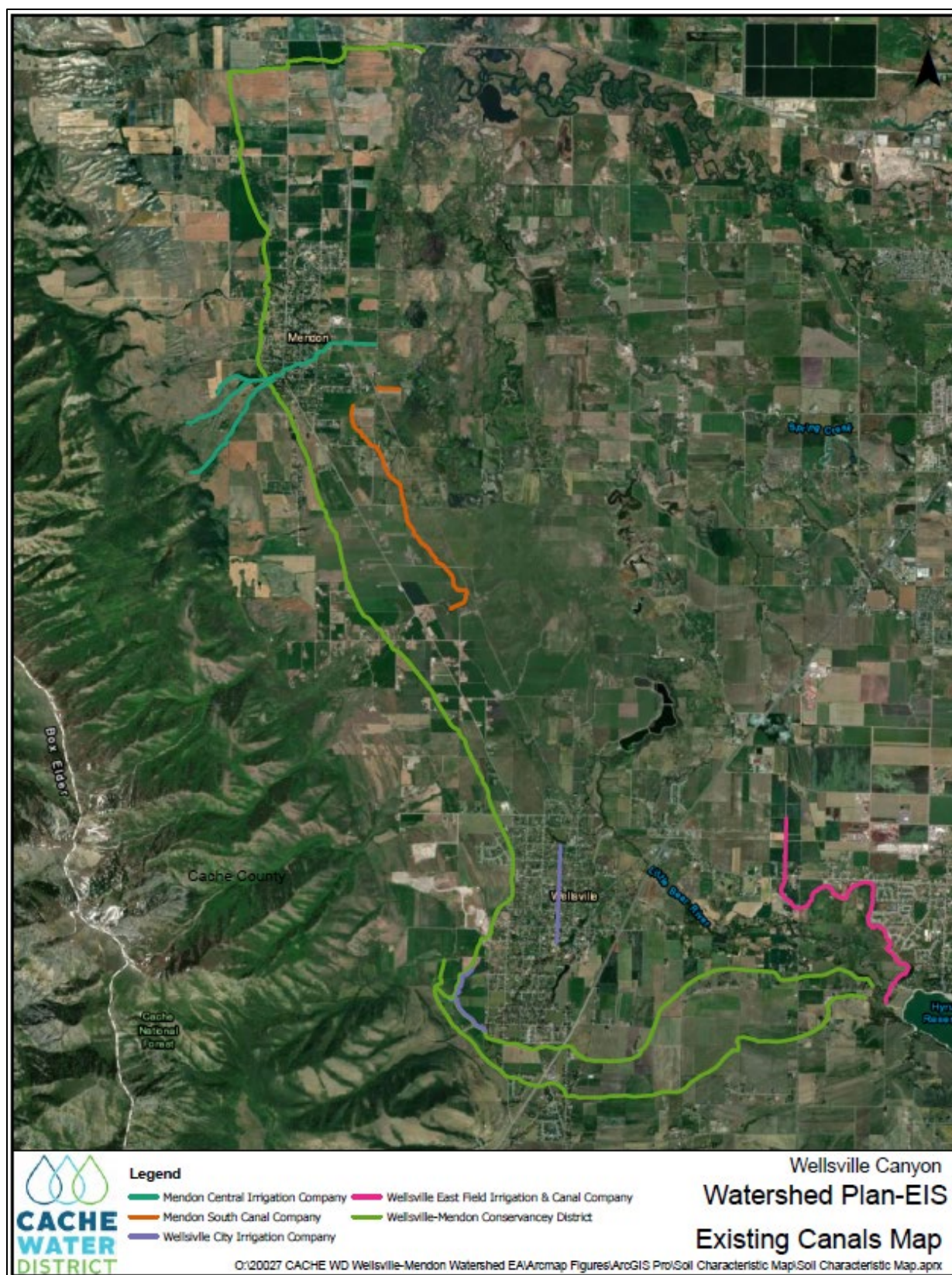


Figure 2-5: Existing Canals Map



Figure 2-6: Earthen Segment of the Upper Canal

Wellsville-Mendon Lower Canal

The Lower Canal also crosses the watershed, passing through Wellsville City and then continuing north toward Mendon City. The current canal is 15.5 miles long. After passing through Mendon, the canal turns back to the east where it flows parallel to Highway 30 before being discharged into Cutler Reservoir. The Lower Canal has a maximum design capacity of 85 cfs at the head of the canal with some stretches being able to carry about 100 cfs during flooding. Several sections of the canals have been piped due to seepage losses, damage to the canals, and new housing developments, or new

road construction. A canal liner has also been installed in some sections of the canals to help manage seepage losses. However, the area still incurs seepage, evaporation, and other water losses.

This canal has a history of overtopping and breaching during flood events, often being intentionally breached by the WMCD to control the location of flooding to protect life and structures. The WMCD does have a spill structure in Wellsville at Murray Springs; however, fully utilizing this structure risks flooding through town where the natural channel does not have the capacity to convey runoff from rain-on-snow or frozen ground events.

Franson Civil Engineers was hired in 2019 to measure the flow at several locations along the lower canal to evaluate the amount of water lost. Based on those measurements, approximately 39% of diverted flows are lost. Further evaluations were completed in 2022 and 2023 determining that 3,514 acre-feet of water are lost annually to seepage as documented in Appendix D.



Figure 2-7: Earthen Segment of the Lower Canal

2.2.1.3 Wellsville City Irrigation System

The Wellsville City Irrigation System is a delivery system that obtains water from the WMCD Lower Canal and delivers water to city residents through a series of channels and ditches for secondary irrigation and agricultural use. The current system consists of approximately 21.7 miles of open ditches to service approximately 700 shareholders. Most shareholders use their water by flood irrigating on a water turn. The nature of this conveyance system creates water loss from seepage, evaporation, system operation spills from unused water, and inefficiencies/operation

issues of water users. An estimated 2,000 acre-feet of water is lost from the system each year based on preliminary water measurements as summarized in Appendix D.

There are many of the residents of Wellsville City that don't have water shares. These residents use culinary water for irrigation. This causes a significant increase in demand for the culinary system during the summer months, requiring more storage, water sources, and increased pumping costs to keep up with city growth.

2.2.1.4 Mendon City Irrigation

Mendon City Irrigation consists of a series of parallel pipes and ditches running from West to East. The current system consists of approximately 11.5 miles of pipes and ditches to service approximately 322 shareholders. Most shareholders use their water by flood irrigating on a water turn. The nature of this conveyance system creates water loss from seepage, evaporation, system operation spills from unused water, and inefficiencies/operation issues of water users. The parallel pipes and ditches are aged and are losing approximately 857 acre-feet of water annually as documented in Appendix E.

2.2.1.5 Wellsville East Field Irrigation System

The Wellsville East Field Irrigation System is a delivery system that is owned and operated by the Wellsville East Field Irrigation & Canal Company and delivers water to city residents through an earthen canal for secondary irrigation and agricultural use. The current system is approximately 14.2 miles in length and services approximately 100 shareholders. The nature of this conveyance system creates water loss from seepage, evaporation, system operation spills from unused water, and inefficiencies/operation issues of water users. An estimated 2,595 acre-feet of water is lost from the system each year based on preliminary water measurements summarized in Appendix D.



Figure 2-8: Wellsville East Field Canal



Figure 2-9: Wellsville Reservoir (UDWR)

2.2.1.6 Public Recreation

Existing recreational opportunities in the watershed are limited. Residents of the area would benefit greatly from any new recreational measures proposed. This is a unique component of the PL-566 funding program as it allows for the betterment of cultural, aesthetic, and even personal well-being by offering a public recreation purpose as a part of the funding program.

The Proposed Action is needed to create new recreational access on project facilities within the watershed. Although recreational opportunities do exist in the watershed, they are primarily limited to walking/hiking, bicycling, and other land-based

recreation. The need for the project to expand the current number of recreational opportunities for community members became evident during scoping, when the community and sponsors expressed support for potential measures to increase recreational opportunities in Wellsville and Mendon cities (see Appendix A for scoping documentation). The Proposed Action would provide non-motorized personal watercraft access to Wellsville Reservoir and construct a reflection pond and walking trail at Mendon City Cemetery. Recreational improvements such as these will provide residents with a higher quality of life and will increase the public's well-being by providing new opportunities for leisure and enjoyment.

2.2.2 Opportunities

The following opportunities presented by the project will serve as a means of resolving immediate problems (stressors) and promoting positive, long-term stability and change in large-scale issues (drivers) affecting the project area:

- **Opportunity 1:** Enhance community resilience to flooding risks through the implementation of project measures.
- **Opportunity 2:** Enhance the local ecosystem by reducing erosion and nutrient loading to the Little Bear River.
- **Opportunity 3:** Improve water distribution efficiency and agricultural productivity in the watershed through the implementation of project measures.
- **Opportunity 4:** Conserve water resources and optimize water use efficiency on agricultural lands in the watershed.
- **Opportunity 5:** Reduce community reliance on culinary water for irrigation and reduce summertime pumping demands through the implementation of project measures.
- **Opportunity 6:** Provide new access to the outdoors and recreational opportunities for local residents.
- **Opportunity 7:** Reduce erosion, maintain topsoil in-place, and retard bank degradation and lateral stream movement.

3.0 Affected Environment: Current & Future Conditions

3.1 Resource Categories of Concern

During the scoping process, relevant resources or environmental concerns were identified to be analyzed in detail and to identify which resources should be eliminated from detailed study. Resource concerns were identified for the project based on required scoping concerns in the NWPM and from additional concerns identified by the SLO, public, stakeholders, Tribes, or agencies during scoping meetings and the 30-day public comment period. Table 3-1 identifies the resource categories of concern and their relevance to this supplemental Plan-EIS. Additionally, the table identifies the ecosystem services established during scoping.

Table 3-1: Resource Categories of Concern and Ecosystem Services Identified During Scoping

Item/Concern	Relevant to the Proposed Action (Yes/No)	Rationale
SOIL-RELATED CONCERNS		
Soil Resources	Yes	Soil resources were considered in this Plan-EIS.
Geology	Yes	Geologic conditions in the project area were considered in this Plan-EIS.
Prime and Unique Farmland, and Farmland of Statewide or Local Importance	Yes	NRCS Web Soil Survey (WSS) was accessed in May 2023. Prime farmlands occur in the project area. There would be no reduction in prime or unique farmland under the Proposed Action.
Upland Erosion & Sedimentation	Yes	Upland erosion occurs during flood events and results from flood irrigation tailwater. This is a major focus of the National Water Quality Initiative (NWQI). This resource was considered in this Plan-EIS.
WATER-RELATED CONCERNS		
Water Resources	Yes	Surface and groundwater quantities would be affected by the Proposed Action. Water resources/water quantity/water rights were considered in this Plan-EIS.
Sole Source Aquifers (SSA)	No	No sole source aquifers are in or near the project area according to the U.S. EPA Sole Source Aquifer interactive map (EPA, 2022b).

Item/Concern	Relevant to the Proposed Action (Yes/No)	Rationale
Water Quality	Yes	Construction activities would occur in drainages and near water sources which may impact surface water quality. Modifications to runoff patterns could change surface water quality. Groundwater quality is expected to be improved by the Proposed Action. This resource was considered in this Plan-EIS.
Floodplain Management	Yes	Project measures would occur within the Federal Emergency Management Agency (FEMA) designated floodplain, so this resource was considered. The purpose of the Proposed Action is the restoration of historical floodways and flood paths as well as flood reduction. Project actions would not result in any change in flood in or out of the basin.
Coastal Zone Management Areas	No	No coastal zone management areas are present in the area. Resource concern is not applicable.
Waters of the U.S., & Special Aquatic Sites	Yes	Wetlands occur within the project area. Permitting and mitigation would be required. No water in the project area is utilized for interstate or foreign commerce.
Coral Reefs	No	No coral reefs are present in the project area. Resource concern is not applicable.
Regional Water Resource Plans (including coastal plans)	Yes	The project supports the goals of multiple regional water management plans.
Wild and Scenic Rivers	No	No wild or scenic rivers are in or near the project area, according to the National Wild and Scenic Rivers System (NWSRS) interactive map (NWSRS, 2021).
AIR-RELATED CONCERNS		
Air Quality	Yes	Temporary construction activities would likely produce dust and emissions.
Clean Air Act (CAA)	No	Project actions would not generate long-term emissions. Permits would not be required.
PLANT AND ANIMAL-RELATED CONCERNS		
Special Status Plant Species	Yes	Endangered Species Act (ESA) listed Ute Ladies'-Tresses occur within the project area. Considered in this Plan-EIS.

Item/Concern	Relevant to the Proposed Action (Yes/No)	Rationale
Special Status Animal Species	Yes	ESA-listed Monarch Butterfly and Yellow-billed Cuckoo and State-listed Species of Greatest Conservation Need (SGCN) have the potential to occur in the project area. Evaluated in detail in this Plan-EIS.
Migratory Birds	Yes	Migratory birds are likely to occur within the watershed.
Bald and Golden Eagles	Yes	Bald and Golden Eagles may occur within the watershed.
Essential Fish Habitat	No	There is no essential fish habitat located in the project area.
Protected Natural Areas/Conservation Areas	No	There are no protected natural areas or conservation areas located in the project area.
Invasive Species/Noxious Weeds	Yes	Invasive species are known to occur in the project area. Construction disturbance increases the risk of invasive species becoming established. Considered in this Plan-EIS.
Fish and Wildlife (including coordination requirements)	Yes	Limited wildlife exists in the area due to residential and commercial development and due to the waterways drying up in the summer/fall months. There is potential for minor impact to those species that do occur in the watershed as a result of construction and maintenance activities.
Riparian Areas	Yes	Riparian areas occur in association with tributaries to the Little Bear River and Threemile Creek.
Forest Resources	No	There are no forest resources in the project area. Not considered in this Plan-EIS.
HUMAN USE-RELATED CONCERNS		
Cultural Resources and Tribal Consultation	Yes	Cultural & historic resources occur within the project area. Section 106 consultation has been completed in accordance with 36 CFR 800.1(c), and consultation documentation is provided in Appendix A.
Environmental Justice and Civil Rights	No	Per E.O. 14148, E.O. 14173, and the Council on Environmental Quality's (CEQ's) memorandum dated February 19, 2025,

Item/Concern	Relevant to the Proposed Action (Yes/No)	Rationale
		Environmental Justice analysis should not be included in NEPA documents. National Bulletin (NB) issue 190-25-8, dated March 13, 2025, directed agencies to remove Environmental Justice analysis from ongoing NEPA documents.
Social Issues	No	There are no significant social issues that would be impacted by the Proposed Action.
Local, Regional, and National Economy	Yes	The National Economic Efficiency (NEE) alternative was identified and evaluated in this Plan-EIS. Local socioeconomics were used as the representative metric to establish an analytic baseline for this resource concern.
Public Health and Safety	Yes	Public health and safety concerns would be improved by limiting flooding and reduction potential structure failures.
Scenic Beauty	Yes	Disturbed ground and heavy equipment would be present during construction and may temporarily impact on the aesthetic resources around the project area.
Parklands (including National Parks, Monuments, and Historical Sites)	No	There are no natural areas or parks located within or near the project area according to the National Parks and Monuments Map (National Park Service, 2022b) and the Utah State Parks Map (Utah Department of Natural Resources, 2022a).
Significant Scientific Resources	No	There are no significant scientific resources in or near the project area. The project area does not contain geological, paleontological, or other features of scientific interest or uniqueness that would constitute significant scientific resources under 190 NCHP 601.70.
Land Use	Yes	There are no land use changes anticipated under the Proposed Action. However, current recreational opportunities would be enhanced. This resource was considered in this Plan-EIS.
SCOPED ECOSYSTEM SERVICES OF CONCERN		
Provisioning	Yes	There are provisioning services in the project area, namely, Food Production/Agriculture,

Item/Concern	Relevant to the Proposed Action (Yes/No)	Rationale
		Water Savings/Seepage Control, and Drinking Water Supply
Regulating	Yes	There are regulating services in the project area, namely Flood Control, Public Safety, Water Quality, and Drought Resiliency.
Supporting	No	Supporting services are categorized as an intermediate ecosystem service. As an intermediate ecosystem service, their service is already included in the final ecosystem service, which mainly consists of benefits derived from provisioning, regulating, and cultural services. Because there is no measurable benefit associated with supporting services, it is not included in the ecosystem services analysis for this Plan-EIS.
Cultural	Yes	There are cultural services in the project area, namely, Recreational Experiences, Cultural/Spiritual Experiences, Aesthetic Value, and the Existence Value of Cultural/Historic Properties.
OTHER CONCERNS IDENTIFIED BY SLO, AGENCIES, AND THE PUBLIC		
Transportation Infrastructure	Yes	Construction would temporarily impact existing transportation routes.
Dam Safety	Yes	Wellsville Reservoir and Hyrum Dam exist in or near the project area. This resource concern was considered in this Plan-EIS.
Great Salt Lake	Yes	The Proposed Action would improve the overall water quality of the Great Salt Lake, which is a special legislative resource concern for the State of Utah.

3.2 Inventory of Existing Resource

The inventory of existing resources provides the environmental baseline in NEPA terms and describes the overall physical, biological, social, and economic conditions of the watershed in PR&G terms. To the extent possible, reasonably foreseeable future conditions are also projected for each evaluated resource concern identified in section 3.1. All resources identified during the external scoping process are presented in the following subsections. The resources have been presented at a level of detail commensurate with the available data pertaining to that resource within the watershed. Figures, tables, and maps have been included where applicable to provide additional information on certain resource concerns.

3.2.1 Geology

As shown in Figure 3-1 Geologic Conditions Summary, the project area is bounded on the east by the Bear River Mountains and on the west by the Wellsville Mountains, with the Cache Valley in the middle. The project area is located in southwest Cache Valley in the foothills of the steep Wellsville Mountains. The West Cache Fault Zone lies at the base of the Wellsville Mountains and together, with the East Cache Fault Zone, creates a boundary on both sides of the Cache Valley Graben. Both faults show evidence of large surface-faulting earthquakes in the late Holocene epoch of the Quaternary period. The most recent earthquake along the Wellsville fault is estimated to have occurred between 4,400 and 4,800 years ago. A slip rate of 0.11-0.21 millimeters/year was estimated by a paleoseismic investigation published in 2000. Figure 3-1 shows both of the aforementioned fault lines running through the project boundary.

As shown in Figure 3-1, multiple geologic units exist within the project area. The western side of the project boundary is comprised of main-stream alluvium which the Utah Geological Survey (UGS) defines as “unconsolidated, crudely stratified, clay-to-boulder size material deposited in channels and flood plains of major rivers, including Bear, Little Bear, Logan, and Blacksmith Fork.” East of the alluvium, there are two different Pleistocene-age lacustrine deposits from Lake Bonneville. The first was deposited in the “Provo stage” of Lake Bonneville and consists of well-sorted grain classes with a thickness between 15-23 meters. The second deposit is largely made up of fanglomerate, or poorly sorted debris, from the Pleistocene known as the Salt Lake formation; its thickness in this area is unknown. The foothills of the Wellsville Mountains are comprised of the Alpine and Bonneville formations which are well-graded lacustrine deposits from the Miocene. Further into the mountains the geology is primarily Oquirrh Limestone formed during the Lower Permian and Pennsylvanian.

3.2.2 Prime and Unique Farmland

Farmland is rated as prime, unique, statewide, or local importance based on national, state, and local criteria that consider the physical and chemical characteristics to support crop production and produce crop yields when properly managed. Prime farmland produces the highest yields based on the climate conditions, whereas statewide importance does not meet the national criteria, but is economically very important at the state level and so on. Table 3-2 summarizes the distribution of the existing farmland ratings as provided by the NRCS. The value of each land is closely associated with its potential productivity from the predominant crops in the area which include alfalfa, other hay/non-alfalfa, winter wheat, safflower, barley, grass/pasture, and fallow/idle cropland (CropScape, 2023). These land classifications were obtained through the NRCS WebSoil Survey online tool and the USDA CropScape interface.

Table 3-2: Farmland Classifications

Classification	Acres in Area of Interest (AOI)	% of AOI
Farmland of local importance	4,916.7	15.8%
Farmland of statewide importance	8,503.2	27.3%
Not prime farmland	6,048.7	19.4%
Prime farmland if irrigated	11,680.2	37.5%
Total	31,148.8	100%

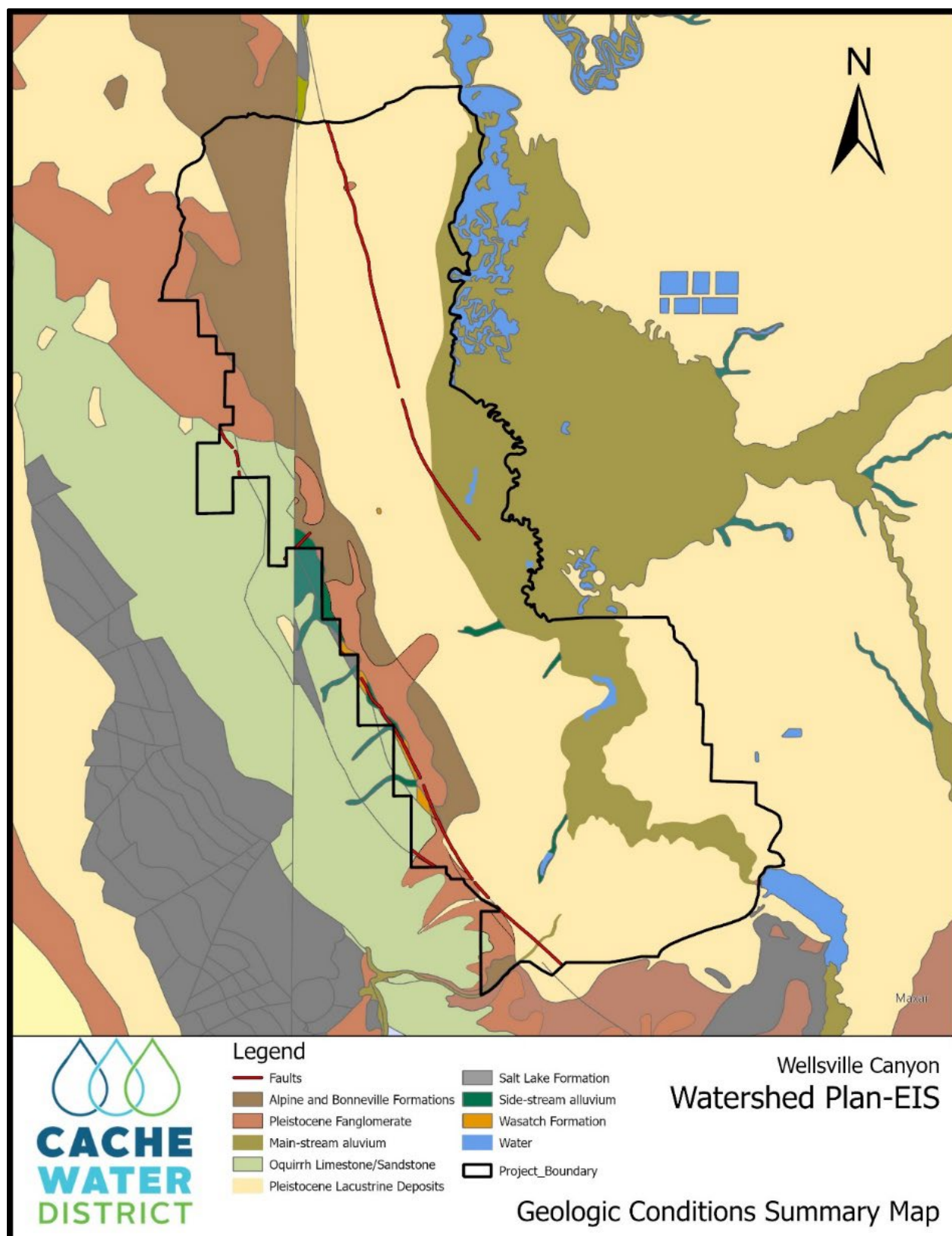


Figure 3-1: Geologic Conditions Summary

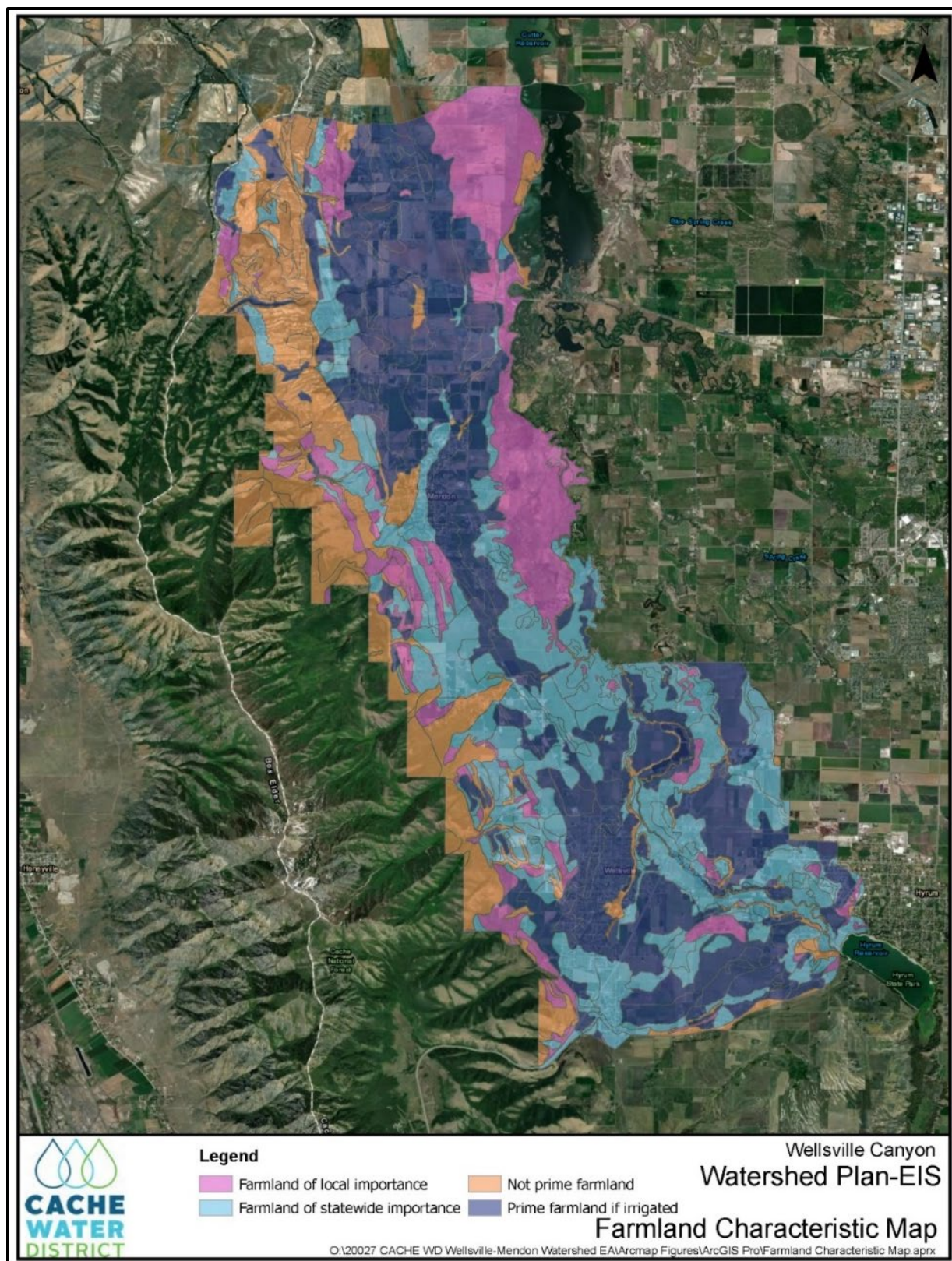


Figure 3-2: Farmland Classifications

3.2.3 Soils

The Cache Valley area between the mountain ranges was originally settled predominantly for agricultural purposes, and soil characteristics greatly influenced the success of agricultural efforts. Soil in the study area varies widely, as shown in Figure 3-3. A study of multiple soil characteristics allows for correlation between soil type, farmland classification, vegetative productivity, and other characteristics. A summary of the soil classifications retrieved from the NRCS WebSoil Survey database is included in Table 3-3. For ease of understanding, the Unified Soil Classification system (USC) is used to present the information and to highlight the relationships that are potentially affected by the Proposed Actions.

Table 3-3: Soil Characteristic Summary

Description	United Soil Classification	Mean Hydraulic Conductivity (inches/hour)	Acres in AOI	% of AOI
NA	NA	0	944.7	3.0%
Fat Clay	CH	0.21	1,432.7	4.6%
Lean Clay	CL	2.82	10,591.7	34%
Silty Clay	CL-ML	2.82	10,210.1	32.8%
Clayey Gravel	GC	2.82	166	0.5%
Silty Clayey Gravel	GC-GM	9.17	4,245	13.6%
Silty Gravel	GM	9.17	488.5	1.6%
Silt	ML	2.82	1,445.9	4.6%
Clayey Sand	SC	9.17	189.3	0.6%
Clayey Silty Sand	SC-SM	28.23	1,302.9	4.2%
Silty Sand	SM	91.74	132	0.5%
Total			31,148.8	100.0%

Figure 3-3 displays the general soil characteristics within the project area by describing the texture of the soil units by sediment class (gravel, sand, silt, or clay). A review of the NRCS WebSoil Survey database includes drainage classifications attributed to the specific soil locations throughout the project area. These drainage classifications are included in Table 3-4 to be compared to the soil characteristics and other soil conditions throughout the impact evaluation. Table 3-4 also quantifies the area within each drainage classification.

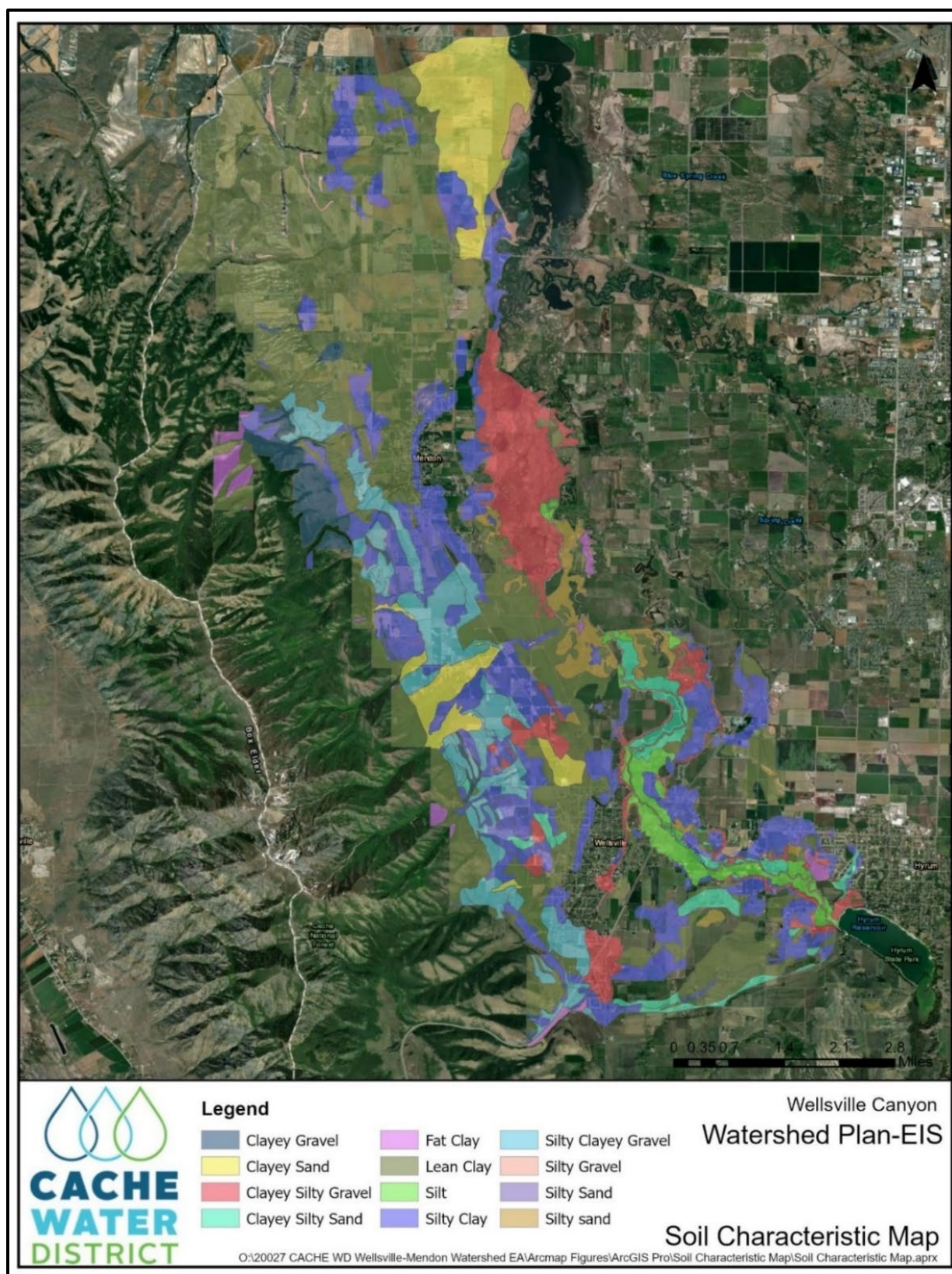


Figure 3-3: Soil Characteristic Map

Table 3-4: Drainage Classifications

Classification	Drainage Description	Acres in AOI	% of AOI
GC-GM	Well Drained	2370.3	7.6%
GC-GM	Poorly Drained	76.4	0.2%
GC-GM	Somewhat Excessively Drained	1533.9	4.86%
GM	Somewhat Excessively Drained	488.5	1.57%
GC	Well Drained	166	0.53%
CL	Well Drained	7234.3	23.7%
CL	Somewhat Poorly Drained	1143.78	3.7%
CL	Poorly Drained	680.3	2.19%
CL-ML	Well Drained	3605.9	11.4%
CL-ML	Somewhat Poorly Drained	5577.4	17.94%
CL-ML	Poorly Drained	832.3	2.68%
CL-ML	Somewhat Excessively Drained	16.5	0.1%
CH	Very Poorly Drained	1393.2	4.5%
SM	Well Drained	52.2	0.16%
SM	Somewhat Excessively Drained	79.8	0.3%
SC-SM	Well Drained	1231.7	3.96%
SC-SM	Moderately Well Drained	53.2	0.2%
SC	Somewhat Excessively Drained	152.2	0.49%
ML	Somewhat Poorly Drained	1445.9	4.65%

Soil health is reflected by three important characteristics including:

- The ability to infiltrate and store water.
- The ability to filter, buffer, degrade, immobilize, and detoxify organic and inorganic pollutants.
- The ability to cycle nutrients including carbon, nitrogen, phosphorus, and many others that are stored and transformed.

The success of agriculture is highly dependent upon the tilth of the soil. In most of the project area, soil conditions are being fully met. However, the unnaturally high groundwater limits the ability of the soils to cycle nutrients by creating an anoxic environment for part of the year that is killing crop roots but is insufficient to create a wetland environment. Additionally, cyclic saturation is interrupting the formation of a healthy mycorrhizal biome, which is necessary for the nitrogen fixation cycle to fully function. These biogeochemical cycles are critical for plant growth and nutrient absorption processes.

3.2.4 Upland Erosion and Sedimentation

Sediment pollution sources to the Little Bear River include erosion from flood runoff, agricultural runoff, livestock grazing, urban activities, and streambank erosion. Erosion is a function of soil types, the cohesive nature of the soils, slopes, vegetative cover, and tillage practices. The NRCS has classified the erosion hazards of specific soils using the soil erodibility factor “K” and cover management practice “C” from the Revised Universal Soil Loss Equation (RUSLE). The soil erodibility K factors range from 0 to 1. The higher the value of the K factor, the more erodible the soil is.

Table 3-5 summarizes the K factors as they relate to the soil classifications in the project area. Based on the values in the table, the soils in the project area are not highly erosive when vegetated unless they exist on steep slopes. Figure 3-4 shows the relationship between erodibility of the soils and the location of the Little Bear River. In addition to the soil loss coefficient, the cover management factor “C” describes the effects of vegetative cover on erosion and ranges from 0 to 1. It is the ratio of the proposed crop method to bare soil. This ratio varies throughout the growth season. Of importance to the project area are major crops including alfalfa, winter wheat, barley, grass hay, and safflower. Areas that are flood inundated or saturated will have very little or no vegetation during the spring and early summer months, making their rainfall erosivity higher. The early season C factors for cover management for these crops are summarized in Table 3-6. Table 3-7 displays the erodibility based on no-till management practices (i.e., “P factor”).

Table 3-5: Soil Erosion

Classification	Description	Soil Erodibility Factor “K”	Acres in AOI	% of AOI
CH	Fat Clay	0.19	1432.7	4.6%
CL-ML	Silty Clay	0.32	10210.1	32.8%
GC	Clayey Gravel	0.10	166	0.5%
GC-GM	Silty Clayey Gravel	0.15	4245	13.6%
GM	Silty Gravel	0.15	488.5	1.6%
ML	Silt	0.37	1445.9	4.6%
SC	Clayey Sand	0.20	189.3	0.6%
SC-SM	Clayey Silty Sand	0.19	1302.9	4.2%
SM	Silty Sand	0.11	132	0.5%
CL	Lean Clay	0.35	10591.7	34%
N/A	—	—	944.7	3.0%
Total	—	—	31,148.8	100%

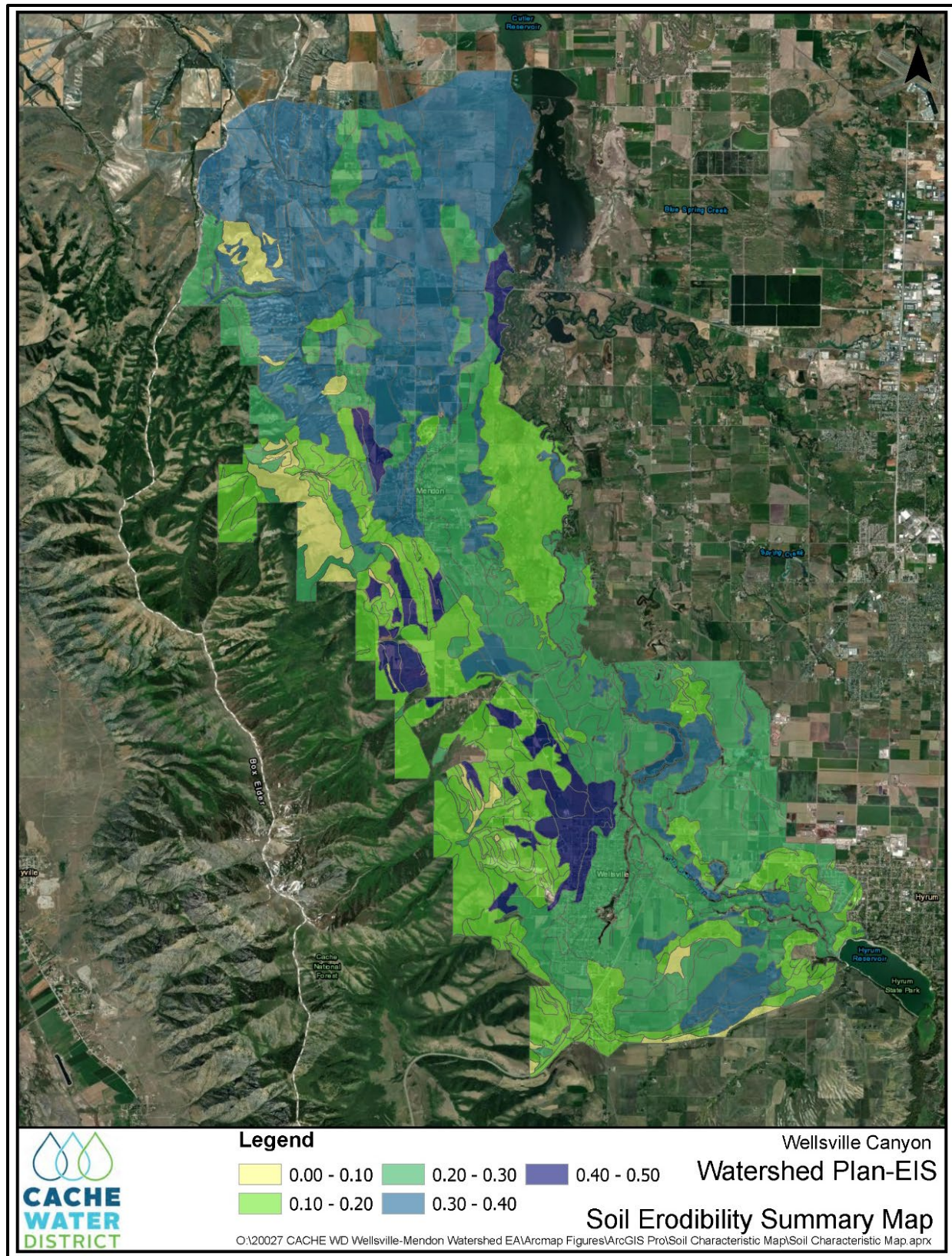


Figure 3-4: Soil Erosion Map

Table 3-6: Erodibility Potential Based on Ground Cover

Cover Management Practice	“C”
Fallow, without vegetation	1.0 by definition
Winter Wheat, in disked residues, 10 – 50% cover	0.30
Silage Corn, Residue removed, fall plowing, 0 – 10% cover	0.86
Alfalfa, established, with residues	0.07
Barley, in disked residues, 10 – 50% cover	0.30
Grass Hay, established, with residues	0.03
Potatoes, rows with slope, 0 – 10% cover (ridged)	0.64

Table 3-7: Erodibility Potential Based on No-Till Management Practices

“No-Till” Supporting Practice	“P” (at a 6% slope)
Traditional Non-Conservation Management	1.0 by definition
Contour Plowing	0.50
Strip Cropping	0.38
Terracing	0.25

3.2.5 Water Resources

The project area consists of four hydrologic units in the Middle Bear River as shown in Figure 1-2. Small streams, springs, and perennial channels along the Wellsville Mountains are fed by snowmelt in the Wellsville Mountains which contributes short-term peak flows in the spring and long-term base flows through groundwater flow supplied from higher level recharge. Multiple seasonal streams from small, steep drainage basins as well as foothill springs convey this water to the Little Bear River.

The Little Bear River is the most critical water resource for people living within and near the project area. The path of the Little Bear River through the project area involves its entry into two major reservoirs in the Cache Valley, namely, Hyrum Reservoir and Cutler Reservoir. The Little Bear River enters Cache Valley from the south and collects water from a variety of springs and from winter snowmelt before collecting in Hyrum Reservoir (near the southeast boundary of the project area). After leaving Hyrum Reservoir, the river continues its course until entering Cutler Reservoir from the south (near the northeast boundary of the project area).

Monthly average precipitation in the project area is represented by Figure 3-5. Water resources are more readily available to residents during the spring and winter months, when there is much more precipitation. During the drier summer months, water is far more limited. Most specifically, June, July, and August experience significantly lower levels of precipitation as is typical in the valley. This limitation of the area’s water resources requires utilization of water conservation measures during times when resources are more plentiful.

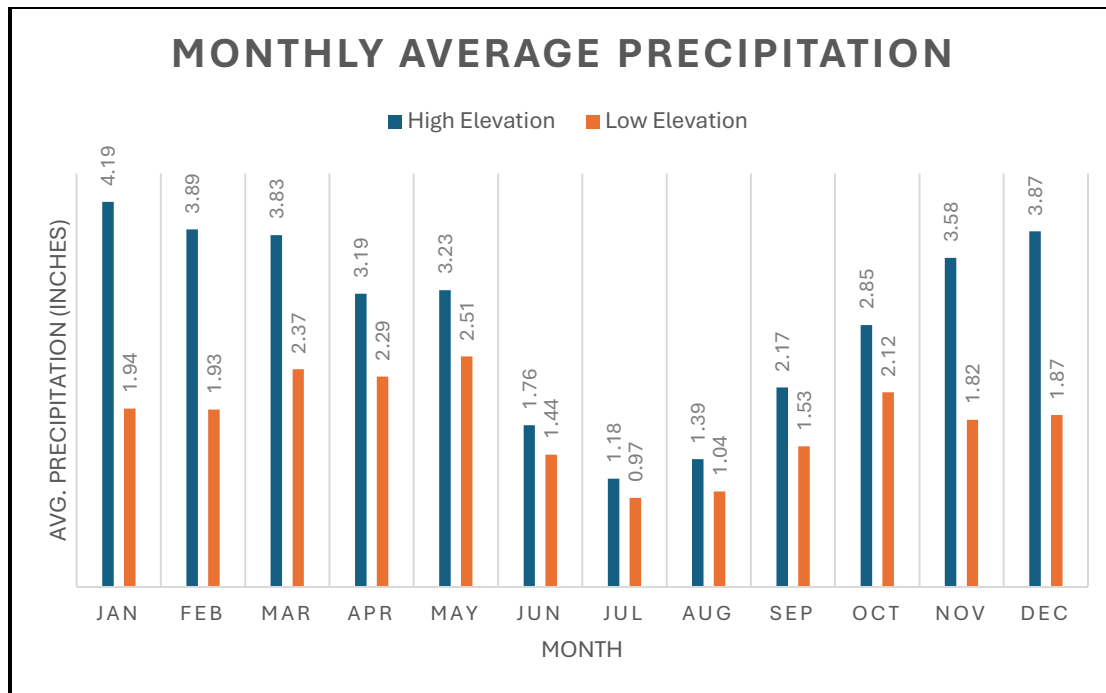


Figure 3-5: Monthly Average Precipitation

(<https://streamstats.usgs.gov/ss/>)

3.2.5.1 Surface Water Quantity

Surface water for agriculture in the project area comes primarily from the Little Bear River watershed and is delivered from Hyrum Dam at Hyrum Reservoir. The Little Bear River is a tributary of the Bear River and discharges on average 120 cfs (USGS StreamStats). As mentioned above, the Little Bear River enters Cache Valley from the south and collects into Hyrum Reservoir. The river heads northward from out of the reservoir and passes through the project area before entering Cutler Reservoir.

Surface water for the Little Bear River comes primarily from early season snowmelt from the mountains and groundwater springs in the area. Thus, as is typical for basin and range rivers and streams, a much higher quantity of surface water is available during the early season compared to the summer and fall. As a result, water supplies can be limited during the summer. The two reservoirs mentioned earlier, Hyrum and Cutler, serve as a mitigator to this issue and store water for use during the hot summers. The canals which extend from Hyrum Reservoir serve to deliver this water to farmers to maintain their agricultural fields.

3.2.5.2 Groundwater Quantity

Groundwater wells in Cache Valley are used for irrigation, domestic, industrial, and culinary water supply. Within the project area, groundwater depths vary greatly. A review of the NRCS WebSoil Survey data for the project area and well logs from the Utah Division of Water Rights have been used to understand the depths to groundwater. Figure 3-6 shows the estimated depths to groundwater within the project area. It can be clearly seen that the majority of the site has a depth of 200 centimeters or greater to the water table, with virtually all variation from this on the eastern side of the site.

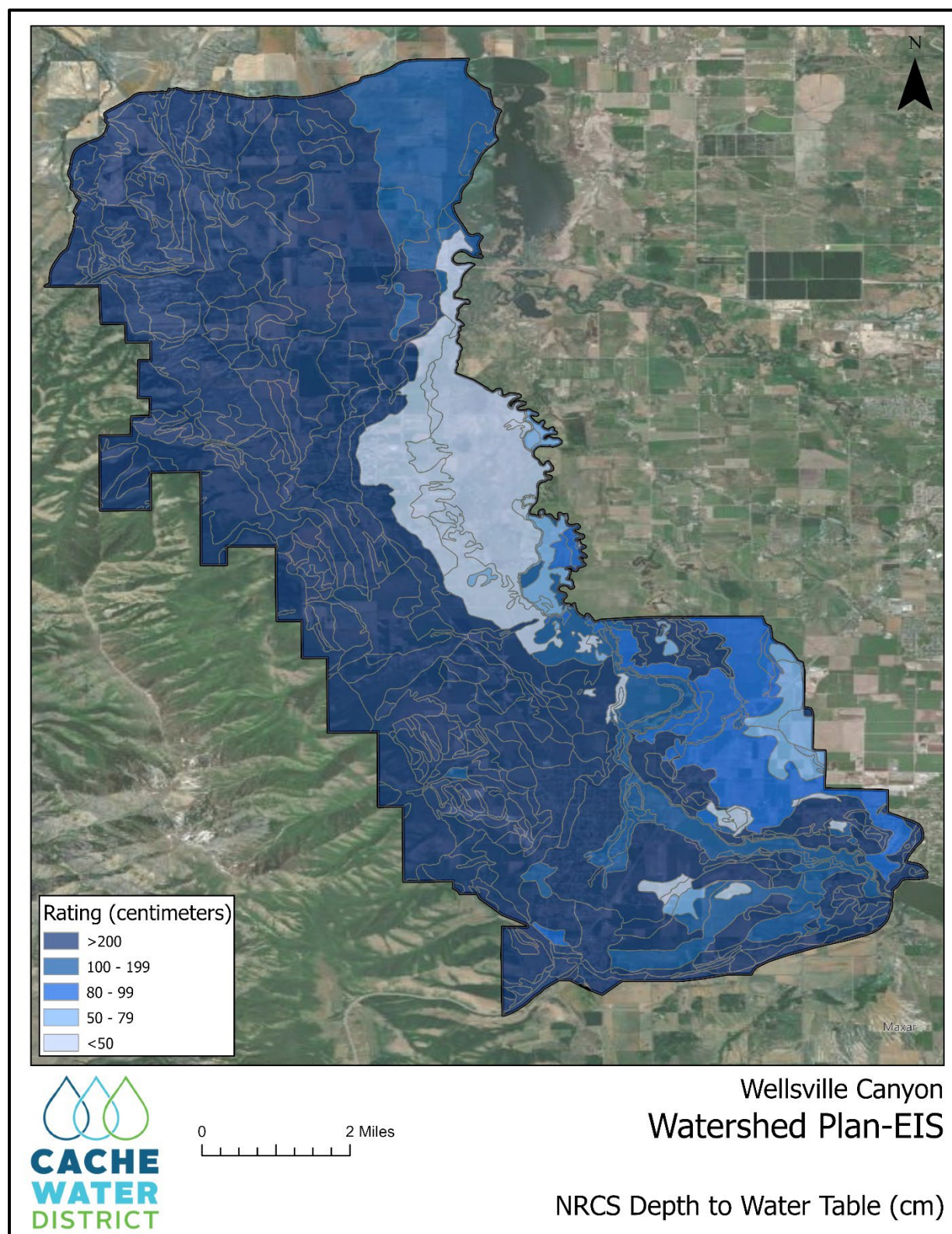


Figure 3-6: Depth to Water Table (cm)

3.2.5.3 Water Rights

A fairly detailed summary of the water rights in the study area is included in Appendix D, being pulled from TM001 in Appendix E. However, this section provides a full summary of the analysis to gather current information on water rights.

