APPENDIX E:

OTHER SUPPORTING INFORMATION

- **EIS Request Letter**
- **Technical Memorandum 001 (TM001) – Water Rights**
- **Technical Memorandum 002 (TM002) – Hydrology**
- **Technical Memorandum 003 (TM003) – Existing Flood Inundation**
- **Technical Memorandum 004 (TM004) – Design Criteria**
- **Technical Memorandum 005 (TM005) – Canal Transmission Losses**
- **Technical Memorandum 006 (TM006) – Culinary Water Savings**
- **Technical Memorandum 007 (TM007) – Operation & Maintenance Costs**
- **Technical Memorandum 008 (TM008) – Capital Cost Evaluation**
- **Technical Memorandum 009 (TM009) – Crop Yields**
- **Technical Memorandum 010 (TM010) – Alternatives**
- **Economic Investigations & Analysis Report (June 2025) & Spreadsheet**
- **PR&G Alternative Formulation & Screening Matrix**
- **PR&G Ecosystem Services Framework Worksheet**
- **Aquatic Resources Delineation (ARD) Report – J-U-B Engineers**
- **Biological Assessment – J-U-B Engineers**
- **USFWS IPaC Official Species List (OSL)**
- **USFWS IPaC Full Resource List**
- **USFWS Email Correspondence – ULT Survey Requirements**
- **Utah Natural Heritage Program Online Species Search Report**
- **Redacted Cultural Resources Inventory Report (Certus Environmental Solutions, LLC)**
- **NRCS Web Soil Survey Custom Soil Resource Report**
- **NRCS WebSoil Survey Data Spreadsheet PDF**

Watershed Plan-EIS Request Letter

[Date]

Via email

Derek Hamilton
Utah Water Resources Coordinator
USDA-NRCS
125 South State Street, Room 4010
Salt Lake City, UT 84138-1100

Re: Wellsville-Mendon Watershed Plan-EA – EIS Request

Dear Derek Hamilton:

The purpose of this letter is to present the case of transitioning the Wellsville-Mendon Watershed Plan Environmental Assessment (EA) (NR218D43XXXXC005) to an Environmental Impact Statement (EIS). Throughout the process of scoping and working with the project sponsors, many projects have been identified that would require us to do a supplemental EA to address all the needs. Several of these projects are interconnected, which may require temporary fixes that will be altered later if future projects are funded by the supplemental EA. Additionally, the projects that have been identified in the Wellsville-Mendon Watershed Plan EA have already seen an increase in material costs since the EA process started.

If we continue with this EA process, we will be much more limited in the projects that can be evaluated and moved forward due to rising material and labor costs pushing the total project costs well above the $25-million Federal cap. Transitioning this project from an EA to an EIS will provide better continuity between the proposed projects, and more can be done within the watershed area that will benefit the project sponsors, the community, and future generations. This letter will discuss the purpose behind the request and present evidence in support of the transition.

History

Initially, this project started with a WaterSMART application to provide funds to install a pressurized irrigation (PI) system for Wellsville, Utah. The WaterSMART application was awarded but Wellsville City Irrigation Company decided to explore other funding options that would provide more grant funds and provide greater benefits to the community beyond just secondary irrigation.

The PL-566 program was identified as a better funding option that provides more grant money as well as a much higher limit to the funding, and Wellsville City Irrigation Company made the decision to pursue this funding option. With a higher cap on the funding limit, additional projects were possible to be funded under the PL-566 program that addresses a broader spectrum of issues.

Alternatives Identified in Scoping

During the scoping process of the Wellsville-Mendon Watershed Plan EA, many more projects were identified that could be funded by the PL-566 program. These projects include:

- Wellsville City PI
- Town of Mendon PI
- Piping the Upper and Lower Canals
- Three-Mile Canyon Flood Improvements
- Flood Management Projects within Wellsville, Mendon, and Cache County
- Improvements to the Lower Canal to Aid in Flood Management

With further development of the proposed projects, many of the identified projects were determined to be interconnected. The Wellsville City Irrigation Company, and several other irrigation companies within Mendon receive water from the Lower and Upper canals, owned and operated by the Wellsville-Mendon Conservation District (WMCD). Throughout the process of developing the priority projects for the initial EA, the WMCD canal repeatedly came up as an important feature for all project sponsors. Not only is it a vital source of water for Wellsville, Mendon, and Cache County, but it also inadvertently provides flood management for the watershed area. This project was not considered an option in the initial submittal.

While the WaterSMART application was being completed, a title transfer was started that would give ownership of the Upper and Lower Canals to the WMCD, which had previously been owned by the U.S. Bureau of Reclamation. This process was completed after the EA process was started. With the canal property now owned by WMCD, they have the ability to pipe the canal and leave the existing open canal in place as a flood management facility.

Due to the anticipated cost to pipe the canal and update the existing channel to better handle the flood waters, this project was planned for the supplemental EA. As the other projects have been developed, however, several reasons to make this a higher priority have been identified. One of the flood management projects involves a spill from the canal that will provide a safe location to empty the canal during a severe flood event. If the canal is piped and the existing system is converted to a flood collection system, it will simplify the design of the spill location, reducing the overall cost. This would also simplify other flood control projects that have been identified by allowing flood water to be discharged into the canal.

Additionally, piping the lower canal will simplify the operations of the Wellsville PI and the Mendon PI systems. Under the current conditions, water from the canal will need to be diverted into wet wells at a fixed flow rate due to the lag times required to change the overall flow in the canal. This is due to the distance from the Hyrum Reservoir, several miles to the south. The PI systems will be designed for on-demand operation that allows users to irrigate at any time throughout the day. This type of on-demand operation causes fluctuations in the total water usage throughout the day making it difficult to pinpoint the needed supply from the WMCD Lower Canal. Piping the canal will also add the benefit of agricultural water management by conserving water that is currently lost through seepage. The conserved water will be stored in Hyrum Reservoir for on-demand use.

Material Costs/Labor Costs/Inflation

The total cost to construct the identified projects exceeded the $25 million cap of the EA. Therefore, the projects being considered as part of the preferred alternative in the initial EA included the Wellsville PI, Mendon PI, the canal spill at 2900 South between Wellsville and Mendon, Three-Mile Canyon Flood Improvements, and a few of the other flood management projects within the watershed. It was determined that a supplemental EA would be necessary to fund the additional projects identified during scoping. The projects that were planned for the supplemental EA included piping the Upper and Lower Canals and additional flood management projects that were identified as lower priority by the sponsors in the initial EA.

In addition to the total project exceeding the amount of funds available for the initial EA, material and labor costs have significantly increased since the start of the EA process. As mentioned previously, this project started with a WaterSMART application for the Wellsville PI system that was submitted in 2019. At the time the WaterSMART application was submitted, we had estimated that construction would cost approximately $5,116,000 for the PI system. This estimate involved pumping out of the existing Wellsville Reservoir with one main pump station for the whole system and two booster pumps.

The most recent cost estimate from October of 2021 projected that the cost will be $14,767,000. This estimate included two booster pumps and two pump stations that conveyed water to two storage ponds that gravity fed the system. The addition of the ponds to the project added approximately $1,148,000 to the total cost. Excluding the cost of the ponds from the 2021 estimate, the cost for the project has more than doubled over the past three years.

- Original Cost Estimate: $5,116,000
- Current Cost Estimate: $14,767,000

These price increases have affected all aspects of the project. When the cost estimates were prepared in October 2021, the projects that would be evaluated as part of the EA were identified at an amount below the $25-million cap. If material and labor costs continue to go up, this could cause the total cost of projects identified in the EA to exceed the $25-million cap for the EA.

Conclusion

A transition from an EA to an EIS will allow for better design and interconnection of projects within the Wellsville-Mendon watershed. It will allow for all projects that provide a higher benefit/cost ratio to be constructed providing value to the local community and score higher on the N.E.D. process.

Please feel free to call if you have any questions.

Sincerely,

Nathan Daugs

cc: Chad Brown

Tyler Withers

TM001 – Water Rights

Technical Memorandum 001 – Water Rights

Table of Contents

1.0 Water Rights..... 1

1.0 Water Rights

There are various entities within the project area that hold water rights. These entities are as follows: Mendon Central Irrigation Company, Mendon City, Mendon North Irrigation Company, Mendon South Irrigation Company, US Bureau of Reclamation (USBR)/Wellsville-Mendon Conservation District, Wellsville City, Wellsville City Corporation, Wellsville City Irrigation Company, Wellsville East Field Irrigation Company, and Wellsville North Field Irrigation Company. The tables below summarize water rights held by the entities listed above.

Many of the rights are of a supplementary nature, meaning the combined total of the primary and supplementary water rights cannot be more than the water right duty assigned to the basin.

These water rights pull from Points of Diversions (PODs) of both surface water and groundwater. The two figures show the water rights held by each of the various owners and their PODs. The figures show the project boundary in relation to the water rights information as well as Public Land Survey System (PLSS) townships within the area.

Table 1: Water Rights Owned by USBR on behalf of the Wellsville-Mendon Conservation District

Water Right #	Quantity	Source
25-1945	85 cfs AND 17,800 ac-ft of storage	Little Bear River
25-1944	1 cfs	South Fork Little Bear River
25-1943	1 cfs	Little Bear River
25-1942	2.4 cfs	Little Bear River
25-1994	2.4 cfs	Little Bear River
25-1995	1 cfs	Little Bear River
25-1996	1 cfs	Little Bear River

Table 2: Water Rights Owned by Mendon North Irrigation Company Inc.

Water Right #	Quantity	Source
25-1749	2 cfs	Graveyard Creek
25-1750	2 cfs	Graveyard Creek
25-1751	2 cfs	Deep Canyon Creek
25-1752	2 cfs	Deep Canyon Creek
25-1753	2 cfs	Deep Canyon Creek
25-1754	2 cfs	Deep Canyon Creek
25-1755	2 cfs	Deep Canyon (Rocky Point) Creek
25-1756	2 cfs	Graveyard Creek (Pond Stream)

Water Right #	Quantity	Source
25-1757	2 cfs	Deep Canyon (Rocky Point) Creek

Table 3: Water Rights Owned by Mendon City

Water Right #	Quantity	Source
25-7316	52.16 ac-ft	2 wells
25-7710	1.5 cfs	1 well
25-1795	0.5 cfs	Melvin Muir Spring Stream
25-1794	0.33 cfs	P.A. Sorensen Spring Stream
25-1760	1 cfs	Deep Canyon Creek
25-1759	1 cfs	Deep Canyon Creek
25-5407	1 cfs	Deep Canyon Stream

Table 4: Water Rights Owned by Mendon Central Irrigation Company

Water Right #	Quantity[1]	Source
25-1306	3 cfs	Mendon Creek
25-1305	5 cfs	Mendon Creek
25-1304	3 cfs	Mendon Creek
25-1303	5 cfs	Mendon Creek
25-1302	3 cfs	Mendon Creek
25-1301	5 cfs	Mendon Creek
25-1743	3 cfs	Gitten Spring Stream
25-1742	5 cfs	Gitten Spring Stream
25-1741	3 cfs	Maple Bench Spring Stream
25-1740	5 cfs	Maple Bench Spring Stream
25-1737	3 cfs	Gitten Spring Stream
25-1736	5 cfs	Gitten Spring Stream

1 – UDWRi website, which is not 100% accurate was used for these values. The values shown appear to be the quantity for each water right.

Table 5: Water Rights Owned by Mendon South Canal Company

Water Right #	Quantity	Source
25-1747	7 cfs	Gardner Creek

Table 6: Wellsville East Field Irrigation Company Inc.

Water Right #	Quantity	Source
25-1733	30 cfs OR 8532.42 ac-ft	Little Bear River
25-9968	2 cfs	Little Bear River
25-9969	165 ac-ft	Little Bear River
25-1734	15 cfs	Little Bear River
25-1735	10 cfs	Little Bear River

Table 7: Water Rights Owned by Wellsville City Irrigation Company

Water Right #	Quantity	Source
25-1315	Appears to be 8.673 cfs OR 1402.13 ac-ft	West Spring Stream, Murray Dam Diversion
25-1316	Appears to be 8.673 cfs OR 1402.13 ac-ft	West Spring Stream, Murray Dam Diversion
25-1317	Appears to be 8.673 cfs OR 1402.13 ac-ft	West Spring Stream, Murray Dam Diversion
25-1318	12.283 cfs	East Spring Stream

Table 8: Water Rights Owned by Wellsville City

Water Right #	Quantity	Source
25-1973	3 cfs	Wellsville Canyon Creek
25-1974	3 cfs	Wellsville Canyon Creek
25-1976	3 cfs	Wellsville Canyon Creek
25-1977	3 cfs	Wellsville Canyon Creek
25-1978	3 cfs	Wellsville Canyon Creek
25-2114	3 cfs	Wellsville Canyon Creek
25-288	2 cfs OR 23.82 ac-ft	Parkinson Spring Stream
25-289	Appears to be 0.56 ac-ft	Little Bear River
25-401	2 cfs	Little Bear River
25-402	0.5 cfs	Dugway Spring Stream
25-403	1.5 cfs	Wellsville Canyon Creek
25-576	1.4 cfs	Middle Branch Wellsville Canyon Creek
25-7428	2.23 cfs	a well

Water Right #	Quantity	Source
25-10593	0.6 cfs OR 6.644 ac-ft	Little Bear River (an approved but unperfected change moved the right into 2 existing wells)
25-10594	0.6 cfs OR 6.644 ac-ft	Little Bear River (an approved but unperfected change moved the right into 2 existing wells)
25-10595	0.6 cfs OR 6.644 ac-ft	Little Bear River (an approved but unperfected change moved the right into 2 existing wells)
25-10596	0.6 cfs OR 6.644 ac-ft	Little Bear River (an approved but unperfected change moved the right into 2 existing wells)
25-11396	0.91 cfs OR 45.5 ac-ft	Little Bear River
25-1146	0.6 CFS OR 5.644 AC-FT	Little Bear River (an approved but unperfected change moved the right into 2 existing wells)
25-1656	1 cfs	Brigham Spring
25-1657	3 cfs	Wellsville Canyon Creek
25-1658	1.4 cfs	Middle Branch Spring Area
25-1659	0.66 cfs	Upper South Branch Spring
25-1887	3 cfs	Middle Branch Spring Area
25-1898	3 cfs	Wellsville Canyon Creek
25-1972	3 cfs	Middle Branch Spring Area

Table 9: Water Rights Owned by Wellsville North Field Irrigation Company

Water Right #	Quantity	Source
25-1373	2.66 cfs or 523.23 ac-ft	Parkinson Spring Stream
25-1372	3 cfs or 263.38 ac-ft	Darley Spring Stream
25-1371	7.3 cfs	Hansen Spring and Darley Spring

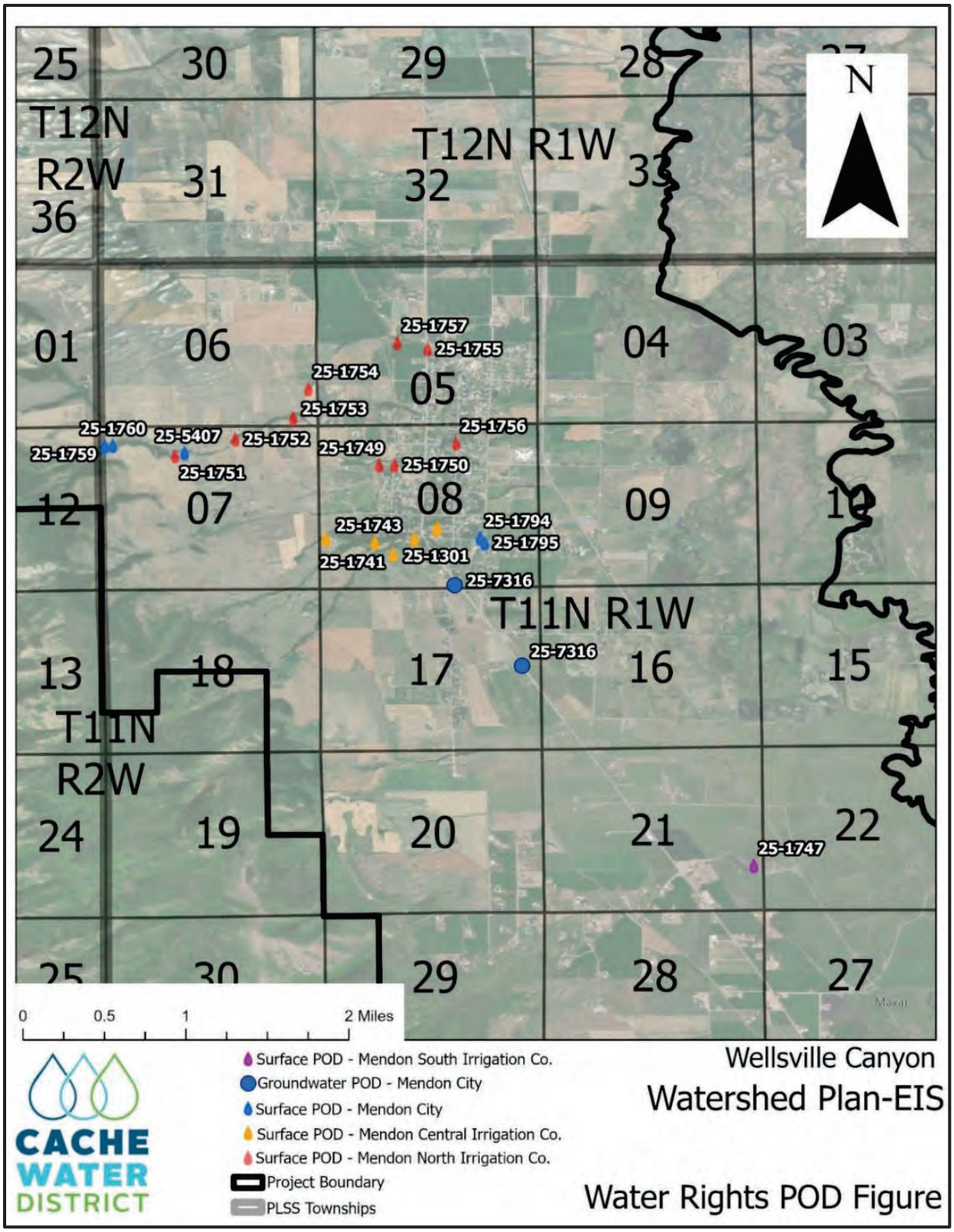


Figure 1: Water Rights Points of Diversion - North

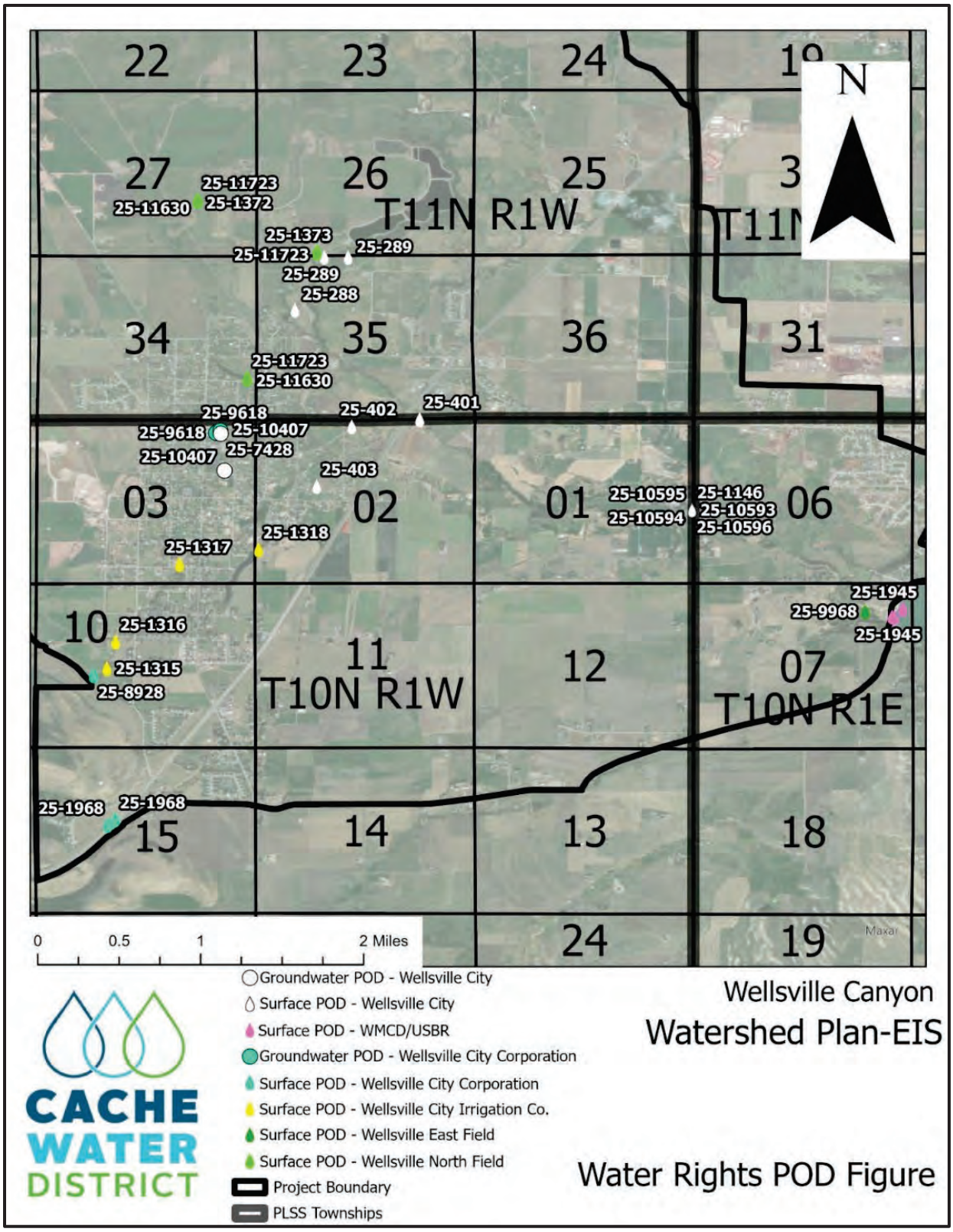


Figure 2: Water Rights Points of Diversion – South

TM002 – Hydrology

Technical Memorandum 002 – Hydrology

Table of Contents

1.0 Introduction 1
2.0 Wellsville Canyon Watershed EIS HUCs 2
3.0 Project Area 3
4.0 Nature of Flooding in Project Area 3
5.0 Characteristics of the Wellsville Canyon Watershed 4
6.0 Available Hydrologic Data 5
6.1 River and Stream Gauging Stations 5
6.2 Weather Stations with Precipitation and Temperature data 5
6.3 Snow Depth and SNOTEL Sites 6
6.4 Annual Precipitation Patterns 6
6.5 Soils, Infiltration, Runoff Characteristics and Erosivity 8
6.6 Return Frequencies and Design Storms 9
6.6.1 Simulating Summer Rainfall Events (NOAA Atlas 14) 10
6.6.2 Simulating Winter and Early Spring Rain on Snow Events 11
6.6.3 Storm Definitions for Evaluation during Rain-on-Snow Events 20
6.7 Areas of Runoff 23
6.8 Soil Conditions Affecting Hydrology 23
6.8.1 Soil Classifications 24
6.8.2 Hydrologic Soil Classifications (A-D) 25
6.9 Land Uses Affecting Hydrologic Runoff 26
7 Methodology and Procedures 1
7.1 Curve Numbers for Rain-on-Snow Events 1
8 Existing Floodplains and Required Design Storm 3
9.0 Selection of Design Storms 6
9.1 Calculation of Basin Cumulative Curve Numbers 6
9.2 Method of Comparison of Direct Runoff 6
9.3 Selection of Design Storms 9
10.0 Mannings Roughness 10
11.0 Conclusion 10

Figures

Figure 1: Hydrologic Units 2

Figure 2: South Looking Valley Overview (Google Earth Pro) 4

Figure 3: Average monthly precipitation for the Wellsville Canyon Watershed 7

Figure 4: This 2023 Rain-on-Snow caused this Erosion Event even though the rain event was small. 9

Figure 5: Little Bear SNOWTEL Station, 2023 12

Figure 6: Little Bear River Gaughing Station at Paradise, UT 12

Figure 7: Melt Depth (Varying Wind Speed) 16

Figure 8: Melt Depth (Varying Air Temperature) 17

Figure 9: Melt Depth (Varying Precipitation Temperature) 18

Figure 10: Melt Depth (Varying All Three Variables) 18

Figure 11: Wellsville Canyon Precipitation Frequency Curves 21

Figure 12: 2017 Temperatures 22

Figure 13: 2017 Wind Speed 22

Figure 14: Rain on Snow Cumulative Water vs NOAA Atlas 14 Rainfall 23

Figure 15: Soil Characteristic Map 24

Figure 16: NRCS Hydrologic Soil Classifications (A-D) 25

Figure 17: Cropping Patterns (2022) 1

Figure 18: 2017 Rain-on-Snow Flood Event Calibration Map 4

Figure 19: Existing FEMA Floodplains 5

Figure 20: Whole Watershed Direct Runoff Comparison 8

Figure 21: Below Canal Direct Runoff Comparison 9

Tables

Table D2.3-1: Cache Valley NWS Weather Stations .....**Error! Bookmark not defined.**

Table D2.4-1: Summary of 24-hr NOAA Atlas 14 Precipitation Frequency Estimates.....**Error! Bookmark not defined.**

Table D2.4-2: Top Land Uses in the Watershed.....**Error! Bookmark not defined.**

1.0 Introduction

To evaluate the alternatives associated with the Wellsville Canyon Watershed Plan/EIS, it was necessary to determine the amount of water generated by the watershed area during storm events for the following purposes:

- To evaluate the proposed impacts on mapped and unmapped floodplains and flood prone areas, and to ensure that proposed alternatives seek to protect and improve the functionality of the floodplains and mitigate flooding risks (PR&G Guiding Principle #3).
- To evaluate the risks to public health and safety and to take appropriate measures to minimize those risks (PR&G Guiding Principle # 4).
- To determine the flows to be used to evaluate the impacts of the current flood control system (No Action Alternative) and proposed improvements to reduce flooding and long term land inundation for the 2-, 5-, 10-, 25-, 50-, 100-, 200-, and 500-year recurrence events including the depths of flooding in homes, businesses, public buildings, roads, and agricultural fields to evaluate the economic impacts on the sponsors and communities.

To accomplish these purposes, this technical memorandum:

- Identifies the hydrologic units (HUCs) used in the EIS.
- Defines the project area developed through the scoping process.
- Defines the nature of flooding in the project area with historical reference floods for comparison.
- Defines the characteristics of the Wellsville Canyon Watershed and project area.
- Discusses the available data to evaluate the watershed and project area.
- Defines the methodology used based on the available data and NRCS procedures in the National Engineering Handbook (NEH).
- Develops the NOAA Atlas 14 Rainfall hyetographs for summer thunderstorms and the related rain on snow hyetographs controlling flood events in accordance with the NEH.
- Develop the appropriate hydrologic parameters for the model.
- Identify and discuss calibration efforts and details, including verification methods.
- Evaluate the hydrologic flows for the existing conditions for the 2-, 5-, 10-, 25-, 50-, 100-, 200-, and 500-year event for key locations identified as compared to observations to the calibration year.

2.0 Wellsville Canyon Watershed EIS HUCs

The Wellsville Canyon Watershed is located at the southwest end of Cache Valley in northern Utah and drains on the east side of the Wellsville Mountains to the Little Bear River, as shown in Figure 1. The watershed area consists of four hydrologic units, identified by the 16 digit hydrologic unit codes (HUCs), and is made up of steep slopes from the Wellsville Mountains that become milder as they enter the historic Lake Bonneville shoreline and ultimately approach the Little Bear River. Much of the area on the eastern side of the watershed is relatively flat due to lacustrine deposits from ancient Lake Bonneville. The total combined area of the hydrologic units is 70,846 acres.

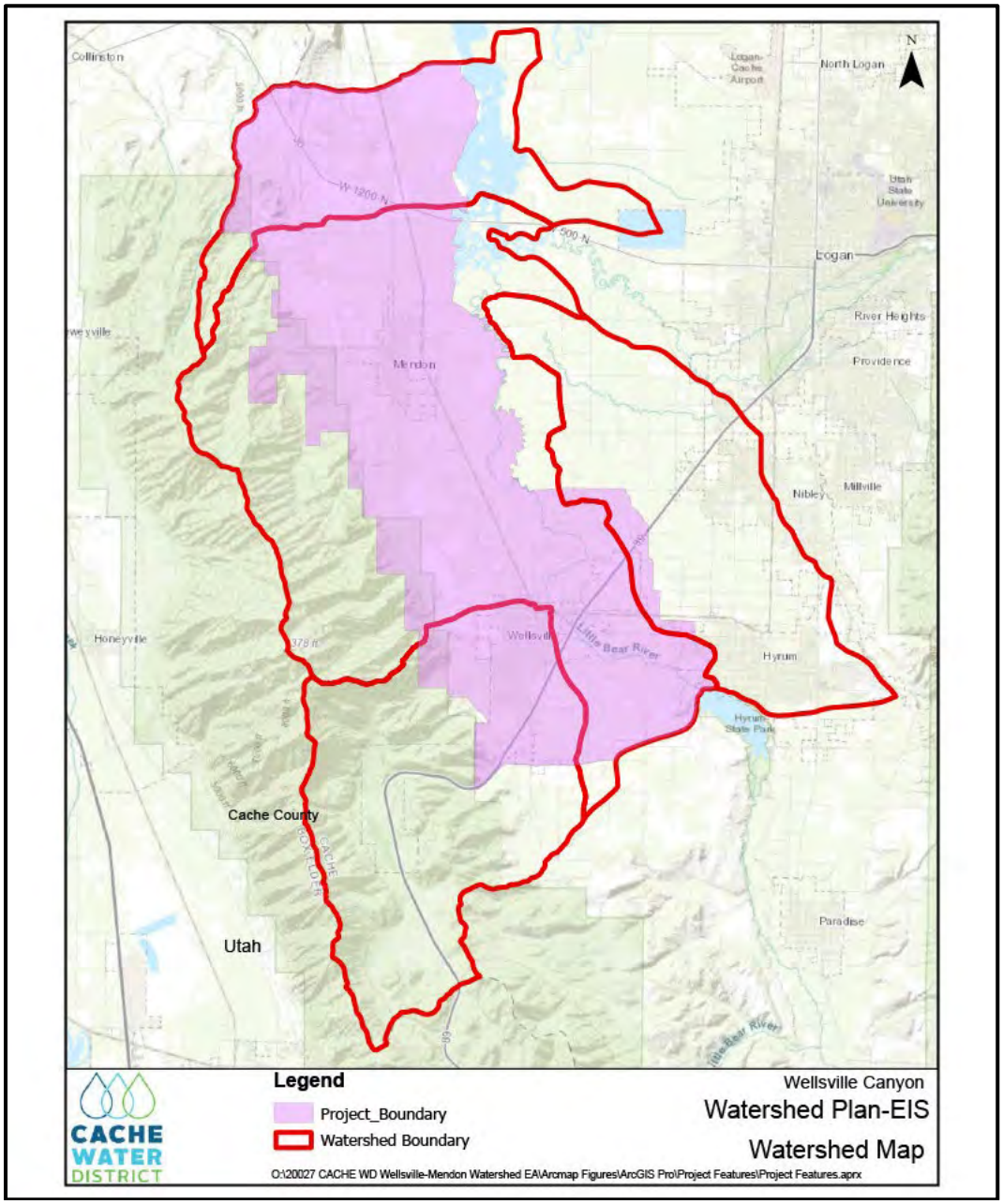


Figure 1: Hydrologic Units

3.0 Project Area

During the scoping process, the project area was defined based on the flooding conditions and the need for improved agricultural water management, with emphasis on effects to the Wellsville Mendon Conservation District, Wellsville City, Mendon City, and Cache County as reflected in Figure 1. This area is commonly referred to as Western Cache Valley and is positioned in the south-western side of the valley. This area encompasses 31,090 acres.

4.0 Nature of Flooding in Project Area

During scoping, flooding conditions were defined in this portion of Cache County based primarily on rain-on-snow events occurring in the late winter to early spring months. Numerous examples were identified including 2017, 2012, 2011, and 2006. Residents and sponsors provided numerous pictures included in Chapter 2 of the Plan-EIS showing this flooding. A review of local news media, emergency response records, and USGS records were used to identify rain-on-snow events dating from 1939 to 2021.

The USGS storm events database provided records for two events including 1998 and 2012.

In the narrative for January 11, 1998, the event report states:

> "Minor flooding occurred in the Mendon (1.09" of rain) and Wellsville (1.50") areas late on the 11th. Several Roads were closed, and basements flooded". (https://www.ncdc.noaa.gov/stormevents/eventdetails.jsp?id=5664804)

While the rainfall depths are provided in this report, it is not known where the measurements are referenced too. There were no documented rain gauges in either community.

In the narrative event for January 19, 2012, the event report states:

> "Deep Pacific moisture, combined with embedded weather disturbances moving through the region in the middle of January, resulted in heavy and wet snowfall in the mountains and mountain valleys in northern Utah. Occasional heavy rain was observed in the northern Utah valleys. This rain, when combined with frozen ground and snowmelt, produced flooding in portions of Cache Valley and Ogden Valley".
>
> "Heavy rainfall in the Cache Valley, combined with frozen ground and snowmelt, produced flooding in portions of Mendon and Wellsville. Culverts in those areas quickly became clogged with debris, and several homes reported basement flooding. State Route 23 was also closed for a period of time due to water flowing across the road." (https://www.ncdc.noaa.gov/stormevents/eventdetails.jsp?id=363360)".

A discussion with local residents and sponsors confirmed that while thunderstorms can be extremely intense and of substantial duration, they do not occur as often as rain-on-snow events.

5.0 Characteristics of the Wellsville Canyon Watershed

It is important to understand the nature of the watershed, with the overall characteristics and storm patterns that cause flood events. A perspective figure is included to highlight the overall characteristics of the watershed. It should be noted that Cache Valley is surrounded on three sides by ranges of the Wasatch Mountains as shown in Figure 2.

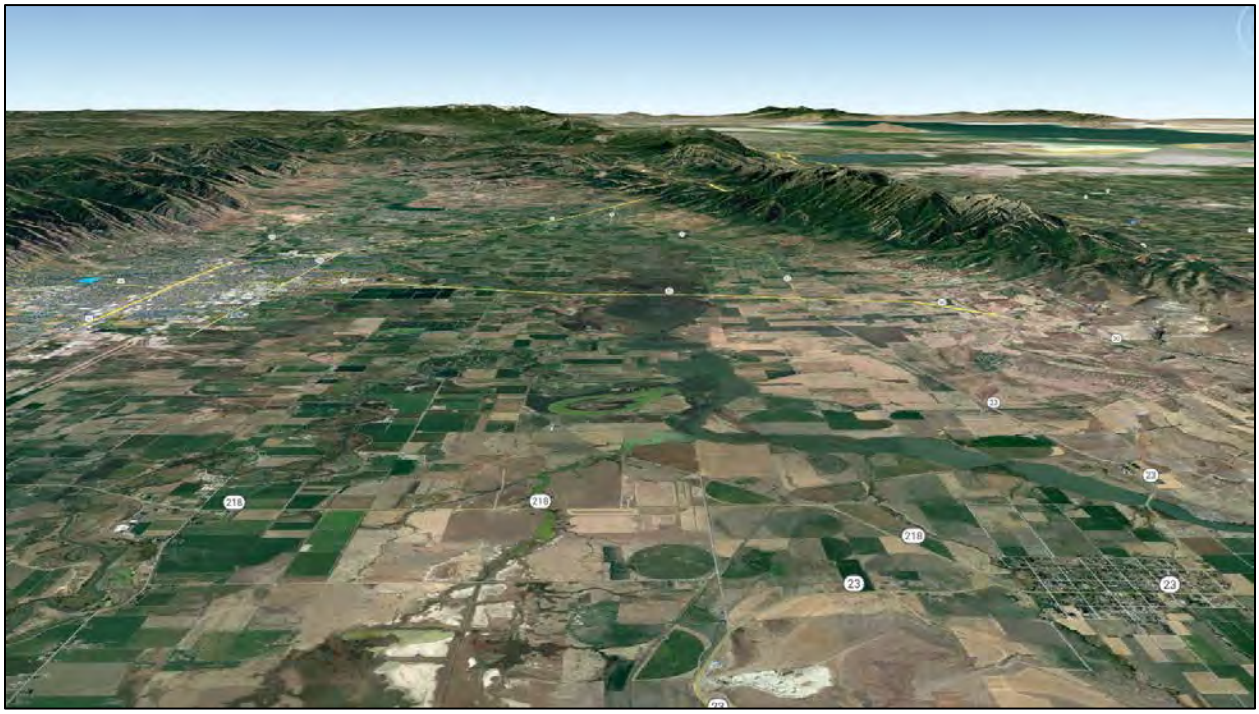


Figure 2: South Looking Valley Overview (Google Earth Pro)

The mountains affect the climate throughout the year with extremes in some cases. Under normal conditions, the tall mountains immediately adjacent the communities of Wellsville and Mendon at elevations near 4,500 feet rise to a peak summit of Box Elder Peak (9,372 ft) and Wellsville Cone (9,356 ft). While only moderately high compared to the other Wasatch and Uintah Mountains, the relatively narrow mountains create an orthographic barrier that creates a weather shadow, protecting Wellsville and Mendon from storms directly from the west, but also causing a shadow of significantly less precipitation from other areas in the valley.

However, during the monsoon season, the steep nature and the close confines of the surrounding valley can trigger severe thunderstorms with possible flooding. These storms are generally associated with low pressure carrying large amounts of moisture from the southwest and the Pacific ocean with very warm super-saturated air. As this air hits the steep mountain faces, it rises rapidly, forming very intense thunderstorms, which are then trapped in Cache Valley by the higher mountains to the east. These storms, either coming over the top of the mountains on the west, or more commonly through the gaps, often then drop into the valley as they are rapidly cooled by the high cold elevations and are trapped where they mix with the hot air already in the valley and re-intensify.

During the winter months, these same mountains trap cold air and form inversions which often prevent ground snow from melting. As the snow accumulates, and the underlying ground is frozen, and insulated from thawing, the conditions are prepared for the rain-on-snow events. Then, a warm southern storm with highly saturated atmospheric conditions rapidly increases the air temperature. Then, a combination of temperatures warmer than freezing (32 degrees F), sustained warm winds, and warm rain trapped in the valley, often with thunderstorm intensity during the first 12 hours. combine to rapidly melt snow, providing a combination of melted snow and rain to the total available water for runoff.

However, these storms, while intense, do not have the raw intensity of a summer monsoon storm, lacking the potential solar energy and heat available to the summer storms. What they do have is the accumulated snow on frozen ground and the warm winds supporting the melting of the snow.

These two conditions drive the more frequent flooding in the Wellsville Canyon Watershed.

6.0 Available Hydrologic Data

Historical hydrologic data is publicly available from numerous sources to complete the necessary analysis. This information has been identified here for clarification and to help narrow down the available methods that were used to evaluate the flood runoff events.

6.1 River and Stream Gauging Stations

There are no historical river or stream gauging stations on the Little Bear River directly from this watershed or any of the tributaries within this watershed. The only representative flow data for the Little Bear River are from releases from Hyrum Reservoir on the upstream boundary of the watershed and a gauge upstream of the Reservoir near Paradise, Utah. This gauge provided information on the water supply to Hyrum Reservoir and flooding potential along the Little Bear River but did not help with estimating the runoff from the Wellsville Mountains due to the difference in topography and elevation. However, it did help identify whether a rainfall event caused a corresponding increase in river flows and was useful in determining whether a storm was localized or valley wide.

6.2 Weather Stations with Precipitation and Temperature data

There are three rain gauges in Cache Valley with daily rainfall, temperature, and dew point data of more than 30 years. These include the KVNU Radio Station (1956 to present), Utah State University (1893 to present), and USU Experimental Farm (1969 to present). All of these stations are located north and east of the project area. A comparison of these stations with regard to the project area (Wellsville & Mendon) is provided in the table below, due to the importance of utilizing information on wind, temperature, precipitation, and dew point for model calibration. While there are no weather stations in the project area, the USU Experiment Farm, with data since 1969, is the most representative of the local conditions and was used for this Plan-EIS where possible. However, data from all of the stations was used to develop and calibrate other relationships discussed later.

Table 1: Cache Valley NWS Weather Stations

Location	Wellsville	Mendon	Logan KVNU	USU	USU Experiment Farm
Elevation	4560	4500	4475	4800	4490
Distance from Project	N/A	N/A	6.7 Miles	8.4 Miles	4.05 Miles
Location	41°38’12” N 111°56’08”	41°42’29” N 111°59’46”	41°44’07” N 111°51’23”	41°44’25” N 111°48’48”	41(°39’54” N 111°53’30”
Orthographic Relationship	West Side of Valley	West Side of Valley	Center of Valley	East Side of Valley	Southwest Side of Valley

6.3 Snow Depth and SNOTEL Sites

There are no SNOTEL sites in the Wellsville Mountains. The Little Bear River is monitored at its headwaters to the south of the Wellsville Canyon Watershed. This site has 48 years of data for reference not including 2025. This site consists of a measurement site that measures the weight of the water and provides the snow water equivalent (SWE) on a daily basis. Characteristics of this gauge are provided in Table 2.

Table 2: Little Bear (LTBU1) SNOTEL Site Characteristics

Elevation	6544 ft
Basin	South Fork of the Little Bear River
Distance from Wellsville	16.0 miles
Distance from Mendon	21.8 miles
Orthographic Relationship	North Facing General Orientation

While this SNOTEL site is not a perfect gauge and typically melts out earlier than the snow on the east facing Wellsville Mountains, it does provide good insight on rain-on-snow events. This gauge helps define the elevation of the major events causing flooding with a break point of approximately 6,500 feet in elevation. A detailed review of this gauge compared to runoff in the Little Bear River demonstrates that this gauge is typically right at the edge of the rain and snow mix and change in those storms.

6.4 Annual Precipitation Patterns

The watershed experiences characteristically hot summers and cold winters. Most precipitation on the watershed comes as winter snow, spring rain, and some late summer monsoons. Due to the lack of SNOTEL sites or other gauging stations in the watershed, particularly at higher elevations, precipitation in the elevations above the valley floor were obtained from the USGS StreamStats

program, version 4 ((https://streamstats.usgs.gov/ss/) and based on the USU Experiment Farm. Results are shown in Figure 3 in blue, averaged over the watershed. In the valley and agricultural areas of the watershed, precipitation patterns are indicated by the red bars which show data from the StreamStats extrapolations based on surrounding elevations and historical weather patterns. Average yearly data for the watershed is more than 35 inches of precipitation, with most of the moisture falling during the winter months in the high elevations of the Wellsville Mountains. However, in the low elevations, the annual precipitation is only 21.8 inches and comes mostly outside of the growing season.

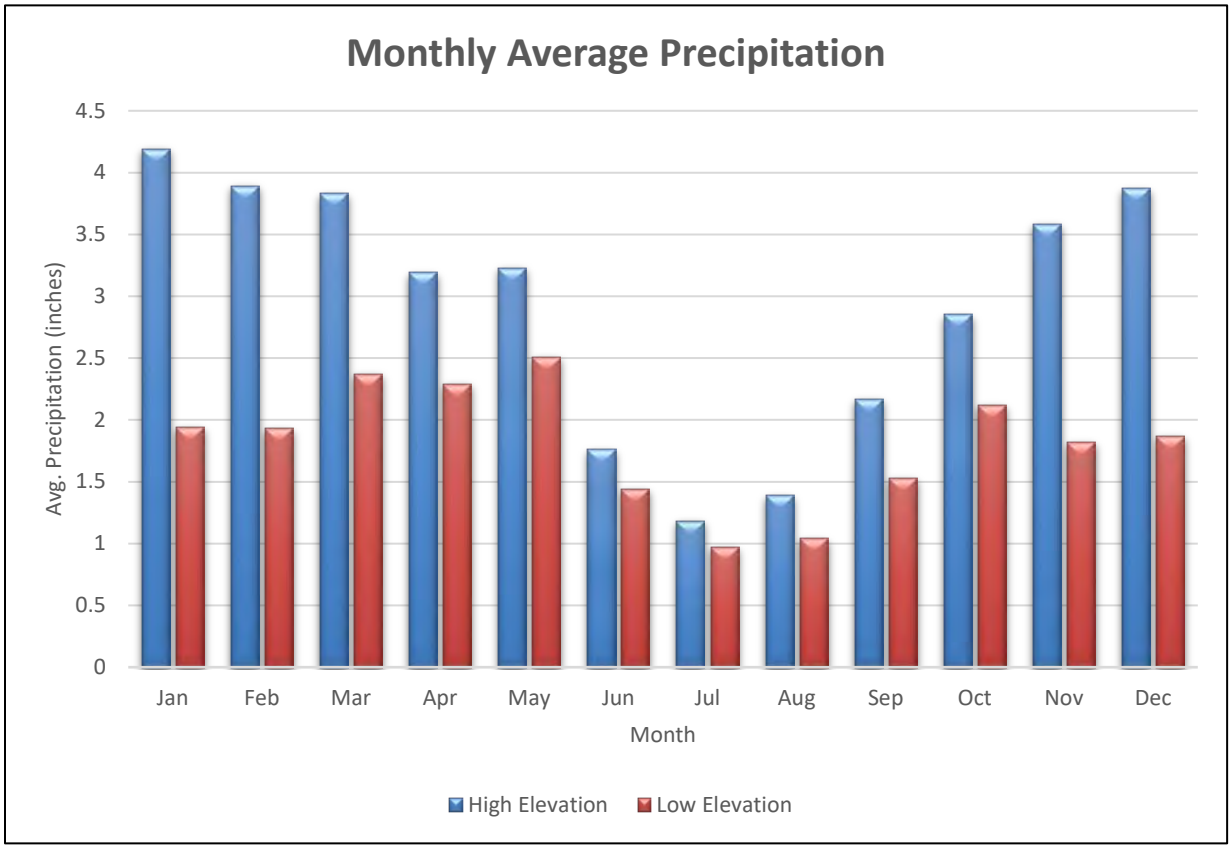


Figure 3: Average monthly precipitation for the Wellsville Canyon Watershed

As can be seen in the figure, a significant amount of moisture falls between December and March in an average year and is often in the form of snow. In wet years, such as 2017 and 2023, this can be significantly more, often accumulating more than 2 feet of snow with a SWE exceeding 3 inches during the early spring months in the wet years. The SWE is based on the National Weather Service (NWS) rule of thumb, ranging from 10 to 12 inches of snow for 1 inch of water (https://www.weather.gov/arx/why_snowratios). This incorporates the results of periodic melting or "sweetening" of the snowpack, as well as the "sponge effect" associated with absorbing lighter intensity rains which commonly occur prior to the larger events.