WMCD receives water from one water right, 25-1945. The water right is filed under the U.S. Bureau of Reclamation (USBR), and WMCD has use of the water through agreements with the USBR. Wellsville City Irrigation Company has 750 shares in WMCD for water from the Upper and Lower Canals. It also has several water rights from other sources including West Spring Stream (known locally as Murray Spring) and East Spring Stream.

Wellsville City does not have any water rights designated for secondary water. However, they are the majority shareholder in Wellsville City Irrigation Company with 1,150 shares. Currently, approximately half of the city residents use culinary water to irrigate.

Mendon City does not have any water rights that are designated for secondary water. However, they own 215 shares in WMCD. Additionally, there are five irrigation companies within Mendon City that supply residents with secondary water. These companies do not own shares in WMCD but convey water from other sources owned by private landowners, or shares leased by private landowners from Mendon City. Of the five companies, approximately 80% of the residents have access to secondary water.

3.2.6 Water Quality

In the project area, water is used for irrigation, recreation, livestock, and culinary purposes. It is the basis of settlement of communities, the focus of the majority of ecosystems of concern, and the foundation of economies. Its quality, both on the surface and underground, is critical for the livelihood of local residents.

3.2.6.1 Surface Water Quality

The Clean Water Act (CWA), as amended (1972), establishes the basic structure for regulating quality standards for surface waters. Surface waters of the State of Utah, namely, rivers or streams, lakes, reservoirs, creeks, and canals are classified according to their designated beneficial uses to protect against controllable pollution.

The Environmental Protection Agency (EPA) is charged with regulating its implementation and has delegated a certain portion of its authority to the U.S. Army Corps of Engineers (USACE) and the Utah Department of Environmental Quality (UDEQ), which includes the Utah Division of Water Quality (UDWQ) and the Utah Division of Drinking Water (UDDW). UDWQ is responsible for classifying each water body, through Utah Administrative Code (UAC) R317-2-13 as unimpaired or impaired, describes which designation requires further analysis to determine pollutants and remedial actions, if necessary.

Under rules generated by the state of Utah, beneficial uses are classified into the following categories:

- Primary recreational contact
- Secondary or infrequent recreational contact
- Protection for cold water species
- Protection for warm water species

- Protection for waterfowl, shore birds, and other wildlife
- Protection for agriculture and stock watering
- Protection for public drinking water sources

The beneficial uses for the Little Bear River and its tributaries from Cutler Reservoir to the headwaters are classified as follows:

- Class 2B — Protected for infrequent primary contact recreation. Also, protected for secondary contact recreation where there is a low likelihood of ingestion of water or a low degree of bodily contact with the water. Examples include, but are not limited to, wading, hunting, and fishing.
- Class 3A — Protected for cold-water species of game fish and other cold-water aquatic life, including the necessary aquatic organisms in their food chain.
- Class 3D — Protected for waterfowl, shore birds, and other water-oriented wildlife not included in Classes 3A, 3B, or 3C, including the necessary aquatic organisms in their food chain.
- Class 4 — Protected for agricultural uses including irrigation of crops and stock watering.

According to UDWQ, the Little Bear River and its tributaries are listed as impaired for Class 3A. This is due to high levels of total phosphorus and hydrologic modification. Hydrologic modification, which occurred in the lower segment of the Little Bear River in the past and involved channelization, has led to continued streambank erosion and increases in the sediment loads reaching the river.

The beneficial uses for Cutler Reservoir are listed as Classes 2B, 3D, and 4, described above, as well as Class 3B. Cutler Reservoir, according to its total maximum daily limit (TMDL) (UDWQ, 2010), is listed as impaired for Class 3D and Class 3B. The pollutants of concern are low dissolved oxygen and excess total phosphorus. Class 3B is described as follows:

- Class 3B – Protected for warm-water species of game fish and other warm-water aquatic life, including the necessary aquatic organisms in their food chain.

TMDLs have been established by the State of Utah on the Little Bear River because the water quality does not meet the required beneficial uses. The primary pollutant of concern is phosphorus.

According to the TMDL for the Little Bear River (UDWQ, 2010), significant sources of phosphorus and Total Suspended Solids (TSS) in the area include:

- 1) Sheet, rill, and gully erosion caused by livestock/wildlife overgrazing and reduced vegetative cover
- 2) Damaged and unstable streambanks
- 3) Stream channel erosion
- 4) Effluent from wastewater treatment lagoons
- 5) Urban drainage and runoff
- 6) Agricultural runoff
- 7) Animal feed operations near waterways
- 8) Other commercial and industrial processes

Agricultural TMDL implementation efforts have, through the NRCS Environmental Quality Improvement Program (EQIP), targeted the conversion from flood irrigation to sprinklers and the removal of uncontrolled discharges from confined animal feed operations (CAFO). Further water

quality concerns are raised during flood events. As stated earlier, the large rain-on-snow and frozen ground events which the area is prone to cause severe flooding events which can negatively impact local homes, businesses, utilities, and agricultural fields.

3.2.6.2 Groundwater Quality

Groundwater wells in Cache Valley are used for irrigation, domestic, industrial, and culinary water supply. The project area specifically has very few wells due to groundwater quality and associated nitrate levels. A study completed by the United States Geological Survey in 2020 found that there were multiple wells within the Cache Valley where arsenic and nitrate levels exceeded the maximum allowable limits (Miller, 2020). The report noted that at least ten wells in Cache Valley exceeded the Maximum Contamination Limit (MCL) of 0.010 mg/L for arsenic at least once between 1975-2015 (Miller, 2020). Furthermore, the report noted that many wells in northern Cache Valley are contaminated with nitrates, exceeding the MCL of 10 mg/L. According to the Utah Geological Survey (UGS), groundwater quality in Cache Valley is generally very good with the exception of nitrates and arsenic.

Arsenic contamination in groundwater occurs naturally as a result of water-rock interactions (Miller, 2020). When residents pump from the wells, the level of arsenic in the groundwater becomes more concentrated over time. Arsenic is associated with neuropathy, increased risk of cancer/diabetes, and problems with the circulatory system. Luckily, the contaminated wells are identified so risks to public health and agriculture from arsenic are low. Nitrate contamination is typically associated with shallow wells located in discharge zones (Miller, 2020). Nitrates can be contributed to the groundwater via runoff/infiltration of agricultural fertilizers. Risks of nitrate consumption include “blue baby syndrome,” which can occur in both humans and livestock (Miller, 2020). Nitrate issues in Cache Valley are primarily located in the northern end of the valley, closer to the Utah-Idaho border (Miller, 2020).



Figure 3-7: Arsenic Contaminated Well Near Project Area

There are wells in the area that cannot be used for drinking water or stock watering purposes without significant treatment for arsenic removal (Lance Houser, P.E., July 24, 2023). One specific well which is known to be contaminated with unsafe arsenic levels is located just outside the project area boundary near the top of Threemile Canyon (see Figure 3-7). The presence of nitrates in the shallow groundwater aquifer remains the most pertinent groundwater quality concern in the project area.

3.2.7 Floodplain Management

Flood hazard areas and potential flood severity that may occur are categorized by the Federal Emergency Management Agency (FEMA). These categorizations are depicted on a community's Flood Insurance Rate Map (FIRM). Special flood hazard areas (SFHAs), Zone A on a FIRM, are defined as areas that have a 1% or greater chance of being inundated by a flood event in any given year. The 1% annual chance flood is also referred to as the base flood or 100-year flood. Moderate flood hazard areas are areas between the limits of the base flood and the 0.2% annual-chance (or 500-year) flood. Minimal flood hazard areas are those outside the SFHAs and have less than the 500-year flood (FEMA 2020). FIRM panel numbers are listed in Appendix D.

FIRMs were reviewed to determine if the project area lies within an area of potential risk. The Little Bear River, Wellsville Mendon Lower Canal, and some of the canyons in the area are classified as base flood/100-year flood zones, also known as Zone A. In Wellsville, some homes on the western side of the city and a few homes on the eastern and southern parts of the city are within Zone A. In Mendon, homes in the southern part of the city and a few in the northern portion are in Zone A. Large parts of the unincorporated areas of Cache County also lie in Zone A. Figure 3-8 presents a summary of the FEMA flood zones and also highlights the natural flood channels described earlier in the Plan-EIS.

3.2.7.1 Wetlands and Waters of the United States (WOTUS)

Wetlands play an important role in the ecology of a watershed, such as water storage, water filtration, nutrient and chemical absorption, and flood attenuation. They also provide habitats for various birds, fish, reptiles, amphibians, and plant species. The USACE administers and enforces Section 404 of the CWA, which defines wetlands as “those areas inundated or saturated by surface or ground water 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 National Wetlands Inventory (NWI) Mapper tool was accessed to identify potential wetlands within the project area. Based on the range of proposed alternatives, a survey area was defined to determine the need for further assessment. Possible wetland areas classified in the project area were:

- Freshwater forest/shrub
- Freshwater pond
- Riverine features

Possible wetlands near the Little Bear River were classified as:

- Freshwater emergent
- Freshwater forested/shrub

Based on the *Aquatic Resources Delineation Report* (JUB, 2024), the following areas of wetlands were identified as summarized in Table 3-8. Based upon this information, a Water Resource Assessment was completed in accordance with the USACE *Corps of Engineers Wetland Delineation Manual* (USACE, 1987) and the *2008 West Regional Supplement* (USACE, 2008). All potential wetland areas were investigated for wetland indicators (hydric soils, vegetation, hydrology, etc.) as established in the above delineation manuals, with detailed results in the *Aquatic Resources Delineation Report* located in Appendix E.

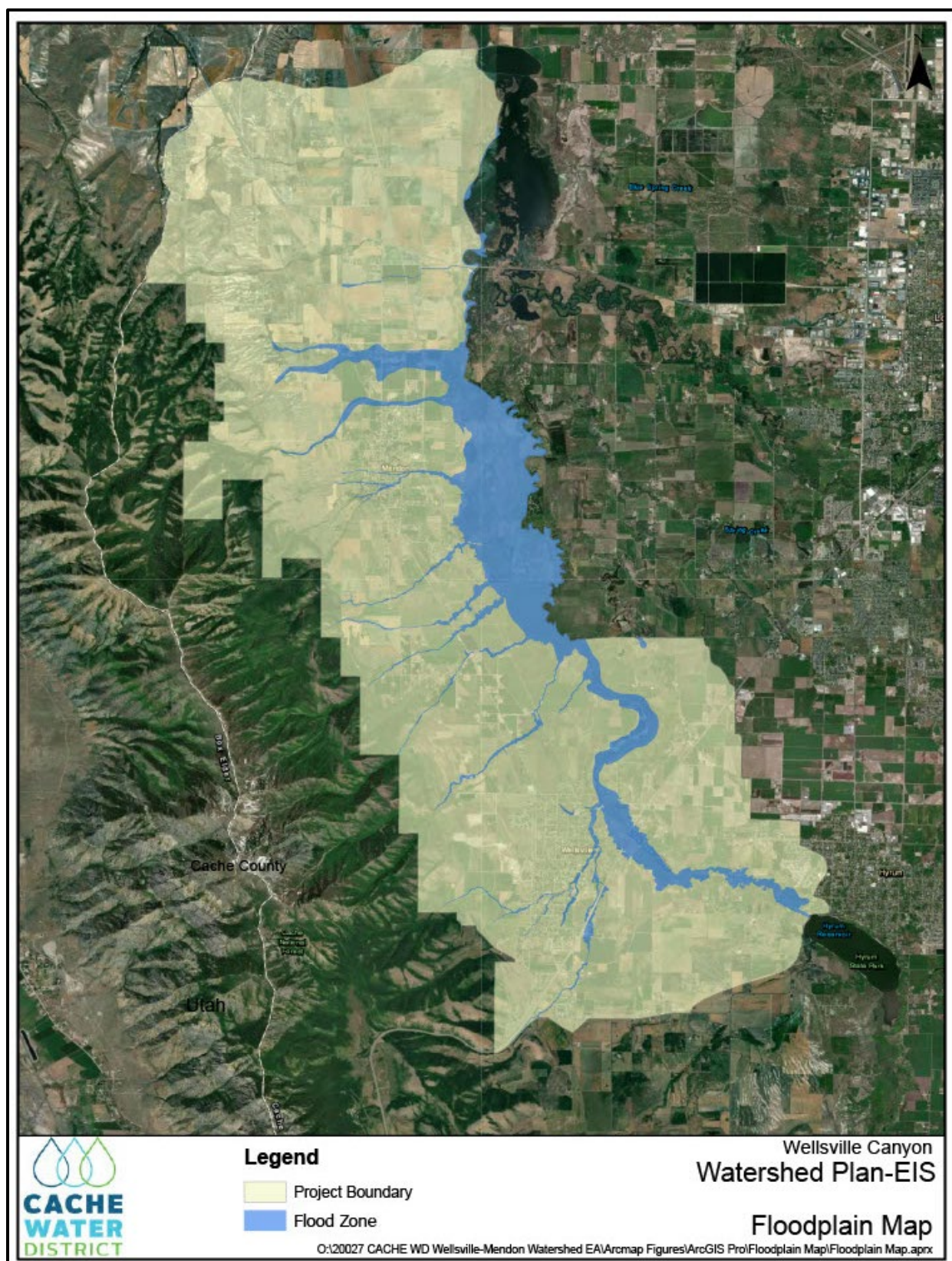


Figure 3-8: Floodplain Map

A total of 56.89 acres of wetlands and 67.59 acres of linear features occurs within the project area, a summary of which can be found in Table 3-8. The findings of the report concluded that all features in the study area have a surface water connection with the Little Bear River, a known WOTUS, and are therefore jurisdictional. For more information, see the *Aquatic Resources Delineation Report* included in Appendix E.

No other wetlands or WOTUS were identified within the survey area. All of the identified features in this section would be considered jurisdictional and fall under the regulatory authority of USACE. Section 404 of the CWA requires wetlands to be protected from discharges of dredged or fill material, which could adversely affect the environment.

Table 3-8: Aquatic Wetland Features

Aquatic Resource Type	Aquatic Resource Size (Acres)	Aquatic Resource Length (linear feet)
WETLANDS		
Palustrine Aquatic Bed (PABGx, PABGh, & PABHh)	0.62 acres	—
Palustrine Unconsolidated Bottom (PUBHh & PUBF)	0.97 acres	—
Palustrine Emergent (PEM1A, PEM1B, PEM1Bf, PEM1Ch)	54.35 acres	—
Palustrine Scrub-Shrub/Emergent Mix (PSS1B & PEM1C)	0.94 acres	—
TOTAL WETLANDS	56.89 acres	—
LINEAR FEATURES		
Riverine, Lower Perennial, Unconsolidated Bottom, Permanently Flooded (R2UBH)	0.90 acres	1,369.62 feet
Riverine, Lower Perennial, Unconsolidated Bottom, Semi Permanently Flooded (R2UBF)	0.11 acres	463.9 feet
Riverine, Intermittent, Streambed, Temporarily Flooded, Excavated (R4SBAX)	2.43 acres	15,606.56 feet
Riverine, Intermittent, Streambed, Seasonally Flooded (R4SBC)	17.27 acres	67,942.79 feet
Riverine, Intermittent, Streambed, Seasonally Flooded, Excavated (R4SBCx)	46.88 acres	160,378.13 feet
TOTAL LINEAR FEATURES	67.59 acres	245,761.0 feet
TOTAL AQUATIC FEATURES	124.48 acres	245,761.0 feet

Source: *Aquatic Resources Delineation Report (JUB, 2024)*. Located in Appendix E.

3.2.8 Regional Water Resource Management Plans

The study area encompasses areas which are included under multiple regional water management plans. These plans establish conservation goals and other planning criteria for the local area's water resources. Furthermore, these plans prioritize the needs of the area with regard to the management of these resources and emphasize the types of issues/problems that should be addressed. The water management plans that are related to the Wellsville Canyon watershed include the following:

- Water Master Plan – Cache Water District, 2019
- Water Resources Plan – Utah Division of Water Resources, 2021
- Municipal & Industrial Conservation Goals Plan – Utah Division of Water Resources, 2019
- Bear River Management Plan – Utah Department of Natural Resources, 2017

3.2.9 Great Salt Lake

The water level of the Great Salt Lake is an issue of particular concern for the State of Utah at the time of writing this Draft Plan-EIS. Several environmental and anthropogenic factors in combination with one another have led to dangerous declines in the lake's water level. Ensuring that the lake is able to remain a critical ecological force in the region is a top priority for the State of Utah.

Although this project is not directly tied to the Great Salt Lake, it is being evaluated in this Plan-EIS for any indirect impacts that could occur as a result of a Proposed Action. These factors make the Great Salt Lake's water level a special legislative resource concern and warrant its inclusion in this Plan-EIS.

3.2.10 Dam Safety

There are two dams within the project area which require dam safety analysis: Wellsville Dam and Hyrum Dam. Both of these dams are briefly described below in terms of dam safety (breach zones, safety rating, existing conditions at the dam).

Aside from these two dams, there are no other aspects of dam safety which require analysis in this Draft Plan-EIS.

3.2.10.1 Wellsville Dam

Wellsville Dam is owned by Wellsville City Irrigation Company and is located in the Wellsville City Park in southern Wellsville City. At the time of its completion in 1957, the dam had a structural height of 25 feet, a hydraulic height of 24 feet, and a dam crest length of 280 feet. At the spillway crest, the reservoir's area is 140 acres with the reservoir's storage capacity at the dam crest at 50 acre-feet (UDWRi, 2025).

The most recent safety inspection of the dam was on May 17, 2023, which concurred with the previously established hazard/safety rating of moderate. Based on the most recent and previous inspection reports, the removal of woody debris/vegetation from the dam embankment remains the only consistent hazard associated with the dam. Inspection reports indicate that efforts to remove the pile-up of woody debris are ongoing.

Figure 3-9, based on data available on the Utah Division of Water Rights website, shows the approximate breach floodplain zone of the Wellsville Dam. While the floodplain zone may appear extensive, it should be noted that the water depth would likely only be a few inches due to the relatively small size of the Wellsville Dam.

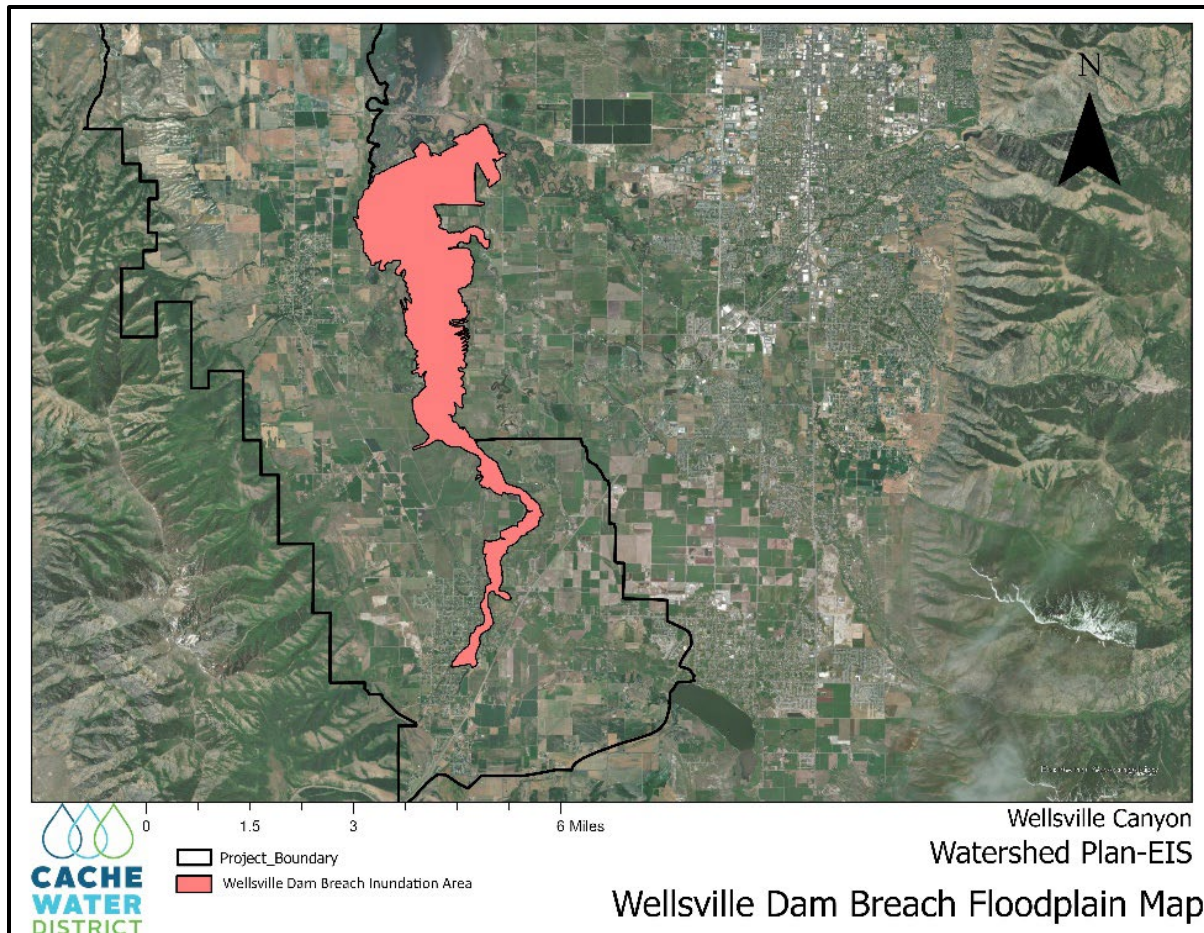


Figure 3-9: Wellsville Dam Breach Floodplain Map

3.2.10.2 Hyrum Dam

Hyrum Dam, owned by the U.S. Bureau of Reclamation (USBR), is significantly larger than Wellsville Dam and is a greater hazard. The dam, owned by the USBR, is operated by the Hyrum-South Cache Water Users Association. The dam is located just south of Hyrum City and is fed by the Little Bear River. As described on the USBR's "Projects and Facilities" webpage for Hyrum Dam, the dam was constructed between 1934 and 1935.

The maximum base width of the dam is 600 feet, with a structural height of 116 feet, a hydraulic height of 82 feet, and a crest length of 540 feet. The total capacity of Hyrum Dam is 18,685 acre-feet. According to the U.S. Army's National Inventory of Dams (NID), the most recent inspection date of Hyrum Dam was August 27, 2020. At this inspection, the dam was given a hazard/safety rating of high.

The spillway of Hyrum Dam is currently undergoing replacement by USBR, although this project should not impact the dam breach floodplain zone.

Figure 3-10, based on data obtained from the Utah Division of Water Rights Mapper, shows the approximate floodplain breach zone of Hyrum Dam.

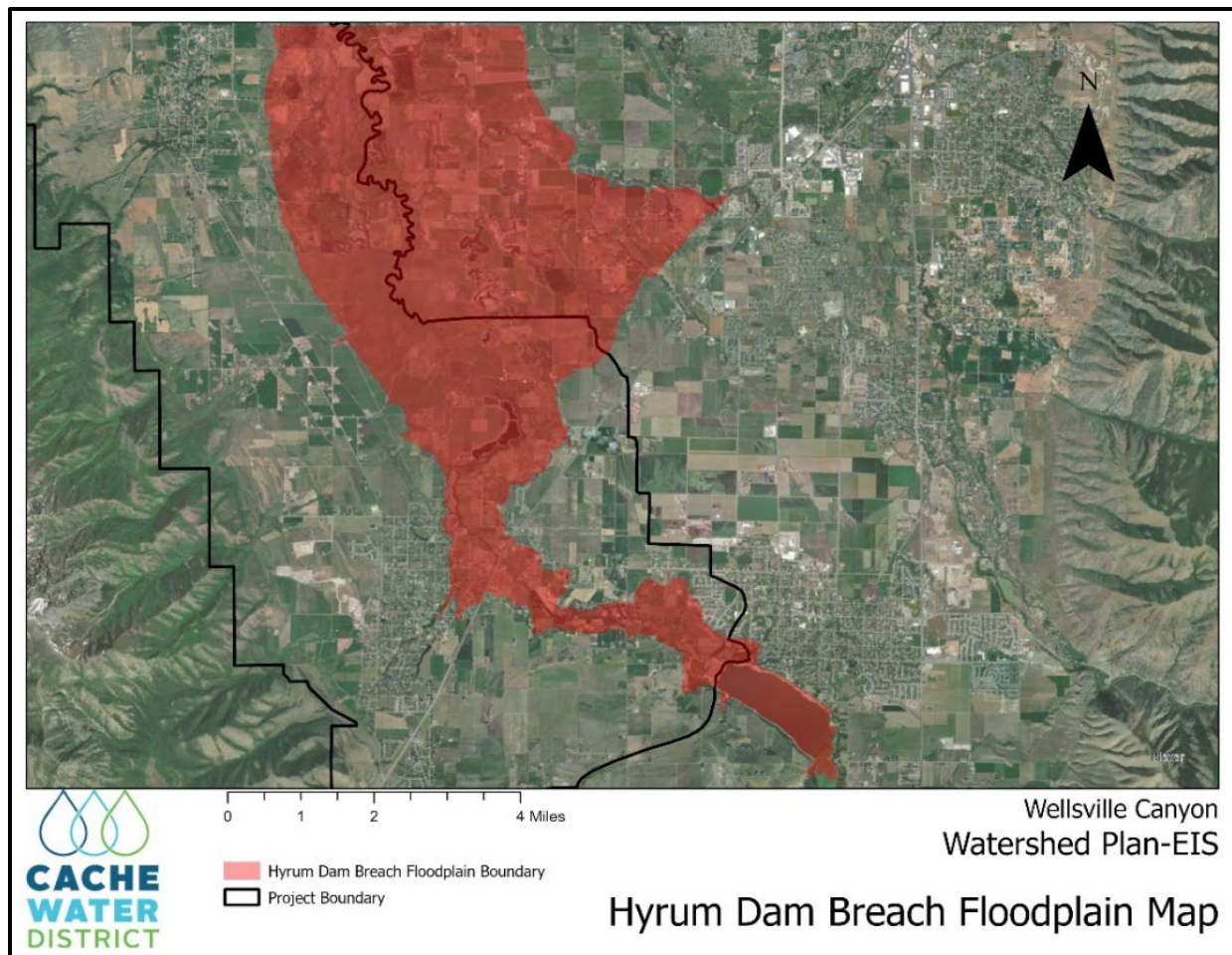


Figure 3-10: Hyrum Dam Breach Floodplain Map

3.2.11 Air Quality

The Clean Air Act (CAA) is a federal law that regulates air pollution nationwide. The CAA requires the EPA to institute National Ambient Air Quality Standards (NAAQS) for six primary air pollutants to protect public health and welfare. These pollutants include carbon monoxide, particulate matter, ozone, nitrogen dioxide, lead, and sulfur dioxide (EPA 2018). Particulate matter includes fine particles that are 2.5 micrometers or smaller ($PM_{2.5}$) and fine particles that are 10 micrometers or smaller (PM_{10}). Air quality conditions are designated as "attainment," "maintenance," "nonattainment," or "unclassifiable." Areas that do not exceed the NAAQS standards are designated as attainment, while areas that exceed the standards are designated as nonattainment.

In 2009, Cache County was designated a nonattainment area in violation of the 2006 $PM_{2.5}$ 24-Hour NAAQS of 35 micrograms per cubic meter. In 2018, the EPA determined that the Logan area, in Cache County, met the conditions for attainment based on air-monitoring data from 2015 to 2017 and was the first nonattainment area in the state to meet attainment requirements since the standard was tightened in 2006. However, in May 2021, the EPA redesignated all of Cache County as an attainment area for $PM_{2.5}$. At the time of writing this Draft Watershed Plan-EIS, Cache County remains an attainment county under all six criteria pollutants under NAAQS.

3.2.12 Threatened and Endangered Botanical Species

The Endangered Species Act (ESA) provides protection to federally listed, threatened, and endangered species and their designated critical habitats under the jurisdiction of the U.S. Fish and Wildlife Service (USFWS). An official species list was obtained from the USFWS Information for Planning and Consultation (IPaC) system and last updated on December 19, 2024 (Appendix E). The official species list identified the species in Table 3-10 as potentially present within the watershed. However, it is stated that there are no critical habitats within the area.

Although no individuals were identified in the project area (area surveyed in 2021, 2023, and 2024), approximately 18.45 acres of potentially suitable habitat were identified within 300 feet of the Action Area, within Mendon, as identified in the Biological Assessment (Appendix E). “Action Area” is an ESA term which represents the area of potential disturbance and, in the case of this project has the same extents as the APE for cultural resources.

Table 3-9: Threatened and Endangered Botanical Species in the Project Area

Species	Status	Habitat	Present?
Ute ladies'-tresses (<i>Spiranthes diluvialis</i>)	Threatened	Suitable habitat occurs within the watershed.	No. 18.45 acres of potentially suitable habitat.

Source: U.S. Fish and Wildlife Service's Information, Planning, and Consultation (IPaC) online services, (<https://ecos.fws.gov/ipac/>), last updated December 19, 2024.

Source: Biological Assessment for the Wellsville-Mendon Watershed Project, March 2024.

3.2.13 Invasive Plants and Noxious Weeds

Invasive species are defined as non-native to the ecosystem and whose introduction or presence can likely cause economic or environmental harm or harm to human health. Invasive species compete directly with native species for moisture, sunlight, nutrients, and space. federal agencies were directed in Executive Order 13112 to expand and coordinate their efforts to combat the introduction and spread of plants not native to the United States. Noxious or invasive weeds are plants designated by the federal, state, or county government as injurious to public health, agriculture, recreation, wildlife, or property.

As of 2021, there are 54 weeds on Utah's noxious weed list (Utah Weed Control Association, 2021). The weeds are classified into the following categories:

- Class IA – Early Detection Rapid Response (EDRR) Watch List
- Class IB – Early Detection (ED)
- Class II – Control
- Class III – Containment
- Class IV – Prohibited

Table 3-11 shows a series of invasive plant species that may occur within the watershed. The information was derived from the Cache County Noxious Weed Supervisor's notice in the March 2024 issue of *Cache Conservation News* which can be found in the administrative record. A large portion of the plants in the wetland that surround Cutler Reservoir are invasive species.

Table 3-10: Potentially Occurring Invasive Plants in Cache County

Common Name	Taxonomy	Utah Status
Bermuda grass	<i>Cynodon dactylon</i>	Class III
Russian salt tree	<i>Caragana halodendron</i>	Class IB
Crack willow	<i>Salix fragilis</i>	Class IV
Canada thistle	<i>Cirsium arvense</i>	Class III
cogongrass-japanese blood grass	<i>Imperata cylindrica</i>	Class IV
Dame's rocket	<i>Hesperis matronalis</i>	Class IV
Dyer's Woad	<i>Isatis tinctoria</i>	Class II
Field bindweed	<i>Convolvulus arvensis</i>	Class III
Hoary cress	<i>Cardaria drabe</i>	Class III
Houndstongue	<i>Cynoglossum officinale</i>	Class III
Jointed goatgrass	<i>Aegilops cylindrica</i>	Class III
Musk thistle	<i>Carduus nutans</i>	Class III
Myrtle spurge	<i>Euphorbia myrsinites</i>	Class IV
Perennial pepperweed	<i>Lepidium latifolium</i>	Class III
Perennial sorghums	<i>Sorghum halepense</i>	Class III
Phragmites- common reed	<i>Phragmites australis ssp.</i>	Class III
Poison hemlock	<i>Conium maculatum</i>	Class III
Puncturevine (goathead)	<i>Tribulus terrestris</i>	Class III
Quackgrass	<i>Agropyron repens</i>	Class III
Russian knapweed	<i>Centaurea repens</i>	Class III
Russian olive	<i>Elaeagnus angustifolia</i>	Class IV
Scotch broom	<i>Cytisus scoparius</i>	Class IV
Scotch thistle	<i>Onopordium acanthium</i>	Class III
Tamarisk (salt cedar)	<i>Taramix ramosissima</i>	Class III

Source: General Notice to Control Noxious Weeds, Cache Conservation News, p. 3, dated March 2024.

3.2.14 Riparian Areas

Riparian areas are directly influenced by water from a watercourse or water body. They typically exist along lakes, rivers, streams, and constructed water bodies such as ditches, canals, ponds, and reservoirs. Riparian areas are of ecological importance because they support a wide variety of botanical species and are critical habitats for wildlife. They also help to control erosion along the waterways as well as capture sediment that could return to the streams (Bear River TMDL, 2010). Riparian communities in Cache County include cottonwood (*Populus fremontii* and

P. angustifolia), redbud dogwood (*Cornus sericea*), box elder (*Acer negundo*), and willow species (*Salix exigua*) (Bear River TMDL, 2010). Riparian vegetation is present along some of the canal channels and the drainages within the project area.

3.2.15 Threatened and Endangered Animal Species

The ESA provides protection to federally listed, threatened, and endangered species and their designated critical habitats under the jurisdiction of the USFWS. An official species list was obtained from the USFWS IPaC system and last updated on December 19, 2024 (Appendix E).

The official species list identified the species in Table 3-12 as potentially present within the watershed. However, it is stated that there are no critical habitats within the area. A biological survey was conducted in 2023 to confirm whether there was any suitable habitat for any endangered or threatened species in the project area. The results of the survey concluded that there was no suitable habitat for any listed animal species in the project area. The full Biological Assessment may be found in Appendix E.

Table 3-11: Threatened and Endangered Animal Species in the Project Area

Species	Status	Habitat	Present?
Yellow-billed cuckoo (<i>Coccyzus americanus</i>)	Threatened	Suitable riparian nesting habitat of appropriate patch size and configuration below 8,500 feet in elevation (USFWS, 2023).	No.
Monarch butterfly (<i>Danaus plexippus</i>)	Candidate	Monarchs require milkweed, nectar sources, overwintering habitat, and migration habitat (USFWS, 2023)	No.

Source: U.S. Fish and Wildlife Service's Information, Planning, and Consultation (IPaC) online services, (<https://ecos.fws.gov/ipac/>), last updated December 19, 2024.

Source: Biological Assessment for the Wellsville-Mendon Watershed Project dated March 2024.

3.2.16 Utah Special Status Animal Species

The project area was evaluated for the Utah Sensitive Species List and Species of Greatest Conservation Need (SGCN) in the Utah Division of Wildlife Resources (UDWR)'s Natural Heritage Program on August 21, 2023 (see Appendix E). These species were evaluated for their potential to occur within a 0.5- or 2-mile radius of the Action Area in the Biological Assessment. Findings can be found in Table 3-13. Further details may be found in the Biological Assessment in Appendix E.

Table 3-12: Species of Greatest Conservation Need in Utah

Species	Taxonomy	Potential Occurrence Radius
American bittern	<i>Botaurus lentiginosus</i>	2 miles
American white pelican	<i>Pelecanus erythrohynchus</i>	2 miles
Brown (grizzly) bear	<i>Ursus arctos</i>	2 miles
Yellow-billed cuckoo	<i>Coccyzus americanus occidentalis</i>	0.5 miles

Species	Taxonomy	Potential Occurrence Radius
Columbian sharp-tailed grouse	<i>Tympanuchus phasianellus columbianus</i>	0.5 and 2 miles
Burrowing owl	<i>Athene cunicularia</i>	0.5 and 2 miles
Bald eagle	<i>Haliaeetus leucocephalus</i>	0.5 and 2 miles
Pilose crayfish	<i>Pacifastacus gambelii</i>	0.5 and 2 miles
Lewis's woodpecker	<i>Melanerpes lewis</i>	0.5 and 2 miles
Little brown myotis	<i>Myotis lucifugus</i>	0.5 and 2 miles
Long-eared myotis	<i>Myotis volans</i>	2 miles
Long-legged myotis	<i>Myotis volans</i>	2 miles
Northern leopard frog	<i>Lithobates pipiens</i>	0.5 and 2 miles
Green River pebblesnail	<i>Fluminicola coloradoensis</i>	0.5 and 2 miles
Western toad	<i>Anaxyrus boreas</i>	2 miles
White-faced ibis	<i>Plegadis chihi</i>	2 miles
Whooping crane	<i>Grus americana</i>	2 miles

Source: Utah Department of Natural Resources (UDNR) Utah Natural Heritage Online Species Search Report. Generated August 21, 2023.

Source: Biological Assessment for the Wellsville-Mendon Project. Dated March 2024.

3.2.17 Fish and Wildlife

Fish and wildlife species (including migratory birds) and their habitats are managed on multiple federal and state levels. Wildlife populations that are most understood are those that are documented and listed for protection under the ESA discussed above, state species of concern, or desired game. Other wildlife species around the project area are listed in Table 3-15. Further information on species which may occur in the project area can be found in the Biological Assessment included in Appendix E.

3.2.17.1 Fish

Fish species investigations completed as part of the TMDL studies completed on the Bear River and Little Bear River in Utah have identified numerous species that are both native and non-native in the system. Table 3-14 summarizes the identified species with the associated classifications and status.

Table 3-13: Fish of Interest in the Project Area

Species	Taxonomy	Native/Introduced
Channel catfish	<i>Ictalurus punctatus</i>	Introduced
Brown trout	<i>Salmo trutta</i>	Introduced
Largemouth bass	<i>Micropterus salmoides</i>	Introduced

Species	Taxonomy	Native/Introduced
Smallmouth bass	<i>Micropterus dolomieu</i>	Introduced
Common carp	<i>Cyprinus carpio</i>	Introduced
Green sunfish	<i>Lepomis cyanellus</i>	Introduced
Utah sucker	<i>Catostomus ardens</i>	Native - Present
Bluehead Sucker	<i>Catostomus discobolus</i>	Native – Present
Green sucker	<i>Pantosteus discobolus</i>	Native -- Unknown
Fathead minnow	<i>Pimephales promelas</i>	Native - Present
Walleye	<i>Sander vitreus</i>	Introduced
Black crappie	<i>Pomoxis nigromaculatus</i>	Introduced
Black bullheads	<i>Ameiurus melas</i>	Introduced
Yellow perch	<i>Perca flavescens</i>	Introduced
Utah chub	<i>Gila atraria</i>	Native-Present

Sources: Bear River/Cutler Reservoir TMDL and Little Bear River TMDL, Utah Department of Environmental Quality (UDEQ)

3.2.17.2 Wildlife

The project area exists on the valley floor where the land is primarily open and agricultural in nature, with some residential or commercial properties interspersed as well. Sufficient habitat exists within the project area to support common small mammals—which are inherently part of rural and agricultural areas—migratory birds, and some big game in the foothills of the local mountains. Table 3-15 summarizes the wildlife identified by the State of Utah wildlife agencies as having potential habitat in the project area. Additionally, the Threemile Canyon portion of the project area has a known beaver (*Castor canadensis*) population, that has created dams along Threemile Creek. The beaver will be managed in accordance with state standards and if concerns arise, work will be coordinated with the Utah Division of Wildlife Resources (DWR).

Table 3-15 was derived from the Biological Resource Report included in Appendix E of this document.

Table 3-14: Wildlife with Mapped Habitats in the Project Area

Species	Taxonomy	Native/Introduced
Hungarian partridge	<i>Perdix perdix</i>	Introduced game species
Ring-necked pheasant	<i>Phasianus colchicus</i>	Introduced game species
Columbian sharp-tailed grouse	<i>Tympanuchus phasianellus columbianus</i>	Native
Bald eagle	<i>Haliaeetus leucocephalus</i>	Native
Peregrine falcon	<i>Falco peregrinus</i>	Native

Species	Taxonomy	Native/Introduced
Northern leopard frog	<i>Lithobates pipiens</i>	Native
Ferruginous hawk	<i>Buteo regalis</i>	Native
Deseret mountain snail	<i>Oreohelix peripherica</i>	Native
Lyrate mountain snail	<i>Oreohelix haydeni</i>	Native
Monarch butterfly	<i>Danaus Plexippus</i>	Native
Snowy plover	<i>Charadrius nivosus</i>	Native

3.2.18 Migratory Birds and Eagles

USFWS is mandated by the Fish and Wildlife Conservation Act (FWCA) and the Migratory Bird Treaty Act of 1918 (MBTA) to identify species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become candidates for listing under the ESA.

The Bald and Golden Eagle both warrant special attention due to the Bald and Golden Eagle Protection Act (BGEPA). Features in the surrounding area such as riparian zones, wetlands, fence lines, tall trees, and power lines may provide perches and temporary foraging areas for migratory birds. Table 3-16 identifies the migratory bird species with the potential to occur within the Action Area as defined by the Biological Assessment included in Appendix E. All listed species are either Birds of Conservation Concern (BCC) or Species of Greatest Conservation Need (SGCN).

Table 3-15: Migratory Birds List

Species	Taxonomy	Habitat	Habitat Present?	Breeding Season
American white pelican	<i>Pelecanus erythrorhynchos</i>	Preferred habitats include lakes, marshes, & salt bays.	No.	Apr 1 to Aug 31
Bald eagle (Protected under BGEPA)	<i>Haliaeetus leucocephalus</i>	Almost always nests in tall trees and commonly near bodies of water where fish and waterfowl prey are available	Nesting or stopover habitat may occur. The UNHP documents occurrence of this species within 0.5 miles of the Action Area.	Dec 1 – Aug 31
Black rosy-finch	<i>Leucosticte atrata</i>	Alpine areas, usually near rock piles, and cliffs. Winters in open country including mountain meadows, high	No.	Jun 15 – Aug 31

Species	Taxonomy	Habitat	Habitat Present?	Breeding Season
		deserts, valleys, and plains.		
Black tern	<i>Chlidonias niger</i>	Wetlands and plains/prairies	No.	May 15 – Aug 20
Bobolink	<i>Dolichonyx oryzivorus</i>	Hayfields, meadows, marshes, and prairies.	Nesting or stopover habitat may occur within the Action Area.	May 20 – July 31
California gull	<i>Larus californicus</i>	Preferred habitat includes lakes and marshes	Foraging or stopover habitat may occur within the Action Area.	Mar 1 – Jul 31
Cassin's finch	<i>Carpodacus cassinii</i>	Occupies a variety of coniferous forest types, often in mature forests of lodgepole and ponderosa pine, over a broad elevation range.	No.	May 15 – Jul 15
Clark's grebe	<i>Aechmophorus clarkii</i>	Preferred habitats include lakes, marshes, and coasts	No.	Jun 1 – Aug 31
Evening grosbeak	<i>Coccothraustes vespertinus</i>	Breeds in coniferous and mixed forests, also associated with pine trees	Foraging or stopover habitat may occur within the Action Area.	May 15 – Aug 10
Flammulated owl	<i>Otus flammeolus</i>	Breeds in mature, open forests that include ponderosa pine or other large coniferous trees. Will nest in burned forest.	No.	May 10 – Aug 15
Franklin's gull	<i>Leucophaeus pipixcan</i>	Nest in freshwater marshes with abundant emergent vegetation and patches of open water	No.	May 1 to Jul 31

Species	Taxonomy	Habitat	Habitat Present?	Breeding Season
Golden eagle (Protected under BGEPA)	<i>Aquila chrysaetos</i>	Generally, prefers open habitats, surrounded by cliffs, cliff edges, or mountains which is also where they choose to nest.	No.	Jan 1 – Aug 31
Lesser yellowlegs	<i>Tringa flavipes</i>	Shallow lagoons and marshes. Nests on the ground in moss lined with detritus.	Foraging or stopover habitat may occur within the Action Area.	Breeds Elsewhere
Lewis's woodpecker	<i>Melanerpes lewis</i>	Ponderosa Pine Forest, open riparian woodland dominated by cottonwood or logged/burned pine forest.	No. However, the UNHP documents occurrence of this species within 0.5 miles of the Action Area.	Apr 20 – Sep 30
Long-eared owl	<i>Asio otus</i>	Nests in densely wooded areas in trees. Prefers to live in woodlands, conifer groves	No. However, foraging or stopover habitat may occur within the Action Area.	Mar 1 – Jul 15
Marbled godwit	<i>Limosa fedoa</i>	Nest in loose colonies in dry areas of prairie wetlands	Foraging or stopover habitat may occur within the Action Area.	Breeds elsewhere
Olive-sided flycatcher	<i>Contopus cooperi</i>	Montane and Northern coniferous forests, forest edges & meadows as well as ponds/wetlands	No.	May 20 – Aug 31
Pectoral sandpiper	<i>Calidris melanotos</i>	Breeds in wet, coastal tundra areas.	Foraging or stopover habitat may occur within the action area	Breeds Elsewhere
Pinyon jay	<i>Gymnorhinus cyanocephalus</i>	Pinyon-Juniper woodland, sagebrush, scrub oak, and chaparral communities	No.	Feb 15 – Jul 15

Species	Taxonomy	Habitat	Habitat Present?	Breeding Season
Rufous hummingbird	<i>Selasphorus rufus</i>	Nests are built up to 30 feet high in coniferous or deciduous trees. Breed in open or shrubby areas	Nesting or stopover habitat may occur within the Action Area.	Apr 15 – Jul 15
Sage thrasher	<i>Oreoscoptes montanus</i>	Nests in greasewood and sagebrush communities in low elevation deserts throughout the state	No.	Apr 15 – Aug 10
Virginia's warbler	<i>Vermivora virginiae</i>	Typically prefers Pinyon-Juniper woodlands	No.	May 1 – Jul 31
Western grebe	<i>Aechmophorus occidentalis</i>	Freshwater lakes and marshes with extensive open water bordered by emergent vegetation.	Foraging or stopover habitat may occur within the Action Area.	Jun 1 – Aug 31
Willet	<i>Tringa semipalmata</i>	Prefers to inhabit shorelines of marshes, mudflats, coastal beaches, and lakes	Nesting or stopover habitat may occur within the Action Area.	Apr 20 – Aug 5

Sources: U.S. Fish and Wildlife Service's Information, Planning, and Consultation (IPaC) online services, (3), last updated December 19, 2024. Utah Division of Wildlife Resources Natural Heritage Program Online Species Search Report dated August 21, 2023.

3.2.19 Socioeconomics (Local, Regional, National Economy)

3.2.19.1 Occupation and Economy

Approximately 76% of the project area is utilized for agricultural production. Within the project area, there is an expected total agricultural area of 23,732 acres (CropScape, National Agricultural Statistics Service) of 31,148.8 acres in the entire watershed. Agricultural (farmed) land is a major part of the economy of both incorporate and unincorporated lands within Cache County. The local economy relies heavily on agricultural products produced in the project area. Table 3-17 describes the value of agriculture to Cache County. It can be seen that agriculture makes up the economic foundation of the project area. Since 2012, there has been an increase in the market value of products sold in Cache County. This trend is directly correlated with the County's ongoing efforts to increase irrigation efficiency and the overall market trend in crop values (with alfalfa often being a favored crop).

Table 3-16: Agricultural Value in Cache County

Statistic	Cache County	
	2012	2017
Number of farms	1,217	1,397
Land in farms (acres)	268,511	276,273
Average size of farm (acres)	221	198
Market value of products sold	\$142,884,000	\$162,737,000
Average per farm	\$117,406	\$116,796

Source: USDA reports: Utah for 2012 and 2017

3.2.19.2 Population

Data was gathered from the 2020 U.S. Census, including population distribution and population growth in the project area. Tables 3-18 through 3-21 summarize that data.

Table 3-17: Population Distribution by Gender and Age Compared to the U.S.

Socioeconomic Criteria		Cache County	Utah	U.S.
Total Population		133,154	3,337,975	331,893,745
Gender	Female	50.0%	49.6%	50.8%
	Male	50.0%	51.4%	49.2%
Age	Under 5	8.1%	7.7%	6.0%
	5-18	22.0%	21.3%	16.3%
	18 -65	60.1%	59.6%	61.2%
	65 and over	9.8%	11.4%	16.5%

Source: 2020 U.S. Census

Table 3-18: Population Growth Compared to the U.S.

Population Year	Cache County	Utah	U.S.
Total Population 2000	91,391	2,233,169	281,421,906
Total Population 2010	112,656	2,763,885	308,745,538
Total Population 2020	133,154	3,271,616	331,449,281
Projected Population 2029	153,858	3,765,009	350,776,723
Projected Population 2050	207,094	4,969,929	398,330,000

Source: 2020 U.S. Census

Table 3-19: Hispanic or Latino Population Distribution Compared to the U.S.

Ethnicity	Cache County	Utah	U.S.
Hispanic or Latino	10.9%	14.4%	18.5%
Non-Hispanic or Latino	79.1%	85.6%	81.5%

Source: 2020 U.S. Census

Table 3-20: Distribution of Races within the Project Area Compared to the U.S.

Race	Cache County	Utah	U.S.
White	92.9%	90.6%	76.3%
African American	1.1%	1.5%	13.4%
Asian	2.3%	2.7%	5.9%
American Indian and Alaska Native	1.1%	1.6%	1.3%
Native Hawaiian and Pacific Islander	0.5%	1.1%	0.2%
Identified by two or more	2.1%	2.6%	2.8%

Source: 2020 U.S. Census

3.2.20 Land Use (Recreation)

The project area lies within the Wellsville Canyon watershed and Threemile Creek watershed, and includes Wellsville City, Mendon City, and unincorporated Cache County land (see Figure 1-2 and Figure 1-3). Land use in the area includes agriculture, residential, and commercial properties. Although agriculture is still a major activity in the area, many of the residents work outside of these two cities. Irrigation water is supplied to the area through the Wellsville Canal and Hyrum-Mendon Canal from Hyrum Reservoir. The canals are managed by Wellsville-Mendon Conservation District. The Wellsville Reservoir, which is located within the project area, is used for water storage and recreation.

Most of the recreation within the project area takes place in the Wellsville Mountains and on the Little Bear River. There are various trailheads and paths that allow the public to access the mountains. The cities of Wellsville and Mendon both have public parks that will be affected by this project.

Furthermore, Hyrum Reservoir State Park, although not in the project area, is located directly outside of the southeastern boundary of the study area and serves as an important recreational site for locals. Canoe trails, walking paths, and cycling paths also create recreational opportunities for residents living in the project area. Figure 3-11 details the recreational opportunities and land management designations within the project boundary.