As stated previously, this saturated snow becomes an issue as super saturated warm fronts move into the area and rain falls. The snow initially absorbs the water, but then rapidly starts melting and acts as an additional water source, adding to the precipitation depth. In many cases, this can increase the effective precipitation depth by as much as 0.5 to 1.5 inches of water over a 24-hour

period based on historical storms in 1983, 2006, 2011, and 2017. Most historical flooding events within this watershed have occurred in the winter or early spring during rain-on-snow events.

Prior to settlement, rain-on-snow events would have flowed overland and concentrated into streams that reached the Little Bear River. As settlement and development have occurred since the late 1850s, the natural flow paths were interrupted by agriculture, grading, and residential development. The natural ephemeral or seasonal drainage pathways and channels have been graded out for agricultural dryland farming and, subsequently, irrigated agriculture. Later, the same areas were re-graded for homes, and in some cases, subdivisions. As a result, the watershed area has mixed agricultural and residential land use.

6.5 Soils, Infiltration, Runoff Characteristics and Erosivity

Soil conditions are very different during different times of the year. It is for this reason that the NEH Part 630 and 634 states that the NRCS method for calculating direct runoff and routing (TR-55) does not apply to rain-on-snow events or rain-on-frozen ground events without specific modification or calibration to the soil condition. There are several parts of the hydrologic cycle represented in this method which vary between the winter, spring, and summer seasons.

The initial abstraction consists mainly of interception, infiltration during the early parts of the storm, and surface depression storage. Typically, this is assumed to be 0.2 times the maximum potential retention in the storm. (NEH 210-630, Chapter 10, pg. 10-3). While the factor of 0.2 can vary, all of the NEH reference data is associated with 0.2 and does not provide for that deviation. The basis of investigation for the development of representative curve numbers (CNs) is based on research of multiple references(as stated in the NEH Part 630 Chapters 8, 9, 10,) for soil complexes throughout the country and runoff related to summer rainfall events. As a result, specific representative events must be evaluated to reflect the flood conditions of concern, and supporting validation must be provided if direct calibration data is not available.

Under the Wellsville Canyon Watershed, three primary conditions occur:

1. Summer rainfall on normally established vegetation with alfalfa and pasture in various conditions of harvesting.
2. Rain-on-frozen ground with winter fetch and cultivated lands and without leaves on the herbaceous plants and trees.
3. Rain-on-snow with winter fetch and cultivated lands and without leaves on the herbaceous plants and trees.

Two approaches are available to modify the conditions of the three runoff events.

1. Treat the initial abstraction as a variable subject to air temperature, snow depth and SWE (Al-Houri and Barber, 2011). However, this method does not consider the conditions of changing soils or the variation in the vegetative conditions.
2. Vary the soil CN as a function of changing hydrologic soil conditions and vegetative cover conditions. While this does not change the initial abstraction ratio, it does change the storativity—which is the basis of the initial abstraction—defined as the amount of water a soil can store before water begins to runoff. Additionally, it is much easier for the common reader to follow and understand changes in soil conditions and is very reflective of what is changing.

As documented by Watanabe et. al. (2011), snow melt freezes during the early part of the event at the ground interface preventing infiltration. However, as the storm continues, the melting of the snow continues to draw energy from the soil and thaws the now saturated soils. Based on this approach, it was assumed that the soils would be changed from an antecedent runoff condition (ARC) 2 to ARC 3. It is this approach that is used for this project. Additionally, by assuming that the rainstorm starts with light rain, leading to a melting condition that would lead to the thawing of the soil surface, and becoming a saturated condition.

Additionally, there is an indirect correlation between the CN and the associated erosivity of the soils. As vegetative cover reduces on a given soil, erosivity increases. Under a frozen soil condition, the soil holds together quite well. But, as thawing begins, the process of ice converting to water in the freeze-thaw cycle disrupts the soil structure, often causing surface soil dispersion to take place, which can be highly erosive. This, combined with the super saturation of the soils as they melt, allow for potentially rapid erosion events and subsequent nutrient loading to the Little Bear River. As a result, any effort to decrease the CN and reduce runoff from a spring and winter rain-on-snow event directly correlates to a reduction in erosion of topsoil.



Figure 4: This 2023 Rain-on-Snow caused this Erosion Event even though the rain event was small.

6.6 Return Frequencies and Design Storms

As discussed above, the flood events most commonly experienced in this watershed are predominantly a result of rain-on-snow events with extreme events being caused by summer localized monsoon storms. This becomes a very complex process of model development and

calibration. The procedures used to develop the design storms is discussed in this section in detail. The design storm distributions are in accordance with the National Engineering Handbook (NEH) for the varying return frequencies. Per the PR&G, the required frequencies include the 2-, 5-, 10-, 25-, 50-, 100-, 200-, and 500-year storms. Each of these storms have two potential conditions which can control the event, a summer monsoon thunderstorm represented by the typical NOAA Atlas 14 event, or a rain-on-snow event. Each are summarized below.

6.6.1 Simulating Summer Rainfall Events (NOAA Atlas 14)

Design rainfall used in this Watershed Plan-EIS is based on NEH Part 630, Chapter 4. Under the NEH, the design rainfall event is a synthetic rainfall distribution of a 24-hour duration per 630.0403 (2). Additionally, as stated in NEH 630.0403, the distribution progresses smoothly from very low intensity to very high intensity, and then back to low intensity, while actual events have variable rainfall throughout the whole storm. Finally, the design storm contains the 100-year event of all durations from 5 minutes to 24 hours, all imbedded in a single storm (NEH Part 630.0403 (2)).

The synthetic rainfall used for this Watershed Plan-EIS is the NOAA Atlas 14 distribution (NEH Part 630.0403 (6)).

Rainfall intensity data for Wellsville, Utah, Mendon, Utah, and below the 6,500-foot elevation contour in the project area are shown in Table 3. These depths are typically associated with high-intensity thunderstorm events

This elevation was selected to focus on the primary areas where runoff is expected to be generated. As discussed later, due to the very low curve number of the wilderness areas, it was decided to focus the runoff precipitation analysis on the same area as the snowmelt areas.

Table 3: Summary of 24-hr NOAA Atlas 14 Precipitation Frequency Estimates

	Average Recurrence Interval (years)							
	2	**5**	**10**	**25**	**50**	**100**	**200**	**500**
Wellsville								
24-hr Duration (in inches)	1.65	2.00	2.30	2.72	3.05	3.39	3.75	4.24
Precipitation Frequency Estimate at Lower and Upper Bounds (in inches)	1.49-1.82	1.81-2.21	2.07-2.53	2.44-2.99	2.72-3.35	3.02-3.74	3.31-4.13	3.71-4.68
Mendon								
24-hr Duration (in inches)	1.61	1.97	2.26	2.68	3.02	3.37	3.73	4.23
Precipitation Frequency Estimate at Lower and Upper Bounds (in inches)	1.47-1.77	1.79-2.16	2.06-2.48	2.43-2.94	2.72-3.31	3.02-3.70	3.32-4.10	3.72-4.67
6500 Ft. Contour Elevation								

	Average Recurrence Interval (years)							
	2	**5**	**10**	**25**	**50**	**100**	**200**	**500**
24-hr Duration (in inches)	2.24	2.75	3.18	3.78	4.26	4.77	5.30	6.04
Precipitation Frequency Estimate at Lower and Upper Bounds (in inches)	2.03-2.48	2.48-3.04	2.86-3.51	3.39-4.18	3.8-4.71	4.23-5.28	4.67-5.88	5.26-6.72

Note: NOAA Atlas 14 PDS-based precipitation frequency estimates with 90% confidence intervals for project area

The data from NOAA ATLAS 14 is used as input data to develop the frequency distribution curves using the NRCS spreadsheet created by William Merkel and published as a NRCS technical tool. The unsmoothed version was used as the starting point. This spreadsheet was then verified by the project team and modified to include additional smoothing parameters and specific parameters in preparation for hydraulic modeling. This methodology is in accordance with NEH 630.0406 based on Technical Release-20 (TR-20).

Using these procedures as described, rainfall distributions were prepared for the 2-, 5-, 10-, 25-, 50-, 100-, 200-, and 500-year events for the summer rainfall events.

6.6.2 Simulating Winter and Early Spring Rain on Snow Events

Rain-on-snow events are commonly seen in the intermountain west as winter super saturated warm fronts from the south and southwest (commonly called the “pineapple express”) collide into the high mountain slopes, causing them to create high-intensity spring rains at the lower elevations and intense wet snow at the higher elevations. These rain-on-snow events are usually accompanied by warm winds and warm air temperatures causing rapid snow melt while the ground remains frozen during the early parts of the storm (typically well past the peak runoff point) to super saturated as the soils thaw. Additionally, these events can cause extensive erosion as the thawing of the soils causes a dispersive effect on the soils, destroying surface soil structure and mobilizing soils which would otherwise be only mildly or moderately erosive. As a result, these events can rapidly turn a rainstorm event into a much more severe flood event.

6.6.2.1 Winter and Early Spring Qualifying Rain Events

NOAA Atlas 14 does not accurately represent winter and early spring precipitation events. Rather, it is developed based on the high intensity storms which occur in the summer months. As a result, an independent analysis was required.

Second, only storms associated with an increase in flooding or potential flooding were desired as a representative storm. To determine this relationship, it became necessary to evaluate data from the precipitation gauges, Little Bear River gauging station, and when available, the Little Bear River SNOTEL site to determine if the event was a qualifying rain-on-snow event. When it appeared that the storm could have been a representative storm occurring between December 31 and April 1, the date, and the amount of precipitation in a 24-hour period was documented. An example of this evaluation is shown in Figures 5 and 6 for a rainstorm that occurred on March 14 - 15, 2023. Note that there was a decrease in snow water equivalent coinciding with a significant increase in flow in the river during this rainstorm event.

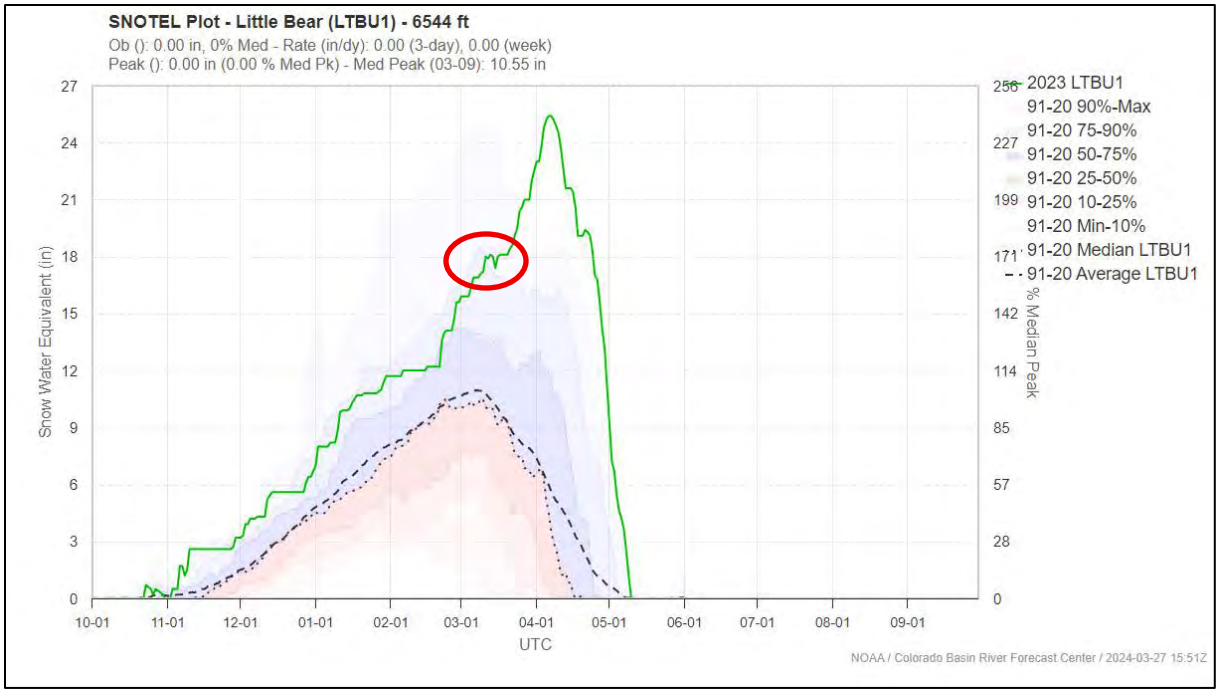


Figure 5: Little Bear SNOWTEL Station, 2023

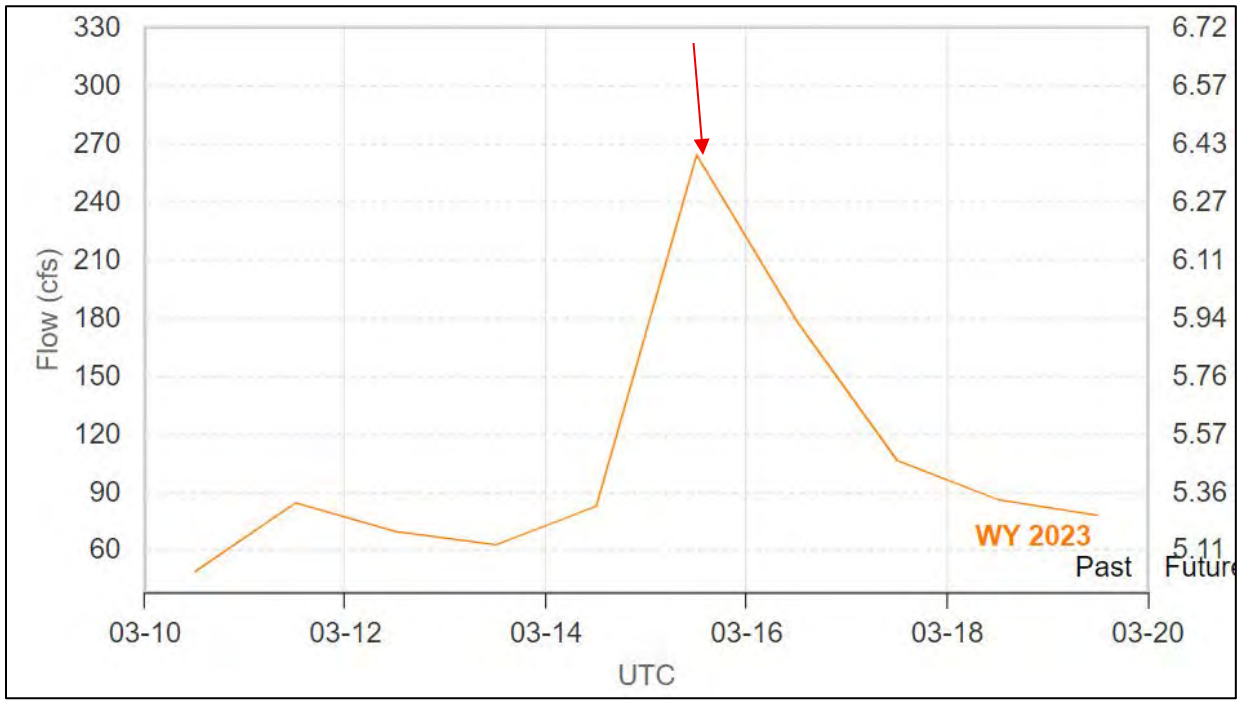


Figure 6: Little Bear River Gaughing Station at Paradise, UT

6.6.2.2 Snow Melt Frequency Distributions

Snowmelt is often ignored in flood frequency analysis. However, in the Intermountain West, rain-on-snow is typically the controlling event. In order to incorporate the snowmelt with the rain, it becomes necessary to develop a relationship between rainfall and snowmelt. While the EPA SWMM model attempts to use some variables to determine snowmelt, it does not provide a direct hydrograph involving all of the energy equation values that are easy to document. To enable incorporation of rain-on-snow, the energy equation (NEH Part 630.1101 (a)) was the basis of this discussion as summarized below.

$$\Delta H = Hrs + Hrt + Hs + Hl + Hg + Hp$$

Where:

ΔH = Change in heat content (calories or BTUs) in the snowpack over a period of time.

Hrs = Net solar radiation.

Hrt = Net thermal radiation.

Hs = Sensible heat transfer from air.

Hl = Latent heat of vaporization from condensation or evaporation/sublimation.

Hg = Conducted heat from underlying ground.

Hp = Advected heat from precipitation.

With this understanding, it is also important to recognize that two other key definitions are binding.

$$Mt = \frac{\Delta H}{80B}$$

Where:

Mt = Melt (cm)

ΔH = Change in heat content as defined above

80 = Latent heat of fusion in cal/cm^3, the amount of heat to melt 1 cubic cm of ice into water.

B = Thermal quality of snow, typically 0.95 to 0.97. The U.S. Army Corp of Engineers reports 0.97 reflects snow “ripe or sweet” and ready to melt (EM 1110-2-1406).

Finally, the definition of a calorie (cal) needs to be defined as the amount of heat to change 1 cm^3 of water 1°C. Under this definition, the following information from the referenced sources is used.

Shortwave Radiation (Hrs)

The primary source of solar radiation is shortwave radiation as discussed in EM1110-2-1406 (pg. 5.2). During rain-on-snow events, cloud density and atmospheric moisture content are very high. The result is very low solar penetration. As documented by the U.S. Army Corp of Engineers (USACE) in EM1110-2, Table 5-2, shortwave radiation is a minor contribution. The USACE states that this is assumed to be 0.05 to 0.06 in/day

Longwave Radiation (Hrt)

Longwave radiation is fairly important during a rain-on-snow event. The calculation of the longwave radiation is based upon the USACE equation (EM 1110-2-1406, eq 5-9) below:

$$Mrt = 0.029(Ta - 32).$$

Where:

Mrt = Melt from long wave radiation under cloudy skies in inches per day.

Ta = Average temperature in °F over a period of time.

Sensible heat transfer (Hs) and Condensation (l) melt

The USACE provides a combination equation derived from a pair of equations based on the energy from wind and evaporation and condensation (EM 1110-2-1406, eq 5-15). This equation is provided as:

$$Mce = .0084V[.22(Ta - 32) + .78(td - 32)]$$

Where:

Mce = Combined melt from sensible heat (convection) and evaporation and condensation in inches per day.

Ta = Average temperature in °F over a period of time.

Td = Average dew point temperature. However, in saturated atmosphere in a rainstorm, this may be assumed the same as Ta for if Td is not available.

V = Average wind velocity in mph over the period of time.

With these assumptions, this equation simplifies to become the following:

$$Mce = .0084V(Ta - 32)$$

Ground Convection

The USACE has documented the heat transfer from the ground into the snow as 0.01 to 0.03 inches/day. In their derivations, they use 0.03. However, it should be recognized that this is an extremely small amount of melt. In a rain-on-snow event in the Intermountain West, the ground is usually frozen (Tg ≤ 32°F). Under this condition, the flow of heat from the ground to the snow is ≤ 0. Under most rain-on-snow events, as reported in Watanabe et. al. (2011), the melt freezes at the snow-soil interface, preventing infiltration as well as creating a zone that stops the transfer of energy early in the storm event. This condition often would occur before precipitation even begins.

Precipitation (Hp)

The USACE provides an equation derived to calculate the melt from precipitation as listed below (EM 1110-2-1406, eq 5-18):

$$Mp = 0.007(Tp - 32)Pr$$

Where:

Mp = Melt from the temperature difference of the precipitation in inches/day.

Tp = Temperature of the precipitation in °F which is the dew point temperature.

Pr = 24-hour precipitation in inches per day.

Total Change of Energy (ΔH)

Based on the USACE total equations, they are all added together as follows:

$$Mt = Mrs + Mrt + Mce + Mg + Mp$$

Consolidating these equations, the following results:

Mt=.06+.029(Ta-32) +.0084V(Ta-32) +.007(Ta-32)Pr +.03

This is then reorganized to the following (EM1110-2-1406, eq 5-19):

Mt=.09+(.029+.0084V+.007Pr)(Ta-32)

This matches the NEH equation 11-4 in Part 630.1103 (a) for melting during rainy periods with the addition of a calibration factor added. This final equation is:

Mt=C[.09+(.029+.0084V+.007Pr)(Ta-32)]

However, neither manual gives clarification for determining the calibration factor (C) for obvious reasons. As shown in the equation, the total melt is a function of the change in heat in the snowpack divided by the latent heat of fusion and thermal quality of the snow. While the equation above is based on decades of research and calibration, variables that change seasonally or between or during events include:

- Thermal quality of the snow "B"
- Wind speed "V"
- Air temperature
- Dew Point

As a result, the USACE has assumed that the calibration coefficient is equal to 1.0 regionally based on their efforts over the duration of a storm. However, for practical application, it is important to understand the sensitivity to these variables under this assumption.

Sensitivity Analysis

Data for the Wellsville Canyon project was used to evaluate the sensitivity of snow melt to rainfall temperature, air temperature, and wind speed. NOAA Atlas 14 precipitation data for the 2- to 500-year rain events and 24-hour storms were used as a basis of the rainfall calculation comparison

with Wellsville City and Mendon City below the 6,500-foot elevation contour on the mountains above the cities. The results were independent of location, so only the Wellsville City information results are included in this memorandum. (Refer to the Administrative Record for further results.). The total melt was then calculated for multiple values of wind speed and air temperature, and a plot of sensitivity was created.

The following graphs reflect the results based on the sensitivity plots.

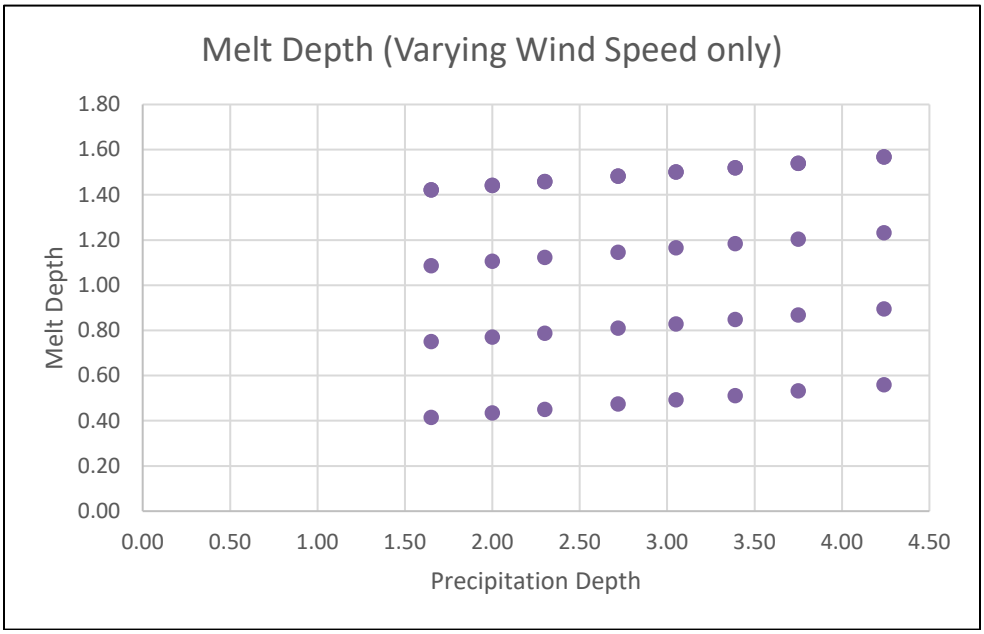


Figure 7: Melt Depth (Varying Wind Speed)

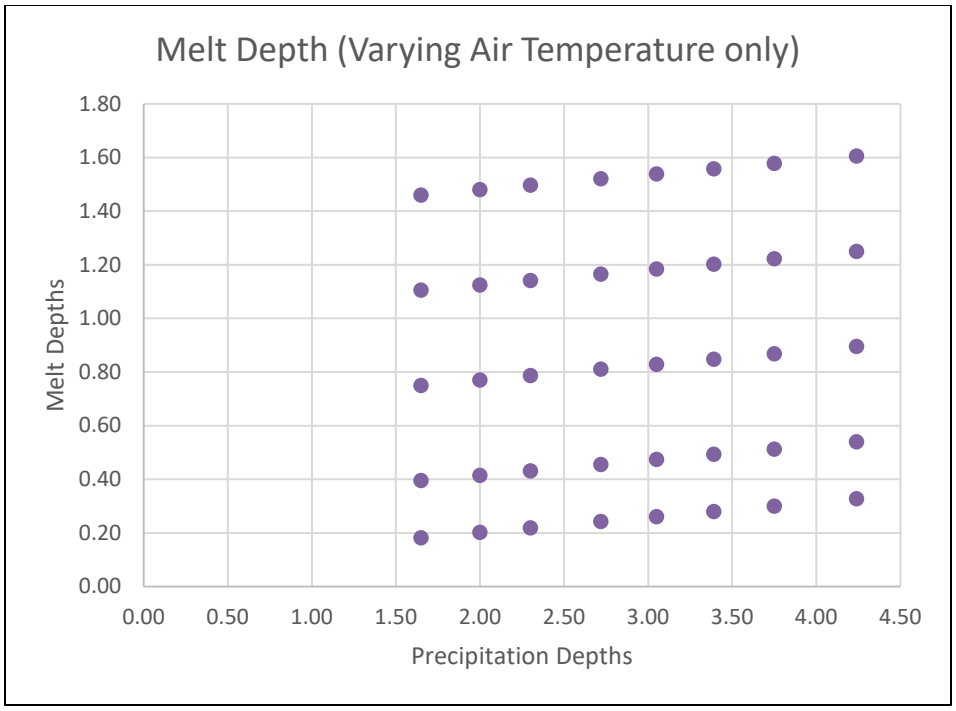


Figure 8: Melt Depth (Varying Air Temperature)

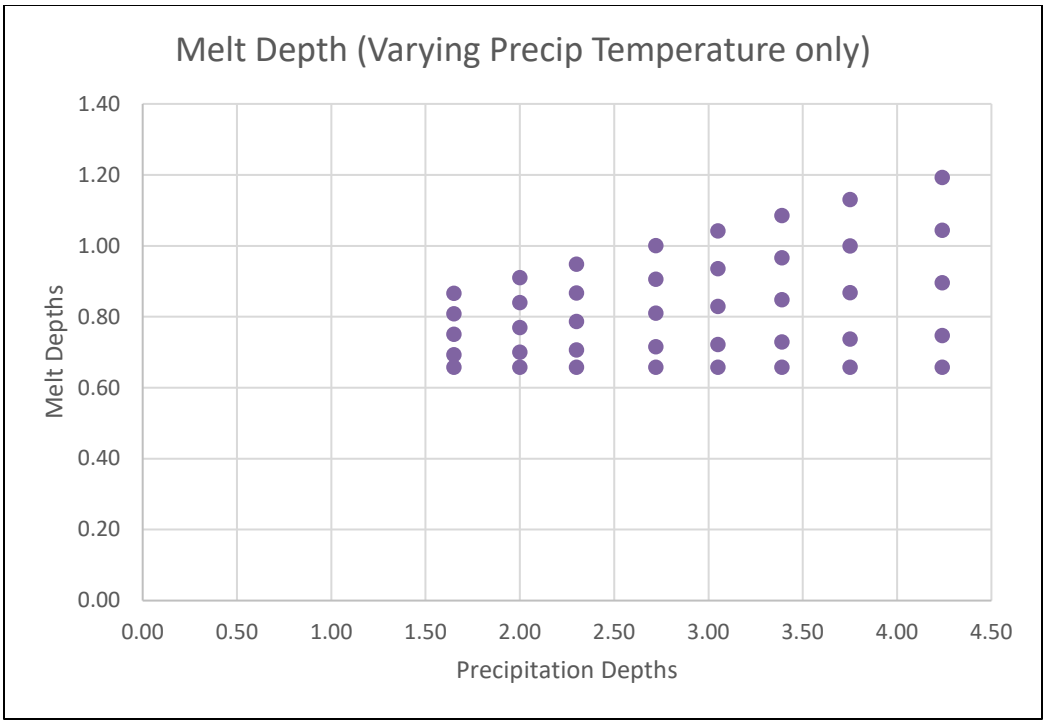


Figure 9: Melt Depth (Varying Precipitation Temperature)

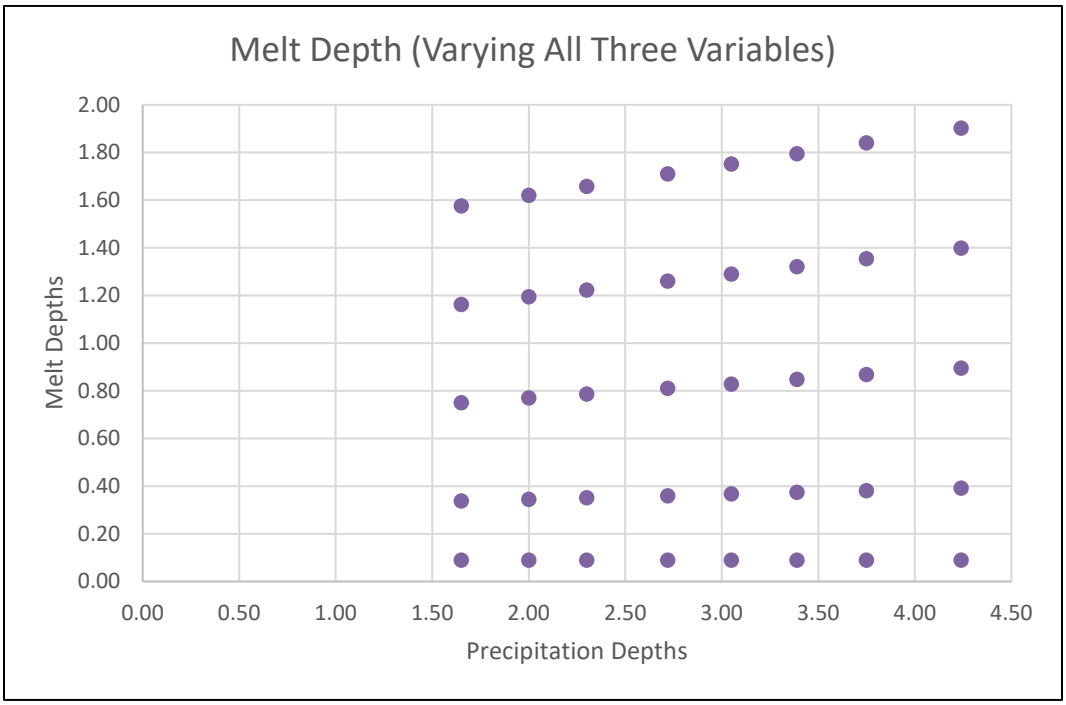


Figure 10: Melt Depth (Varying All Three Variables)

Based on the results of the sensitivity analysis, the following becomes apparent:

- The snowmelt is sensitive to all three variables: wind, air temperature, and precipitation temperature. However, the air temperature and the wind speed had greater impacts than the temperature of the rain or amount of rain.
- Based on this review, wind speed and air temperature are of greater importance than the temperature changes in precipitation. This supports the conclusions of the USACE and is well supported by numerous energy discussions in both snowmelt and evapotranspiration (ET), particularly with the Penman Montieth equation. The conversion of the phases of water is more directly affected by radiant and convection energy than the transfer of energy within the water itself.

Development of Frequency Snowmelt Equation

By applying the conclusions of Watanabe et. al. (2011) and recognizing that the solar radiation over a day is insignificant, the equation for Mt can be further simplified to the following where all variables are previously defined, but as a function of time, and the temperature of the precipitation is returned to the equations (all units are in inches, inches per day, and °F).

$$\mathrm{Mt(t)} = \frac{.09}{\mathrm{F}} + \left[\frac{.029(\mathrm{Ta(t1)} - 32)}{\mathrm{F}} + \frac{.0084\mathrm{V(t1)}(\mathrm{Ta(t1)} - 32)}{\mathrm{F}} + .007\,\mathrm{Pr(t2)}\,(\mathrm{Tp(t2)} - 32)\right]$$

Where:

Mt(t) = Melt function over time in inches/hour. This will be a snowmelt hydrograph that is additive to the NOAA Atlas 14 hydrograph.

Ta(t1) = Air temperature over time. This may be a constant throughout the storm, a step function, or more complicated based on available data. It does not need to have the same time step as the rainfall; however, it should be a multiple of the rainfall time step.

V(t1) = Windspeed over time. This may be a constant throughout the storm, a step function, or more complicated based on available data. It necessarily does not need to have the same time step as the rainfall; however, it should be a multiple of the rainfall time step.

Pr(t2) = NOAA Atlas 14 cumulative rainfall hydrograph in inches per hour at the appropriate timestep.

Tp(t2) = Temperature of precipitation over time. This may be a constant throughout the storm, a step function, or more complicated based on available data. It must be the same time step as the rainfall.

F = 24. The correction Factor to correct the units of the equation developed using dimensional analysis.

Upon defining the melt function above, the total design hydrograph function is developed by merely adding the precipitation function and the melt function together.

Boundary Conditions for the Snowmelt Function

The following boundary conditions and restrictions apply to the equations of melt and rainfall for total precipitation.

1. The total amount of melt is less than the amount of snow-water equivalent available at the beginning of the storm.
2. The total snowmelt and precipitation cannot simply be added and applied to the NOAA Atlas 14 distribution pattern. This would disregard the nature of the wind convection and latent heat to have increased effects early in the storm and to not follow the precipitation and wind patterns.
3. This function assumes air and precipitation temperatures are greater than freezing. Otherwise, the event is snow and ice accumulating, and this procedure does not apply.

6.6.3 Storm Definitions for Evaluation during Rain-on-Snow Events.

The NEH provides specific guidance for the development of rainstorm hydrographs to be used in the evaluations of flood events. However, as stated previously, the evaluations of rain-on-snow conditions demonstrate that the rainfall intensities and amounts are not as high as the summer thunderstorms of the same return period. However, the combination of snowmelt causes them to be of greater impact. As a result, it became necessary to complete a frequency analysis on qualifying events based on available historical data.

Data from the Little Bear River gauging station was collected on a daily basis from December through April for the available period of record previously discussed. Additionally, the daily SWE for the Little Bear SNOTEL site was also collected for December through April for its entire period of record. Finally, the weather data including precipitation, temperature, dew point, snow depths, precipitation type, wind speed, and wind direction on a daily and 15 minute or other time step if required basis. All the data was then compared in parallel to determine the following:

1) If there is a precipitation event?
    a. Is it rain or snow? If snow, then it is not a qualifying event.
    b. Is there snow on the ground? If no, then it is not a qualifying rain-on-snow event. Possibly rain-on-frozen ground instead.
    c. Is the temperature above freezing? If no, then it is not qualifying since the areas slightly higher will be snow.
    d. Is there a rise in the flows of the Little Bear River? If not, it is a small localized event and is not qualifying.
    e. Does the SWE at the Little Bear SNOTEL site decrease coinciding with the event? If yes, it reflects a basin wide rain-on-snow event. If all of these conditions are met, this is a qualifying event.

Based on this process, the periods of record were evaluated, and a significant pattern was identified. It was discovered that rain-on-snow events are very common in the watershed and often trigger runoff conditions. A partial duration frequency analysis was then completed on the precipitation data, and a return frequency curve was created. Figure 11 compares the rain-on-snow precipitation to summer rain (NOAA Atlas 14) developed for this watershed

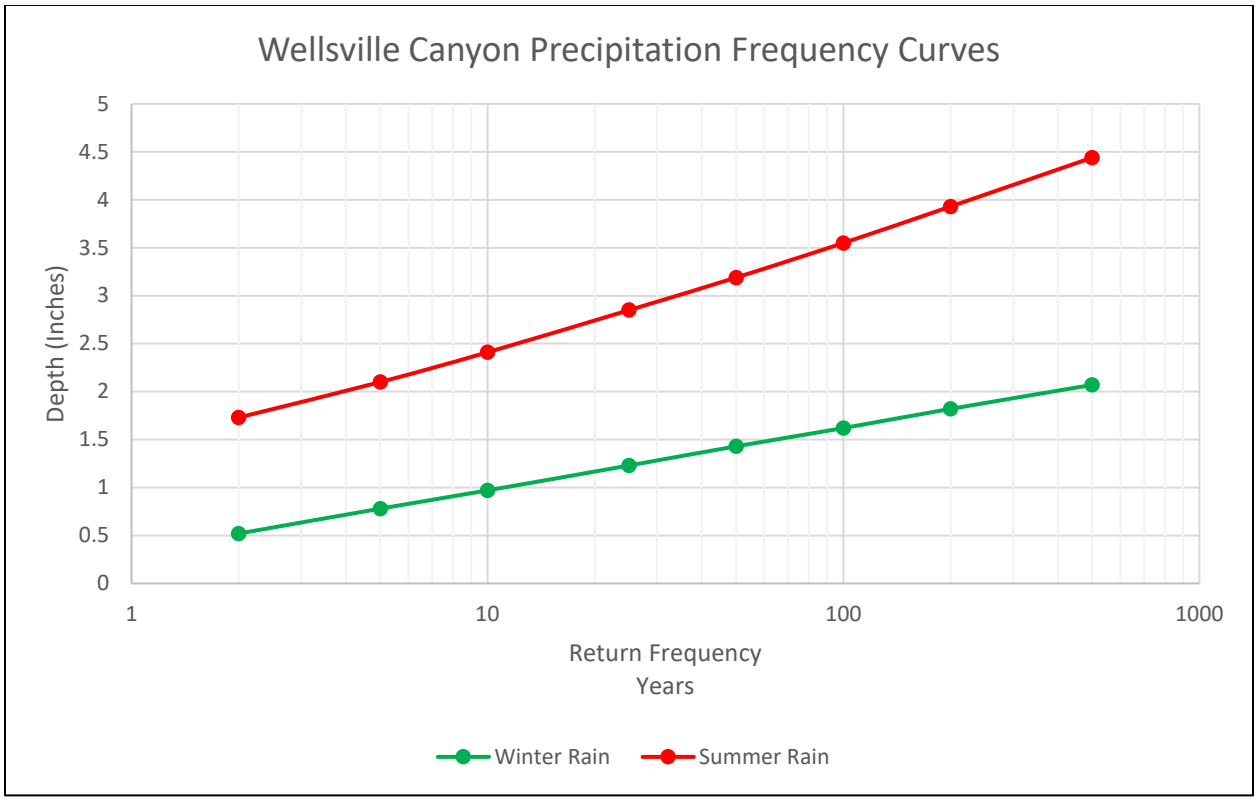


Figure 11: Wellsville Canyon Precipitation Frequency Curves

While wind and temperature are the most sensitive variables in the snowmelt scenario, the Wellsville Canyon Watershed also benefits from the fact that the orthographic shadowing from storms also tends to moderate the variability of winds in significant sustained storms. After discussions with the NRCS State Engineers, it was decided to utilize the 2017 data, which was the most complete, rather than synthesize data for wind and temperatures for each condition to evaluate the rain-on-snow events.

The following key elements were assumed based upon the 2017 storm event starting at hour zero.

- The air temperature in the storm and the dew point temperature follows the pattern in Figure D2.6-9: 2017 Temperatures
- The temperature of the precipitation was assumed to be the same as dew point temperature per the USACE guidance.

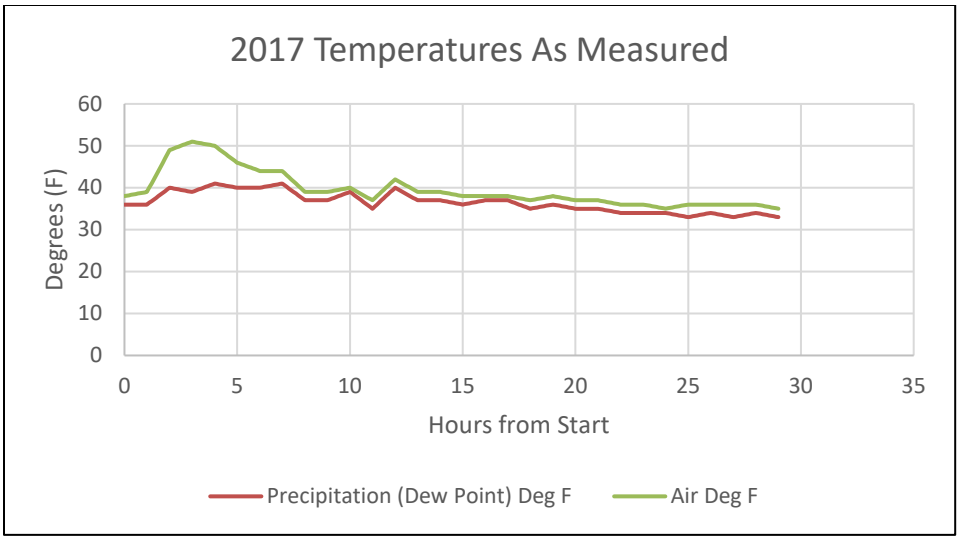


Figure 12: 2017 Temperatures

The wind follows the pattern below, with the wind starting high and then dropping off throughout the storm with gusts and significant fluctuations. While a smooth wind pattern would be aesthetic and could be used for simulation, it was decided to use a representative year for the purposes of this EIS.

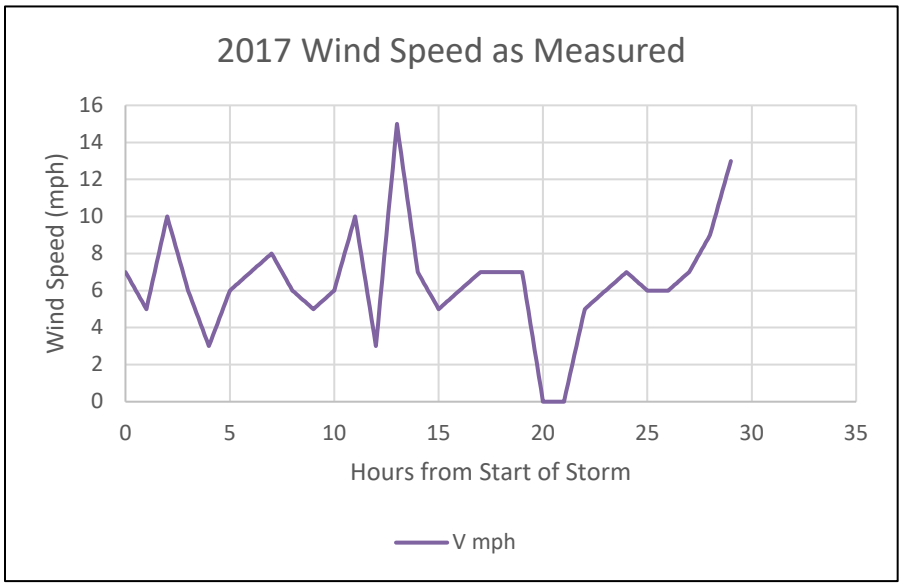


Figure 13: 2017 Wind Speed

Applying the rain-on-snow equations discussed previously, Figure 14 rain-on-snow cumulative water equivalent is generated under each return frequency in comparison with the corresponding NOAA Atlas 14 event. However, now that the available water is defined, it is important to address the factors that affect the amount of runoff potential to determine the controlling events.

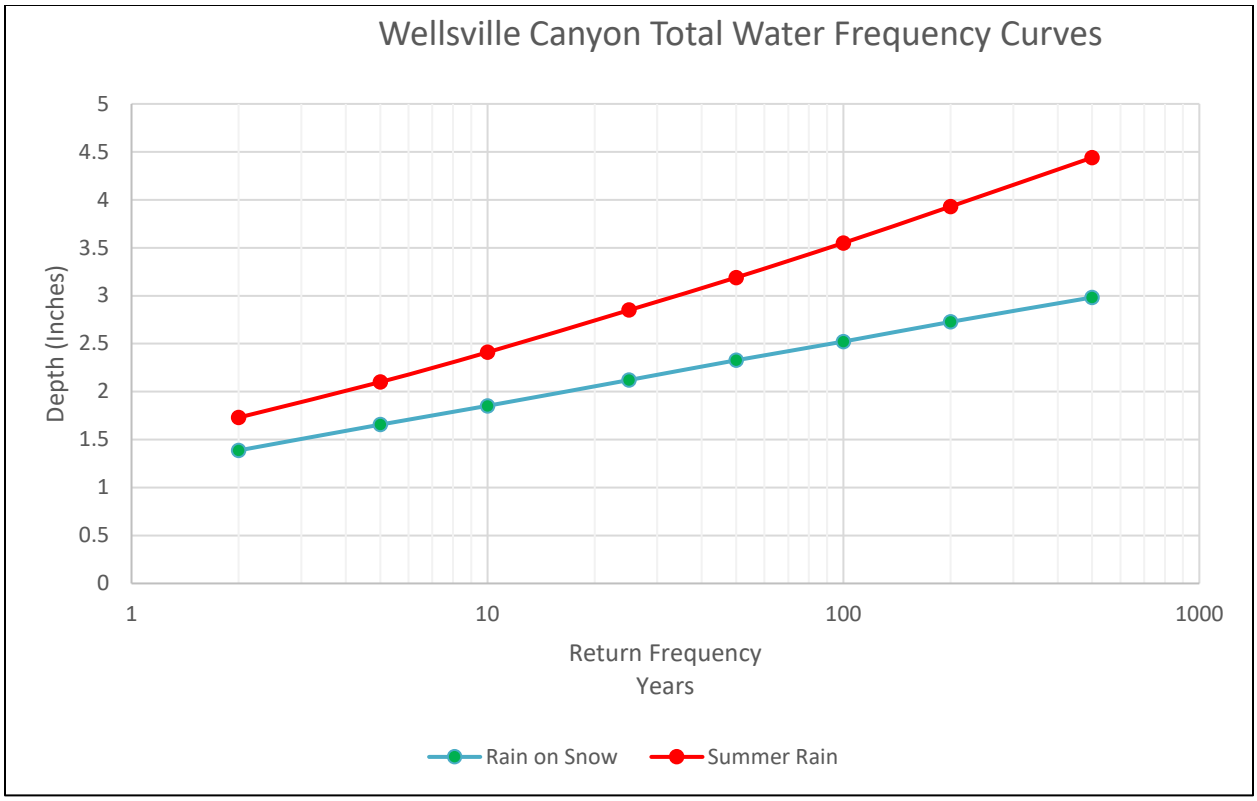


Figure 14: Rain on Snow Cumulative Water vs NOAA Atlas 14 Rainfall

6.7 Areas of Runoff

Under the conditions of the Wellsville Canyon Watershed, runoff is based on the initial abstraction and the conditions of the soils and the vegetative conditions. While these conditions change throughout the season, it is useful to understand the conditions where the direct runoff will be zero. Two scenarios can result in zero direct runoff. First, an elevation where flood generating spring rain-on-snow events changes to snow accumulating events. As stated previously, this elevation is typically about 6,500 feet in elevation, or the same elevation as the Little Bear SNOTEL gauge.