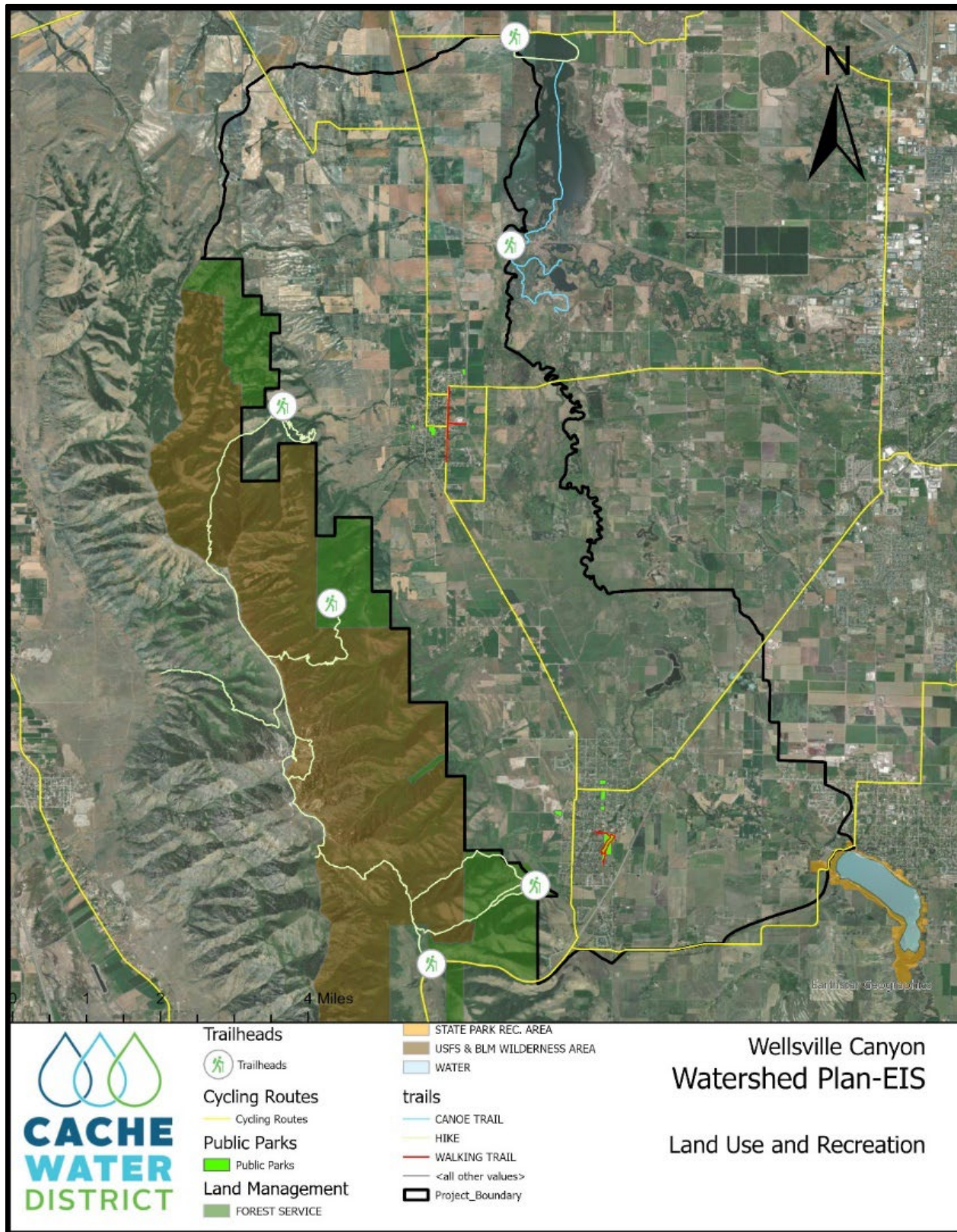


Figure 3-11: Land Use and Recreation in the Project Area

3.2.21 Cultural and Historic Resources & Tribal Consultation

Section 106 of the National Historic Preservation Act of 1966 (NHPA) and Utah Code (UCA) 9-8-404, as amended, mandates that federal agencies take into account the potential effects of a proposed federal undertaking on historic properties. Historic properties include prehistoric or historic districts, sites, buildings, structures, or objects that are included in, or eligible for inclusion in, the National Register of Historic Places (NRHP) (36 CFR 800.16).

The affected environment for cultural resources is identified as the area of potential effects (APE), in compliance with the regulations found in Section 106 of the NHPA (36 CFR 800.16). The Area of Potential Effects (APE) is defined as “the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist. The area of potential effects is influenced by the scale and nature of an undertaking and may be different for different kinds of effects caused by the undertaking” (36 CFR, 800.16(d)). A map of the direct APE is included in section 1.4.3 (Figure 1-4) and a figure showing the Indirect/No Action APE is included in the Cultural Resources Report in Appendix E. See section 1.4.3 for a description of the direct and/or indirect APEs for this project.

To be eligible for listing on the NRHP, a cultural resource must possess integrity in at least one of the following qualities: significance in American history, architecture, archeology, engineering, or culture. These qualities must be present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, association, and that:

- A. Are associated with events that have made a significant contribution to the broad patterns of our history; or
- B. Are associated with the lives of significant people in our past; or
- C. Embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
- D. Have yielded, or may be likely to yield, information important in prehistory or history.

Collectively, the indirect APE contains 24,322 acres, while the direct APE encompassed 847.60 acres. The visual APE encompassed all archaeological sights within 660 feet from each bank of the channel (i.e., the canal watershed). To identify historic properties within the direct APE, per 36 CFR 800.4, and, in consultation with the Utah State Historic Preservation Office (SHPO) applicable THPOs/Tribes, and the USBR and USFS, a cultural resource inventory was conducted by Certus Environmental Solutions from November 18–December 5, 2021, (when project was a Plan-EA) and again from June 11-17, 2024, based on APE and schedule changes as a result of the project’s transition to a Plan-EIS. A total of 975 acres were intensively surveyed, including 50- to 100-foot-wide linear corridors in the proposed work and staging areas depending on the nature of the proposed improvements. The surveyed area consisted of 921 acres of private land, 5 acres of USFS, and 49 acres within USBR Rights-of-Ways. The principal investigator, Sheri Ellis, exceeds the Secretary of the Interior’s (SOI) qualifications in archeology and architectural history. The inventory included a file search and intensive field survey aimed at identifying historic properties within the direct APE.

The survey identified 13 cultural resources sites within the APE. Per 36 CFR 800.4(c), the NRCS evaluated the sites for their eligibility to the NRHP (Table 3-21). Of those sites, the NRCS determined that 8 are eligible for listing on the NRHP under the A-D criteria.

As part of the desktop study performed by Certus for the indirect APE (breach inundation zone), a total of 352 cultural resources, including archaeological sites and historical buildings and/or structures, were identified. Of the 352 identified sites, 11 archaeological sites and 341 historic buildings/structures are eligible for the NRHP.

Further details on the Indirect APE (24,322 acres) may be found in the redacted cultural resources report located in Appendix E. A redacted report with detailed information on methodology and the identified cultural resources is included in Appendix E.

Table 3-21: Cultural Resources in the Project Area

Site No.	Cultural Resource Sites	Site Eligibility	Eligibility Criteria
42CA88	Utah Northern Railroad/Union Pacific Railroad	Eligible	Criterion A, Criterion C
42CA174	Wellsville-Mendon Lower Canal System	Eligible	Criterion A
42CA184	Wellsville-Mendon Upper Canal System	Eligible	Criterion A
42CA198	Wellsville Canal/East Field Lateral	Eligible	Criterion A
42CA322	Mendon South Canal	Eligible	Criterion A
42CA337	Ogden, Logan, & Idaho Railroad	Eligible	Criterion A, Criterion B
42CA338	Stone Foundation & Fire Ring	Eligible	Criterion A, Criterion D
42CA339	Mendon Cemetery	Eligible	Criterion D
42CA340	Wellsville Dam & Reservoir	Ineligible	None
42CA341	Wellsville Cemetery	Eligible	Criterion D
42CA342	Mendon Main Street Culvert & Rock Wall	Ineligible	None
NA	Wellsville 200 East Culvert	Ineligible	None
NA	Wellsville Canyon Creek Bridge (Structure 005051D)	Ineligible	None

Source : Cultural Resources Report (Certus Environmental Solutions, 2024)

As lead federal agency, and per Section V.c.1 the NRCS State Prototype Programmatic Agreement with the Utah SHPO, the NRCS provided its proposed APE, identification of historic properties, and assessment of effects in a single transmittal to the Utah SHPO and Wellsville Certified Local Government (CLG) on February 12, 2025, to seek their concurrence. SHPO concurrence was received for the APE and site eligibility on March 1, 2025. No response was received from the Wellsville CLG. The NRCS consulted with the USBR and USFS via email on February 13, 2025, with an overview of the undertaking, APE, and noting that although 49 acres of USBR ROW and

5 acres of USFS-administered lands were intensively inventoried, none of those areas are within the final APE. The USBR deferred Section 106 responsibilities to the NRCS (Appendix A). Consultation letters were sent to THPOs/Tribes on February 12, 2025, and received by February 19, 2025. Consistent with 36 CFR 800.4, consultation included the delineation of the Area of Potential Effects (APE) and determinations of site eligibility. Follow-up emails were sent in April 2025, and phone calls in May 2025). There were no responses from THPOs/Tribes. Documentation of this process may be found in the Tribal consultation table in Appendix A. Consistent with the scope of this section, discussion of the effects determination, resolution of adverse effects, and associated consultation is provided in Chapter 5. The NHPA Section 106 consultation process is described in detail in Chapter 7 of this Watershed Plan-EIS.

The Tribes that were consulted are listed below:

- Eastern Shoshone Tribe of the Wind River Reservation, Wyoming
- Northwest Band of the Shoshone Nation, Utah
- Shoshone-Bannock Tribes of the Fort Hall Reservation, Idaho
- Ute Indian Tribe of the Uintah & Ouray Reservation, Utah

The other NHPA Section 106 Consulting Parties contacted as a part of the consultation process were:

- Bureau of Reclamation (deferred Sec. 106 responsibility to NRCS, see Appendix A)
- Wellsville Certified Local Government

3.2.22 Public Health and Safety

Flooding has historically been a problem in western Cache County, as previously explained in section 2.2.1.1. Significant flooding occurs in Wellsville City, Mendon City, and the unincorporated county between Wellsville and north of Mendon. Flooding is the result of aging and undersized culverts and the canals overtopping or breaching during flooding. The overtopping and breaching canals risk causing a flood wave to occur. This is a potential risk to life, particularly in Mendon, where a sudden breach could occur at night based on risk assessments completed as part of Cache County hazard assessments following the 2009 Logan City Canal Breach and subsequent emergency response meetings (Discussions with Logan City 2007-2017 Planning Section Chief, 2021).

Several flood channels in Wellsville and Mendon pass through the cities. Runoff from the agricultural dryland farms which exist on the alluvial plains above the canals overwhelm these flood channels and the drainage systems within the communities and flood the homes and businesses. Open canals in the area also present a water hazard and drowning risk to children as identified in public meetings.

3.2.23 Scenic Beauty and Visual Resources

Both natural and constructed features contribute to the visual resources within the project area, including mountain views and riparian vegetation along open waterways. Viewers, including residents and recreationists, have a perception of the existing physical characteristics and quality of the environment. The viewshed in the project area consists of mountains, residential properties, and agricultural lands.

3.2.24 Transportation Infrastructure

Transportation in the project area consists of narrow country roads, city roads, SR-23, and US 89/91. These county, city, and state roads are often the primary methods of transportation for both labor and shipping. Additionally, these roads are highly susceptible to flood damage during flood events resulting in the failure of the sub-grade, road base, and asphalt. During these periods, as shown in Chapter 2, the roads can be covered with flood debris and made unsafe to pass through. For example, SR-23 has a drainage of concern that crosses it within 0.25 miles of Wellsville Elementary School. SR-23 is a primary North/South road on the west side of the valley and is redundant for Highway 89 in case of emergencies.

3.2.25 Ecosystem Services

During the scoping process, ecosystem service benefits that currently exist in the watershed were identified. The scoping process identified provisioning, regulating, and cultural services in the watershed. The services identified also included intermediate supporting services, which is why those services were not carried forward in the ecosystem services analysis. The entire ecosystem services analysis is documented in the PR&G Ecosystem Services Scoping and Evaluation Worksheet located in Appendix E.

The provisioning services in the area result from cultivated cropland areas and the use of the local groundwater for culinary (drinking) water. Currently, the main crops grown on the agricultural lands in the area include alfalfa, safflower, barley, other hay/non-alfalfa, and fallow/idle cropland, among others (see Figure 3-2). These areas produce direct benefits from harvested crops that are used for various purposes, including as livestock feed (meaning the service also contributes to meat production). The water for these crops comes from the canals in the watershed. However, as described earlier, the watershed currently experiences water losses due to seepage and evaporation that can lead to difficulties accessing secondary water during the late irrigation season.

Regulating services in the project area serve as buffers against environmental catastrophe. Currently, there are limited flood control capabilities in the watershed that lead to frequent flooding events and flooding off of the alluvial plains above the canals as well as in the local canyons. These floods reduce the ability of the watershed to provide public safety regulating services (i.e., flooding impedes access to emergency services, including 9-1-1 services, due to the limited options for access to many of the areas in the watershed). Water quality in the Little Bear River is listed as impaired for Beneficial Use Class 3A in the TMDL. This is due to high levels of total phosphorus and hydrologic modification. Hydrologic modification, which occurred in the lower segment of the Little Bear River in the past and involved channelization, has led to continued streambank erosion, and increases in the sediment loads reaching the river. The area is already suffering the effects of long-term climate trends which predict more frequent extreme weather events, including flooding and drought. The area does not currently have the regulating services needed to buffer against these long-term trends to any significant extent.

Cultural services are present, although limited, in the watershed. There are opportunities for walking, hiking, cycling, and other outdoor activities. However, the area lacks access to Wellsville Reservoir. There is an inherent aesthetic value to the visual environment in the study area which includes the canals, nearby mountains, and structures in the floodplain. There is also an inherent existence value tied to the 13 cultural/historic sites identified in the Cultural Resources survey report.

3.3 Forecast Future Conditions

The forecasting of future conditions in the watershed serves as a method to establish an analytic baseline against which the formulated alternatives may be compared against. This forecast considers all reasonably foreseeable large-scale processes in the natural, human, and economic environments. These forecasts are made to establish reasonably foreseeable impacts under the No Action/Future Without Federal Investment (FWOFI) alternatives.

The subsections below summarize the forecasted future conditions in environmental and socioeconomic resource conditions within the watershed in response to ongoing long-term processes.

3.3.1 Environment

The Utah State Hazard Mitigation Plan (SHMP) includes a chapter that provides documentation of the expected future conditions for the state based on ongoing climate trends. It is expected that Utah will experience temperature increases, although how much temperatures will increase is not known (SHMP, 2019). These same models predict an overall decrease in precipitation throughout the southwestern United States (SHMP, 2019). If these forecasts hold true, Utah will experience increased drought frequency as a result of the increasing temperatures. This will, in turn, have an impact on the frequency and severity of wildfires. The general trend nationwide is that more extreme weather patterns are expected, meaning that not only may drought become more frequent, but that flooding may also become more frequent as well. Extreme precipitation associated with monsoonal rainfall and warming temperatures will likely increase the number of flood events in Utah (SHMP, 2019). The ecological makeup of the state would be impacted. Increased average air and soil temperatures would likely favor botanical species more adapted to these soil conditions. Additionally, insects and pests would likely become more prevalent as the die-off period would not be as intense or last for as long.

If existing conditions in the watershed were allowed to continue, it could be reasonably forecasted that erosional and sedimentation processes would continue to nutrient load the Little Bear River and its tributaries, especially during flood events. The water quality of the river would continue to be impeded and aquatic ecosystems and riparian areas along and near the river would continue to be impaired as a result.

3.3.2 Society

As flood events continue to occur and become more frequent as a result of long-term climate trends, the watershed would continue to endure risks to life, injury, property, and agricultural fields. Additionally, the functionality and sustainability of the floodplain would continue to be impeded and hindered by flood events, which is not in line with the PR&G Guiding Principles of Floodplain Protection. As existing conditions continue, it can be reasonably forecasted that, at some point in the future, the flood identified in the Indirect APE/No Action APE would occur. This would damage more than 750 cultural/historic properties in the watershed, depleting critical cultural services in the watershed.

3.3.3 Economy

Of course, future flood damages would continue to cost the local community money to mitigate. If no action is taken as a part of this project, the local economic conditions would have to continue

to endure flood damage and their ensuing costs, which is not in line with the PR&G Guiding Principle of Sustainable Economic Development.

Crop yields would likely decrease in the watershed as secondary water conveyance, access issues would continue, and seepage and evaporation losses would continue. Culinary water costs could increase due to the increased demand for the groundwater due to culinary water being used for irrigation.

3.3.4 Ecosystem Services

The provision of the three ecosystem services considered in this Plan-EIS would continue to degrade if existing conditions were allowed to continue. Provisioning Services would deteriorate as farmland quality would continue to be diminished with continued flooding and loss of topsoil, leading to decreased crop yields. Regulating Services would remain in poor condition and would likely become more desperately needed in light of increased flood and drought frequency predicted by long-term climate trends. Cultural services would remain in their existing state, with limited access to the outdoors at Wellsville Reservoir. Additionally, the cultural and historic sites in the Indirect APE would eventually be damaged or destroyed as a result of the Indirect APE flood event.

4.0 Formation of Alternatives

4.1 Alternative Formulation Process

Numerous action measures in three PL 83-566 categories (flood prevention, agricultural water management, and public recreation) were identified in the development of action alternatives. The process of formulating alternatives was the basis for selecting combinations of measures to include as the Preferred Alternative.

The alternative development process for this Draft Plan-EIS followed the procedures outlined in the USDA-NRCS NWPM (NRCS 2024) Parts 500 through 506, USDA-NRCS National Watershed Program Handbook (NRCS 2014) Parts 600 through 606, Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies (U.S. Water Resources Council [USWRC] 1983), Guidance for Conducting Analyses Under the Principles, Requirements, and Guidelines (PR&G) for Water and Land Related Resources Implementation Studies and Federal Water Resource Investments (DM 9500-013) and other applicable NRCS watershed planning policies.

As discussed in Chapter 2 of this Plan-EIS, the watershed is susceptible to significant problems and damages associated with intense rain-on-snow flood events. Additionally, the cities of Wellsville and Mendon do not have a reliable supply of secondary water, and the Lower Canal and Wellsville East Field Canal currently experience significant annual water losses to seepage (see Appendix B, Project Options Maps, for canal locations).

There are limited recreational opportunities in the area, with public access to Wellsville Reservoir limited. Additionally, recreational opportunities in Mendon City, while present, are primarily targeted towards physical activity rather than visual/aesthetic enjoyment, creating a need for an aesthetically pleasing recreational space in Mendon City.

Conceptual flood control, agricultural water management, and public recreation management measures were identified and presented to the public and interested agencies at a public scoping meeting (Appendix A). These measures were then screened for pairwise compatibility and combined into an Initial Array of alternatives. The Initial Array was then taken through two rounds of screening to arrive at the Final Array of alternatives.

An important component of alternative formulation is understanding how the entire PR&G framework fits into the process. Figure 4-1 describes the complete PR&G process and shows how the Proposed Actions are all tied to the PR&G Guiding Principles and the Ecosystem Services Framework which then brings about a social value.

4.1.1 Guiding Principles & Alternatives Required to be Developed

Alternatives were developed in accordance with the PL-566 program guidelines to address the purpose (see section 2.1) and need (see section 2.2) and the following guiding principles of the PR&G (DM9500-013 pg. 21):

- **Healthy and Resilient Ecosystems:** A primary objective is to identify alternatives that will protect and restore the ecosystem functionality by 1) avoiding adverse impact, then 2) minimizing impacts with mitigation of any unavoidable damage, and finally 3) full mitigation to offset environmental damage. Mitigation must be included in the alternative development, design, and costs.

- **Sustainable Economic Development:** The alternatives should consider both the quantity and quality of water for both present and future generations as part of a larger economic and environmental evaluation to ensure that future projects are both economically feasible and sustainable for both the local and national best interests. The alternative should reduce uncertainty and risks, allowing a full range of adaptable management options to maintain project feasibility in the future.
- **Floodplains:** The alternatives must seek to avoid adverse impacts to flood prone areas and floodplains and, where possible, improve floodplain sustainability and functionality.
- **Public Safety:** DM 9500-013 states, “An objective of PR&G is to reduce the risks to people including life, injury, property essential public services, and environmental threats concerning air and water quality.” Public safety, and improvement to public safety, using nonstructural and structural options must be considered.
- **Environmental Justice:** The PR&G process requires that the alternatives provide fair treatment to all people through all stages of the process. The disproportionate impact on minorities, Tribal, and low-income populations is not allowed.
- **Watershed-Scale Approach:** This approach recognizes that there may be impacts both upstream and downstream of the project area and the applicable political or administrative boundaries. Under most conditions, it is necessary to evaluate the impacts beyond just a single hydrologic unit.

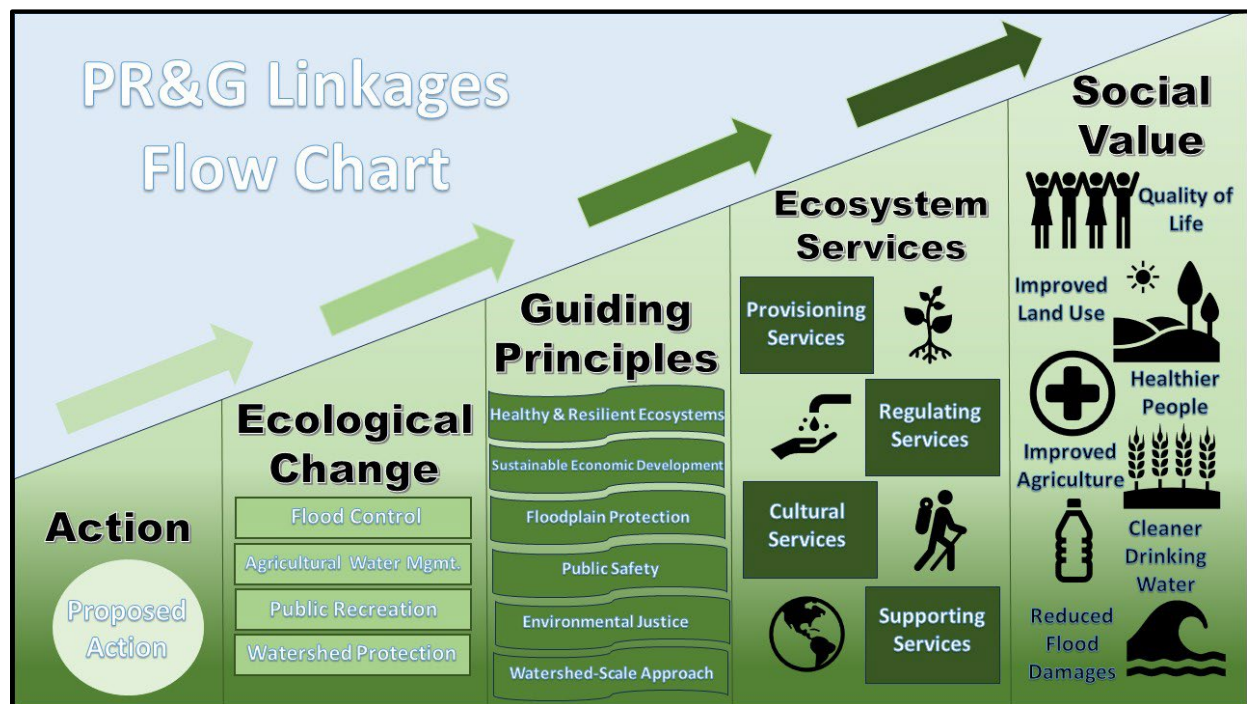


Figure 4-1: PR&G Linkages Flow Chart (NRCS)

The PR&G mandates that a wide range of alternatives be developed including a Future without Federal Investment (FWOFI) Alternative (also called a No Action Alternative), a Nonstructural Alternative, a Locally Preferred Alternative, and an Environmentally Preferred Alternative (from NEPA) which is comparable to the Least Environmentally Damaging Practicable Alternative

(from USACE). Each of these Alternatives are identified in this chapter. A more detailed description of each alternative required to be developed is provided below.

- **Future without Federal Investment (FWOFI) or No Action:** This is the baseline against which all other alternatives are compared and evaluated. This is required by NEPA and should always be included as part of PR&G.
- **Nonstructural Alternatives:** These are alternatives that alter the use of existing infrastructure or human activities to avoid or minimize adverse changes to existing hydrologic, geomorphic, and ecological processes.
- **Locally Preferred Alternative:** This alternative is developed in cooperation with sponsors and local interests that have oversight or implementation authorities and responsibilities.
- **Environmentally Preferable Alternative (from NEPA) and Least Environmentally Damaging Practicable Alternative (LEDPA) (USACE):** An environmentally preferable alternative is required to be identified by the NEPA process but is not required to be the selected/implemented alternative. Additionally, if a Clean Water Act section 404 permit (any potential impacts to wetlands or WOTUS) is required, the principles of LEDPA should be followed and complied with during the development of alternatives. This is best accomplished via the principles of first, avoidance, then, minimization, then, and only then, mitigation.
- **Additional Alternatives:** These are alternatives that are needed to address additional federal, state, or local concerns not addressed by the alternatives above.

4.1.2 Alternative Formulation Criteria

The SLOs, NRCS, and agency/public stakeholders adhered to the following alternative plan formulation process that included the following phases:

- **Phase I:** Identification of deficiencies resulting from the identified project need.
- **Phase II:** Formulation of potentially suitable management measures to address each identified deficiency.
- **Phase III:** Evaluation of pairwise compatibility for each measure against one another to form a viable alternative that addresses all problems and the purpose and need.
- **Phase IV:** Combination of the remaining measures into an Initial Array of alternatives.
- **Phase V:** First screening of the Initial Array against the Federal/Project Objectives and the project Constraints.
- **Phase VI:** Second screening of the Initial Array against the ecosystem services and the Benefit-Cost Ratio (BCR)/Net Benefits.
- **Phase VII:** Identification of the Final Array of Alternatives

The PR&G plan criteria (PR&G Chapter 2, Item 1(H)) include completeness, effectiveness, efficiency, and acceptability. These criteria were used in the screening of the Final Array of alternatives as one metric to identify the Preferred Alternative. These criteria, however, were used only as targets and not as formal screening criteria during the screening of the Initial Array of alternatives (which relies more on objectives, constraints, ecosystem services, and economic benefits).

4.1.3 Risk and Uncertainty

As described in NWPM 501.42(B)(1)(b), risk and uncertainty are inherent in the watershed planning process. Risk refers to those outcomes that can be described using well-known probability distributions and uncertainty refers to potential outcomes that cannot be described in objectively known probability distributions. Risk and uncertainty are inherent as they originate from the underlying variability of complex natural, social, and economic conditions.

It can be reasonably predicted that extreme weather events including drought, wildfires, land cover changes, and floods will continue or increase over time and would result in immediate adverse impacts; the exact frequency and intensity of these events cannot be known. Changes in agricultural practices/cover and urbanization/population growth can influence the timing and intensity of these events but cannot be reasonably known at this time. Depending on the actual future conditions, the project/alternatives may be less effective at solving the identified problems.

4.1.4 Formulation Process

This subsection presents the formulation of alternatives in more detail, drawing upon the results of the seven-phase formulation criteria plan presented in section 4.1.2 above. The full alternative formulation process is documented in the Alternative Formulation and Screening Matrix located in Appendix E. The process is further summarized in Appendix D.

4.1.4.1 Phase I: Identification of Deficiencies

The SLOs and stakeholders identified locations within the watershed that experience issues associated with one or more of the project problems (i.e., flood prevention, agricultural water management, and public recreation). From these identified locations, a set of nine deficiencies were identified for the project area. The identified deficiencies are listed in Table 4-1.

Table 4-1: Identified Deficiencies

Number	Deficiency Description
1	Mendon Flooding at Deep Canyon, 300 North, 400 North, Cemetery Ditch, 100 East, Bird Canyon, and Center Street
2	Mendon 500 North Detention Basin Catch Pond Capacity, 400 North Flooding, and Flooding at Threemile Canyon/Yonk Loop North of Mendon
3	Mendon Pond Stream Diversion Structure and Culvert Capacities at Main Street, 100 South, 400 South, and an Unnamed Channel South of Bird Canyon
4	Wellsville-Mendon Lower Canal Flood Control Capacity & Nutrient Loading/Erosion to the Little Bear River
5	Wellsville Wide Canyon Flooding
6	Wellsville and Mendon Cities Secondary Water Access
7	Wellsville-Mendon Lower Canal Water Conveyance and Seepage Issues
8	Wellsville East Field Canal Water Conveyance and Seepage Issues
9	Wellsville Reservoir and Mendon Cemetery Impaired Recreational Access and Lack of Cultural Services

4.1.4.2 Phase II: Formulation of Potentially Suitable Management Measures

This phase identified potential management measures for each of the deficiencies identified in Phase I and qualitatively evaluated them for their suitability as a potential component of a fully fleshed out alternative plan. Certain measures were eliminated based on a variety of factors which are discussed in detail in section 4.3. A total of 21 potential management measures passed and were carried forward for Phase III. The qualitative evaluation of all considered measures is documented in the Alternative Formulation & Screening Matrix located in Appendix E.

4.1.4.3 Phase III: Pairwise Compatibility of Each Measure

Phase III took each of the 21 potential management measures and screened them for pairwise compatibility to be combined into a full alternative plan. This Plan needed to address three problems—Flood Prevention, Agricultural Water Management, and Public Recreation—which required a combination of enough measures to address each of the problems and opportunities in a single alternative. Most of the measures were compatible with one another as an alternative component. However, certain measures (e.g., nature-based and nonstructural measures) were only compatible with a particular set of measures and so warranted their carrying forward to generate other alternatives. Other measures were mutually exclusive (e.g., piping the Lower Canal versus lining the Lower Canal). The full pairwise compatibility assessment is located in the Alternative Formulation & Screening Matrix in Appendix E.

4.1.4.4 Phase IV: Combination of Measures into Initial Array of Alternatives

This phase took each of the management measures deemed to be compatible with one another as a component/increment of a full alternative and identified a wide Initial Array of alternatives. Each full alternative, in theory, addressed the identified problems and opportunities. The Initial Array of alternatives is listed in Table 4-2.

Table 4-2: Initial Array of Alternatives

Alternative Name	Where Described in Plan-EIS
No Action/FWOFI Alternative	See section 0
Action Alternative 1 – Piping Alternative	See section 4.2.2
Action Alternative 2 – Lining & Buyouts Alternative	See section 4.2.3
Action Alternative 3 – Lining Alternative	See section 4.3
Action Alternative 4 – Piping & Filling Alternative	See section 4.3

4.1.4.5 Phase V: First Screening of the Initial Array

This phase includes the first screening of the Initial Array against the following criteria:

- A. The Federal Objective (see section 2.1.1)
- B. The Project Objectives (see section 2.1.2)
- C. The Project Constraints (see section 2.1.3)

This screening was also qualitative and assessed the ability of each of the alternatives to meet the project objectives and meet the avoidance/minimization criteria of the project constraints. The full

screening is described in more detail in the Investigations and Analysis Report (Appendix D) and is documented in Appendix E. The results of the first screening are described in Table 4-3.

Table 4-3: Results of First Screening of Initial Array of Alternatives

Alternative	Carried Forward?	Rationale
No Action/FWOFI Alternative	Yes	Although the alternative does not meet the objectives/constraints criteria, the baseline alternative is required to be carried forward into the Final Array.
Piping Alternative	Yes	The Piping Alternative meets the Federal Objective, Project Objectives, and avoidance and minimization criteria of the Project Constraints. Carried forward.
Lining & Buyouts Alternative (Nonstructural Alternative)	Yes	The Lining & Buyouts Alternative meets the Federal Objective, Project Objectives, and avoidance and minimization criteria of the Project Constraints. Carried forward. This alternative also fulfills the requirement of a nonstructural alternative in the Final Array.
Lining Alternative	Yes	The Lining Alternative meets the Federal Objective, Project Objectives, and avoidance and minimization criteria of the Project Constraints. Carried forward.
Piping & Filling Alternative	No	The Piping & Filling Alternative, while a nature-based solution, does not meet the Federal Objective or the objective for Flood Control. Additionally, the alternative does not meet any of the avoidance or minimization criteria of the Project Constraints. Not carried forward.

4.1.4.6 Phase VI: Second Screening of the Initial Array

This phase includes the second screening of the Initial Array of alternatives against the following criteria:

- A. The Four Ecosystem Service Categories (provisioning, regulating, supporting, and cultural)
- B. The Benefit-Cost Ratio (BCR) and Net Economic Benefits

This screening was both qualitative (ecosystem services) and quantitative (economics) and assessed the ability of each of the alternatives to meet and improve the provision of each ecosystem service category in the watershed and meet the minimum BCR of 1.0 or higher.

The full screening is described in more detail in the Investigations and Analysis Report (Appendix D) and is documented in Appendix E. The results of the second screening are described in Table 4-4.

Table 4-4: Results of Second Screening of Initial Array of Alternatives

Alternative	Carried Forward?	Rationale
No Action/FWOFI Alternative	Yes	Although this alternative does not improve the provision of any ecosystem service categories, it is carried forward into the Final Array because it represents the baseline condition against which action alternatives are evaluated and is required under NEPA and the PR&G..
Piping Alternative	Yes	The Piping Alternative would improve the delivery of provisioning, regulating, and cultural ecosystem services in the watershed and would meet the BCR requirement, with a BCR of 2.46 and net benefits of \$8,749,147.
Lining & Buyouts Alternative (Nonstructural Alternative)	Yes	The Lining & Buyouts Alternative would improve the provision of provisioning, regulating, and cultural ecosystem services in the watershed & would meet the BCR requirement, with a BCR of 1.73 and net benefits of \$5,819,942. Although the benefits are not as high as in the Piping Alternative and because this alternative is a nonstructural-structural combination alternative, which is required for flood prevention projects under NEPA and the PR&G, it was carried forward to the Final Array despite its inability to meet all the screening criteria.
Lining Alternative	No	The Lining Alternative was eliminated based on its inability to improve the provision of the ecosystem services in the watershed and did not make it to the full economic analysis. So, although this alternative would have likely had a viable BCR, the alternative left significant issues related to regulating services (safety hazard of the open channel canal) and provisioning services (evaporation out of the canal) that could be better addressed by the Piping Alternative, which also meets the economic criteria.

4.1.4.7 Phase VII: Identification of the Final Array of Alternatives

The final plan formulation phase identified the Final Array of Alternatives based on the two screening processes conducted and also identified the:

- Environmentally Preferred/LEDPA Alternative (from NEPA), and
- the Locally Preferred Alternative (PR&G)

The Final Array of Alternatives is described in section 4.4.

4.2 Alternatives Considered

The following alternatives were brought forward for detailed analysis. The individual management measures included under each alternative are described in this section. The measures are classified into increments, which comprise the basic unit of evaluation for the economic analysis that was performed for the Alternatives in the Final Array. An increment is a project evaluation unit that could be installed as a standalone measure and still provide benefits to the community. When all the increments are taken together, they comprise a full Alternative that includes multiple projects that would provide benefits.

4.2.1 No Action /Future Without Federal Investment (FWOFI) Alternative

Taking no action would consist of activities carried out if no federal action or funding were provided. This alternative would not address the flooding that has occurred historically. The canals would be maintained in their existing condition as earthen and worn out HDPE-lined channels. The WMCD Lower Canal and existing flood drainages within the communities of Wellsville and Mendon as well as unincorporated Cache County would continue to overtop during flood events and flooding in the Wellsville Canyon watershed would continue. It was this flooding that led Cache County Public Works in cooperation with the WMCD to strategically breach the WMCD Lower Canal during the 2017 rain on snow event referenced in the Hydrology tech memo located in Appendix E (TM002). Additionally, erosion and sedimentation from the alluvial plains above the canals would continue under this alternative. There would be no improvements to recreational access installed.

The No Action Alternative would not meet the project's Purpose and Need and would not solve the Problems (PL-566 authorized purposes) or meet the objectives identified in Chapter 1 as the existing infrastructure would continue to operate in its current condition and would not improve flood prevention, conserve irrigation water, or improve recreational access. Residents would continue to use culinary water for irrigation (that is, watering lawns and gardens), putting stress on existing water supply and infrastructure. This alternative would not meet the Federal Objective to protect the environment and promote sustainable economic development. Additionally, the No Action Alternative would not successfully meet the PR&G Guiding Principles of Healthy and Resilient Ecosystems, Sustainable Economic Development, Floodplains, Public Safety, or Watershed Approach.

The No Action/FWOFI alternative will serve as the analytical baseline throughout the remainder of this Watershed Plan-EIS against which the other alternatives included in the Final Array may be compared against (along with each other).

4.2.2 Action Alternative 1 – Proposed Action – Piping Alternative

4.2.2.1 Overview of Alternative

The Piping Alternative would continue to divert the water for WMCD from below Hyrum Reservoir at the existing diversion points. However, this alternative would then convey the irrigation water of the Wellsville-Mendon Lower Canal through a pressurized piped system in Wellsville and Mendon cities and part of unincorporated Cache County, Utah. The existing Lower Canal would be improved to carry floodwater by cleaning the cross-section and improving the capacity of the canal, lining it with concrete-canvas lining (long life, low maintenance, and hydraulically efficient) to carry the 100-year flood flow without overtopping and add open channel overflow systems at 200 West (Wellsville), 2900 South and 3400 South (unincorporated Cache County), and 200 South (Mendon). This would be accomplished through a combination of conduits and channel improvements to convey floodwater from the foothills of the Wellsville Mountains to the natural floodplain of the Little Bear River east of the communities. This would also include the abandonment of the existing Murray Spring overflow system due to the insufficient channel and culvert capacities, construction of flow diversion structures in the channels, and piped overflow systems at 200 West (Wellsville), 3400 South and 2900 South (unincorporated Cache County) and 200 South Mendon. Additional flood control pipelines capturing flood flows from Wide Canyon (Wellsville), Bird Canyon (Mendon), Thimbleberry Canyon (Mendon), 300 North (Mendon), and 400 North (Mendon) would also be constructed.

Although both the pressurized irrigation pipeline and flood conveyance improvements occur within the Lower Canal corridor, they represent separate works of improvement serving distinct PL-83-566 authorized purposes. The pipeline conveys irrigation water for agricultural water management, while channel modifications and spill structures are designed solely for flood routing. Costs and benefits associated with these measures are evaluated independently.

This alternative would also pipe and enclose a portion of the Wellsville Eastfield Canal, beginning near the edge of the Bureau of Reclamation's property near the existing diversion at the base of Hyrum Dam and passing through Hyrum and parts of unincorporated Cache County.

The alternative would also completely pressurize Wellsville City Irrigation Company's irrigation system within Wellsville City and Mendon City's irrigation system managed by the Mendon North, Mendon Central, Mendon South, Mendon Second North, Greater Mendon irrigation companies, and other irrigation companies. This alternative would install regulating ponds to stabilize peak demands on the pressurized irrigation systems. A new access ramp limited to non-motorized personal watercraft would be built at Wellsville Reservoir for recreational activities and a reflection pond installed at Mendon Cemetery.

The specific management measures selected for inclusion in this alternative plan are described in the following subsections.

4.2.2.2 Channel Improvements

Lower Canal – Wellsville, Mendon, and Unincorporated Cache County

The Piping Alternative involves using the existing Lower Canal as a collection and conveyance channel for floodwater. This measure would be installed with the piping and pressurization of the Lower Canal irrigation water discussed later in this section. The irrigation piping and flood conveyance improvements are separate works of improvement serving distinct authorized

purposes and are evaluated independently. Under the current conditions, the canal already functions in this capacity to some degree. This measure would consist of leaving the canal open for flood management if irrigation flows in the Lower Canal are delivered by a pipeline. Cache County, Wellsville City, and Mendon City all understand that an agreement would be necessary for each entity to take responsibility for the operation and maintenance of the canal for flood control in this scenario.

Additionally, channel improvements would be completed to improve the capacity of the Lower Canal for flood conveyance since the existing irrigation canal has insufficient capacity during flood events as demonstrated in the 2017 and 2005 flood events discussed in the Hydrology Tech Memo (Appendix E) and reflected in the Flood Inundation Memo (Appendix E). The channel has been evaluated using the 50-year hydrologic flows as the basis of design with a minimum of one foot of freeboard. The system was then evaluated to ensure there isn't overflowing during the 100-year event. Some of these improvements would include increasing channel capacity by widening some sections, flattening the side slopes from 1.5:1 (h:v) to 2:1 in some sections, and replacing the failing LDPE linings in other sections with a concrete-canvas lining and new spill locations (discussed later) to allow the canal to be maintained as a flood management channel.

Bird Creek – Mendon City

Channel improvements would take place along Bird Creek in Mendon between 100 West and 100 East. These improvements would consist of channel shaping and cleaning along that segment of the Bird Creek drainage to reduce flood risks and damage associated with this area of the city. These channel improvements would be accomplished in accordance with the Utah Field Office Technical Guide (FOTG), National Engineering Handbook (NEH), and NRCS Standard Practices.

4.2.2.3 Culverts

Although the PL 83-566 program does not fund culverts, the project sponsors have decided to include them as associated features within the Piping Alternative and fund them through non-federal sources. Funding for all culvert improvements would be the responsibility of Wellsville City, Mendon City, or Cache County. Culverts will be designed to meet applicable NRCS Conservation Practice Standards (Code 578) during final design. Associated costs are included in the economic analysis consistent with NWPM 501.80.

Bird Creek Culverts – Mendon City

The culvert beneath 100 West (SR-23) would be enlarged to accommodate the capacity needed of the design storm. Because culverts are not funded by the PL-566 program, the Utah Department of Transportation (UDOT) would pay for the implementation of the culvert beneath 100 West. Mendon City would pay to increase the size of the culvert at Main Street and 100 South at 50 East in order to pass the design storm. Additional culvert improvements at 5400 West would be paid for by Cache County to pass the design flow. Crossings in the public right of way were sized as reinforced concrete boxes (RCB) with concrete improved headwalls providing IL-94 loading under the current AASHTO requirements. Table 4-5 shows those crossings which need to be replaced under this measure. Sponsors have identified and prioritized these measures.

Table 4-5: Bird Creek Culvert Improvements

Location	Size and Type	Length
100 West (UDOT)	6 ft x 4 ft RCB	100 feet
Main Street (Mendon)	7 ft x 4 ft RCB	100 feet
100 South 50 East (Mendon)	7 ft x 4 ft RCB	100 feet
5400 West (Cache County)	8 ft x 4 ft RCB	60 Feet

WMCD Lower Canal Crossings – Cache County, Wellsville City, Mendon City

Each individual culvert crossing was evaluated based on the existing layout and size and the predicted flows under the conditions of this alternative. Those that did not provide adequate capacity were sized according to the 100-year flows to ensure they did not provide any backup or canal bank overtopping. Crossings in the public right-of-way were sized as reinforced concrete boxes (RCB) with concrete improved headwalls providing IL-94 loading under the current AASHTO requirements. Those culverts that are private were sized using NRCS criteria for farm equipment crossings (HS-10 loading) unless it was determined greater loading was required at present or in the future. For the private crossings, HOBAS pipe embedded 1 foot into the canal bottom to maximize the hydraulic cross section available for flows are used as determined by the WMCD. These pipes, while not as hydraulically efficient, provide the hydraulic capacity in most instances with the required earth cover. However, in instances where a single HOBAS pipe was inadequate, RCB was utilized. Table 4-6 summarizes those crossings which needed to be replaced under this measure. Sponsors have identified and prioritized these measures. At this point, it has not been determined if the private crossings will be paid for by the individual owners or by the sponsors, possibly using other available funds. However, it is understood that federal funds will not be available for the culvert crossings. Associated installation costs for these culverts are included in the economic evaluation regardless of funding source.

Table 4-6: WMCD Lower Canal Crossings

Location	Size and Type	Length
3200 West (Cache County)	8 ft x 4 ft RCB	80 feet
6100 South (Cache County)	8 ft x 4 ft RCB	60 feet
Station 14+760 (Private)	84" HOBAS	20 feet
200 East (Wellsville)	8 ft x 4 ft RCB	60 Feet
Station 25+103 (Private)	72" HOBAS	20 Feet
Station 26+382 (Private)	72" HOBAS	20 Feet
Station 27+748 (Private)	8 ft x 4 ft RCB	20 Feet
Station 28+929 (Private)	8 ft x 4 ft RCB	20 Feet
4600 South (Cache County)	10ft x 4 ft RCB	66 Feet
4200 South (Cache County)	10ft x 4 ft RCB	66 Feet

Location	Size and Type	Length
Station 38+094 (Private)	10ft x 4 ft RCB	20 Feet
3900 South (Cache County)	10ft x 4 ft RCB	207 Feet
Station 40+857 (Private)	12 ft x 4 ft RCB	20 Feet
3400 South (Cache County)	10ft x 4 ft RCB	90 Feet
Station 44+668 (Private)	72" HOBAS	20 Feet
Cobblestone Road (Cache County)	8 ft x 4 ft	90 Feet
1800 South (Cache County)	8 ft x 4 ft	80 Feet

4.2.2.4 Spills and Pipelines

200 West (Wellsville City), 2900 South and 3400 South (Cache County), 200 South (Mendon) Spills & Pipelines & Murray Springs Spill Abandonment (Wellsville City)

The Lower Canal's capacity decreases farther north toward Mendon City because its primary use is irrigation conveyance where capacities decrease as deliveries are made. However, the canal is also used for flood management purposes. Although both functions occur within the Lower Canal corridor, irrigation conveyance and flood conveyance improvements represent separate works of improvement serving distinct PL-83-566 authorized purposes, and associated costs and benefits were evaluated independently. During high flow events, the canal has the potential to breach and spill uncontrollably along the alignment between Wellsville City and Mendon City. Under the Piping Alternative, new spill structures would be constructed near 200 West in Wellsville, 2900 South and 3400 South in unincorporated Cache County, and 200 West in Mendon to alleviate the limited capacity of the canal. These spills consist of a ramp weir structure of various heights depending on the location built of compacted earth and lined with the same lining as the canal, additional design information is available in the Alternatives Tech Memo located in Appendix E.

There is an existing overflow structure in the Lower Canal at Murray Springs. The structure would be abandoned in place, protecting its historical condition and relevance. However, due to downstream channel and crossing conditions, this spill has not been a viable flood discharge option for many years. This would be replaced by the 200 West Spill (Wellsville) which would be discharged into a 48-inch reinforced concrete pipeline (RCP) which will flow down the corridor shown in Figure 4-2. The pipeline conveys flows in Wellsville north on 200 West to 800 South, east at the intersection of 800 South to 100 West, then north again to the intersection of 600 South, turns east to Center Street, then north to 500 South, East to 100 East, then north to the discharge at the Murray Springs Crossing just north of the Wellsville Dam Park. Manhole junctions are included at mid-block and at each intersection for maintenance per industry standard. Flood control collection catch basins will be included at each intersection and low points during design but have not been included in the modeling of flood flows since they are storm water related assistance. It will also be necessary to include a premanufactured pretreatment system at the discharge of the piped system prior to discharge to comply with UPDES requirements. The discharge assumes a flared end section with rock riprap for energy dissipation. This pipeline discharges into Murray Springs, the same channel as the existing flows enter. However, the

discharge is moved downstream to an area where channel and crossings are sufficient to manage the flood flows to the confluence with the Little Bear River.

The 3400 South spill would be discharged into a 48-inch RCP that would convey the flows down to the intersection of 4800 West as shown in Figure 4-2. At the intersection, the pipeline would then flow to the north and discharge into an existing channel that would convey the flows back to the Little Bear River. Manhole junctions are included at mid-block and at each intersection for maintenance per industry standard. Flood control collection catch basins will be included at each intersection and low points during design but have not been included in the modeling of flood flows since they are storm water related assistance. It will also be necessary to include a premanufactured pretreatment system at the discharge of the piped system prior to discharge to comply with UPDES requirements. The discharge assumes a flared end section with rock riprap for energy dissipation. This pipeline would also convey the flows from Brushy Canyon that would collect the water before it crosses the canal. If the right-of-way (ROW) cannot be obtained for the open channel segment of this measure, then a pipeline would be used instead. The economic analysis has assumed the costs of a pipeline to be conservative.

The 2900 South spill would discharge into a 48-inch RCP pipeline that would convey the flows from the spill down past a private residence, across SR-23, along 2900 South, until finally discharging into the Little Bear River as shown in Figure 4-2. Manhole junctions are included at mid-block and at each intersection for maintenance per industry standard. Flood control collection catch basins will be included at each intersection and low points during design but have not been included in the modeling of flood flows since they are storm water related assistance. It will also be necessary to include a premanufactured pretreatment system at the discharge of the piped system prior to discharge to comply with UPDES requirements. The discharge assumes a flared end section with rock riprap for energy dissipation.

There is an existing 48-inch culvert located under the Lower Canal at the Francis family's property near 2900 South. Floodwaters run off the mountains and out of the Gibson and Coldwater canyons during these events and run under the Lower Canal through the 48-inch culvert. However, the drainage that runs past the Francis property does not have capacity to carry these flows and has historically overtopped the channel and flooded private property. The debris accumulation causes overtopping of the road during flood events at this location. The sponsors determined that the problems in this area could be addressed by plugging or removing the crossing where it currently goes under the canal, detaining the floodwaters above the canal where the property owner has volunteered his property that would be inundated, and diverting this water into the canal over a lateral weir. This structure is located as shown in Figure 4-2. The overflow weir is built by cutting the banks down to the 100-year water surface, compacting the soils to the NEH specified densities for a earthen berm, and lining it with the canvas concrete liners just like the canal. This liner can be crossed with light maintenance vehicles periodically. This overflow weir has been designed and modeled to spill all flows into the canal up to the 100-year event and then provides a slight shock or detention area during larger events to help mitigate potential impacts.

An additional existing culvert crossing that collects flows from the canyon above Maple Rise campground also passes under the canal approximately 550 feet of the Francis crossing. Upon modeling the existing conditions and documentation following the 2017 flood events, it was determined that this crossing should also be treated the same ways as the Francis crossing. However, this crossing is designed to not provide significant detention and to flow more freely into the canal without impacting the upstream property as shown in Figure 4-2.

The 200 South (Mendon) spill would discharge into a 48-inch RCP that would convey the flows from the spill down 200 South to 100 East, then South to 1600 S (Cache County Road address) approximately 250 feet, then east to finally discharge into the Little Bear River. It is assumed that system west of 5,400 West will be an open channel flow system. However, due to the uncertainty at this time and the unknown conditions that will be available at the time of design, RCP has been assumed all of the way to the river. This alignment is shown Figure 4-2. Manhole junctions are included at mid-block and at each intersection for maintenance per industry standard. Flood control collection catch basins will be included at each intersection and low points during design but have not been included in the modeling of flood flows since they are storm water related assistance. It will also be necessary to include a premanufactured pretreatment system at the discharge of the piped system prior to discharge to comply with UPDES requirements. The discharge assumes a flared end section with rock riprap for energy dissipation.