The second condition is an elevation where the predominant vegetative density is so high that it creates an "initial abstraction" in the summer higher than the total precipitation. The initial abstraction for a practical definition includes the water that is captured in the initial infiltration of the soil, caught in the surface depressions, and caught by the leaf canopy prior to having sufficient remaining precipitation to start running off. For the purposes of the Plan-EIS, and a review of the data, the land classification of "wilderness", based on USDA CropScape, consistently at/above elevation 6,500 feet meet this criterion. As a result, it was decided to use the same area of evaluation for both the summer rainfall evaluation and the spring and winter rain-on-snow runoff events since the two conditions would nearly balance each area.

6.8 Soil Conditions Affecting Hydrology

The soil throughout the basin was evaluated using the NRCS WebSoil Survey application. This section summarizes the conditions of the watershed affected by the potential projects.

6.8.1 Soil Classifications

Figure 15 summarizes the soil textures of the project area emphasizing the hydrologic characteristics based on the Web Soil Survey. As shown in the figure, much of the southern part of the project area is lean clay and clayey-silty gravels. However, much of the northern part of the area is lean clay. This soil reflects the difficult conditions associated with infiltration in many of the project areas.

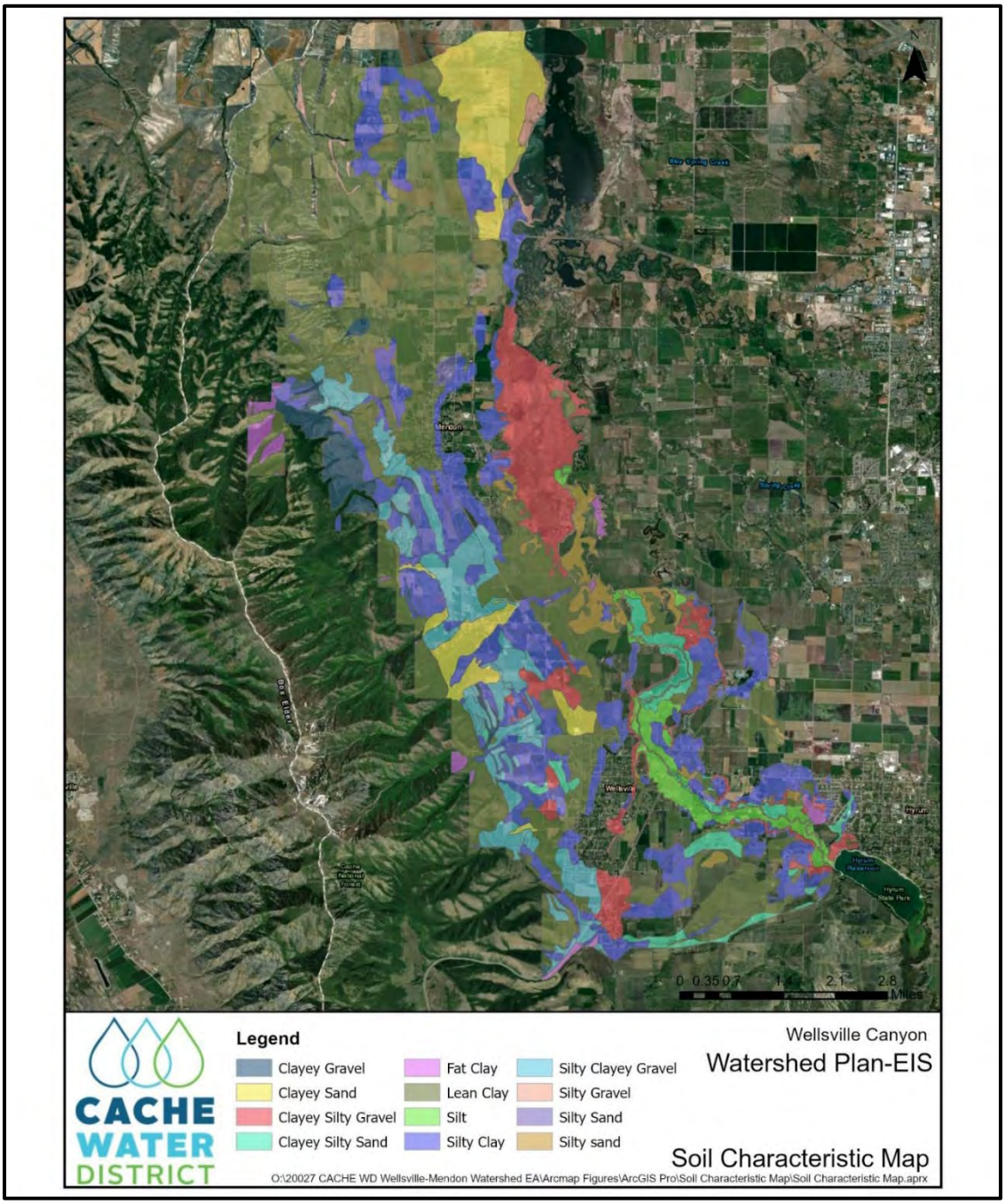


Figure 15: Soil Characteristic Map

6.8.2 Hydrologic Soil Classifications (A-D)

Figure 16 summarizes the hydrologic soil group as defined by TR-55 based on Web Soil Survey. As shown in this figure, the project area is predominantly covered by C soils with a mix of B soils. There are substantial D soils on the eastern side of the project and almost no A soils within the project area. This reflects the conditions of the top 60 inches of soils under normal conditions and is closely related to the soil texture classification. The Group D soils reflect the higher percentage of clay in the soil while the Group A and Group B soils reflect the higher percentages of sand.

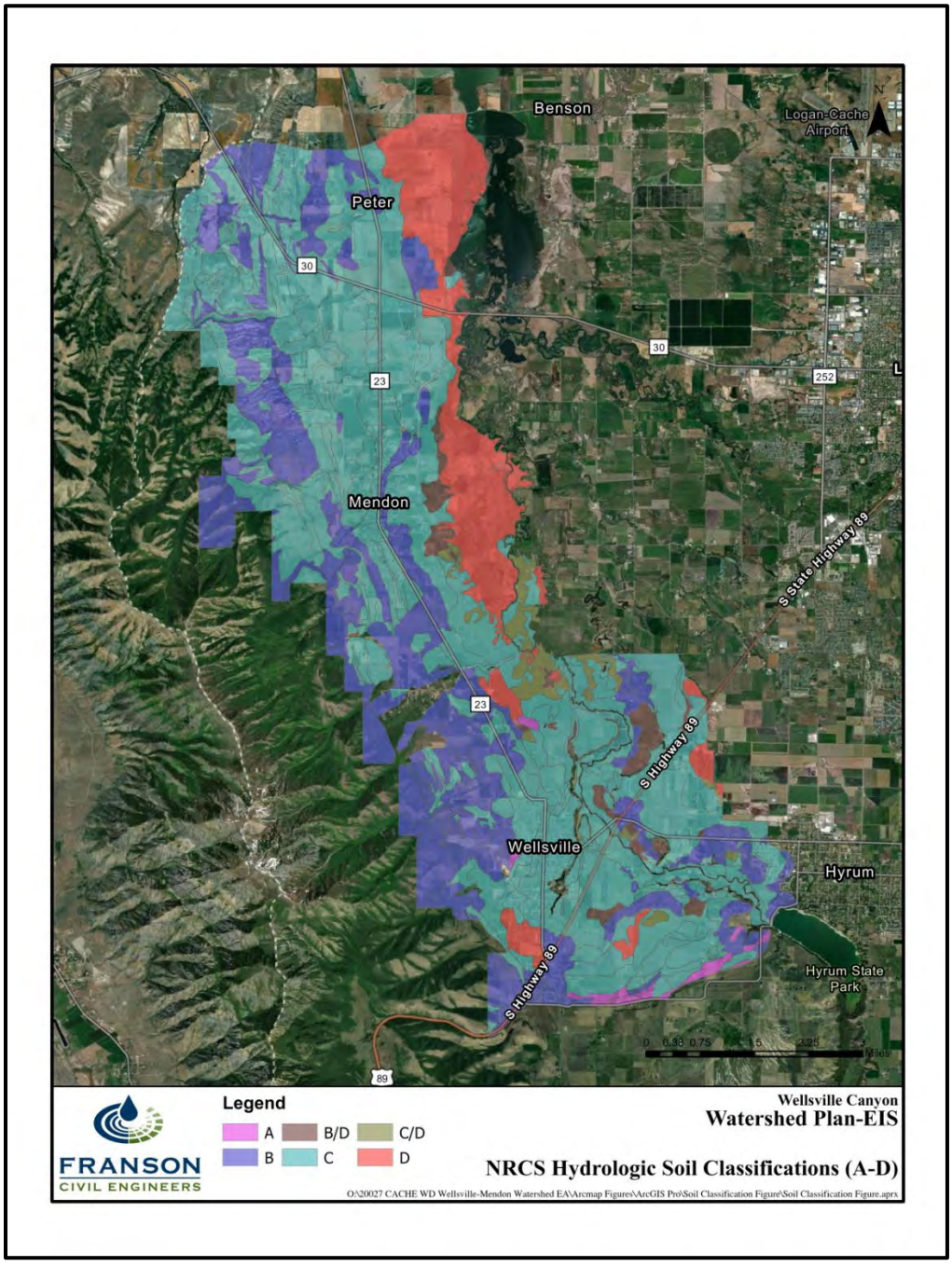


Figure 16: NRCS Hydrologic Soil Classifications (A-D).

6.9 Land Uses Affecting Hydrologic Runoff

Most of the project area identified during scoping is used for agricultural purposes. The primary land uses/cropping patterns, as provided by the USDA National Agricultural Statistics Service, are provided in Table 4 for elevations below 6,500 feet. A detailed map of the 2022 cropping patterns can be referenced in Figure 17. This information is important in evaluating the effects of flooding as well as determining runoff characteristics.

Table 4: Top Land Uses in the Watershed

Crop	Percentage of Project Area
Alfalfa	41.28%
Other Hay/Non-Alfalfa	15.07%
Winter Wheat	07.96%
Grass/Pasture	03.22%
Barley	02.50%
Safflower	02.16%
Spring Wheat	01.50%
Other Crops	01.44%
Non-Agricultural Crops	13.36%
Developed Land	10.46%
Total Agricultural Land	**75.13%**
Total Non-Agricultural Land	**24.87%**
Total Land	**100.00%**

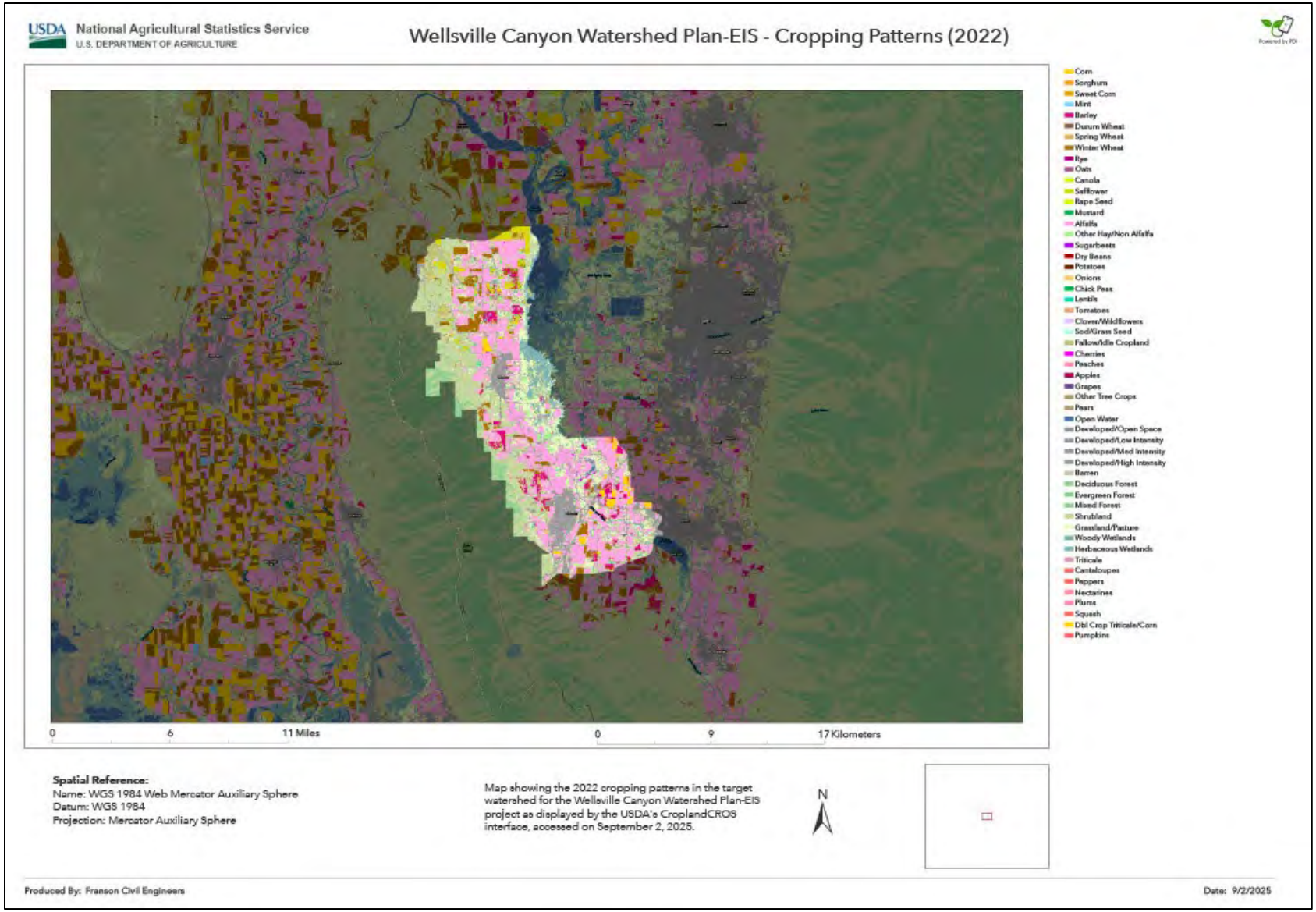


Figure 17: 2022 Cropping Patterns (USDA Cropland CROS)

7 Methodology and Procedures

To evaluate the direct runoff and the flows generated during rain-on-snow and summer monsoon flood events, the methodology defined in the NEH was followed. As discussed previously, two flooding conditions are of concern, the early season rain-on-snow or rain-on-frozen-ground events, and the hot summer monsoon rain events. These two events require a different methodology to evaluate them as discussed in the NEH Part 630.

In accordance with TR 210-60 in the NEH, the NRCS Curve Number method is the preferred method for calculating the direct runoff per TR-55 for high intensity rainfall events associated with monsoon rain events on a regional basis.

However, as stated in the TR-55 technical manual, the Curve Number method does not apply to rain-on-snow or rain-on-frozen-ground events. As a result, it is necessary to calculate the runoff using different methodologies. NEH Part 630 Chapter 11 describes the procedures for calculating the effects of snowmelt on runoff. However, the TR-55 method does not incorporate this methodology directly. It therefore became necessary to evaluate methods to calibrate the assumptions to a known event to determine the appropriate soil runoff conditions for rain-on-snow with frozen ground.

7.1 Curve Numbers for Rain-on-Snow Events

A combination of resources was used to assign curve numbers to each subbasins land use in the models. The Cropland Data Layer from the USDA's National Agricultural Statistics Service was used to determine what probable crop is grown in the different fields that cover most of the watershed. The probable crop was then used to classify the likely ground cover at the time of a rain-on-snow event. Additionally, the Web Soil Survey database was used to assign an appropriate soil group and soil condition related to the soil. An appropriate NRCS curve number was assigned to each ground cover and soil group using the runoff curve number tables in the NEH Part 630 Chapter 9, under normal conditions. These curve numbers are what would be expected for each soil type under a normal summer rainfall condition. This information was then stored in a GIS layer.

Frozen, wet ground in a rain-on-snow event will include a saturated surface that either prevents or retards infiltration. However, lacking published guidance regarding the recommended modifications, it becomes necessary to identify reference conditions that can be used to validate the assumptions. Two major problems quickly became apparent in this project area.

- First, the lack of gauging stations to calibrate, and the numerous variables that affect the runoff conditions, rendered quantitative statistical validation unreasonable.
- Second, due to the time frame of the rain-on-snow events and the extent of cloud cover, aerial imagery and satellite imagery could not be used to calibrate flooding extents.

As a result, detailed interviews with the Wellsville City Irrigation Company water master (Kirt Lindley), Wellsville City Public Works Director (Scott Wells), Mendon City Councilman (John Hardman), and several of the local sponsor representatives allowed a comparison and discussion of where flooding took place, where the canals overtopped, where roads overtopped, and the extents of ponding combined with available photographs taken by local residents during the 2017

floods. Where possible, additional documentation of the event conditions and extents were obtained from the County Emergency Manager as well.

Based upon this effort, three curve number conditions were evaluated, and then modified and updated based on site conditions and field observations.

1. The frozen ground retarded the infiltration by:
    a. Changing all soils to D, assuming nearly no infiltration.
2. The frozen ground partially retarded soils by retarding flows:
    a. A and B to C.
    b. C and D to D.
3. All soils changed by becoming saturated and moved to ARC 3:

The known conditions of temperatures, wind, solar radiation, snow conditions, and precipitation measured at the USU Experiment Farm were used from the 2017 event to model a HEC-RAS rain-on-snow event in the rain-on-grid condition. This type of model eliminates the need for independent calculations and hydraulically routes all of the flows two-dimensionally. The following results are summarized below:

1. Condition 1: Flows were too high. It quickly reflected that this assumption was too extreme and exceeded those flows experienced in 2017.
2. Condition 2: Flows were still too high in the areas where there was significant A and B soils.
3. Condition 3: Fairly representative of the expected conditions, with ponding in the right locations and in similar extents, overflowing the canals in the right locations and approximately similar flow depths, and flow extents at key locations like what was experienced during the 2017 event. Apparent flow rates appeared to be representative of flows experienced at key locations based on interviews with the canal watermaster and City Public Works representatives' identifications of high-water marks.

During the process of calibrating the 2017 storm, it quickly became apparent that the conditions above the Lower Wellsville-Mendon Canal (LWMC) and below the LWMC were not the same. Above the canal, the area was less agriculture-intensive, more subject to alluvial fan flows, had less development, more dry land farming, if farmed, and was likely to either be not grazed or only seasonally grazed.

However, below the LWMC, agriculture and land use was more developed, grazing was more continual and intensive year-round, agricultural practices were irrigated and more intensive. As a result, the curve numbers expected during the summer months, and the winter months are significantly different from each other seasonally and geographically. In response to the differences, corresponding CN's had to be developed to reflect these differences. For comparison of the conditions, the composite CN for above the canal, below the canal, and for the entire basin for both seasons are provided in Table 5. The detailed calibrated CNs are included in the administrative record for reference.

Table 5: Composite Curve Numbers

Composite CNs	Summer Rainfall	Rain on Snow
Above Canal	54.3	64.6
Below Canal	80.9	92.7
Entire Area	62.5	73.2

The rain-on-snow CNs were then used for the 2017 simulation. Figure 18 to Figure 20 help document the extent of the flooding resulting from the 2017 simulated event with discharge flows at several key locations.

8 Existing Floodplains and Required Design Storm

The only existing flooding maps for the project area are those created by the Federal Emergency Management Agency (FEMA). The existing FEMA flood mapping for the watershed is shown in Figure 19. Flooding of homes, businesses, and public facilities and infrastructure are all incorporated in the current floodplain maps.

Based upon the presence of the existing floodplains and life risk, it is required to use the 100-year design storm based on FEMA requirements within the floodplain. Since the Lower Canal collects water from the point of beginning to the point where it spills at Mendon, the 100-year (1%) event will be required for design. North of Mendon, while the canal itself is not in the floodplain, there are floodplains affected by the runoff events, additionally requiring the evaluation of the 100-year event. Ultimately, the PR&G conditions will govern. However, stating the 100-year event is the design event does not state what the criteria clearly will be. For the purposes of this EIS, the design criteria were developed based on the US Bureau of Reclamation's recommendations for the design of small canals. Canals were designed not to overflow in the 100-year return event. To accomplish it, the channel was sized based on:

1) Size for the 50-year return frequency with 1 ft of freeboard.
2) Verify the channel will not overtop in the 100-year event based on the flows generated in the existing conditions incorporating all spills and inflows.

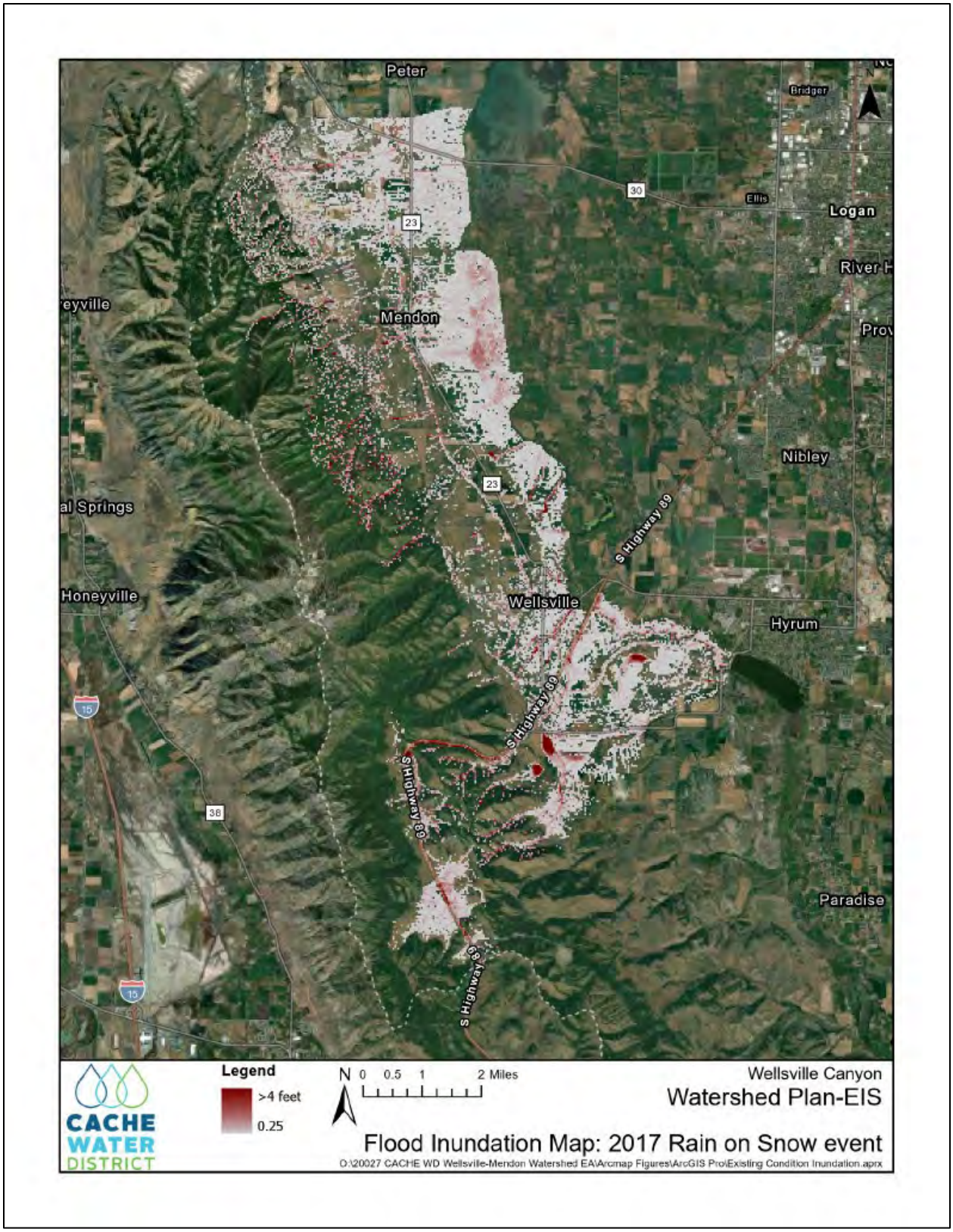


Figure 18: 2017 Rain-on-Snow Flood Event Calibration Map

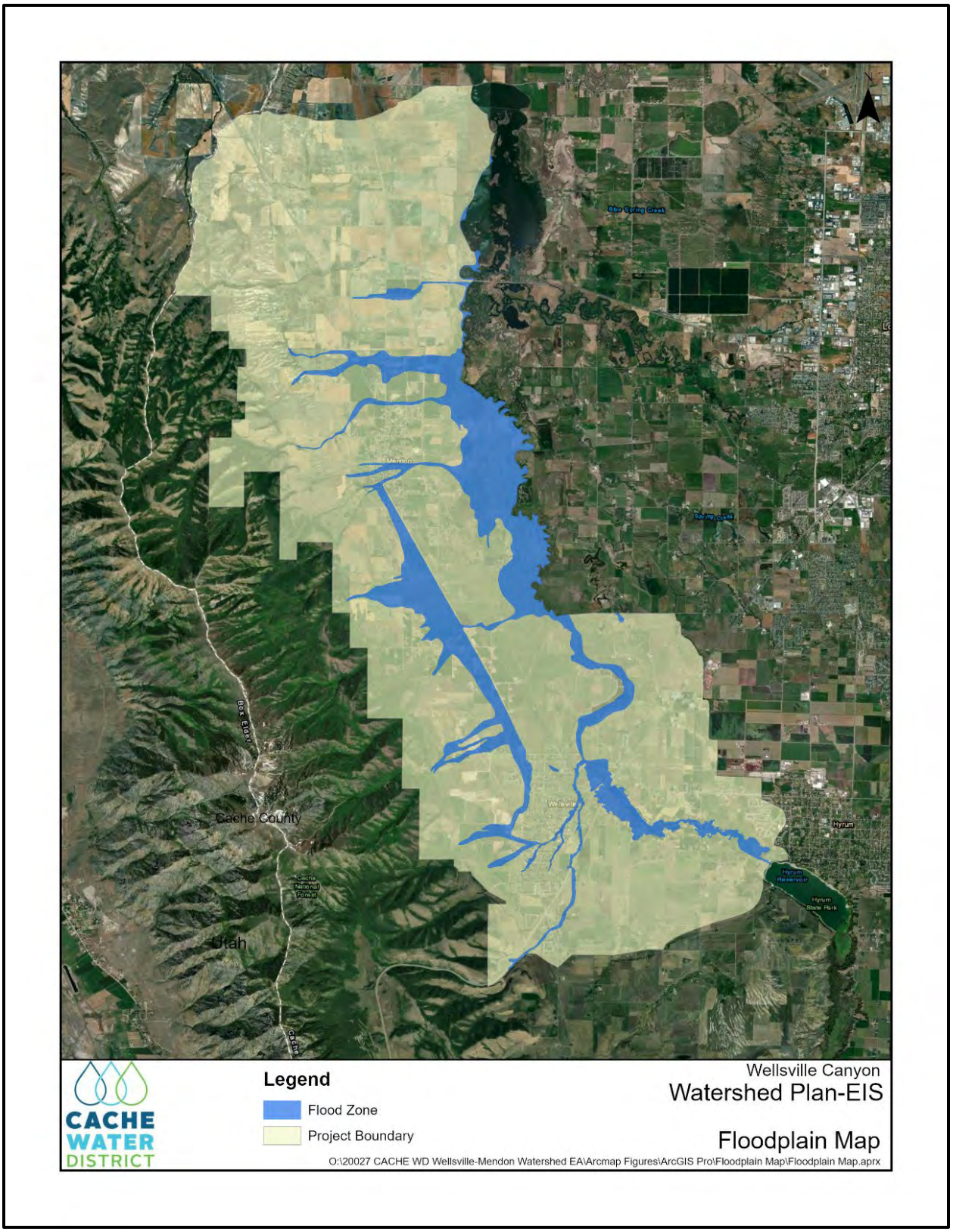


Figure 19: Existing FEMA Floodplains

9.0 Selection of Design Storms

Having calibrated the curve numbers for the rain-on-snow event of 2017, it was still important to determine whether the rain-on-snow or summer thunderstorm event would be the controlling flood event for each of the required flood frequencies. Due to the extreme time and expense of modeling all of the sub-basins, an approach using the direct runoff calculated using the NRCS Curve Number method was selected.

9.1 Calculation of Basin Cumulative Curve Numbers

Calculation of cumulative curve numbers for both rain-on-snow conditions and summer conditions were completed by focusing on all of the project lands above the lower canal where the rain-on-snow events are being generated and flooding the communities to the 6,500 feet elevation contour. Using the methodology described in NEH Part 630 Chapter 10, the composite CN was calculated as using an area weighted average methodology for the rain-on-snow conditions and the summer thunderstorm conditions. These CNs are provided in the following table.

Table 6: Composite Curve Numbers

Condition	Composite CN
Summer	62.5
Rain on Snow	73.2

Detailed summary tables for each are provided in Appendix E for those interested in the details.

9.2 Method of Comparison of Direct Runoff

Direct runoff (in inches) is defined by the following equation in NEH Part 630 Chapter 10, equation 10-9.

$$Q = \frac{(P - Ia)^2}{(P - Ia) + S}$$

Where:

Q = Direct runoff in inches

P = Precipitation in inches

Ia = Initial Abstraction in inches

S = maximum potential retention (Storativity) in inches

In this derivation, Mockus (Mockus, V. 1949) provided an equation for the estimation of total (and peak rates of) surface runoff for individual storms. Mockus assumed the Ia was a function of the maximum retention, S. A common empirical relationship is then provided shown as follows:

$$Ia = \lambda S$$

Where:

Ia = Initial Abstraction in inches

S = maximum potential retention in inches

λ = a dimensionless ratio or proportion of the maximum storage, or storativity. This value is assumed to be 0.2 by the NRCS. Otherwise, all the CN tables are invalid and must be recreated.

Now use the parameter CN as a function of the maximum storage from NEH Part 630 Chapter 10, equation 10-12.

$$CN = \frac{1000}{10 + S}$$

Based on the above equations, the storage is solved in terms of the CN, as is the initial abstraction. With substitution, the direct runoff is solved directly from the CN for each total precipitation event.

Under this process, the total precipitation for the rain-on-snow event is the sum of the rainfall and the snowmelt within the 24-hour period of the event. For the purposes of the peak flood event evaluation, this duration of storm equates to the maximum depth and areal extents of flooding in the Wellsville Canyon project area. Per the directions of the NEH, a 24-hr duration storm is used for the EIS, recognizing that longer events are common for rain-on-snow events. However, it is also recognized that the higher intensities, and greater snowmelt occur within the first 24-hours, making this assumption reasonable.

During the development process, the following conditions have been evaluated as part of the calibration process.

- NOAA Atlas 14 Summer Thunderstorm
- Wellsville Canyon PDF with Spring Rain-on-Snow qualified intensity

Table 7 summarizes the results of this analysis.

Table 7, Direct Runoff Comparisons by Frequency of Event (Inches)

Condition	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr	200-Yr	500-Yr
NOAA Atlas 14 Thunderstorm	0.04	0.12	0.20	0.35	0.49	0.66	0.85	1.13
Wellsville Canyon PDF with Spring Rain on Snow	0.10	0.19	0.26	0.38	0.48	0.59	0.71	0.86

This information was then plotted to help visualize the relationship between each set of assumptions.

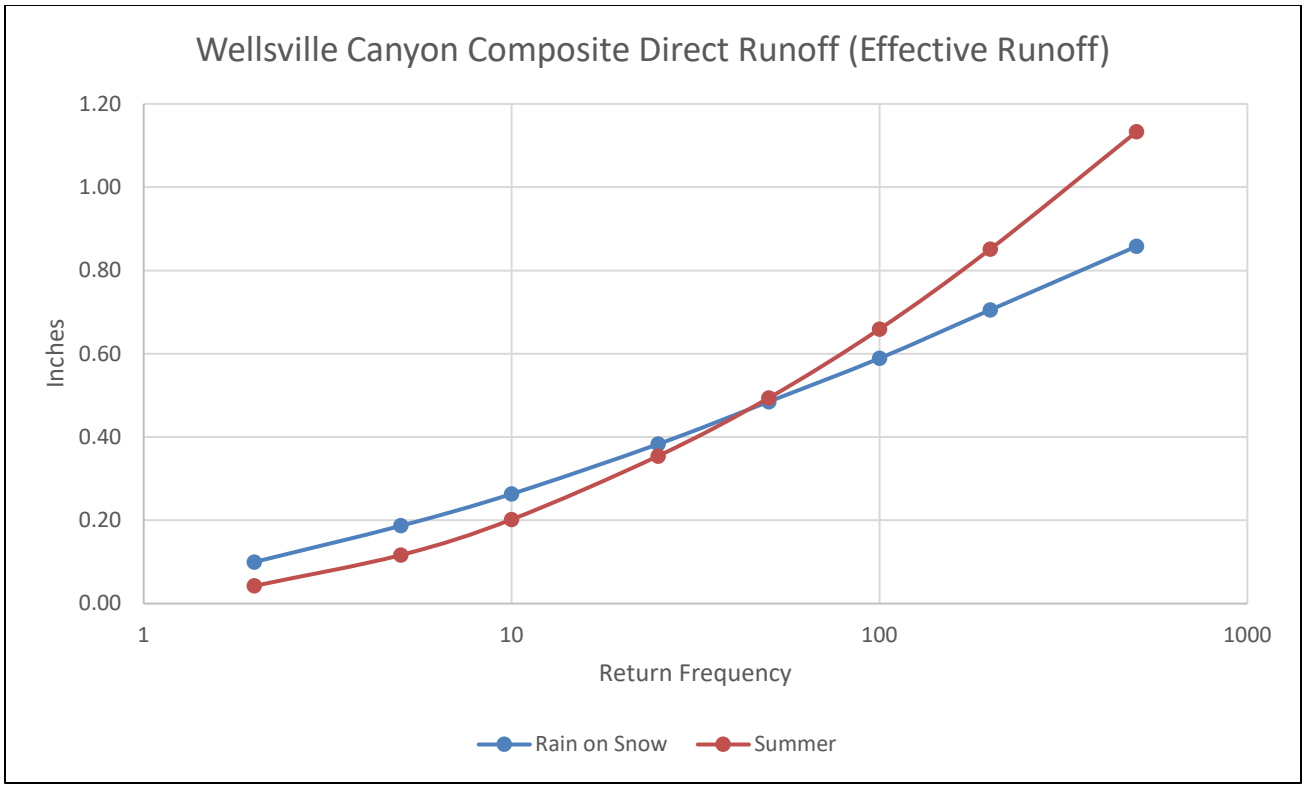


Figure 20: Whole Watershed Direct Runoff Comparison

As can be seen, the direct runoff from the spring rain-on-snow event and the summer thunderstorm are nearly the same in the 50-year event when comparing the whole watershed, with the direct runoff being very similar. To then validate the correct methodology, the 2017 event was compared, which was nearly a 2-year rain-on-snow event. This would have equated to a similar flood event to a 5-yr thunderstorm.

Historical records and communications with canal companies and communities indicate that while flood events have been less frequent in recent drought years, they were more common during the 1980s and 1990s and reoccurred in 2023, as shown in the photo included in this memorandum. The design team also noted that increased development below the canal may shift the controlling storm event, as illustrated in the following figure.

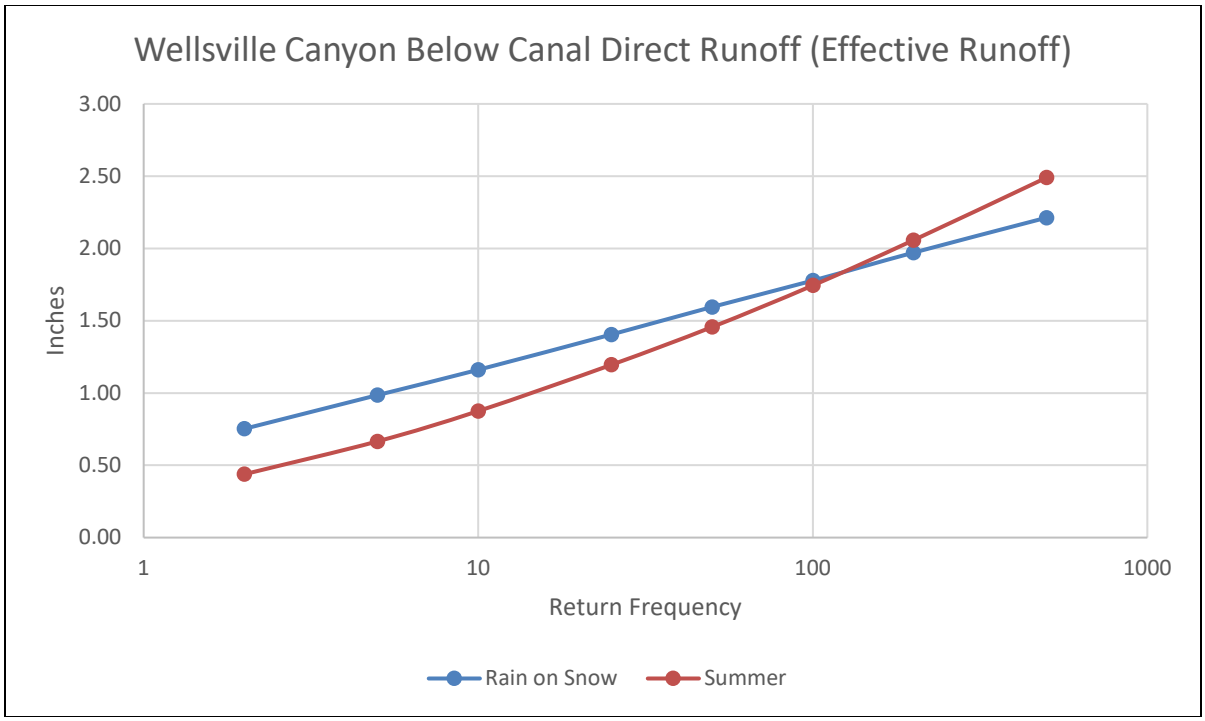


Figure 21: Below Canal Direct Runoff Comparison

The rain-on-snow is the driving condition and is the controlling condition in the spring below the canal, with greater development, out to the 100-year return frequency. These results are a caution to basin agencies, demonstrating that strict enforcement of design criteria to protect the drainage characteristics above the canal will be critical in maintaining the life of any projects that are built.

9.3 Selection of Design Storms

Based on the evaluation above discussion and Figure 23, the following design storms were selected for each frequency condition.

Table 8: Selected Design Storms for Each Frequency Condition

Frequency	Design Storm for Evaluation
2-Year	Rain on Snow
5-Year	Rain on Snow
10-Year	Rain on Snow
25-Year	Rain on Snow
50-Year	NOAA Atlas 14 Thunderstorm
100-Year	NOAA Atlas 14 Thunderstorm
200-Year	NOAA Atlas 14 Thunderstorm
500-Year	NOAA Atlas 14 Thunderstorm

10.0 Mannings Roughness

The last variable, applied after the selection of the design storms, is the surface-roughness coefficient (Manning's n) applied to each vegetative condition in each season. This also varies seasonally and above and below the canal. Additionally, it is not just a simple table number based on channel hydraulics. Two-dimensional models already incorporate some of the roughness conditions by the nature of two-dimensional flow and a complete topographic surface. As a result, some reductions are appropriate. However, due to the shallow flow over the alluvial fans, typically less than 0.2-feet in the Wellsville Canyon Watershed, the actual friction is in the laminar range and is much higher. As a result, sheet flow numbers are more representative. Developing these factors becomes a test of calibration to documented flow depths combined with reference data and experience. However, the resulting challenge comes from the fact that the conditions in snowmelt are reflected in some vegetative types are laid down while others stand up and are resilient. Site visits and field observations immediately following snowmelt and during a rain-on-snow event in 2023 were completed to make observations and qualitative comparisons for estimating roughness based on apparent hydraulic similarities. The resulting coefficients for each landcover type for both above and below the canal are included in the administrative record.

11.0 Conclusion

This memorandum completed the following:

- Identified the hydrologic units (HUCs) used in the Plan-EIS and .
- defined the project area developed through the scoping process.
- Defined the nature of flooding in the project area with historical reference floods and identified the 2017 flood as the calibration flood.
- Defined the characteristics of the Wellsville Canyon Watershed and project area soils, landcover, and runoff characteristics.
- Discusses the available data to evaluate the watershed and project area including the controlling flood events, identifying that rain on snow control some events while summer thunderstorms control others.
- Defined the methodology used based on the available data and NRCS procedures in the National Engineering Handbook (NEH).
- Develops the NOAA Atlas 14 Rainfall hyetographs for summer thunderstorms and the related rain on snow hyetographs controlling flood events in accordance with the NEH.
- Developed the appropriate hydrologic parameters for the model.
- Identify and discuss calibration efforts and details, including methods used to verify the hydrographs.
- Identified controlling precipitation events, calibrated curve numbers, and developed field-based Manning's roughness coefficients for both summer and rain on snow runoff conditions.

Detailed hydrographs for each rainstorm event, on a 6-minute time step, are included in the administrative record for each storm frequency and each runoff basin.

TM003 – Existing Flood Inundation

Technical Memorandum 003 – Existing Flood Inundation

Table of Contents

1.0 Introduction **2**
2.0 Existing Floodplains **3**
2.1 Existing Floodplains 3
3.0 No Action/Future Without Federal Investment (FWOFI) **4**
3.1 Existing (No Action/FWOFI) Alternative Flooding 4
4.0 Proposed Flooding of Alternatives **5**
4.1 Alternative 1, Structural Alternative 5
4.2 Alternative 2, the Non-Structural Alternative 6
5.0 Conclusion **7**
5.1 Summary of Results 7

1.0 Introduction

This technical memorandum has been prepared to summarize the evaluations completed for the flood inundation analysis. As directed by the PR&G and NEH, the evaluation calibrated the flood models as described in TM 002 and used to evaluate the 2, 5, 10, 25, 50, 100, 200, and 500-year events. This memo provides the documentation of the 100-year event comparison. The other events are documented in Appendix C.

2.0 Existing Floodplains

The existing conditions have been evaluated based on calibration developed in TM 002, Hydrology and mapped in Appendix C.

2.1 Existing Floodplains

The existing flood plains in the area are defined by the Federal Emergency Management Agency (FEMA) and published effective on May 9, 2023, are reflected in Figure 1. These are the areas identified by FEMA as being included in the 1 % floodplain. This FEMA floodplain does not include base flood elevations or detailed evaluations.

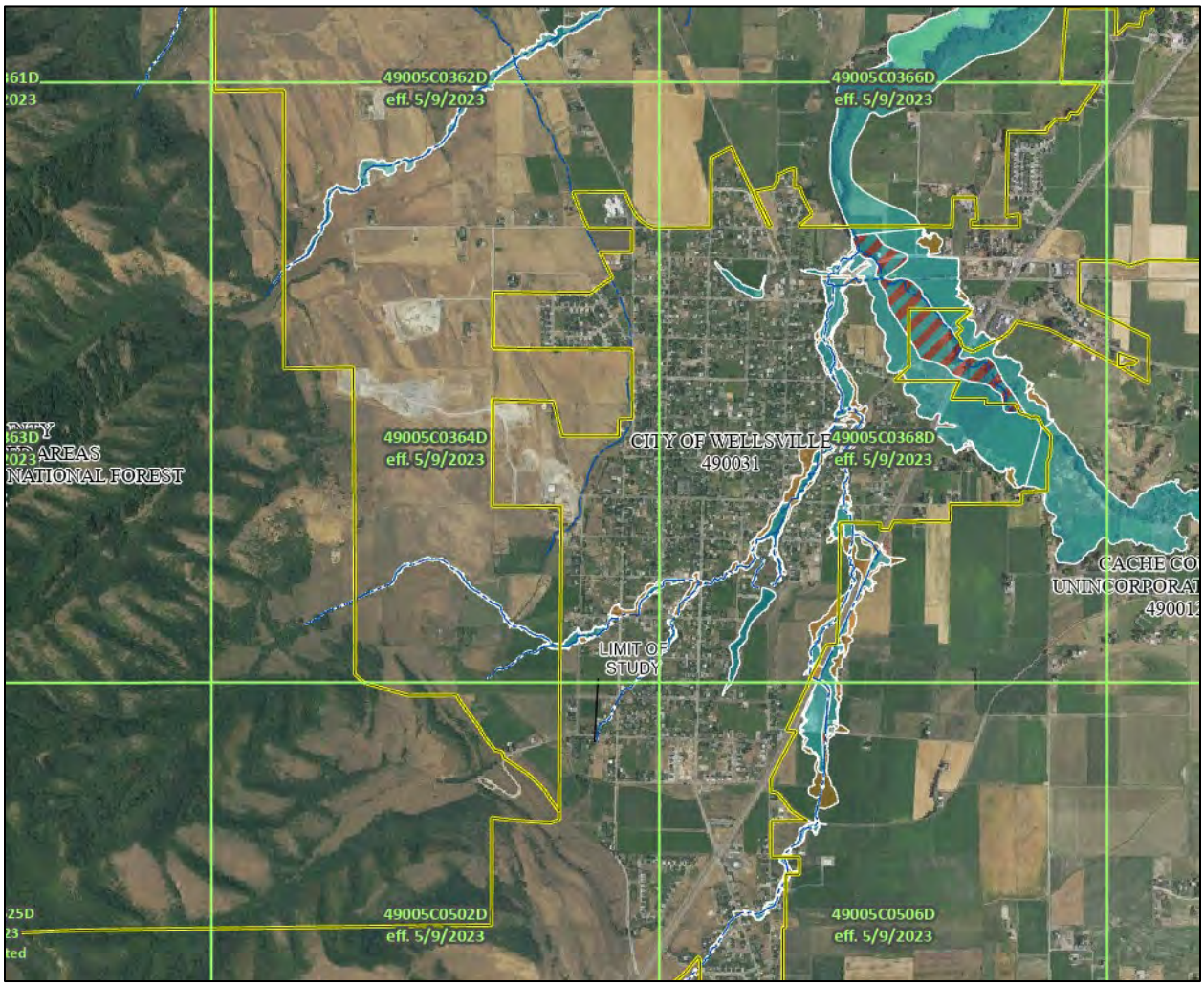


Figure 1: Existing Flood Plain (2023 Effective)

3.0 No Action/Future Without Federal Investment (FWOFI)

3.1 Existing (No Action/FWOFI) Alternative Flooding

The existing conditions are defined as what happens if no federal action occurs. As described in TM 002, the controlling flood condition is controlled by the NOAA Altas 14 summer 1% (100-year) 24-hour thunderstorm. The extents of flooding under these conditions do not match the conditions of the FEMA 100-year flood plain map which does not address the alluvial fan nature of the flows in this area nor the effects of the canals cross-slope. As a result, these maps more accurately address the true flooding expected in the 1% chance flood condition. The FWOFI 1% flood conditions are shown in Figure 2.