Wide Canyon Pipeline – Wellsville City

The Piping Alternative would install a pipeline to address flooding issues created by the discharge from the Wide Canyon in Wellsville. The floodwater would be collected into a 30-inch RCP to the west of 300 West where the Wide Canyon flows enter Wellsville is a defined channel at approximately 480 South as shown in Figure 4-2. Additional inlets would be installed along 300 West to the intersection of 500 South to help capture the overland flood flows coming from other areas to the West of the City in this area. The 30-inch RCP will flow north to 500 South where it would then turn east to 200 West, then north to 400 South, East to 100 West, North to 300 South, West to 100 East, then South to spill into Murray Springs Creek on the North Bank from the 200 West Wellsville Spill outfall. Manhole junctions are included at mid-block and at each intersection for maintenance per industry standard. Flood control collection catch basins will be included at each intersection and low points during design but have not been included in the modeling of flood flows since they are storm water related assistance. It will also be necessary to include a premanufactured pretreatment system at the discharge of the piped system prior to discharge to comply with UPDES requirements. The discharge assumes a flared end section with rock riprap for energy dissipation.

400 North Pipeline – Mendon City

During the events mentioned in the hydrology technical memo, floodwater from the Deep Canyon area and the alluvial fan areas to the west of town travel east along 470 North in Mendon and concentrates at SR-23. During these large events, floodwaters will either overtop SR-23 or travel south to 400 North at overtop at that location. Therefore, on the west side of SR-23 from 470 North to the 400 North/SR-23 intersection, inlets in a grassed waterway would be installed with piping conveying the flood waters south to 400 North, then east along the north side of 400 North to an existing culvert crossing. It would then be piped in an 18-inch RCP along the south side of 400 North to 100 East and be discharged into the existing drainage swale along the west side of 100 East as shown in Figure 4-2. Manhole junctions are included at mid-block and at each intersection for maintenance per industry standard. Flood control collection catch basins will be included at each intersection and low points during design but have not been included in the modeling of flood flows since they are storm water related assistance. It will also be necessary to include a premanufactured pretreatment system at the discharge of the piped system prior to discharge to comply with UPDES requirements. The discharge assumes a flared end section with rock riprap for energy dissipation.

300 North Pipeline – Mendon City

At times, the Deep Canyon drainage dumps flow into the roadway swales in 300 North from the Deep Canyon channel piped under the WMCD Lower Canal. A 30-inch pipeline system from the canal along the existing channel corridor easterly to 100 West, then south to 300 North, along 300 North going east on the north side of the road to discharge into the existing grassed channel west of 150 East to convey this flood water as shown in Figure 4-2.

Manhole junctions are included at mid-block and at each intersection for maintenance per industry standard. Flood control collection catch basins will be included at each intersection and low points during design but have not been included in the modeling of flood flows since they are storm water related assistance. It will also be necessary to include a premanufactured pretreatment system at the discharge of the piped system prior to discharge to comply with UPDES requirements. The discharge assumes a flared end section with rock riprap for energy dissipation.

100 South (Bird Creek) Pipeline – Mendon City

The 100 South drainage area is comprised of a large region from the east edge of Deep Canyon and Thimbleberry Canyon drainages through Mendon City to Main Street. This area contributes significant flows to Bird Creek. This measure, also shown in Figure 4-2, would install a 42" RCP flood control pipeline from 250 West, west of the WMCD Lower Canal collecting discharges from Thimbleberry Canyon and significant flows from the south, cross under the canal piped east along 100 South to 50 East (Bird Creek) on the north side of 100 South. . Manhole junctions are included at mid-block and at each intersection for maintenance per industry standard. Flood control collection catch basins will be included at each intersection and low points during design but have not been included in the modeling of flood flows since they are storm water related assistance. It will also be necessary to include a premanufactured pretreatment system at the discharge of the piped system prior to discharge to comply with UPDES requirements. The discharge assumes a flared end section with rock riprap for energy dissipation.

4.2.2.5 Secondary Water System

Secondary Water System Supplied by Two Regulating Ponds – Wellsville City

This alternative measure would involve the construction of two separate regulating ponds at different elevations on the hillside to the west of Wellsville City. These two ponds would be positioned to supply water to two separate pressure zones throughout the city, an upper and a lower zone. The Upper Pond would be supplied by the Lower Canal and Murray Spring from a pump station constructed adjacent to the Lower Canal. The Lower Pond would be supplied via a gravity flow from the Wellsville-Mendon Upper Canal and the Wellsville Reservoir from a pump station constructed adjacent to the reservoir. This configuration would allow for lower pumping costs by minimizing the pressure head required to supply water to each pressure zone from each water source. The pressure zones and pond elevations would be able to supply each connection with 45 psi. Two additional zones would require booster pumps to meet the minimum pressure requirement of 45 psi. The pipeline configuration sizing and pond locations are shown in Figure 4-3.

Secondary Water System – Mendon City

Irrigation or agricultural water has been delivered to portions of Mendon City through multiple irrigation companies and their associated pipelines or open ditches. These irrigation systems have been around for many years and provide flood irrigation options to their respective shareholders. This existing delivery system is aged and difficult to maintain due to the location of portions of the alignments and various other reasons.

This measure would replace this delivery system with a piped and pressurized secondary system to improve water usage within Mendon City. This pressurized secondary system would provide outdoor watering for many residents that are currently not able to be served by the aging delivery systems. The alignments of the proposed system would also be moved out into public ROW as much as possible to allow for easier access and maintenance. The existing delivery would still be available for flood irrigation uses as needed, while the pressurized system would be utilized for outdoor watering and agricultural pressure irrigation.

To improve operational efficiency within this proposed system, a pump station and equalization pond would be constructed. This pond would address the peak watering times so as not to draw on the existing canal infrastructure and create water delivery issues for other shareholders. The pipeline configuration sizing and pond locations are shown in Figure 4-3.

4.2.2.6 Wellsville-Mendon Lower Canal Conveyance

Lower Canal Pressurized Pipeline – Wellsville, Mendon, and Unincorporated Cache County

This measure would continue to divert the water for the Wellsville-Mendon Conservation District (WMCD) from below Hyrum Reservoir at the existing diversion points but would then enclose the Lower Canal and convey water with a pipeline in Wellsville and Mendon cities and part of unincorporated Cache County, Utah. The pipeline would get progressively smaller as it moves to the north because deliveries are being made, reducing the pipe size. The pipeline would end at the last shareholder's property. The pipeline would be installed in the existing downslope canal bank. Figure 4-3 reflects the expected pipe size and alignment from this evaluation

4.2.2.7 Wellsville East Field Canal Conveyance

Canal Enclosure – Wellsville City

This measure would pipe the existing Wellsville East Field Canal starting about 300 feet downstream of the existing Hyrum Reservoir Spillway and ending 2.5 miles later. This measure would provide users with a closed system which would prevent losses due to seepage. This canal would be piped in the existing alignment with a 48-inch Type "S" High Density Polyethylene pipe with check boxes and measured flow turnouts at the existing locations. This canal will not be pressurized. This measure is shown in Figure 4-3.

4.2.2.8 Public Recreation

Wellsville Reservoir Boat Ramp – Wellsville City

This measure would include a measure to install a reinforced concrete boat ramp (15 feet wide) for small personal non-motorized watercraft (kayaks, paddleboards, canoes, etc.) on the east side of Wellsville Reservoir. This would provide access for residents to use the existing Wellsville Reservoir for recreation in new ways. The sponsors' proposed locations for this measure is shown in Figure 4-5.

Mendon Cemetery Reflecting Pond – Mendon City

The Mendon Cemetery continues to progressively expand. Within a newer section of the cemetery, Mendon City would construct a pond that will improve the overall site with a walking area, benches, and a water feature for the general public. This pond would be maintained by the city and is an integral part of the overall cemetery plan. This overall plan would also provide walking paths and reflection areas throughout the site. This recreational opportunity would also generate unique cultural services in the watershed of a new opportunity for individual spiritual reflection and growth. The reflection pond will be a separate, smaller, pool from the large regulating pond that would be installed above the cemetery. It will be a publicly accessible amenity that would serve as a water feature with benches and a trail. One diversion would serve the primary regulating pond and the other would serve the reflection pond. The pond would utilize existing water rights, although a point of diversion (POD) change may be necessary—there is a spring at this location which is included in the planned water supply for this pond. Mendon City, a co-sponsor, owns the property for the proposed pond. The location of these measures are shown in Figure 4-5.

Summary of Alternative

The Proposed Action Alternative meets the Purpose and Need of the project as required by NEPA and addresses the problems and opportunities in PR&G terms. Each of the actions selected to develop the Piping Alternative met individual category criteria described throughout this chapter including meeting all of the requirements of the PL 83-566 program and the PR&G guiding principles. Table 4-5 below describes the selected measures that compose the Piping Alternative. The Piping Alternative meets the Federal Objective to protect the environment by reducing erosion and sedimentation in the project area and along the Little Bear River. By improving water delivery reliability, public safety, water quality, irrigation water management, and water conservation, the alternative to pipe the canal achieves the PR&G Guiding Principles of Healthy and Resilient Ecosystems, Sustainable Economic Development, Public Safety, Environmental Justice, and Watershed-Scale Approach.

Table 4-7: Piping Alternative

PIPING ALTERNATIVE	
Proposed Measure	PL 83-566 Authorized Purpose
Construct Detention Basins	Flood Prevention
Construct Lower Canal Flood Spills	Flood Prevention
Channel Improvements, Culverts, & Pipelines	Flood Prevention
Pressure Pipe Portion of the WMCD Lower Canal	Agricultural Water Management
	Flood Prevention
Pipe Segment of the Wellsville East Field Canal	Agricultural Water Management
Construct Secondary Systems in Wellsville and Mendon	Agricultural Water Management
Construct Regulating Ponds for Secondary Systems	Agricultural Water Management
New Access Ramp at Wellsville Reservoir	Public Recreation
New Reflection Pond/Walking Trail at Mendon Cemetery	Public Recreation

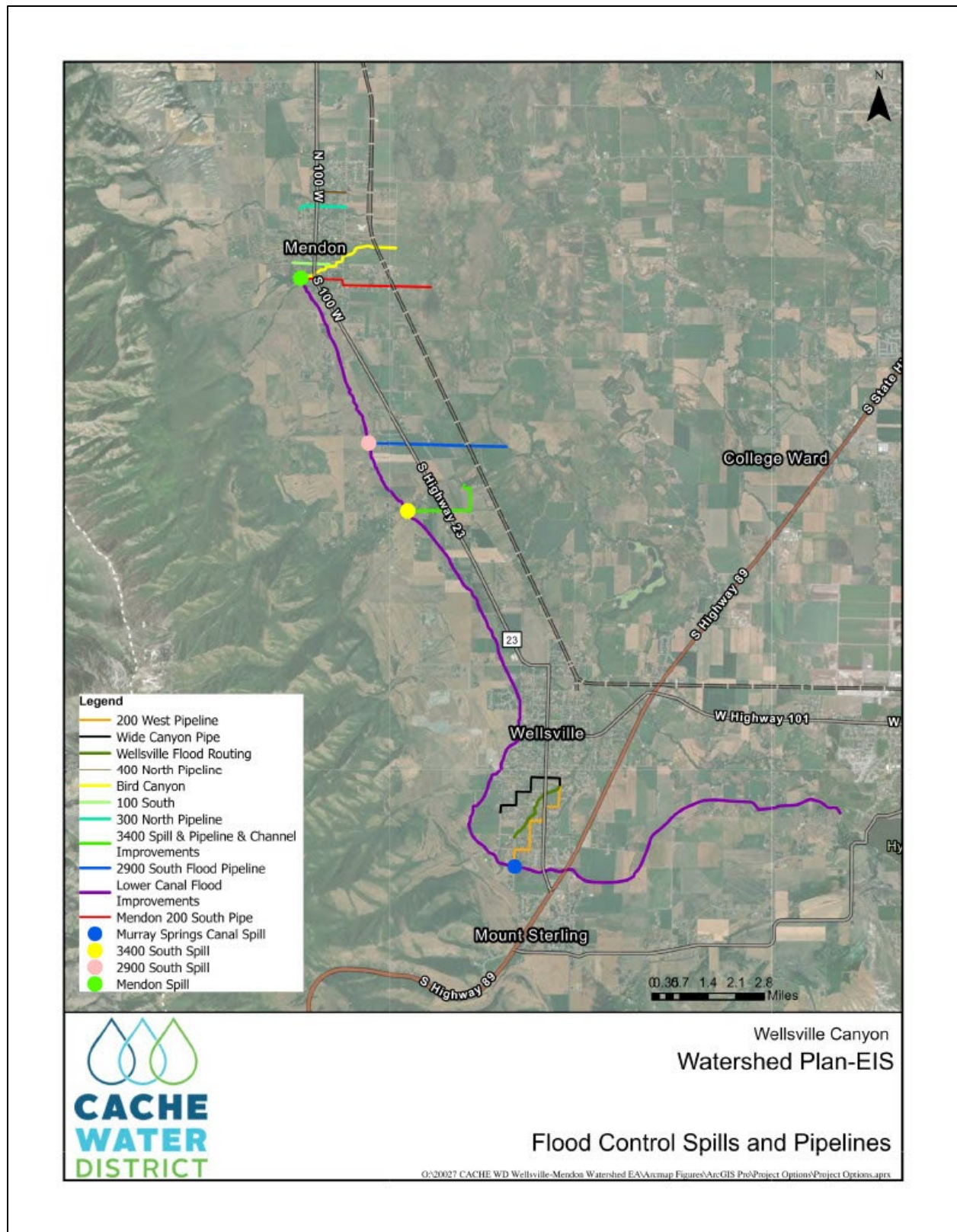


Figure 4-2: Flood Control Spills and Pipelines

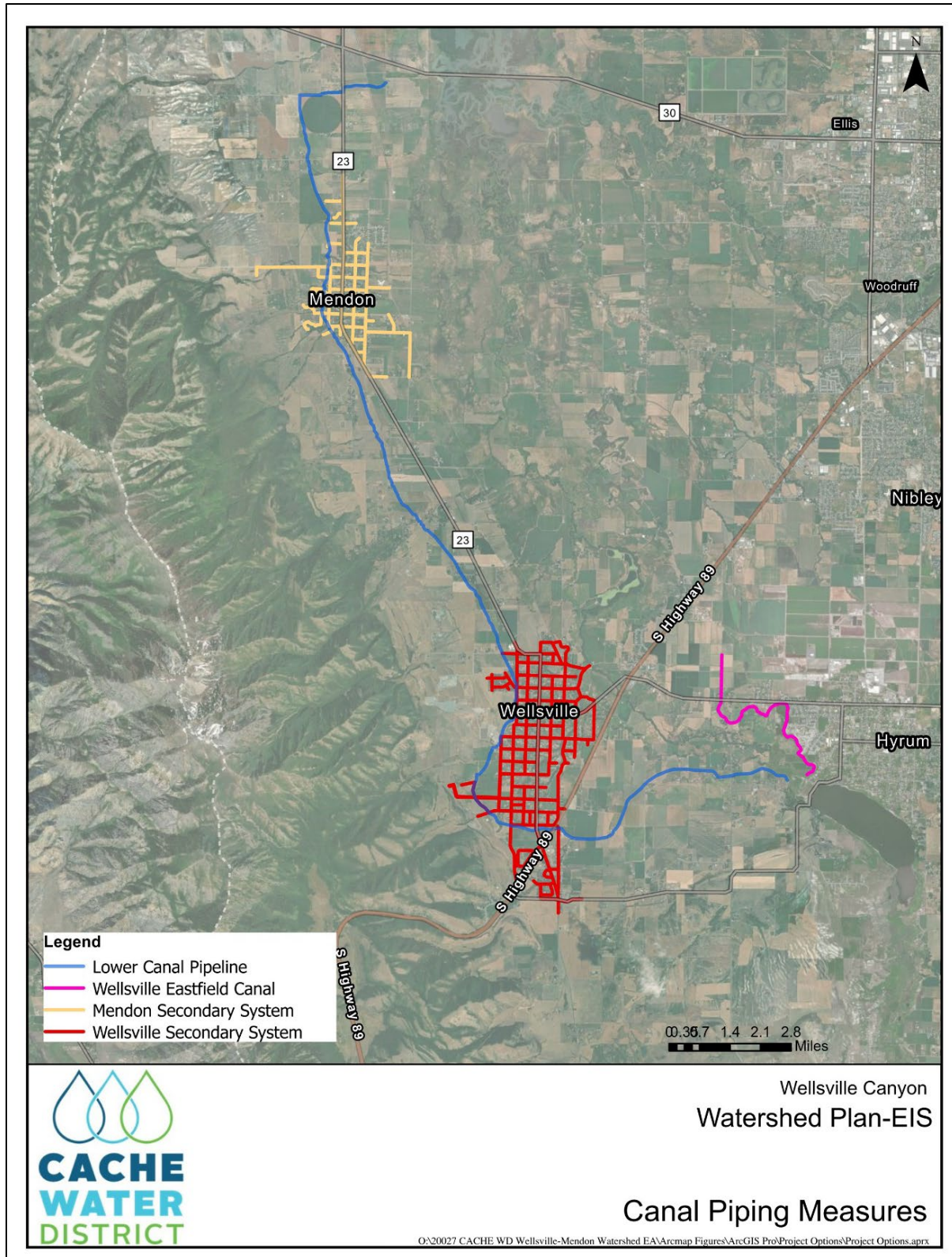


Figure 4-3: Canal Piping Measures

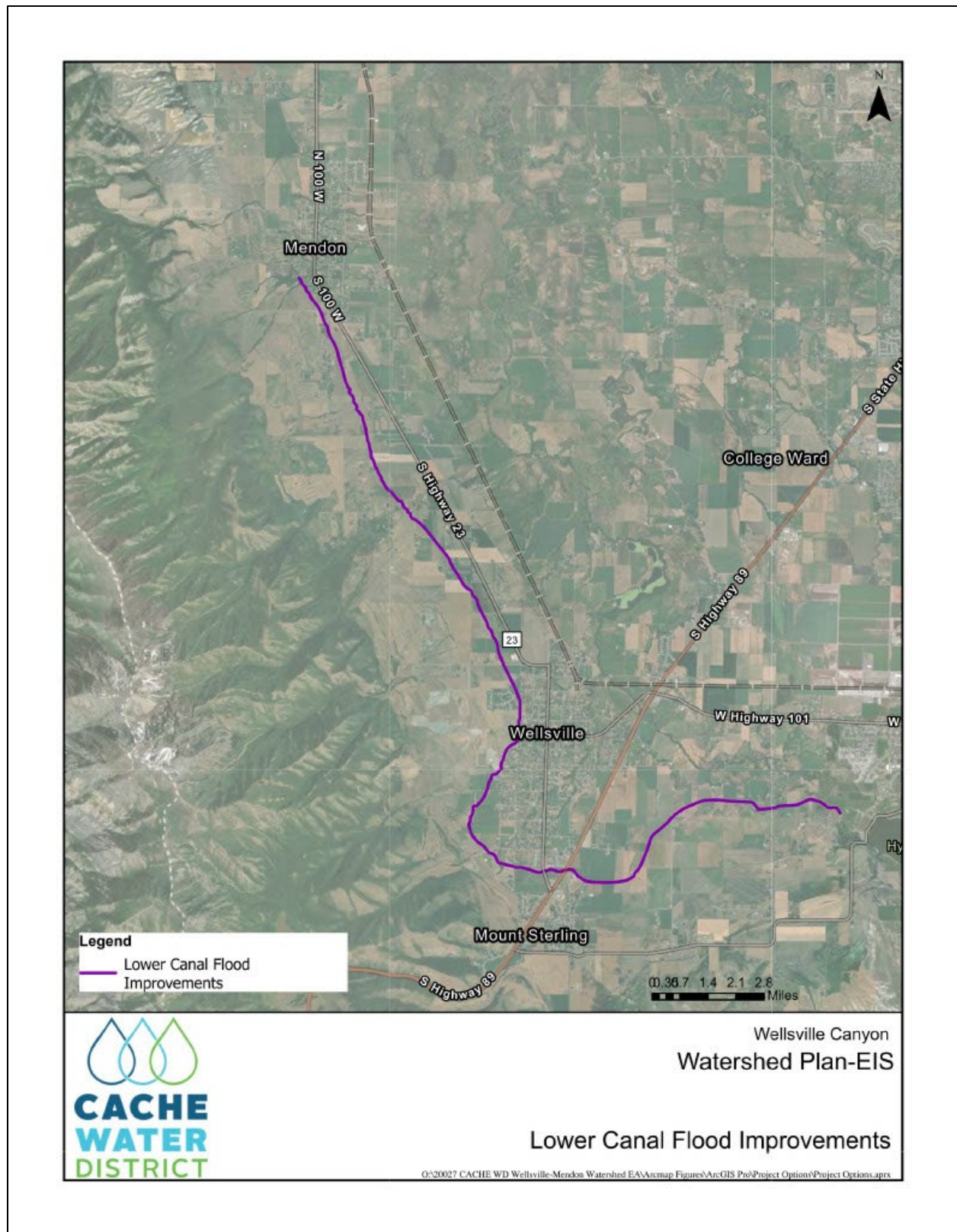


Figure 4-4: Lower Canal Flood Improvements

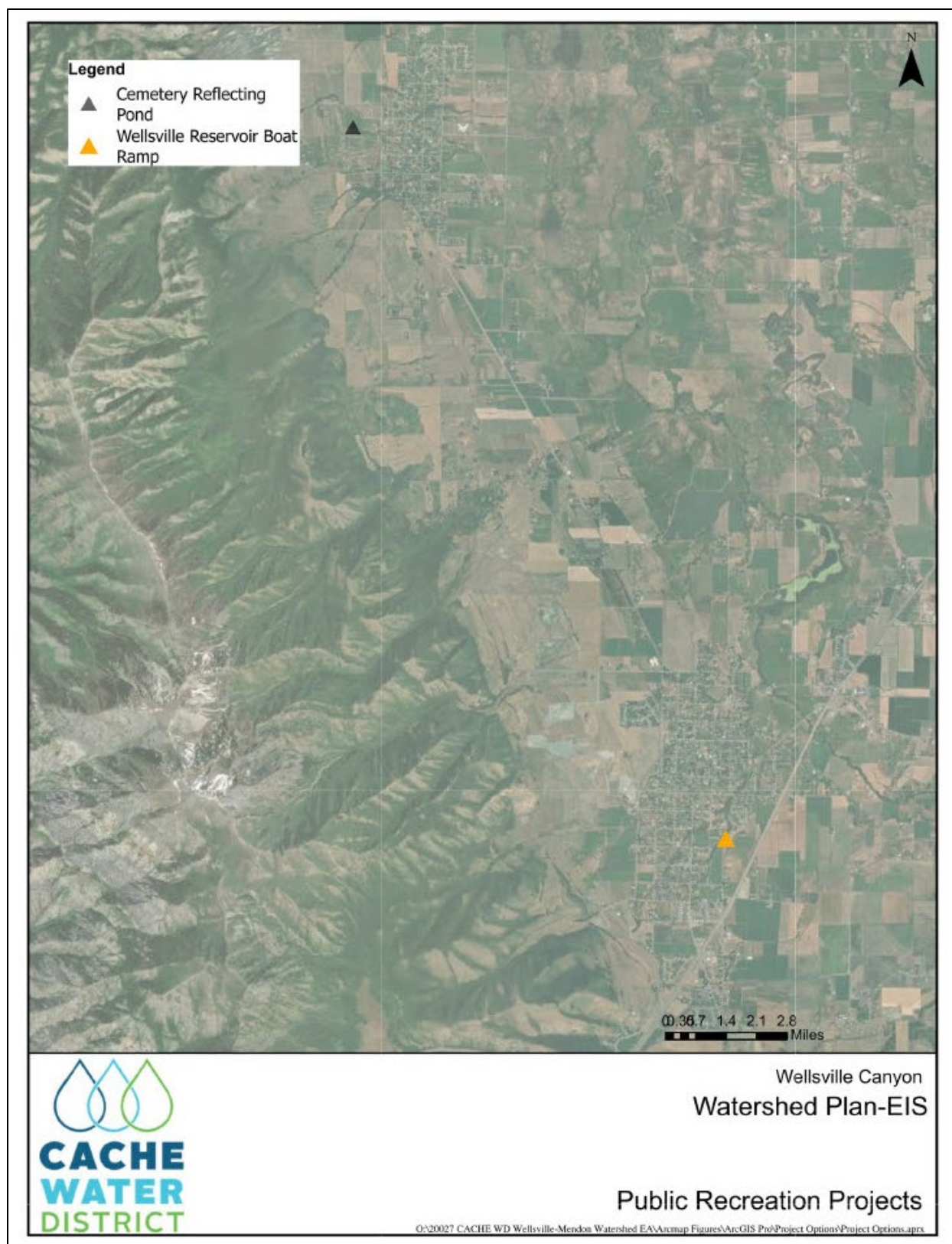


Figure 4-5: Public Recreation Projects

4.2.3 Action Alternative 2 – Nonstructural-Structural Combination Alternative – Lining & Buyouts Alternative

4.2.3.1 Overview of Alternative

This alternative would have funding made available through PL 83-566 allowing for lining of the Lower Canal. The PR&G requires full consideration of at least one nonstructural option in the Final Array of alternatives. The nonstructural alternative may be combined with other structural measures as long as the benefits of the structural element are fewer or smaller than the benefits of the nonstructural measure(s). Under the Lining & Buyouts Alternative, the purpose of flood prevention would be addressed using a nonstructural measure.

The principal difference between the Lining & Buyouts Alternative and the Piping Alternative is that the Lining & Buyouts Alternative would line WMCD Lower Canal with the concrete canvas liner (impermeable liner) to conserve irrigation water and reduce operational spillage. The channel would be cleaned to form a uniform cross-section but would not be increased in size for additional flood flows. Culvert crossings would not be improved for additional capacity.

The nonstructural element of this alternative would be to seek voluntary buyouts of the structures/properties within the 100-year (1% chance in any given year) existing conditions flood inundation area to eliminate the risks associated with flood events as reflected by detailed modeling.

This alternative would deliver the water of the Wellsville Eastfield Canal Company through a piped portion of the Wellsville Eastfield Canal beginning at the existing diversion at the base of Hyrum Dam passing through Hyrum and parts of unincorporated Cache County, Utah. The alternative would also construct improvements to completely pressurize the Wellsville City Irrigation Company's irrigation system within Wellsville City and the Mendon North, Mendon Central, Mendon South, Mendon Second North, and Greater Mendon Irrigation companies' irrigation systems within Mendon City. This alternative would also provide for regulating ponds of the secondary systems in Wellsville and Mendon to stabilize peak demands on the pressurized irrigation systems. A new access ramp limited to non-motorized personal watercraft would be built at Wellsville Reservoir for fishing and other recreational activities and a reflecting pond would be constructed at Mendon Cemetery.

4.2.3.2 Nonstructural Flood Prevention Measures

Buyouts of Structures in Floodplain – Wellsville, Mendon, and Unincorporated Cache County

The flood prevention problems in the watershed would be addressed using a nonstructural measure under the Lining & Buyouts alternative. Buyouts of the structures/homes within the existing 100-year conditions flood inundation area and relocation of current residents would be the means of doing so. The floodplain identified for this alternative is not the same as the FEMA floodplain because it addresses flood impacts associated with water historically collected and rerouted by the canal which may result in overtopping in locations not associated with the historical drainage. These overtopping areas, by their nature, lead to significant flooding by modeling which underestimates the potential impact. In reality, each potential overtopping location becomes a potential breach location which becomes a risk to life, property, and the environment beyond the scope of this EIS analysis. By conducting buyouts, the risk to life and property presented by flooding would be reduced. The PR&G requires full consideration of a nonstructural option in the Final Array of Alternatives and this measure was included in the Lining & Buyouts alternative and

was carried through full economic and environmental screening and compared against the Piping and No Action Alternatives in substantial and equal detail, even though it is not supported by either the agencies or the sponsors. The locations of these buyouts are reflected in the Figure 10 in the Alternatives Tech Memo located in Appendix E and the buildings which fall within the flooded areas. It should be noted that, should this alternative be selected, a survey of all potential historic buildings/structures in the floodplain would need to occur, in order to determine if there would be adverse effects and/or costs to mitigate effects to any eligible buildings/structures.

4.2.3.3 Secondary Water System

Secondary Water System Supplied by Two Regulating Ponds – Wellsville City

This alternative measure would involve the construction of two separate regulating ponds at different elevations on the hillside to the west of Wellsville City. These two ponds would be positioned to supply water to two separate pressure zones throughout the city, an upper and a lower zone. The Upper Pond would be supplied by the Lower Canal and Murray Spring from a pump station constructed adjacent to the Lower Canal. The Lower Pond would be supplied via a gravity flow from the Wellsville-Mendon Upper Canal and the Wellsville Reservoir from a pump station constructed adjacent to the reservoir. This configuration would allow for lower pumping costs by minimizing the pressure head required to supply water to each pressure zone from each water source. The pressure zones and pond elevations would be able to supply each connection with 45 psi. Two additional zones would require booster pumps to meet the minimum pressure requirement of 45 psi. The pipeline configuration sizing and pond locations are shown in Figure 4-3.

Secondary Water System – Mendon City

Irrigation or agricultural water has been delivered to portions of Mendon City through multiple irrigation companies and their associated pipelines or open ditches. These irrigation systems have been around for many years and provide flood irrigation options to their respective shareholders. This existing delivery system is aged and difficult to maintain due to the location of portions of the alignments and various other reasons.

This measure would replace this delivery system with a piped and pressurized secondary system to improve water usage within Mendon City. This pressurized secondary system would provide outdoor watering for many residents that are currently not able to be served by the aging delivery systems. The alignments of the proposed system would also be moved out into public ROW as much as possible to allow for easier access and maintenance. The existing delivery would still be available for flood irrigation uses as needed, while the pressurized system would be utilized for outdoor watering and agricultural pressure irrigation.

To improve operational efficiency within this proposed system, a pump station and equalization pond would be constructed. This pond would address the peak watering times so as not to draw on the existing canal infrastructure and create water delivery issues for other shareholders. The pipeline configuration sizing and pond locations are shown in Figure 4-3.

4.2.3.4 Wellsville-Mendon Lower Canal Conveyance

Lower Canal Lining – Wellsville, Mendon, and Unincorporated Cache County

This measure would include installing a new liner along the Wellsville-Mendon Lower Canal. This differs from the Piping Alternative which would pressure-pipe the canal instead. Currently, only

about 25% of the Lower Canal is lined and much of this liner is damaged and failing. Upon field investigation, this liner was installed on top of the soil without a protective cover and has exposed the liner to extreme solar degradation as well as damage from exposure to puncture tear for wind, animals crossing (hooved wildlife and livestock), winter ice, and vandalism. This alternative evaluated the feasibility and cost of lining the canal alignment from Wellsville to Mendon with the canvas concrete product discussed previously. This was evaluated and modeled based on restoring the existing trapezoidal cross section and lining it. The cleaned cross section was then modeled for the irrigation flows, and under each of the flood conditions. This measure includes the entire length of the canal from the head of the canal near Hyrum Dam to the last irrigation delivery. In addition, due to the decreased roughness of the canal and the emphasis on decreasing operational spills, it became necessary to install irrigation check structures with automated gates approximately every 0.5 miles to regulate water surface elevations, regulate water storage within the system as demands fluctuate, and to allow the system to fully maximize its capabilities. Additionally, the turnout gates were automated to maintain delivery stability and accuracy. Irrigation meters would be installed at each turnout where they do not currently exist. This alignment is shown in Figure 4-4.

4.2.3.5 Wellsville East Field Canal Conveyance

Canal Enclosure – Wellsville City

This measure would pipe the existing Wellsville East Field Canal starting about 300 feet downstream of the existing Hyrum Reservoir Spillway and ending 2.5 miles later. This measure would provide users with a closed system which would prevent losses due to seepage. This canal would be piped in the existing alignment with a 48-inch Type “S” High Density Polyethylene pipe with check boxes and measured flow turnouts at the existing locations. This canal will not be pressurized. This measure is shown in Figure 4-3.

4.2.3.6 Public Recreation

Wellsville Reservoir Boat Ramp – Wellsville City

This measure would include a measure to install a reinforced concrete boat ramp (15 feet wide) for small personal non-motorized watercraft (kayaks, paddleboards, canoes, etc.) on the east side of Wellsville Reservoir. This would provide access for residents to use the existing Wellsville Reservoir for recreation in new ways. The sponsors’ proposed locations for this measure is shown in Figure 4-5.

Mendon Cemetery Reflecting Pond – Mendon City

The Mendon Cemetery continues to progressively expand. Within a newer section of the cemetery, Mendon City would construct a pond that will improve the overall site with a walking area, benches, and a water feature for the general public. This pond would be maintained by the city and is an integral part of the overall cemetery plan. This overall plan would also provide walking paths and reflection areas throughout the site. This recreational opportunity would also generate unique cultural services in the watershed of a new opportunity for individual spiritual reflection and growth.

The reflection pond will be a separate, smaller, pool from the large regulating pond that would be installed above the cemetery. It will be a publicly accessible amenity that would serve as a water feature with benches and a trail. The pond could also be used for storage for the secondary

system in Mendon City. A new diversion would be needed for this feature that would include a pump and distribution line to get the water out of the canal and into the pond. One diversion would serve the primary regulating pond and the other would serve the reflection pond. The pond would utilize existing water rights, although a point of diversion (POD) change may be necessary—there is a spring at this location which is included in the planned water supply for this pond. Mendon City, a co-sponsor, owns the property for the proposed pond. The location of these measures are shown in Figure 4-5.

Summary of Alternative

The Lining & Buyouts Alternative meets the Purpose and Need of the project as required by NEPA and addresses the problems and opportunities identified under PR&G. Each of the actions selected to develop the Lining & Buyouts Alternative met individual category criteria described throughout section 4.2 and 4.3 of this chapter including meeting all of the requirements of the PL-566 program and the PR&G guiding principles. Table 4-6 describes the selected management measures that comprise the Lining & Buyouts Alternative.

The Lining & Buyouts Alternative fulfills the requirement to include a nonstructural alternative plan in the Final Array of Alternatives described in NWPM 501.42(B)(2)(c)(2). However, as was determined during the initial alternative screenings, this alternative does not meet the project constraints to (1) minimize property disruptions, (2) minimize impacts to cultural/historic properties, (3) minimize water pollution, and (4) to protect special status species that may be present.

Table 4-8: Lining & Buyouts Alternative

LINING & BUYOUTS ALTERNATIVE	
Proposed Measure	PL 83-566 Authorized Purpose
Conduct Nonstructural Buyouts of Structures/Properties	Flood Prevention
Line and Expand a portion of the WMCD Lower Canal	Agricultural Water Management
Pipe Segment of the Wellsville East Field Canal	Agricultural Water Management
Construct Secondary Systems in Wellsville and Mendon	Agricultural Water Management
Construct Regulating Ponds for Secondary Systems	Agricultural Water Management
New Access Ramp at Wellsville Reservoir	Public Recreation
New Reflection Pond/Walking Trail at Mendon Cemetery	Public Recreation

4.2.4 Locally Preferred Alternative

Under the PR&G, it is required to identify an alternative plan that is locally preferred. This alternative was developed with sponsors and local interests that have oversight or implementation authorities and responsibilities. In the case of this project, the locally preferred alternative is Action Alternative 1 – Piping Alternative because it would be the most cost-effective for the sponsors and received the most positive input and support from project stakeholders during scoping and the NOI 30-day comment period. Furthermore, this alternative would provide protection from flooding to various homes, businesses, and agricultural fields and agricultural water availability would be improved generally, through the period of analysis.

4.2.5 Environmentally Preferred Alternative (from NEPA)

The NEPA process mandates that an environmentally preferred alternative be identified as a part of the planning process. Additionally, if an individual (not nationwide) CWA Section 404 permit (any potential impacts to WOTUS) is sought, the principles of the U.S. Army Corps of Engineers (USACE) Least Environmentally Damaging Practicable Alternative (LEDPA) must be followed and complied with during the development of alternative plans. LEDPA principles are best adhered to using the framework of first avoidance, then minimization, then mitigation. Action Alternative 1 – Piping Alternative is the environmentally preferable alternative for this Plan-EIS because it is the alternative which maximizes environmental benefits. The Piping Alternative would have significant positive impacts to water quality, groundwater quantity, floodplain management, and other environmental resources as discussed in detail in Chapter 5.

4.2.6 National Economic Efficiency (NEE) Alternative

Under the PR&G, the NRCS must identify the federally assisted alternative plan with the greatest net benefits, otherwise known as the National Economic Efficiency (NEE) plan. The alternative selected as the NEE must also comply with the PL 83-566 program and be in accordance with the six Guiding Principles of the PR&G. These principles incorporate selecting the alternative in the Final Array with the highest benefit-cost ratio (BCR). For this Plan-EIS, the NEE Alternative is Action Alternative 1 – Piping Alternative, which has a BCR of 2.46 and total net benefits of \$8,749,147. More details are available in Chapter 6 of this Plan.

4.3 Alternatives Considered But Eliminated From Detailed Study

In the alternative formulation and screening process outlined in sections 4.1.2 and 4.1.4 of this Plan, the elimination of individual management measures that either did not meet the NEPA Purpose and Need or address the PR&G problems and opportunities were eliminated and not carried forward for further consideration and incorporation into alternative plans. Additionally, during the screening of the Initial Array of Alternatives against the objectives, constraints, ecosystem services, and economic benefits—two action alternative plans were eliminated from further consideration. Both the eliminated management measures and the eliminated alternative plans are discussed in this section, along with their reason for elimination.

4.3.1 Piping and Filling Alternative (Nature-Based Solution)

The Piping and Filling Alternative was initially considered for detailed evaluation and included in the Initial Array of Alternatives. This alternative would continue to divert the water for the Wellsville-Mendon Conservation District (WMCD) from below Hyrum Reservoir at the existing diversion points. This alternative would then pressure pipe the Wellsville-Mendon Lower Canal in Wellsville, Mendon, and part of unincorporated Cache County, Utah. This alternative eliminated the open channel Lower Canal and restored the natural flood channel flow paths where possible, which acts as a nature-based solution to the problem of flood prevention in the watershed. Where necessary, a combination of conduits and open channels flowing north and east to the Little Bear River floodplain would be used to accomplish this.

Additionally, this alternative would divert the water of the Wellsville Eastfield Canal Company by piping a portion of the Wellsville Eastfield Canal beginning at the existing diversion at the base of Hyrum Dam passing through Hyrum and part of unincorporated Cache County, Utah.

The alternative would also construct improvements to completely pressurize the Wellsville City Irrigation Company's irrigation system within Wellsville City and the Mendon North Irrigation Company's, Mendon Central Irrigation Company's, Mendon Second North Irrigation Company's, Mendon South Irrigation Company's, and Greater Mendon Irrigation Company's irrigation systems within Mendon City. This alternative would also provide for regulating ponds to stabilize peak demands on the pressurized irrigation systems. A new access ramp limited to non-motorized personal watercraft would be built at Wellsville Reservoir and a reflecting pond would be installed at Mendon City Cemetery.

However, after a meeting with the project sponsors and the NRCS held on September 20, 2023, it was decided that this alternative would be eliminated from detailed study for several reasons. First, the expected environmental impacts would be too great to justify and would not adhere to LEDPA principles, with the project failing to meet any of the established project constraints. Second, even though the Alternative included a nature-based solution, the Federal Objective to protect the environment was not met because the surrounding ecosystem, which has acclimated to the current conditions (i.e., absence of the natural flow paths) would be destroyed, likely including suitable habitat for some federally listed species. This alternative would unavoidably result in the flooding of homes and other structures located in the floodplain. For these reasons, the project also fails to fully meet the Purpose and Need and meet the PR&G problems and opportunities.

Overall, the alternative did not constitute a fully complete, effective, efficient, or acceptable solution. For these reasons, the Piping and Filling Alternative was eliminated from detailed study during the first screening of the Initial Array of Alternative plans.

4.3.2 Lining Alternative

The Lining Alternative was developed to be nearly identical to the Piping Alternative with the notable exception of lining the Lower Canal instead of pressure piping it. All other management measures included in this plan were the same as the Piping Alternative including the installation of secondary water systems in Wellsville & Mendon, the piping of the Wellsville East Field Canal, the installation of spills and other flood control infrastructure in Wellsville, Mendon, and unincorporated Cache County, and the construction of a boat ramp in Wellsville and a cemetery reflecting pond in Mendon for public recreation. The only difference between the two was that this alternative would line the canal with a synthetic liner.

This Alternative passed the first screening of the Initial Array of Alternatives, meeting the project objectives and constraints and being carried forward to the second round of screening, which focused on the alternatives' ability to improve the provision of ecosystem services and meet the BCR/economic requirements. During the second round of screening, it became clear early on that this alternative would not be able to improve the provision of the ecosystem services in the area as well as the Piping Alternative. Although lining the Lower Canal would certainly improve the provisioning services in the area by reducing seepage losses, the problem of canal evaporation would persist. Additionally, water quality (i.e., the problem of nutrient loading to the Little Bear River) would not be completely addressed, with significant sediment still being able to make it to the Little Bear River. Regulating ecosystem services would not be improved to the same extent as the Piping Alternative either, with the public safety concerns associated with an open-channel canal (i.e., drowning) remaining under this alternative.

After analyzing the alternative against the ecosystem services, it became clear to the sponsors that this alternative would not meet the Purpose and Need or address the problems and opportunities to the same degree as the Piping Alternative. The ability of the watershed to provide better provisioning and regulating services would not meet the criteria of completeness, effectiveness, efficiency, and/or acceptability under this alternative. It was for these reasons that the Lining Alternative was eliminated from detailed study during the second round of screening of the Initial Array of Alternative plans.

Because the Alternative was eliminated based on the ecosystem services, the benefit-cost analysis was not performed for this alternative since it was eliminated prior to that stage of the screening.

4.3.3 Management Measures Eliminated

At various phases of the alternative formulation and screening process (Appendix D and Appendix E), management measures that were initially considered for their benefit to the project area were ultimately eliminated for various reasons as described in this section. While these measures do not constitute entire alternative plans that would fulfill the Purpose and Need or address the problems and opportunities on their own, they were considered at some point during the formulation/screening process as components which could potentially be included as a part of a larger alternative plan.

4.3.3.1 Threemile Canyon Improvements – Unincorporated Cache County North of Mendon

Threemile Canyon is north of Mendon, and the channel improvements proposed are described in this section. Along the Threemile Creek stream alignment, beavers have created several dams and deadfalls that redirect flows and cause flooding and overtopping of the road at the crossing of 8000 West during extreme flood events. Although initial thoughts had been to relocate the beaver population, the current consideration is to leave the area upstream of 8000 West in its current condition and to adhere to the current state beaver management plan (if concerns arise, work will be coordinated with the Utah Division of Wildlife Resources). To alleviate flooding impacts to the road, this alternative would raise the roadway elevation to avoid flooding impacts. In addition, the Threemile Canyon channel downstream (east) of 8000 West is proposed to be cleared of woody vegetation to alleviate restrictions that lead to flooding and a silted in culvert at the old railroad crossing be removed. Finally, in past rain events that caused flooding in 2005, 2011, and 2017, the Threemile Canyon/Yonk Loop area experienced undercutting and damage. This measure would install a single large detention basin upstream on the Autonomous Solutions, Inc. (ASI) property to mitigate flooding in future rain events. Two basins in this area were initially considered but hydraulic analyses showed the single ASI basin to be satisfactory for the flooding in the area.

These measures were eliminated due to their inability to meet the minimum BCR requirement of 1.0 during economic screening. The locations in these measures were included in the wetlands, biological, and cultural field surveys; however, no work is ultimately being proposed in these sites.

4.3.3.2 Railway Swale, Detention Basins, & Conduit – Yonk Loop Area North of Mendon

Yonk Loop is an area north of Mendon City that has historically seen sheet flow and concentrated flooding in and around it. The slope around the Loop has some elevation change from the west then begins to flatten out as it travels east towards SR-23. The west portion of the road has historically gathered drainage from the adjacent basin but at times has had problems passing the larger storms due to culvert sizing issues. Collecting runoff from this drainage is problematic due

to the several different low points across the road that runs perpendicular to the foothill drainages of the Wellsville Mountains. An additional measure to specifically address the flooding issues that have occurred in the past at the intersection of 600 North and 7200 West (the northwest corner of Yonk Loop) is to construct a detention basin at this location that would collect flood flows from the south side of 600 North (i.e., the area south of Threemile Canyon).

A flood control conduit for the detention basin described in the previous paragraph would be constructed for outflows in a storm drain down 600 North that would then discharge into the regional drainage swale described below. One management measure that would avoid major collection and piping of stormwater on county roads would be to create a regional drainage swale along an old railroad corridor and convey the drainage to a discharge point in the canal. This alternative would require a drainage easement along private properties and would be constructed with wide, shallow slopes that can easily be traversed in an agricultural setting. Additionally, Cache County does not want to add storm drain infrastructure and maintenance liability to their roadways.

These management measures were eliminated due to their inability to meet the minimum BCR requirement of 1.0 during economic screening. The locations of these measures were included in the wetlands, biological, and cultural field surveys; however, no work is ultimately being proposed in these sites.

4.3.3.3 Pressure Piping the Wellsville Upper Canal – Wellsville City

The project originally included a measure to pressure pipe the Wellsville Upper Canal in addition to the Lower Canal. This measure would have met individual criteria under the PL 83-566 program. However, for the project to progress at a faster pace than the PL 83-566 program allows, the sponsor decided to use other funding to expedite the process of piping the Upper Canal. Phase I of the project is being constructed currently and was funded with state funding. Phase II of the project was funded under Reclamation's WaterSMART program and is currently undergoing NEPA-level analysis prior to implementation. It is for this reason that this management measure was eliminated from detailed study.

4.3.3.4 Hawbush Flood Channel – Wellsville City

Wellsville Canyon, also known as Sardine Canyon, generates some significant flooding during heavy rain events. Hawbush is the natural channel that flows parallel to Highway 89 on the south side of the road as it comes out of the canyon. The channel passes through a residential area on the south end of Wellsville City. In past years during heavy rain events, this area has experienced flooding of homes and roads. This area was evaluated for some channel improvements to prevent future flooding. However, the measure was ruled out because Wellsville City has since implemented non-PL 83-566 projects that will mitigate these flooding issues.

4.3.3.5 2900 South Channel Improvements – Wellsville City

There is an existing 48-inch culvert located under the Lower Canal at the Francis family's property near 2900 South. Cache County has replaced culverts downstream where the drainage crosses SR-23 due to flood damage in 2017. However, the culverts are undersized and do not have adequate capacity to pass flows during heavy flood events. Flood waters run off the mountains and out of the Gibson and Coldwater canyons during these events and run under the Lower Canal through the 48-inch culvert. However, the drainage that runs past the Francis property does not have capacity and has historically overtopped the channel and flooded their property. The debris

accumulation causes overtopping of the road during flood events in this location. The measure was considered to make channel improvements (widening, culvert rehabilitation, etc.) in the area surrounding the Francis property and 2900 South but it was eliminated due to lack of sponsor support. The sponsors determined that the problems in this area could be addressed by diverting the water where it currently goes under the canal. The water would instead enter the canal and be managed with the canal floodwater.

4.3.3.6 2400 South Channel Improvements and Flood Pipeline – Wellsville City

This measure included installation of a pipeline along 2400 South to capture flood flows that come out of Coldwater and Gibson canyons and pass under the Lower Canal through a small siphon. The idea was proposed to install a pipeline that would connect to the culvert under the canal and convey the flows to the northeast and connect in with the 2400 South Spill pipeline to convey the flows to the Little Bear River. This measure was eliminated because the flooding issues will be addressed by allowing water to enter and managing the water through the canal.

4.3.3.7 3400 South Channel Improvements – Wellsville City

Maple Rise Road, or 3400 South, is another location Cache County identified as experiencing issues during heavy rain events. This road crosses over the natural drainages of several canyons including both Brushy and Shumway canyons. Some crossings do not generate any flooding issues, but the flows that come out of the canyons are diverted to flow parallel to 3400 South to the east. During high runoff events in the past, the road has been undercut, and SR-23 has been flooded. Additionally, as the flows continue along 3400 South and intersect with 4800 West, more flooding occurs over roads and to residential and agricultural landowners as the flows continue to the north impacting more landowners before discharging back into the natural drainage channel. One measure included constructing a designated open flood channel along 3400 South. The existing channel would be improved along 4800 West until the channel discharges into the natural drainage channel to the north. This measure was not explored further because a closed conduit increment was moved forward instead and the narrow county ROW along 3400 South that would make it difficult to construct a channel without needing to acquire easements and negatively impacting residential property.

4.3.3.8 Wide Canyon Detention Pond and Channel Improvements – Wellsville City

Development has encroached on the natural drainage channel. Flood flows exceed the current capacity of the flood channel. A second suggested option was implementation of detention basins. Several locations along the channel were evaluated and used the proposed regulation ponds with increased capacity to dual function as detention basins. This measure was eliminated due to a lack of sponsor support because of property acquisition difficulties.

Wide Canyon is west of Wellsville City. The historic channel has been encroached upon and rediverted through residential development efforts. As a result, several homes are flooded during flooding events. One increment suggested during scoping consisted of widening and improving the channel to increase the capacity. The channel would require significant improvements to be able to pass the 100-year flood event. This project increment was eliminated due to insufficient room between homes and structures.

4.3.3.9 Pond Stream Channel Improvements – Mendon City

Currently Pond Stream carries a base flow from several springs located near the center of town. Much of this water is used for irrigation for various crops on the north end of the community. Because of the topography of the drainage, it can contain a large amount of runoff without restrictions. The exception to this is at road crossings. At Main Street and 100 East there are restrictions on the flow due to culvert sizes, or diversion structures. These restrictions create natural detention areas that retard the peak flows running through the community. Improving the channel through the clearing of debris and fallen trees along with channel reshaping/resizing at the 100 East location would take place under this measure and would improve this conveyance system. This measure was eliminated because analysis showed that the existing infrastructure at these locations would be sufficient when regular maintenance and other considered measures are implemented.

4.3.3.10 Threemile Canyon Upper Detention Basin – Unincorporated Cache County

Under this measure, high flow rates in the downstream channels would be mitigated through the construction of an upper detention basin near the upper reaches of Threemile Creek. The costs would be higher, and more land would be required for this measure. The location of the basin was shown to be too close to the top of the watershed to attenuate flood flows when undergoing hydraulic analyses; therefore, it was eliminated.

4.3.3.11 Culvert Upsizing and Upper Swale – Yonk Loop Area North of Mendon

This measure would increase the Yonk Loop culverts to accommodate the large drainage flows from the west and the roadside swale be enlarged to handle the flows that run past this location. This would minimize/mitigate flooding of adjacent crop land. This measure was not carried forward because it did not constitute a long-term solution to the identified problems since development will continue in the Yonk Loop area that will present future issues of flooding as these developments occur near and/or alter existing flood channels.