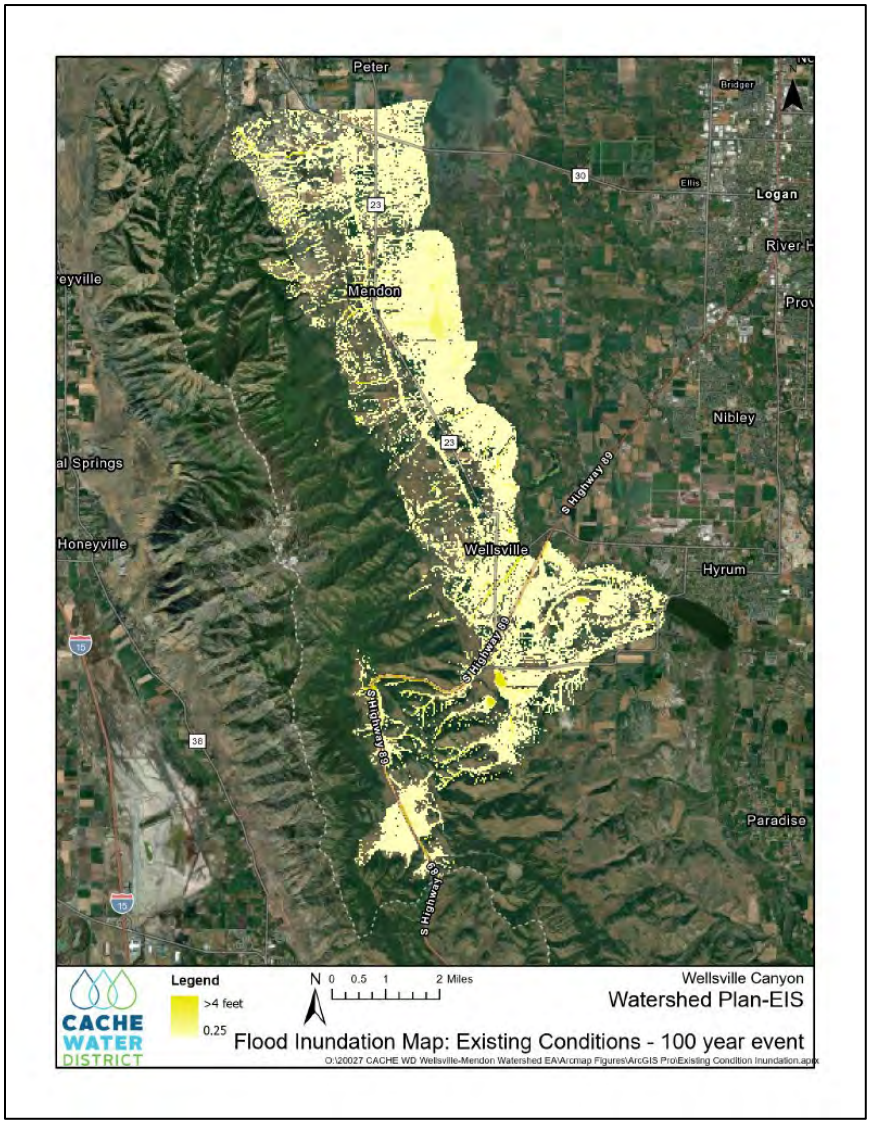


Figure 2: Existing Conditions Map 100-Year Event

4.0 Proposed Flooding of Alternatives

4.1 Alternative 1, Structural Alternative

Alternative 1 includes improving the canal to carry the flood flows through much of the areas from the head of the Lower Wellsville-Mendon Canal to the siphon crossing Bird Canyon in Mendon. Additionally, piped systems were provided to collect flood flows and carry them east and north of the communities to the Little Bear River. The effects of the canal improvements and piped collection system are reflected in the inundation mapping of the 1% chance event are shown in Figure 3.

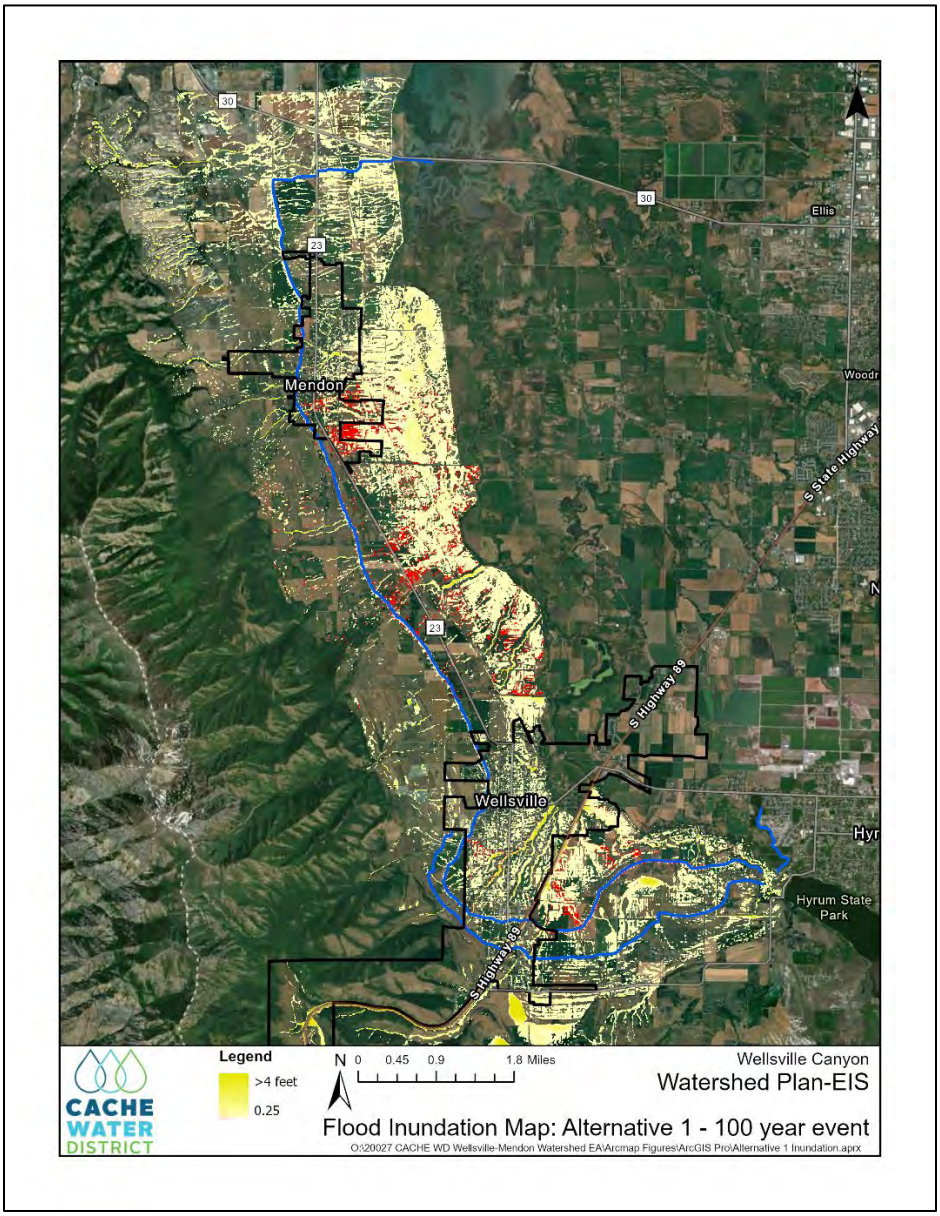


Figure 3: Alternative 1 100-Year Event

4.2 Alternative 2, the Non-Structural Alternative

Alternative 2 includes improving the canal to carry the flood flows through the canal, lined to deliver irrigation water and reduce seepage losses and improve operational efficiency. As a result, the improved canal will carry more flood flows than existing. However, it will not carry all the flood flows. Additionally, the flood flows will still spill over the edges of the canal in flood events, leading to flooding of homes and property. This alternative would particularly focus on flooding in Mendon, where the Structural Alternative provides the greatest improvements. The effects of this alternative are reflected in the inundation mapping of the 1% chance event are shown in Figure 4.

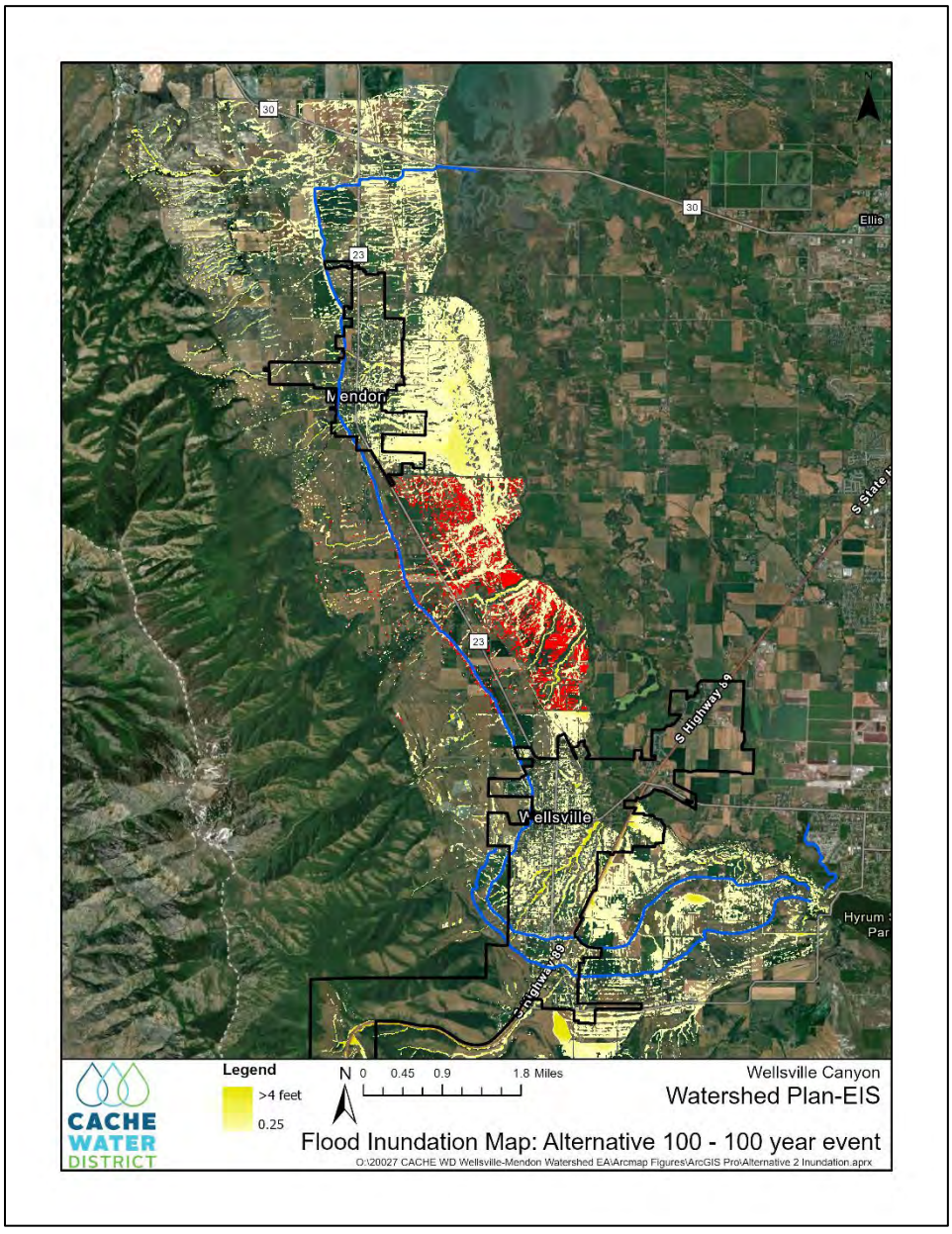


Figure 4: Alternative 2 100-Year Event

5.0 Conclusion

5.1 Summary of Results

As can be seen, the flooding impacts evaluated using models calibrated based on flooding in 2017 have been developed for each condition. The resulting flood impacts for the 1% event were evaluated for the existing condition (FWOFI), proposed structural alternative and non-structural alternative.

The comparison of each of the events for the 2, 5, 10, 25, 50, 200, and 500-year event were evaluated and are included in Appendix C of the Plan-EIS. The 100-Year event maps are also included/compared in Appendix B of the Plan-EIS.

TM004 – Design Criteria

Technical Memorandum 004 – Design Criteria

Table of Contents

1.0 Introduction 1

2.0 Design Criteria 3

2.1 Cache County Floodplain Development Permit 3
2.2 Cache County Manual of Roadway Design & Construction Standards (2021) 3
2.3 Cache Valley Storm Water Design Standards (2017) 3
2.4 FEMA CLOMR and LOMR 3
2.5 Mendon City Design Standards 3
2.6 Wellsville City Design Standards 4
2.7 NRCS Critical Area Planting (Code 342) 4
2.8 NRCS Dust Control on Unpaved Roads and Surfaces (Code 373) 4
2.9 NRCS Irrigation Pipeline (Code 430) 4
2.10 NRCS Irrigation Reservoir (Code 436) 4
2.11 NRCS Access Control (Code 472) 4
2.12 NRCS Pumping Plant (Code 533) 4
2.13 NRCS Access Road (Code 560) 5
2.14 Stormwater Runoff Control (Code 570) 5
2.15 NRCS Open Channel (Code 582) 5
2.16 NRCS Structure for Water Control (Code 587) 5
2.17 NRCS National Engineering Handbook (NEH) 5
2.18 NRCS National Engineering Manual (NEM) 5
2.19 Pollutant Discharge Elimination System General Construction Permit 6
2.20 UDOT Drainage Standards and Specifications 6
2.21 UDOT Roadway Standards and Specifications 6
2.22 Union Pacific Railroad 6
2.23 Utah Division of Water Rights Dam Safety Rules 6
2.24 Utah Chapter of APWA 2017 Standards and Specifications 7
2.25 Utah DWQ TMDL for Cutler Reservoir 7
2.26 Utah DWQ TMDL for Little Bear River 7
2.27 Utah Pollutant Discharge Elimination System MS4 Permit (UTR090000) 7

3.0 References 8

1.0 Introduction

The U.S. Department of Agriculture Natural Resources Conservation Service (NRCS) and Cache Water District—the project sponsor—have initiated a Watershed Plan Environmental Impact Statement (Plan-EIS) of the Wellsville Canyon Watershed in Cache County, Utah. The project includes:

- evaluating how to reduce flooding in the cities of Wellsville, Mendon, and the surrounding agricultural lands that are within the Wellsville Canyon Watershed,
- evaluating agricultural water management alternatives to conserve water,
- evaluating secondary irrigation water management alternatives in Wellsville and Mendon to conserve water,
- reducing maintenance issues, and
- improving public recreation opportunities.

The proposed solutions to mitigate these concerns involve:

- installation of diversion structures to prevent overtopping of canals during flooding,
- rehabilitation of several existing culverts to restore channel capacity,
- installation of pressurized irrigation systems in Wellsville and Mendon,
- piping the Lower Canal and portions of Wellsville East Field Canal
- construction of irrigation reservoir(s), and
- installation of a ramp for launching non-motorized watercraft on Wellsville Reservoir.

This technical memorandum identifies the design criteria to meet NRCS and other applicable design requirements and standards. The irrigation companies included in the project did not have any standards or requirements above and beyond the city and county that the canals are in. The feasibility of addressing flood control, irrigation, and recreation elements of this project were evaluated and a list of design criteria relating to these elements is presented.

Table 1 summarizes the applicable design standards upon which the 30% design for the project is based and identifies the future final design standards.

Table 1: Design Criteria Utilized for Each Project Element

Design Criteria & Practice Standards	Flood Control	Irrigation	Recreation
Cache County Floodplain Development Permit	X	X	
Cache County Manual of Roadway Design & Construction Standards (2021)	X	X	
Cache Valley Storm Water Design Standards (2017)	X	X	X
FEMA CLOMR and LOMR	X	X	X
Mendon City Design Standards	X	X	

Design Criteria & Practice Standards	Flood Control	Irrigation	Recreation
Wellsville City Design Standards	X	X	X
NRCS Critical Area Planting (Code 342)	X	X	X
NRCS Dust Control on Unpaved Roads and Surfaces (Code 373)	X	X	X
NRCS Irrigation Pipeline (Code 430)		X	
NRCS Irrigation Reservoir (Code 436)		X	
NRCS Access Control (Code 472)	X	X	
NRCS Pumping Plant (Code 533)		X	
NRCS Drainage Water Management (Code 554)	X		
NRCS Access Road (Code 560)		X	X
NRCS Recreation Area Improvement (Code 562)			X
NRCS Recreation Land Grading and Shaping (Code 566)			X
NRCS Stormwater Runoff Control (Code 570)	X	X	X
NRCS Open Channel (Code 582)	X		
NRCS Structure for Water Control (Code 587)	X	X	
NRCS National Engineering Handbook (NEH)	X	X	X
NRCS National Engineering Manual (NEM)	X	X	X
Pollution Discharge Elimination General Construction Permit	X	X	X
Union Pacific Railroad	X		
UDOT Drainage Standards and Specifications	X	X	
UDOT Roadway Standards and Specifications	X	X	
Utah Chapter of APWA 2017 Standards and Specifications	X	X	
Utah Division of Water Rights Dam Safety Rules	X	X	
Utah DWQ TMDL for Cutler Reservoir	X	X	
Utah DWQ TMDL for Little Bear River	X	X	
Utah Pollutant Discharge Elimination System MS4 Permit	X	X	X

2.0 Design Criteria

2.1 Cache County Floodplain Development Permit

The Cache County Floodplain Development permit requires any structure within a special flood hazard area to provide flood protection up to the 100-year base flood elevation (FEMA Flood Zone A). Cache County also requires that any channels or culverts be designed for the 50-year storm when they are not in the floodplain. (2021 Cache County; Section 4.5). This design criteria will also be required for projects in Wellsville and Mendon.

2.2 Cache County Manual of Roadway Design & Construction Standards (2021)

Any proposed project will need to be designed to meet the requirements set forth by APWA standards and specifications and county code. All designs will need to be coordinated with Cache County Road Department and the Cache County Engineer.

2.3 Cache Valley Storm Water Design Standards (2017)

The Cache Valley Storm Water Design Standards provide design criteria for onsite storm water quality and collection or infiltration. The document provides hydrologic methodology for modeling and sizing of culverts and catch basins in Cache County. The culverts and catch basins would be sized based on this design criteria. The project proposes a recreational access on Wellsville Reservoir that would be designed incorporating storm water concerns. The Cache Valley Storm Water Design Standards would be used throughout the project watershed area where they apply.

2.4 FEMA CLOMR and LOMR

A conditional letter of map revision and a letter of map revision will be required for any projects completed within a FEMA floodplain. Projects in the floodplain will need to be designed to the 100-year storm event. The flooding for the 5-, 10-, 25-, 50-, 100-, 200-, and 500-year events will need to be mapped and compared to the pre-project and post-project conditions and provided to FEMA with the supporting documentation before any construction can begin. Following construction, an as-built submittal mapping, with the appropriate documentation will also be required.

2.5 Mendon City Design Standards

Mendon City’s design standards provide minimum standards for trenching through and placement of pressure irrigation lines and valves in Mendon City rights-of-way. The minimum standards for thrust blocking are also provided. A pressurized irrigation system is proposed for Mendon City as well as flood water management within city limits. These project areas are within Mendon City rights-of-way. The appropriate design standards would be applied to that work.

2.6 Wellsville City Design Standards

The Wellsville City design standards and construction specifications provide minimum standards for boring and trenching within Wellsville City rights-of-way. They also provide minimum standards thrust blocking, pressure pipe restraining, and for culvert compaction and backfill. A pressurized irrigation system is proposed for Wellsville City which will result in work within the city rights-of-way. Flood water management structures within city limits include culvert improvements.

2.7 NRCS Critical Area Planting (Code 342)

NRCS Code 342 design criteria applies to highly disturbed areas like construction areas, conservation practice construction sites, eroded banks of natural channels, or other areas degraded by human activities. Code 342 would be applied in project areas where permanent vegetation is needed but cannot be achieved with normal seeding/planting methods.

2.8 NRCS Dust Control on Unpaved Roads and Surfaces (Code 373)

NRCS Code 373 provides the minimum design criteria for controlling direct particulate matter emissions that result from vehicle and machinery traffic or wind by applying a palliative on the surface of concern. Within the project area there are unpaved roads and surfaces, including those that would be created using Code 560. Construction on and near these unpaved surfaces would require following Code 373.

2.9 NRCS Irrigation Pipeline (Code 430)

NRCS Code 430 provides the minimum design criteria for water conveyance pipelines. The project proposes installation of pressurized irrigation systems within Wellsville and Mendon.

2.10 NRCS Irrigation Reservoir (Code 436)

NRCS Code 436 provides the minimum design criteria for an irrigation water storage structure. An irrigation storage reservoir is proposed on the west side of Wellsville City and above the cemetery in Mendon City. The proposed reservoirs should be less than 20 acre-feet.

2.11 NRCS Access Control (Code 472)

NRCS Code 472 provides minimum requirements for implementing temporary or permanent access control measures to an area. The project would require access control measures for pipeline maintenance roads and pump station locations.

2.12 NRCS Pumping Plant (Code 533)

NRCS Code 533 provides the minimum design criteria for a facility that delivers water for irrigation. There is a proposed pumping facility to either provide water to an irrigation reservoir

west of Wellsville City or to provide irrigation water directly to a pressurized irrigation pipeline in both the Wellsville and Mendon systems.

2.13 NRCS Access Road (Code 560)

NRCS Code 560 provides the minimum design criteria for the construction of access roads for equipment and vehicles. Access roads would need to be designed to allow for access to construct and maintain the irrigation pipelines and the irrigation pump stations.

2.14 Stormwater Runoff Control (Code 570)

NRCS Code 570 provides design criteria for controlling erosion, sedimentation, and quantity/quality of stormwater leaving developing or developed sites during and following construction activities. Any area where construction activities occur during the project would consider Code 570.

2.15 NRCS Open Channel (Code 582)

NRCS Code 582 provides the minimum design criteria for improvement, construction, and restoration of open channels (NRCS 2015). The project would evaluate possible improvements on the open drainage channels for flood water management. Code 582 would be used where applicable.

2.16 NRCS Structure for Water Control (Code 587)

NRCS Code 587 provides the minimum design criteria for water management systems that control the stage, discharge, distribution, delivery, or direction of water flow. The project includes several culvert replacements (increased hydraulic capacity) and structures in the Wellsville-Mendon Canal to divert water into natural drainages for irrigation water management. These water control structures would be designed in accordance with NRCS Code 587 (NRCS 2014).

2.17 NRCS National Engineering Handbook (NEH)

The National Engineering Handbook (NEH) provides design criteria for a number of different engineering applications. Design criteria applicable to irrigation, drainage, flood prevention and protection, and hydrologic modeling and design are included in the specific design criteria for the project.

2.18 NRCS National Engineering Manual (NEM)

The National Engineering Manual (NEM, NRCS 2017) provides design policies for several different engineering applications. Design policies applicable to irrigation, drainage, flood prevention and protection, and hydrology modeling and design are included in the specific design criteria for the project.

2.19 Pollutant Discharge Elimination System General Construction Permit

Construction would occur in the state of Utah. Utah has the Utah Pollutant Discharge Elimination System (UPDES) which develops permits authorizing effluent discharges and provides criteria and standards for stormwater discharges. A Stormwater Pollution Prevention Plan (SWPPP) following the criteria and standards provided by the state would be developed before project construction. This program is given precedence by EPA over the National Pollutant Discharge Elimination System (NPDES) under the General Construction Permit UTRC00000 effective July 8, 2020. This permit is scheduled for renewal in 2025 by the Utah Division of Water Quality.

2.20 UDOT Drainage Standards and Specifications

Utah Department of Transportation (UDOT) has provided this technical reference as a guide to designing drainage structures and components in areas of UDOT jurisdiction. Design criteria pertaining to this project would be utilized on all UDOT drainage structures along with applicable NRCS and other design standards. Due to the critical nature of roads within the project area for emergency vehicle access, the UDOT design frequency storm for arterial and collector roadways would be used for all culverts and flood control pipelines in the project area of interest. The frequency specified for these types of roadways is a 25-year storm event (p. 8-2).

2.21 UDOT Roadway Standards and Specifications

Utah Department of Transportation (UDOT) has provided these technical requirements to design roadway crossings and components in areas of UDOT jurisdiction. Design criteria pertaining to this project would be utilized on all UDOT roadways along with applicable NRCS and other design standards.

2.22 Union Pacific Railroad

Union Pacific Railroad has design criteria for clearance, sizing, and other aspects of utility crossings under railroad tracks. Union Pacific has tracks that run parallel on the west side to the Little Bear River, therefore most of the drainage must cross under the railroad tracks before it can reach the river. Union Pacific design criteria would be used anywhere that the project improves drainage under the Union Pacific Railroad.

2.23 Utah Division of Water Rights Dam Safety Rules

The Utah Division of Water Rights dam safety program ensures that plans for new dams and enlargement, alteration, or repair of existing dams meet the design criteria and standards enumerated in the Utah Office of Administrative Rules as R655-10, R655-11, and R655-12. These rules are established under the authority of Utah Code Title 73, Chapter 5a.

- Rule R655-10 provides the criteria for how water impounding structures are classified, approval procedures, and reviews.

- Rule R655-11 provides the criteria for the design and construction of water impounding structures.
- Rule R655-12 provides criteria for initial filling, operation, and maintenance of a reservoir.

Most of the criteria in these three rules applies to water impoundments of 20 acre-feet or more. The proposed reservoir(s) for the project are expected to be less than 20 acre-feet and all applicable Dam Safety criteria will be followed.

2.24 Utah Chapter of APWA 2017 Standards and Specifications

The American Public Works Association (APWA) 2017 standards and specifications would be used to provide the technical requirements to design roadway crossings and components in areas of Cache County, Mendon, and Wellsville jurisdictions. Design criteria pertaining to this project would be utilized on all roadways along with applicable NRCS and other design standards.

2.25 Utah DWQ TMDL for Cutler Reservoir

The Utah Division of Water Quality's (UDWQ) Total Maximum Daily Load (TMDL) for Cutler Reservoir establishes the loading limits and requirements for total phosphorus and dissolved oxygen. Canal return flow and drainage ditch flow ultimately ends up flowing to Cutler Reservoir. The project would consider and control for total phosphorus and dissolved oxygen limits.

2.26 Utah DWQ TMDL for Little Bear River

The UDWQ's TMDL for the Little Bear River establishes the loading limits and requirements for total phosphorus and dissolved oxygen. The Little Bear River is split into two sections: the portion above Hyrum Reservoir and the portion above Cutler Reservoir up to Hyrum Reservoir. The proposed project would address the total phosphorus TMDL requirements for the portion of the Little Bear River that drains to the portion above Cutler Reservoir.

2.27 Utah Pollutant Discharge Elimination System MS4 Permit (UTR090000)

The Utah Pollutant Discharge Elimination System's (UPDES) MS4 Permit provides criteria and standards for municipal separate storm sewer systems including requirements for each municipal storm water system to implement standards for best management practices for construction, post construction, and monitoring during construction. Work would be done in Utah so these standards would be applied where applicable.

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TM005 – Canal Transmission Losses

Technical Memorandum 005 – Canal Transmission Losses

Table of Contents

1.0 Introduction 1

2.0 Seepage Measurement Methodology 1

3.0 Seepage Losses 5

3.1 Wellsville-Mendon Lower Canal 5
3.2 Wellsville Eastfield Canal 8
3.3 Wellsville City Irrigation 9
3.4 Mendon Irrigation Companies 11

4.0 Other Losses Not Accounted For in Savings or Calculations 12

4.1 Non-Point Returns 12
4.2 Other Point Return Spills 12

5.0 Summary of Total Water Savings 13

6.0 References 14

Figures

Figure 1: Map of Wellsville-Mendon Lower Canal Flow Measurement Sites 2
Figure 2: Maps of Wellsville-Mendon Lower Canal Flow Measurement Sites 3
Figure 3: Maps of Wellsville Eastfield Canal Flow Measurements 4

Tables

Table 1: Wellsville-Mendon Lower Canal Diversions 5
Table 2: Summary of 2022 Wellsville-Mendon Flow Measurements 6
Table 3: Summary of 2022 Wellsville-Mendon Flow Measurements 7
Table 4: Summary of 2019 Wellsville-Mendon Flow Measurements 7
Table 5: Wellsville-Mendon Loss Summary 8
Table 6: Wellsville Eastfield Canal Diversions 8
Table 8: Wellsville Eastfield Loss Summary 9
Table 9: Summary of 2023 Wellsville Eastfield Canal Flow Measurements 9
Table 10: Summary of Mendon Water Losses 11
Table 11: Water Saving Summary 13

1.0 Introduction

Wellsville-Mendon Conservation District (WMCD) and Wellsville East Field Irrigation & Canal Company (Wellsville East Field) are canal companies that provide water to agricultural users in the Wellsville and Mendon areas within Cache County, Utah. Both canal companies use earthen canals to convey water to their shareholders.

A significant amount of water is lost to seepage through the earthen canals; however, there are no documented studies quantifying these losses. The purpose of this Technical Memo is to describe seepage loss studies carried out by Franson Civil Engineers (FCE) as part of the watershed planning process.

2.0 Seepage Measurement Methodology

This memo includes data from seepage studies performed on four separate occasions. The first occurred on April 7, 2019, the second on September 7-8, 2022, the third on September 14, 2022, and the fourth on September 25, 2023. The first three seepage studies were performed on the WMCD Lower Canal, the fourth was performed on the Wellsville East Field Canal.

Dates were selected during the irrigation season to maintain appropriate temporal representation. A Global Water Flow Probe was used to measure velocity and depth at several locations along the canal. Channel width was measured using an engineer's tape measure. See Figure 1 and Figure 2 for a map of the measurement locations on the WMCD's Lower Canal. Figure 3 is a map of the measurement locations on the Wellsville East Field's canal.

Measurement locations were selected by several criteria, including uniform flow, rectangular cross-sections, and perpendicular flow. These characteristics allowed optimum performance of the measurement tools used. Velocity and depth measurements were recorded, and the discharges were calculated using the midsection method (USBR Water Measurement Manual, 2001) and partially full pipe calculator (Partially Full Pipe Flow Calculations, 2011).

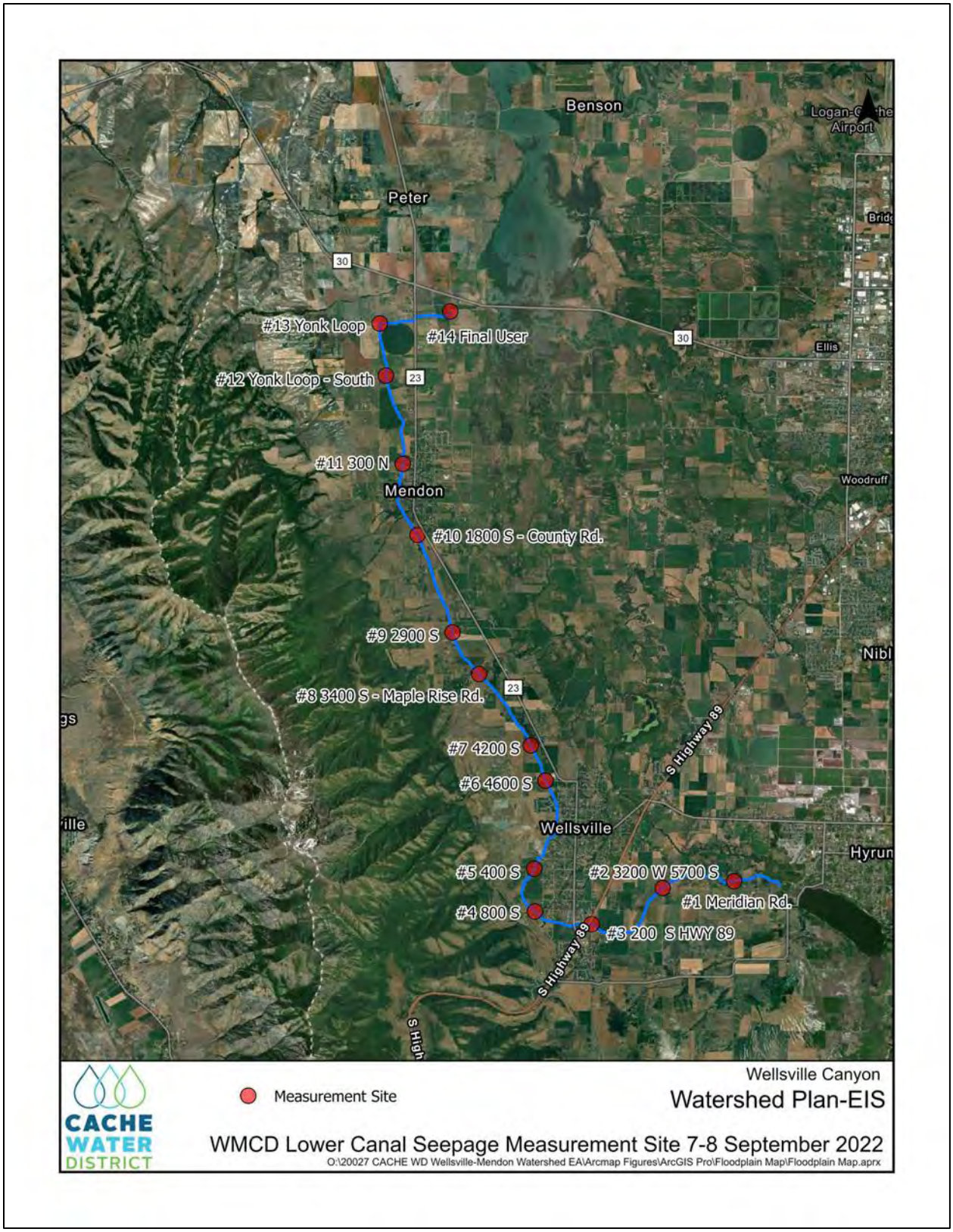


Figure 1: Map of Wellsville-Mendon Lower Canal Flow Measurement Sites

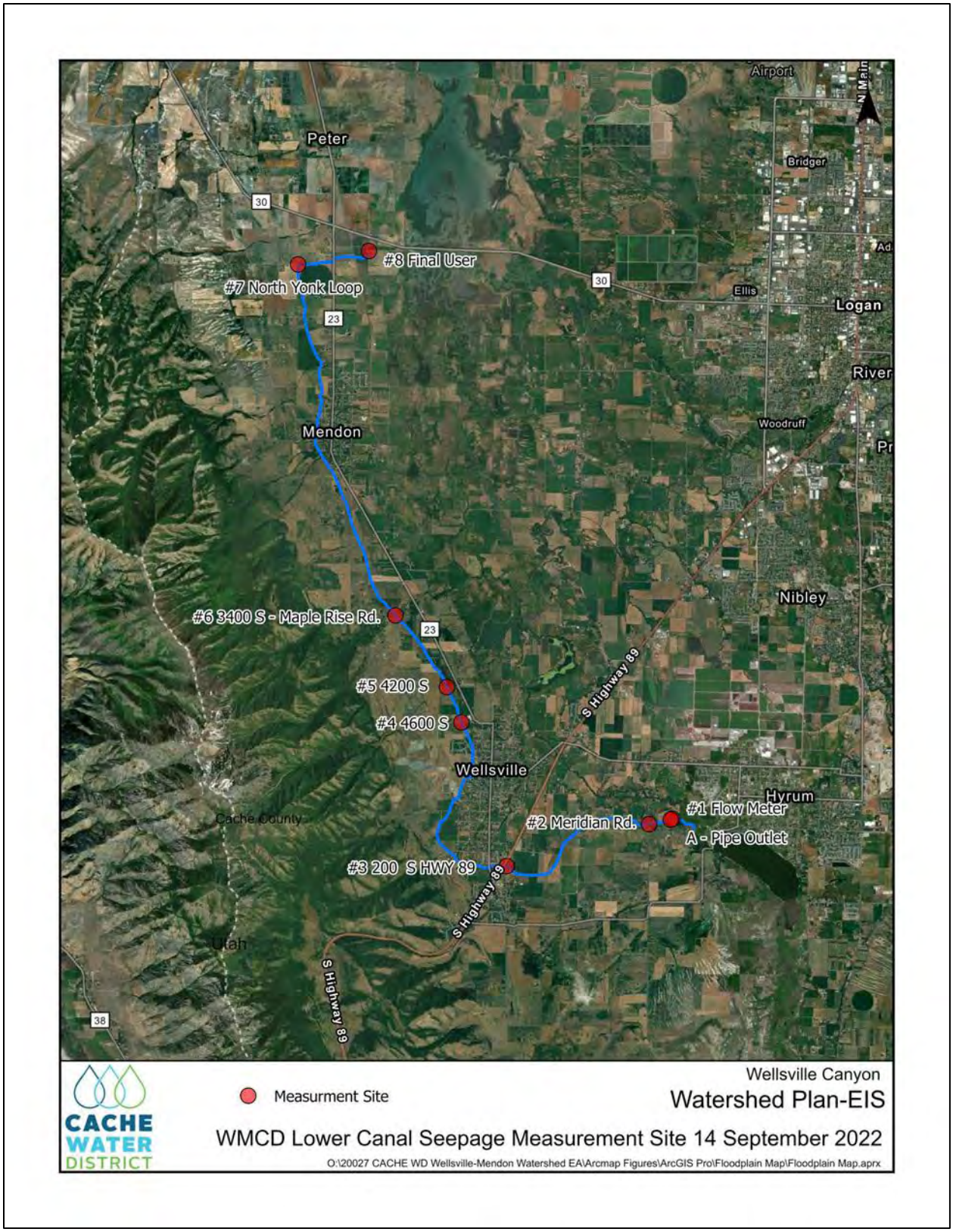


Figure 2: Maps of Wellsville-Mendon Lower Canal Flow Measurement Sites



Figure 3: Maps of Wellsville Eastfield Canal Flow Measurements

3.0 Seepage Losses

3.1 Wellsville-Mendon Lower Canal

The seepage studies performed by Franson Civil Engineers measured flow in and out of the Lower Canal. This included the flow measured at the outlet pipe from Hyrum Reservoir at the beginning of the canal, diversions made to shareholders, in flow from the upper canal, and the tailwater flow after the final shareholder diversion. All flows are represented in cubic feet per second (cfs). Three different studies were performed on the Lower Canal. Measurements for the first seepage study were taken on April 7th, 2019. Measurements for the second seepage study were taken on the 7th and 8th of September 2022. Measurements for the third seepage study were taken on September 14th, 2022. Flows at three locations were measured during the first study; 14 locations were measured during the second seepage study and eight locations were measured on the third seepage study.

Using the data gathered from the three seepage studies performed on the Lower Canal, the resulting percentage of seepage loss for the Lower Canal was calculated. The known diversions were totaled and added to the flow measured at the end of the canal. Second, residual flow and diversions were divided by the initial flow coming out of Hyrum Reservoir. Third, the result from the second step was subtracted from 1 to determine overall percent loss. As shown in the calculations below, the overall percentage loss for the Wellsville-Mendon lower canal was estimated to be 39%.

$$Percent\ Loss = (1 - \frac{Final\ Flow + Diversion}{Initial\ Flow})x100$$

Using the percentage loss explained above, and total diversion data for the Lower Canal taken from the Little Bear River Commissioner's Report, there is an estimated annual seepage loss of 3514 acre-feet along the Lower Canal. Table 1 summarizes the total diversion data from the Little Bear River Commissioner's Report.

Table 1: Wellsville-Mendon Lower Canal Diversions

Year	Diversion Acre-Feet
2022	7545.34
2021	8086.45
2020	10668.1
2019	7011.66
2018	10061.5
2017	8960.8
2016	8319.9
2015	9027.8
2014	9679
2013	10644.1

Year	Diversion Acre-Feet
012	9101.5
Average	9009.65

Table 2 is a summary of the seepage measurements taken on the 7th and 8th of September 2022. During the study there was an issue with the flow probe at Maple Rise on the 7th. To ensure the accuracy of this study, a second set of measurements were recorded on the 8th.

Table 2: Summary of 2022 Wellsville-Mendon Flow Measurements

	Dates: 9/7/22-9/8/2022			
Reach	**Location**	**Flow, cfs**	**Diversion, cfs**	**Loss, cfs**
0	Meridian Rd.	44.82	0.67	2.82
1	3200 West 5700 S	41.34	0.28	3.30
2	200 S HWY 89	37.76	2.10	0.92
3	800 S	34.74	0.00	0.80
4	400 S	33.94	8.07	0.17
5	4600 S	25.69	3.17	1.63
6	4200 S	20.89		
	Subtotals		14.30	9.64
7	4200 S	21.29	1.62	1.79
8	3400 S - Maple Rise		0.00	
9	2900 S	17.87	1.37	0.03393
10	1800 S - Country Rd.	16.47	0.00	1.90
11	300 N	14.57	2.70	0.16372
12	Yonk Loop South	12.03	0.00	3.08
13	Yonk Loop North	8.95	0.00	1.03
14	Final User	7.92	0.00	0.00
	Subtotal		**5.69**	**7.67**
	Totals		**19.99**	**17.32**

Table 3 is a summary of the flow measurements taken on the 14th of September 2022. The number of measurements and locations were modified to allow for the study to be performed in one day.

Table 3: Summary of 2022 Wellsville-Mendon Flow Measurements

Dates: 9/14/2022					
Reach	**Location**	**Flow cfs**	**Diversion (IN) cfs**	**Diversion (OUT) cfs**	**Loss cfs**
0	Pipe Outlet	**42.88**	0.00	0.00	0.00
1	Flow Meter	41.09	0.00	0.00	1.80
2	Meridian Rd.	40.03	0.00	0.78	1.06
3	HWY 89 200 S	35.13	0.00	0.17	4.12
4	4600 S	27.54	1.30	9.37	7.41
5	4200 S	26.41	0.00	0.80	-8.24
6	Maple Rise	25.48	0.00	0.45	0.14
7	Yonk Loop North	19.81	0.00	1.79	5.22
8	Final User	**12.54**	0.00	0.00	5.48
	Total		**1.30**	**13.36**	**16.99**

A separate study on the Wellsville Mendon canal was performed by Franson Civil Engineers on the 7th of April 2019. Table 4 summarizes the flows measured during this seepage study. This seepage study took three flow measurements. Measurements were taken where 4600 S, 4200 S, and 3400 S cross the canal in Wellsville, Utah. The midsection method described above was also used in this study. This study calculated a loss of 38% and is consistent with the other seepage studies performed on this section of canal.

Table 4: Summary of 2019 Wellsville-Mendon Flow Measurements

Summary	
Location	**Flow (cfs)**
4600 S	24
4200 S	20
3400 S	15

A conservative annual water loss on the Wellsville-Mendon Lower Canal of 3,514 AC-FT was calculated based on the seepage studies performed in 2019 and 2022. The total annual loss includes seepage loss only. Table 5 summarizes the calculated losses.

Table 5: Wellsville-Mendon Loss Summary

Wellsville-Mendon Summary		
Annual Diversion	9,010	Acre-Feet
Percentage Seepage Loss	39	%
Seepage Loss	3,514	Acre-Feet

3.2 Wellsville Eastfield Canal

The Wellsville East Field Canal seepage study was performed on September 25th, 2023. The same means and methods used to study the Wellsville-Mendon Lower Canal were used on the Wellsville Eastfield Canal.

The initial measurement on the Wellsville Eastfield Canal was taken at the Utah Water Rights gaging flume. Diversions in and out of the canal, and flow at three locations were measured to determine seepage losses. Figure 3 details the locations where flow was measured on the 25th of September. Percentage loss was determined using the same methodology as explained above. Overall, the percentage loss for the Wellsville East Field Canal was determined to be 27%.

Using the percentage loss explained above, and total diversion data for the Wellsville Eastfield Canal taken from the Little Bear River Commissioner's Report, there is an estimated annual seepage loss of 1,746 acre-feet along the Wellsville Eastfield Canal. Table 6 summarizes the total diversion data from the Little Bear River Commissioner's Report.

Table 6: Wellsville Eastfield Canal Diversions

Year	Diversion (Acre-Feet)
2012	6,532.4
2013	6,766.8
2014	6,424.5
2015	6,119.9
2016	6,330.4
2017	5,870.9
2018	5,873.0
2019	6,195.0
2020	8,819.0
2021	5,342.0
2022	7,359.0
Average	6,512.1

The water loss on the Wellsville Eastfield Canal of 1,746 AC-FT was calculated based on the seepage study performed in 2023. The total annual water loss includes seepage loss only. Table 7 summarizes the calculated losses.

Table 7: Wellsville Eastfield Loss Summary

Wellsville Eastfield Summary		
Annual Diversion	6,512	Acre-Feet
Percentage Seepage Loss	27	%
Annual Loss	1,746	Acre-Feet

Table 8 is a summary of the flow measurements taken on the 25th of September 2023. There were no measured diversions into the canal and only one measured diversion out of the canal.

Table 8: Summary of 2023 Wellsville Eastfield Canal Flow Measurements

Dates: 9/25/2023					
Reach	**Location**	**Flow cfs**	**Diversion (IN) cfs**	**Diversion (OUT) cfs**	**Loss cfs**
0	1	**18.94**	0.00	0.00	
1	2	17.54	0.00		1.40
2	3	13.79	0.00	0.07	3.68
	Total			**0.07**	**5.08**

3.3 Wellsville City Irrigation

Wellsville City Irrigation Company (WCIC) owns water rights to supply water for ~636 acres of land. The main water sources within the system include the Wellsville-Mendon Lower Canal, Murray Springs, and Wellsville Reservoir. Wellsville City has a population of around 3,800 people who are served by the WCIC. Wellsville City has 1,100 shares in the WCIC.

The WCIC system consists of 21.7 miles of open ditches that service Wellsville City residents and the surrounding farmland. Wellsville City has ~1,100 municipal connections. While not all these connections are currently serviced by the WCIC, the City has 1,100 shares in the WCIC which would allow all residents to be serviced by WCIC if the project is implemented. The existing ditches flow into a network that distributes water to individual lots and farms in and around Wellsville City for both agricultural and residential irrigation. Water is then delivered as a flood irrigation stream to individual water users on a turn system around the clock, 24 hours per day, 7 days per week. Additional water losses occur when individual water users do not control their

return flows, those flows that leave the bottom end of their property, and flood neighbors, roads, and surrounding businesses.

Because WCIC's ditches have a large, wetted perimeter to flow rate ratio, they are also much less efficient than larger canals. Soils in this area appear to have moderately high to high seepage rates as defined by the NRCS, ranging from 0.14 to 2.0 inches per hour for almost 68% of the service area. Based on this information, it is expected that water losses in the system will exceed the 30 to 40 percent annual losses experienced by most open ditch systems in Cache County.

For this analysis a conservative estimate of 33% was used to estimate the losses in the system. Enclosing the system will eliminate all losses due to seepage and evaporation, resulting in water savings equal to current water losses, or 33%. Seepage and evaporation losses were estimated by multiplying the total volume diverted, 2,950 acre-feet, by 33% in order to estimate the current water loss due to seepage and evaporation.

In addition to the water lost through seepage and evaporation, about of the flows left in the system end up spilling into Murray Spring Stream (West Spring Stream) from operational wastes. Since water turns often come during the middle of the day or night, many of the residents either miss their turns or choose to use the culinary pressurized water instead of the inconvenience of the flood irrigation streams which leads to very large operational wastes and spills out the ends of the ditches. Meetings with the water master, review of City records and documentation, and subsequent verification with members of the City Council, Public Works, and residents have confirmed that this trend is reasonable if not conservatively low due to the increased number of two job homes where both adults are working during the day and are unable to utilize the water turns. This 50% operation waste results in approximately 990 acre-feet each year that discharges from the project service areas.

The proposed project is anticipated to conserve approximately 2,000 acre-ft of water per year from seepage, evaporation, and end of system operation spills by allowing the water shares in the Wellsville-Mendon Canal to remain in Hyrum Reservoir and be utilized to bring much of the agricultural land from 1acre-ft/acre water allocation to 2 acre-ft/acre water allocation as agreed upon by all of the share holders in the annual meetings. While the logistics of the internal processes are not detailed in this memorandum, internal water leases were discussed and agreed upon since it would not require water right transfers. Additionally, due to the pressurization of the system, additional water in the Murray Springs system would be used by Wellsville City to help offset the potential impacts on agricultural lands as well as within City limits as permitted under their water right filings and use definitions as filed upon initially dating back to the time of settlement for agricultural, livestock, and municipal purposes.

Detailed calculations are shown below. The calculations were made using Microsoft Excel and were not rounded. The values herein reflect the MS Excel values.

- **Loss through seepage and evaporation in unlined ditches = 33%**
- **WCIC bills for a total of 2,950 acre-feet/year**
    - Total Usage = 2,950 acre-feet
        - **According to the Wellsville City Irrigation Company Water Masters documentation.*

- Total Annual Volume lost to seepage/evaporation = 2,950 * 33% = **973.5 acre-feet (See above explanation)**
- Total Annual Volume Spilled
  - Remaining water 2,950 (total flow) -970 (flow lost to seepage) = 1,980 acre-feet;
  - Operational Spillage/Losses: 1,980 acre-feet * 50% = 990 acre-feet (flow lost to spill)
  - **See explanation of operation spillage above. Because the ditch will be enclosed in a pipeline with Wellsville Reservoir, Hyrum Reservoir, and two three regulating ponds, no water will spill.*

- Total Annual Water Savings = Total Annual Water Loss = 990 + 970 = **1,960 acre-feet**

3.4 Mendon Irrigation Companies

There are eight irrigation companies within the Mendon City area. Between these companies there is approximately 11.5 miles of pipeline and ditches. Most shareholders use these systems to flood irrigate the property within their respective service area. The nature of these conveyance systems creates water loss from seepage, evaporation, and other minor inefficiencies/operation issues. There has been no formal seepage loss study performed on the existing channels/ditches. Therefore, the following assumptions were utilized to determine an approximate combined water loss.

First, based on seepage loss studies outlined above, the overall assumed system loss was determined to be 30% for each of the irrigation companies in Mendon. This keeps in line with the studies above. We recognize that losses can vary drastically based on ongoing maintenance efforts, soil types and other characteristics, but based on the similarities of the Wellsville Eastfield Company, Wellsville City Irrigation and the irrigation companies in Mendon, a 30% assumption would be reasonable.

Second, three of the Mendon companies have short length and fully piped systems, therefore seepage losses were assumed to be 0%. In addition, two other companies are also short in length and were assumed to have negligible seepage loss.

Finally, the three remaining companies, Mendon North, Cemetery Ditch and Mendon Central do experience seepage loss. The total losses for the Mendon area that would be saved with the installation of a secondary irrigation system would be 857 acre-feet as shown in Table 9.

Table 9: Summary of Mendon Water Losses

Company	Annual Volume (ac-ft)	System Length (mi)	Assumed System Loss (%)	Total Loss (ac-ft)
Mendon North	714.05	3.53	30	214.21
Cemetery Ditch	357.02	1.84	30	107.11
Mendon Central	1,785.12	2.91	30	535.54
TOTAL	**2,142.15**			**856.86**

4.0 Other Losses Not Accounted For in Savings or Calculations

4.1 Non-Point Returns

Non-point return flows play a significant role in canal system losses, impacting the overall efficiency of water conveyance and distribution. Non-point return flows refer to water runoff and seepage that occur from agricultural fields. To ensure a conservative estimate and due to the difficult nature of measuring non-point return flows and losses, this study did not quantify these losses.

4.2 Other Point Return Spills

There are numerous locations throughout the canal system where ditches and canals spill unused water. This water returns to the river and is not put to use by the water right holder. Water flowing past the final user is an example of this; however, there are more locations where this occurs.

5.0 Summary of Total Water Savings

The Piping and Lining & Buyouts Alternatives would generate the same water savings for the Wellsville East Field Piping, Wellsville Secondary System, and Mendon Secondary System project measures. However, the WMCD Lower Canal Piping project measure will produce more water savings in the Piping Alternative over the Lower Canal Lining project measure in the Lining & Buyouts Alternative. 53,000 feet of canal would be lined as part of the Lining & Buyouts Alternative compared to 78,000 feet being piped in the Piping Alternative. The water savings totals are summarized by in Table 10.

Table 10: Water Saving Summary

	Piping Alternative (AF)	**Lining/Buyouts Alternative (AF)**
WMCD Lower Canal Piping	3,514	2,388
Wellsville Eastfield Canal Piping	1,746	1,746
Wellsville City Secondary System	1,960	1,960
Mendon Secondary System	857	857
Total Water Savings	**8,077**	**6,951**

6.0 References

Bengtson, H. H. (2011). *Partially full pipe flow calculations.*

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TM006 – Culinary Water Savings

Technical Memorandum 006 – Culinary Water Savings

Table of Contents

1.0 Introduction 1

2.0 Existing & Proposed Outdoor Energy Consumption 2

2.1 Wellsville City Outdoor Existing Energy Consumption 2
2.2 Wellsville City Outdoor Proposed Energy Consumption 2
2.3 Mendon City Outdoor Existing and Proposed Energy Consumption 3

3.0 Culinary Water Savings 4

3.1 Wellsville City 4
3.2 Mendon City 4
3.3 Culinary Water Savings Summary 5

1.0 Introduction

One of the main components of the Preferred Alternative is the pressurized irrigation (PI) systems for the cities of Wellsville and Mendon. Both Wellsville and Mendon are experiencing significant growth. This growth puts great pressure on the culinary water systems. Most residents water their lawns and gardens with culinary water. Secondary irrigation water is available during the summer months, which corresponds with the highest demand in culinary water due to outdoor irrigation. A PI system would reduce culinary water demand and reduce system improvement costs by reducing the strain on the existing system and the need to expand the capacity of the existing system by reducing peak demands.

2.0 Existing & Proposed Outdoor Energy Consumption

2.1 Wellsville City Outdoor Existing Energy Consumption

The energy consumption used on outdoor water use for Wellsville City residents was evaluated for all alternatives. For the No Action Alternative, historic electrical power costs for pumping were used to estimate the amount of power consumed for the use of outdoor water. Wellsville City provided power costs for pumping from 2012 to 2021. The data was averaged by month as shown in Figure 1.

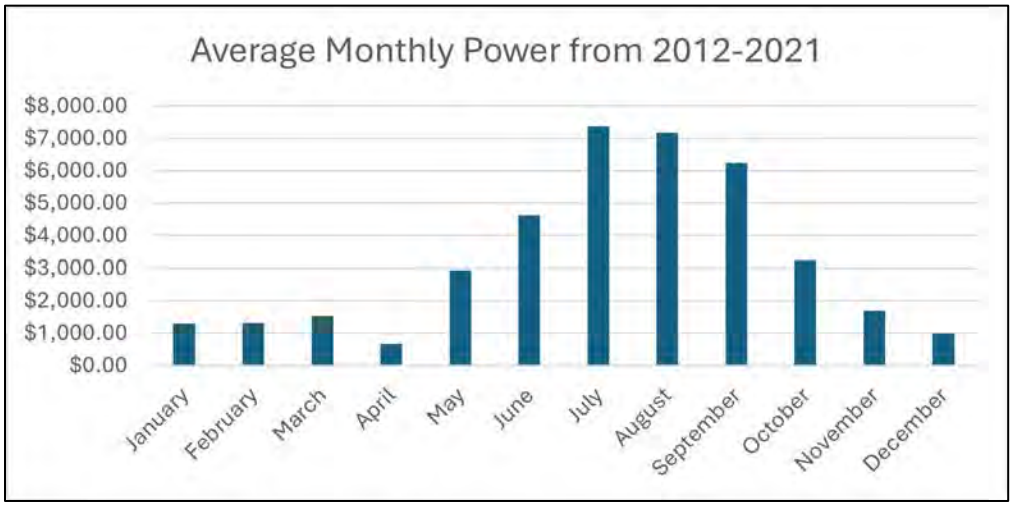


Figure 1: Average Monthly Power from 2012-2021

It was assumed that the monthly indoor water-use power cost was the average of January, February, March, November, and December ($1,400). To calculate the annual outdoor water-use power cost, the calculations below were utilized.

$$Annual\ Outdoor\ Power\ Cost = Total\ Annual\ Power\ Cost - 12 * Monthly\ Indoor\ Power\ Cost$$

$$Annual\ Outdoor\ Power\ Cost = \$39{,}000 - 12 * \$1{,}400 = \$22{,}200$$

To get the energy consumption in kWh, it was assumed that the average cost of power per kWh over the period of data used was $0.10. Energy consumption was then calculated as shown below.

$$Outdoor\ Water\ Use\ Energy\ Consumption = \frac{\$22{,}000/year}{0.10\frac{\$}{kWh}} = 222{,}000\ \frac{kWh}{year}$$

2.2 Wellsville City Outdoor Proposed Energy Consumption

The energy consumption that would be used on Wellsville City outdoor water use would be the same in both the Piping Alternative and the Lining & Buyouts Alternative. To determine the expected energy consumption, each pump was analyzed. There would be four pumps needed to operate the Wellsville City secondary system. The Upper Reservoir Pump would feed the upper reservoir with water from the Lower Canal. The Lower Reservoir Pump would feed the lower reservoir with water from the Lower Canal as well. The South Booster Pump would provide

additional head for residents on the south side of Wellsville City. The Red Slide Booster Pump would provide additional head to residents in the Red Slide Neighborhood on the west side of Wellsville City. Energy consumption was estimated for each pump using the equations below. The amount of energy needed to lift one acre-foot (AF) of water one foot is 1.02 kWh.

$$Energy\ Consumption = \frac{Head * Water\ Use\ in \frac{AF}{year} * kWh\ needed\ to\ life\ 1\ AF\ of\ water\ 1\ foot}{estimated\ efficiency\ of\ pump}$$

$$Energy\ Consumption = \frac{Head\ in\ ft * Water\ Use\ in \frac{AF}{year} * 1.02 kWh}{80\%}$$

The Table below summarizes the data used and results.

Table 1: Wellsville City Proposed Outdoor Energy Consumption

Pump	Acres Served	Head (ft)	Water Use (AF/year)	kWh/year
Upper Reservoir	1386	170	364	78,900
Lower Reservoir	960	65	252	20,900
South Booster	77	39	20	1,000
Red Slide Booster	241	129	63	10,400
			Total	111,200

2.3 Mendon City Outdoor Existing and Proposed Energy Consumption

The data for Mendon City was not complete so to get the energy consumption data for Mendon City a per capita analysis was done using the Wellsville City energy consumption results. This assumption was used because of the similarities in the communities and the proposed secondary systems. The table below shows the comparisons.

Table 2: Mendon City Existing & Proposed Outdoor Energy Consumption

	Connections	Existing Consumption (kWh)	Proposed Consumption (kWh)
Wellsville City	1276	222,000	111,200
Mendon City	443	77,100	38,600

3.0 Culinary Water Savings

3.1 Wellsville City

The culinary water system for Wellsville City relies on springs and wells to provide residents with drinking water. Demand for culinary water rises significantly during the summer months when residents use water for outdoor watering. Outdoor watering results in increasing the demand for groundwater to supply the culinary water system. Pumping costs and future capital costs to expand the culinary water system could be avoided if a PI system was constructed. Wellsville City supplied water consumption data from 2012 to 2021 for the spring and well which is summarized in Figure 2.

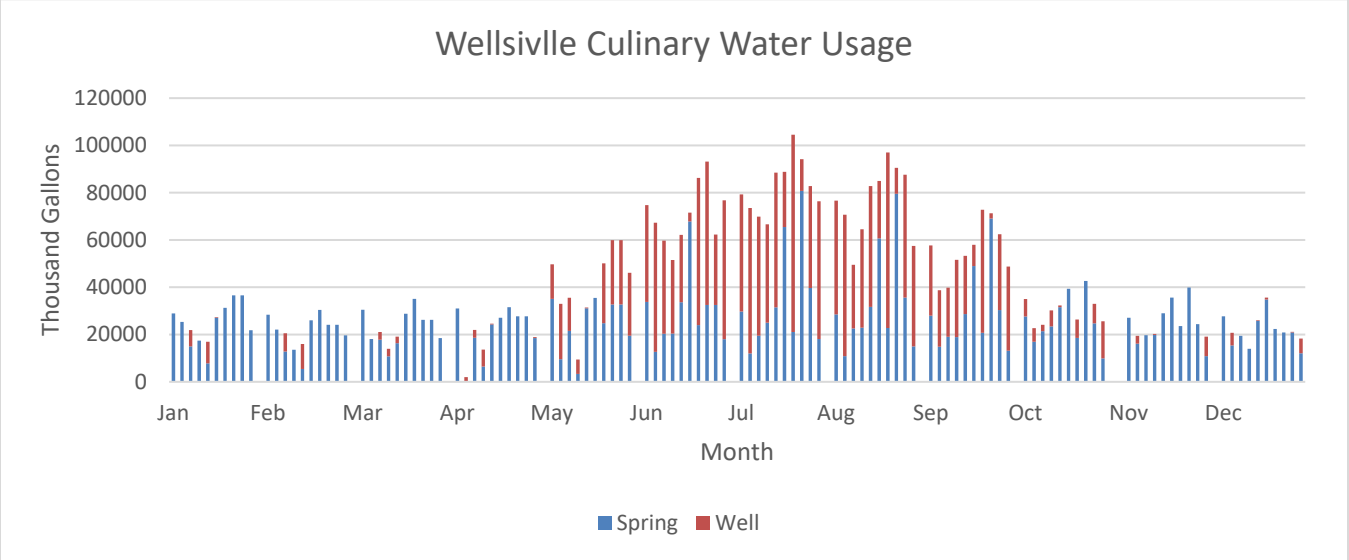


Figure 2 Wellsville City Culinary Water Usage

According to the data provided, Wellsville City's average monthly summer water consumption was 65.1 million gallons. This is based on the five months of May through September. The average monthly winter water consumption for the remaining months was 25 million gallons. The outdoor water usage was estimated as shown in the equation below.

$$Annual\ Outdoor\ Usage = (Monthly\ Summer\ Average - Monthly\ Winter\ Average)\ x\ 5$$

$$Annual\ Outdoor\ Usage = (65.1\ mil\ gal - 25\ mil\ gal)\ x\ 5 = 200.5 \text{ mil gal} = 615 \text{ AF}$$

3.2 Mendon City

Mendon City had incomplete data, so Wellsville City data was used to estimate Mendon culinary water usage. It was assumed that each equivalent residential connection (ERC) was using the same amount of water in both cities. Wellsville City water usage per ERC was multiplied by the number of ERCs in Mendon to get an overall water usage. This data was used to generate Figure 3. Mendon's outdoor annual usage was estimated as shown in the equation below.

$$Annual\ Outdoor\ Usage = \frac{Mendon\ ERC\ x\ Wellsville\ Annual\ Outdoor\ Usage}{Wellsville\ ERC}$$

$$Annual\ Outdoor\ Usage = \frac{443\ ERC\ x\ 615\ AF}{1{,}276\ ERC} = 214\ AF$$

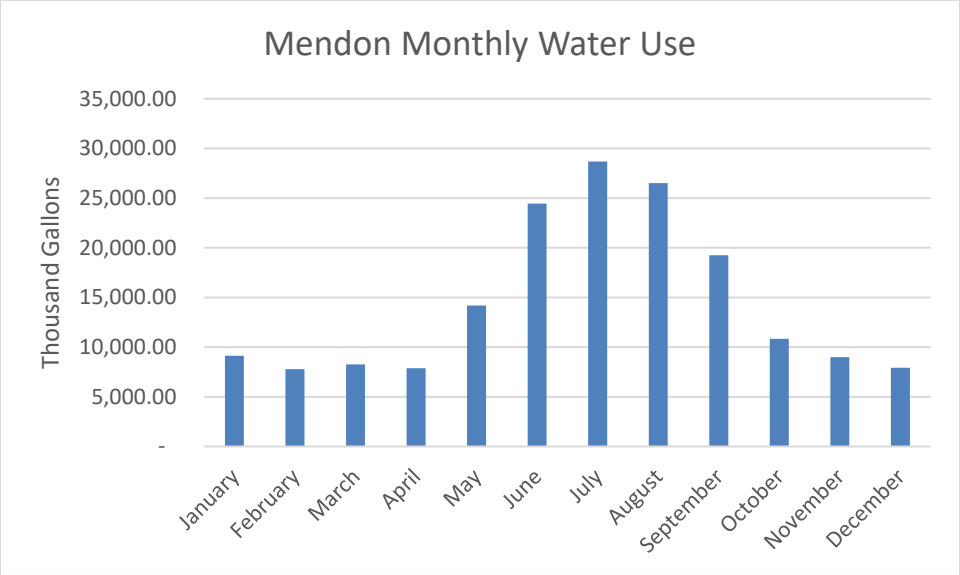


Figure 3 Mendon Monthly Culinary Water Usage

3.3 Culinary Water Savings Summary

The culinary water savings that would be saved annually by installing the Wellsville City pressurized secondary irrigation system is 615 AF. The culinary water savings that would be saved annually by installing the Mendon City pressurized secondary irrigation system is 214 AF. The total annual water savings in both the Piping Alternative and the Lining & Buyouts Alternatives is 829 AF annually.

TM007 – Operation & Maintenance Costs

Technical Memorandum 007 – Operation & Maintenance Cost Evaluation of Existing and Future Conditions

Table of Contents

1.0 Introduction 1
2.0 Flood Control Operations and Maintenance 1
3.0 Agricultural Water Operations and Maintenance 1
3.1 Mendon City Outdoor Water O&M 3
3.2 Wellsville City Outdoor Water O&M 4
3.3 Lower Canal O&M 5
3.4 Wellsville East Field Canal O&M 5
4.0 Recreation Sites 5
5.0 Estimated Annual O&M Costs 6

1.0 Introduction

This technical memorandum details the current and proposed annual costs associated with the operations and maintenance (O&M) of the irrigation and flood control systems in the project area. This information was estimated based on conversations with system operators, historical data, and estimates based on similar systems. These details are split into three categories: Agricultural Water Management (referred to as irrigation, for short), Flood Control, and Recreation. In each category, the current and estimated operations and maintenance for the alternatives are described.

2.0 Flood Control Operations and Maintenance

Wellsville City, Mendon City and Cache County provide O&M of the flood control infrastructure within the project area. Currently, the Lower Canal provides flood control benefits to the surrounding communities. Both proposed alternatives (Piping Alternative & the Lining & Buyouts Alternative) leave the current canal in place. O&M costs for flood control would be passed to Wellsville City, Mendon City, and Cache County in the Piping Alternative. These funds would be assessed on a taxpayer base and collected by the respective governing bodies. It is anticipated that Wellsville City, Mendon City, and Cache County would assume O&M of the improvements to flood control infrastructure in their jurisdictions. As there is no correlation of taxpayer base change with project completion, it is assumed that O&M budgets for each district would remain the same after project construction.

Table 1: Flood Control Operations and Maintenance

	Existing (No-Action)	Piping Alternative	Lining & Buyouts Alternative
Open Channels/Culverts	$756.00	$756.00	$0.00
Pipe/Cleanouts	$2,300.00	$2,300.00	$0.00
Lower Canal Flood Channel	$2,200.00	$2,200.00	$0.00
Management Labor Costs	$1,000.00	$1,000.00	$0.00
Riprap/Channel Repairs	$1,050.00	$1,050.00	$0.00
Repairs Materials/Tools	$3,000.00	$3,000.00	$0.00
Equipment/Vehicle Costs	$3,000.00	$3,000.00	$0.00
Weed Control	$672.00	$672.00	$0.00
Total System	**$13,978.00**	**$13,978.00**	**$0.00**

3.0 Agricultural Water Operations and Maintenance

The following are O&M expenses for water delivery in the project area as well as the anticipated expenses for the alternatives considered.

De-Mossing

The nature of an open earthen canal encourages the growth of moss which restricts flows and makes water delivery very difficult during the summer and late season. As a result, irrigation

companies spend an inordinate amount of money annually to chemically or mechanically control moss. Chemical treatment is the most cost-effective method for WMCD and Wellsville East Field.

Canal Channel and Structure Maintenance

Annual operations during the summer require the water master and staff to manage the system deliveries and diversions. Earthen channels require annual maintenance to repair damages from freeze-thaw cycles, rodent activity, vegetative encroachment, and sloughing. These repairs typically occur every spring, with spot repairs occurring throughout the operating season, and involve vegetation control and channel reshaping.

Pipeline O&M

Pipelines require annual maintenance along with repairs for optimal performance. Maintenance would include regular cleanouts of sediment and occasional cleanouts of larger debris.

Pump O&M

Pump stations require annual maintenance along with repairs for optimal performance. Cycling valves, lubricating pumps, providing regular service and maintenance according to manufacturer recommendations.

Pumping costs would be reduced in the secondary system compared to the culinary system because the pumping head would be reduced. In the culinary system the pumping head required is from the static level of the source well which is lower than the canal water level.

Regulating Pond O&M

Regulating pond O&M would be minimal and would include annual maintenance to repair damages from rodent activity and vegetative encroachment. These repairs typically occur every spring, with spot repairs occurring throughout the operating season.

Culinary Upgrades and O&M

Culinary operation and maintenance would be reduced as secondary systems are installed for outdoor water use. Water system costs and capacities are driven by peak water use. When culinary systems provide outdoor water use, there is a larger peak demand compared to a service area that has separate secondary water systems.

There are also system upgrades that need to be made to keep up with the demand of growing communities. The cost of culinary upgrades expected in the project area per connection was calculated based on analysis of actual Mendon City culinary water meter data from the last 10 years. Overall usage increases during the summer months within Mendon City. On average, usage increased 26% between July-September. This can be attributed to the increase in outdoor water use. For planning purposes, the Utah Administrative Code (UAC) requires the following for outdoor water planning:

- Source = 3.96 gallons per minute (gpm)/irrigated acre
- Storage = 2,528 gallons/irrigated acre

Therefore, based on assumptions regarding irrigated acres within Mendon it can be determined that an additional 762 gpm of source and additional 486,893 gallons of storage would need to be developed and constructed to supply the outdoor watering necessary. City staff have stated that approximately 25% of existing residents do not have access to irrigation water. Therefore a 190-

gpm culinary water source would need to be developed along with the construction of an additional 121,723 gallons of storage to meet the needs of the residents.

Based on the recent bidding climate at the time of this report, a groundwater source developed and equipped to provide 190-gpm would cost approximately $2,000,000. Constructing additional storage would be approximately $2.50/gallon or $387,500. This totals $2,387,500 for Mendon City for 443 service connections or $5,389 per service connection. This value was used in the sections below to calculate the existing culinary O&M for Mendon and Wellsville Cities.

Both the culinary and secondary system O&M costs were analyzed for each of the alternatives. Only the O&M costs resulting from outdoor water use were used in the evaluations below for Mendon City and Wellsville City.

3.1 Mendon City Outdoor Water O&M

Table 2 below shows the Mendon City Culinary O&M for outdoor water use. To get an annual equivalent, an annual payment was calculated assuming a 50-year term, a 3.00% rate, and using the $2,387,500 cost as the principal.

Table 2 also shows other existing O&M costs used for outdoor water use in the culinary system. These values were estimated by reducing the equivalent secondary items in Table 3 by 90%, which also represents saving from not needing to maintain ditches.

Table 2: Mendon City Culinary O&M for Outdoor Water Use

	Existing (No Action)	Piping Alternative	Lining & Buyouts
Culinary Upgrades	$88,400.00	$0.00	$0.00
Pumping Costs	$7,710.00	$0.00	$0.00
Daily check	$1,000.00	$0.00	$0.00
Labor Costs	$36,000.00	$0.00	$0.00
Meters/Service Laterals	$2,300.00	$0.00	$0.00
Pipe Repairs	$5,700.00	$0.00	$0.00
Valve Repairs	$900.00	$0.00	$0.00
Repairs Materials/Tools	$7,200.00	$0.00	$0.00
Equipment/Vehicle Costs	$900.00	$0.00	$0.00
System Filling	$1,500.00	$0.00	$0.00
Valve Exercising	$300.00	$0.00	$0.00
System Draining	$1,500.00	$0.00	$0.00
Total System	**$153,410.00**	**$0.00**	**$0.00**

Table 3: Mendon City Secondary O&M for Outdoor Water Use

	Existing (No-Action)	Piping Alternative	Lining/Buyouts Alternative
Pumping Costs	$0.00	$3,860.00	$3,860.00
Daily check	$0.00	$1,100.00	$1,100.00
Labor Costs	$0.00	$40,000.00	$40,000.00
Meters/Service Laterals	$0.00	$2,500.00	$2,500.00
Pipe Repairs	$0.00	$6,300.00	$6,300.00
Valve Repairs	$0.00	$1,000.00	$1,000.00
Repairs Materials/Tools	$0.00	$8,000.00	$8,000.00
Equipment/Vehicle Costs	$0.00	$1,000.00	$1,000.00
System Filling	$0.00	$1,700.00	$1,700.00
Valve Exercising	$0.00	$300.00	$300.00
System Draining	$0.00	$1,700.00	$1,700.00
Total System	**$0.00**	**$67,460.00**	**$67,460.00**

3.2 Wellsville City Outdoor Water O&M

Table 4 below shows the Wellsville City Culinary O&M for outdoor water use. For 1,276 connections this is $6,876,862. To get an annual equivalent, an annual payment was calculated assuming a 50-year term, a 2.75% rate, and using the present value as the principal.

Table 4 also shows other existing O&M costs used for outdoor water use in the culinary system. These values were estimated by reducing the equivalent secondary items in Table 5 by 90%, which also represents saving from not needing to maintain ditches.

Table 4: Wellsville City Culinary O&M for Outdoor Water Use

	Existing (No Action)	Piping Alternative	Lining & Buyouts
Culinary Upgrades	$254,700.00	$0.00	$0.00
Pumping Costs	$22,200.00	$0.00	$0.00
Maintenance Labor	$72,000.00	$0.00	$0.00
Equipment	$4,300.00	$0.00	$0.00
System and Parts	$17,200.00	$0.00	$0.00
Pond O&M	$1,700.00	$0.00	$0.00
Total System	**$372,100.00**	**$0.00**	**$0.00**

Table 5: Wellsville City Secondary O&M for Outdoor Water Use

	Existing (No-Action)	Piping Alternative	Lining/Buyouts Alternative
Pumping Costs	$0.00	$11,120.00	$11,120.00
Maintenance Labor	$0.00	$80,000.00	$80,000.00
Equipment	$0.00	$4,800.00	$4,800.00
System and Parts	$0.00	$19,100.00	$19,100.00
Pond O&M	$0.00	$1,900.00	$1,900.00
Total System	**$0.00**	**$116,920.00**	**$116,920.00**

3.3 Lower Canal O&M

The O&M costs for the Lower Canal for each alternative are shown in Table 6.

Table 6: Lower Canal O&M

	Existing (No-Action)	Piping Alternative	Lining/Buyouts Alternative
Ditch Cleaning	$10,000.00	$0.00	$0.00
Spray Weeds	$1,000.00	$0.00	$0.00
Replace Portions of Liner	$10,000.00	$0.00	$20,000.00
Pipe Maintenance	$0.00	$10,000.00	$0.00
Total System	**$21,000.00**	**$10,000.00**	**$20,000.00**

3.4 Wellsville East Field Canal O&M

The O&M costs for the Wellsville East Field Canal for each alternative are shown in Table 7. This table only represents costs associated with the portion of canal that is being considered for piping.

Table 7: Wellsville East Field O&M for Proposed Piped Section

	Existing (No-Action)	Piping Alternative	Lining/Buyouts Alternative
Ditch Cleaning	$2,580.00	$0.00	$0.00
De-Mossing	$4,170.00	$0.00	$0.00
Pipe Maintenance	$0.00	$3,000.00	$3,000.00
Total System	**$6,750.00**	**$3,000.00**	**$3,000.00**

4.0 Recreation Sites

Wellsville City currently maintains the Wellsville Reservoir. This typically includes irrigation and mowing, road maintenance, trash pickup, bathroom cleaning and maintenance, and site security. It is not expected that the proposed boat ramp access will significantly increase O&M costs that

already exist. Mendon Cemetery reflection pond O&M costs include repairs and weed control. Table 8 summarizes the recreation O&M.

Table 8: Recreation O&M

	Existing (No Action)	Piping Alternative	Lining & Buyouts
Wellsville Reservoir Boat Ramp	$0.00	$0.00	$0.00
Mendon Cemetery Pond	$0.00	$700.00	$700.00
Total System	**$0.00**	**$700.00**	**$700.00**

5.0 Estimated Annual O&M Costs

The previous section subtotals are summed in Table 9 for the estimated annual O&M costs in the project area for the No Action and Proposed Action Alternatives.

Table 9 Estimated Annual O&M Costs

Category	Subcategory	Existing (No Action)	Piping Alternative	Lining Alternative
Flood Control	Flood Control O&M	$13,078.00	$13,078.00	$0.00
Agricultural Water Management	Mendon City Culinary O&M	$153,410.00	$0.00	$0.00
	Mendon City Secondary O&M	$0.00	$67,460.00	$67,460.00
	Wellsville City Culinary O&M	$372,100.00	$0.00	$0.00
	Wellsville City Secondary O&M	$0.00	$116,920.00	$116,920.00
	Lower Canal O&M	$21,000.00	$10,000.00	$20,000.00
	Wellsville East Field O&M	$6,750.00	$3,000.00	$3,000.00
Recreation	Wellsville Reservoir Boat Ramp O&M	$0.00	$0.00	$0.00
	Mendon Pond O&M	$0.00	$700.00	$700.00
	Total	**$566,338.00**	**$211,158.00**	**$208,080.00**

TM008 – Capital Cost Evaluation

Technical Memorandum 008 – Capital Cost Evaluation of Alternatives

Table of Contents

1.0 Introduction 1
2.0 Recreation 1
2.1 Wellsville Reservoir Boat Ramp 1
2.2 Mendon City Cemetery Reflecting Pond 1
3.0 Agriculture Water Management 1
3.1.Wellsville Secondary Water System 1
3.2 Mendon Secondary Water System 3
3.3 Lower Canal Pipe System 3
3.4 Wellsville East Field Canal Pipe System 4
4 Flood Management 5
4.1 Lower Canal Flood Improvements 5
4.2 Wellsville City Flood Routing 5
4.3 Canal Spills 6
4.4 Bird Canyon Channel Improvements 7
4.5 100 South (Bird Creek) Flood Control Pipeline 7
4.6 300 North Flood Control Pipeline 8
4.7 400 North Flood Control Pipeline 8
5.0 Total Project Installation Cost 9

1.0 Introduction

Proposed project costs were developed through a collaborative process with participating engineering firms. The cost of materials and labor was estimated based on historical project costs and adjusted for inflation. The purpose of this technical memorandum is to identify assumptions made during cost estimating and provide a cost breakdown for construction costs of the Preferred Alternative. Due to supply chain challenges, market uncertainty, and high inflation rates, a 20% contingency was added to absorb the impacts of these various economic factors. Maps showing the location of the various project measures can be found in Appendix B to the Plan-EIS.

2.0 Recreation

2.1 Wellsville Reservoir Boat Ramp

See Table 1 for the construction cost breakdown of a new recreation access boat ramp at Wellsville Reservoir.

Table 1: Wellsville Reservoir Boat Ramp Cost Estimate

Item	Quantity	Unit	Unit Price	Amount
Concrete Kayak Ramp (15 ft wide)	1	LS	$10,000.00	$10,000.00
			Subtotal:	$10,000.00
			Contingency:	$2,000.00
			Mobilization:	$1,000.00
			Total Construction Cost:	$13,000.00

2.2 Mendon City Cemetery Reflecting Pond

See Table 2 for the construction cost breakdown of a new reflection pond in the Mendon Cemetery.

Table 2: Mendon City Pond Cost Estimate

Item	Quantity	Unit	Unit Price	Amount
Pond	1	LS	$15,000.00	$15,000.00
			Subtotal:	$15,000.00
			Contingency:	$3,000.00
			Mobilization:	$1,000.00
			Total Construction Cost:	$19,000.00

3.0 Agriculture Water Management

3.1.Wellsville Secondary Water System

The cost estimate for the Wellsville Secondary Water System was completed using various pipe types. The most cost-effective alternative is presented here. The pump station costs assume that the wet well and everything associated with the pump stations are included. Each pump station will consist of two pumps in parallel that are identical to handle full flow and pressure. See Table 3 for full cost breakdown.

Table 3: Wellsville Secondary Water System Cost Estimate

Item	Quantity	Unit	Unit Price	Amount
General Costs				
SCADA System	1	LS	$50,000.00	$50,000.00
Construction Survey	1	LS	$103,500.00	$104,000.00
Traffic Control	1	LS	$75,000.00	$75,000.00
Asphalt Street Restoration	97,000	SF	$3.75	$364,000.00
Driveway Replacement (20x6, 6 avg per run, avg 144 @ 120 SF $20 per SF	1	LS	$321,000.00	$321,000.00
Upper Reservoir	19.4	AC-FT	$35,000.00	$679,000.00
Lower Reservoir	13.4	AC-FT	$35,000.00	$469,000.00
			Subtotal:	$2,062,000.00
Pump Costs				
Pump Station at the Reservoir	1	LS	$350,000.00	$350,000.00
Pump Station at the Lower Canal	1	LS	$350,000.00	$350,000.00
Booster Pump Station (Red Slide)	1	LS	$20,000.00	$20,000.00
Booster Pump Station (South End)	1	LS	$45,000.00	$45,000.00
			Subtotal:	$765,000.00
Pipe Network				
18" Mag Meters	2	EA	$16,250.00	$33,000.00
Utility Relocations	1	LS	$25,000.00	$25,000.00
Furnish & Install 2" PIP Pipe 125 psi	12,207	LF	$23.72	$290,000.00
Furnish & Install 4" PIP Pipe 125 psi	12,421	LF	$30.00	$373,000.00
Furnish & Install 6" PIP Pipe 125 psi	98,250	LF	$33.00	$3,242,000.00
Furnish & Install 8" PIP Pipe 125 psi	6,697	LF	$40.00	$268,000.00
Furnish & Install 10" PIP Pipe 125 psi	4,767	LF	$47.25	$225,000.00
Furnish & Install 12" PIP Pipe 125 psi	9,839	LF	$63.00	$620,000.00
Furnish & Install 14" PIP Pipe 125 psi	3,066	LF	$81.75	$251,000.00
Furnish & Install 18" PIP Pipe 125 psi	11,242	LF	$103.30	$1,161,000.00
Furnish & Install 20" PIP Pipe 125 psi	8,493	LF	$114.25	$970,000.00
Furnish & Install 24" PIP Pipe 125 psi	4,329	LF	$151.25	$655,000.00
6" Railroad Crossing	140	LF	$360.00	$50,000.00
1" Single Service Connection with meter	1,200	EA	$1,500.00	$1,800,000.00
			Subtotal:	$9,963,000.00
			Total:	$12,790,000.00
			Contingency:	$2,558,000.00
			Mobilization:	$640,000.00
			Total Construction Cost:	$15,988,000.00

3.2 Mendon Secondary Water System

This subsection includes the construction costs associated with the proposed Mendon secondary system. See Table 4 for full breakdown of costs.

Table 4: Mendon Secondary Water System Low-Cost Estimate

Item	Quantity	Unit	Unit Price	Amount
Construction Staking/Survey	1	LS	$97,000.00	$97,000.00
Traffic Control	1	LS	$75,000.00	$75,000.00
Utility Relocation	1	LS	$25,000.00	$25,000.00
Regulating Pond	12	AF	$35,000.00	$420,000.00
Pump Station	1	LS	$350,000.00	$350,000.00
Furnish and Install 6" PVC Pipe C900	29,220	LF	$44.25	$1,293,000.00
Furnish and Install 8" PVC Pipe C900	20,092	LF	$59.75	$1,200,000.00
Furnish and Install 12" PVC Pipe C900	4,895	LF	$109.80	$537,000.00
Furnish and Install 18" PVC Pipe C905	2,818	LF	$147.45	$416,000.00
Furnish and Install 24" PVC Pipe C905	1,497	LF	$215.08	$322,000.00
Furnish and Install Valves & Fittings	120	EA	$5,000.00	$600,000.00
Furnish and Install Flow Meters	10	EA	$1,500.00	$15,000.00
Furnish and Install 2-inch Drains	8	EA	$6,000.00	$48,000.00
Canal Turnout Structure	4	EA	$25,000.00	$100,000.00
1.5" Single Service Connections	500	EA	$4,250.00	$2,125,000.00
			Subtotal:	$7,623,000.00
			Contingency:	$1,525,000.00
			Mobilization:	$458,000.00
			Total Construction Cost:	$9,606,000.00

3.3 Lower Canal Pipe System

See Table 5 for the construction cost breakdown for installing a low-pressure pipe system which will be used for delivering water that is currently conveyed via the WMCD Lower Canal. The pipe type used in the estimate was DR32.5 HDPE pipe with fused connections.

Table 5: Lower Canal Piping Cost Estimate

Item	Quantity	Unit	Unit Price	Amount
Surveying	1	LS	$100,000.00	$100,000.00
Traffic Control	1	LS	$10,000.00	$10,000.00
Furnish and install 10" HDPE pipe	1,339	LF	$44.50	$60,000.00
Furnish and install 14" HDPE pipe	1,740	LF	$73.10	$127,000.00
Furnish and install 18" HDPE pipe	155	LF	$86.65	$13,000.00
Furnish and install 20" HDPE pipe	1,524	LF	$93.55	$143,000.00
Furnish and install 24" HDPE pipe	2,687	LF	$110.80	$298,000.00
Furnish and install 26" HDPE pipe	1,362	LF	$122.05	$166,000.00
Furnish and install 28" HDPE pipe	1,926	LF	$141.25	$272,000.00

Item	Quantity	Unit	Unit Price	Amount
Furnish and install 30" HDPE pipe	480	LF	$171.00	$82,000.00
Furnish and install 32" HDPE pipe	1,604	LF	$194.05	$311,000.00
Furnish and install 34" HDPE pipe	1,664	LF	$214.50	$357,000.00
Furnish and install 36" HDPE pipe	1,720	LF	$245.00	$421,000.00
Furnish and install 42" HDPE pipe	3,280	LF	$300.70	$986,000.00
Furnish and install 48" HDPE pipe	3,730	LF	$372.50	$1,389,000.00
Furnish and install 54" HDPE pipe	49,350	LF	$446.75	$22,047,000.00
Furnish and install 63" HDPE pipe	5,330	LF	$571.50	$3,046,000.00
Appurtenances	1	LS	$2,972,000.00	$2,972,000.00
HWY 89 Road Crossing (135 ft wide, jack and bore)	1	LS	$111,000.00	$111,000.00
Rail Road Crossing (10" pipe, jack and bore)	1	LS	$65,000.00	$65,000.00
Red Slide Crossing (50 ft wide, sidewalks, curb, and gutter)	1	LS	$132,000.00	$132,000.00
Gravel Road/Driveway Crossings (20 ft wide)	11	EA	$750.00	$8,000.00
Asphalt Road/Driveway Crossings (25 ft)	22	EA	$1,250.00	$28,000.00
Inlet 48" Mag Meter	1	LS	$90,000.00	$90,000.00
SCADA System	1	LS	$100,000.00	$100,000.00
12" Mag Meter	73	EA	$18,000.00	$1,314,000.00
Cultural Mitigation	1	LS	$25,000.00	$25,000.00
			Subtotal:	$34,673,000.00
			Contingency:	$6,935,000.00
			Mobilization:	$2,081,000.00
			Total Construction Cost:	$43,689,000.00

3.4 Wellsville East Field Canal Pipe System

See Table 6 for the construction cost breakdown for installing a gravity pipe system which will replace a section of the Wellsville East Field Canal.

Table 6: Wellsville East Field Piping Cost Estimate

Item	Quantity	Unit	Unit Price	Amount
Surveying	1	LS	$7,000.00	$7,000.00
Screen and structure for transition from open channel	1	LS	$10,000.00	$10,000.00
Furnish and install 48" low pressure pipe	10,538	LF	$294.27	$3,101,000.00
Manholes and fittings	1	LS	$234,100.00	$234,000.00
Furnish and install 24" head gates	11	EA	$30,000.00	$330,000.00
Furnish and install 72" diversion boxes	11	EA	$15,000.00	$165,000.00
SCADA System	1	LS	$75,000.00	$75,000.00
Measurement Flume	10	EA	$3,000.00	$30,000.00

Cultural Mitigation	1	LS	$25,000.00	$25,000.00
			Subtotal:	$3,977,000.00
			Contingency:	$795,000.00
			Mobilization:	$239,000.00
			Total Construction Cost:	$5,011,000.00

4 Flood Management

4.1 Lower Canal Flood Improvements

See Table 7 for the construction cost breakdown for improving the lower canal for flood conveyance.

Table 7: Lower Canal Flood Improvements

Item	Quantity	Unit	Unit Price	Amount
Surveying	1	LS	$26,000.00	$26,000.00
Traffic Control	1	LS	$13,000.00	$13,000.00
Demolish and Remove Headgates	50	EA	$5,000.00	$250,000.00
Remove Existing Lining	53,000	LF	$6.75	$358,000.00
Grade and Prepare Canal	225,120	SY	$3.00	$675,000.00
Concrete Canvas Lining	187,600	SY	$90.00	$16,884,000.00
Private Canal Crossing - Hobas Pipe	80	LF	$500.00	$40,000.00
Private Canal Crossing - 8' x 4' Box Culvert	40	LF	$2,000.00	$80,000.00
Private Canal Crossing - 10' x 4' Box Culvert	106	LF	$3,000.00	$318,000.00
Private Canal Crossing - 12' x 4' Box Culvert	20	LF	$4,000.00	$80,000.00
Public Canal Crossing - 8' x 4' Box Culvert	460	LF	$7,000.00	$3,220,000.00
Public Canal Crossing - 10' x 4' Box Culvert	207	LF	$10,000.00	$2,070,000.00
			Subtotal:	$24,014,000.00
			Contingency:	$4,803,000.00
			Mobilization:	$1,441,000.00
			Total Construction Cost:	$30,258,000.00

4.2 Wellsville City Flood Routing

See Table 8 for the construction costs for the flood routing in Wellsville City. This includes construction costs for the Wide Canyon flood control pipeline as well as the Murray Springs culvert upsizing (culvert construction not funded by PL-566).

Table 8: Wellsville City Flood Routing Cost Estimate

Item	Quantity	Unit	Unit Price	Amount
Murray Springs Drainage				
Concrete Box Culverts 4'X8'	720	LF	$1,450.00	$1,044,000.00
Channel Improvements	2,600	LF	$182.00	$473,000.00
Wide Canyon Drainage				

Item	Quantity	Unit	Unit Price	Amount
Inlet with Trash Rack	1	LS	$10,000.00	$10,000.00
30" Dual Wall Corrugated HDPE Pipe	1,300	LF	$100.00	$130,000.00
36" Dual Wall Corrugated HDPE Pipe	4,300	LF	$120.00	$516,000.00
Pipe Cleanout Boxes	5	EA	$9,000.00	$45,000.00
Pipe Outlet Riprap	17	CY	$95.00	$2,000.00
Hot Mix Asphalt	1,156	SY	$30.00	$35,000.00
Construction Surveying	1	LS	$5,000.00	$5,000.00
Traffic Control	1	LS	$5,000.00	$5,000.00
			Subtotal:	$2,265,000.00
			Contingency:	$453,000.00
			Mobilization:	$136,000.00
			Total Construction Cost:	$2,854,000.00

4.3 Canal Spills

This subsection includes line items needed to construct the spill structures and flood pipelines to convey flows from the Lower Canal Channel to the Little Bear River. See Table 9 for the full cost breakdown.