A possible solution was proposed to install an upper swale west of 7200 West in the Yonk Loop area. A wide and shallow swale would be constructed further towards the Wellsville Mountains and canyon outlets that would act as a catchment to all the flood flows diverting them to the north where they could be discharged into the Threemile Canyon flood channel. The swale would be built so that landowners could still use the land for crops or animal grazing. The measure was eliminated because hydraulic analyses proved the cross drainages to be too deep to construct a swale at this location.

4.3.3.12 Canal Tail Water & Lower Canal Spill to Cutler Reservoir – Mendon City

At the tail water of the Wellsville-Mendon Lower Canal north of Mendon City, the channel turns and eventually discharges into the wetlands to the east. At this location, significant drainage has accumulated within the channel at times, and the channel begins to spill over or exceed the capacity of the existing culverts that cross SR-30 and the Union Pacific railroad tracks. An option that was suggested involved channel improvements be completed that included culvert upsizing and channel clearing to allow the drainage to flow freely through the channel and discharge in the wetlands. This measure was eliminated because the issue has been addressed by other more effective project increments that lowered the peak flows in this portion of the canal.

4.3.3.13 Canyon Detention Ponds – Wellsville, Mendon, and Unincorporated County

Early in the scoping process, the measure of installing a detention pond at the outlet of each canyon (of which there are more than ten) along the east face of the Wellsville Mountains was discussed. This measure was eliminated because much of the area that contributes to flood flows during rain events is downstream of the canyon outlets.

4.3.3.14 Bird Canyon & 100 South Channel Improvements – Mendon City

Several channel improvements were initially considered in the Bird Canyon area of Mendon but were ultimately eliminated from consideration. Hydraulic/hydrologic modeling showed existing conditions to be sufficient at 100 East on Bird Creek which is currently able to handle the design flood event. The channel from 100 East to 5400 West in Cache County was considered for flood prevention improvements but was eliminated after the property owners expressed comfort with their current ability to handle flood flows. Initial consideration was given to the 5400 West area for improvements, but it was eliminated when it was discovered that suitable habitat for the threatened Ute-ladies' tresses (ULT) was discovered in the area where improvements were made. One of the planning constraints established avoidance of adverse impacts to suitable habitat for federally listed species.

The 100 South drainage area comprises a large region from the east edge of Deep Canyon through Mendon City to Main Street. There it contributes to the flows in Bird Creek. This measure would increase existing culverts at various locations as well as enlarge ditches and drainage swales to contain flood flows. This measure would also divert excessive flows into Bird Creek to eliminate oversizing of the ditch to the east of Main Street. Also, an embankment with a 15-inch culvert would also be constructed across the drainage above the community at approximately 200 South. The culvert would be enlarged to allow flows to run unobstructed through the embankment and proceed under the canal into the community. The construction process and compaction methods used on this embankment are not known and, if used as a detention area, could result in a catastrophic failure. This measure was eliminated because analysis showed that the existing infrastructure at these locations would be sufficient when other measures considered are implemented.

4.3.3.15 400 South – Mendon City

The 400 South drainage area receives flow from Coldwater Road that was installed by the USFS. These flows cross over the canal beneath Cobblestone and the state highway. From there, the flows are diverted along the highway's eastern right-of-way to 2000 South, where they are released into an irrigation ditch. Several of the pipes along this route are silt laden and undersized. This measure would include cleaning culverts and upsizing the necessary culverts to allow this flow to reach 2000 South without flowing into other systems. This measure was eliminated because analysis showed that the existing infrastructure at these locations would be sufficient when regular maintenance and other considered measures are implemented.

4.3.3.16 Unnamed Stream Channel – Mendon City

This measure relates to the stream channel to the south of Bird Canyon that enters Bird Creek west of the State Highway. Currently there is a 42-inch culvert beneath the canal that allows adequate drainage of the area above. NRCS considered upsizing the culverts that cross the existing roadway to adequately allow drainage so that flow is not obstructed which may cause runoff to flow east through town along 200 South. This measure was eliminated because analysis showed that the

existing infrastructure at these locations would be sufficient when other measures considered are implemented.

4.3.3.17 500 North Channel Improvements – Mendon City

Existing improvements from Pheasant Hollow at 500 North in Mendon have increased flow concentrations that occur at the railroad tracks. Currently, the catch basin at the detention pond cannot collect all the water routed down the curb. The inlet of the detention pond would be revised to intercept the entire flow from the subdivision, and a drainage path would be installed to control flow to the river bottom. This measure was eliminated because analysis showed that the existing infrastructure at these locations would be sufficient when other measures considered are implemented.

4.3.3.18 Deep Canyon Channel Improvements – Mendon City

Deep Canyon is near 300 North in Mendon. While flooding is not always a concern with the Deep Canyon area, under a large storm event, high flows are generated from the large geographic area contributing to the drainage. This may result in a potential hazard if flood water is not routed correctly. The topography and location of the drainage path could aid in channeling flood water around the community. NRCS considered that improvements to the Deep Canyon drainage include upsizing existing culverts and ditches above and below the canal. A restriction exists at the Deep Canyon Road crossing, and excessive flows are channeled down the south side of the roadway into Mendon at about 300 North. In addition, the culvert crossing the state highway is undersized and would cause a retarding of flow. Once across the highway, a drainage ditch or swale with culverts at necessary locations would be constructed running due east to allow water to flow unobstructed to the river bottom. This measure was eliminated because analysis showed that the existing infrastructure at these locations would be sufficient when other measures considered are implemented.

4.3.3.19 Cemetery Ditch (Culverts not Funded by PL-566) – Mendon City

Flooding along 100 East between 100 North and 250 North has also occurred during high runoff events. Under this management measure, existing culverts and ditches along 100 North would be upsized to handle flow that runs down the cemetery stream area. At the intersection of 100 North and 100 East, the runoff would be piped to the east side of 100 East and placed in the existing ditch and then routed to Pond Stream near 250 North. Drop inlets and culverts would be installed at the southwestern corners of the intersections of 100 North and 200 North at 100 East. These culverts would be routed into the ditch on the east side of 100 East and released into Pond Stream. This measure was eliminated because analysis showed that the existing infrastructure at these locations would be sufficient when other measures considered are implemented.

4.3.3.20 100 East North and South Pipelines – Mendon City

Improvements along 100 East that are to happen soon would require the installation of a collection system in the ROW to route the flow to the Pond Stream. This would eliminate any concentrated flows from affecting the homes east of 100 East. This system would include an inlet box and culvert to the main line on the northwest corner of 100 East and 400 North. This measure was eliminated because the 400 South pipeline measure would more effectively address this issue.

In years past, a natural wetland between 200 and 300 South along 100 East existed and provided a drainage path for the southeastern portion of Mendon. This area has been developed, and most

of the wetland appears to be dried up. The management measure suggested for this area involves the installation of a storm water pipe along the east side of 100 East that would collect water in south Mendon. This pipe would be routed along 100 East to 250 South and run east in the existing ditch to the bottom of the river. Inlet boxes and connecting pipes would be installed at locations on the west side of 100 East to facilitate drainage. Existing pipes along 250 South would be upsized to allow for additional flow. This measure was eliminated because hydraulic analysis showed that the other Bird Canyon improvements would mediate the problem at this location.

4.3.3.21 Center Street Pipeline – Mendon City

Currently, a few flooding problems have occurred along the Center Street drainage. This is due to a topographic high point in this area. Most runoff that is routed to this area flows to 100 South or 100 North because of the slope of the existing ground. However, the flow into this drainage from above the canal can cause excess stress on other areas if not contained. Upsizing the existing pipes along the north side of Center Street and installation of inlet boxes at intersections for collection of drainage would help alleviate this issue. At the intersection of 100 East and Center Street, the excess flows would be diverted through a pipe into Bird Creek. Also, diversion structures would be installed to allow continued use of the irrigation system. This measure was eliminated because analysis showed that the existing infrastructure at these locations would be sufficient when other measures considered are implemented.

4.3.3.22 Secondary Water System Supplied by Wellsville Reservoir – Wellsville City

This measure would supply the full water demand for the Wellsville Secondary Water System from the Wellsville Reservoir. Water from the Wellsville-Mendon Lower Canal and Murray Spring would be diverted into Wellsville Reservoir to provide additional supply for the mid to late summer months when the demand is historically higher. This measure was eliminated due to concerns of the fluctuating water surface elevation and environmental impacts of warmer water from the lower canal discharging into the reservoir.

4.3.3.23 Secondary Water System Supplied by Lower Canal – Wellsville City

This measure would supply the full water demand for the Wellsville Secondary Water System from the Wellsville-Mendon Lower Canal. A wet well would be constructed adjacent to the canal to minimize any impacts to the flow in the canal. Water from Murray Spring would be conveyed to discharge into the wet well to supply the demand in early spring and late fall when no water is in the canal. Wellsville-Mendon Lower Canal is supplied by water out of Hyrum Reservoir, several miles upstream. If the flow rate in the canal is changed, it takes several hours for an increase in flow to reach Wellsville City. With the system pumping directly into the pipe network, a constant flow rate would not be possible due to demand fluctuations throughout the day, which is one of the reasons this increment was eliminated. Another factor was the higher pumping costs.

4.3.3.24 Secondary Water System Supplied by Regulation Pond and Wellsville Reservoir – Wellsville City

Another suggested water supply point for the Wellsville Secondary system was pumping directly from Wellsville Reservoir, rather than constructing a new regulation pond. This measure would require a larger pump to meet the pressure needs of the system. Therefore, the pumping costs would be higher, but the capital cost would be lower. After analyzing the initial capital cost versus operation and maintenance over a 20-year period, it was found that the costs were recovered, so the sponsors decided to select another measure.

4.3.3.25 Secondary Water System Supplied by One Large Regulation Pond – Wellsville City

This measure includes supplying the Wellsville Secondary system from a new regulation pond constructed on the west side of Wellsville City at an elevation sufficient to provide 45 psi pressure throughout the system. All water sources (Murray Spring, Wellsville Reservoir, and Wellsville-Mendon Lower Canal) would pump up to the pond, which would have a capacity of storage for 24 hours of peak day usage. PRVs would be required at lower elevation locations throughout the system to maintain pressures lower than 100 psi. This measure was eliminated due to high pumping costs required to convey all three water sources to the pond location and inefficient operation by dissipating energy from pumped water in PRVs.

4.3.3.26 Lower Canal Pressurized by Hyrum Reservoir – Wellsville, Mendon, and Unincorporated Cache County

The Hyrum Reservoir outlet works are open and do not currently leave an option for closed canal systems to the canals that are routed through the Hyrum Dam. If the outlet works at the Hyrum Dam were updated to a closed system to the point where the canals begin, this would allow each canal system to maintain the energy from the Hyrum Reservoir. This is an increment that sponsors would support, but improvements would need to be made at Hyrum Dam, owned by the Bureau of Reclamation. Therefore, this increment was eliminated because the funds from PL 83-566 could not be used for improvements on Reclamation property.

4.3.3.27 Secondary Pipeline System without Regulating Pond – Mendon City

This measure proposed to construct a secondary water system without including a regulating pond. This concept would provide secondary water for many of the residents of the city but would not be able to supply those near the canal channel. There would not be adequate pressures along the canal channel, so a secondary water connection would not be possible until the system built enough pressure due to elevation drop at about 100 West. This increment was removed since it did not provide service to many of the existing residents.

4.3.3.28 Secondary Pipeline System without Pond and Including Development – Mendon City

This measure would be constructed without a regulating pond as well but would be built to serve future development beyond the existing system needs. The existing system would be constructed and serve existing residents, but additional pipelines would be constructed as trunklines out to the east past existing development. These new trunklines would then be available for future development to hook onto as residences are constructed within city limits. This increment was eliminated due to the financial burden that would be placed on existing residents for future development. Mendon City determined that burden should be placed on the future development.

4.3.3.29 Wellsville East Field Canal Pressurized Pipeline Option – Wellsville City

This measure considered would utilize Hyrum Reservoir as a regulation pond and as the point of pressurization. The canal would be piped from Hyrum Reservoir to Meridian Road. This would allow for smaller pipe sizes compared to a gravity pipeline option. This is an increment that sponsors would support, but improvements would need to be made at Hyrum Dam, owned by the Bureau of Reclamation. Therefore, this measure was eliminated because the funds from PL 83-566 could not be used for improvements on Reclamation property.

4.3.3.30 Recreational Trail Along the Canal Alignment – Wellsville City

This measure was brought up in the early stages of the PL-566 funding application. It would involve constructing a recreation trail if the Wellsville-Mendon Lower Canal is piped. The trail would be built above or adjacent to the pipeline alignment and provide recreational opportunities. This measure has been eliminated due to lack of sponsor support and safety concerns with the public having access to the canal.

4.3.3.31 Secondary Regulation Ponds for Recreation – Wellsville City

One of the measures discussed involved the construction of two regulating ponds for the secondary irrigation system. The question was asked if these ponds would be available to the public for recreation. This measure was eliminated due to the ponds being planned on private property and concerns expressed by the landowners regarding the liability of recreational usage.

4.3.3.32 Wellsville Reservoir Campground – Wellsville City

The option of developing a campground on the west side of Wellsville Reservoir was brought up in scoping. This measure was initially removed from consideration early on due to a lack of sponsor support due to their inability to provide matching funds.

4.3.3.33 Wellsville Soccer Field Detention Basin – Wellsville City

While evaluating potential uses for several parcels owned by Wellsville City, the option was suggested of installing a soccer field that would double as a detention basin. This measure was not evaluated further due to these parcels' location and their lack of proximity to areas of concern for flooding in heavy rain events.

4.4 Final Array of Alternatives

The Final Array of Alternative plans, or the Alternatives considered in Section 4.2, are listed in tabular format (Table 4-7) as described by NWPM 501.42(B)(4). The table also describes the ability of each Alternative plan in the Final Array to meet the PR&G evaluation criteria of completeness, effectiveness, efficiency, and acceptability. Table cells that are shaded in **Green** indicate that the Alternative met the specified criteria, table cells that are shaded in **Red** indicate that Alternative did not meet the specified criteria. Figure 4-3 shows the proposed projects that would be installed under each increment considered under the Alternatives.

Table 4-9: Summary of Alternatives Preliminary Screening Evaluation

Screening Category	No Action/FWOFI	Piping Alternative	Lining & Buyouts Alternative
Plan Description			
NEPA Purpose & Need	This Alternative would not meet the purpose and need. Flood control, Ag. Water Mgmt, and public recreation	Flood Control, Ag. Water Mgmt., and Recreation purposes would be met. Needs would be addressed. Is the environmentally	Flood Control, Ag. Water Mgmt., and Recreation purposes would be met using nonstructural measures for flood control.

Screening Category	No Action/FWOFI	Piping Alternative	Lining & Buyouts Alternative
	problems would persist.	preferred and locally preferred alternative.	However, it would relocate many residents.
Contribution to Planning Objectives			
Objective 1 – Flood Control Problem	It would not address flood control infrastructure problems. Flood damage would not be prevented and would continue to occur.	It would install new flood control infrastructure to manage high flows from flood events. It would prevent damage to homes, businesses, & agricultural fields through 2130.	Would conduct voluntary buyouts of all homes in the 100-year existing conditions floodplain and eliminate the flood control problem using a nonstructural measure through 2130.
Objective 2 – Ag. Water Reliability	Would not address the reliability of the Lower Canal or Wellsville East Field systems. Seepage and evaporation losses would continue to occur	Would pipe the Lower Canal and Wellsville East Field Canals to massively reduce seepage and evaporation losses by ~8,926 acre-feet. Agricultural water availability would be improved through 2080.	Would line the Lower Canal with a synthetic liner and pipe the Wellsville East Field Canal to reduce seepage and evaporation losses. Agricultural water availability would be improved through 2080.
Objective 3 – Access to Secondary Water	Access to secondary water would still be limited for residents and farmers would continue to utilize culinary water for irrigation purposes during the late irrigation season.	It would install new secondary water systems in Wellsville and Mendon cities to provide better access to secondary water. Water saved by piping the Lower Canal would reduce culinary water pumping demands for irrigation.	It would include a structural measure to install secondary water systems in Wellsville & Mendon cities to provide better access to secondary water. Water saved by lining the Lower Canal would still reduce culinary water pumping demands for irrigation.
Objective 4 – Recreation Opportunity	There would be no expansion of existing recreational opportunities in the	Would construct a boat ramp at Wellsville Reservoir for non-motorized watercraft and a	Would construct a boat ramp at Wellsville Reservoir for non-motorized watercraft and a reflecting pond at

Screening Category	No Action/FWOFI	Piping Alternative	Lining & Buyouts Alternative
	watershed under this Alternative.	reflecting pond at Mendon City Cemetery to increase the recreational opportunities in the area.	Mendon City Cemetery to increase the recreational opportunities in the area.
Response to Planning Constraints			
Constraint 1 – Disruptions to Property	No construction would occur under this Alternative, at this time. Future flooding events may necessitate property disruptions. and so, while no disruptions to property would occur immediately, there would be the potential for future disruptions as the problems continue. This Alternative does not meet this constraint.	This Alternative would meet this constraint by minimizing disruptions to existing residential and commercial properties during the construction of the project. No properties would be removed as a part of installation.	This Alternative does not meet this planning constraint. The nonstructural component to buyout homes in the 100-year floodplain would cause many disruptions to many properties.
Constraint 2 – Cultural Site Impacts	This Alternative does not meet this planning constraint. By not installing any flood control infrastructure, all historic/cultural sites in the indirect/No Action APE would be continue to be damaged by flooding.	This Alternative would meet the constraint in that it states that projects should minimize impacts to cultural/historic resources to the maximum extent possible. Only the sites related to the canals would be impacted.	This Alternative does not meet this planning constraint. By not installing any flood control infrastructure and conducting buyouts instead, all historic and cultural sites in the indirect/No Action APE would be damaged in this scenario, which would also result in <i>adverse effects</i> to any NRHP eligible properties in the 100-year existing conditions floodplain..

Screening Category	No Action/FWOFI	Piping Alternative	Lining & Buyouts Alternative
Constraint 3 – Transportation Impacts	No construction would occur under this Alternative at this time but could occur in the future, and so, this Alternative does not meet this constraint.	Traffic flow would be temporarily impacted during construction. However, the improvements made to flood channels and canal crossings will improve transportation infrastructure in the watershed overall. This Alternative meets this planning constraint.	Traffic flow would be temporarily impacted during construction. There would be no improvements made to the flood channels under this Alternative, leaving existing infrastructure in place. This Alternative meets this planning constraint.
Constraint 4 – Irrigation Water Access	No construction would occur under this Alternative, so no changes would be made to the ability of farmers to access their irrigation water during the irrigation season.	Construction work on the canals would be completed outside of the typical irrigation season, meaning farmers would maintain access to their water during the irrigation season. Additionally, this option would result in better control of water, mitigation of canal embankment failure risk, reduction in debris, and easier set ups to run a pump to pressurize sprinklers.	Construction work on the canals would be completed outside of the typical irrigation season, meaning farmers would maintain access to their water during the irrigation season. Additionally, this option would result in better control of water, mitigation of canal embankment failure risk, reduction in debris, and easier set ups to run a pump to pressurize sprinklers.
Constraint 5 – Soil Loss	This Alternative does not meet this planning constraint. By not addressing any of the problems, soil loss, sedimentation/nutrient loading, and degradation of the surrounding landscape would occur.	Construction work would ultimately provide improved cropping to the area, leading to improved cover management under this Alternative, despite temporary impacts. Soil disruption will be minimized to the extent practicable	Soil loss, erosion, sedimentation/nutrient loading, and degradation of the surrounding landscape would occur under this Alternative as a result of continued flooding. This Alternative does not meet this planning constraint.

Screening Category	No Action/FWOFI	Piping Alternative	Lining & Buyouts Alternative
		using construction BMPs.	
Constraint 6 – Water Pollution	This Alternative does not meet this planning constraint. By not addressing any of the identified problems, nutrient loading to the Little Bear River would continue and water quality would continue to degrade. Aquatic ecosystems would not improve.	Construction work would greatly reduce the amount of nutrient loading to the Little Bear River as flood control capabilities would be improved and the Lower Canal would be converted to a pressurized system. It can be reasonably forecasted that water quality and aquatic ecosystems in the Little Bear River would improve under this Alternative.	Nutrient loading and sedimentation to the Little Bear River would continue and water quality would continue to degrade under this Alternative. No flood control infrastructure would be installed. It can be reasonably forecasted that aquatic ecosystems would not improve. This Alternative does not meet this planning constraint.
Constraint 7 – Protect Listed Species	This Alternative would not change existing conditions for any listed species or suitable habitats that may occur in the watershed. This Alternative meets this planning constraint.	It is not anticipated that any existing populations of any listed species would be affected as a result of this Alternative. Additionally, no suitable habitat for any listed species would be disturbed during construction.	This Alternative does not meet this planning constraint. Although construction would not impact any suitable habitat, the continued flooding that would occur under this Alternative has the potential to degrade existing suitable habitat for the threatened Ute Ladies'-Tresses.
Contribution to Ecosystem Services			
Provisioning Services	Provisioning services would not be improved under this Alternative. In fact, over time it can be predicted that they would become impaired.	Provisioning Services would be improved under this Alternative. Crop yield value would increase ~108% and water quantities would be increased via canal piping, among other benefits.	Provisioning Services would be improved, although not to the same extent as the Piping Alternative. Crop yield values would increase ~74% but would still be impacted by flooding.

Screening Category	No Action/FWOFI	Piping Alternative	Lining & Buyouts Alternative
			Water quantities would also be improved.
Regulating Services	Regulating services would not be improved under this Alternative. Flooding conditions would worsen over time.	Regulating Services would be improved under this Alternative. Flood control infrastructure would reduce the likelihood of damage to property or loss of life poised by current conditions. The threat of public safety at the Lower Canal would be eliminated by enclosing it. water quality would be improved	Regulating Services would not be improved under this Alternative. Although the problem of flood control would be addressed via property buyouts, the flooding would still occur and would be expected to worsen over time. Also, lining the canal does not remove the risk of drowning as the canal would remain open. Water quality would become impaired.
Cultural Services	Cultural Services would not be improved under this plan. No new opportunities for cultural, spiritual, aesthetic, or recreational enjoyment would be constructed.	Cultural Services would be improved under this Alternative. The construction of two new recreational facilities in Wellsville and Mendon would provide new recreational and aesthetic opportunities in the watershed.	Cultural Services would be improved under this Alternative. The construction of two new recreational facilities in Wellsville and Mendon would provide new recreational and aesthetic opportunities in the watershed.
Supporting Services	Not Evaluated in this Plan-EIS.	Not Evaluated in this Plan-EIS.	Not Evaluated in this Plan-EIS.
Results of Economic Analysis			
Benefit-Cost Ratio (BCR)	0.0 Does not meet the minimum BCR of 1.0.	2.46 Does meet the minimum BCR of 1.0.	1.73 Does meet the minimum BCR of 1.0.
Net Project Benefits	\$0	\$8,749,147	\$5,819,942.

Screening Category	No Action/FWOFI	Piping Alternative	Lining & Buyouts Alternative
Response to Evaluation Criteria			
Completeness	This Alternative would not constitute a complete Alternative as no problems would be addressed.	This Alternative would account for all necessary investments to achieve the planned effects and is a complete solution.	This Alternative would account for all necessary investments to achieve the planned effects and is a complete solution.
Effectiveness	This Alternative would not constitute an effective Alternative as no problems would be solved and no objectives met.	This Alternative would address all the identified problems and meet all of the project objectives to constitute an effective solution.	This Alternative would not constitute an effective solution as not all the project objectives would be met.
Efficiency	This Alternative would not cost anything to implement and so would constitute a cost effective Alternative that would be an efficient solution.	This Alternative is the NEE Alternative and has net positive benefits and a BCR of 2.46. This Alternative constitutes an efficient solution.	This Alternative does have net positive benefits and a BCR of 1.73. However, due to the exorbitant cost to conduct property buyouts in the floodplain and the significantly lower net benefits, it is not an efficient solution.
Acceptability	This Alternative would not be acceptable or consistent with existing federal laws as it would not protect the environment and would not address any of the problems in the watershed.	This Alternative would comply with all federal and state regulatory frameworks and is the environmentally preferred Alternative from NEPA and the locally preferred Alternative. The problems in the watershed would be addressed. This Alternative constitutes an acceptable solution.	This Alternative would not be acceptable as it is highly unlikely that property buyouts could be conducted on an entirely voluntary basis, requiring the use of eminent domain to accomplish it. This Alternative does not constitute an acceptable solution.

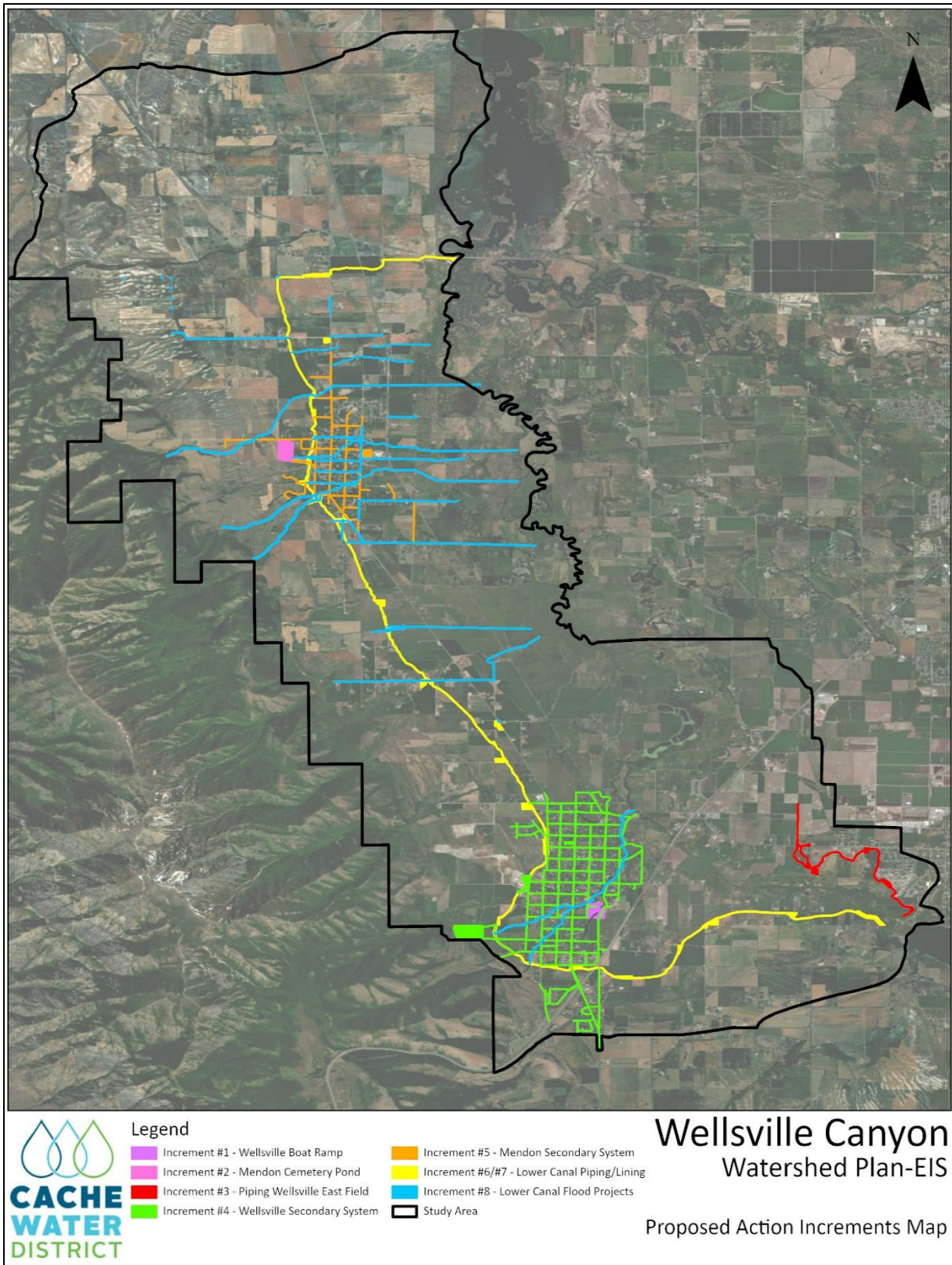


Figure 4-6: Proposed Action Increments Map

5.0 Environmental Consequences: Evaluation of Alternatives

This chapter serves as an evaluation of the potential effects that each Alternative may have on the various resources described in Chapter 3 of this Plan-EIS. While Chapter 3 was representative of the existing conditions in the project area, this chapter serves to examine how those conditions may be altered, positively or negatively, by the Action Alternatives.

The NRCS has a responsibility under NEPA to identify and address potential effects on the environment that may result from implementation of the alternative plans. Additionally, under the PR&G, the NRCS is responsible for ensuring that the alternatives meet the principles and objectives of the program. This Plan-EIS includes the No Action Alternative (FWOFI) and two Proposed Action Alternatives. One of the Proposed Action Alternative has been determined to be the Locally Preferred, Environmentally Preferred, and PR&G NEE (Piping Alternative) for the project. This chapter describes the potential effects on the environmental resources due to construction of either alternative within each resource category. The same organizational format as Chapter 3 is followed for clarity and ease of comparison.

5.1 Summary and Comparison of Alternatives-Planning Process

Table 5-1 compares how well the No Action Alternative (FWOFI), Piping Alternative (Structural), and Lining & Buyouts Alternative (Nonstructural) resolve the identified purposes— Flood Prevention, Agricultural Water Management, and Public Recreation—as well as the project Objectives, Constraints, and Evaluation Criteria. Each alternative is evaluated in comparative form in substantial and equal detail.

Table 5-1: Summary and Comparison of Alternatives – Planning Process

Item or Concern	No Action/FWOFI (Analytic Baseline)	Piping Alternative (Structural)	Lining & Buyouts Alternative (Nonstructural)
Flood Prevention			
Deficiency 1 – Mendon Flooding at Deep Canyon, 300 North, 400 North, Cemetery Ditch, 100 East, Bird Canyon, and Center Street	No federal investment would be made, and no construction would occur. The issues associated with this deficiency would continue.	Upsize culverts at Deep Canyon, Cemetery Ditch, 300 North, and 100 South in Mendon. Diverting excess flow that 100 East culvert can't handle to the Mendon Pond. Upsizing ditches along 100 North. Pipe runoff at intersection of 100 North and 100 East. Installation of drop inlets and culverts at southwest intersections. Install a north and south flood control pipeline	Nonstructural measure to buyout/conduct relocations of all properties in the 100-year existing conditions floodplain in the project area. This option would eliminate the problem of flood prevention and would not require the installation of any structural measures for this authorized purpose.

Item or Concern	No Action/FWOFI (Analytic Baseline)	Piping Alternative (Structural)	Lining & Buyouts Alternative (Nonstructural)
		along 100 East. Upsize pipes along the north side of Center Street and install inlet boxes at intersections. Install a flood control pipeline at Bird Canyon.	
Deficiency 2 – Mendon 500 North Detention Basin Catch Pond Capacity, 400 North Flooding, and Flooding at Threemile Canyon/Yonk Loop North of Mendon	No federal investment would be made, and no construction would occur. The issues associated with this deficiency would continue.	Revise the inlet of the 500 North Detention Basin to intercept all flow from Pheasant Hollow. Install a drainage path to control flow to the river bottom.	Nonstructural measure to buyout/conduct relocations of all properties in the 100-year existing conditions floodplain in the project area. This alternative would eliminate the problem of flood prevention and would not require the installation of any structural measures for this authorized purpose.
Deficiency 3 – Mendon Pond Stream Diversion Structure and Culvert Capacities at Main Street, 100 South, 400 South, and an Unnamed Channel south of Bird Canyon	No federal investment would be made, and no construction would occur. The issues associated with this deficiency would continue.	Rebuild the main street diversion structure to allow for full flood flow to be routed through the pond stream if needed. Install an oversized culvert at 100 East. Clean and upsize culverts at 400 South. Upsize the culverts at the unnamed channel south of Bird Canyon.	Nonstructural measure to buyout/conduct relocations of all properties in the 100-year existing conditions floodplain in the project area. This alternative would eliminate the problem of flood prevention and would not require the installation of any structural measures for this authorized purpose.
Deficiency 4 – Wellsville-Mendon Lower Canal Flood Control Capacity and Nutrient Loading/Erosion to the Little Bear River	No federal investment would be made, and no construction would occur. The issues associated with this deficiency would continue.	Construct flood control pipeline and spill structure near 2900 South and 3400 South in Wellsville to alleviate conveyance capacity of the Lower Canal. Divert the water into the canal near the Francis family property.	Nonstructural measure to buyout/conduct relocations of all properties in the 100-year existing conditions floodplain in the project area. This option would eliminate the problem of flood prevention and would not require the installation of

Item or Concern	No Action/FWOFI (Analytic Baseline)	Piping Alternative (Structural)	Lining & Buyouts Alternative (Nonstructural)
			any structural measures for this authorized purpose.
Deficiency 5 – Wellsville Wide Canyon Flooding	No federal investment would be made, and no construction would occur. The issues associated with this deficiency would continue.	Install a flood control pipeline at Wide Canyon. Upsize the culverts along the natural channel of the Murray Springs Drainage.	Nonstructural measure to buyout/conduct relocations of all properties in the 100-year existing conditions floodplain in the project area. This option would eliminate the problem of flood prevention and would not require the installation of any structural measures for this authorized purpose.
Ag. Water Mgmt.			
Deficiency 6 – Wellsville and Mendon Cities Secondary Water Access	No federal investment would be made, and no construction would occur. The issues associated with this deficiency would continue.	Install secondary water system in Wellsville supplied by two regulating ponds. Install secondary water system in Mendon with a pipe network and a single regulating pond for residents living near the canal.	Install secondary water system in Wellsville supplied by two regulating ponds. Install secondary water system in Mendon with a pipe network and a single regulating pond for residents living near the canal.
Deficiency 7 – Wellsville-Mendon Lower Canal Water Conveyance and Seepage Issues	No federal investment would be made, and no construction would occur. The issues associated with this deficiency would continue.	Enclose the Lower Canal and convey water with a pipeline in Wellsville, Mendon, and unincorporated parts of Cache County, Utah.	Widen the Lower Canal and install a canal liner to convey water in Wellsville, Mendon, and unincorporated parts of Cache County, Utah.
Deficiency 8 – Wellsville East Field Canal Water Conveyance and Seepage Issues	No federal investment would be made, and no construction would occur.	Gravity pipe the existing Wellsville East Field Canal starting ~300 feet downstream of the existing Hyrum spillway and ending 2.5	Gravity pipe the existing Wellsville East Field Canal starting ~300 feet downstream of the existing Hyrum spillway and ending 2.5 miles

Item or Concern	No Action/FWOFI (Analytic Baseline)	Piping Alternative (Structural)	Lining & Buyouts Alternative (Nonstructural)
	The issues associated with this deficiency would continue.	miles later to prevent continued seepage losses at the canal.	later to prevent continued seepage losses at the canal.
Public Recreation			
Deficiency 9 – Wellsville Reservoir and Mendon Cemetery Impaired Recreation Access and Lack of Cultural Services	No federal investment would be made, and no construction would occur. The issues associated with this deficiency would continue.	Construction of a boat ramp for non-motorized watercraft at Wellsville Reservoir and installation of a small reflecting pond and walking path with benches at the Mendon City Cemetery.	Construction of a boat ramp for non-motorized watercraft at Wellsville Reservoir and installation of a small reflecting pond and walking path with benches at the Mendon City Cemetery.
Project Objectives			
Green indicates the objective was met; Red indicates it was not. More detail can be seen in Table 4-7 of this Plan-EIS.			
Objective 1 – Flood Control Problem	NO	YES	YES
Objective 2 – Ag. Water Reliability	NO	YES	YES
Objective 3 – Access to Secondary Water	NO	YES	YES
Objective 4 – Recreation Opportunity	NO	YES	YES
Constraints			
Constraint 1 – Disruptions to Property	YES	YES	NO
Constraint 2 – Cultural Site Impacts	NO	YES	NO
Constraint 3 – Transportation Impacts	YES	YES	YES

Item or Concern	No Action/FWOFI (Analytic Baseline)	Piping Alternative (Structural)	Lining & Buyouts Alternative (Nonstructural)
Constraint 4 – Irrigation Water Access	YES	YES	YES
Constraint 5 – Soil Loss	NO	YES	NO
Constraint 6 – Water Pollution	NO	YES	NO
Constraint 7 – Protect Listed Species	YES	YES	NO
Evaluation Criteria			
Completeness	NO	YES	YES
Effectiveness	NO	YES	NO
Efficiency	YES	YES	NO
Acceptability	NO	YES	NO

5.2 Summary and Comparison of Alternatives-Ecosystem Services

Ecosystem service flow impacts for the No Action/FWOFI Alternative were projected assuming that current conditions/trends would continue to occur for the entire period of analysis while considering all reasonably forecasted future conditions within the watershed. Table 5-2 compares how well the No Action/FWOFI Alternative, Piping Alternative, and Lining & Buyouts Alternative impact the ecosystem service flows in the watershed as well as how they meet the six Guiding Principles of the PR&G which are listed and defined below:

- Healthy & Resilient Ecosystems:** A primary objective is to identify alternatives that will protect and restore ecosystem functionality by 1) avoidance of adverse impact, then 2) minimization of impacts with mitigation of any unavoidable damage, and finally 3) full mitigation to offset environmental damages. Mitigation must be included in the alternative development, design, and costs.
- Sustainable Economic Development:** The alternatives should consider both the quantity and quality of water for both present and future generations as part of a larger economic and environmental evaluation to ensure that future projects are both economically feasible and sustainable for both the local and national best interests. The proposed alternative should reduce risk and uncertainty, allowing a full range of adaptable management options to maintain feasibility for future projects.
- Floodplains:** The alternatives must seek to avoid impacts to flood prone areas and floodplains, and where possible improve floodplain sustainability and functionality.

- **Public Safety:** DM 9500-013 states, “An objective of PR&G is to reduce the risks to people including life, injury, property, essential public services, and environmental threats concerning air and water quality.” Public safety, and the improvement of public safety, using nonstructural and structural options must be considered.
- **Environmental Justice:** The PR&G process requires that the alternatives provide fair treatment to all people through all stages of the planning process. The disproportionate impact on minorities, Tribal, and low-income populations is not allowed.
- **Watershed Approach:** This approach recognizes that there may be impacts both upstream and downstream of the project area and the applicable political or administrative boundaries. Under most conditions, it is necessary to evaluate the impacts beyond just a single hydrologic unit.

Table 5-2: Summary and Comparison of Alternatives – Ecosystem Services Tradeoff

Criterion	No Action (FWOFI) (Analytic Baseline)	Piping Alternative (Structural)	Lining & Buyouts (Nonstructural)
Alternative I.D.			
Locally Preferred	—	X	—
Nonstructural	—	—	X
Environmentally Preferred	—	X	—
National Economic Efficiency	—	X	—
Socially Preferred	—	X	—
Preferred Alternative	—	X	—
Guiding Principles			
The Alternative marked with X and colored green is the plan that <u>best</u> meets the specified Guiding Principles of the PR&G			
Healthy/Resilient Ecosystems	—	X	—
Sustainable Economic Devel.	—	X	—
Floodplains	—	X	—
Public Safety	—	X	—
Environmental Justice	N/A	N/A	N/A
Watershed Approach	—	X	—
Ecosystem Services Effects			

Criterion	No Action (FWOFI) (Analytic Baseline)	Piping Alternative (Structural)	Lining & Buyouts (Nonstructural)
The Alternatives colored green indicates improvement in Service provision, red indicates impairment.			
Provisioning Services			
Food Production/ Agriculture (Non-Monetized)	NO	YES	YES
Water Savings/Seepage (Non-Monetized)	NO	YES	YES
Drinking Water Supply (Non-Monetized)	NO	YES	YES
Regulating Services			
Flood Control (Monetized)	NO	YES	NO
Public Safety (Non-Monetized)	NO	YES	NO
Water Quality in Little Bear (Non-Monetized)	NO	YES	NO
Drought Resiliency (Non-Monetized)	NO	YES	NO
Cultural Services			
Recreational Experiences (Non-Monetized)	NO	YES	YES
Spiritual Experiences (Non-Monetized)	NO	YES	YES
Aesthetic Value of Watershed (Non-Monetized)	NO	YES	NO
Cultural/Historic Sites (Non-Monetized)	NO	YES	NO
Supporting Services			
Not Evaluated in this Plan-EIS	N/A	N/A	N/A
Economic Analysis			

Criterion	No Action (FWOFI) (Analytic Baseline)	Piping Alternative (Structural)	Lining & Buyouts (Nonstructural)
Costs			
Total Project Investment	\$0	\$139,176,000	\$190,452,000
Annual Project Investment	\$0	\$5,796,000	\$7,749,000
Annual OM&R Costs	\$0	\$211,158	\$208,080
Total Annual Project Costs	\$0	\$6,007,158	\$7,957,080
Monetized Benefits for Ecosystem Services			
Provisioning	Not Monetized in this Plan-EIS	Not Monetized in this Plan-EIS	Not Monetized in this Plan-EIS
Regulating	\$0 Damage Reduction Benefit	\$6.83 M Damage Reduction Benefit	\$7.31 M Damage Reduction Benefit
Cultural	Not Monetized in this Plan-EIS	Not Monetized in this Plan-EIS	Not Monetized in this Plan-EIS
Supporting	N/A	N/A	N/A
Total Annual Monetized Benefits	\$0	\$14,756,305	\$11,574,684
Total Annual Monetized Costs	\$0	\$6,007,158	\$7,957,080
Benefit-Cost Ratio	0.0	2.46	1.73
Annual Monetized Net Benefit	\$0	\$8,749,147	\$5,819,942
Regional Economic Development/Economic Impact Assessment	Not Performed for this Plan-EIS		
Regional Employment	N/A	N/A	N/A
Regional Income	N/A	N/A	N/A
Regional Impacts (Other)	N/A	N/A	N/A

5.3 Effects of Individual Alternatives Relative to Resource Concerns

The following list defines the environmental resource impact terms, including classifications and descriptions, in this section.

- **Direct Benefit or Impact:** Impacts caused by a Proposed Action and occurring at the same time and place.
- **Indirect Benefit or Impact:** Impacts caused by an action that are later in time or farther removed in distance but are reasonably expected or foreseeable.
- **Reasonably Foreseeable Benefit or Impact:** The impacts on the environment that result from the incremental impact of actions when added to other past, present, and reasonably foreseeable future actions regardless of the agency (federal or non-federal) or person undertaking such other action.
- **Temporary:** Impacts or effects that are not lasting and the affected resources would be expected to return to the pre-project state. Typically, this is for the duration of construction and a designated restoration period.
- **Permanent:** Impacts or effects that last for an extended duration, often for years after construction. For this evaluation, these impacts are considered to be 50 years based on the design life of the project.

The individual resource concerns are evaluated for impacts under each Alternative in the sections below. Following these assessments, there is a summary and comparison table for the effects on resource concerns for the project modeled after Figure 501D-7 in the NWPM.

Table 5-3 through Table 5-27 present a more detailed analysis of the environmental impacts on each of the resources and will allow for a more representative analysis of the overall impacts caused by each of the three evaluated Alternatives. Table 5-28 then shows a summary and comparison of the effects on resources.

Each table will describe the resource category followed by the expected environmental impacts to the resource under each of the three evaluated alternatives (No Action/FWOFI, Piping Alternative, and Lining & Buyouts Alternative).

Each table is also color coded to correspond with the type of resource impact. **Red** indicates a **Negative impact**, **Yellow** indicates **No impact/No change**, and **Green** indicates a **Positive impact**. All impacts may be temporary or permanent as well as direct or indirect, which is included in the text along with comments explaining the impact in detail.

Additionally, for each resource concern, the magnitude of impacts is evaluated. For the sake of brevity, the Alternative names are simplified in the tables, as Alternative 1 (No Action/FWOFI), Alternative 2 (Piping Alternative), and Alternative 3 (Lining & Buyouts Alternative). “NA” is the abbreviation for No Action and “NS” is the abbreviation for Nonstructural.

5.3.1 Soil Resources

The No Action and the Proposed Action Alternatives have insignificant or no differences regarding the effects on the project area as summarized in Table 5-3.

Table 5-3: Soil Resources Impact Comparison

Alternative	Soil Resources Impacts
Alternative 1 (NA)	The inherent characteristics of soils or damage to soil layering/horizons would not be affected under this alternative. Existing conditions would continue. Soil loss due to erosion is addressed in section 5.3.4.
Alternative 2	The inherent characteristics of soils or damage to soil layering/horizons would not be affected under this alternative. Existing conditions would continue.
Alternative 3 (NS)	The inherent characteristics of soils or damage to soil layering/horizons would not be affected under this alternative. Existing conditions would continue. Soil loss due to erosion is addressed in section 5.3.4.

5.3.1.1 Magnitude of Impacts

All alternatives would have no effect on the soil properties in the project area. Existing conditions would continue unaltered under each alternative considered.

5.3.2 Geology

There are no expected geological impacts by either the No Action Alternative or the Proposed Action Alternatives on either lithology or faulting/tectonics. There are no known paleontological resources within the area, so the resource was eliminated from evaluation.

Table 5-4: Geology Impact Comparison

Alternative	Geology Impacts
Alternative 1 (NA)	Under the No Action/FWOFI Alternative, underlying deposits, lithology, faults, and tectonics would remain in their current state. There are no known paleontological resources in the project area. Existing conditions would continue.
Alternative 2	Under the Piping Alternative, underlying deposits, lithology, faults, and tectonics would remain in their current state. There are no known paleontological resources in the project area. Existing conditions would continue.
Alternative 3 (NS)	Under the Lining & Buyouts Alternative, underlying deposits, lithology, faults, and tectonics would remain in their current state. There are no known paleontological resources in the project area. Existing conditions would continue.

5.3.2.1 Magnitude of Impacts

All alternatives would have no impact on geological and paleontological resources in the project area. Existing conditions would continue unaltered under each alternative considered.

5.3.3 Prime and Unique Farmland

There are significant differences between the No Action/FWOFI and the Proposed Action Alternatives related to Prime farmland, farmland of State Importance, and farmland of Local Importance. Table 5-5 summarizes the impacts of each alternative in a 25-year flood event. Similar

effects are associated with all of the flood events evaluated including the 5-, 10-, 50-, 100-, and 500-year events.

Table 5-5: Farmland Classification Impact Comparison

Alternative	Prime & Unique Farmland Impacts
Alternative 1 (NA)	There would be multiple indirect adverse impacts to farmland in the project area under this Alternative. If no action is taken, the quality of the area's farmland will continue to diminish as a result of flood inundation and surface runoff events.
Alternative 2	There would be direct permanent benefits to all farmland classifications in the project area and soil absorption capabilities under this alternative. Approximately 7,114 acres of land would be restored to full agricultural value if the irrigation systems are pressurized. There would be approximately \$24,000 in pumping savings under this alternative. This restoration of soils to normal nutrient uptake levels through seepage reduction will encourage natural biogeochemical cycling.
Alternative 3 (NS)	There would be direct permanent benefits to all farmland classifications in the project area and soil absorption capabilities under this alternative. Approximately 7,114 acres of land would be restored to full agricultural value if the irrigation systems are pressurized. This restoration of soils to normal nutrient uptake levels through seepage reduction will encourage natural biogeochemical cycling.

5.3.3.1 Magnitude of Impacts

Although the benefits that would result from the Lining & Buyouts Alternative would be very similar to the Piping Alternative, it is reasonable to assume that a piped system would be more beneficial than a lined one due to the slightly higher quantity of water saved that would be lost to seepage under the Lining & Buyouts Alternative.

Additionally, the Lining & Buyouts Alternative would not restore additional acres of farmland to full production as the flood control option would be a simple property buyout of homes in the 100-year existing conditions floodplain. This constitutes the most significant difference between the two action alternatives in terms of the magnitude of the benefits they would provide to the watershed's residents. The Piping Alternative would benefit farmland and agricultural viability in the watershed to a much more significant extent than the Lining & Buyouts Alternative, which would also entail relocating residents, including some farmers.

5.3.4 Upland Erosion and Sedimentation

Table 5-6 summarizes the effects of the No Action/FWOFI and the Proposed Action Alternatives on upland erosion and sedimentation in the project area.

Table 5-6: Upland Erosion & Sedimentation Impact Comparison

Alternative	Upland Erosion & Sedimentation Impacts
Alternative 1 (NA)	Under this alternative, soil erodibility would not be changed. There wouldn't be a need for construction easements/staging areas. Existing conditions would continue. Soil loss would continue to occur and be nutrient loaded to the Little Bear River under this Alternative, worsening the water quality over time.
Alternative 2	There would be a direct temporary impact to erosion as a result of construction. Construction will impact on the location of storage materials. There will be removal of vegetation and possible mobilization of sediments into runoff. The impacts will be temporary since the land will be reclaimed following construction and vegetation restabilization is required by the Utah Pollutant Discharge Elimination System (UPDES).
Alternative 3 (NS)	There would be a direct temporary impact to erosion as a result of construction. Construction will impact on the location of storage materials. There will be removal of vegetation and possible mobilization of sediments into runoff. The impacts will be temporary since the land will be reclaimed following construction and vegetation restabilization is required by the Utah Pollutant Discharge Elimination System (UPDES). Additionally, soil loss would continue to occur and be nutrient loaded to the Little Bear River under this alternative, worsening the water quality over time.

5.3.4.1 Magnitude of Impacts

The least damaging alternative for upland erosion and sedimentation would be the Piping Alternative as it is the only option that reduces nutrient loading to the Little Bear River, an important project component.

Additionally, the only adverse impacts under the Piping Alternative are temporary due to construction. In the long-term, the alternative will provide benefits to cover management practices in the project area.

The No Action Alternative would continue to degrade the Little Bear River via nutrient loading, especially during flood events.

The Lining and Buyouts Alternative would have all the direct temporary benefits of the Piping Alternative in combination with the permanent direct adverse impacts to the Little Bear River via nutrient loading.

5.3.5 Water Resources

This section compares the impacts that the No Action and Proposed Action Alternatives will have on the project area's water resources. Table 5-7 identifies these impacts in detail.