Table 9: Canal Spills Cost Estimate

Item	Quantity	Unit	Unit Price	Amount
Construction Surveying	1	LS	$5,000.00	$5,000.00
Traffic Control	1	LS	$5,000.00	$5,000.00
Mendon Spill				
Canal Spill Structure	1	LS	$3,000.00	$3,000.00
Inlet with Trash Rack	1	LS	$10,000.00	$10,000.00
30" ADS N12 Pipe	1,500	LF	$100.00	$150,000.00
36" ADS N12 Pipe	2,300	LF	$120.00	$276,000.00
42" ADS N12 Pipe	3,500	LF	$145.00	$508,000.00
2900 South Spill				
Francis Overflow	1	LS	$56,000.00	$56,000.00
Canal Spill Structure	1	LS	$3,000.00	$3,000.00
Inlet with Trash Rack	1	LS	$10,000.00	$10,000.00
36" ADS N12 Pipe	1,200	LF	$120.00	$144,000.00
42" ADS N12 Pipe	1,100	LF	$145.00	$160,000.00
48" ADS N12 Pipe	1,500	LF	$216.00	$324,000.00
60" ADS N12 Pipe	2,400	LF	$300.00	$720,000.00
Flood Channel Improvements	1,200	LF	$182.00	$218,000.00
3400 South Spill				
Canal Spill Structure	1	LS	$3,000.00	$3,000.00
Inlet with Trash Rack	1	LS	$10,000.00	$10,000.00

Item	Quantity	Unit	Unit Price	Amount
42" ADS N12 Pipe	500	LF	$145.00	$73,000.00
48" ADS N12 Pipe	3,400	LF	$216.00	$734,000.00
60" ADS N12 Pipe	1,200	LF	$300.00	$360,000.00
30" Maple Rise Pipe	4,800	LF	$100.00	$480,000.00
Murray Springs Spill				
Canal Spill Structure	1	LS	$3,000.00	$3,000.00
Inlet with Trash Rack	1	LS	$10,000.00	$10,000.00
42" ADS N12 Pipe	1,700	LF	$145.00	$247,000.00
48" ADS N12 Pipe	1,900	LF	$216.00	$410,000.00
60" ADS N12 Pipe	2,800	LF	$300.00	$840,000.00
Hot Mix Asphalt	19,392	SY	$30.00	$582,000.00
Unlisted Pipe Appurtenances	1	LS	$814,000.00	$814,000.00
			Subtotal:	$7,158,000.00
			Contingency:	$1,432,000.00
			Mobilization:	$430,000.00
			Total Construction Cost:	$9,020,000.00

4.4 Bird Canyon Channel Improvements

This subsection includes line items needed to construct the channel improvements for the Bird Canyon channel that runs through the south of Mendon. See Table 10 for full cost breakdown. The culvert construction will not be funded by PL-566 project funds.

Table 10: Bird Canyon Cost Estimate

Item	Quantity	Unit	Unit Price	Amount
Construction Staking/Survey	1	LS	$4,000.00	$4,000.00
Install 48" x 72" Box Culvert	100	LF	$1,150.00	$115,000.00
Install 48" x 84" Box Culvert	200	LF	$1,300.00	$260,000.00
Install 48" x 96" Box Culvert	60	LF	$1,450.00	$87,000.00
Asphalt Trench Repair	5,400	SF	$3.75	$20,000.00
Clear and Excavate Drainage Ditch	1,200	LF	$12.00	$14,000.00
			Subtotal:	$500,000.00
			Contingency:	$100,000.00
			Mobilization:	$30,000.00
			Total Construction Cost:	$630,000.00

4.5 100 South (Bird Creek) Flood Control Pipeline

This subsection includes line items needed to construct a flood control pipeline along 100 South in Mendon. See Table 11 for the full cost breakdown.

Table 11: 100 South Pipeline Cost Estimate

Item	Quantity	Unit	Unit Price	Amount
Construction Staking/Survey	1	LS	$6,000.00	$6,000.00
F&I 42" Class III RCP	2,300	LF	$266.70	$613,000.00
F&I Catch Basin	6	EA	$4,000.00	$24,000.00
Concrete Headwall	1	EA	$2,500.00	$3,000.00
Asphalt Trench Repair	1,700	SF	$3.75	$6,000.00
			Subtotal:	$652,000.00
			Contingency:	$130,000.00
			Mobilization:	$40,000.00
			Total Construction Cost:	$822,000.00

4.6 300 North Flood Control Pipeline

This subsection includes line items needed to construct the flood control pipeline for the existing channel originating and running along 300 North in Mendon. See Table 12 for the full cost breakdown.

Table 12: 300 North Pipeline Cost Estimate

Item	Quantity	Unit	Unit Price	Amount
Construction Staking/Survey	1	LS	$6,000.00	$6,000.00
F&I 30" Class III RCP	2,600	LF	$180.50	$469,000.00
F&I Catch Basin	6	EA	$4,000.00	$24,000.00
F&I Diversion Structure	1	EA	$5,000.00	$5,000.00
Asphalt Trench Repair	900	SF	$3.75	$3,000.00
			Subtotal:	$507,000.00
			Contingency:	$101,000.00
			Mobilization:	$31,000.00
			Total Construction Cost:	$639,000.00

4.7 400 North Flood Control Pipeline

This subsection includes line items needed to construct the flood control pipeline along 400 N in Mendon. See Table 13 for the full cost breakdown.

Table 13: 400 North Pipeline Cost Estimate

Item	Quantity	Unit	Unit Price	Amount
Surveying	1	LS	$5,000.00	$5,000.00
F&I 18" Class III RCP	1,500	LF	$111.30	$167,000.00
F&I Catch Basin	5	EA	$4,000.00	$20,000.00
Asphalt Trench Repair	1,600	SF	$3.75	$6,000.00

Subtotal:	$198,000.00
Contingency:	$40,000.00
Mobilization:	$12,000.00
Total Construction Cost:	$250,000.00

5.0 Total Project Installation Cost

The total estimated project installation cost for the preferred alternative is $146,549,000. See Table 14 below for a summary of all project measures construction costs and non-construction costs.

Table 14: Summary of Installation Costs

	Construction Cost	Non-Construction Cost	Total Installation Cost
Recreation			
Wellsville Reservoir Boat Ramp	$13,000	$5,000	$18,000
Mendon Cemetery Pond	$19,000	$6,000	$25,000
Recreation Subtotal	**$32,000**	**$11,000**	**$43,000**
Agriculture Water Management			
Wellsville East Field Piping	$4,986,000	$878,000	$5,864,000
Wellsville Secondary Water System	$15,988,000	$2,739,000	$18,727,000
Mendon Secondary Water System	$9,606,000	$1,649,000	$11,255,000
WMCD Lower Canal Piping	$43,664,000	$7,459,000	$51,123,000
Agriculture Subtotal	**$74,244,000**	**$12,725,000**	**$86,969,000**
Flood Management			
Lower Canal Flood Improvements	$30,258,000	$5,155,000	$35,413,000
Wellsville City Flood Routing	$2,854,000	$488,000	$3,342,000
Canal Spills	$9,020,000	$1,635,000	$10,655,000
Bird Canyon Channel Improvements	$630,000	$113,000	$743,000
100 South (Bird Creek) Flood Control Pipeline	$822,000	$143,000	$965,000
300 North Flood Control Pipeline	$639,000	$112,000	$751,000
400 North Flood Control Pipeline	$250,000	$45,000	$295,000
Flood Subtotal	**$44,473,000**	**$7,691,000**	**$52,164,000**
Total Project Cost Estimate	**$118,749,000**	**$20,427,000**	**$139,176,000**

TM009 – Crop Yields

Technical Memorandum 009 – Crop Water Use and Crop Yields

Table of Contents

1.0 Introduction **1**
2.0 Available Data **1**
3.0 Primary Crops in the Project Area **2**
4.0 Crop Yields in Project Area **4**
5.0 Expected Consumptive Use **5**
6.0 Resulting Yield Curves **7**
7.0 Existing Water Shortages **10**
8.0 Crop-Water Demand Characteristics and Crop Shifting **18**
9.0 Pumping Cost Reduction Benefits **19**
10.0 Summary of Crop Yields and Benefits **20**
11.0 References **21**

1.0 Introduction

As agriculture is the predominant land use in the project area, benefits achieved through increased crop yield have the potential to contribute significantly to project benefits. Additionally, in order for any proposed projects to be successful, they must be economically sustainable in both the short and long term (PR&G Guiding Principle #2). In order to understand and quantify the impacts of project alternatives, it is important to analyze the resulting effects on crop yields due to improved water supply within the specific project area. Table 1 provides the basis of crop yield analysis and quantification. Information sources include Utah State University (USU) and University of Idaho (U of I) Extensions, USDA National Agricultural Statistics Service, and NRCS vegetative productivity estimates.

This data is used to evaluate and develop curves describing crop yields for the main crops grown in the project area. Yield curves describe the correlation between consumptive water use and yield quantity. These curves are used to estimate possible yield increase or decrease experienced in project alternatives analyzed in the watershed planning process based on changes in irrigation methods, water savings in the transmission and distribution system, and changes in management or scheduling. Impacts are quantified using estimated water shortages based on historical yields data and changes to water supply with project, with results provided in a change in yield per acre basis. Temporal characteristics of crop-water demand are also discussed to give further insight into project benefits and anticipated impacts from project alternatives.

2.0 Available Data

Table 1 identifies the data used to establish the existing and optimal conditions for the watershed evaluation.

Table 1: Data Sources Used

Purpose	Title	Sources and Comments
Cropping Pattern	CropScape-Cropland Data Layer	https://nassgeodata.gmu.edu/CropScape/, USDA National Agricultural Statistics Service
Maximum Potential Yields	Irrigated Alfalfa Variety Performance, 2011-2014, North Logan, Utah	USU Extension, August 2015. Earl Creech, Thomas Griggs, Clark Israelsen, TJ Bingham, Jason Clark, and Mark Pieper, Utah State University and West Virginia University.
Maximum Potential Yields	Corn Silage Performance, 2004, 2006, Cache County, Utah	USU Extension, September 2005, T.C. Griggs, C.E. Israelsen, K. Pack, D.R. Fillmore, and D.D. Knudsen. Dept. of Plants, Soils, & Biometeorology, USU Extension, and Utah Agricultural Experiment Station.
Maximum Potential Yields	Crop Profile for Barley in Utah, May 2006	USU Extension,
Mid-Range Potential Yields	Utah Agricultural Statistics and Annual Summary Report, 2012	Utah Department of Agriculture and Food

Purpose	Title	Sources and Comments
Consumptive Use Optimal Amounts	All Crop based on https://waterrights.utah.gov/techinfo/consumpt/default.asp based on the Richmond, UT station near Lewiston, UT.	Data Derived from: Consumptive Use of Irrigated Crops in Utah, Research Report 145, Utah Agricultural Experiment Station, Utah State University, Logan, Utah, 1998.
Farm Irrigation Efficiencies – Existing Flood, Wheel Lines, Handlines, and Pivots Conditions	UT652.0605 State Supplement, UT-FOTG	Potential Farm Efficiency of Irrigation Systems, Table UT6-1
Cache Valley Annual Crop Values	USDA/NASS 2024 State Agriculture Overview for Utah.	USDA/NASS 2024 https://www.nass.usda.gov/Quick_Stats/Ag_Overview/stateOverview.php?state=UTAH.
Annual Agricultural Statistics, focusing on crop Value Annually	Utah Agricultural Statistics, 2023. (also available for previous years)	USDA/NASS https://www.nass.usda.gov/Statistics_by_State/Utah/Publications/Annual_Statistical_Bulletin/index.php Annual reports available for 2011 through 2024

3.0 Primary Crops in the Project Area

Based on data from the USDA National Agricultural Statistics Service, Table 2 summarizes the crops primarily grown in the project area under current management conditions. Other crops grown include potatoes, triticale, and some fruits. However, the total area of these crops is limited by the available water supply and limitations in irrigation scheduling. Additionally, two varieties of grass hay are grown in the area with widely varying yields and value but are not distinguished in the agricultural statistics data. Red timothy (*Phleum pratense*) is both higher in value and yield but is more sensitive to the soil conditions. Tall fescue (*Lolium arundinaceum*) and other grass hay, including orchard grass hay (*Dactylis glomerata*) are more commonly grown in the lower areas and are cut and baled once a year, followed by late season grazing. It is significantly lower in value and yield. For the purpose of not overstating economic sustainability, this Plan-EIS uses the tall fescue and orchard grass yields and values. The average crop acreage per year is 5,456 acres based on the Cropland CROS database for the project area, excluding lawns and residential turf. The cropping pattern for 2022 and the service area analyzed can be seen in the "2022 Cropping Patterns" figure in Appendix C.

Table 2: Historical Cropping Patterns based on Cropland CROS(Acres)

Crop	2019	2020	2021	2022	2023	Average	Percentage
Alfalfa	3,447	3,347	3,414	3,386	3,420	3,403	53.4%
Barley	136	133	109	239	106	145	2.3%
Corn	253	210	219	217	278	235	3.7%
Grass Hay	1,208	1,252	1,237	1,389	1,388	1,295	20.3%
Safflower	146	152	136	22	38	99	1.6%
Wheat	336	272	344	202	232	277	4.4%
Total	5,526	5,366	5,459	5,455	5.462	5,454	100%

Source: Cropland CROS

A review of the primary crops in the figures reflects that safflower is primarily a crop grown in the dry-land areas. Additionally, barley and wheat are often interchangeable in the Cropland CROS classifications due to the similar classifications. For this memorandum's evaluation, only the four top crops have been carried forward for consistency of analysis. It should also be noted that the areas provided annually are not consistent within the project area in Cropland CROS, partly due to the method of data collection and classification. Additionally, these acreages are not consistent with the detailed acreages provided based on the Cache County Parcel Data, US Bureau of Reclamation documentation, and field verifications. This primarily results from the granular nature and classification issues associated with Cropland CROS using Landsat data, national ground truth calibration, and the scale of the mapping. While the data has inaccuracies in precision, it does provide a reasonably accurate representation of the crop patterns and variations over time. Individual site calibration was further applied to improve the data.

A review of data from the USBR records associated with work completed as part of modifications to the Hyrum Reservoir Spillway improvements and WMCD Canal title transfer, and a review of service area records with the Utah Division of Water Rights, shows that each canal company service area currently irrigated as agricultural land is significantly different than reported by Cropland CROS. It should be noted that the USBR definition of agricultural land requires a minimum of 10 acres. These acres are reflected as:

- Wellsville Eastfield Canal: 2,733 acres
- WMCD
    - Lower Canal – 3,497 acres
    - Upper Canal – 884 acres

4.0 Crop Yields in Project Area

Based on data from the USDA Web Soil Survey, publications from USU and University of Idaho (U of I) Extensions, and a review of Utah Agricultural Statistics within the region, the crop yield conditions were quantified, as shown in Table 3. The "Irrigated, Some Conservation" column is representative of the yields experienced in the project area as confirmed through conversations with a local farmer and retired local USU extension agent Clark Israelsen (2021), who worked with USU and the NRCS in Cache Valley for over 40 years. These values have further been compared to information from USDA reports for the area. The maximum potential yields are based on conditions in Cache Valley where Utah State University and Extension were able to carefully monitor and document consumptive water demands and soil moisture. These values are considered obtainable and reasonable where the irrigation supply and schedule can be carefully controlled and have been documented at locations in the Benson Irrigation Company, Cub River Irrigation Company, and other areas where similar improvements have helped agricultural growers who previously suffered from deficit irrigation to manage and regulate their water more efficiently.

Table 3: Agricultural Yield Data for Cache County

Crop	Non-Irrigated[1]	Irrigated, No Conservation[2]	Irrigated, Some Conservation[3]	Maximum[4]
Alfalfa (tons/acre)	1.20	3.6	4.9	9.2
Corn (tons/acre)	0.00	19.9	26.9	34.0
Grass Hay (tons/acre)	1.2	2.4	4.4	6.0
Wheat (bushels/acre)	30.0	80.0	132.0	150.0

1. Non-Irrigated Yields taken from Web Soil Survey data and USU Extension production reports for dry land equivalents within Cache Valley.
2. Irrigated, No Water Conservation yields taken from Web Soil Survey data for areas known to be flood irrigated and data from USU Extension and USDA for this Area.
3. Irrigated Conservation yields were taken from the Web Soil Survey in Cache County for areas known to be sprinkler irrigated at the time of the survey, as well as supporting yield data from 2004, 2006, and 2011 from USU Extension, and USDA Utah Agricultural Statistics.
4. Maximum yield estimates were taken from USU Extension reports for Cache Valley.

5.0 Expected Consumptive Use

Consumptive use reflects the amount of water consumed through the process of evapotranspiration, the water retained in the plant tissue, and the evaporation of water from plant/soil surfaces. This water is drawn up through the root system from the root zone, which varies by crop and is commonly assumed to have a maximum depth of about 60-inches when calculating available soil moisture. Table 4 provides a summary of the expected maximum root zone depths utilized for this Plan-EIS. The following paragraphs describe the methodology used to quantify consumptive use for each crop and service area identified above.

Table 4: Crop Root Zone Depths

Crop	Root Zone (inches)
Alfalfa	60
Corn	42
Grass Hay	24
Wheat	48

Reference: Utah FOTG, Utah Chapter 6 Supplement, Periodic Move Sprinkler Design Sheet, 2019.

The root zone available to each crop was treated as a reservoir based on the management allowable deficit (MAD) concept. MAD is the amount of water stored in the root zone between field capacity (after the soil has freely drained), and the permanent wilting point of the plants. For the crops in this Plan-EIS, a MAD of 50% is typically based on the Utah FOTG. It has also been assumed that any moisture above the capacity of the root zone either runs off or deep percolates and is not available for crop use.

For precipitation, it was assumed that only 90% of the precipitation falling during the growing season is available for crop use. For precipitation outside the growing season, only 90% is effective until the root zone is filled to field capacity, after which the remainder either runs off or deep percolates. This results in a significant reduction in effective precipitation in most years.

The “Non-Irrigated” category utilized the available soil water supply characteristic as described for the project area by NRCS Web Soil Survey and the calculated MAD combined with the growing season effective precipitation. The non-growing season MAD water supply in inches was calculated for the project area by crop and added to the monthly average effective precipitation to determine the total amount of water available for consumptive use to each crop during the growing season under the non-irrigated scenario. This is also the amount of water available to all of the crops from effective precipitation.

The “Irrigated, No Conservation” scenario was evaluated based on the available soil water supply, effective precipitation, and the application of flood irrigation. Irrigation contribution was developed through calibration of curves using known diversions and applying reductions between a range of irrigation efficiencies, taking into account delivery system and application system losses. These range between 35-50% efficiency for flood irrigation based on UT652.0605 State Supplement (Table UT6-1), roughly 60-65% for wheel lines and hand lines depending upon maintenance, and 75-85% for Pivot and Linear systems depending upon nozzle types. For this Plan-EIS, flood irrigation was estimated as 35% based on field observations and covers most of the Wellsville Eastfield irrigation service area. This is further complicated by the limitations in

irrigation scheduling and delays in turns resulting from time delays in flow modifications during summer resulting from moss in the canal. These inefficiencies, which are not addressed by water losses, result in further irrigation inefficiencies which are not addressed by the measurement of distribution uniformity. The Lower Wellsville-Mendon Canal additionally has an assumed efficiency of 55% for this area. This reflects a combination of the irrigation of the canal system delivering flood irrigation, wheel lines, hand lines, and pivots in combination. It also reflects the challenges with operating a very long canal, with the delays in flow delivery associated with it.

The "Irrigated, Conservation" scenario was evaluated based on the available soil water supply, effective precipitation, and the application of irrigation through existing flood, and pressurized sprinkler irrigation methods. For this Plan-EIS, the piping of the canals significantly improves the delivery of water to the farms, increasing delivery efficiency and the ability to provide water on a schedule consistent with improved management under the MAD concept. For this reason, the overall seasonal farm irrigation efficiency was assumed to reflect closer to 50% for the Wellsville Eastfield Canal, which will still be an open channel flow, though still in a pipe.

The Wellsville-Mendon Lower Canal, which is pressurized, will benefit much more from the project from the project. By pressurizing, with the water storage of Hyrum Reservoir, this system will be converted to a demand system, no longer based on turn schedule. This will allow the full implementation of irrigation water management based on the MAD. These improvements will benefit flood irrigation but will benefit the pressurized sprinkler irrigation systems even more so. With these improvements, the estimated overall seasonal farm efficiencies are expected to increase to approximately 70% for the Wellsville Mendon Canal. The "Maximum" consumptive use was taken from the total SCS-BC ET requirements for the project area based on USU Extension's Technical Report 145 as updated for each crop. This is based on the full consumption requirements being met at the appropriate times for each crop and does not reflect the benefits of the effective precipitation during the summer. Effective precipitation is being treated as an independent water supply in this memorandum. Table 5 summarizes the annual average consumptive use for the primary crops for this Plan-EIS based on the procedures just explained.

Table 5: Annual Average Maximum Consumptive Use Associated with Crop Yields, Inches

Crop	Non-Irrigated[1]	Irrigated, No Conservation[2]	Irrigated, Conservation[3]	Maximum[4]
Alfalfa	8.8	13.2	16.5	31.5
Corn	8.31	13.5	15.5	19.5
Grass Hay	8.1	10.4	15.3	21.4
Wheat	7.4	11	16	21.1

1. Non-Irrigated Yields taken from Web Soil Survey data and USU Extension production reports for dry land equivalents within Cache Valley and correlated with dryland irrigation average available water.
2. Irrigated, No Water Conservation yields taken from Web Soil Survey data for areas known to be flood irrigated and data from USU Extension.
3. Irrigated Conservation yields were taken from the Web Soil Survey in Cache County for areas known to be sprinkler irrigated at the time of the survey, as well as supporting yield data from 2004, 2006, and 2011 from USU Extension.
4. Maximum yield estimates were taken from USU Extension reports for Cache Valley. Alfalfa maximum estimated ET based on 1998 USU Research Report 145.

6.0 Resulting Yield Curves

A plot of consumptive use and corresponding crop yield for each crop is referred to as a crop yield curve or a crop production curve. For each of the main crops grown in the project area, the corresponding crop production curves are provided as a basis for estimating the expected yields under the various water conservation options. By estimation potential water conservation, increases in consumptive use can be directly correlated with increases in yield for the main crops and the associated economic benefits. It should be noted that crop yield curves extend beyond maximum consumptive use levels; however, the yield decreases with significant overwatering beyond the maximum yields and are not reflected in these curves. For the scope of this project, these curves were not extended to include the overwatering impacts due to a limited water supply but were capped at the apparent maximum yields previously identified. Figure 1 provides the yield curve for alfalfa, reflecting the existing conditions of the WMCD (Orange) and Wellsville Eastfield Canal (Red). Figures 2 through 4 provide the same information for silage corn, grass hay, and wheat. As these curves demonstrate, the existing yield curves reflect the deficit irrigation conditions the systems currently operate.

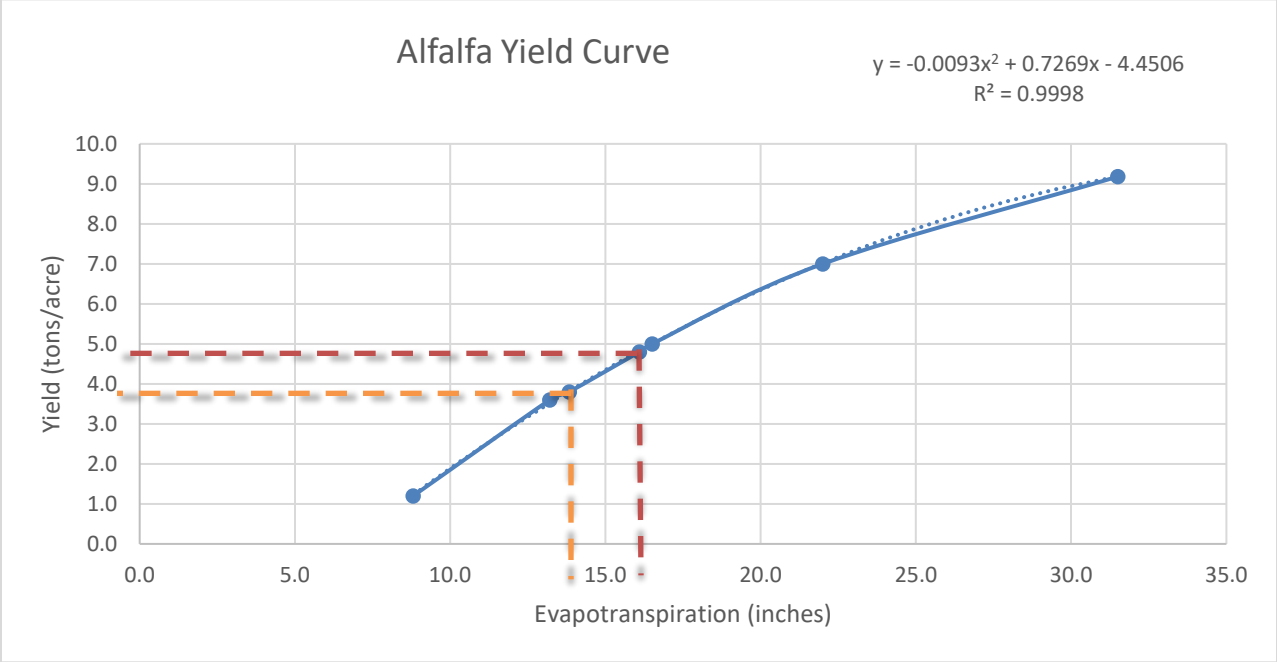


Figure 1: Yield Curve for Alfalfa

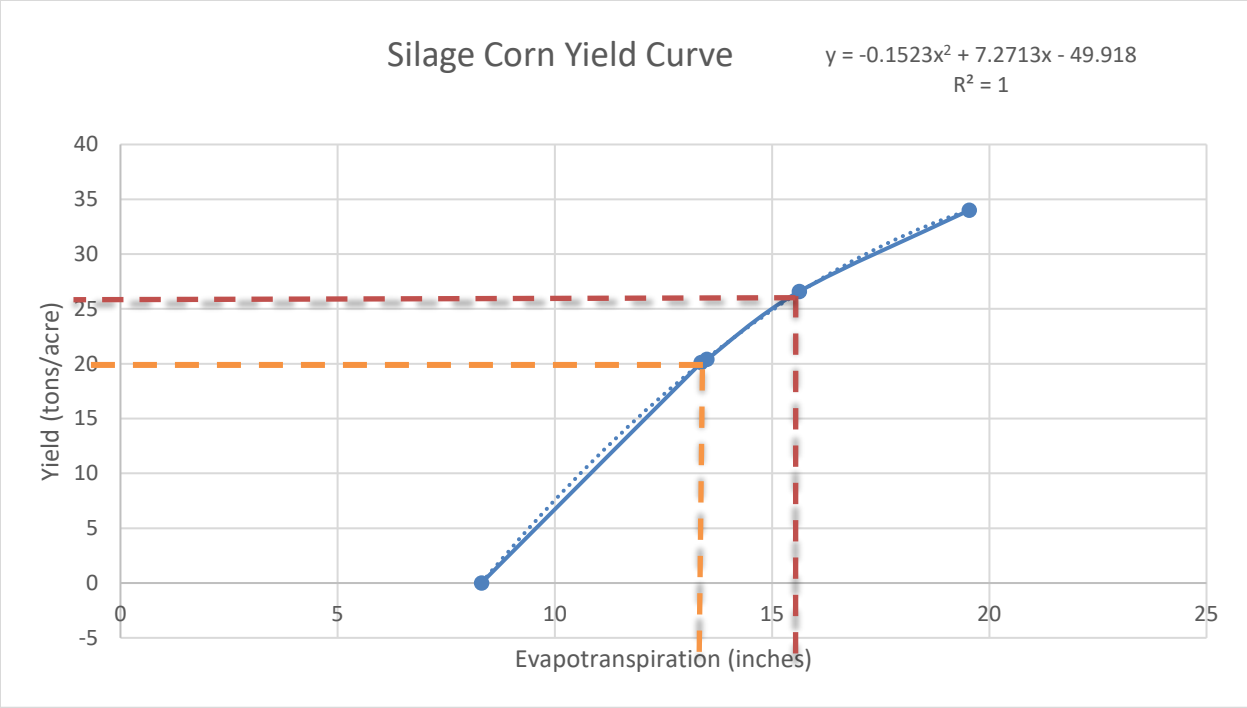


Figure 2: Yield Curve for Silage Corn

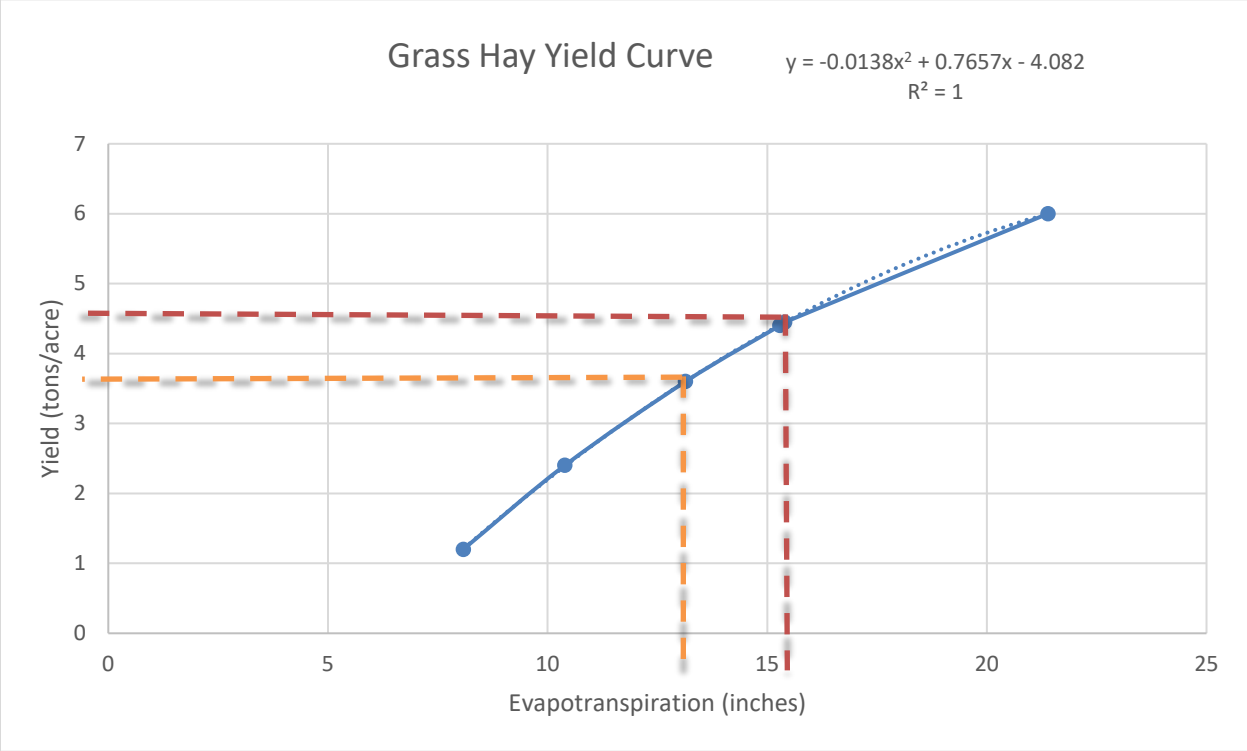


Figure 3: Yield Curve for Grass Hay

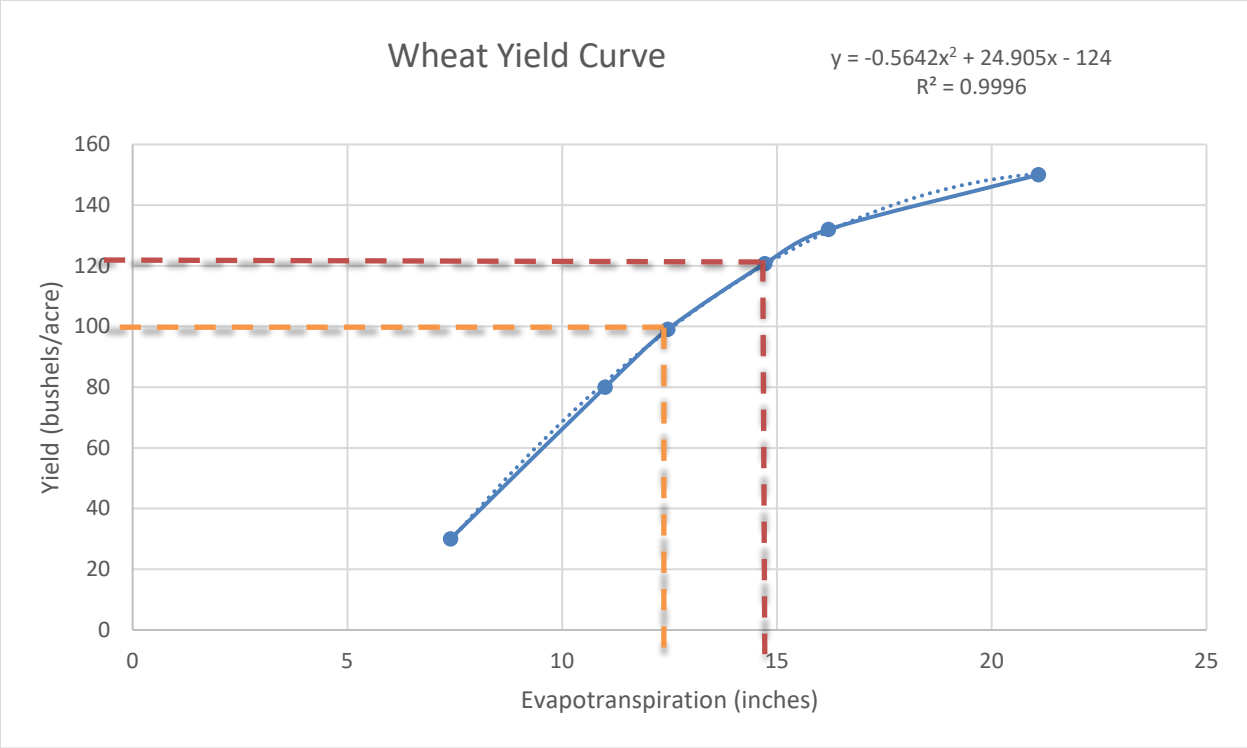


Figure 4: Yield Curve for Wheat

7.0 Existing Water Shortages

A.1. Irrigation Water

For the existing conditions, the total irrigation water delivered to the crops was estimated by taking the average annual diversions and subtracting the total transmission losses in the Lower Canal system and the Wellsville East Field Canal system. Table 6 summarizes the conveyance losses from TM005.

Table 6: Summary of Conveyance Losses

Conveyance Losses (AF)		Totals (AF)
Wellsville City Irr System	1,960	6,331
Mendon City Irr System	857	
WM Lower Canal	3,514	
Wellsville EF Canal	1,746	1,746

Table 7 summarizes the average annual diversions for the Lower Canal and the Wellsville East Field Canal. The existing irrigation efficiency for each canal is a reflection of three major items. is assumed to be 65% reflecting a mix of flood irrigation, hand lines, wheel lines, and pivots. This value was estimated to be representative of the average for the period-of-record. The amount of irrigation water available for consumptive use (IRRav) is calculated from the total water delivered, assumed irrigation efficiency (EFFirr),and total service acres(AREAsys) in each system.

$$IRRav = VOLann\ x \frac{Effirr}{AREAsys}$$

Table 7: Existing Water Available for Crops

System	Average Annual Diversion (AF)	Conveyance Losses (AF)	Total Water Delivered (AF)	Existing Crop Acres in Direct Service Area	Assumed Irrigation Efficiency	Diverted Water Available for Crops (in)
WM Lower Canal[1)]	9,010	6,331	2,679	3497	55%	8.7
Wellsville East Field Canal	6,512	1,746	4,766	2,733	55%	13.6

[1)]This includes agricultural lands in the service areas of the WCIC and Mendon City canal companies.

It was assumed that only 95% of the transmission losses are recovered with the piping projects, recognizing that not all projects will be perfect, especially in the long term. This is reflected in Table 8.

Table 8: Expected Water Conservation

System	Average Annual Diversion (AF)	Existing Conveyance Losses (AF)	Expected Conservation (AF)
WM Lower Canal*	9,010	6,331	6,014
Wellsville East Field Canal	6,512	1,746	1,659

Table 9 summarizes the expected additional irrigation water available with project as well as the total water available with project. For the WM Lower Canal system, it is assumed that the conserved water will benefit the entire WMCD system which includes an additional 884 acres in the Upper Canal system currently in the process of being pressurized using a USBR WaterSMART grant and is not included in this project. As discussed in TM005, the shareholders, including the WCIC which owns 1000 shares, have agreed that the conserved water will be utilized on agricultural lands, since it will exceed the needs of the pressurized irrigation system of WCIC. Additionally, WCIC has additional water in the Murray Springs and other spring systems that will be captured and pumped into the system through the proposed improvements, and this water may also be utilized on agricultural lands within the overlapping boundaries of the WCIC and WMCD within the allowed consumptive requirements.

While these discussions and agreements have been discussed in shareholder meetings, the conditions of the discussions are beyond the scope of this memorandum. The irrigation efficiencies assumed are as discussed in Section 5.0 of this memorandum. Based on the NRCS policy, no considerations or projections of future changes in land use by agriculture land users in cropping patterns, agricultural cropping shifts due to improved water supply, or motivations for implementing improved on farm irrigation methods. However, while this Plan-EIS does not include these potential benefits, sponsors recognize that these changes will happen based on regional experience with other programs including the USBR-WaterSMART and NRCS-EQIP programs. The amount of irrigation water available with project is also shown in Table 9 below.

Table 9: Irrigation Water Available for Crops with Project

System	Additional Water Delivered from Conservation (AF)	Total Water Diverted (AF)	Irrigation Water Delivered with Project (AF)	Crop Acres Benefited with Project	Total Irrigation Water Available for Crops with Project (in)
WM Upper and Lower Canal[1]	6,014	9,010	8,693	4381	16.59
Wellsville East Field Canal	1,659	6,512	6,425	2,733	10.97

[1)] This includes agricultural lands in the service areas of the WCIC and Mendon City canal companies.

2) This is the water available to the farm turnouts.

A.2. Effective Precipitation

During the non-growing season, the potential available water was estimated as an average for soils along the canals, using the root zone depths shown in Table 4 (Crop Root Zone Depths) and the available soil moisture capacity after draining to field capacity. For each crop, the estimated average beginning soil moisture available for consumptive use is documented in Table 10. A comparison is then made to the effective precipitation during the non-growing season, assuming that only 80% of the moisture is potentially effective. It should be noted that the effective non-growing season precipitation of the project area is expected to be approximately 6.69 inches, which is significantly higher than the soils can hold at field capacity. Based on these assumptions, the effective precipitation ranges from 22% for wheat and 54% for alfalfa.

Table 10: Non-Growing Season Available Moisture

Crop	Root Zone		WM Upper and Lower Canal		Wellsville East Field Canal	
	Inches	MAD[1)]	Average Soil Water Capacity (inches/inch)[2)]	MAD Soil Water (inches)[3)]	Average Soil Water Capacity[2)] (inches/in)	Net Available Soil Water[3)] (inches)
Alfalfa	60	50%	0.153	2.29	0.152	2.29
Grass	42	50%	0.153	1.60	0.152	1.60
Wheat	24	50%	0.153	0.92	0.152	0.92
Corn	48	50%	0.153	1.83	0.152	1.83

[1)] The Management allowed deficit is the amount of water between the permanent wilting point and the field capacity that is allowed to be used between irrigations for a safe management tool without impacting crop yields.

[2)] Calculated as the weighted average of all the soils in the irrigated areas of the canal service areas.

[3)] Net available soil water available to crops at the beginning of the growing season on an average year multiplied by the MAD.

During the growing season in semi-arid conditions, Research Report 145 emphasizes that about 80% of the precipitation that falls is effective. Under those conditions, the effective precipitation is independent of root zone and is assumed to apply directly to consumptive use, reducing the amount of irrigation water necessary under a pressurized system with reservoir upstream to store water. Based on these assumptions, there is approximately 6.48 inches of effective precipitation available per growing season.

Based on these evaluations, Table 11 summarizes the total available effective precipitation for each crop in the project area for consumptive use. This is also the amount of effective water available for dryland farms, which in many cases defines the crops that can be grown on them.

Table 11: Effective Total Precipitation - Dry Land Equivalent

Crop	Root Zone	WM Upper and Lower Canal	Wellsville East Field Canal
	Inches	Net Available Precipitation (inches)	Net Available Precipitation (inches)
Alfalfa	60	8.77	8.77
Grass	42	8.08	8.08
Wheat	24	7.40	7.40
Corn	48	8.31	8.31

A.3. Total Available Existing Water

The total existing water available for each agricultural crop is a function of effective precipitation during the growing season, root zone storage within the MAD at the beginning of the year, and the irrigation water available to the crops. Table 12 summarizes the total available existing water by crop and irrigation area. It should be emphasized that for both canal service areas, a significant portion of the total water supply annually is dependent upon precipitation, which can be highly variable in the Intermountain West as reflected by the standard deviations reported in Technical Report 145.

Table 12: Total Existing Water Available

Crop	Root Zone (Inches)	Total Available Water (inches)*		Total Consumptive Irrigation Water (inches)	
		WM Upper and Lower Canal	Wellsville East Field Canal	WM Lower Canal	Wellsville East Field Canal

Alfalfa	60	13.83	16.09	5.06	7.32
Grass	42	13.14	15.40	5.06	7.32
Wheat	24	12.46	14.72	5.06	7.32
Corn	48	13.37	15.63	5.06	7.32

[*] Total Available Water = Total Effective Precipitation + Total Consumptive Irrigation Water

A.4. Available Irrigation Water After Conservation Project

The total amount of conserved water from the proposed project was applied to the Wellsville Eastfield Irrigated Lands and the WMCD's full-service area as discussed in section 7.A.1. This water was distributed over each piece of ground by crops under the condition that maximum consumptive use was not exceeded. In other words, water was applied only up to the amount needed to maximize yields, without providing for overwatering. Table 13 summarizes all the irrigation water provided to each irrigation company.

While there is sufficient water for consumptive use, there is a water right duty in this basin limiting the total amount of water available for diversion to a maximum of 3 acre-feet per acre (36 inches). As a result, the expected irrigation efficiencies are based on the on-farm delivery assumptions discussed in section 5 of this memorandum. Table 14 summarizes these total farm deliveries and expected diversions.

Table 13: Total Available Consumptive Irrigation

Crop	Additional Irrigation Provided (inches)		Total Consumptive Irrigation (inches)		Total Consumptive Water (inches)	
	Upper and Lower Canal[2)]	Wellsville Eastfield Canal	Upper and Lower Canal	Wellsville Eastfield Canal	Upper and Lower Canal	Wellsville Eastfield Canal
Alfalfa	14.04	4.63[1)]	19.10	11.95	27.87	20.72
Grass	9.86	3.64	14.92	10.97	23.00	19.1
Wheat	8.63	3.64	13.69	10.97	21.1	18.4
Corn	6.13	3.64	11.19	10.97	19.5	19.3

[1)] Alfalfa will receive more water due to the nature of the run of the river flows nature of the water supply combined with the growing season and irrigation demand period and harvest cycle and periods of Alfalfa compared to the other crops.

[2)] WMCD crop water supplies are limited based on the maximum supplies to meet maximum yields. Grass, Wheat, and Corn's demands are maximized under this alternative.

Table 14: Proposed Irrigation Water Deliveries

Crop	Root Zone (Inches)	Proposed On Farm Delivery (inches)[1)]		Proposed Irrigation Water Diversions (inches)[2)]	
		WM Upper and Lower Canal	Wellsville East Field Canal	WM Upper and Lower Canal	Wellsville East Field Canal
Alfalfa	60	27.28	23.91	28.72	25.16
Grass	42	21.31	21.93	22.44	23.09
Wheat	24	19.56	21.93	20.59	23.09
Corn	48	15.99	21.93	16.83	23.09

Using the crop yield curves developed in Section 6 of this memorandum, and the existing consumptive use estimates, the expected yields were estimated and summarized in Table 15, including the combined Lower and Upper Canal for the WMCD.

Table 15: Estimated Yields

	Existing Yields[1)]		Expected Yields with Project	
	Wellsville East Field	Lower Canal	Wellsville East Field	Lower and Upper Canal
Alfalfa (ton/acre)	4.8	3.8	6.56	8.52
Grass Hay (ton/acre)	4.5	3.6	5.53	6.0
Wheat (bushel/acre)	120.9	99.1	143.46	150.0
Corn (ton/acre)	26.6	20.1	33.78	34.0

[1)] These yields are reflected in figures 1 through 4.

The benefit of the proposed agricultural project is the increased agricultural production expected. This is calculated as the differences between the proposed conditions and the existing and is called the Yield Increase by project measure as included in Table 16.

Table 16: Yield Increase by Project Measure

	Wellsville East Field Yield	WMCD
Alfalfa (ton/acre)	1.8	4.73
Grass Hay (ton/acre)	1.1	2.39
Wheat (bushel/acre)	22.6	50.94
Corn (ton/acre)	7.2	13.92

The percentages of the top four crops in Table 3 were applied to the total acreages from section 3. The resulting acreages for each crop are shown in Table 17.

Table 17: Benefitted (Acres)

	Existing Benefitted		Expected Benefitted Irrigated Agricultural	
	Wellsville East Field	**Lower Canal**	**Wellsville East Field**	**WM Lower and Upper* Canal**
Alfalfa	1785	2284	1785	2862
Grass Hay	679	869	679	1089
Wheat	145	186	145	233
Corn	123	158	123	198
Total	2733	3497	2733	4381

*The water savings in the lower canal is available for all shareholders benefits in the WMCD on both the Upper and Lower Canal since all shareholders help pay for the projects.

The quantified economic value is based on the 5-year average commodity prices included in Table 18 based on the local pricing as reported in the National Agricultural Statistics reported annually by the USDA for 2021-2025.

Table 18: Commodity Prices

Alfalfa ($/ton)	$226
Grass Hay ($/ton)	$159
Wheat ($/bushel)	$6.94
Corn ($/ton)	$70.00

The estimated annual crop income was calculated by multiplying the yield per acre by the benefited acres by the unit price for each commodity. The resulting income for each commodity is shown in Table 19 both the existing and the proposed conditions.

Table 19: Annual Crop Income

	Wellsville East Field		WMCD	
	Existing	Proposed	Existing	Proposed
Alfalfa	$1,936,400	$2,646,400	$1,956,300	$5,510,800
Grass Hay	$481,500	$597,000	$498,800	$1,038,900
Wheat	$121,600	$144,400	$127,900	$242,600
Corn	$229,000	$290,800	$222,100	$471,200
Total	**$2,768,500**	**$3,678,600**	**$2,805,100**	**$7,263,500**

The net benefits are the simple differences between the existing and proposed total conditions. Thos are summarized in Table 20. Additionally, the due to the requirements to perform an incremental analysis the evaluation under the PR&G process, the proposed project has been analyzed incrementally by separating the water conservation obtained by the Wellsville Eastfield Canal, the WMCD Lower Canal, the WCIC, and Mendon City Irrigation City System as summarized in Technical Memorandum 005.