Table 5-7: Water Resources Impact Comparison

Alternative	Water Resources (Quantity) Impacts
Alternative 1 (NA)	There would be no change to surface water quantity, water rights, or canal seepage losses and spillage under the No Action/FWOFI Alternative. Existing conditions would continue. However, farmers would continue to have limited access to secondary water supply during the late irrigation season and would rely more on groundwater pumping and culinary water for late-season irrigation needs, creating a direct negative impact.
Alternative 2	There would be direct permanent benefits to surface water quantity and canal seepage/spillage losses under this alternative. By piping the systems, diversions take place on a demand basis, leaving flows in the Little Bear River and Hyrum Reservoir when demands are lower in May and June. Piping the canals will conserve approximately 8,926 acre-feet which currently seeps out or is lost as operational waste. Water rights would not be impacted. Groundwater quantity would be improved as pumping demands are reduced as a result of the secondary water saved.
Alternative 3 (NS)	There would be direct permanent benefits to surface water quantity and canal seepage/spillage losses under this alternative. By lining the Lower Canal system and piping the East Field system, diversions take place on a demand basis, leaving flows in the Little Bear River and Hyrum Reservoir when demands are lower in May and June. Lining and expanding the Lower Canal will conserve approximately 8,926 acre-feet which currently seeps out or is lost as operational waste. Water rights would not be impacted. Groundwater quantity would be improved as pumping demands are reduced as a result of the saved secondary water.

5.3.5.1 Magnitude of Impacts

The total acre-feet of water saved by either action alternative would be close to the same. The Piping Alternative may save a slightly higher amount of water than the Lining & Buyouts Alternative, but it would be a negligible amount.

The No Action/FWOFI Alternative would leave current conditions in place and seepage issues would continue for the WMCD and the Wellsville East Field Canal Company including reliance on groundwater pumping and culinary water to meet late-season irrigation needs.

5.3.6 Surface Water Quality

The Little Bear River is regulated by TMDLs in Utah. Table 5-8 compares the expected impacts of each alternative.

Table 5-8: Surface Water Quality Impact Comparison

Alternative	Surface Water Quality Impacts
Alternative 1 (NA)	The No Action/FWOFI Alternative would continue to degrade and impair the water quality of the Little Bear River via heavy nutrient loading during flood events. Direct negative impact.
Alternative 2	There would be direct permanent benefits to sediment management, total phosphorus, and nitrates under this alternative. The inundation areas will be revegetated following construction, crop management will improve, and overall erodibility will decrease. Anything that increases or decreases erosion and sediment will have a correlated impact on total phosphorus in the Little Bear River. In this case, there will be permanent benefits due to improvement to lands following construction. The increased vegetative density in the areas of flood inundation and saturation that are restored to full utilization, the increased nitrogen uptake will likely reduce nitrates in the runoff. The Alternative is in accordance with the National Water Quality Initiative (NWQI) practices 430 (irrigation pipeline), 442 (sprinkler system), 608 (surface drain, main or lateral), 554 (drainage water management), 342 (critical area planting), and 340 (cover crop). Dissolved oxygen is linked with the total phosphorus and nitrates. Phosphorus and nitrates are necessary nutrients for algal blooms, which reduce dissolved oxygen. The reduction of Phosphorus will reduce algal growth and corresponding impacts on dissolved oxygen.
	There would be direct temporary impacts to sediment management and total phosphorus under this alternative. During construction, there is a possibility of increased sediment loading to the Little Bear River from direct stormwater and snowmelt runoff. This will require mitigation during construction, using sediment control measures such as the SWPPP. Phosphorus tends to bind to fine sediments like clay and organics. Any action which increases or decreases erosion and sediment movement will have a correlated impact on total phosphorus levels in the Little Bear River. In this case, negative impacts to total phosphorus will result from construction activities and will be temporary.
Alternative 3 (NS)	There would be direct temporary and permanent impacts to sediment management and total phosphorus under this alternative. This Alternative would continue to degrade and impair the water quality of the Little Bear River via heavy nutrient loading during flood events. Direct negative impact. During construction, there is a possibility of increased sediment loading to the Little Bear River from direct stormwater and snowmelt runoff. This will require mitigation during construction, using sediment control measures such as the SWPPP. Phosphorus tends to bind to fine sediments like clay and organics. Any action which increases or decreases erosion and sediment movement will have a correlated impact on total phosphorus levels in the Little Bear River. In this case, negative impacts to total phosphorus will result from construction activities and will be temporary.

5.3.6.1 Magnitude of Impacts

Of the alternatives considered, the Piping Alternative would have the most beneficial impacts to surface water quality. The No Action/FWOFI Alternative would continue to impair the water

quality of the Little Bear River via nutrient loading during flood events. The Lining & Buyouts Alternative would combine the temporary adverse impacts associated with construction and the direct permanent impacts associated with nutrient loading to the Little Bear River.

5.3.7 Groundwater Quality

Arsenic and nitrate contamination are groundwater quality concerns that are particularly pronounced in the project area. This section addresses the impacts of each alternative on the groundwater within the project area.

Table 5-9: Groundwater Quality Impact Comparison

Alternative	Groundwater Quality Impacts
Alternative 1 (NA)	Under the No Action/FWOFI Alternative, there would be no change to groundwater quality. This includes shallow groundwater quality, confined aquifer water quality, nitrate management aquifer, or arsenic levels. Existing conditions would continue.
Alternative 2	There would be indirect permanent benefits to the nitrate management aquifer and to arsenic contamination. The project will support the BMPs established by the DEQ and the NRCS including the reduction of potentially nutrient-rich surface water that will infiltrate and contaminate the groundwater, This Alternative would be carried out in accordance with the National Water Quality Initiative (NWQI). The construction of a new pressure irrigation system will reduce water demands from pumping which means more water can be pumped from locations that have less arsenic contamination. Overall, there will be less arsenic to manage.
Alternative 3 (NS)	There would be indirect permanent benefits to the nitrate management aquifer and to arsenic contamination. The project will support the BMPs established by the DEQ and the NRCS including the reduction of potentially nutrient-rich surface water that will infiltrate and contaminate the groundwater, This alternative would be in accordance with the National Water Quality Initiative (NWQI). The construction of a new pressure irrigation system will reduce water demands from pumping which means more water can be pumped from locations that have less arsenic contamination. Overall, there will be less arsenic to manage.

5.3.7.1 Magnitude of Impacts

Both the Piping and Lining & Buyouts Alternatives would have a number of permanent benefits to groundwater conditions in the project area. There is no significant variation in the magnitude of impacts the two action alternatives would have on this resource. The No Action/FWOFI Alternative would not solve any of the current problems, particularly arsenic contamination, and would allow the existing conditions to continue into the foreseeable future. Thus, while the action alternatives do include adverse effects, they also have a series of permanent benefits not offered by the No Action/FWOFI Alternative.

5.3.8 Floodplain Management

This section focuses on the impact of the Alternatives on the regulatory floodplains within the project area. There are minimal differences between the Alternatives.

Table 5-10: Floodplain Management Impact Comparison

Alternative	Floodplain Management Impacts
Alternative 1 (NA)	There would be no changes to the floodplains in/near Wellsville City, Mendon City, or other unincorporated areas of Cache County under the No Action/FWOFI Alternative. Existing conditions would continue. Direct permanent impact as the flooding will continue to impair and degrade floodplain sustainability and functionality.
Alternative 2	There would be a direct permanent benefit to Wellsville City, Mendon City, and other unincorporated areas of Cache County under the Piping Alternative. Improvements would be made to the floodplains in/near these areas via the construction of an overflow system, regulating ponds, and a pressure-irrigation system in Wellsville and Mendon. All these things will help to restore natural floodplain functionality.
Alternative 3 (NS)	There would be a direct permanent impact to Wellsville City, Mendon City, and other unincorporated areas of Cache County under the Lining & Buyouts Alternative. Property buyouts would be conducted to remove the residents living in the 100-year existing conditions floodplain. However, this would not improve the management of the floodplain or the functionality thereof. Flooding would continue to occur and would impair and degrade floodplain sustainability and functionality.

This section also compares the impacts of the Alternatives for flood impacts under the 25-year flood event. The figures in Appendix C and the economic analysis spreadsheet in Appendix E show the homes, businesses, and roads impacted by the 5-, 10-, 25-, 50-, 200-, and 500-year flood events under the Alternatives. The figures below show the structures inundated during the 100-year flood event, which are also included in Appendix B. Details of all the associated flood frequencies are included in the existing flood inundation & hydrology technical memoranda in Appendix E and the flood inundation maps in Appendices B & C. This information is also summarized in detail in the Investigations & Analysis Report in Appendix D.

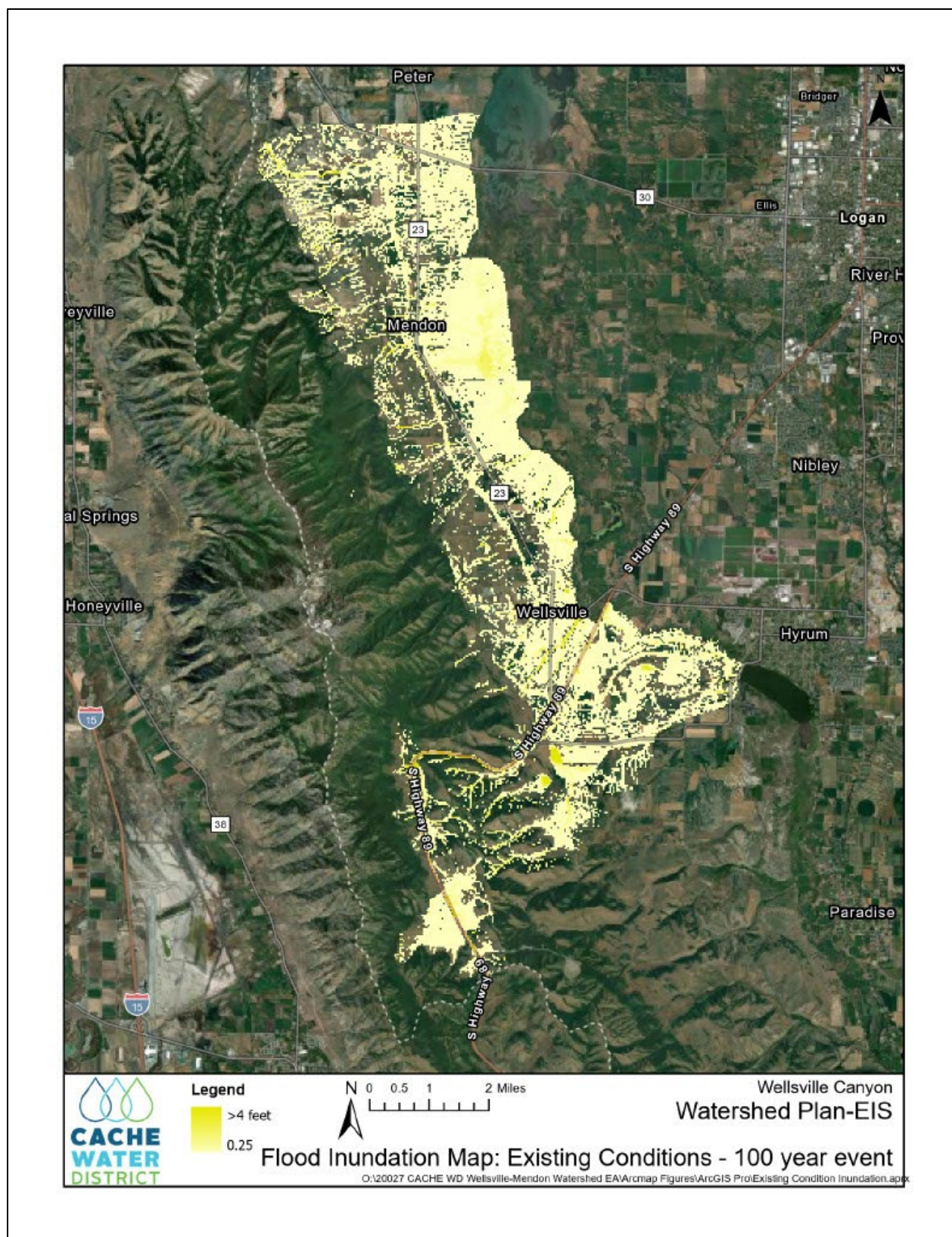
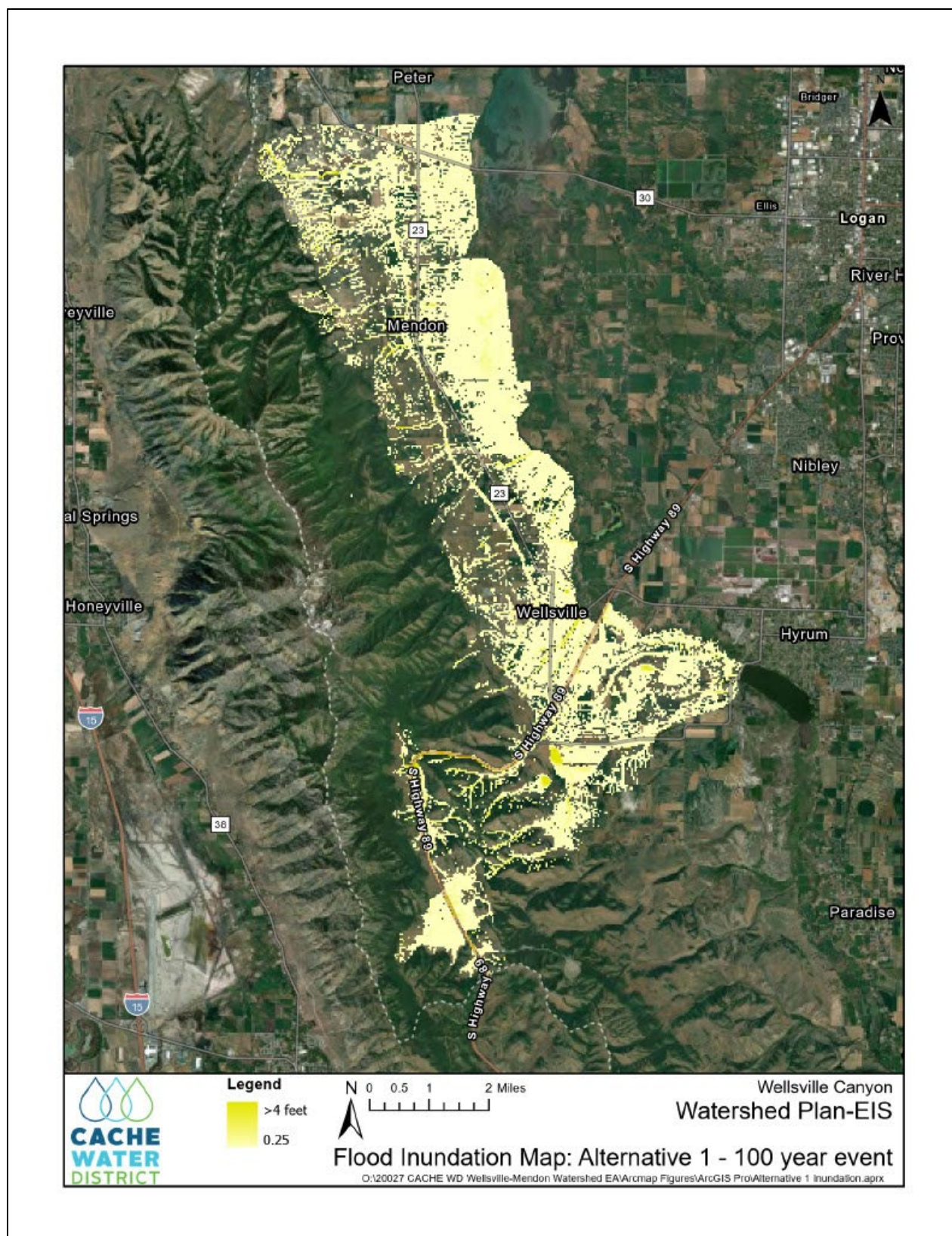


Figure 5-1: Flood Inundation Map: Existing Conditions – 100-Year Event



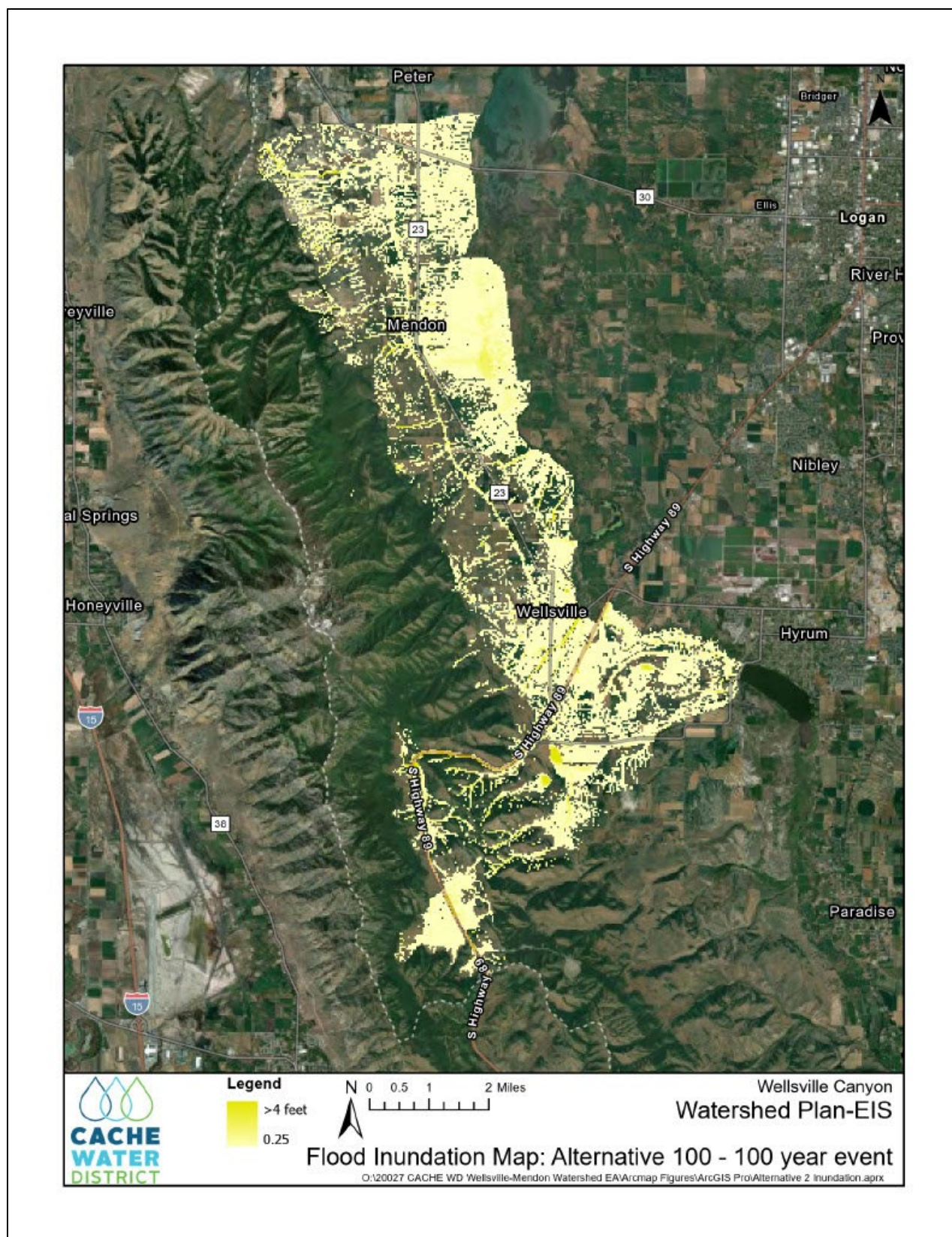


Figure 5-3: Flood Inundation Map: Lining & Buyouts Alternative – 100-Year Event

5.3.8.1 Magnitude of Impacts

The Piping Alternative would improve the overall functionality and sustainability of the floodplain. The nonstructural Lining & Buyouts Alternative would have adverse impacts and would allow flooding to continue to deteriorate the floodplain as it does under existing conditions. The No Action/FWOFI Alternative would not alter existing floodplain management conditions but, like the Lining & Buyouts Alternative, would have adverse impacts and would allow flooding to continue to deteriorate the floodplain.

5.3.9 Wetlands and Waters of the United States (WOTUS)

This section compares the impacts on wetlands between the alternatives being considered. The Proposed Action Alternatives were configured based on the LEDPA principles of first avoidance, then minimization, and lastly ensuring that adverse impacts would be temporary.

Table 5-11: Wetlands Impact Comparison

Alternative	Wetlands/WOTUS Impacts
Alternative 1 (NA)	Under the No Action/FWOFI Alternative, there would be no change to any wetlands within the project area. Existing conditions would continue. Flooding would continue and could potentially impact wetlands.
Alternative 2	There would be direct permanent impacts to various wetland and linear feature classifications within the project area. The classifications affected include Palustrine Emergent (54.35 acres), Scrub-Shrub/Emergent Mix (0.94 acres), Palustrine Unconsolidated Bottom (0.97 acres), Palustrine Aquatic Bed (0.62 Acres), and 67.59 acres of Linear Features. The total acreage of aquatic resources to be impacted would be 124.48 acres. All wetland impacts will be permitted. This alternative would be in accordance with the LEDPA principles of first avoidance, second minimization, then mitigation
Alternative 3 (NS)	There would be direct permanent impacts to the same total acreage of aquatic resources to be impacted under the Piping Alternative (124.48 acres). However, additional damage to wetlands would likely occur as a result of ongoing flooding. It is unreasonable to conduct an aquatic resources survey for the entire 100-year existing conditions floodplain, so it is assumed that all wetlands in this zone would face potential damages under the Lining & Buyouts Alternative. This alternative would have significantly higher wetland acreages adversely impacted than the Piping Alternative. All wetland impacts will be permitted.

5.3.9.1 Magnitude of Impacts

The Piping Alternative would impact ~124.48 acres of jurisdictional aquatic resources (see Aquatic Resources Delineation in Appendix E). This same acreage would be impacted as a result of project implementation under the Lining & Buyouts Alternative; however, the Lining & Buyouts Alternative would maintain the current risk that wetlands could be damaged by flooding. It is not feasible to conduct a survey for the entire watershed, but it may be reasonably forecasted that the Lining & Buyouts Alternative would adversely impact a significantly higher acreage of wetlands than the Piping Alternative. The No Action/FWOFI Alternative would not impact existing wetlands.

5.3.10 Regional Water Resources Management Plans

As discussed in Chapter 3, the watershed falls under the jurisdiction of multiple regional water management plans. The following section discusses how well each alternative in the Final Array would meet the goals and objectives of the regional water management plans identified in Chapter 3.

5.3.10.1 CWD Water Master Plan (2019)

- **No Action/FWOFI Alternative:** Would not meet the goals of the 2019 CWD Water Master Plan to (1) strengthen relationships between stakeholders and the CWD, (2) understand stakeholder interests and concerns, and (3) meet the priorities of the 5-year action plan including protecting water rights and supplies, conserving water, and improving understanding of environmental water needs.
- **Piping Alternative:** Would support the goals of the 2019 CWD Water Master Plan by (1) strengthening relationships between stakeholders and the CWD by providing more reliable management of water and installing protections from flooding, (2) taking action in response to stakeholder concerns related to flooding and seepage losses, and (3) meet multiple priorities of the 5-year action plan by protecting water supply, improving irrigation water reliability, generating water savings, and promoting environmental awareness through this Plan-EIS.
- **Lining & Buyouts Alternative:** This alternative would partially support the goals of the 2019 CWD Water Master Plan but would not strengthen relationships between the CWD and their stakeholders as many of them would be bought out from their properties, which is not in stakeholder's interests compared to other potential solutions. However, there would be water savings for CWD stakeholders who were not bought out as a result of the canal lining and the piping of the Wellsville East Field Canal.

5.3.10.2 UDWR Water Resources Plan (2021)

- **No Action/FWOFI Alternative:** Would not meet the goals of the 2021 UDWR Water Resources Plan to (1) increase water conservation efforts and (2) promote projects to deliver more water to the Great Salt Lake (GSL).
- **Piping Alternative:** Would support the goals of the 2021 UDWR Water Resources Plan by (1) implementing water conservation efforts for the WMCD, Wellsville East Field, Wellsville City, and Mendon City and (2) would divert less water from the Little Bear River, providing a potential benefit to the quantity of water provided to the GSL.
- **Lining & Buyouts Alternative:** Would support the goals of the 2021 UDWR Water Resources Plan by (1) implementing water conservation efforts for the WMCD, Wellsville East Field, Wellsville City, and Mendon City and (2) would divert less water from the Little Bear River, providing a potential benefit to the quantity of water provided to the GSL.

5.3.10.3 UDWR M&I Conservation Goals Plan (2019)

- **No Action/FWOFI Alternative:** Would not meet the 2019 UDWR M&I conservation goals such as (1) improved irrigation efficiency and (2) water conservation education.
- **Piping Alternative:** Would support the 2019 UDWR M&I conservation goals by (1) improving irrigation efficiency through delivery and secondary system installation and (2)

promoting education about water conservation through the public circulation of this Plan-EIS.

- **Lining & Buyouts Alternative:** Would support the 2019 UDWR M&I conservation goals by (1) improving irrigation efficiency through delivery and secondary system installation and (2) promoting education about water conservation through the public circulation of this Plan-EIS.

5.3.10.4 UDNR Bear River Management Plan (2017)

- **No Action/FWOFI Alternative:** Would not meet the 2017 UDNR Bear River Management Plan's goals to conserve the ecosystem and water resources when implementing projects that have the potential to affect Bear River lands.
- **Piping Alternative:** Would support the 2017 UDNR Bear River Management Plan's goals to conserve the ecosystem and water resources when implementing projects that have the potential to affect Bear River lands. No adverse impacts to the Bear River are expected as a result of this alternative's implementation.
- **Lining and Buyouts Alternative:** Would support the 2017 UDNR Bear River Management Plan's goals to conserve the ecosystem and water resources when implementing projects that have the potential to affect Bear River lands. No adverse impacts to the Bear River are expected as a result of this alternative's implementation.

5.3.11 Great Salt Lake

Table 5-12 identifies the expected environmental impacts on any additional resources that were considered under this project, namely the Great Salt Lake (GSL). The summary chapter of the Plan-EIS describes the GSL as a resource of statewide concern, and the impact analysis supports this claim.

Table 5-12: Great Salt Lake Impact Comparison

Alternative	Great Salt Lake Impacts
Alternative 1 (NA)	Under the No Action/FWOFI Alternative, there would be no impact to flows to the Great Salt Lake.
Alternative 2	Under the Piping Alternative, there would be direct permanent benefits to the GSL, as the improvements would allow less water to be diverted from the river (as there would be no evaporation/seepage losses in a piped system), allowing more water to remain in the river system and flow to the GSL.
Alternative 3 (NS)	Under the Lining & Buyouts Alternative, there would be a direct permanent benefits to the GSL, as the improvements would allow less water to be diverted from the river (as there would be no seepage losses in a lined system), allowing more water to remain in the river system and flow to the GSL.

5.3.11.1 Magnitude of Impacts

The quantity of water that would make it to the GSL would potentially be increased as a result of the two action alternatives, as both of them would allow less water to be diverted to the canal, allowing more water to remain in the river and flow towards the GSL than under existing conditions. The proposed actions would not adversely affect flows to the GSL but would improve overall water quality. There would also likely be benefits to the GSL under certain measures

resulting from any saved water/prevented seepage/evaporation losses and because of improved management of the water which may allow operators to divert less water from the river, leaving more in the river itself to flow to the GSL.

5.3.12 Dam Safety

Table 5-13 summarizes the environmental consequences related to Dam Safety for the two dams within the project area.

Table 5-13: Dam Safety Impact Comparison

Alternative	Dam Safety Impacts
Alternative 1 (NA)	There would be no change to dam safety on either Hyrum Dam or Wellsville Dam under the No Action/FWOFI Alternative. Existing conditions would continue.
Alternative 2	There would be no impacts to dam safety on either Hyrum Dam or Wellsville Dam under the piping Alternative.
Alternative 3 (NS)	There would be no impacts to dam safety on either Hyrum Dam or Wellsville Dam under the piping Alternative.

5.3.12.1 Magnitude of Impacts

No alternatives would benefit or adversely impact the stability of Wellsville Dam or Hyrum Dam, increase or decrease the downstream population, or affect the water supplies of the dam. There would be no impact to dam safety as a result of the alternatives.

5.3.13 Air Quality

Pollutants such as PM 2.5, CO, SO_x, NO_x, and other greenhouse gases (GHGs) would be generated from heavy-duty diesel engines and light duty gasoline engines used by construction equipment. However, all air quality impacts will be temporary during construction and no long-term impacts are anticipated under any alternative. The specific impacts are compared in Table 5-14.

Table 5-14: Air Quality Impact Comparison

Alternative	Air Quality Impacts
Alternative 1 (NA)	Under the No Action/FWOFI Alternative, there would be no change to PM 2.5, PM 10, or GHG emissions in the project area. Existing conditions would continue.
Alternative 2	There would be direct temporary impacts to PM 2.5, PM 10, and GHG emissions under this alternative. Minor short-term effects during construction from dust during earthwork phases and materials hauling. UPDES mitigation required.
	There would be a direct permanent benefit to GHG emissions under this alternative. Significant reductions in GHG emissions would occur due to major pumping reductions caused by the installation of a new pressure irrigation system.

Alternative	Air Quality Impacts
Alternative 3 (NS)	There would be direct temporary impacts to PM 2.5, PM 10, and GHG emissions under this Alternative. Minor short-term effects during construction from dust during earthwork phases & materials hauling. UPDES mitigation required.
	There would be a direct permanent benefit to GHG emissions under this Alternative. Significant reductions in GHG emissions would occur due to major pumping reductions caused by the installation of a new pressure-irrigation system.

5.3.13.1 Magnitude of Impacts

Both the Piping and Lining & Buyouts Alternatives would permanently reduce the amount of GHGs emitted in the project area. The adverse impacts to air quality would be short-term and minor. Neither action alternative would be more damaging to air quality than the other. Reductions in GHG emissions would not occur under the No Action/FWOFI Alternative, leaving existing conditions in place.

5.3.14 Special Status Plant Species

As summarized in Table 5-16 below, 18.45 acres of potentially suitable ULT habitat was identified; however, no individuals were found, and it is unlikely that any aspects of the proposed project would impact ULTs, leading to a determination of “No Effect” in the Biological Assessment. A copy of the Biological Assessment and the USFWS ECOS IPaC Report is included in Appendix E.

Table 5-15: Threatened and Endangered Plant Species Impact Comparison

Alternative	Threatened & Endangered Plant Species Impacts
Alternative 1 (NA)	Under the No Action/FWOFI Alternative, there would likely be no effect on the Ute-Ladies' Tresses (<i>Spiranthes diluvialis</i>). Existing conditions would continue.
Alternative 2	Under the Piping Alternative, there would likely be no effect on the Ute-Ladies' Tresses (<i>Spiranthes diluvialis</i>). Existing conditions would continue.
Alternative 3 (NS)	Under the Lining & Buyouts Alternative, there would likely be no effect on the Ute-Ladies' Tresses (<i>Spiranthes diluvialis</i>). Existing conditions would continue.

5.3.14.1 Magnitude of Impacts

The project received a “No Effect” determination in the Biological Assessment (Appendix E). No impacts are expected to the ULT under any considered alternative plan.

5.3.15 Special Status Animal Species

As summarized in Table 5-17 below, while there are potential endangered or threatened species in the watershed, there was no suitable habitat identified for the Yellow-billed Cuckoo or the Monarch Butterfly in the Action Area, leading to a “No Effect” determination in the Biological Assessment. A copy of the Biological Assessment and the USFWS ECOS IPaC Report are included in Appendix E.

Table 5-16: Threatened and Endangered Animal Species Impact Comparison

Alternative	Threatened & Endangered Animal Species Impacts
Alternative 1	Under the No Action/FWOFI Alternative, there would be no change to any populations of Yellow-Billed Cuckoo (<i>Coccyzus americanus</i>) or Monarch Butterfly (<i>Danaus plexippus</i>).
Alternative 2	Under the Piping Alternative, there would be no change to any populations of Yellow-Billed Cuckoo (<i>Coccyzus americanus</i>) or Monarch Butterfly (<i>Danaus plexippus</i>).
Alternative 3 (NS)	Under the Lining & Buyouts Alternative, there would be no change to any populations of Yellow-Billed Cuckoo (<i>Coccyzus americanus</i>) or Monarch Butterfly (<i>Danaus plexippus</i>).

5.3.15.1 Magnitude of Impacts

None of the alternatives considered, including the No Action/FWOFI Alternative, would change the existing conditions for any Endangered Species Act (ESA) listed species that may occur within the project area. More detailed findings are discussed in the Biological Assessment located in Appendix E.

5.3.16 Fish, Wildlife, Utah Special Status Species, Migratory Birds, and Eagles

The impacts on fish and wildlife from the two possible action alternatives are limited to discussions to native species of concern as identified by the UDWR and the USFWS. Also included are eagles, which are protected under the Bald and Golden Eagle Protection Act (BGEPA) and migratory birds.

Table 5-17: Fish, Wildlife, Utah SGCN, Migratory Birds, and Eagles Impact Comparison

Alternative	Fish, Wildlife, SGCNs, Eagles, and Migratory Birds Impacts
Alternative 1 (NA)	Under the No Action/FWOFI Alternative, there would be no change to any existing populations of migratory birds or eagles. Existing conditions would continue.
Alternative 2	Under the Piping Alternative, impacts would be minimized on any existing populations of migratory birds or eagles. However, there would be some temporary disturbance during construction that could deter any avian species present from using the area during project implementation. Further information may be found in the Biological Assessment and the USFWS ECOS IPaC Report located in Appendix E. There may be indirect benefits to fish and wildlife under this alternative through water quality and air quality improvements.
Alternative 3 (NS)	Under the Lining & Buyouts Alternative, impacts would be minimized on any existing populations of migratory birds or eagles. However, there would be some temporary disturbance during construction that could deter any avian species present from using the area during project implementation. Further information may be found in the Biological Assessment and the USFWS ECOS IPaC Report located in Appendix E. There may be indirect benefits to fish and wildlife under this alternative through water quality and air quality improvements.

5.3.16.1 Magnitude of Impacts

The two action alternatives will have some short-term adverse impacts to any fish/wildlife that may be present in the project area during construction. There is no difference in the magnitude of these adverse impacts between the two action alternatives. There would be no change in existing conditions for fish and wildlife under the No Action/FWOFI Alternative. However, the benefits of the action alternatives would provide indirect benefits to fish and wildlife in the area (i.e., water and air quality improvements).

5.3.17 Invasive Species/Noxious Weeds

Invasive species relevant to the project area are discussed in Chapter 3. Impacts to invasive species are described in Table 5-19.

Table 5-18: Invasive Species Impact Comparison

Alternative	Invasive Species/Noxious Weeds Impacts
Alternative 1 (NA)	There would be no changes to existing or new invasive species under the No Action/FWOFI alternative and no efforts would be made to prevent the introduction of additional invasive species or noxious weeds. Existing conditions would continue.
Alternative 2	There would be direct temporary and possible long-term impacts under this alternative. Ground disturbance creates an opportunity for the spread and introduction of invasive species due to construction activities. Mitigation and BMPs would be required.
Alternative 3 (NS)	There would be direct temporary and possible long-term impacts under this alternative. Ground disturbance creates an opportunity for the spread and introduction of invasive species due to construction activities. Mitigation and BMPs would be required.

5.3.17.1 Magnitude of Impacts

Both action alternatives would have a similar impact on this resource, both adverse. Both alternatives would have ground disturbance elements and would introduce the risk of adding new invasive species into the vegetative communities within the project area. The No Action/FWOFI Alternative would not include any construction and would not raise the current risk of invasive species spreading. However, without the installation of the project, there would be adverse impacts to other environmental resource conditions and the area would not receive the environmental benefits brought by the action alternatives.

5.3.18 Riparian Areas

Riparian areas will be associated with the canals within the project area as well as Hyrum Dam, Wellsville Dam, and Cutler Reservoir. Table 5-20 summarizes the related impacts on the riparian zones.

Table 5-19: Riparian Areas Impact Comparison

Alternative	Riparian Areas Impacts
Alternative 1 (NA)	There would be no change to any existing riverine riparian zones within the project area under this alternative. Existing conditions would continue.
Alternative 2	There would be no change to any existing riverine riparian zones within the project area under this alternative. Existing conditions would continue.
Alternative 3 (NS)	There would be no change to any existing riverine riparian zones within the project area under this alternative. Existing conditions would continue.

5.3.18.1 Magnitude of Impacts

All three alternatives considered would have no impact on the quality and quantity of riparian areas in the project area. Under no alternative would there be a change in existing riparian conditions.

5.3.19 Cultural & Historic Resources

The alternatives could potentially affect historic properties within the Area of Potential Effects (APE). A summary of the eight historic properties within the APE, potential impacts, and finding of effect for the Action Alternatives are shown in Tables 5-20 and 5-21. Applying the Criteria of Adverse Effect (36 CFR 800.5), the NRCS has determined that the Piping Alternative would result an *adverse effect* to two eligible canals, the Wellsville-Mendon Lower Canal, and the Wellsville Canal/East Field Canal (Table 5-20).

The Lining & Buyouts Alternative was technically not considered as part of Section 106. Given there are 316 homes and 1 commercial building in that area, with many being historic, there would likely be adverse effects as a result of relocation or demolition of properties, resulting in a greater *adverse effect* than under the Piping Alternative.

Within the No Action/FWOFI Alternative APE, a total of 11 eligible archaeological sites and 341 eligible buildings/structures are currently identified, though more likely exist. These historic properties would continue to be potentially affected by flooding under the No Action Alternative.

Table 5-20: Piping Alternative - Determination of Effects Findings for Historic Properties Sites in the APE

Site Number	Description of Impact	Effects Determination
	Piping Alternative	
42CA88	The Utah Northern Railroad corridor would be crossed by new pipelines at 18 locations. Crossings would generally be perpendicular to the tracks and involve boring under the railroad.	No Adverse Effect
42CA174	The Wellsville-Mendon Lower Canal will be piped along most of its length by placing the pipe in the downhill bank berm. The channel will remain open, and the berm will remain in place and comparable to the current berm in	Adverse Effect

Site Number	Description of Impact	Effects Determination
	composition. Many of the field-level ditches associated with the system, especially those within the street grids of Wellsville and Mendon, would be piped as part of the proposed pressurized irrigation system. Thus, while the main canal would largely remain intact, the associated system would be impacted more substantially. 36 CFR 800.5(a)(2).	
42CA184	The Wellsville-Mendon Upper Canal passes through a staging area, and several proposed pipelines would cross the canal. These crossings occur either through boring under the currently open channel or through open trenching with recontouring of the channel. It is important to note that this canal is slated for piping through an unrelated undertaking. If said piping has occurred by the time the construction for the present undertaking begins, this canal site would no longer exist on the ground surface.	No Adverse Effect
42CA198	A long segment of the Wellsville Canal/East Field Canal from the diversion at Hyrum Reservoir, passing through Hyrum, and ending in unincorporated Cache County would be enclosed and piped. This would eliminate the surface expression of the canal. 36 CFR 800.5(a)(2).	Adverse Effect
42CA322	The Mendon South Canal would be or otherwise intersected at four locations by pipelines for the proposed pressurized irrigation system. These crossings would occur either through boring under the currently open canal channel or through open trenching with restoration of the channel upon completion.	No Adverse Effect
42CA337	The Ogden, Logan & Idaho Railroad site crosses the project area in one location north of Mendon. It crosses an area where bank stabilization, channel vegetation clearing, and similar activities would occur within Threemile Creek. These measures would be limited to the creek channel and would not extend into upland areas. There are no features of this site within the channel. Thus, the project would effectively avoid the site.	No Historic Properties Affected
42CA339	Pressurized irrigation system pipes would be installed in the roadways of the Mendon City Cemetery. A temporary construction staging area would be located at the entrance of the cemetery, and recreation-related improvements would occur along the west edge of the site. None of these actions would alter any contributing features of the site or introduce	No Adverse Effect

Site Number	Description of Impact	Effects Determination
	visual intrusions that would alter the setting or feeling of the site.	
42CA341	While the survey area encroaches on the Wellsville Cemetery, no features associated with it will be impacted by the proposed watershed improvements. The proposed pipelines near the cemetery will be installed in roadways outside the site boundary.	No Historic Properties Affected

As lead federal agency, and per Section V.c.1 the NRCS State Prototype Programmatic Agreement with the Utah SHPO, the NRCS provided its proposed APE, identification of historic properties, and assessment of adverse effects in a single transmittal to the Utah SHPO and Wellsville Certified Local Government (CLG) on February 12, 2025, to seek their concurrence.

SHPO concurrence was received for the determination of adverse effects on March 1, 2025. To resolve the adverse effects, per 36 CFR 800.6, the NRCS, in consultation with the SHPO, Sponsors, THPOs/Tribes, and others, will develop mitigation stipulations what will be executed in a Memorandum of Agreement (MOA). A draft Memorandum of Agreement (MOA) has been prepared and is included in Appendix A. No response was received from the Wellsville CLG. The NRCS consulted with the USBR and USFS via email on February 13, 2025, on the finding of adverse effect, and invited the agencies to participate in the development of the MOA.

The USBR deferred Section 106 responsibilities to the NRCS (Appendix A). Consultation letters were sent to THPOs/Tribes regarding the determination of adverse effects on February 12, 2025, and received by February 19, 2025. Follow-up emails were sent in April 2025 with an invitation to participate in the development of the MOA, and phone calls in May 2025). There were no responses from THPOs/Tribes. Documentation of this process may be found in the Tribal consultation table in Appendix A. The NHPA Section 106 consultation process is described in detail in Chapter 7 of this Watershed Plan-EIS.

The Tribes that were consulted are listed below:

- Eastern Shoshone Tribe of the Wind River Reservation, Wyoming
- Northwest Band of the Shoshone Nation, Utah
- Shoshone-Bannock Tribes of the Fort Hall Reservation, Idaho
- Ute Indian Tribe of the Uintah & Ouray Reservation, Utah

The other NHPA Section 106 Consulting Parties contacted as a part of the consultation process were:

- Bureau of Reclamation (deferred Sec. 106 responsibility to NRCS, see Appendix A)
- Wellsville Certified Local Government

5.3.19.1 Magnitude of Impacts

Of the three alternatives evaluated in this Plan-EIS, the Piping Alternative would have the least adverse effect on historic properties in the APE. NRCS is consulting pursuant to 36 CFR 800.6 to resolve adverse effects associated with the Preferred Alternative through development and

execution of a MOA. Both action alternatives would have similar levels of direct and permanent adverse effects to historic properties as a result of construction. The action alternatives would beneficially affect the 11 historic properties and 341 eligible historic buildings/structures within the Indirect APE due to a reduction in future flood events. However, under the No Action/FWOFI Alternative, historic properties within the Indirect APE would continue to be potentially affected by flooding. The Lining & Buyouts Alternative would have direct permanent adverse effects as a result of the relocation or demolition of historic buildings/structures eligible for the NRHP due to buyouts.

5.3.20 Public Health and Safety

Public health and safety are affected differently by the Proposed Action Alternatives and the No Action/FWOFI Alternative. Table 5-24 summarizes the impacts resulting from different elements of alternatives on risks of health and safety.

Table 5-21: Public Health and Safety Impact Comparison

Alternative	Public Health & Safety Impacts
Alternative 1 (NA)	There would be no changes to public health and safety under the No Action/FWOFI Alternative resulting from flood control, irrigation O&M, or construction. Existing conditions would continue.
Alternative 2	There would be a direct temporary impact due to construction. There would be potential short-term impacts to public health and safety as a result of diesel and gasoline emissions from construction equipment and from the inherent risk associated with construction zones. Standard BMPs would be used.
	There would be multiple direct permanent benefits to public health and safety under this alternative. Piping the canals will reduce the risk of drowning, particularly at drainage crossings and regulating structures. The potential of a sunny day canal breach would be virtually eliminated. The potential of flooding homes/businesses would be reduced, and the potential of catastrophic road failure and washout would be reduced in many areas. Construction of the new PI system will allow for less flooding of the roads and will improve access to it.
Alternative 3 (NS)	There would be a direct temporary impact due to construction. There would be potential short-term impacts to public health and safety as a result of diesel and gasoline emissions from construction equipment and from the inherent risk associated with construction zones. Standard BMPs would be used.
	There would be multiple direct permanent benefits to public health and safety under this alternative. Piping/lining the canals will reduce the risk of drowning, particularly at drainage crossings and regulating structures. The potential of a sunny day canal breach would be virtually eliminated. By conducting property buyouts, the potential of flooding homes/business will be greatly reduced throughout the watershed.

5.3.20.1 Magnitude of Impacts

The Piping Alternative would be the alternative with the most benefits to public health and safety as it would completely eliminate the risk of drowning in portions where the canal(s) would be piped. The Lining & Buyouts Alternative would also lower the risk of drowning where the

Wellsville East Field Canal is piped, but the open-lined canal would have a greater risk of drowning than the enclosed pipeline. The No Action/FWOFI Alternative would not have any improvements to the existing condition of public health and safety.

5.3.21 Scenic Beauty

Scenic beauty and visual resources will experience temporary direct impacts associated with construction activities until vegetated under the Proposed Alternatives. Table 5-25 summarizes the differences between alternatives.

Table 5-22: Scenic/Visual Resources Impact Comparison

Alternative	Scenic Beauty/Visual Resources Impacts
Alternative 1 (NA)	Under the No Action/FWOFI alternative, there would be no changes to any close, mid-range, or long range viewsheds within the project area. Existing conditions would continue.
Alternative 2	There would be direct temporary impacts to close, mid-range, and long range viewsheds under this alternative. There would be temporary impacts to viewscapes as a result of construction activities.
Alternative 3 (NS)	There would be direct temporary impacts to close, mid-range, and long range viewsheds under this alternative. There would be temporary impacts to viewscapes as a result of construction activities.

5.3.21.1 Magnitude of Impacts

Although the two action alternatives would have direct temporary impacts to the viewshed in the project area, the overall viewscapes post-construction would likely be virtually the same.

The No Action/FWOFI Alternative would not impact on the current viewshed in the area and would allow existing conditions to continue. Thus, outside of temporary visual impairment from construction equipment, the visual resources in the project area will not be changed by any of the alternatives considered to any significant degree.

5.3.22 Transportation Infrastructure

Table 5-26 summarizes the differences in transportation impacts between the alternatives.

Table 5-23: Transportation Impact Comparison

Alternative	Transportation Infrastructure Impacts
Alternative 1 (NA)	Under the No Action/FWOFI alternative, there would be no changes to traffic flow/safety, road conditions, or canal crossings. Existing conditions would continue.
Alternative 2	There would be a direct temporary impact on traffic flow and safety under this alternative. Temporary impacts to traffic flow would be created by project construction.
	There would be a direct permanent benefit to canal crossing as a result of the project. The improvements to the flood channels and canal crossings will also be improved.

Alternative	Transportation Infrastructure Impacts
Alternative 3 (NS)	There would be a direct temporary impact on traffic flow and safety under this alternative. Temporary impacts to traffic flow would be created by project construction.
	There would be a direct permanent benefit to canal crossing as a result of the project.

5.3.22.1 Magnitude of Impacts

The No Action alternative would not modify any existing transportation routes and would keep existing conditions in place. The Piping and Lining & Buyouts Alternatives, however, would create overall improvements to transportation infrastructure in the area by benefiting canal crossings and flood channels (flood channels only under the Piping Alternative). Both action alternatives would also temporarily hinder traffic flow during construction, though to no varying degree from one another.

5.3.23 Land Use (Recreation)

Land use and recreation are likewise affected differently by each activity. These differences are summarized in the following table.

Table 5-24: Land Use and Recreation Impact Comparison

Alternative	Land Use & Recreation Impacts
Alternative 1 (NA)	Under the No Action/FWOFI alternative, there would be no changes to public parks, walking/hiking/cycling trails, or federal or state lands. Additionally, there would be no impacts to land use practices under this alternative. Existing conditions would continue.
Alternative 2	The Piping Alternative would create multiple direct permanent benefits in the project area. A benefit to public parks would be created through the installation of a new access ramp at Wellsville Reservoir and a reflection pond at Mendon Cemetery providing additional recreation opportunities for local residents. Land use will be improved via improved agricultural production on land currently damaged by flooding and canal seepage. This alternative will help to improve the economic viability of agriculture in the project area.
Alternative 3 (NS)	The Lining & Buyouts Alternative would create multiple direct permanent benefits in the project area. A benefit to public parks would be created through the installation of a new access ramp at Wellsville Reservoir and a reflection pond at Mendon Cemetery providing additional recreation opportunities for local residents. Land use will be improved via improved agricultural production on land currently damaged by flooding and canal seepage. This alternative will help to improve the economic viability of agriculture in the project area.

5.3.23.1 Magnitude of Impacts

Both the Piping and Lining & Buyouts Alternatives would have similar benefits to land use practices and recreational opportunities in the project area. Neither action alternative would be

more negative than the other for these resources. The No Action/FWOFI Alternative would not provide any new recreational opportunities or beneficial changes in current land use conditions.

5.3.24 Ecosystem Services

Effects of the alternatives on ecosystem services are covered in section 5.2 of the Plan-EIS.

5.3.25 Summary and Comparison of Environmental Consequences

Table 5-28 provides a side-by-side summary comparison of the environmental effects of the alternatives for each resource concern evaluated in this Plan-EIS. In the sections above, the resource concerns have been evaluated for quantity, quality, duration, and significance (magnitude) of environmental effects. Table 5-28 seeks to summarize this information by identifying which alternative plan(s) are most beneficial and least beneficial to each resource concern. If a table cell is marked **green (3)**, it indicates that that alternative is the most beneficial for that resource concern. If a table cell is marked **yellow (2)**, it indicates that that alternative is the second most beneficial for that resource concern. If a table cell is marked in **red (1)**, it indicates that that alternative is the least beneficial for that resource concern. If alternative effects are equal among alternatives for a particular resource concern, each alternative will be marked as such.

Table 5-25: Summary and Comparison of Alternatives – Effects on Resource Concerns

Resource Concerns	No Action/FWOFI	Piping Alternative	Lining & Buyouts Alternative
Soil-Related Concerns			
Soil Resources	3	3	3
Geology	3	3	3
Prime & Unique Farmland	1	3	2
Upland Erosion and Sedimentation	2	3	1
Water-Related Concerns			
Water Resources	1	3	3
Water Quality	2	3	1
Floodplain Management	1	3	2
Wetlands and Waters of the United States	3	2	1
Regional Water Resources Management Plans	1	3	2
Great Salt Lake	3	3	3
Dam Safety	1	3	3
Air-Related Concerns			
Air Quality	1	3	3
Plant and Animal-Related Concerns			

Resource Concerns	No Action/FWOFI	Piping Alternative	Lining & Buyouts Alternative
Special Status Plant Species (ESA)	3	3	3
Special Status Animal Species (ESA)	3	3	3
Migratory Birds	3	2	2
Bald and Golden Eagles	3	2	2
Invasive Species/Noxious Weeds	3	2	2
Fish and Wildlife	1	3	3
Riparian Areas	3	3	3
Human-Related Concerns			
Cultural Resources & Tribal Consultation	2	3	1
Socioeconomics/Economy	3	3	3
Public Health and Safety	1	3	2
Scenic Beauty	3	2	2
Transportation Infrastructure	1	3	2
Land Use/Recreation	1	3	3
TOTAL RESOURCES MOST BENEFICIAL	12	20	12
TOTAL SCORE	52	70	58

As shown in the table, the Piping Alternative would be the most beneficial alternative overall, being the most preferable option for 20/25 resource concerns and with an overall score of 70 out of a maximum of 75. The second most preferable option would be the Lining & Buyouts Alternative (12/25, overall score 58) because it would still address the problems and opportunities in the watershed and meet the NEPA Purpose and Need. The least preferable option would not meet the Purpose and Need or address the problems and opportunities, the No Action/FWOFI Alternative (12/25, overall score 52).