Table 20: Expected Annual Benefits by Project Measure

	Wellsville East Field	WMCD				Project Total
		WMCD Lower Canal	WCIC	Mendon City	WMCD Total	
Water Saved (Ac-ft)	1746	3514	1960	851	6331	8,077
Existing	$2,768,500	$1,556,961	$868,425	$379,714	$2,805,100	$5,573,600
Proposed	$3,678,600	$4,031,581	$2,248,691	$983,228	$7,263,500	$10,942,100
Net	$910,100	$2,474,620	$1,380,266	$603,514	$4,458,400	$5,368,500

8.0 Crop-Water Demand Characteristics and Crop Shifting

Yield curves show a correlation between annual consumptive use and crop yield, but do not illustrate the effects of seasonal fluctuations in water supply. Different crops peak in water demand at different times during the irrigation season. Wellsville-Mendon Conservation District's (WMCD) water source includes storage allocations in Hyrum Dam. Because WMCD relies on stored water, heavier use earlier in the season leaves less water available later, resulting in reduced deliveries toward the end of the irrigation season in average years.

This water availability influences crop selection in the area by favoring crops whose consumptive use demand peak earlier in the season. Water conservation allows stored water to be saved for later in the season, increasing the ability of local farmers to grow later-peaking crops. These crops are typically higher in value and provide additional economic benefits. Crops with earlier peaking consumptive use include wheat and barley, while alfalfa, orchard and fruit crops, and potatoes peak later and have significantly higher values. Figure 5 below shows the consumptive use demand for some of these crops as described in USU Extension Technical Report 145 for the area.

It is anticipated that as more water is conserved and later-peaking crops become more viable, crop shifting will occur, with grains such as wheat and barley being replaced by alfalfa, potatoes, and other higher value crops.

There is no reliable methodology to estimate the amount of crop-shifting that will occur due to project alternatives, so crop shifting was not quantified in the economic analysis. However, understanding the expected crop-shifting instills confidence that economic benefits due to water conservation are conservative, and that additional economic benefits are likely, further ensuring the economic sustainability of the proposed projects.

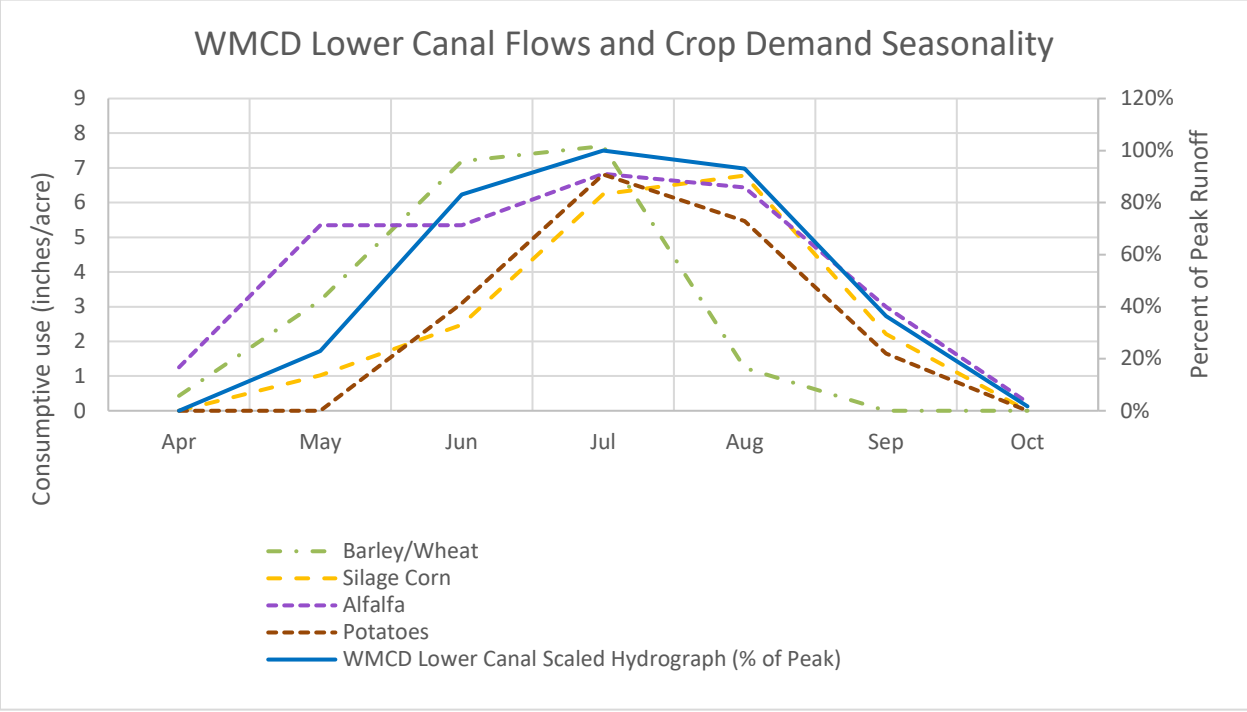


Figure 5: Crop Consumptive Use Compared to Little Bear River Runoff

9.0 Pumping Cost Reduction Benefits

In the Preferred Alternative, the WMCD's Lower Canal would be piped as a low-pressure system. The additional head would allow adequate pressure to run sprinkler heads from gravity pressure for acres directly below the canal and within the service area. Figure 6 shows that some acres within the WMCD service area currently lack adequate pressure from the existing open canal. There are approximately 193 acres within the Lower Canal service area that currently require pumping, representing about six farms. Assuming each farm uses Rocky Mountain Power, each farm would have an annual reduction of power costs of approximately $4,000. Together, this represents an annual benefit of about $24,000 under the Preferred Alternative (Piping Alternative).



Figure 6: Low Pressure Areas in WMCD Lower Canal Service Area (Source: Google Earth)

10.0 Summary of Crop Yields and Benefits

The average annual crop yield income expected under the No Action, Piping, and Lining & Buyouts Alternatives are summarized in Table 21 below. To calculate the annual crop yield income for the Lining & Buyouts Alternative it was assumed that the percentage of the canal being lined was proportional to the increase in yield income or 78%. Also, the pumping savings would only be seen if the Lower Canal is piped.

Table 21: Average Annual Income and Benefits by Alternative

Alternative	No Action	Piping	Lining/Buyouts
Annual Crop Yield Income	$5,573,600	$10,942,100	$9,742,950
Pumping Savings	$0	$24,000	$0
Total	$5,573,600	$10,942,100	$9,742,950
Increase	n/a	96.7%	74.8%

The above table demonstrates the detailed results of the overall benefits of this projects proposed.

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TM010 – Alternatives

Technical Memorandum 010 – Alternatives

Table of Contents

1.0 Introduction & Alternatives Considered 2
1.1 No Action/Future Without Federal Investment (FWOFI) 2
1.2 Proposed Action – Piping Alternative 2
1.3 Proposed Action – Lining & Buyouts Alternative 3
2.0 Channel Improvements 4
2.1 Lower Canal – Wellsville, Mendon, & Unincorporated Cache County 4
2.2 Bird Creek – Mendon City 5
3.0 Culverts 5
3.1 Bird Creek Culverts – Mendon City 5
3.2 WMCD Lower Canal Crossings – Cache County, Wellsville City, Mendon City 5
4.0 Spills & Pipelines 7
4.1 200 West (Wellsville City), 2900 South & 3400 South (Cache County), 200 South (Mendon) Spills & Pipelines, Murray Springs Spill abandonment (Wellsville City) 7
4.2 Wide Canyon Pipeline – Wellsville City 13
4.3 400 North Pipeline – Mendon City 13
4.4 300 North Pipeline – Mendon City 13
4.5 100 South (Bird Creek) Pipeline – Mendon City 14
5.0 Secondary Water System 17
5.1 Secondary Water System Supplied by Two Regulating Ponds – Wellsville City 17
5.2 Secondary Water System – Mendon City 17
6.0 Wellsville-Mendon Lower Canal Conveyance 18
6.1 Lower Canal Pressurized Pipeline – Wellsville, Mendon, & Unincorporated Cache County 18
6.2 Lower Canal Lining – Wellsville, Mendon, & Unincorporated Cache County 18
7.0 Wellsville East Field Canal Conveyance 18
7.1 Canal Enclosure – Wellsville City 18
8.0 Public Recreation 19
8.1 Wellsville Reservoir Boat Ramp – Wellsville City 19
8.2 Mendon Cemetery Reflecting Pond – Mendon City 19
9.0 Nonstructural Flood Prevention Measure 23
9.1 Buyouts of Structures in Floodplain – Wellsville, Mendon, & Unincorporated Cache County 23
10.0 Conclusion 25

1.0 Introduction & Alternatives Considered

This section provides a brief discussion of the alternatives and measures carried forward through the EIS process. Each measure was incrementally evaluated for engineering efficacy, modeled hydrologically and hydraulically (H&H), and then evaluated in detail for economic feasibility as part of this process. Each measure was also evaluated as a complete part of an entire alternative package for these same conditions, as well as all of the PR&G and NEPA criteria and constraints. Additionally, all corridors and easements have been verified and confirmed, and property owner agreements are in place with the Sponsors.

1.1 No Action/Future Without Federal Investment (FWOFI)

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 and 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 to the Plan-EIS. 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.

1.2 Proposed Action – Piping Alternative

The Piping Alternative would continue to divert the water for the 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 a 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.

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.

1.3 Proposed Action – Lining & Buyouts Alternative

The PR&G requires full consideration of at least one nonstructural or nonstructural-structural combination plan 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 authorized 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 the H&H analysis.

This alternative would also 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.

2.0 Channel Improvements

2.1 Lower Canal – Wellsville, Mendon, & Unincorporated Cache County

This measure 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 for irrigation water discussed later in this section. 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 Existing 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 (See Figure 1) and new spill locations (discussed later) to allow the canal to be maintained as a flood management channel. This measure was included as part of the Piping Alternative.

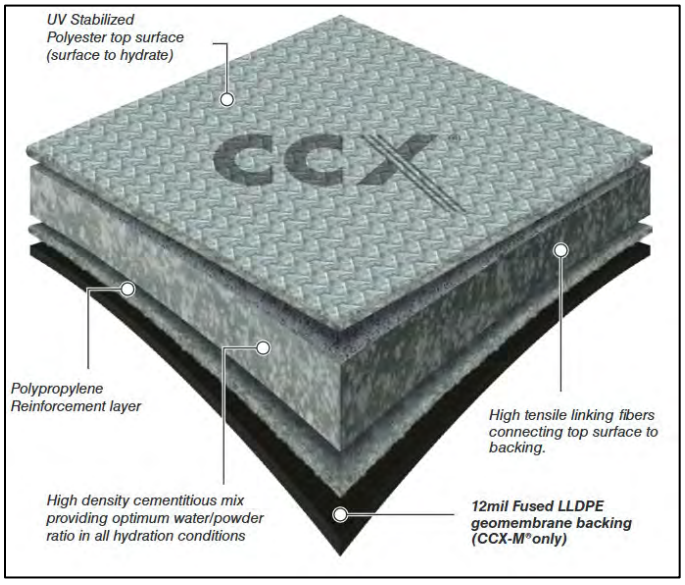


Figure 0-1: Concrete Canvas Lining Material Section

2.2 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.

This measure was included as a part of the Piping Alternative.

3.0 Culverts

Although the PL 83-566 program does not fund culverts, the project sponsors have decided to include them as part of the watershed plan in the Piping Alternative and fund them using non-Federal sources. Funding for 100% of the culvert improvements would be the responsibility of Wellsville City, Mendon City, or Cache County.

3.1 Bird Creek Culverts – Mendon City

The culvert beneath 100 West (SR-23) would be enlarged to accommodate the capacity needed for 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 1 shows those crossings which need to be replaced under this measure. Sponsors have identified and prioritized these measures.

Table 1 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

This measure was included as a part of the Piping Alternative.

3.2 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 the Piping 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 that 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 would be 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 2 summarizes those crossings that need to be replaced under this measure. Sponsors have identified and prioritized these measures. It is understood that federal funds will not be available for the culvert crossings.

Table 2: 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
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

This measure was included as a part of the Piping Alternative.

4.0 Spills & Pipelines

4.1 200 West (Wellsville City), 2900 South & 3400 South (Cache County), 200 South (Mendon) Spills & Pipelines, Murray Springs Spill abandonment (Wellsville City)

The capacity of the Lower Canal decreases as it flows north toward Mendon City, since it primarily serves irrigation needs and the flow reduces as water is delivered along the way. However, the canal is also used for flood management purposes. 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 South 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. A depressed pipe inlet structure is installed upstream, approximately 10-feet of the ramp weir structure, to divert the flows. The diversions and spills were sized based on the 50-year and 100-year storms to balance the flows and pipes and to minimize construction costs of the pipes, diversions, and canal improvements. All flows are diverted up to the 100-year flow event without any overtopping of the canals, thus meeting the requirements of the NEH flood mitigation requirements. Figures 2 – Figure 4 show the conceptual design of these spill and pipeline inlet structures. The primary difference being the height of the ramp weir diversion and whether flows are designed to pass the structure or not. All of the structures have been configured to balance the diversions and pipeline sizing as well as to mitigate any potential negative environmental impacts on discharge channels.

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 5. 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 stormwater 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 the 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 5. 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 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 5. 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 stormwater 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 5; the cross-sections are shown in Figure 6. 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 an 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 based on 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 5.

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 5. 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 stormwater 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.

These measures were included as a part of the Piping Alternative.

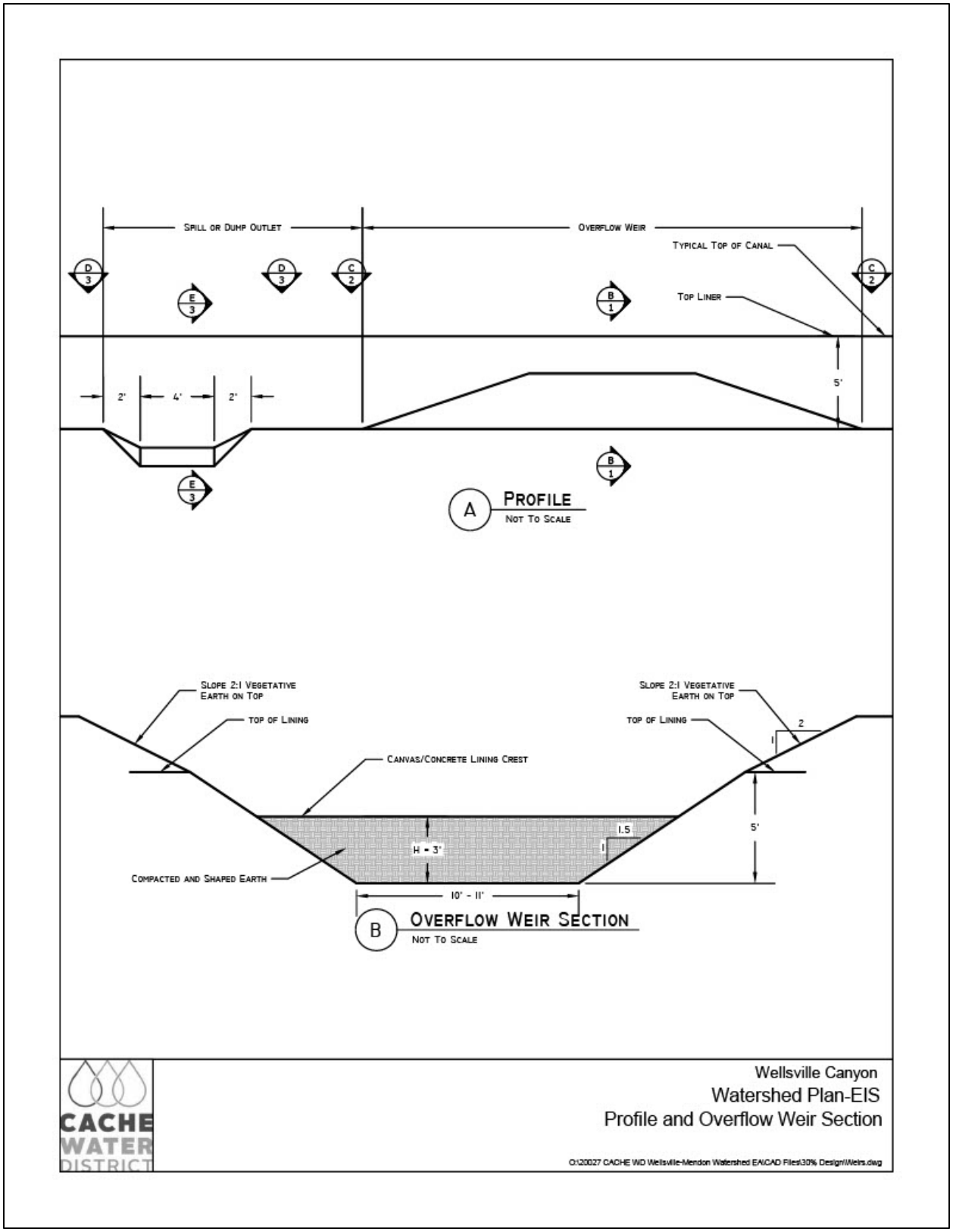


Figure 2: Spill Structure Profile & Section

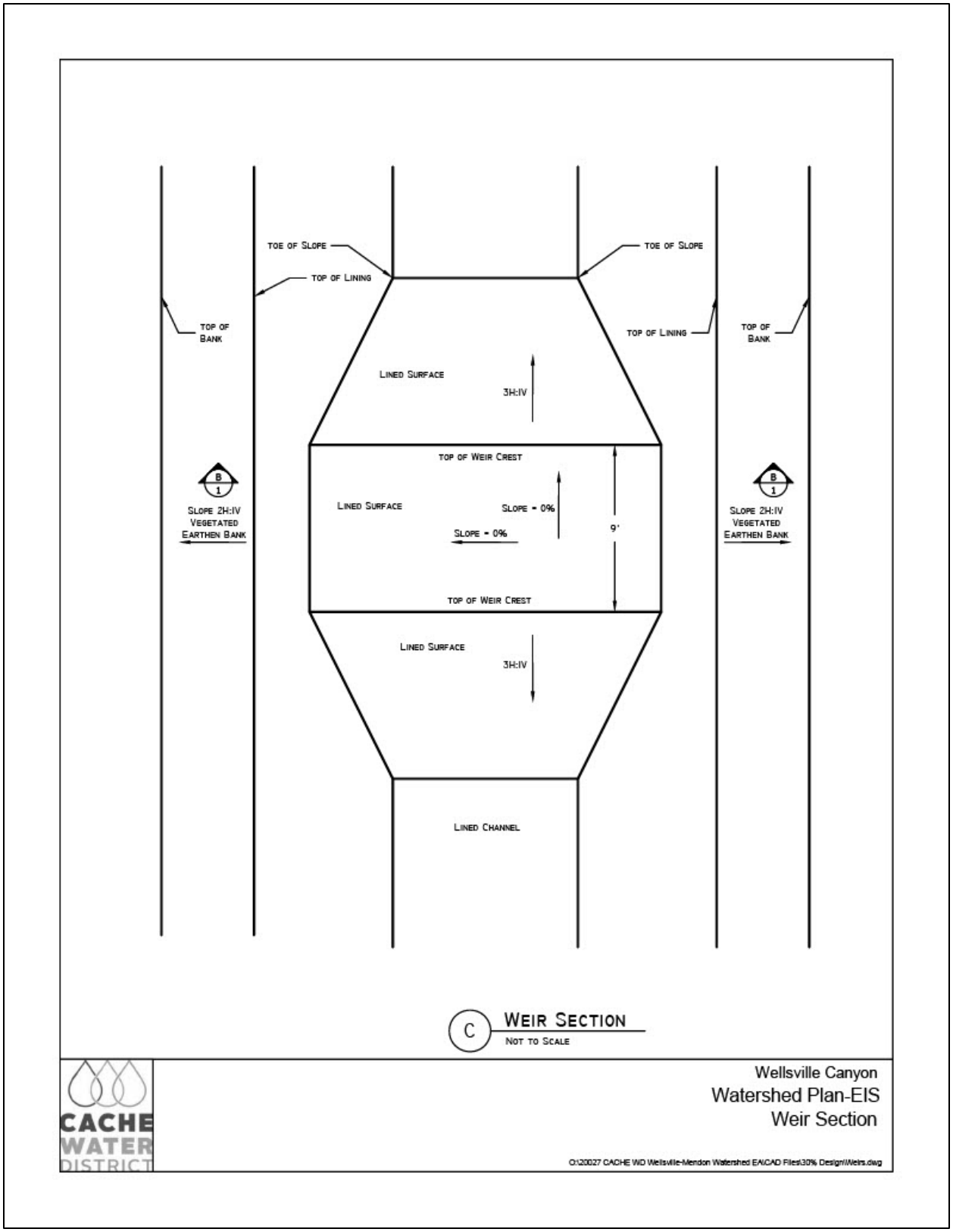


Figure 3: Spill Structure Plan

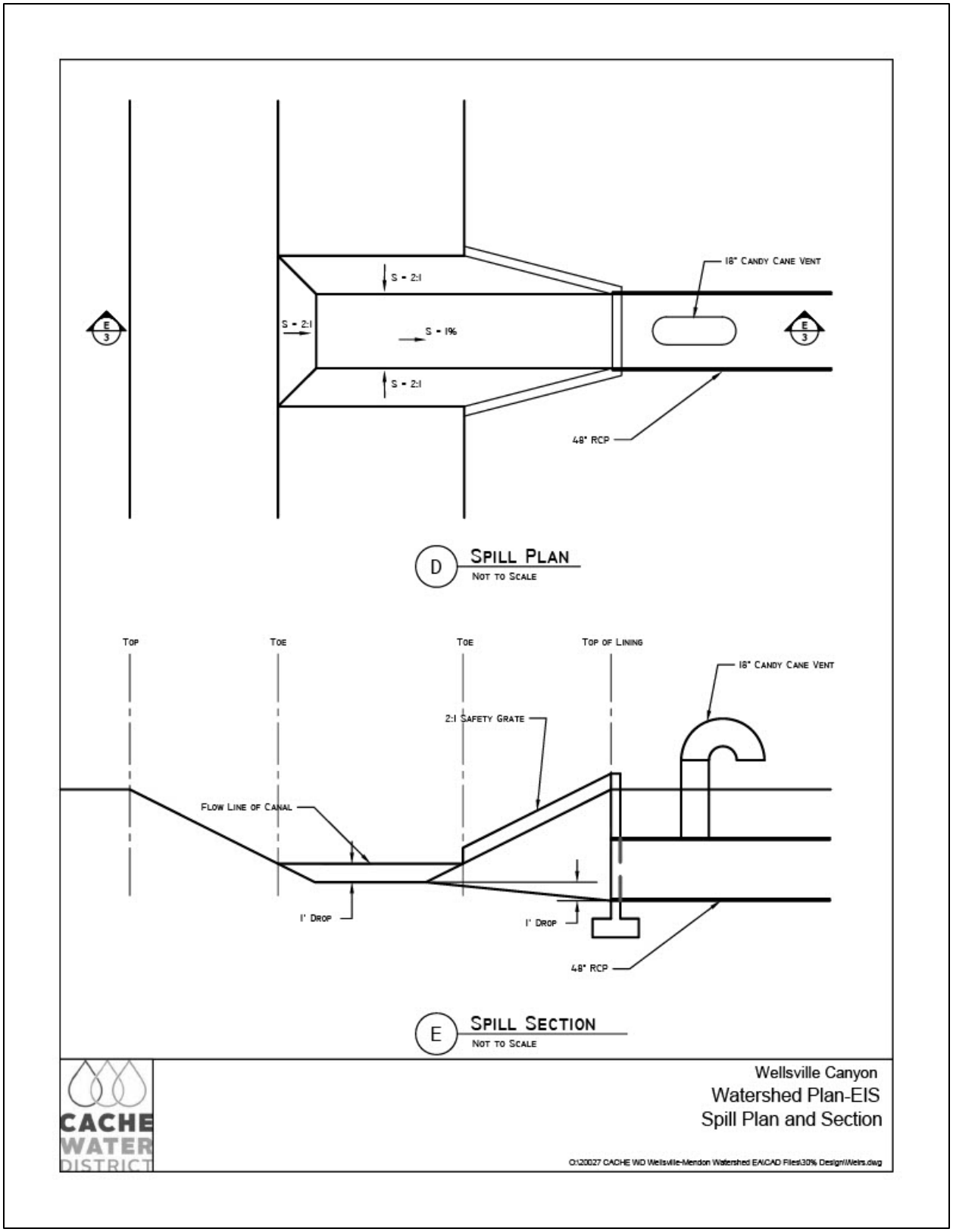


Figure 4: Piped Outlet Sections

4.2 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 as a defined channel at approximately 480 South as shown in Figure 5. 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 stormwater 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 measure was included as a part of the Piping Alternative.

4.3 400 North Pipeline – Mendon City

During the events described in the hydrology technical memo (Appendix E), 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 5. 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 stormwater 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 measure was included as a part of the Piping Alternative.

4.4 300 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 5.

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 stormwater 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 measure was included as a part of the Piping Alternative.

4.5 100 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 5, 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 stormwater 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 measure was included as a part of the Piping Alternative.

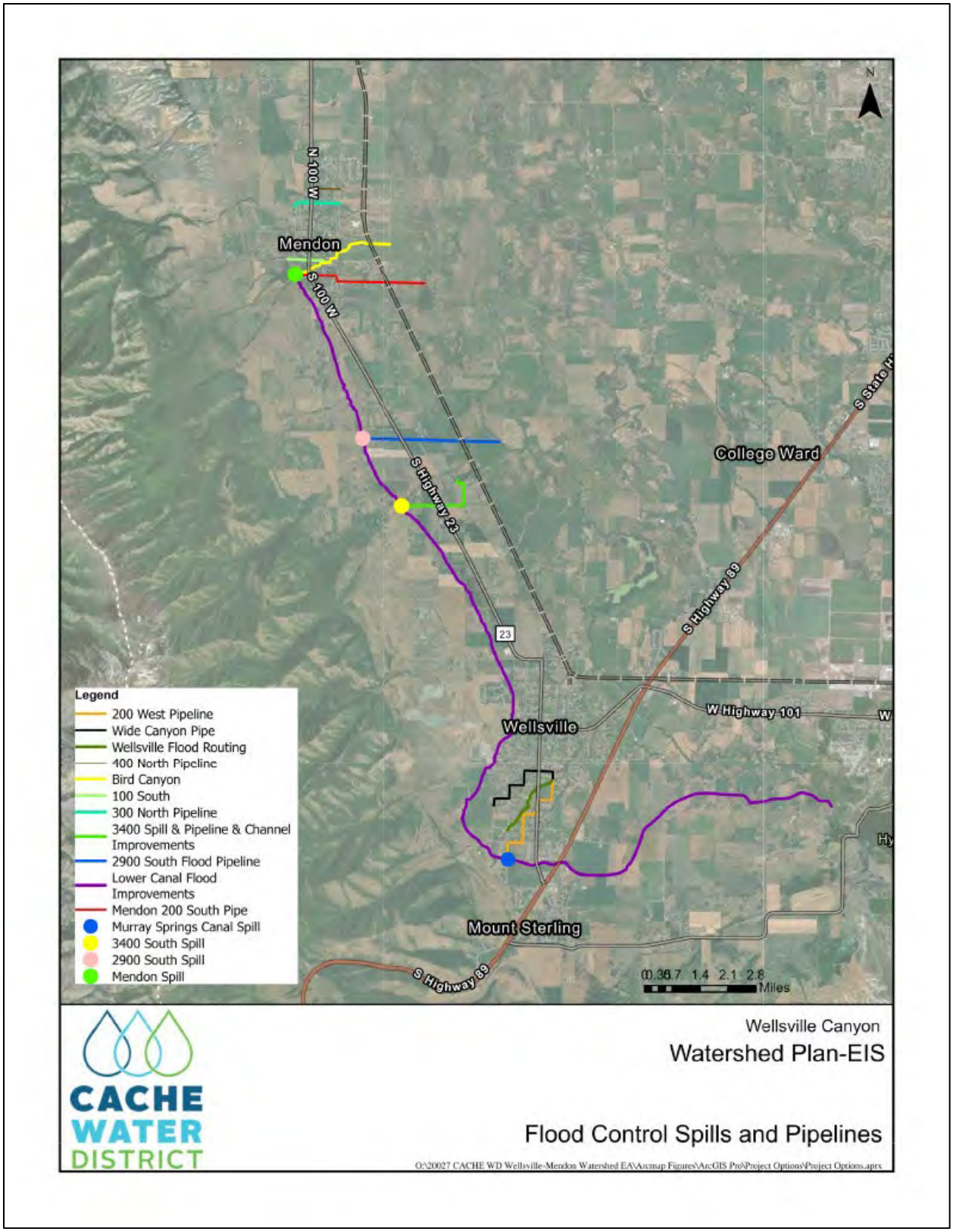


Figure 5: Flood Control Spills, Pipelines, & Lateral Weir Locations

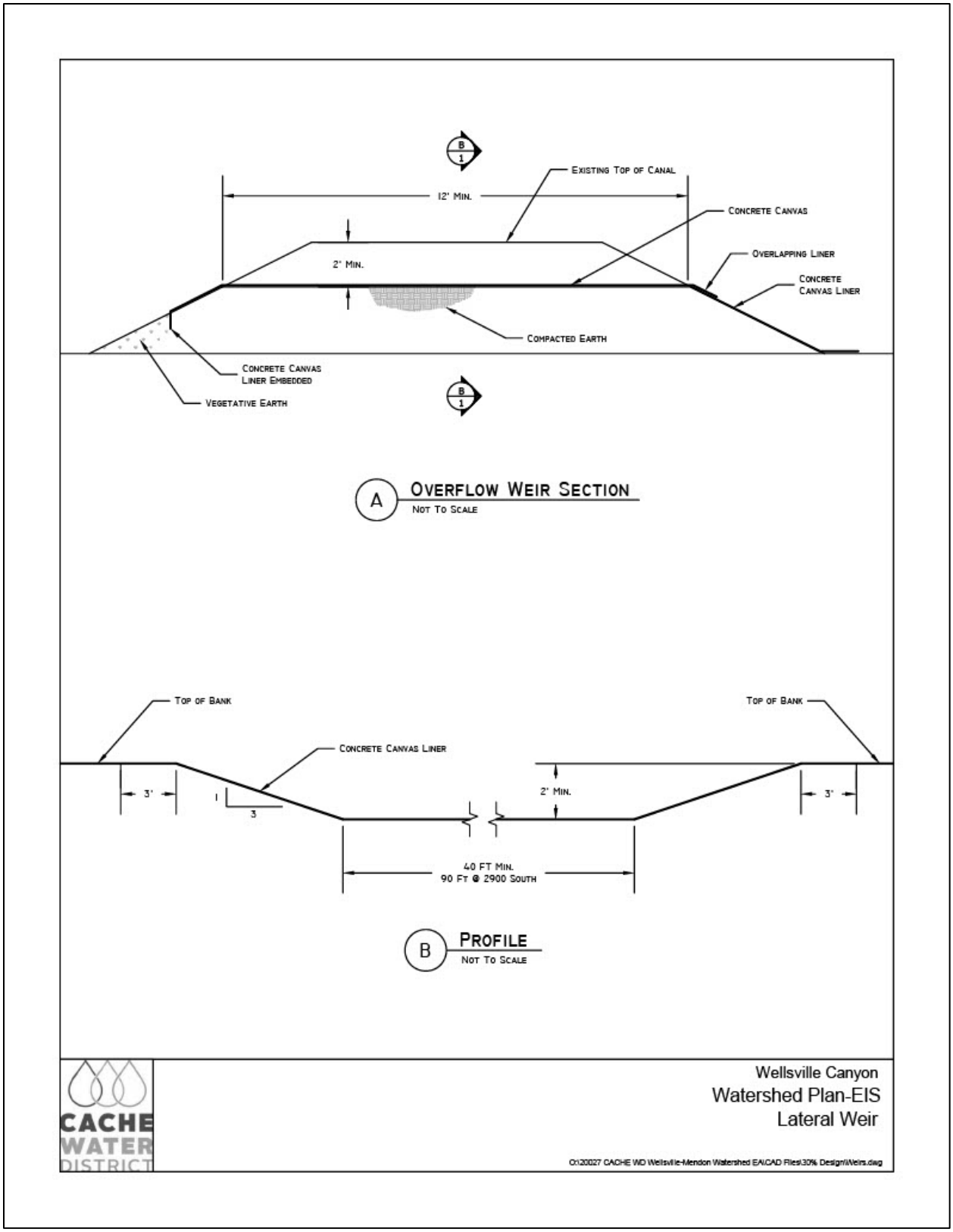


Figure 6: Lateral Weir Concept Profile & Section

5.0 Secondary Water System

5.1 Secondary Water System Supplied by Two Regulating Ponds – Wellsville City

This 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 7.

This measure was included as a part of the Piping Alternative and the Lining & Buyouts Alternative.

5.2 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 7.

This measure was included as a part of the Piping Alternative and the Lining & Buyouts Alternative.

6.0 Wellsville-Mendon Lower Canal Conveyance

6.1 Lower Canal Pressurized Pipeline – Wellsville, Mendon, & 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 7 reflects the expected pipe size and alignment from this evaluation. This measure was included as a part of the Piping Alternative.

6.2 Lower Canal Lining – Wellsville, Mendon, & 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, animal crossings (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 8. This measure was included as a part of the Lining & Buyouts Alternative.

7.0 Wellsville East Field Canal Conveyance

7.1 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 7. This measure was included as a part of the Piping Alternative and the Lining & Buyouts Alternative.

8.0 Public Recreation

8.1 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 9.

This measure was included as a part of the Piping Alternative and the Lining & Buyouts Alternative.

8.2 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 9. This measure was included as a part of the Piping Alternative and the Lining & Buyouts Alternative.

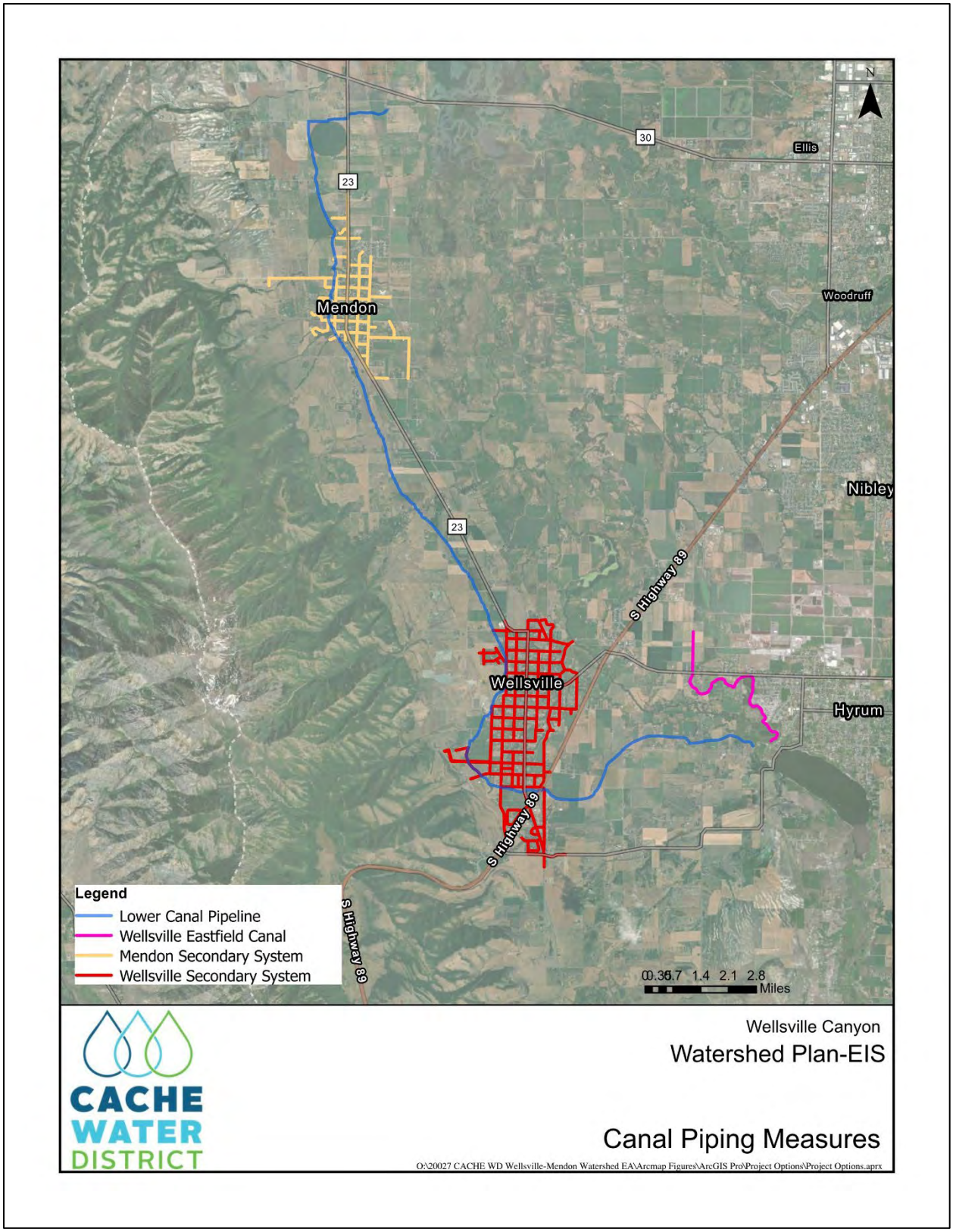


Figure 7: Canal Piping Measures

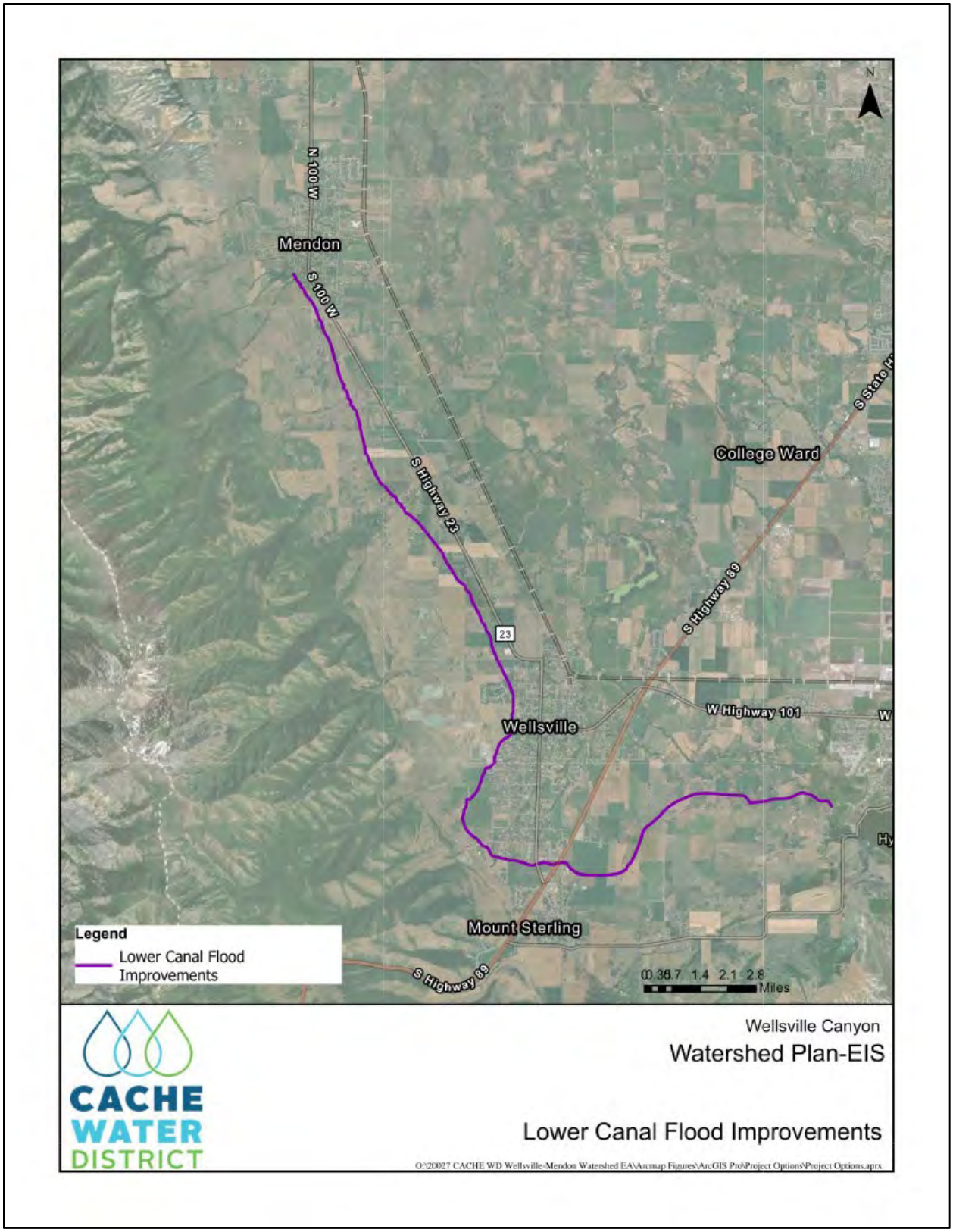


Figure 8: Lower Canal Flood Improvements

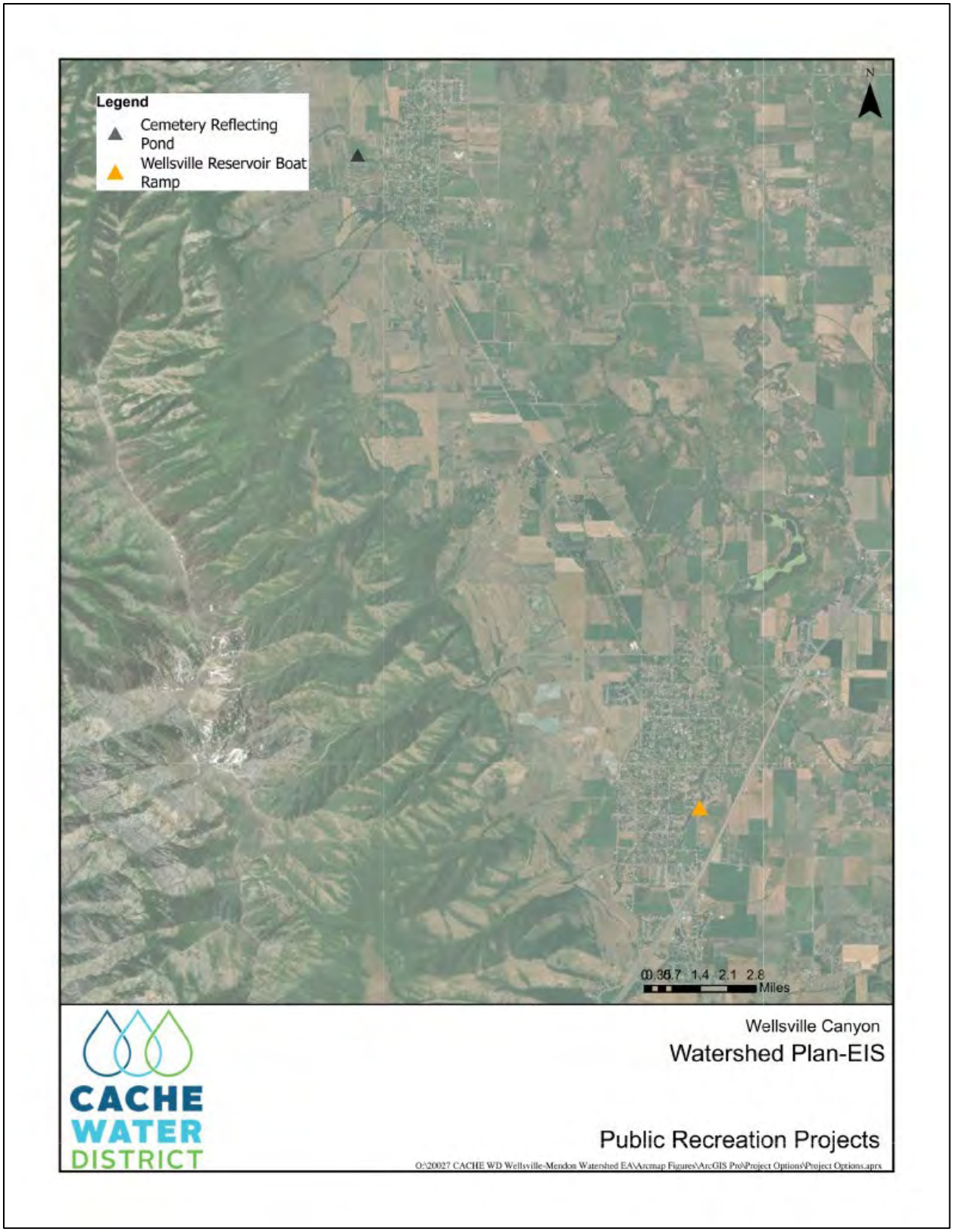


Figure 9: Public Recreation Projects

9.0 Nonstructural Flood Prevention Measure

9.1 Buyouts of Structures in Floodplain – Wellsville, Mendon, & 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 Figure 10, which shows the 100-year existing conditions floodplain. All structures within the inundated areas would be bought out under this measure.