5.3.26 Reasonably Foreseeable Effects Analysis

NRCS analyzed the potential for significant and adverse reasonably foreseeable effects in addition to the resource-specific evaluations described in the previous sections as described in 501.43(3)(b)(1). Reasonably foreseeable effects can result from individually minor but collectively significant actions taking place over a period of time. The focus of a reasonably foreseeable effects analysis is on whether the Proposed Action(s) will have any effects when combined with any known or foreseeable action by NRCS, other agencies, or any other entities.

5.3.26.1 Methodology

NRCS searched agency websites and contacted agency/organization staff to identify past, present, and reasonably foreseeable projects with the potential to have effects in combination with the Proposed Action. The following agencies and entities, which have some claim to a project or lands within Cache Valley, are listed below with a description of past and current projects which have the potential to contribute to effects which the actions of this project could, in combination, have significant adverse impacts.

Projects located outside of the study area/target watershed were evaluated for reasonably foreseeable effects to (1) adhere to the PR&G Guiding Principle of utilizing a watershed-scale approach and (2) to acknowledge that this project, if implemented, will not occur in isolation but rather in the context of all the other planned/ongoing projects in the surrounding areas.

5.3.26.2 Natural Resources Conservation Service (NRCS)

Farm Bill Programs/Projects

Various projects are ongoing in the area through this program which aims to introduce practices that conserve water and reduce water quality impacts from local agricultural practices. These projects are included under various NRCS funding programs such as EQIP, CSP, ACEP, and RCPP. These projects will have no adverse impact on this area, although there will be reasonably foreseeable effects from these projects in the form of benefits as all of these programs will develop solutions to treat many of the same resource concerns evaluated and improved by this project such as irrigation efficiency and water quality, among others.

PL 83-566 Program

Logan River Watershed Plan-EIS: This project includes efforts to improve flood control, agricultural water management, and public recreation by piping all of the canals associated with the Crockett Avenue Irrigation and Distribution System and two other canal companies on the Logan Island; installing a pressurized-irrigation system in Logan, North Logan, Hyde Park, and Benson, Utah; removing two in-stream diversion structures from the Logan River; providing 25 cfs of in-stream flows from Logan First Dam all the way to Cutler Marsh year-round; and providing “blue trail” access for recreation. The 25 cfs in-stream flow will mitigate the temperature and dissolved oxygen issues in the Logan River during the summer months when the Logan River currently violates water quality standards. There will be no adverse impacts to this area as a result of this project, although there will likely be some benefits.

North Cache Valley Watershed Plan-EIS: This project includes efforts to improve agricultural water management and public recreation in Franklin County, Idaho, and Cache County, Utah. This project would upgrade various agricultural pump stations, provide drainage control infrastructure, and install recreational access to the Bear River. There are no expected adverse effects to this area as a result of this project.

Lower Bear River Watershed Plan-EIS: This project includes planning efforts to provide a water supply to agricultural water users and improve flood prevention to protect areas with flooding issues as well as to develop secondary water systems for local communities with growing demand for water resources, as well as to promote and enhance wildlife habitat and recreational opportunities in the watershed. The project is being planned for the areas north of Brigham City, Utah, including Bear River City, Deweyville, Honeyville, Elwood, Corinne, and Tremonton. The

Plan-EIS is still in development. There will be no adverse effects to the Great Salt Lake or other environmental resources concerns as a result of this project, if implemented, in conjunction with the Wellsville Canyon Plan-EIS.

5.3.26.3 United States Forest Service (USFS)

Third Dam Project

This project focuses on sediment removal at Third Dam on the Logan River. This project is expected to be completed in either 2025 or 2026 and will remove approximately 100,000 cubic yards of sediment from Third Dam. The BMPs required restrict the turbidity of discharges during sediment removal to limits that protect fish and aquatic life and will have no impact in this area.

5.3.26.4 United States Bureau of Reclamation (USBR)

Trapper Park Lower Logan River Restoration Project

This project, located on the Logan River, is restoring approximately 11,000 feet (2.1 miles) of the Logan River near Trapper Park in Logan City, Cache County, Utah. River improvements would include replacing a river diversion structure; piping an existing canal (1.1 miles); removing old car bodies (commonly called Detroit rip rap), concrete rubble, and car tires' improving ecological conditions on lands in a recently created river corridor conservation easement; improving floodplain functionality; enhancing in-channel habitat; and stabilizing channel banks. There are no anticipated effects as a result of this project.

Wellsville Upper Canal Piping Project Phase II

The WMCD Upper Canal, as described in the eliminated alternatives section of this Plan-EIS, is being piped through alternative funding from the PL-566 even though it was initially considered as a potential measure to include alternatives in this project. Phase II of the project, which will pipe ~2 miles of the Upper Canal is undergoing NEPA analysis with the Bureau of Reclamation. The project would pipe 2 miles of the Upper Canal and install a booster pump station, a drain line, and three phase power to the pump near the base of Hyrum Dam. There will be adverse impacts to the Upper Canal, which is an NRHP eligible historic property. These impacts are being mitigated as part of the planning process. There would be an adverse effect caused by this project and the Wellsville Canyon project as both projects will have an adverse effect on finding for different historic properties in the area, requiring mitigation.

Hyrum Safety of Dams (SOD)/Spillway Replacement Project

The USBR is currently implementing a project to replace the deficient spillway at Hyrum Dam. The construction is ongoing and is expected to last several years, through at least 2029. The work is being done to enhance the spillway of Hyrum Dam and bring it into compliance with current dam safety standards.

5.3.26.5 Findings of Reasonably Foreseeable Effects Analysis

NRCS reviewed the potential for there to be additive or interactive effects from the Proposed Action(s) in combination with the projects listed above. Effects on various resources are anticipated as a result of the Proposed Action (as described above) and the previously listed projects; however, none of these resources would be affected adversely by the Proposed Actions past the short-term temporary adverse impacts during construction which would not be additive or interactive.

The Proposed Actions would result in permanent adverse effects to eligible historic properties. Separate adverse effects are anticipated from the Bureau of Reclamation's Wellsville Upper Canal Phase II Piping Project, a distinct federal undertaking evaluated under its own NEPA and Section 106 processes. Although both projects occur within the watershed and contribute to the broader historical resources context, adverse effects are assessed and resolved independently. Mitigation for the Reclamation project is being addressed through its Programmatic Agreement, while NRCS adverse effects are being resolved through development of a MOA.

There is the potential for reasonably foreseeable effects to occur as a result of more water being conveyed to regional water users (i.e., as a result of an alternative which includes water savings), creating a greater availability of water. As additional water use occurs in relation to that increased availability, there is the potential to reduce return flows to the Little Bear River and its associated waterways, although this additional use cannot be guaranteed until implementation.

Furthermore, another potential reasonably foreseeable effect could occur as an indirect/unintended consequence of increased water conveyance capabilities in that in-channel stream velocities could increase and cause scouring in the downstream environment, which could have adverse effects on water quality. Although this effect could occur, the implementation of the Piping Alternative would generate significant improvements to in-channel water quality by reducing erosion and nutrient loading to the Little Bear River through flood control improvements.

There could also be beneficial effects as a result of the Proposed Actions. This project will improve irrigation efficiency and water quality in the Little Bear River which will collectively benefit the larger Cache Valley area in combination with NRCS Farm Bill projects, other PL 83-566 projects with emphases on agricultural water management and watershed protection, sediment removal at Third Dam, and the river restoration project on the Lower Logan River.

As described earlier, other areas surrounding the watershed also experience damages related to flooding. The authorized purpose of several other PL-566 watershed projects seeks to address flooding issues in these surrounding watersheds which will collectively benefit the entire region when analyzed in conjunction with the Wellsville Canyon Watershed Plan project.

6.0 Preferred Alternative

The NRCS's Proposed Action (Preferred Alternative) is Action Alternative 1 – Piping Alternative. The following subsections provide details on the Piping Alternative in terms of its selection rationale, specific component measures, associated irreversible or irretrievable commitment of resources, potential areas of controversy, necessary permits and compliance efforts, included mitigation measures, costs and cost-sharing, ecosystem service benefits, installation and financing, and required operations and maintenance (O&M).

6.1 Rationale for the Preferred Alternative

Action Alternative 1 – Piping Alternative was selected as the Preferred Alternative due to its ability to meet the NEPA Purpose and Need, to address the problems and opportunities, meet the Federal Objective and project objectives, and to maximize net public benefits with appropriate consideration of costs above that of the No Action/FWOFI Alternative and Action Alternative 2 – Nonstructural – Lining & Buyouts Alternative.

The Piping Alternative was developed in collaboration and coordination with the local sponsor and co-sponsors to address the issues related to flood risks in the watershed, irrigation water conveyance, access to secondary water, and lack of recreational opportunities in the watershed. NRCS and the sponsors developed and screened a variety of candidate management measures to address flooding, agricultural water management, and public recreation through structural, and nonstructural measures before ultimately arriving at the measures included in the Piping Alternative.

The environmental consequences, or impacts, both adverse and beneficial, of the Piping Alternative were analyzed under an ecosystem services framework described in Chapter 1 to better understand the alternative's contribution of net public benefits.

The Piping Alternative supports the purpose of PL 83-566 as it reduces existing problems related to Flood Prevention, Agricultural Water Management, and Public Recreation. It minimizes all the established project constraints including disruptions to existing residential and commercial properties, adverse impacts to cultural and historic resources to the extent possible, impacts to existing transportation routes for residents and emergency services, disruptions to the ability of farmers to access irrigation water, soil loss and landscape degradation, water pollution and nutrient loading to the Little Bear River, and all adverse impacts to suitable habitat for federally listed species.

6.2 Measures to be Installed

The following measures would be implemented to address the problems and opportunities in the Wellsville Canyon Watershed (see project options maps in Appendix B for geographic locations of the measures to be installed):

Table 6-1: Measures to be Installed

PL-566 Authorized Purpose	Name of Measure
Flood Prevention	300 North Flood Control Pipeline
Flood Prevention	100 South (Bird Creek) Flood Control Pipeline

PL-566 Authorized Purpose	Name of Measure
Flood Prevention	Bird Canyon Channel Improvements
Flood Prevention	Lower Canal Channel Improvements
Flood Prevention	400 North Flood Control Pipeline
Flood Prevention	200 West (Wellsville) Spill & Flood Control Pipeline
Flood Prevention	2900 South Spill & Flood Control Pipeline
Flood Prevention	3400 South Spill & Flood Control Pipeline
Flood Prevention	200 South (Mendon) Spill & Flood Control Pipeline
Flood Prevention	Floodwater Management Near Francis Family Property
Flood Prevention	Murray Springs Diversion Structure Abandonment
Flood Prevention	Bird Creek Culverts (not funded by PL-566)
Flood Prevention	WMCD Lower Canal Crossings (not funded by PL-566)
Flood Prevention	Wide Canyon Flood Control Pipeline
Agricultural Water Mgmt.	Wellsville Secondary Water System with 2 Regulating Ponds
Agricultural Water Mgmt.	Mendon Secondary Water System with 1 Regulating Pond
Agricultural Water Mgmt.	Pressure Pipe the WMCD Lower Canal
Agricultural Water Mgmt.	Gravity Pipe the Wellsville East Field Canal
Public Recreation	Wellsville Reservoir Non-Motorized Boat Ramp
Public Recreation	Mendon City Cemetery Reflecting Pond & Trail

6.3 Irreversible or Irretrievable Commitment of Resources

Irreversible effects are those caused by the Preferred Alternative that cannot be reversed and are considered permanent. Irretrievable effects are gains and losses of outputs such as land use and may occur in the short-term or the long-term. The Preferred Alternative does not have any irreversible effects. The Preferred Alternative would have two irretrievable resources. The first would be the use of construction equipment and materials in the form of labor and fossil fuels. The use of these resources is typically understood to be irretrievable. Additionally, the use of project financial resources is irretrievable in the short-term but should be supported in the long-term via the benefits of alternative implementation.

6.4 Areas of Controversy

No areas of controversy have been identified related to the Preferred Alternative. No comments of opposition to the project were received during the 30-day public review period, and no new issues of concern were raised.

6.5 Permits and Compliance

Prior to construction of the proposed project components, during construction, and in some cases, following construction the following permits or authorizations will be required:

- **Stream Alteration Permits:** Section 73-3-29 of the Utah Code requires any person, governmental agency, or other organization wishing to alter the bed or banks of a natural stream to obtain written authorization from the State Engineer prior to beginning work.
- **Conditional Letter of Map Revision (CLOMR) and Letter of Map Revision (LOMR):** Prior to bidding the project for construction, it will be necessary to prepare a FEMA CLOMR or CLOMR-F and LOMR or LOMR-F to address any construction within the floodplain along the Little Bear River under the Preferred Alternative in both Wellsville City and Mendon City, Utah. Following construction, a LOMR or LOMR-F will then be required.
- **Floodplain Disturbance Permits:** Under FEMA rules and regulations, each local regulation agency is required to implement a floodplain disturbance permit for the pressure irrigation systems in Wellsville and Mendon. It will be necessary to obtain this permit from Cache County, Wellsville City, and Mendon City.
- **Construction Water Discharge Permits:** When construction dewatering is required that will discharge to Waters of the United States (WOTUS), wetlands, or ditches, or other possible waterways, a construction water discharge permit will be required from the Utah Division of Water Quality.
- **Building Permits (For Structures):** All constructed structures of the project will be required to comply with the international building code (IBC) and international electrical code (IEC). These will require inspection by the Cache County building inspector and will require the appropriate building permits.
- **Utah Pollutant Discharge Elimination System (UPDES):** Construction activities that disturb more than one acre of land require a SWPPP to comply with the UPDES permit. BMPs must be in place to prevent sedimentation or other impacts on water quality in the project area. This permit process requires an NOI, NOT, and regular inspections by the contractor's storm water inspector as well as an inspector of the agency responsible for compliance (<https://deq.utah.gov/water-quality/storm-water-permits-updes-permits>).
- **USACE Permits:** This project would require compliance with Sections 401, 402, and 404 of the Clean Water Act. While most, if not all, of the wetlands that are affected by the project are associated with the canals, ditches, and return flows from the irrigation system, they will require consultation with the USACE and may require mitigation. While significant efforts have been taken to minimize disturbances to the environment according to the principles of LEDPA, there are some impacts that will still require some permitting. It is expected that most of these disturbances will be covered by the Nationwide Permit 58. However, due to the current status of the definition of jurisdictional wetlands, the governing regulations for the USACE, and new Supreme Court rulings such as the 2023 decision in *Sackett v. EPA*, it is always necessary to coordinate with the USACE during design prior to construction bidding to determine permitting and mitigation requirements. Consultation will continue during design.
- **Utah SHPO:** Section 106 of the NHPA has been completed as described in Section XXX.
- **Right of Way Permits:** Whenever work is completed within the right-of-way, a public agency—including a city, county, or state—work in the right-of-way, or an encroachment

permit is required. A permit for these construction activities will be required from Cache County.

- **Special Use Permits or Special Condition Permits:** Within Cache County, special permits are required for the construction of projects involving pipelines 24 inches or larger whether in the right-of-way or not. These permits must be obtained by the co-sponsors prior to beginning construction.
- **Easements:** Easements from private and public landowners would be obtained prior to construction. Utility easement encroachment permits would also be acquired from local utility companies where necessary.

The project sponsor and co-sponsors are responsible for obtaining and complying with any permits.

6.6 Mitigation of Potential Effects

The following subsections will address impacts associated with the Preferred Alternative relative to specific resources and will describe the measures and management practices which would be implemented under the alternative to provide avoidance, minimization, and mitigation if necessary.

6.6.1 Soils

Because there are no expected impacts on the soil located within the project area, no BMPs or other management measures would be employed relative to the resource. Ground disturbance will be avoided to the extent practicable and topsoil preservation and restoration efforts will be included as a component of the Storm Water Pollution Prevention Plan (SWPPP).

6.6.2 Geology

Because there are no expected impacts to the underlying lithology or tectonics of the area, no BMPs or other management measures will be implemented relative to this resource.

6.6.3 Prime & Unique Farmland

There are no negative impacts associated with the Preferred Alternative to the conditions of prime and unique farmland in the project area; no BMPs or other management measures would be required relative to this resource.

6.6.4 Upland Erosion & Sedimentation

BMPs would be implemented to minimize the effect of project activities on erosion and sedimentation within the project area, including but not limited to:

- Since the area of disturbance is greater than 1.0 acre, a SWPPP is required under the Utah Pollution Discharge Elimination System (UPDES). The SWPPP would be prepared in compliance with Section 402 of the Clean Water Act and would describe the measures to avoid, minimize, and mitigate erosion and prevent soils from leaving the site during and after construction until the site is stabilized. The Preferred Alternative would use the Cache Valley Storm Water Design Criteria (most recent version).
- With the required SWPPP, a Notice of Intent (NOI) would be required from the State of Utah before ground disturbance could begin.

- Suitable erosion control measures such as the use of construction timing, straw waddles, dikes, silt fences, vegetative barriers, compost socks, and other BMPs approved by the Cache Valley Storm Water Design Criteria (most recent version). Straw bales would not be allowed in efforts to prevent the spread of noxious weeds.
- Topsoil preservation and revegetation would be required as part of the SWPPP.
- Revegetation would be consistent with the surroundings with native seeds, seedlings, bare root starts, and pole plantings being used in disturbed areas and agricultural compatible vegetation used in the agricultural areas.
- Tracking pads would be used at the access points to all public roads from construction easements and staging areas to minimize movement of soils.
- Regular inspections using EPA and UDWQ compliant inspection forms will be used to monitor compliance with the SWPPP and storm water rules in compliance with the UPDES general construction permits.
- A Notice of Termination (NOT) will be obtained at the end of project construction.

6.6.5 Water Resources (Surface & Groundwater Quality & Quantity)

BMPs would be implemented to mitigate and reduce impacts to surface and groundwater quality and quantity during and after construction.

- Provide sanitation facilities for construction workers to prevent the contamination of the area with nitrates, phosphates, *Escherichia Coli* (E. Coli), and other water-borne pathogens.
- Ensure the SWPPP addresses the use of petroleum products and other potentially hazardous materials including proper storage and disposal in accordance with UPDES requirements. This includes the availability of spill kits at all fueling sites, on all fueling trucks, and on crew trucks.
- Designated concrete wash-out facilities would be used away from water bodies for all concrete clean-up operations and at approved locations designated in the SWPPP. Concrete remnants would be legally disposed of off-site upon completion of all concrete operations. Within Cache Valley, most of this disposal material is delivered to a recycling facility where possible.

6.6.6 Floodplain Management

BMPs would be implemented to mitigate and reduce impacts to floodplain functionality during and after construction.

- Ensuring the SWPPP includes the appropriate BMPs to provide for sediment traps, sediment pond, intercepting channels, and containment facilities to capture and remove sediment before it can enter a natural or man-made regulated water body.
- Topsoil preservation and revegetation would be required as part of the SWPPP.
- Regular inspections using EPA- and UDWQ-compliant inspection forms will be used to monitor compliance with the SWPPP and storm water rules in compliance with the UPDES general construction permits.
- CLOMRs will be obtained prior to obstruction.
- LOMRs will be obtained following construction.

6.6.7 Wetlands/WOTUS/Special Aquatic Sites

BMPs would be implemented to mitigate and reduce impacts to affected wetlands within the project area during and after construction.

- Consultation with USACE regarding compliance with Section 404 of the Clean Water Act. Permits would be finalized prior to construction. Jurisdictional wetlands would be fenced off with construction fencing to protect them during construction. Appropriate BMPs such as filter strips, waddles, and silt fences would be placed to protect the wetlands that are not to be disturbed from impacts within the construction and staging areas. Additionally, under USACE Nationwide Permit 58, the construction of crossings will require the restoration of any disturbed wetlands to the same conditions (or as close as can be reasonably expected) prior to construction of buried pipelines.
- All temporary use (staging and temporary construction easement) areas would be located outside marked wetland boundaries. Ground disturbance would be limited to parking, turning, storing materials, or storing equipment. These areas would be reclaimed, including re-seeding and weed control, when construction is final.

6.6.8 Riparian Areas

Because there are no impacts expected on any riparian zones within the project area, no BMPs or other management measures would be required relative to this resource.

6.6.9 Air Quality

BMPs would be followed to mitigate for temporary impact on air quality due to construction related activities including but not limited to:

- Since the area of disturbance is greater than 1.0 acre, a SWPPP is required under UPDES.
- As part of the SWPPP, a dust control plan would be required. These would include, but would not be limited to, the application of dust suppressants and watering to control fugitive dust, minimizing the extent of disturbed surfaces during times of high wind, installing tracking pads at all accesses to roadways, removing tracked-out materials deposited onto adjacent roadways, establishing vegetative cover on bare ground as soon as possible after grading to reduce wind-blown dust, requiring appropriate emission-control devices on all construction equipment, using only properly operating and well-maintained construction equipment, limiting earthwork activities, and controlling traveling speeds on unimproved road surfaces.
- Compliance with Utah State Rule R307-309, including the development of a fugitive dust control plan for PM10 and PM2.5 nonattainment and maintenance plan areas, would be maintained throughout construction.

6.6.10 Invasive Species

BMPs would be implemented to mitigate and reduce negative impacts during and after construction, including but not limited to:

- Limit ground disturbances to only the areas necessary to safely implement the Preferred Alternative.
- Construction limits would be flagged onsite to avoid unnecessary plant loss or ground disturbance.

- Weed control on all disturbed areas would be required with a special emphasis on invasive or noxious species.
- The disturbed area would be reclaimed using native topsoil, native seeds, and replacing organic matter.
- Upon completion of work, decontamination would be performed within the work area before the vehicle and/or equipment would be removed from the project site.
- The disturbed areas would be seeded at appropriate times with weed-free, native seed mixes (except in agricultural areas) consisting of a variety of appropriate seeds to promote the revegetation of the disturbed areas.
- Weed control measures would be implemented to county and state standards at a minimum.
- Maintain disturbed areas on a regular basis to prevent the establishment of noxious weeds and/or invasive botanical species.
- Clean equipment prior to delivery to the project site, eradicating noxious weeds/invasive species before the start of and during construction as discovered, and routine monitoring after construction completion. Special precautions were taken to prevent the spread or introduction of noxious weeds or other invasive botanical species. There will be a mandatory inspection of all construction equipment before it arrives on site. This will ensure that any invasive botanical species will be removed prior to construction activities actually starting.
- Compliance with Utah State Rule R68-9 (Utah Noxious Weeds Act) would be maintained during project implementation.

6.6.11 Special Status Botanical Species (Ute-Ladies' Tresses)

BMPs would be implemented to mitigate and reduce negative impacts during and after construction, including but not limited to:

- Ensure that the potential suitable habitat site for ULTs within Mendon is clearly marked
- Avoid ground disturbance and soil compaction within the marked potentially suitable habitat, including:
 - Use only water (no chemicals, reclaimed production water, or oil field brine) for dust abatement measures.
 - Clean vehicles and equipment prior to entering suitable habitat.
 - Control noxious weeds within suitable habitat with herbicides or manual treatments. If using herbicides within a suitable habitat area:
 - A Pesticide Use Permit (PUP) will be approved through authorizing Federal or state agency.
 - Herbicides will be used with reduced application rates and with reduced pump pressure, per label instructions.
 - No aerial or broadcast herbicide treatments will be applied for vegetation management within 2,500 feet of suitable or occupied ULT habitat.
 - For noxious weed control within 2,500 feet of suitable or occupied ULT habitat, manual spot treatments (i.e., backpack sprayers) shall be used.
 - All those involved in the herbicide application shall be accompanied by a qualified botanist/ecologist familiar with ULTs to help herbicide applicators identify ULTs and avoid impacts on individual plants.
 - Treatments would not be done when wind speeds exceed 6 miles per hour.

- Herbicides shall be stored in spill proof containers away from special status plant habitats.
- Ensure that ULT clearance surveys are completed as required: three clearance surveys have been completed for this site, as of 2024. The surveys are valid for three growing seasons after the last survey was completed. If disturbance and construction may occur after 2027, additional clearance surveys of the potentially suitable habitat would need to be completed
 - All clearance surveys will be conducted by a qualified botanist and follow USFWS Utah Field Office guidelines for conducting and reporting botanical inventories and monitoring of Federally listed, proposed, and candidate plants (USFWS, 2011).
-

6.6.12 Fish & Wildlife/Special Status Animal Species

BMPs would be employed to minimize the effect of project activities on fish, wildlife, migratory birds, and other protected species with mapped habitats within the project area including USFWS endangered or threatened species or Utah special status species.

- Complete all work within the designated Action Area during established working hours.
- Contain all work activities, including those within staging areas, to upland areas to minimize potential impacts to water quality, whenever feasible.
- Ensure all applicable local or state water quality permits are in place, and where applicable, obtain an EPA construction General Permit for the Proposed Action. Meet associated permit conditions during construction operations.
- Ensure the contractor develops and follows an approved SWPPP and a SPCC plan or other similar plan.
- Comply with all measures in the associated SWPPP and SPCC plan when fueling, performing cleaning and maintenance, and storing or disposing of hazardous materials.
- Comply with all measures in the associated SWPPP or similar document for implementing temporary erosion and sediment controls (TESCs), covering and storing materials, and other erosion prevention measures. Do not perform construction activities during extreme wet weather conditions, whenever practicable. If heavy precipitation is predicted to occur within 24 hours, take appropriate measures to cover up any stockpiles and check that TESCs are functioning.
- Perform pre-construction surveys for migratory birds and raptors in all areas where vegetation removal will occur no more than 7 days before disturbance in areas of suitable habitat, when construction activities or vegetation removal would occur during the breeding and nesting season of migratory birds (March 1 – September 30) or eagles (December 1 – August 31). Repeat surveys if construction and vegetation removal are paused and resumed. If an active nest is discovered in the Action Area, halt construction and/or vegetation removal and contact the NRCS biologist for guidance.
- Rehabilitate all areas of ground disturbance. Spread or grade stockpiled materials and use a native seed mix (99.9% noxious weed-free seed) approved by NRCS (and landowner) to reseed all areas where ground disturbance has occurred. Ensure the seed mix and plants are appropriate to the region and include milkweed species (*Asclepias sp.*) when appropriate to the site.
 - If appropriate for the area, apply seed by hydroseeding, using a temporary erosion control mulch tackifier to provide stabilization, eliminate erosion concerns, and create vegetation recruitment opportunities.

- Clean equipment of mud and other debris to avoid noxious weed or seed dispersal within or near the Action Area. Use pressure washing where appropriate to remove soil, plant parts, or other materials that may carry invasive and noxious weeds before arriving at the Action Area. Ensure this cleaning occurs each time equipment is brought into the Action Area from a different location.
 - Ensure the contractor provides the site inspector with the opportunity to inspect the equipment before unloading at the construction site. If upon inspection, dirt, debris, and seeds are visible, ensure the contractor immediately removes the equipment from the Action Area and rewashes it. Ensure the equipment is clean by having the site inspector re-inspect the equipment.
- Protect native site vegetation and plant communities, including wetland vegetation and milkweed, when practicable. Clearly mark, flag, or fence areas where vegetation is to be protected.

6.6.13 Cultural & Historic Resources

The NRCS has determined that the project will result in “Adverse Effect to Historic Properties.” In consultation with the Utah SHPO, federally recognized Tribes, the Project Sponsors, canal companies, and other identified consulting parties, the NRCS has developed a MOA to mitigate adverse effects to two historic canals (Appendix A). The MOA establishes mitigation measures including historic documentation, aerial recording of canal features, updates to site forms, development of interpretive materials, and procedures for unanticipated discoveries.

The following would be implemented in the event of unanticipated discoveries:

- In the event of an unanticipated archaeological discovery during construction, the NRCS shall follow procedures outlined in the Prototype Programmatic Agreement with the Utah SHPO. If significant discoveries requiring longer-term work stoppage for consultation and mitigation are encountered, the NRCS will consult per 36 C.F.R. 800.6 to develop a plan to further mitigate the adverse effect.
- If human remains are discovered under any circumstance, the remains will be treated in accordance with the requirements of the Native American Graves Protection and Repatriation Act (NAGPRA) (25 U.S.C. 3001 et seq.) and its implementing regulations (43 C.F.R. 10). All construction activities within 100 feet of the remains shall cease immediately and the NRCS shall consult pursuant to 43 C.F.R. 10.5, to develop a written plan of action to manage the discovery. Construction in the area of the remains may need to be halted throughout the review process. Continuation of work following a discovery will be contingent upon approval by the NRCS Cultural Resource Specialist in consultation with the Utah SHPO, tribes, and other consulting parties that the approved plan has been satisfactorily completed.

6.6.14 Land Use & Recreation

Because there are no expected negative impacts to Land Use or Recreation in the project area, no BMPs or other management measures would be required relative to this resource. The Preferred Alternative will only bring benefits to this resource category through the construction of the new

access ramp for non-motorized watercraft on Wellsville Reservoir and the reflection pond/walking trail at Mendon Cemetery.

6.6.15 Public Health & Safety

BMPs would be employed to minimize the effect of project activities on public health and safety including but not limited to:

- Construction sites would be closed to public access.
- All construction would be completed in compliance with federal safety laws, rules and regulations governed by the Occupational Safety and Health Administration (OSHA).
- All traffic control will be in compliance with the Manual on Uniform Traffic Control Devices or MUTCD (most recent addition). Flaggers will be used where beneficial and required for safety.
- Noise control and dust control measures would be employed to minimize their effect on the public.

6.6.16 Scenic & Visual Resources

BMPs would be employed to minimize the effect of project activities on scenic and aesthetic resources in the project area, including but not limited to:

- Noise control measures would be employed to minimize effects on the public.
- Implementation of construction-related and visual resource-specific BMPs will coincide with the dust control plan, erosion control plan, and the vegetative restoration plans included in the SWPPP.
- The public will not be allowed access to the project area while construction is ongoing. This will prevent any major barriers to scenic viewsheds by limiting physical access to the project site. Of course, there will be unavoidable aesthetic impacts in the short-term as heavy equipment cannot be removed from view without extraordinary effort.

6.6.17 Transportation

BMPs would be employed to minimize the effect of project activities on transportation corridors within the project area, including but not limited to:

- All traffic control will follow the Manual on Uniform Traffic Control Devices or MUTCD (most recent addition). Flaggers will be used where beneficial and required for safety.
- The public will not be allowed to access any existing transportation corridors normally available on the site. This will temporarily impact transportation corridors in order to protect public health and safety.

6.7 Costs and Cost-Sharing

Project construction implementation costs are broken down into PL-566 program categories as shown in Table 6-1. Technical and Administrative Costs are not included in these costs. See Appendix D for additional breakdowns of construction cost estimates.

Table 6-2: Summary of Construction Costs for the Preferred Alternative

Category	Subcategory	Construction Costs
Flood Control	Lower Canal Flood Projects	\$44,473,000.00
	Subtotal	\$44,473,000.00
Agricultural Water Management	Wellsville East Field Piping ¹	\$5,011,000.00
	Wellsville Secondary Water System	\$15,988,000.00
	Mendon Secondary Water System	\$9,606,000.00
	WMCD Lower Canal Piping ¹	\$43,689,000.00
	Subtotal	\$74,294,000.00
Public Recreation	Wellsville Reservoir Boat Ramp	\$13,000.00
	Mendon Cemetery Pond	\$19,000.00
	Subtotal	\$32,000.00
Total		\$118,799,000.00

¹includes \$25,000 for cultural mitigation

These construction costs are anticipated to be shared by several entities and funding programs. See Table 6-2 for cost-share details.

Table 6-3: Estimated Construction Cost Share

Category	Subcategory	NRCS Funding	Estimated Costs (Dollars)		
			Cost Share – PL 83-566	Cost Share – Other Funds	
			Federal	Federal	Non-Federal
Flood Control	Lower Canal Flood Improvements ¹	up to 100%	\$24,450,000	\$0	\$5,808,000
	Wellsville City Flood Routing ¹	up to 100%	\$1,810,000	\$0	\$1,044,000
	Canal Spills	up to 100%	\$9,020,000	\$0	\$0
	Bird Canyon Channel Improvements ¹	up to 100%	\$168,000	\$0	\$462,000
	100 South Flood Control Pipe	up to 100%	\$822,000	\$0	\$0

Category	Subcategory	NRCS Funding	Estimated Costs (Dollars)			
			Cost Share – PL 83-566	Cost Share – Other Funds		
				Federal	Federal	
	300 North Flood Control Pipeline	up to 100%	\$639,000	\$0	\$0	
	400 North Flood Control Pipeline	up to 100%	\$250,000	\$0	\$0	
	Subtotal		\$37,159,000	\$0	\$7,314,000	
Agricultural Water Management	Wellsville East Field Piping	up to 75%	\$3,758,250	\$0	\$1,252,750	
	Wellsville Secondary Water System	up to 75%	\$11,991,000	\$0	\$3,997,000	
	Mendon Secondary Water System	up to 75%	\$7,204,500	\$0	\$2,401,500	
	WMCD Lower Canal Piping	up to 75%	\$32,766,750	\$0	\$10,922,250	
	Subtotal		\$55,720,500	\$0	\$18,573,500	
Public Recreation	Wellsville Reservoir Boat Ramp	up to 50%	\$6,500	\$0	\$6,500	
	Mendon Cemetery Pond	Up to 50%	\$9,500	\$0	\$9,500	
	Subtotal		\$16,000	\$0	\$16,000	
Total			\$92,895,500	\$0	\$25,903,500	

¹Includes culverts at 0% of Public Law 83-566 funds.

6.8 Ecosystem Services Benefits

The Preferred Alternative would improve the provision of ecosystem services in the project area in the following ways:

6.8.1 Provisioning Services

- **Food Production/Agriculture:** Farmland quality would be improved with the reduction of flooding in the watershed. Additionally, the loss of topsoil would be reduced in the area and access to irrigation water would be improved for the watershed. Annual crop yield value is expected to be ~\$7,352,280 or a 108% increase from existing conditions. The calculation for this value is summarized in a technical memorandum in Appendix E.
- **Water Savings/Seepage:** Seepage in the Lower Canal and Wellsville East Field Canal would be reduced significantly providing 8,077 acre-feet of average water savings annually. The calculations for these values are included in a technical memorandum in Appendix E. Additionally, late season water shortages would be less frequent and drastic.
- **Drinking Water Supply:** The alternative would reduce the reliance of local communities on the culinary water supply for irrigation purposes in the late growing season. Additionally, groundwater quantities would be improved as there would be less reliance on pumping for secondary water needs. On average, this alternative would result in 829 acre-feet of groundwater savings annually (See Appendix E). These water savings would also reduce the arsenic concentrations in the groundwater and improve the groundwater quality.

6.8.2 Regulating Services

- **Flood Control:** Flood events would be much less likely to occur and would not pose as significant a risk to life, injury, structures, or agricultural fields. Flood control infrastructure will help the community to adjust to long-term climate trends which forecast an increase in extreme weather events, including flooding. The watershed's floodplain sustainability and functionality would be improved as it would not be interrupted by flooding as frequently. The average annual flood damage reduction benefit of this alternative is ~\$6.83 million.
- **Public Safety:** The public would be less likely to be damaged by flooding under this alternative. This alternative would also eliminate the safety hazard of potential drowning in the Lower Canal by enclosing the system. The protection that the Preferred Alternative would provide to transportation routes would improve access for residents to emergency services, including 9-1-1 services.
- **Water Quality:** Piping the Lower Canal would significantly reduce nutrient loading and runoff to the Little Bear River and its tributaries that are currently particularly harmful during flooding events. It can be expected that the Little Bear River's water quality would be improved and would allow for a healthier and more resilient aquatic ecosystem. This alternative would allow the river to meet the TMDL sediment load reduction goals for the river.
- **Drought Resiliency:** The Preferred Alternative would help the local community build resilience to forecasted long-term climate trends, including increased drought frequency in the western United States by reducing pumping demands on the groundwater and increased water savings. The alternative would result in 829 acre-feet of groundwater savings annually. The calculations for this value are included in Appendix E.

6.8.3 Cultural Services

- **Recreational Experiences:** The Preferred Alternative would add to the current number of recreational opportunities for residents in the watershed by installing an access ramp for

non-motorized watercraft at Wellsville Reservoir and a walking trail along the new reflecting pond at Mendon City Cemetery.

- **Spiritual Experiences:** The installation of a reflecting pond would serve as a new spiritual opportunity for residents looking to relax and remember those who are interred at the cemetery. This service is particularly useful as it is not exclusive to any religious denomination and can provide spiritual services to anyone who uses it.
- **Aesthetic Value:** The scenic beauty of the project area would not significantly change under the Preferred Alternative.
- **Existence Value of Historic/Cultural Sites:** The Preferred Alternative, while adversely impacting two historic sites (the two canals), would provide flood protection to all the historic properties in the Indirect/No Action APE.

The Preferred Alternative is expected to improve conditions related to all six PR&G Guiding Principles: Healthy and Resilient Ecosystems, Sustainable Economic Development, Floodplains, Public Safety, and Watershed Approach.

6.9 Installation and Financing

The following subsections present the details regarding the installation and financing of the Preferred Alternative. Much of the data provided in these sections is based off of (and pulled from) the Economic Analysis Report dated June 2025. A full copy of this report is available in Appendix E.

6.9.1 Installation

The co-sponsors would obtain all approvals and permits for the project prior to the start of construction. During design, a project permit checklist would be created with a tracking process to ensure all permits are complied with accordingly. The entire project would be designed (2 years) and constructed/installed (3 years) over a 5-year period commencing in 2026 and ending in 2030. The sponsors developed an appropriate design and construction phasing schedule that focused on sequencing of the project based on maintaining the economic viability of the co-sponsors and individuals during construction, protects the environment and ecosystem, and minimizes risks (Table 6-3 and Figure 6-1).

Table 6-4: Construction Timeline and Installation Costs by Funding Source for the Preferred Alternative, Wellsville Canyon Watershed, 2025

Project Year	PL 83-566 Non-Construction Funds	PL 83-566 Construction Funds	Other, Non-Federal Non-Construction Funds	Other, Non-Federal Construction Funds	Total Installation Costs
1	\$5,010,533	\$18,750 ¹	\$87,500	\$6,250	\$5,123,033
2	\$5,010,533	\$18,750	\$87,500	\$6,250	\$5,123,033
3	\$4,036,283	\$23,597,000	\$0	\$23,597,000	\$51,230,283
4	\$3,616,450	\$21,088,000	\$0	\$21,088,000	\$45,792,450
5	\$2,528,200	\$14,689,500	\$0	\$14,689,500	\$31,907,200
Total Project	\$20,202,000	\$59,412,000	\$175,000	\$59,387,000	\$139,176,000

1: These costs are associated with cultural resources mitigation, totaling \$50,000 and cost-shared at 75% since they are associated with adverse impacts to canals (i.e., agricultural water management purpose)

Wellsville Canyon Watershed Project - Proposed Sequencing			
SUMMARY OF SEQUENCING		SUMMER	WINTER
2026	- Plan-EIS Finalized/ROD Issued - Design & Permitting Year #1	- Plan-EIS Finalized. Record of Decision (ROD) publication. - Design & Permitting Work is Initiated.	Design & Permitting Work Continues.
2027	Design & Permitting Year #2	Design & Permitting Work Continues	- Design & Permitting Work Continues - Contractor Selection
2028	Implementation/Construction Year #1	- Flood Improvement Install Phase #1 - Wellsville Secondary System Phase #1 - Mendon Secondary System Phase #1	- Lower Canal Piping Phase #1 - East Field Canal Piping - Wellsville Reservoir Boat Ramp - Mendon Cemetery Pond
2029	Implementation/Construction Year #2	- Flood Improvement Install Phase #2 - Wellsville Secondary System Phase #2 - Mendon Secondary System Phase #2	Lower Canal Piping Phase #2
2030	Implementation/Construction Year #3	Flood Improvement Install Phase #3	- Lower Canal Piping Phase #3 - Lower Canal Widening - Project Closeout/Completion

Figure 6-1: Proposed Sequencing

6.9.2 Responsibilities

NRCS is responsible for leading the planning efforts, providing engineering design and construction oversight assistance, and certifying project completion. The sponsors and co-sponsors would be responsible for engineering design, project administration, environmental permitting, contracting, and construction implementation. The sponsor has the needed authority as a water district in the State of Utah and has agreed to exercise those authorities to implement the actions described in this Plan-EIS.

6.9.3 Contracting

Implementing the Preferred Alternative would be completed using NRCS funding mechanisms. The sponsor and co-sponsors would be primarily responsible for overseeing and administering project construction in coordination with the NRCS.

6.9.4 Real Property Rights

Real property acquisition or relocation would not be required for the Preferred Alternative. All construction would be completed either in existing right of way or in easements that have been obtained from project participants.

6.10 Operation, Maintenance, and Replacement

The various SLOs would be responsible for the Operation & Maintenance (O&M) of the pressurized irrigation system for the extent of its design life, as well as any associated replacement costs and activities that could occur. Prior to construction, a separate O&M agreement based on NRCS's Operation and Maintenance Manual would be made between NRCS and the SLOs. The agreement would continue through the design life of the project and could be modified with NRCS's approval as appropriate.

Operation, maintenance, and replacement costs have been estimated in TM008 in Appendix E and Table 6-4. See Appendix D and Appendix E for additional details on assumptions and line items.

Table 6-5: Operation, Maintenance, and Replacement Costs Summary

Category	Subcategory	Estimated Preferred Alternative Annual OM&R Cost
Flood Control	Lower Canal Flood Projects	\$13,078
Agricultural Water Management	Wellsville East Field Piping	\$3,000
	Wellsville Secondary Water System	\$116,920
	Mendon Secondary Water System	\$67,460
	WMCD Lower Canal Piping	\$10,000
Public Recreation	Wellsville Reservoir Boat Ramp	\$0
	Mendon Cemetery Pond	\$700
Total		\$211,158

6.11 Economic Tables and Structural Tables

A summary of the economic analysis of the Preferred Alternative (NEE Alternative and Future with Federal Funding) and the No Action/FWOFI Alternative is provided in Chapter 4. The full NEE Analysis is provided in Appendix D and the economist's report in Appendix E.

Table 6-5 (NWPM 506.11, Economic Table 1) and Table 6-6 (NWPM 506.12, Economic Table 2) present the proportion of PL 83-566 funding and other funding sources for construction and supporting technical services. The average annual NEE costs are shown in Table 6-6 and Table 6-7 (NWPM 506.18, Economic Table 4). The costs shown are the annual costs for the Preferred Alternative above the No Action Alternative, which is discussed further in Appendix D.

Table 6-8 (NWPM 506.20, Economic Table 5a) presents the average annual damage reduction benefits separated into the agricultural and the non-agricultural damage reductions. Using the resulting benefits and cost from Table 6-7 and Table 6-8, Table 6-9 (NWPM 506.21, Economic Table 6) presents a comparison of the NEE average annual benefits and average annual costs.

A Benefit-Cost Analysis (BCA) was performed for the project which identified the Preferred Alternative's BCR as 2.46, approximately double the minimum BCR of 1.0 to represent net positive annual benefits.

Table 6-6: Estimated Installation Cost for Preferred Alternative, Wellsville Canyon Watershed Plan, Utah September 2025

Installation Cost Items	Estimated Costs (2025 Dollars) ¹		
	PL 83-566 Funds	Other Funds	Total
Recreation	\$24,000	\$19,000	\$43,000
Wellsville Reservoir Boat Ramp	\$10,000	\$8,000	\$18,000
Mendon Cemetery Pond	\$14,000	\$11,000	\$25,000
Agriculture Water Management	\$68,159,500	\$18,809,500	\$86,969,000
Wellsville East Field Piping	\$4,593,750	\$1,270,250	\$5,864,000
Wellsville Secondary Water System	\$14,670,000	\$4,057,000	\$18,727,000
Mendon Secondary Water System	\$8,814,250	\$2,440,750	\$11,255,000
WMCD Lower Canal Piping	\$40,081,500	\$11,041,500	\$51,123,000
Flood Management	\$44,727,000	\$7,437,000	\$52,164,000

Installation Cost Items	Estimated Costs (2025 Dollars) ¹		
	PL 83-566 Funds	Other Funds	Total
Lower Canal Flood Improvements	\$29,595,000	\$5,818,000	\$35,413,000
Wellsville City Flood Routing	\$2,296,000	\$1,046,000	\$3,342,000
Canal Spills	\$10,555,000	\$100,000	\$10,655,000
Bird Canyon Channel Improvements	\$276,000	\$467,000	\$743,000
100 South Flood Control Pipe	\$963,000	\$2,000	\$965,000
300 North Flood Control Pipeline	\$749,000	\$2,000	\$751,000
400 North Flood Control Pipeline	\$293,000	\$2,000	\$295,000
Total Project	\$112,910,500	\$26,265,500	\$139,176,000

1 – NWPM 506.11 (2014) requirements to show costs on Federal & non-Federal land is met. All would be on Non-Federal lands.

Table 6-7: Estimated Cost Distribution for Preferred Alternative, Wellsville Canyon Watershed Plan, Utah September 2025\$

Installation Cost Items		Flood Control	Ag. Water Mgmt.	Public Recreation	Total Project
Installation Costs: PL 83-566 Funds	Construction Costs ¹	\$37,159,000	\$55,683,000	\$16,000	\$92,858,000
	Engineering Technical Assistance Costs	\$7,119,000	\$11,881,000	\$7,000	\$19,007,000
	Mitigation	\$0	\$37,500	\$0	\$37,500
	Admin Costs	\$449,000	\$558,000	\$1,000	\$1,008,000
	Total PL 83-566 Costs	\$44,727,000	\$68,159,500	\$24,000	\$112,910,500
Installation Costs: Other Funds	Construction	\$7,314,000	\$18,561,000	\$16,000	\$25,891,000
	Engineering	\$0	\$0	\$0	\$0
	Real Property	\$0	\$0	\$0	\$0
	Mitigation	\$0	\$12,500	\$0	\$12,500
	Permits	\$123,000	\$50,000	\$2,000	\$175,000
	Admin. Costs	\$0	\$186,000	\$1,000	187,000
	Total Other Funds	\$7,437,000	\$18,809,500	\$19,000	\$26,265,500
Total Project Cost		\$52,164,000	\$86,969,000	\$43,000	\$139,176,000
Amortized Costs FY2025 Rate		\$2,163,600	\$3,630,700	\$1,700	\$5,796,000
Annual O&M		\$13,078	\$197,380	\$700	\$211,158
Total Annual Costs		\$2,176,678	\$3,828,080	\$2,400	\$6,007,158

¹Culvert costs are sponsor-funded associated costs included in total project costs but not eligible for PL-83-566 cost-share..

Table 6-8: Recreational Facilities—Estimated Construction Costs, Wellsville Watershed, Utah [September 2025 Dollars]¹

Works of Improvement	Number²	Estimated Unit Cost	Total Construction Cost
Wellsville Reservoir Boat Ramp	1	Each	\$18,000
Mendon Cemetery Pond	1	Each	\$25,000
1 Price base: 2025			
2 Estimated quantity, subject to minor variation at the time of detailed planning.			
3 Estimated federal construction costs amount to \$21,500; Estimated non-federal construction costs amount to \$21,500.			

Table 6-9: Estimated Average Annual Costs for Preferred Alternatives, Wellsville Canyon Watershed Plan, Utah September 2025\$

Evaluation Unit	Project Outlays		Total
	Amortization of Installation Cost	Operation and Maintenance	
Recreation	\$1,700	\$700	\$2,400
Agriculture Water Management	\$3,630,700	\$197,380	\$3,828,080
Flood Management	\$2,163,600	\$13,078	\$2,176,678
Total Project	\$5,796,000	\$211,158	\$6,007,158

Discount Rate: 3.00%

Amortization period: 55 years (5 years to implement the project, 50 years project life)

Recreation O&M costs shown are aggregated for the recreation evaluation unit. Installation-level O&M values are shown in Table 6- 9 for informational purposes.

Table 6-10: Structural Table 3b. Structural Data – Channel Work

					Channel Dimensions								
Channel Name (reach)	Drainage Area (mi)	(100) Year Freq Design Discharge (ft ³ /s)	Flow Depth (ft)	Hyd. Gradient (ft/ft)	Gradient (ft/ft)	Bottom Width (ft)	Elev. (feet msl)	Side Slopes (h:v)	n Value	Velocities (ft/s) ³	Excavation Volume (yd ³)	Existing Channel Type ¹	Present Flow Cond. ²
Lower Canal–Inlet → 200 W/900 S	19.65	217.4	4.0	0.000457	0.000457	10-12	4626.49 – 4618.49	1.5 : 1	0.012	4-7	Negligible	M	I
Lower Canal–200 W/900 S → 3400 S	8.40	281	5.0	0.000409	0.000409	12-14	4618.48 – 4605.15	1.5 : 1	0.012	4-7	Negligible	M	I
Lower Canal–3400 S → 2900 S	5.32	171	5.0	0.000402	0.000402	12-14	4605.15 – 4603.44	1.5 : 1	0.012	4-7	Negligible	M	I
Lower Canal–2900 S → Bird Canyon Spill	2.85	84.4	5.0	0.000565	0.000565	12-14	4603.44 – 4600.23	1.5 : 1	0.012	4-7	Negligible	M	I
Bird Creek–100 W → 100 E	2.53	47.22	6.8	0.028	0.028	2	4526.5 – 4466.3	3 : 1	0.03	5-9.1	Cut – 2,050 Fill -- 52	N	I

Date Prepared: April 2026

1 N An unmodified, well-defined natural channel or stream.

M Manmade ditch or previously modified channel or stream (show approximate date of original construction in parenthesis).

O None or practically no defined channel."

2 Pr Perennial-Flows at all times except during extreme drought.

I Intermittent-Continuous flow through some seasons of the year.

E Ephemeral-Flows only during periods of surface runoff, otherwise dry.

S Ponded water with no noticeable flow-Caused by lack of outlet or high groundwater table.

3 Discharge velocities are based on design discharge (100-year).

Table 6-9: Estimated Average Annual Flood Damage Reduction Benefits, Wellsville Canyon Watershed Plan. Utah September 2025\$

	Average Annual Damages without Project		Average Annual Damages with Project		Average Annual Benefits	
Item	Ag Related ¹	Non-Ag Related	Ag Related ¹	Non-Ag Related	Ag Related	Non-Ag Related
Floodwater Damage						
Structures, Contents, Vehicles	\$7,312,493	\$0	\$484,691	\$0	\$6,827,802	\$0
Roads/Crossings	\$0	\$0	\$0	\$0	\$0	\$0
Crop	\$0	\$0	\$0	\$0	\$0	\$0
Saturation	\$0	\$0	\$0	\$0	\$0	\$0
Sediment/Erosion Damage	\$0	\$0	\$0	\$0	\$0	\$0
Indirect Damages Damage	\$0	\$0	\$0	\$0	\$0	\$0
Grand Total	\$7,312,493	\$0	\$484,691	\$0	\$6,827,802	\$0

¹ Agriculture-related damage includes damage to rural communities. Price base 2025. Prepared 09/2025.

Table 6-10: Comparison of Benefits and Costs, Wellsville Canyon Watershed Plan, Utah, September 2025\$

Evaluation Unit	Average Annual Costs	Average Annual Benefits	Benefit Cost Ratio	Net Benefits
Recreation	\$2,400	\$11,963	4.98	\$9,563
Wellsville Reservoir Boat Ramp	\$700	\$7,305	10.44	\$6,605
Mendon Cemetery Pond	\$1,700	\$4,658	2.74	\$2,958
Agriculture Water Management	\$3,828,080	\$7,916,540	2.07	\$4,088,460
Wellsville East Field Piping	\$253,000	\$913,850	3.61	\$660,850
Wellsville Secondary Water System	\$904,220	\$1,752,366	1.94	\$848,146
Mendon Secondary Water System	\$540,660	\$756,924	1.40	\$216,264

Evaluation Unit	Average Annual Costs	Average Annual Benefits	Benefit Cost Ratio	Net Benefits
WMCD Lower Canal Piping	\$2,130,200	\$4,493,400	2.11	\$2,363,200
Flood Management¹	\$2,176,678	\$6,827,802	3.14	\$4,651,124
Lower Canal Flood Improvements	\$1,470,800			
Wellsville City Flood Routing	\$139,000			
Canal Spills	\$443,100			
Bird Canyon Channel Improvements	\$33,170			
100 South Flood Control Pipe	\$42,470			
300 North Flood Control Pipeline	\$33,570			
400 North Flood Control Pipeline	\$14,570			
Grand Total	\$6,007,158	\$14,756,305	2.46	\$8,749,147

¹ All flood management measures were evaluated as a single increment in the economic analysis because it is not possible to quantify individual flood damage reduction benefits for any single measure since the canal conveys water in and out of each subbasin.

7.0 Consultation, Coordination, and Public Participation

This chapter details other consultation and coordination between NRCS and other federal, state, and local Government Agencies, Native American Tribes, and the public during the preparation of this Plan-EIS. Compliance with NEPA is a federal responsibility that involves the participation of each of these entities in the planning process. NEPA requires full disclosure concerning major actions taken by federal agencies and accompanying alternatives, impacts, and the potential mitigation of impacts. The scoping process is detailed in Chapter 1.

7.1 Consultation

7.1.1 Standard Consultation Requirements

Standard consultation requirements include NHPA Section 106 consultation, NEPA consultation, and Biological consultation (i.e., ESA section 7 and PL 83-566 section 12).

7.1.1.1 NHPA Consultation

SHPO Consultation

In compliance with Section 106 of the NHPA, the Utah SHPO were involved in consultation for the project (36 CFR 800.3). After establishing itself as lead federal agency (36 CFR 800.2), the NRCS consulted with the Utah SHPO on defining the APE (36 CFR 800.3), identification of historic properties (36 CFR 800.4), project effects (adverse effect determination) (36 CFR 800.5), and consultation for the MOA (36 CFR 800.5(d)(2)). For NRCS-Utah standard consultation procedures, per the State Prototype Programmatic Agreement Section V.c.1 with the Utah SHPO, “NRCS may provide its proposed APE, identification of historic properties and/or scope of identification efforts, and assessment of effects in a single transmittal to the Utah SHPO and Indian Tribes, provided this documentation meets the substantive standards in 36 CFR Part 800.4-5 and 800.11” (NRCS and SHPO 2025). Consultation initiation letters requesting concurrence on APE, site eligibility, and project effects, were sent on February 12, 2025. SHPO sent concurrence back on March 1, 2025. The NRCS notified the Advisory Council on Historic Preservation (ACHP) of the adverse effect determination in letter emailed on March 27, 2025. The ACHP declined to participate in consultation in their response on April 11, 2025. SHPO concurrence and ACHP notification may be found in Appendix A.

Tribal/THPO Consultation

In accordance with the National Historic Preservation Act (NHPA) of 1966, EO 13007, and EO 13175, Tribal consultation was conducted by the NRCS to maintain the government-to-government relationship. NRCS has responsibilities to help fulfill the U.S. government’s responsibilities toward Tribes when considering actions that may affect Tribal rights, resources, and assets.

Tribes who hold ancestral land, traditional use, and/or traditional cultural property claims in and near the Project Area were identified using the former NPS Native American Graves Protection and Repatriation Act Native American Consultation Database (NACD), a database through which any federally recognized tribe could identify those counties in Utah where they had consultation interests. The U.S. Department of Housing and Urban Development Tribal Directory Assessment

Tool (TDAT), the BIA website, and the Utah Division of Indian Affairs (UDIA) website were used as supplemental sources to identify tribes with consultation interests. The assembled list of tribes identified from the NACD, TDAT, BIA website, and UDIA website are discussed below.

- Eastern Shoshone Tribe of the Wind River Reservation, Wyoming
- Northwest Band of the Shoshone Nation, Utah
- Shoshone-Bannock Tribes of the Fort Hall Reservation, Idaho
- Ute Indian Tribe of the Uintah & Ouray Reservation, Utah

Per 36 CFR 800.3-800.5, the NRCS consulted with the assembled list of Tribes regarding delineation of the project APE, cultural resource site eligibility, and project effects (adverse effect determination) on February 12, 2025.

A summary of the communication dates and responses from the tribes during the Section 106 consultation process is provided in the Tribal Consultation Table, which can be found in Appendix A. The follow up email dates and responses are summarized here:

- Follow-Up Email with invitation to participate in the MOA: March 25, 2025
 - No responses received.
- Follow Up Phone Calls: April 30, 2025
 - No response received.

Consultation with the tribes will continue during the Plan-EIS review period and the results will be documented in the Final Plan-EIS. The MOA for the mitigation of adverse effects is in development. A copy of the MOA is included in Appendix A. A fully executed MOA will be included in the Final Plan-EIS.

7.1.1.2 Agency and Consulting Party Consultation

The NRCS identified the USBR, Wellsville Certified Local Government (CLG), and USFS as consulting parties under Section 106. The NRCS established itself as the lead federal agency, pursuant to 36 CFR 800.2 via email on February 13, 2025, to the USBR, and USFS. As lead federal agency, and per Section V.c.1 the NRCS State Prototype Programmatic Agreement with the Utah SHPO, the NRCS provided its proposed APE, identification of historic properties, and assessment of effects in a single transmittal to the Wellsville Certified Local Government (CLG) on February 12, 2025, to seek their concurrence. No response was received from the Wellsville CLG. The NRCS consulted with the USBR and USFS via email on February 13, 2025, with an overview of the undertaking, APE, and noting that although 49 acres of USBR ROW and 5 acres of USFS-administered lands were intensively inventoried, none of those areas are within the final APE. The NRCS also invited both agencies to participate in the development of the MOA to mitigate adv

7.1.1.3 NEPA Consultation

Tribal Scoping for NEPA

Consultation was initiated during the NEPA scoping process when the NRCS reached out to the assembled list of Tribes regarding known historic properties or places of traditional religious and cultural importance near the project area. The Tribal Consultation table in Appendix A provides the contacts and addresses of those who were sent scoping notices. Tribes were also asked about any additional Tribes that should be contacted. Letters were mailed on April 22, 2021, to the Tribes

listed above for the public scoping meeting—held virtually with an option for in-person attendance—on May 11, 2021. Letters were also sent to the Tribes notifying them of the publication of the Notice of Intent (NOI) in the Federal Register in May 2024. Letters to the Tribes regarding the NOI were sent on May 7, 2024.

7.1.1.4 Biological Consultation

Section 12 of Public Law (PL) 83-566

Consultation with the USFWS specifically pursuant to Section 12 of PL 83-566 was initiated on May 14, 2024. No adverse effects and no mitigation were identified. Consultation documentation can be found in Appendix A.

Section 7 of the Endangered Species Act (ESA)

Communication and coordination with the USFWS were initiated upon preparation of the Biological Assessment (Appendix E) and carried out throughout the planning process. All beneficial and adverse effects to special status species were communicated to the USFWS through informal Section 7 consultation review. Concurrence with these determinations was received from USFWS on January 7, 2026. Documentation is included in Appendix A.

7.2 Coordination

7.2.1 NEPA Agency Coordination

Seven agencies received a scoping notice included in an email invite to a Microsoft Teams virtual meeting for agencies held on May 10, 2021. The meeting was attended by representatives from Utah Division of Emergency Management, USBR, EPA, USFWS, UDOT, Division of Water Rights, ACOE, Utah Department of Natural Resources, and the Utah Department of Public Safety.

Letters were sent on August 22, 2023, to interested agencies and key stakeholders as listed in Table 7-1 to invite their participation as a cooperating agency. The Utah State Historic Preservation Office (SHPO) was consulted on aspects of the project pertaining to historic and/or cultural resources (e.g., determination of effects, mitigation, concurrence, etc.).

Table 7-1: Cooperating Agencies

Agency	Accepted / Declined
Environmental Protection Agency (EPA)	Accepted
U.S. Bureau of Reclamation (USBR)	Accepted
Utah Department of Transportation (UDOT)	Declined
U.S. Fish and Wildlife Service (USFWS)	No Response Received
Bureau of Land Management (BLM)	Declined
U.S. Forest Service (USFS)	Declined
U.S. Army Corps of Engineers (USACE)	No Response Received

Cooperating Agencies were sent a copy of the NOI prior to its publication in the Federal Register for an opportunity to provide comments and review. Comments were implemented prior to the publication of the NOI in the Federal Register on May 7, 2024.

7.3 Public Involvement

The Scoping Report prepared for the project (Appendix A) presents the scoping efforts and comments received during the 30-day comment period (April 27, 2021, to May 27, 2021). A scoping notice announcing the public scoping meeting and period was placed in *The Herald Journal*, a newspaper of general circulation in the project area, virtually on *HJ News* community calendar event, and on the project website. A public scoping notice was mailed to local residents, shareholders, and representatives from the following Tribes: Eastern Shoshone Tribe of the Wind River Reservation, Shoshone-Bannock Tribes of the Fort Hall Reservation, Ute Indian Tribe of the Uintah and Ouray Reservation, and the Northwest Band of the Shoshone Nation. The public meeting was held virtually on May 11, 2021. The comments and responses are included in Appendix A.

Following the publication of the Notice of Intent (NOI) to the Federal Register on May 7, 2024, a public comment period was initiated (May 7 to June 7, 2024). Eight comments were received during this period. They are summarized in Appendix A of this Plan-EIS.

All comments received, along with a copy of the NOI itself, are included in Appendix A and the project's administrative record (AR).

7.4 Plan Development and Review

This Plan-EIS was developed in close coordination with multiple agencies, and the public underwent the following informal and formal reviews, detailed below:

- Public and Agency Scoping (Plan-EA): April and May 2021
- Notice of Intent (NOI) Public/Agency Review (Transition to EIS): May and June 2024
- State-Level Preliminary Review: June and July 2025
- National Level Technical Review: December 2025 – February 2026
- Programmatic Review: March-April 2026
- Draft Plan-EIS Public/Agency Comment Period: May and June 2026
- Final Plan-EIS Public/Agency Comment Period: **TO BE INSERTED**

7.5 Distribution List

A notice of availability for the Draft Plan-EIS was distributed to the following government agencies/staff and organizations.

7.5.1 Federal Agencies

- Environmental Protection Agency (EPA)
- U.S. Bureau of Reclamation (USBR)
- Federal Emergency Management Agency (FEMA)
- U.S. Fish and Wildlife Service (USFWS)
- U.S. Army Corps of Engineers (USACE)
- U.S. Forest Service (USFS)

- U.S. Bureau of Land Management (BLM)
- U.S. Geological Survey (USGS)

7.5.2 Tribes

- Eastern Shoshone Tribe of the Wind River Reservation, Wyoming
- Northwest Band of the Shoshone Nation, Utah
- Shoshone-Bannock Tribes of the Fort Hall Reservation, Idaho
- Ute Indian Tribe of the Uintah & Ouray Reservation, Utah

7.5.3 State Entities

- State Representatives and Senators
- U.S. Representatives and Senators
- State of Utah – Office of the Governor
- Utah Department of Environmental Quality (UDEQ)
- Utah Department of Transportation (UDOT)
- Utah Department of Natural Resources (UDNR)
- Utah Department of Water Resources (UDWRe)
- Utah Division of Wildlife Resources (UDWR)
- Utah State Historic Preservation Office (SHPO)
- Utah State University (USU)
- Utah Public Lands Policy Coordinating Office (PLPCO)

7.5.4 Local Government

- Cache Water District (CWD)
- Cache County
- Wellsville City
- Mendon City
- Wellsville-Mendon Conservation District (WMCD)

7.5.5 Businesses and Organizations

- Wellsville City Irrigation Company
- Wellsville East Field Irrigation & Canal Company
- Mendon North Irrigation Company
- Mendon Second North Irrigation Company
- Mendon Central Irrigation Company
- Mendon South Irrigation Company
- Greater Mendon Irrigation Company

7.5.6 Private Parties

Private parties include property owners and residents within the study area. The names and addresses of private parties who received notices of the Plan-EIS are not listed in this chapter for privacy reasons.

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9.0 List of Preparers

This Plan-EIS was reviewed by NRCS-Utah resource specialists and the NRCS's National Water Management Center (NWMC) in Little Rock, Arkansas.

Table 9-1: Plan-EIS Preparers

Name	Title (Years of Experience)	Discipline Covered	Education
Employer: Natural Resources Conservation Service – Utah (NRCS-Utah)			
Derek Hamilton	Water Resources Coordinator (25+ yrs)	NEPA/PR&G	B.S. Geography
		ESA Section 7	M.S. Environmental Science
Tara Hoffmann	Water and Cultural Resources Specialist (20 yrs)	Cultural & Historic	B.S. Natural Resources
		NHPA Section 106	M.A. Anthropology
Nicole Steiff	Project Engineer (10 yrs)	Engineering	B.S. Civil Engineering
Stephen Lira	State Economist (10 yrs)	PR&G Planning	B.S. Natural Resources M.S. Ag. Economics
Joshua Breggar	Geologist (3+ yrs)	Geology & Soils	B.S. Geology
			M.S. Geology
Employer: Franson Civil Engineers (FCE)			
Chad Brown, <i>P.E.</i>	Project Manager (20+ yrs)	Project Management	B.S. Civil/Env't. Engineering
		Engineering	M.S. Civil/Env't. Engineer
Lance Houser, <i>P.E.</i>	Senior Technical Manager (32+ yrs)	H&H Analysis	B.S. Ag./Irr. Engineering
		Engineering	M.S. Civil/Env't. Engineer
Landon Richins	Environmental Specialist (3+ yrs.)	Primary Author	B.S. Env't. Science & Mgmt.
		NEPA/PR&G	M.S. Natural Resources
Martilyn Neilson, <i>E.I.T.</i>	Engineer I (4+ yrs)	Engineering	B.S. Civil Engineering
		Economics	
Matt Gurr	Senior Designer (18+ yrs)	Figure Creation	A.S. Drafting Technology
Employer: J-U-B Engineers			

Name	Title (Years of Experience)	Discipline Covered	Education
Zan Murray, <i>P.E.</i>	Executive Vice President (27 yrs)	Project Management	ME Civil Engineering
		Engineering	BS Civil Engineering
Quinn Dance, <i>P.E.</i>	Staff Engineer (13 yrs)	Engineering/H&H	BS Civil Engineering
Rebecca Hendricks Miller	Environmental/Biologist (15 yrs)	Wetlands/ESA Sec. 7	MS Organismal Biology BA Environmental Studies & Biology
Employer: Other			
Hal Gordon	Economist (34+ yrs)	Economics	B.S. Range Science
		PR&G Planning	M.S. Ag. Economics
Sheri Ellis, <i>SOI Qualified</i>	Archaeologist/Historian (33+ yrs)	Cultural Resources	B.S. Psych. & Anthropology
		Viewshed Analysis	M.S. American Studies
Matt Hess	Construction Estimator (26+ yrs)	Cost Estimating	N/A

10.0 Index and Glossary

Acronym	Meaning
ACHP	Advisory Council on Historic Preservation
APE	Area of potential effects
BCC	Birds of Conservation Concern
BMP	Best Management Practice
CAA	Clean Air Act
CFS	Cubic feet per second
CO ₂	Carbon dioxide
CWA	Clean Water Act
CWD	Cache Water District
EIS	Environmental Impact Statement
EJ	Environmental Justice
EO	Executive Order
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
GHG	Greenhouse Gas
H&H	Hydrology & Hydraulics
HDPE	High-density polyethylene pipe
HUC	Hydrologic unit codes
IPaC	Information for Planning and Consultation
NAAQS	National Ambient Air Quality Standards
NEE	National Economic Efficiency
NEPA	National Environmental Policy Act of 1969
NHPA	National Historic Preservation Act of 1966
NPS	National Park Service
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NWI	National Wetlands Inventory

Acronym	Meaning
NWMC	National Water Management Center
NWPM	National Watershed Program Manual
NWSRS	National Wild and Scenic Rivers System
Plan-EIS	Watershed Plan and Environmental Impact Statement
PL 83-566	Watershed Protection and Flood Prevention Act
PR&G	Principles, Requirements, and Guidelines
ROD	Record of Decision
SGCN	Species of Greatest Conservation Need
SLO	Sponsoring Local Organization
SWPPP	Storm Water Pollution Prevention Plan
T&E	Threatened and Endangered
TM	Technical Memorandum
UDAF	Utah Department of Agriculture and Food
UDNR	Utah Department of Natural Resources
UDWR	Utah Division of Wildlife Resources
UDWRe	Utah Division of Water Resources
UDWRi	Utah Division of Water Rights
UGS	Utah Geological Survey
UPDES	Utah Pollutant Discharge Elimination System
USACE	United States Army Corps of Engineers
USBR	United States Bureau of Reclamation
USDA	United States Department of Agriculture
USGS	United States Geological Survey
USFWS	United States. Fish and Wildlife Service
WMCD	Wellsville-Mendon Conservation District

Glossary of Common Terms

Acre-foot The amount of water that will cover one acre at a depth of one foot, Equal to 43,560 cubic feet. Abbreviated as AF

Aesthetic Resources	Any portions of an area that provide visitors with especially scenic views of natural or <u>cultural resources</u> . The scenic worth of a given area. Also called <u>Visual Resources</u> .
Affected Environment	A description of the existing conditions of the environment where the <u>Proposed Action</u> would take place is included in a <u>National Environmental Policy Act</u> (NEPA) Analysis.
Air Quality	The overall condition or quality of the air/atmosphere in a specified region or location.
Alkali	Describes silicate minerals that contain alkali metals such as sodium and potassium.
Alluvium	A collection of deposited <u>sediments</u> (sand, silt, clay, gravel) left by rivers, streams, and other running water sources. Typically found in <u>drainages</u> , <u>channel</u> beds, and <u>deltas</u> . Compare <u>Colluvium</u> .
Alluvial Fan	When a <u>channel</u> flows out at a steep <u>slope</u> and loses its speed, it forms a triangular deposit of <u>alluvium</u> referred to as an <u>alluvial fan</u> .
Anthropogenic	Coming from human activity. Non-natural processes, man-made.
Annual Runoff	The maximum instantaneous peak <u>discharge</u> in a water year
Appropriation Doctrine	Also called the <u>Doctrine of Prior Appropriation</u> . The water rights system used in the Western U.S. which is based on the concept of “ <u>First in time, first in right</u> ”. In order to maintain water rights under the appropriation doctrine, the owner must put the water to beneficial use. See <u>Beneficial Use</u> . See <u>Water Rights</u> . See <u>First in Time, First in Right</u> .
Aquifer	A geologic formation that contains sufficient saturated <u>permeable</u> material to yield water to springs and <u>wells</u> .
Area-depth curve	A graph showing the change in average <u>rainfall</u> depth as the size of the area receiving the <u>rainfall</u> changes

Artesian Well	A <u>well</u> that taps confined <u>groundwater</u> . Water in the <u>well</u> rises above the level of the top of the <u>aquifer</u> under artesian pressure.
Bank	A submerged ridge of sand in a body of water. Usually exposed during low water events.
Base Flow	The sustained or fair-weather <u>discharge</u> that persists after storm runoff and associated quick return flow are depleted. It is usually derived from <u>groundwater</u> discharge or gradual snow or ice melt over extended periods of time but need not be continuous flow. It can be based on annual or seasonal periods depending upon when major <u>floods</u> usually occur. It may also be defined as the stream <u>discharge</u> derived from groundwater sources. It is sometimes considered to include flow from regulated lakes or <u>reservoirs</u> .
Bedrock	A solid layer of rock beneath the soil. Also called a <u>Regolith</u> .
Beneficial Use	Under the <u>Doctrine of Prior Appropriation</u> , Water Rights are maintained through beneficial use by the holder. Beneficial use is the use of the water right that is reasonable and appropriate under reasonably efficient practices to accomplish without waste the purpose for which the appropriation is lawfully made. See <u>Water Rights</u> . See <u>Appropriation Doctrine</u> .
Best Management Practices	Practices employed to reduce, eliminate, or otherwise mitigate environmental impacts as well as to ensure the safety of workers on a project. Abbreviated BMPs.
Biogeochemical Cycles	A series of critical processes in which components of biology, geology, and chemistry heavily overlap. These cycles are critical for the existence of life on Earth. The most important of the cycles revolve around the cycling of the five elements required for life on Earth: Carbon, Hydrogen, Nitrogen, Oxygen, Phosphorus, and Sulfur. Also Called <u>Nutrient Cycles</u> .
Biological Assessment	An evaluation was performed to assess all the <u>biota</u> located in a particular project area. A final report is produced to be included in the Appendices of a <u>National Environmental Policy Act</u> (NEPA) Document. Also called a <u>Biological Evaluation</u> .

Biological Evaluation	See <u>Biological Assessment</u> .
Canal	An artificial waterway constructed to convey water for <u>irrigation</u> or to allow the passage of boats or ships inland.
Channel	The bed of a stream or river. Also, a natural passageway or depression of perceptible extent containing continuously or periodically flowing water or forming a connecting link between two bodies of water.
Channel Flow	Water flow in a defined <u>channel</u> , either natural or manmade
Channelization	The straightening and deepening of a <u>channel</u> to permit water to move faster or to drain faster from an area,
Clean Water Act	Federal legislation enacted in 1972 to restore and maintain the chemical, physical, and biological integrity of the surface waters of the United States. The act states that all waters be fishable and swimmable. Abbreviated CWA.
Colluvium	Groupings of unconsolidated <u>sediments</u> and geologic materials at the base of hillslopes. The material was deposited by processes such as rain-wash or soil creep. Compare <u>Alluvium</u> .
Compaction	A decrease in the <u>pore space</u> of soil. An increase in soil bulk density.
Conservation Storage	Water impounded for <u>consumptive uses</u> , such as municipal, industrial, and <u>irrigation</u> water supply, and non-consumptive uses such as <u>recreation</u> , and fish and wildlife
Conservation Tillage	A <u>tillage</u> practice that leaves residues on the soil surface for <u>erosion</u> control and water conservation. It includes specific residue management practices, such as <u>no-till</u> , <u>mulch-till</u> , or <u>ridge-till</u>
Consumptive Use	A term used mainly by <u>irrigation</u> engineers to describe the amount of water used in crop growth plus <u>evaporation</u> from the soil.

Contact	The surface between two types or ages of rocks. See Also <u>Geologic Units</u> .
Conveyance Loss	Water lost in transit through a pipe or canal to <u>evaporation</u> and <u>seepage</u> .
Correlation	A statistical index that measures linear variation between variables
Council on Environmental Quality	The federal agency which provides guidance to federal agencies on the implementation of NEPA. Abbreviated CEQ.
Cover	The vegetation and organic <u>detritus</u> , such as mulch and residue, that exist on the soil surface. In some classification schemes, <u>fallow</u> or bare soil is considered the minimum cover class.
Cover Crops	Crops that are planted to reduce soil erosion during periods when crops for harvest are not being grown. Cover Crops are one of the most common methods used in <u>No-Till</u> agriculture. See <u>Conservation Tillage</u> .
Cross-Section	The shape of a <u>channel</u> , stream, or valley is determined by a line approximately perpendicular to the main path of water flow, along which measurements of distance and elevations are determined. May also be used as a visual aid to examine different soil horizons. See <u>Soil Horizons</u> . See <u>Soil Profile</u> . See <u>Water Column</u> .
Cubic Feet per Second	A volumetric unit of water flow. Sometimes called second-feet. Abbreviated “cfs”.
Culinary Water System	A location’s <u>infrastructure</u> for providing <u>potable water</u> to the public.
Cultural Resources	Any resource in a particular area that may be deemed significant in terms of current or historical cultures. Resources that comprise historical and archaeological sites and artifacts. See <u>Aesthetic Resources</u> .
Cultural Services	As defined by the <u>Principles, Requirements and Guidelines (PR&G)</u> , cultural services are <u>ecosystem services</u> that make the World a place in

which we want to live in such as recreational, spiritual, aesthetic viewsheds, tribal or other cultural and community values.

Dam An artificial barrier, together with any associated spillways and appurtenant works, across a watercourse or natural drainage area, that does or may impound or divert water

Depth-area Curve A graph showing the change in average rainfall depth as size of area changes.

Detritus Dead and decaying organic matter. See Humus.

Direct Effect An impact that occurs as a result of the proposal or alternative in the same place and at the same time as the action.

Direct Runoff Water that enters the stream channel during a storm. It mainly consists of rainfall on the stream surface, surface runoff, and quick return flow. Abbreviated Q.

Discharge Quantity of water flow at a location in a stream or river, commonly measured and reported in units of cubic feet per second or cfs. Abbreviated q.

Dissolved Oxygen The amount oxygen dissolved in a body of water. Typically expressed as a percentage.

Diversion An alteration in the natural course of a stream or river.

Doctrine of Prior Appropriation See Appropriation Doctrine. See Water Rights.

Downstream Impacts See Indirect Impacts.

Drainage Area The area of a watershed draining into a stream at a given point. The area may be of different sizes for surface runoff, subsurface runoff or flow,

and base flow. Generally, the surface runoff area is used as the drainage area.

Drainage Classification A classification method is used to identify the ability of a soil to drain water. Classification ranges from Very Well Drained to Excessively Drained.

Drawdown The drop in the water table or level of groundwater when water is being pumped from a well; the amount of water used from a tank or reservoir; the drop in the water level of a tank or reservoir.

Earthquake A rupture along a tectonic plate boundary or fault line which causes the Earth to shake. Also called Seismic Activity. See Also Fault. See Also Fault Scarp. See Also Paleoseismology.

Ecology The study of the relationships between organisms and their environment.

Ecosystem A natural environment in which all organisms are connected and fulfill various niches. Includes all biotic and abiotic components of the area.

Ecosystem Services Ecosystem Services is the framework established by the Principles, Requirements, and Guidelines (PR&G) that describes the benefits that people derive from nature and is characterized as the good and services provided by a healthy and functioning environment. Most commonly, the Ecosystem Services Framework is organized into four service categories including: Provisioning Services, Regulating Services, Supporting Services, and Cultural Services.

Endangered Species Any organism classified as an Endangered Species is listed on the federal Endangered Species List managed by the US Fish and Wildlife Service. These species illicit special protection and consideration when executing projects.

Environmental Assessment A document created in compliance with the National Environmental Policy Act in which a series of alternatives for a project area are evaluated to assess and predict the expected environmental impacts a project will have. Abbreviated EA.

Environmental Impact Statement	When significant environmental impacts are identified in the <u>Environmental Assessment</u> , an Environmental Impact Statement must be prepared under the <u>National Environmental Policy Act</u> . This document will assess the environmental impacts of a project in greater detail than an EA and will provide <u>mitigations</u> to these impacts where possible. Abbreviated EIS.
Erosion	The natural process by which material is worn away by a natural process such as wind or water. Compare <u>Weathering</u> .
Eutrophication	The proliferation of large <u>algal blooms</u> in surface waters exposed to heavy nutrient loading (most specifically phosphorus). Occasionally harmful algae will grow under these conditions. Usually caused by excess agricultural <u>runoff</u> .
Evaporation	The process by which surface or subsurface water is converted to atmospheric vapor. Compare <u>Sublimation</u> .
Evapotranspiration	The Water withdrawn from soil by <u>evaporation</u> and plant <u>transpiration</u> . See <u>Consumptive Use</u> . Abbreviated “ET”. Compare <u>Transpiration</u> . Compare <u>Evaporation</u> .
Excess Rainfall	The part of <u>rainfall</u> during a given <u>storm</u> that exceeds the <u>infiltration</u> capacity and is available for direct <u>runoff</u> .
Excessive Precipitation	Standard term for <u>rainfall</u> in which the rate of fall is greater than certain accepted limits, chosen with regard to the normal <u>precipitation</u> of a given place or area. Not the same as excess rainfall.
Exotic Species	See <u>Invasive Species</u> .
Fallow	Cropland remained unseeded for a period of time. This may be a normal part of the cropping system for weed control, water conservation, soil conditioning, etc. Also called <u>Idle Cropland</u> .
Fault	A geologic feature in which ruptures occur, causing seismic activity. Cracks along the Earth’s surface along which mountains can be uplifted, valleys and rift zones can form, and earthquakes can occur.

Fault Scarp	A small, yet clearly visible, offset on the ground surface where normal <u>faulting</u> has visibly occurred. See <u>Normal Fault</u> .
Fault Trace	An intersection of a <u>fault</u> with the Earth's surface to create a visible disturbance. See <u>Fault</u> . See <u>Fault Scarp</u> .
Federal Objective	As established by the Water Resources Development Act of 2007, the Federal Objective states that all <u>water resource</u> investments proposed in an <u>EIS</u> should "reflect national priorities, encourage economic development, and protect the environment".
First in Time, First in Right	Phrase indicating that older <u>water rights</u> have priority over more recent rights if there is not enough water to satisfy all rights. See Also <u>Water Rights</u> . See Also <u>Appropriation Doctrine</u> . See <u>Beneficial Use</u> .
Flood	A relatively high flow as determined by either gage height or <u>discharge</u> quantity/ An event during which a stream overflows its normal banks.
Flood Frequency	How often, on average, a <u>discharge</u> of a given magnitude occurs at a particular location on a <u>stream</u> . Usually expressed as the <u>probability</u> that the <u>discharge</u> will exceed some size in a single year.
Floodplain	The strip of relatively smooth land adjacent to a stream <u>channel</u> constructed by the present water course and covered by water when the stream flows over its banks
Fluvial	Pertaining to a river or stream.
Flux	A movement of mass or energy between compartments of a material or energy cycle.
Frequency	The number of occasions that the same numerical measure of a particular quantity has occurred between definite time periods. Often stated in terms such as return interval, <u>recurrence interval</u> , or percent chance.
Future Without Federal Investment	The Future without Federal Investment, or FWOFI, is an alternative required to be developed under the <u>Principles, Requirements, and</u>

Guidelines for watershed planning (PR&G). It describes an alternative where no federal investment is made. Can also serve as the NEPA No-Action Alternative. See No-Action Alternative.

Geologic Units A geologic unit is an individual rock type underlying a particular area. They are usually abbreviated on geologic maps with short 2–3-character abbreviations that describe the geologic time period in which the unit was formed and what sort of material makes up the unit.

Geomorphology The study of the shape and evolution of the Earth’s physical surface. The shape of the landscape. See Topography.

Gradient A degree of inclination, or a rate of ascent or descent, of an inclined part of Earth’s surface with respect to the horizontal. See Also Slope.

Greenhouse Gases Greenhouse Gases are gases in the atmosphere that trap heat. The Environmental Protection Agency (EPA) publishes emissions regulations for various Greenhouse Gases including Carbon Dioxide, Methane, Nitrous Oxide, and Fluorinated Gases such as Hydrocarbons, Perfluorocarbons, and Sulfur Hexafluoride. Also called Fossil Fuels. Abbreviated GHG.

Groundwater The water in the saturated zone beneath the water table. See Also Hydrogeology.

Groundwater Law See Appropriation Doctrine. See Water Rights. See Beneficial Use. See First in Time, First in Right.

Habitat The environment in which an organism lives naturally.

Head The measure of pressure at the base or other reference point of a column of fluid. Normally measured in feet of water.

Humus Amorphous, partially decomposed organic matter. See also Detritus.

Hydrogeology The science that deals with subsurface waters and related geologic aspects of surface waters, including the movement of groundwater; the mechanical, chemical, and thermal interaction of groundwater with the

porous medium; and the transport of energy and chemical constituents by the flow of groundwater.

Hydrograph A graph showing the discharge, stage, velocity, or any other property of water with respect to time for a given point on a stream or for a given point in any drainage system.

Hydrologic Soil Group A group of soils having similar physical and runoff characteristics.

Hydrologic Unit Watershed boundaries are organized in a nested hierarchy by size. Abbreviated “HU”.

Hydrology Science that deals with the occurrence and distribution of naturally occurring water on, around, and under the Earth’s surface.

Idle Cropland See Fallow.

Indirect Impact Reasonably foreseeable impacts that occur removed in time or space from the Proposed Action. Also called downstream impacts.

Infiltration The part of rainfall that enters the soil; the process by which part of the rainfall enters the soil.

Infiltration Rate The rate at which water enters the soil after prolonged wetting of the soil profile.

Infrastructure Constructed improvements to a project area that allow for a more comfortable quality of life. Could include pipes, canals, dams, roads, trails, etc.

Irrigation The use of water in controlled quantities to grow agricultural crops. Used to satisfy any water requirements of crops not provided by natural rainfall.

Irrigation Pool Reservoir storage is used to store water for release as needed in irrigation.

- Invasive Species** Any organism that has been introduced into an area where it does not naturally occur. Also called Exotic Species.
- Kilowatt Hour** A power demand of 1,000 watts for one hour. These are the units in which power company rates are typically expressed.
- K Factor** The Soil Erodibility Factor used in the Universal Soil Loss Equation. See Also Soil Erodibility. See Also Universal Soil Loss Equation.
- Lacustrine Deposits** Having to do with a lake. Often used when referring to ancient lake sediment deposits.
- Lag** On a hydrograph, the time from the centroid of rainfall to the peak of the hydrograph. Abbreviated “L”.
- Land Cover** A broad land classification such as agricultural or forest, etc.
- Land Use** A land classification, such as row crops or pasture, that indicates a type of land use. Roads may also be classified as a separate land use.
- Lead Agency** The federal agency in charge of the creation of an Environmental Assessment or Environmental Impact Statement under the National Environmental Policy Act (NEPA).
- Loam** A soil mixture of sand, silt, and clay.
- Loss** The portion of precipitation lost as runoff from the surface of the land due to evaporation and/or deep percolation.
- Marsh** A water-saturated, poorly drained area, intermittently or permanently water covered.
- Mean** The average of a series of numbers. It can be arithmetic or geometric, depending on the equation used to compute the mean.

Median	The value in an array of numbers that has as many lower values as it has higher values.
National Economic Efficiency Alternative	Under the Principles, Requirements, and Guidelines (PR&G) all water resource projects must develop a national economic efficiency alternative which showcases the most economically beneficial alternative to complete a project. Abbreviated NEE.
National Environmental Policy Act	The federal legislation governing the <u>analysis</u> of environmental impacts in federally funded projects. The legislation is executed by the Lead Agency. It requires the development of an <u>Environmental Assessment</u> , <u>Environmental Impact Statement</u> , or <u>Categorical Exclusion</u> document for any federal project. Abbreviated NEPA.
No-Action Alternative	Under the requirements of the <u>National Environmental Policy Act</u> (NEPA), an Environmental Assessment or Environmental Impact Statement must evaluate a <u>No-Action Alternative</u> which discusses what would happen to the project area if no action were taken. See <u>Future Without Federal Investment</u> .
Nonstructural Alternative	The Nonstructural Alternative must be included per the <u>Principles, Requirements, and Guidelines (PR&G)</u> . This alternative describes how existing <u>infrastructure</u> could be modified to potentially fulfill a project's need without constructing additional <u>infrastructure</u> .
Normal Fault	Inclined fractures of the crust where <u>faulting</u> has moved one block upwards and another block downwards. Normal faults are characterized by vertical movement. See <u>Horst</u> . See <u>Graben</u> . See <u>Fault</u> . See <u>Fault Scarp</u> .
Notice of Intent	The <u>National Environmental Policy Act</u> (NEPA) requires that a Notice of Intent to prepare an <u>Environmental Impact Statement</u> be written and submitted by the federal agency. The Notice of Intent describes the project's <u>purpose and need</u> , environmental impacts, and sets up the administrative framework out of which the document will be prepared. Abbreviated NOI.
No-Till	Managing the amount, orientation, and distribution of crops and other plant residue on the soil surface year-round, while limiting the soil-disturbing activities.

Noxious Weeds	Plants designated by a federal, state, or county government as injurious to public health, agriculture, <u>recreation</u> , wildlife, or property.
Nutrients	Naturally occurring elements and compounds which provide sustenance needed for organism growth and development.
Nutrient Cycling	See <u>Biogeochemical Cycles</u> .
Nutrient Loading	See also <u>Eutrophication</u> . A process by which sediments and minerals are loaded into a water body at high levels, causing water quality concerns and disruptions to aquatic ecosystems.
Organic	Containing Carbon. <u>Biotic</u> Material. Compare <u>Abiotic</u> .
Operation & Maintenance	The various different tasks and expenses required to upkeep and maintain function of <u>infrastructure</u> . Abbreviated O&M.
Paleoseismology	The study of ancient/historical <u>earthquakes</u> along a <u>fault</u> line by examining displacements along <u>fault scarps</u> . Paleoseismic studies are used in calculating average <u>recurrence intervals</u> for earthquakes. See Also <u>Colluvial Wedge Model</u> .
Palustrine Wetlands	Freshwater <u>wetlands</u> that include open water bodies of less than 20 acres in which water is less than 2 meters deep.
Peak Discharge	The maximum <u>discharge</u> attained during a <u>flood</u> .
Percent Chance	A statistical description of the <u>probability</u> that an event of a given size will be equaled or exceeded during any given year. This name is often given to the <u>probability</u> scale on log-normal paper. Percent chance is the inverse of <u>recurrence interval</u> .
Permeability	The ability of a material to allow the passage of a liquid, such as water through rocks.
pH	The concentration of Hydroxyl in a substance. The higher the Hydroxyl concentration, the lower the pH and the lower the Hydroxyl concentration, the higher the pH. pH is measured on a scale from 1 – 14

with lower values indicating more acidity and higher values indicating greater alkalinity.

Photosynthesis A common method of primary production in which plants are able to acquire energy through sunlight. See Also Autotroph.

PL 83-566 Public Law 83-566. Also known as the Watershed Protection and Flood Prevention Act of 1954.

Porosity A measure of the water-bearing capacity of subsurface rock.

Potable Water Water that is clean enough to drink safely. See Also Culinary Water.

PR&G The Principles, Requirements, and Guidelines for Water and Land Related Resource Implementation Studies and Federal Water Resource Investments. The reference document from the US Department of Agriculture most commonly used in applying PR&G to a project is the DM 9500-013.

PR&G Guiding Principles A set of six overarching principles that all water resource projects should aim to achieve and must comply with in order to properly apply the PR&G, they include Healthy and Resilient Ecosystems, Sustainable Economic Development, Floodplains, Public Safety, , and Watershed-Scale Approach.

Precipitation The total measurable supply of water of all forms of falling moisture, including dew, rain, mist, snow, hail, and sleet; usually expressed as a depth of liquid water on a horizontal surface in a day, month, or year, and designated as daily, monthly, or annual precipitation.

Pressure Force per unit area. Typically expressed in pounds per square inch (psi), bars, or atmospheres.

Prime & Unique Farmland Farmland is rated as prime, unique, statewide, and local importance based on national, state, and local criteria that consider the physical and chemical characteristics to support crop production and produce crop yields when properly managed. Prime farmland produces the highest yields based on climate conditions.

Prior Appropriation	See <u>Appropriation Doctrine</u> . See <u>Water Rights</u> .
Probability	The likelihood that certain event will occur
Proposed Action (Preferred Alternative)	Under the <u>National Environmental Policy Act</u> (NEPA) process, the environmental document produced will evaluate a Proposed Action for a project detailing what will be done to the project area to accomplish the project successfully.
Provisioning Services	As defined by the <u>Principles, Requirements and Guidelines (PR&G)</u> , Provisioning Services are <u>Ecosystem Services</u> that provide tangible goods for direct human use or consumption.
Pump	A device that converts mechanical energy into hydraulic energy.
Purpose and Need	Under the <u>National Environmental Policy Act</u> (NEPA), an <u>environmental assessment</u> or <u>environmental impact statement</u> should clearly describe the project's purpose for being evaluated and list the various needs that illicit the <u>Proposed Action</u> .
Quaternary Period	A geologic time period starting 2.58 million years ago to the present.
Rainfall	A fall of rain; <u>precipitation</u> in the form of liquid water. The amount of rain, usually expressed in inches depth of water on an area, that reaches the surface of the Earth.
Rain-on-Snow Event	A flooding event that occurs after rainwater falls atop snow deposits causing the additional snow to <u>runoff</u> and <u>flood</u> .
Recession Curve	The part of the descending limb on a <u>hydrograph</u> that extends from the point of inflection to the time when direct <u>runoff</u> has ceased.
Recharge	The process of addition of water to the <u>saturated zone</u> . See Also <u>Infiltration</u> .

Record of Decision Following the preparation of an environmental impact statement, the lead federal agency must issue a Record of Decision on whether or not the proposed project may proceed. Abbreviated ROD.

Recreation Any activity performed by a human being for the sole purpose of obtaining enjoyment, excitement, or relaxation. Common recreational activities include fishing, hunting, hiking, boating, running, walking, wildlife watching, auto touring, and swimming.

Recurrence Interval The average number of years within which a given event will be equaled or exceeded. A 50-year frequency flood has an average recurrence interval of 50 years, and so on. It is the inverse of a percent chance. Often used when referring to flooding or seismic activity. Also called the return interval.

Regolith See Bedrock.

Regulating Services As defined by the Principles, Requirements and Guidelines (PR&G), Regulating Services are Ecosystem Services that maintain a World in which it is possible for people to live and provide critical benefits that buffer against environmental catastrophe or disaster either locally, regionally, or on a larger scale.

Remediation See Mitigation.

Reservoir A pond, lake, tank, basin, or other space, either natural or man-made. A reservoir stores, regulates, and controls water.

Return Interval See Recurrence Interval.

Rill A very small brook or trickling stream of water usually without any tributaries. Also, the channel formed by such a stream.

Rill Erosion Small gullies that occur on the land slope in a random pattern.

Riparian Areas	Ecological zones typically lie within or along a river or stream. These areas typically include all plants and animals along streams and riverbanks.
Saturated Hydraulic Conductivity	The rate of flow of water through a unit cross section of a <u>porous</u> mass under a unit hydraulic gradient at a temperature of 60 F. Abbreviated Ksat.
Scope	The range of actions, alternatives, and impacts to be considered in an <u>environmental impact statement</u> or <u>environmental assessment</u> under the <u>National Environmental Policy Act</u> (NEPA).
Scoping Process	Generally conducted at the beginning of the project planning process, the scoping process seeks to identify issues, concerns, and potential impacts that require detailed analysis, and which can be eliminated from detailed study.
Secondary Water System	Unfiltered and untreated water that is primarily used for agricultural <u>irrigation</u> .
Sediments	Small grains of geologic material of varying size classes. Includes gravel, sands, silts, and clays. See <u>Alluvium</u> . See <u>Colluvium</u> . See <u>Loess</u> .
Sedimentation	A process by which mass eroded from elsewhere settles to the bottom of rivers, lakes, or oceans.
Seepage	The loss or leakage of water by <u>infiltration</u> into the soil from a river, <u>canal</u> , <u>reservoir</u> , or other waterway.
Seismic Activity	See <u>Earthquake</u> . See <u>Paleoseismology</u> .
Sheet Erosion	<u>Erosion</u> on a <u>slope</u> before a rill or small gully is formed.
Sheet Flow	Flow over plane surfaces. Sheet flow usually occurs in the headwaters of a stream. NRCS limits maximum sheet flow length to 100 feet. Maximum depths are normally in the magnitude of 0.1 foot.

Slip Rate	The approximate rate at which a <u>fault</u> moves each year. Is used to calculate average <u>recurrence intervals</u> for <u>earthquakes</u> .
Slope	The angle of inclination of land, measured in degrees.
Soil	The unconsolidated portion of the Earth's crust modified through physical, chemical, and <u>biotic</u> processes into a medium capable of supporting plant growth. See Also <u>Soil Horizons</u> . See Also <u>Soil Profile</u> . See Also <u>Regolith</u> . See Also <u>Erosion</u> . See Also <u>Web Soil Survey</u> . See Also <u>Tilth</u> . See Also <u>Humus</u> .
Soil Erodibility	An indicator of a soil's susceptibility to raindrop impact, runoff, and other eroding processes. See Also <u>K Factor</u> . See Also <u>Universal Soil Loss Equation</u> .
Soil Horizons	The various layers of soil. Typical horizon order is O, A, E, B, C, and R.
Soil Profile	A <u>cross-section</u> of a segment of soil which allows the different <u>soil horizons</u> to be seen.
Special-Status Species	Any organism that is listed or proposed for listing on state or federal <u>endangered/threatened species</u> lists. Also called <u>Species of Greatest Conservation Need</u> .
Species of Greatest Conservation Need	See <u>Special-Status Species</u> . Abbreviated SGCN. Are species identified by states in their wildlife action plans as being in need of additional conservation or protection. All SGCN are special status species, but not all special status species are SGCN.
Storm	A <u>rainfall</u> event.
Stream	Water flowing in a watercourse or <u>channel</u> .
Structural Measure	For <u>flood</u> prevention work, any form of earthwork dam, ditch <u>levee</u> , drop <u>spillway</u> , jetties, riprap, etc., or installation of concrete, masonry, metal, or other material.
Subsurface	Underground.

Subsurface Runoff Water that infiltrates the soil and reappears as seepage or spring flow and forms part of the flood hydrograph for that storm. Difficult to determine in practice and seldom worked with separately.

Supporting Services As defined by the Principles, Requirements and Guidelines (PR&G), Supporting Services are Ecosystem Services that support the underlying processes for maintaining conditions for life on Earth such as nutrient cycling, soil formation, and primary production (photosynthesis).

Surface The uppermost level of the land.

Surface Runoff Total rainfall, minus interception, evaporation, infiltration, and surface storage, that moves across the ground surface to a stream or depression.

Threatened Species See Endangered Species.

Tillage Cultivation of the Land.

Tilth The physical structure and health of the soil.

Topography The general configuration of the land' surface. See Geomorphology.

Tributary A stream that contributes its water to another stream or water body.

Universal Soil Loss Equation An equation used to quantify the tons of soil lost each year to erosion in a particular tract of land. The equation takes numerous factors into account such as cover management, tillage practices, slope steepness and length, and constants such as the soil erodibility factor or the rainfall erosivity factor. Abbreviated USLE.

USDA CropScape An online application from the United States Department of Agriculture that allows for the download of agricultural cropping data by defining a project boundary.

Visual Resources See Aesthetic Resources.

Water Loss	The part of the <u>storm rainfall</u> that does not appear as <u>runoff</u> for the duration of the <u>flood</u> .
Water Quality	The overall condition of an area's <u>water resources</u> . Considers a variety of factors including <u>dissolved oxygen</u> , <u>pH</u> , <u>turbidity</u> , and <u>electrical conductivity</u> .
Water Rights	The right that an individual entity holds to make use of a water source. In the Western United States, water rights are determined based on the <u>Doctrine of Prior Appropriation</u> . See <u>Appropriation Doctrine</u> .
Watershed	The surface area contributing direct <u>runoff</u> to a stream at a given point.
Watershed Approach	An approach to <u>water resources</u> projects that recognizes that there may be impacts both upstream and downstream of the project area and the applicable political or administrative boundaries. This approach is required under the <u>Principles, Requirements, and Guidelines (PR&G)</u> .
Water Resources	The broad category that defines any water (surface or <u>groundwater</u>) in a given area that may be utilized for any particular purpose.
Water Supply	The amount of water in a stream or <u>reservoir</u> , or <u>groundwater</u> , available to supply necessary demands.
Water Table	The upper surface of <u>groundwater</u> .
Water Year	The year taken as beginning October 1. Often used for convenience in streamflow work, since in many areas, streamflow is at its lowest at that time.
WebSoil Survey	An online application developed by the US Department of Agriculture Natural Resources Conservation Service which allows for the download of detailed soils data after defining an Area of Interest.
Well	A bored, drilled, or driven shaft or a dug hole whose depth is greater than the largest surface dimension and whose purpose is to reach underground

water supplies or oil or to store or bury fluids below ground. See Also Pump. See Also Groundwater. See Also Drawdown. See Also Piezometer. See Also Saturated Zone.

Wetland Any area where water covers the surface of the soil or is near the surface of the soil for the majority of the year. Wetlands are often classified into smaller, more specific, subgroups.

Sources: National Engineering Handbook Part 630 Hydrology, United States Geological Survey Water Science Glossary, United States Forest Service NEPA Glossary, Bureau of Land Management A Citizen's Guide to NEPA, National Park Service Glossary of Terms, Bureau of Land Management Glossary of Ecological Terms, HWH Corp Glossary of Hydraulic Terms, Soil Science Society of America Glossary of Soil Science Terms, DM 9500-013 Guidance for Conducting Analyses under the Principles, Requirements, and Guidelines for Water and Land Related Resources Implementation Studies and Federal Water Resource Investments, Open Library Glossary of Environmental Science, National Park Service Glossary of Geologic Terms, The Edwards Aquifer Glossary of Water Resource Terms.

11.0 Appendices

Appendix A. Comments and Responses

Appendix B. Project Map

Appendix C. Support Maps

Appendix D. Investigation and Analysis Report

Appendix E. Other Supporting Information