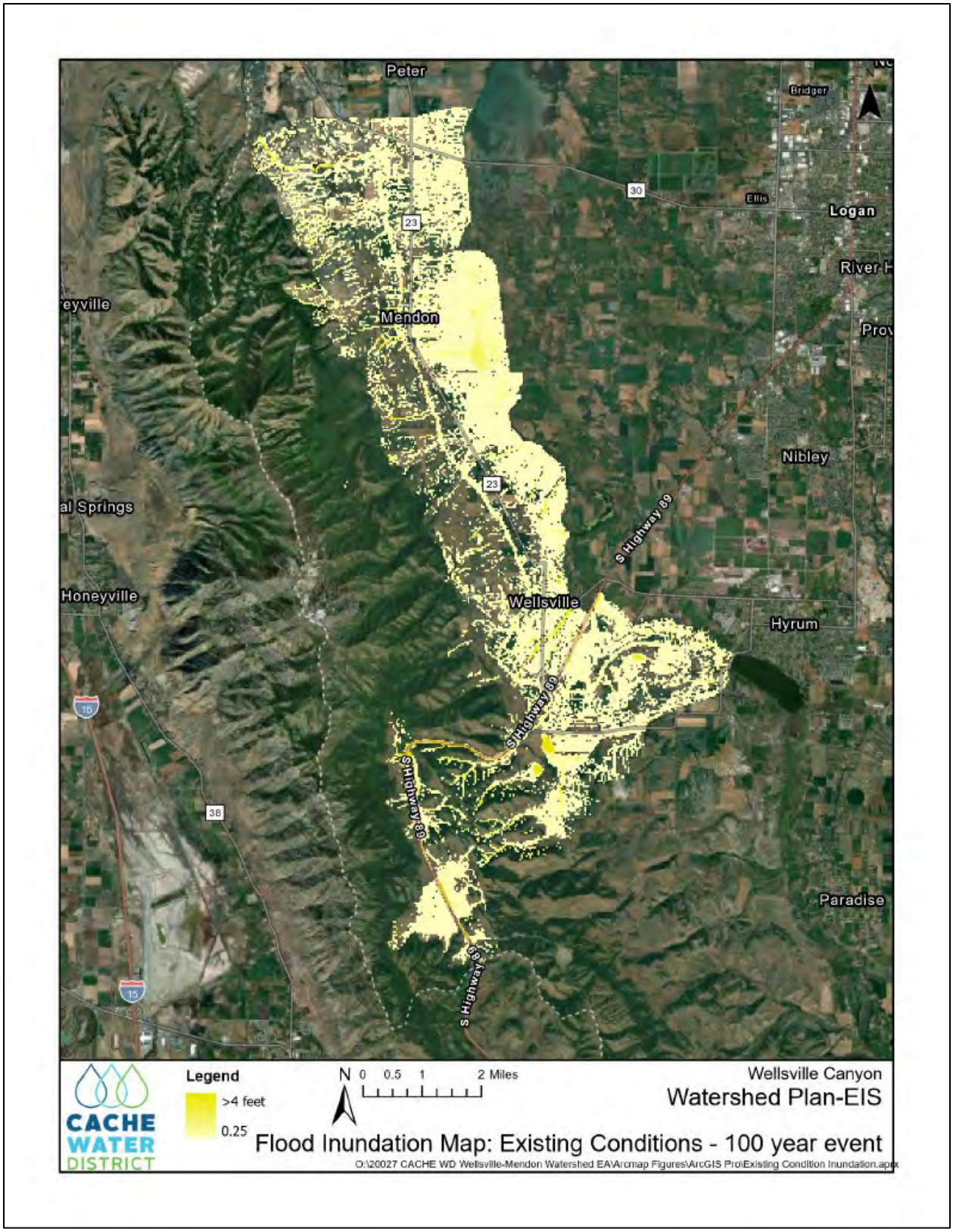


Figure 10: Existing Conditions 100-Year Event Map (Voluntary Buyouts Area)

10.0 Conclusion

This technical evaluation has incrementally evaluated the engineering feasibility in accordance with the NEH and Utah FOTG each measure and alternative identified in this section. Any measures not technically feasible has already been removed from consideration and was not included for further evaluation.

Each of the measures have gone through a detailed incremental economic and environmental evaluation to determine if all of the requirements for the PR&G guidelines are met as shown in the Alternative Formulation & Screening Matrix located in Appendix E to the Plan-EIS. Additionally, the Sponsors, Agencies, and other interested parties have provided extensive input into the development and refinement of these measures.

Economic Investigations & Analysis Report

June 2025

Economic Investigation and Analysis Report: National Economic Efficiency Analysis

Wellsville Watershed Plan

Proposed Floodwater Retarding Structures

Cache County, Utah

Prepared for:

NRCS

September 2025

Prepared by:

Hal Gordon, Economist

Table of Contents

Executive Summary **5**
Introduction **6**
Project Background **6**
Location and Setting 6
Major Water Uses in the Project Area 6
Flooding 7
Existing Facilities and Infrastructure 7
Existing Flood Control Infrastructure 7
Irrigation Conveyance and Distribution 7
Recreation Area 8
Analysis Considerations **8**
Funding 8
Evaluation Unit 8
Project Implementation Timeline 8
Analysis Period 8
Project Life 8
Project Purpose and Need 9
Flood Control 9
Agricultural Water Management 9
Public Recreation 9
Public Health and Safety 9
Alternatives Considered During Formulation **10**
Alternatives Considered but Eliminated from Detailed Study **11**
Pressure Piping the Wellsville Canal (Upper Canal) 11
Piping and Filling Alternative 11
Alternatives Considered for Detailed Study **12**
No Action Alternative 12
Alternative 1 – Pipe the Canals, Improve the Lower Canal for Flood Flows, and Recreation 12
Costs of the Piping Alternative 1 13
Benefits of the Piping Alternative 1 14
Alternative 1 Recreation Increments ..... **Error! Bookmark not defined.**
Alternative 2 – Line Canal and Improve Lower Canal for Flood Flows, Flood Property Buyout 15
Canal Lining (Alternative 2) 15
Relocation and Property Buy-Out 16

Replacement Costs 17
Benefits of the Lining Alternative 2 17
Benefits Considered but Not Included in Analysis 18
Additional Agricultural Damage Reduction Benefits 18
Improve Water Conservation 18
Public Safety Avoided Costs 18
Groundwater Recharge 18
Change in Aesthetics and Associated Property Values 18
Incremental Analysis 18
The Preferred Alternative 21
Project Benefits 22
Beneficial Effects 28
Watershed Project Costs 29
Watershed Project Benefits and Costs 31
Economic Tables 31

List of Tables

Table 1: Piping Alternative Actions 13
Table 2: Alternative 1 Recreation Increments Costs 15
Table 3: Canal Lining Alternative Actions 16
Table 4: Relocation and Property Buy Out Costs 17
Table 5: Incremental Analysis of Annual NEE Costs and Benefits 19
Table 6: Comparison of Benefits and Costs [1/] 21
Table 7: Annual Expected Crop Production Benefits 23
Table 8: Wellsville East Field Benefited Acreage and Yield Increase by Crop 24
Table 9: Wellsville Secondary Benefited Acreage and Yield Increase by Crop 24
Table 10: Mendon Benefited Acreage and Yield Increase by Crop 24
Table 11: Lower Canal Piping Benefited Acreage and Yield Increase by Crop 25
Table 12: Project Area Structures Depreciated Replacement Value (DRV) 26
Table 13: Watershed Planning Area 100 yr Flooded Structures (W/O Project) 27
Table 14: Structures Flooded in the Wellsville Watershed Project Area Without Project 27
Table 15: Summary of Annual Expected Damages 28
Table 16: Summary of Floodwater Reduction Benefits 28
Table 17: Watershed Project Annual Cost Summary 30
Table 18: Watershed Project Benefit-Cost Summary[1/] 31
Economic Table 6-1: Estimated Installation Cost Wellsville Watershed, Utah [2025 Dollars]1 32
Economic Table 6-2: Estimated Cost Distribution – Water Resource Project Measures, Wellsville Watershed, Utah [2025 Dollars]1 34

Economic Table 6-3: Cost Allocation and Cost Sharing Summary for Multi-Purpose Watershed Project Plans, Wellsville Watershed, Utah [2025 Dollars]1 35
Economic Table 6-4: Recreational Facilities—Estimated Construction Costs, Wellsville Watershed, Utah [2025 Dollars]1 36
Economic Table 6-4: Estimated Average Preferred Alternative Annual Costs, Wellsville Watershed, Utah (2025 Dollars)1 36
Economic Table 6-5: Estimated Average Annual Flood Damage Reduction Benefits Wellsville Watershed, Utah (2025 Dollars)[1] 37
Economic Table 6-6: Estimated Average Annual Watershed Protection Damage Reduction Benefits Wellsville Watershed, Utah [2025 Dollars]1 37
Economic Table 6-7: Comparison of Preferred Alternative Benefits and Costs Wellsville Watershed, Utah [2025 Dollars][1] 38

Executive Summary

This National Economic Efficiency (NEE) analysis evaluates the costs and benefits of an Alternative that may include the following components: 1) Pressurized Irrigation Pipeline System; 2) Canal Lining; and 3) Recreation Site on a small waterbodies over the No Action Alternative for the Wellsville Watershed Project. All economic benefits and costs are provided in 2025 dollars and have been expressed in average annual values using the fiscal year 2025 federal water resources planning rate of 3.00 percent.

The proposed preferred project Alternative 1 evaluates piping a segment of an irrigation delivery canal, constructing regulating ponds, installing an open channel overflow system, line and expand portions of an irrigation canal for flood control and develop aquatic recreation sites.

The ag management projects would pipe a portion of the Wellsville East Field Canal, pipe the WMCD Lower Canal, and install secondary systems in Wellsville and Mendon to improve water conservation, improve water supply management, delivery reliability, reduce flooding damages and improve public safety. In total, the ag management portion of the project is estimated to cost $86,969,000. Average annual installation costs are $3,828,080. Watershed Protection and Flood Prevention Act (PL 83-566) funds would cover about $68,345,500 (including design and engineering). The sponsors and other non-federal funds would contribute $18,623,500. The improvements for flood control is estimated to cost $52,164,000. Average annual installation costs are $2,176,678. Watershed Protection and Flood Prevention Act (PL 83-566) funds would cover about $44,727,000. The sponsors and other non-federal funds would contribute $7,437,000. The recreation improvement cost is estimated to be about $43,000. Average annual installation costs are $2,400. Watershed Protection and Flood Prevention Act (PL 83-566) funds would cover about $25,000. The sponsors and other non-federal funds would contribute $18,000.

Watershed Works of Improvement	NRCS Cost	%	Sponsors Cost	%	Total Cost
Construction Items					
Flood Control [1/]	$37,159,000	100%	$0	0%	$37,159,000
Flood Control Culverts	$0	0%	$7,314,000	100%	$7,314,000
Agricultural Water Management	$55,720,500	75%	$18,573,500	25%	$74,294,000
Recreation	$16,000	50%	$16,000	50%	$32,000
Subtotal: Construction Costs	**$92,895,500**		**$25,903,500**		**$118,799,000**
Non-Construction Items [3/]					
NRCS Technical Assistance/Engineering	$19,007,000	100%	$0	0%	$19,007,000
Flood - Construction Administration	$449,000	100%	$0	0%	$449,000
Ag - Construction Administration	$558,000	75%	$186,000	25%	$744,000
Recreation - Construction Administration	$1,000	50%	$1,000	50%	$2,000
Permits			$175,000	100%	$175,000
Land Acquisition			$0	100%	$0
Subtotal: Non-Construction Costs	**$20,015,000**		**$362,000**		**$20,377,000**
Grand Total:	**$112,910,500**		**$26,265,500**		**$139,176,000**

Canal replacement, pipeline construction and recreation improvements would be completed over approximately 5 years.

The Piping Alternative 1 is anticipated to provide agricultural, ecological, operational, recreation and public safety benefits. By ensuring irrigation water delivery to agricultural lands, eliminating the need for pumping, and reducing operation and maintenance costs, the proposed project is anticipated to generate $7,376,280 in average annual agricultural benefits. The Piping Alternative would also reduce flood damages by $6,827,802 per year. Additional unquantified benefits of the Piping Alternative in this analysis include other agricultural damage-reduction benefits and improved public safety. The Recreation portion of the project would develop a boat ramp and day use area on one reservoir and community pond near the cities of Wellsville and Mendon. The improvements would improve recreational access and public safety. In total, this portion of the project is estimated to produce $11,963 in annual benefits.

In sum, the Piping and Recreation Alternative 1 has an estimated $6,007,158 in annual average costs and would provide an estimated $14,756,305 in annual average benefits; this would result in annualized net benefits of approximately $8,749,147.

Introduction

This NEE Analysis that evaluates the costs and benefits of the Piping, Canal Lining, and Recreation Alternatives over the No Action Alternative for the Wellsville Watershed Project. The analysis uses Natural Resources Conservation Service (NRCS) guidelines for evaluating NEE benefits as outlined in the NRCS Natural Resources Economics Handbook and the U.S. Department of Agriculture's (USDA) Guidance for Conducting Analyses Under the Principles, Requirements, and Guidelines for Water and Land Related Resources Implementation Studies and Federal Water Resource Investments (DM 9500-013).

All economic benefits and costs are provided in 2025 dollars and, in accordance with the NRCS Natural Resources Economics Handbook, are presented in average annual values using the fiscal year 2025 federal water resources planning rate of 3.00 percent.

Project Background

LOCATION AND SETTING

The project area is located in western Cache County, Utah. The cities of Wellsville and Mendon, and unincorporated land, are within the project area. Major crops grown in the area are identified in the Plan-EIS, and include: Alfalfa, Grass Hay, Wheat, and Corn Silage.

MAJOR WATER USES IN THE PROJECT AREA

- Agricultural irrigation
- Municipal and industrial water use
- Recreation
- Hydropower generation (Cutler Reservoir)

Hyrum Reservoir is the main water storage reservoir in the watershed project area, and the Little Bear River (flowing out of Hyrum Reservoir) is the primary source of water for agricultural production in the

watershed area. Other irrigation water is supplied from several springs and small creeks on the east slope of the Wellsville Mountains. There are no regional floodwater management reservoirs within the project area, but there are several small private irrigation storage reservoirs in the project area.

FLOODING

The flooding events are caused by rain in the valley and in the Wellsville mountains. Snow persists above 6,500 feet elevation in the mountains. Many flood events are caused by rain-on-snow and frozen ground events. Flood events typically create sheet flow, that erode soil on agricultural lands until entering natural drainage channels. Flood damages may occur on irrigated and dryland cropland, roads and farm and residential properties. Some natural floodway channels have been obstructed with rural and urban development.

EXISTING FACILITIES AND INFRASTRUCTURE

Existing Flood Control Infrastructure

Flood runoff overwhelms multiple aging and undersized drainage systems as well as agriculturally altered natural drainage channels, causing flooding to agricultural communities in western Cache County. Numerous floods have been documented over the last 35 years within the watersheds, threatening improved land, critical infrastructure, and agricultural land.

Irrigation Conveyance and Distribution

In the project area, surface water is used for irrigation, recreation, livestock, and culinary purposes. Groundwater wells in Cache Valley are used for irrigation, domestic, industrial, and culinary water supply. The specific area of the project has very few wells due to groundwater quality and associated nitrate levels.

Hyrum-Mendon Canal (Lower Canal)

The Lower Canal's water is piped out of Hyrum Reservoir through a siphon before daylighting into the canal. The canal then gravity flows to the west where it passes through Wellsville and then runs north toward Mendon. After passing through Mendon City, the canal turns back to the east where it flows parallel to Highway 30 before discharging into Cutler Reservoir. Throughout the life of the canal, several sections have been piped due to seepage losses, damage to the canal, new housing developments, or new roads. In addition to piping sections of the canal, a canal liner has been installed on several segments of the alignment to cover approximately 25% of the total length. While these measures have helped, the canal still experiences significant seepage losses.

Wellsville Canal (Upper Canal)

Water for the Wellsville Canal is diverted out of Hyrum Reservoir also. The pressure head generated as the water is discharged from Hyrum Reservoir operates a turbine that turns a crank shaft which is directly connected to a pump. This pump lifts the flows through a penstock to the Wellsville Canal before daylighting into the canal. From here, the canal gravity flows to the west towards Wellsville. Once the canal reaches Highway 89, it flows to the North along the hillside where it terminates and discharges any remaining water into the Lower Canal. Several sections of this canal have also been piped due to damage, seepage losses, or new housing developments.

Wellsville Reservoir

Wellsville Reservoir is located within Wellsville City at the Wellsville City Park. It is primarily used for irrigation storage by the Wellsville City Irrigation Company with other uses including recreation and fishing.

Recreation Area

Recreation areas within the project area include fishing at Wellsville Reservoir, the Little Bear River, and Cutler Marsh and Reservoir.

Of the eight authorized purposes to receive federal funding as established by NRCS, the project includes Flood Protection, Agricultural Water Management and Recreation. Watershed Protection was also considered in the formulation of project alternatives, although not designated as a project purpose. The Proposed Action would provide flood risk reduction to areas of Cache County through the installation of floodwater conveyance infrastructure. The Proposed Action would also improve agricultural water management in the lands controlled by the project sponsor and the various co-sponsors, as well as for local farmers. The Proposed Action will create new recreational access for non-motorized watercraft and fishing. Finally, while the Proposed Action Alternatives do not include structural or physical actions to reduce erosion and sediment loading to the Little Bear River, they all include a nonstructural element of public education and outreach in cooperation with Utah State University Extension to educate and seek to modify dryland farming techniques on the highly erosive soils upgradient of the canals. As a result, the Proposed Action will improve watershed protection measures to reduce erosion and the consequent nutrient loading to the Little Bear River which creates various water quality concerns when left unmetered.

Analysis Considerations

This section describes the economic analysis, funding sources, interest rates, evaluation units, project implementation timeline, period of analysis, and the project purpose for the Preferred Alternative 1. All values in this analysis are presented in 2025 dollars.

FUNDING

PL 83-566 funds would cover $112,910,500, which includes $92,858,000 construction costs, $19,007,000 engineering, $37,500 mitigation and $1,008,000 project administration. The sponsors and other non-federal funds would contribute $26,264,500.

EVALUATION UNIT

The proposed project has two broad evaluation units, each near the communities of Wellsville and Mendon, Utah. The first unit consists of converting from irrigation canal to pressurized pipeline (four increments), or canal lining (one increment), which serves the entire irrigation district. The second unit are recreation sites at Wellsville Reservoir and Mendon Pond.

PROJECT IMPLEMENTATION TIMELINE

If PL 83-566 funds are made available, construction would likely be completed over approximately 5 years. The project would be completed in at most four phases based on the amount of construction that could be completed during the non-irrigation season. For each phase, the analysis assumes that full benefits would be realized the year after construction is completed.

ANALYSIS PERIOD

The analysis period is 55 years since the project would take 5 years to construct and 50 years is the expected project life.

PROJECT LIFE

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

PROJECT PURPOSE AND NEED

The purpose of this project is to reduce flooding 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.

Flood Control

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-snow events is 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 portions of unincorporated Cache County.

The installation of the Piping Canal Alternative 1 will reduce flooding concerns associated with intense rain-on-snow and/or frozen ground events within the project area. More dependable floodwater conveyance will benefit residences in the project area.

While all the flood events were considered for the entire project area, only the Mendon area flood damages were monetized for the cost benefit analysis. This is a conservative assumption that was made since the exact location of the breach of the canal is unknown. However, it can be assumed that the Mendon area will flood due to the size of the siphon at Bird Canyon.

Agricultural Water Management

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. The water is supplied from the Little Bear River through Hyrum Reservoir storage and Little Bear River instream flows.

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 Canal. 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.

Public Recreation

Existing recreational opportunities in the watershed are limited. Residents of the area would benefit greatly from any new recreational measures proposed. The Proposed Action would provide non-motorized personal watercraft access to Wellsville Reservoir. Recreational improvements 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.

Public Health and Safety

Flooding has historically been a problem in Western Cache County. 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.

Alternatives Considered During Formulation

This section presents the alternatives considered during project formulation. Additional information is found in the Plan-EIS. During the formulation phase, alternatives were evaluated based on meeting both National Environmental Policy Act (NEPA) and environmental review requirements specific to NRCS federal investments in water resources projects (PR&G). According to NEPA, “agencies shall rigorously explore and objectively evaluate all reasonable alternatives” (40 Code of Federal Regulations 1502.14). "Reasonable alternatives means a reasonable range of alternatives that are technically and economically feasible, meet the purpose and need for the proposed action, and, where applicable, meet the goals of the applicant" (40 Code of Federal Regulations 1508.01). According to the PR&G DM 9500-013 (USDA-NRCS, 2017a), alternatives should reflect a range of scales and management measures and be evaluated against the Federal Objective and Guiding Principles; against the extent to which they address the problems and opportunities identified in the purpose and need; and against the criteria of completeness, effectiveness, efficiency, and acceptability.

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

According to the PR&G and the NWPM 501.45 (2024), Agricultural Water Management, Flood Protection, and Recreation were the project purposes analyzed for the Wellsville Watershed Plan-EIS. Economic Table 7, Comparison of NEE Benefits and Costs, contains a summary of the average annual project costs and benefits. An Excel Workbook, with associated sheets within the workbook, provide the detail for the complete economic analysis. Incremental analysis was conducted considering project measures.

As described in the General Plan EIS, the main purpose of the watershed plan is to reduce the average annual flood damages and improve irrigation water management and crop production. While only irrigation canal system failure related flood damages, crop production benefits, and recreation benefits were quantified, other types of benefits serving the project purposes were still considered qualitatively when evaluating the costs and benefits of project alternatives.

According to PR&G, after preliminary consideration, agencies may remove from detailed study those alternatives that do not achieve the Federal Objective and Guiding Principles. In addition, alternatives that may at first appear reasonable but clearly become unreasonable because of cost, logistics, existing technology, social, or environmental reasons may also be eliminated from further analysis. These alternatives were briefly discussed to indicate that they were considered, and the analysis documented the reason(s) why they were eliminated (e.g., they do not achieve the Federal Objective and Guiding Principles).

In general, the NEE alternative was developed in accordance with PR&G by evaluating economic, social, and environmental impacts from flood damage reduction, irrigated crop improvement and recreation in rural communities. Given the emphasis placed on replacing open irrigation canals with pipeline by the local steering committee to provide reliable irrigation water and reducing flood damages , the geographic extents of evaluated alternatives are limited to the immediate project area. The annual benefits of the project alternatives are based on the estimated reduction in average annual flood damages, irrigation improvements and recreation benefits compared to future conditions without mitigative action (No Action Alternative). Three categories: 1) Flood Protection, 2) Irrigation Water Management and 3) Recreational opportunities were identified in the development of action alternatives.

Alternatives Considered but Eliminated from Detailed Study

Alternatives that were eliminated during formulation are shown below. Alternatives selected for further evaluation are discussed in the Plan-EIS.

PRESSURE PIPING THE WELLSVILLE CANAL (UPPER CANAL)

The project originally included a measure to pressure-pipe the Upper Canal (Wellsville Canal). This alternative would have fulfilled the project Purpose and Need and would have met individual criteria in the PL 83-566 guidelines. However, in order for the project to progress at a quicker pace than the PL 83-566 program allows, the sponsor decided to use other program funding to expedite the project. It is for this reason that the option to pressure-pipe the Upper Canal was eliminated from further study.

PIPING AND FILLING ALTERNATIVE

The Piping and Filling Alternative was initially considered for detailed evaluation. 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 pressure pipe the Hyrum-Mendon Canal in Wellsville, Mendon, and part of unincorporated Cache County, Utah. This alternative eliminates the open channel Hyrum-Mendon Canal and restores the natural flood channel flow paths where possible. Where necessary, a combination of conduits and open channels flowing North and East to the Little Bear River floodplain would be used.

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 peaking demands on the pressurized irrigation systems. A new access ramp limited to non-motorized personal watercraft would be built at Wellsville Reservoir.

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. Second, the alternative's benefit/cost ratio would be too disproportionate. This alternative would unavoidably result in the flooding of homes and other structures located in the floodplain. And third, and perhaps most importantly, the project did not receive sponsor support. For these reasons, the project also fails to fully meet the Purpose and Need.

Additionally, the alternative did not meet all the Guiding Principles of the PR&G because it didn't support healthy & resilient ecosystems, sustainable use of floodplains, or utilize a watershed-scale approach. The alternative did not meet the Federal Objective to protect the environment and did not constitute a fully complete, effective, efficient, or acceptable solution. For these reasons, the Piping and Filling Alternative was eliminated from detailed study.

Alternatives Considered for Detailed Study

The following section describes the alternatives carried forward for detailed analysis. These included a No-Action (PR&G Future Without Federal Investment) with various Proposed Action Alternatives. The No-Action Alternative represents a baseline condition, and the Proposed Action Alternatives were developed to meet the project Purpose and Need. The alternatives were developed in accordance with the PR&G and NEPA process.

NO ACTION ALTERNATIVE

The No Action Alternative contains activities that would occur if no federal action or funding were provided. This alternative would not address flooding into the canals. The canals would be maintained in their existing condition as earthen channels and irrigation conveyance within the communities of Wellsville and Mendon and would continue to overtop during rain-on-snow events and flooding in the Wellsville Canyon Watershed Plan area would continue. Additionally, erosion and sedimentation from the alluvial plains above the canals would continue under this alternative. There would be no recreational access to Wellsville Reservoir constructed.

The No Action Alternative will not meet the project's purpose and need as it will not be able to reduce flood risks and concerns in the project area. The existing infrastructure would continue to operate in its current condition and would not improve flood control, 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. 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.

ALTERNATIVE 1 – PIPE THE CANALS, IMPROVE THE LOWER CANAL FOR FLOOD FLOWS, AND RECREATION

This alternative would have funding made available through PL 83-566 allowing for the placement of pipes into the existing canal. The Piping Alternative would continue to divert the water for the Wellsville-Mendon Conservation District from below Hyrum Reservoir at the existing diversion points. However, this alternative would then enclose the Wellsville-Mendon Canal (Lower Canal) and convey water through piping in Wellsville and Mendon cities and part of unincorporated Cace County, Utah. The existing Wellsville-Mendon Canal would be improved with the addition of open channel overflow systems at 2900 South (unincorporated Cache County) and 200 South (Mendon City). This would be accomplished through a combination of conduits and channels to convey floodwaters from the west side of Cache Valley between Wellsville and Petersboro to the natural floodplain of the Little Bear River east of the communities.

This alternative would use the water rights of the Wellsville Eastfield Canal Company to enclose and pipe a portion of the Wellsville Eastfield Canal beginning at 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, and Greater Mendon Irrigation companies. This alternative would also install regulating ponds to stabilize peak demands on the pressurized irrigation systems.

Two water-based recreation sites would be built under Alternative 1, a boat ramp and day-use area on Wellsville Reservoir and a day-use area on Mendon Pond.

This Proposed Action Alternative meets the Purpose and Need of the project as required by NEPA. The table below describes the selected actions that compose the Piping Alternative.

Table 1: Piping Alternative Actions

Proposed Action	PL 83-566 Authorized Purpose
Construct Regulating Ponds	Ag Water Management
Install Open Channel Overflow System	Flood Protection
Pipe Portion of Lower Canal	Flood Protection
	Ag. Water Management
Pipe Segment of Wellsville E. Field Canal	Ag. Water Management
Pressurize W & M Cities' Irrigation System	Flood Protection
	Ag. Water Management
New Access Ramp at Wellsville Reservoir	Public Recreation

The Piping Alternative meets the Federal Objective to protect the environment by improving water delivery reliability, improving public safety, improving water quality, improving irrigation water management, and improving water conservation, the alternative to pipe the canal achieves the PR&G Guiding Principles of Healthy and Resilient Ecosystems, Sustainable Economic Development, Public Safety, and Watershed-Scale Approach.

Costs of the Piping Alternative 1

This section evaluates the costs of the Pipeline Alternative over the No Action Alternative. Under the No Action Alternative, the district would continue to operate and maintain the existing canal and lateral system in its current condition.

Economic Table 1 and Economic Table 2 in the Plan-EIS summarize installation costs, distribution of costs, and total annual average costs for the Pipeline Alternative. Average annual costs include those associated with installation and other direct costs. Economic Table 4 summarizes the annual average costs of the Pipeline Alternative over the No Action Alternative. These NEE annual average costs are estimated at $6,007,158.

Pipeline Installation Costs

The cost of the pipeline alternative was estimated to be approximately $139,176,000, which includes construction and engineering technical assistance (planning, design and construction management). This also includes contingency costs.

Replacement Costs

The Pipeline Alternative 1 would result in no additional replacement costs above the No Action Alternative since all the installed components have useful lives equal to the 50-year project life.

Benefits of the Piping Alternative 1

The on-site damage-reduction benefits to agriculture and the local rural community from canal failures include avoided crop production damages, flooded homes and businesses and high operation and maintenance costs.

Agricultural Damage Reduction Benefits

The district's antiquated canal system make it difficult to deliver reliable water to irrigators due to canal failure. When the canal fails, irrigation water is not delivered to crop fields when needed. Delivering reliable irrigation water to agricultural land provides substantial monetary benefits, about $4,427,500 per year.

Flood Damages to Homes and Businesses

When the irrigation canal fails and erodes the canal bank, localized washouts occur and increases risk of flood damage to nearby residences and properties. The Proposed Pipe Alternative would eliminate future damages associated with the canal failures. The Pipeline Alternative 1 would reduce flood damages from canal failures by an estimated $6,827,802 annually.

Operations and Maintenance Cost Savings

The irrigation district anticipates that operation and maintenance (O&M) on the existing canal would decrease by about $14,750 and O&M on the culinary water distribution decrease by about $525,510 per year as a result of the Pipe Alternative 1.

Other benefits not included in the analysis, which may result indirectly from the Pipeline Alternative 1, include more reliable water delivery and the potential for increased on-farm investments in improved irrigation water management.

Recreation Increments

Two Recreation Increments were added to Alternative 1 and Alternative 2.

New Access Ramp at Wellsville Reservoir

This section evaluates the costs of the Recreation Area at the new Access Ramp at Wellsville Reservoir over the No Action Alternative. Under the No Action Alternative, pond users would continue to use existing unimproved access points in their current condition.

The Total Installation Cost is $18,000, and the Average Annual Costs are $700. There are no expected installation costs associated with mitigation (fish, wildlife or cultural resources) and property rights. There are no operation, maintenance, and repair costs with the No Action alternative.

Recreation at Mendon Cemetery Pond Increment

This section evaluates the costs of the Recreation Area at Mendon Cemetery Pond Alternative over the No Action Alternative. Under the No Action Alternative, pond users would continue to use existing unimproved access points in their current condition.

Recreation Benefits at Wellsville Reservoir and Cemetery Pond

The Wellsville Watershed project proposes to build a new access ramp at Wellsville Reservoir. Recreation Use Days data was not readily available, but estimated after discussion with the City Manager for Wellsville, Utah. Currently estimates are two boats per day during the summer, and that it would double with the new boat ramp. Annual benefits were estimated at $7,305 per year.

The Cemetery Pond was estimated to have the same annual recreation days increase as the Wellsville boat ramp, but these days are split evenly between sightseeing, wildlife viewing and picnicking. Annual benefits were estimated at $4,658 per year.

The benefits of both Recreation Alternatives exceeded their cost, but alone they did not meet the Federal Objective to protect the environment by improving water delivery reliability, improving public safety, improving water quality, improving irrigation water management, and improving water conservation.

Recreation Increments Costs

The Total Installation Cost is $25,000, and the Average Annual Costs are $1,700. There are no expected installation costs associated with mitigation (fish, wildlife or cultural resources) and property rights. There are no operation, maintenance, and repair costs with the No Action alternative.

Table 2: Alternative 1 Recreation Increments Costs

Works of Improvement	Installation Cost	Amortization of Installation Cost	Operation, Maintenance and Replacement Cost	Total Annual Cost
Wellsville Reservoir Boat Ramp	$18,000	$700	$0	$700
Mendon Cemetery Pond	$25,000	$1,000	$700	$1,700

ALTERNATIVE 2 – LINE CANAL AND IMPROVE LOWER CANAL FOR FLOOD FLOWS, FLOOD PROPERTY BUYOUT

Alternative 2 was similar to Alternative 1, except the “Pipe Portion of Lower Canal” was excluded and replaced with “Line and Expand Portion of Lower Canal” and a “Buy Out and Relocate Flooded Structures” option was added. Flood damages and benefits to homes and businesses would be similar to the Piping Canal Alternative 1.

Canal Lining (Alternative 2)

This alternative would have funding made available through PL 83-566 allowing for lining of the canals. The principal difference between the Lining Alternative and the Piping Alternative is that this alternative would line and increase the capacity of the Hyrum-Mendon Canal to carry both irrigation and flood water from the west alluvial plains between Wellsville and Petersboro in Cache County rather than enclose and pipe it. This would include the addition of overflow structures. Flood flows would then be carried North and East through a combination of conduits and channels to convey to the natural floodplain of the Little Bear River. This alternative would require the installation of new canal infrastructure to manage the increased flow.

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 on the Western edge of the new Wellsville Secondary System to stabilize peaking demands on the pressurized irrigation systems.

Costs of the Canal Lining (Alternative 2)

This section evaluates the costs of the Lining Alternative 2 over the No Action Alternative. Under the No Action Alternative, the district would continue to operate and maintain the existing canal and lateral system in its current condition.

Economic Table 1 and Economic Table 2 in the Plan-EIS summarize installation costs, distribution of costs, and total annual average costs for the Lining Alternative 2. Average annual costs include those associated with installation and other direct costs. Economic Table 4 summarizes the annual average costs of the Lining Alternative 2 over the No Action Alternative. These annual average costs are estimated at $7,957,080 and include $190,452,000 in total installation costs (including $120,250,000 in buy-out/relocation costs).

Relocation and Property Buy-Out

This nonstructural alternative would establish a flood easement for the 100-year floodplain and require acquisition of private lands. Approximately 316 homes and 1 commercial building/post office are located within the 100-year flood inundation area that would need to be purchased. All structures would need to be demolished, utilities relocated, roads removed, and the land returned to a natural state.

This Proposed Action Alternative meets the Purpose and Need of the project as required by NEPA. Each of the actions selected to develop the Lining 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. The Table below describes the selected actions that comprise the Lining Alternative.

Table 3: Canal Lining Alternative Actions

Proposed Action	PL 83-566 Authorized Purpose
Construct Regulating Ponds	Ag Water Management
Install Open Channel Overflow System	Flood Protection
Rehabilitate Murray Spring Structure	Ag. Water Management
	Flood Protection
Line and Expand Portion of Lower Canal	Ag. Water Management
Pipe Segment of Wellsville E. Field Canal	Ag. Water Management

Proposed Action	PL 83-566 Authorized Purpose
Pressurize W & M Cities' Irrigation System	Flood Protection
	Ag. Water Management
New Access Ramp at Wellsville Reservoir	Public Recreation

The Lining Alternative meets the Federal Objective to protect the environment in the project area and along the Little Bear River. By improving water delivery reliability, improving public safety, improving water quality, and improving water conservation, the alternative to line and expand the Lower canal achieves the PR&G Guiding Principles of Healthy and Resilient Ecosystems, Sustainable Economic Development, Public Safety, and Watershed-Scale Approach.

Costs of Relocation and Property Buy-Out

Costs were estimated and averaged per structure type and the total cost for purchase of structures alone would be extremely high (over 120 million dollars). Costs do not include purchase of undeveloped lands, demolition of structures, relocation of roads and utilities, or restoration of land. Adverse social impacts are also anticipated by removing families from homes. Since this alternative was not selected, costs did not include cultural resource mitigation costs for structures eligible for the National Register of Historic Places.

Table 4: Relocation and Property Buy Out Costs

Type of Bldg	Average Value/ Bldg.	Relocate Cost (2x total value)	Land Owner Damages Cost/ Acre	Misc Cost	Total Cost/ Property	Total # of Properties	Grand Total Cost
Residence	$185,804	$371,608	$1,500	$5,000	$378,108	317	$119,860,218
Public	$189,755	$379,511	$0	$10,000	$389,511	1	$389,511
						Total	**$120,250,000**

Replacement Costs

The Pipeline Alternative 2 would result in no additional replacement costs above the No Action Alternative since all the installed components have useful lives equal to the 50-year project life.

Benefits of the Lining Alternative 2

The on-site damage-reduction benefits to agriculture and the local rural community from canal failures include avoided crop production damages, flooded homes and businesses and high operation and maintenance costs.

Agricultural Damage Reduction Benefits

The district's antiquated canal system make it difficult to deliver reliable water to irrigators due to canal failure. When the canal fails, irrigation water is not delivered to crop fields when needed. Delivering reliable irrigation water to agricultural land provides substantial monetary benefits, estimated to be about $3,879,011 annually.

Flood Damages to Homes and Businesses

When the irrigation canal fails and erodes the canal bank, localized washouts occur and increases risk of flood damage to nearby residences and properties. The Proposed Lining Alternative 2 would eliminate future damages associated with the canal failures by buying out and relocating homes and structures in the 100 year flood plain. The Pipeline Alternative 2 would reduce flood damages from canal failures by an estimated $7,312,493 annually.

District Operations and Maintenance Cost Savings

The irrigation district anticipates that operation and maintenance (O&M) on the existing canal would decrease by about $14,750 and O&M on the culinary water distribution decrease by about $525,510 per year as a result of the Pipe Alternative 2.

Other benefits not included in the analysis, which may result indirectly from the Pipeline Alternative 1, include more reliable water delivery and the potential for increased on-farm investments in improved irrigation water management.

Based on the high costs and adverse social impacts to occupants of structures, this Alternative 2 was eliminated from further study.

BENEFITS CONSIDERED BUT NOT INCLUDED IN ANALYSIS

Additional Agricultural Damage Reduction Benefits

The Pipeline Alternative will reduce the likelihood of pipeline failure and may reduce damages to irrigators crop production by improving water supply reliability, flexibility and efficiency. Irrigation water users can adjust their water use to what they need when they need it.

Improve Water Conservation

The pipe alternative may reduce water loss from canal seepage and evaporation during the irrigation season by converting to pipe. It was assumed this amount of water was minimal and was not included in the analysis.

Public Safety Avoided Costs

A new, reliable pipeline removes the hazard of canal failure and possible drownings in waterways and eliminates the possibility of damages to downstream property. While canal failure is very possible, the extent of damage varies dramatically depending on the timing and location of the canal failure.

Groundwater Recharge

Portions of the existing open canal may be recharging the groundwater and aquifer. However, the loss of groundwater recharge is assumed to be minimal or non-existence because on the minimal length of canal converted to pipe and the canal is lined and currently has minimal seepage. Also, these costs are not quantified in this analysis due to a lack of available quantitative information.

Change in Aesthetics and Associated Property Values

Other direct costs may include the potential reduction in aesthetic values to area residents due to the removal of canals. However, the aesthetic costs are not quantified in this analysis due to a lack of available quantitative information.

Incremental Analysis

The Pipeline Alternative was evaluated using an incremental analysis, which identifies how total costs and benefits change as project phases are added. The pipeline project was divided into five phases of

construction and two recreation increments. For the pipeline incremental analysis, costs for constructing any given segment would not change if it were the only segment to be constructed. Agricultural water management benefits and costs were developed for each of the pipeline phases, and for the two recreational areas. The phases were selected based on how the proposed pipeline is installed sequentially from an operational perspective. The flood benefits were estimated for the entire watershed project area and assumed all pipeline or canal lining improvements were installed. Flood benefits would not occur without all the pipeline increments being installed.

Table 5: Incremental Analysis of Annual NEE Costs and Benefits

Works of Improvement	Increment	Agricultural Damage Reduction Flood Reduction	Non-Agricultural Other	Average Annual Benefits	Average Annual Costs[2]	Benefit Cost Ratio
Recreation						
Wellsville Reservoir Boat Ramp	1	$7,305		$7,305	$700	10.44
Mendon Cemetery Pond	2	$4,658		$4,658	$1,700	2.74
Agriculture Water Management						
Wellsville East Field Piping	3	$913,850		$913,850	$253,000	3.61
Wellsville Secondary Water System	4	$1,752,366		$1,752,366	$904,220	1.94
Mendon Secondary Water System	5	$756,924		$756,924	$540,660	1.40
WMCD Lower Canal Piping	6	$4,493,400		$4,493,400	$2,130,200	2.11
WMCD Lower Canal Lining	7	$3,029,426		$3,029,426	$1,443,000	2.10
Flood Management						

Works of Improvement	Increment	Agricultural Damage Reduction Flood Reduction	Non-Agricultural Other	Average Annual Benefits	Average Annual Costs[2]	Benefit Cost Ratio
Lower Canal Flood Improvements	8				$1,470,800	
Wellsville City Flood Routing	8				$139,000	
Canal Spills	8				$443,100	
Bird Canyon Channel Improvements	8				$33,170	
100 South (Bird Crk) Flood Control Pipe	8				$42,470	
300 North Flood Control Pipeline	8				$33,570	
400 North Flood Control Pipeline	8				$14,570	
Sub-Total				$6,827,802	$2,176,678	3.14
Buy-Out/Relocation	9			$7,312,493	$4,813,800	1.52
Total						
Alternative 1. Piping Canal	1,2,3-6, 8	$14,756,305		$14,756,305	$6,007,158	2.46

Works of Improvement	Increment	Agricultural Damage Reduction Flood Reduction	Non-Agricultural Other	Average Annual Benefits	Average Annual Costs[2]	Benefit Cost Ratio
Alternative 2. Lining Canal & Buy Out	3-5, 7-9	$13,777,022		$13,777,022	$7,957,080	1.73

1/Price Base: 2025 dollars amortized over 55 years at a discount rate of 3.00 percent.

THE PREFERRED ALTERNATIVE

The National Efficiency Evaluation (NEE) alternative and the Federally Recommended alternative is Alternative 1, which includes two Recreation Increments. The NEE alternative is defined as the federally assisted alternative with the greatest public benefits, with appropriate consideration of costs. Public benefits (i.e., positive ecosystem services) encompass environmental, economic, and social goals; include monetary and non-monetary effects; and allow for the consideration of both quantified and unquantified measures.

Alternative 1 was selected by the sponsor as the Preferred Alternative based on the beneficial outcomes and proposed costs. Each sub-measure in Alternative 1 had benefit cost ratios that were greater than 1.00 as shown below.

Table 6: Comparison of Benefits and Costs [1/]

	Average Annual Benefits	Average Annual Costs	Benefit Cost Ratio	Net Benefits
Alternative 1. Piping Canal	$14,756,305	$6,007,158	2.46	$8,749,147
Alternative 2. Lining Canal & Buy Out	$13,777,022	$7,957,080	1.73	$5,819,942

[1/] Discount rate 3.00% with a 55-year period of analysis. Price base 2025

Agency policy allows for the use of the other social effects to justify a proposed action, even if the associated B/C ratio were less than 1:1. This is due to a priority placed on protecting lives. Also, trying to monetize the value of life, or in the case of flood control structures, avoidance of loss of life, is laden with subjective value judgments. Threat to human life can therefore be used to supersede purely economic considerations when deemed appropriate.

The preferred alternative will allow the sponsors to provide reliable irrigation water to agricultural and urban property, and recreational opportunities. Average annual monetary benefits are estimated to be $11,807,525. Average annual cost is estimated at $6, 007,158 resulting in net benefits of $5,800,367. Socially, the threat to human life will be minimized. Environmentally, adverse impacts will be minimized during construction. Long-term there would be adverse, although negligible, impacts.

- **Benefit to Cost Ratio:** 1.97 to 1.0
- **Net Beneficial Effects:** $5,800,367

- **Funding Schedule:** The most likely scenario is for the project to be implemented over five years including the design and construction.
- **Period of Analysis:** 55 years (including 5 years for design and construction)
- **Project Life:** 50 years

Project Benefits

Benefits are determined as the difference between the without-project and the with-project condition. The planning policy used for this plan/environmental document (P&G and PR&G) state that Federal investments in water resources as a whole should strive to maximize public benefits, with appropriate consideration of costs. Public benefits (i.e., positive ecosystem services) encompass environmental, economic, and social goals; include monetary and non-monetary effects; and allow for the consideration of both quantified and unquantified measures. The preferred alternative will allow the Sponsors to reduce the potential for loss of life, and to continue protection of existing property and infrastructure, improve agricultural water management, and provide recreational opportunities to local communities. The preferred alternative maximizes public benefits.

The stream of monetary benefits was described in average annual equivalent terms. The average annual expected benefits were the difference between the No Action Alternative and each project Action Alternative. The expected average annual damages for each alternative, storm event (8 events), and damage category below were estimated with the following equation:

$$\sum \underline{(PFED_{i-1} + FED_i)/2} * (PPFE_{i-1} - PFE_i)$$

- $i = 1$
- $PFED_{i-1}$ - Previous Flood Event Damages
- FED_i - Flood Event Damages
- $PPFE_{i-1}$ - Probability of Previous Flood Event
- PFE_i - Probability of Flood Event

The damage (and benefit) categories used in this analysis are defined below.

Environmental and Social Benefits

Environmental and social benefits were not monetized but are further explained for each alternative studied in detail in the environmental consequences section of the Plan-EIS.

Environmentally adverse impacts will be minimized during construction. Long-term, there would only be negligible adverse impacts anticipated from any of the evaluated alternatives.

Socially, the threat of loss of life or property will be minimized with reduced flood depths at buildings with the irrigation canal and pipeline improvements. If the Recreation Alternative is implemented, there will be a significant increase in recreational activities.

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 entire ecosystem services analysis is documented in the PR&G Ecosystem Services Scoping and Evaluation Worksheet located in the Plan-EIS.

The Provisioning Services in the area result from the water quantity and quality improvements in the irrigation canal. Improved irrigation water delivery will produce direct benefits from harvested crops. Additionally, a provisioning service is generated by the recreation fishing opportunities.

The Regulating Services in the study area include damages and safety hazards associated with flooding through town below the canal system.

Cultural Services are present in the watershed. There are opportunities for walking, hiking, cycling, and other outdoor activities.

Agricultural Water Management Benefits

The proposed Piping Canal Alternative 1 will provide more reliable water later into the irrigation season, reduce crop production costs, improve water quality and improve water supply flexibility and efficiency. All estimated benefits were estimated within a customized Excel template. The Piping Canal Alternative, which includes four project increments, benefits are $7,916,540. The expected benefits are in the table below.

Table 7: Annual Expected Crop Production Benefits

Alternative 1 Total Annual Crop Benefits:	**Piping Alt Increment 3** **Piping Wellsville East Field**	**Piping Alt Increment 4** **Wellsville Secondary System**	**Piping Alt Increment 5** **Mendon Secondary System**	**Piping Alt Increment 6** **Lower Canal Piping**
Change in Crop Income:	$910,100	$1,380,266	$603,514	$4,458,400
Pump Savings Below Lower Canal	$0	$0	$0	$24,000
Total Annual Benefits:	$910,100	$1,380,266	$603,514	$4,482,400

Change in Crop Income

The canal improvement and pipelines will provide more reliable irrigation water and extend the irrigation season and increase crop yields. Crop acres, yield and prices were estimated by Jess Argyle, Dairy Nutritionist, Utah State University Extension Service for Cache County, Utah (1/24/2025), and Franson Civil Engineers, Logan, Utah after discussion with local farmers and irrigators.

Several crops are grown in the watershed project area; however, four crops make up the majority of the total cropland and are: Alfalfa, Grass Hay, Wheat and Corn Silage. The project crop acres were estimated by multiplying the total crop area by the weighted percentage of the four largest crop acres, to account for all the acreage without having to separate them into various different crops. All four crops were sprinkler irrigated. About a 5 to 30% crop yield increase was estimated for with project improvements.

Cropland acres and crop production data, With and Without Project Alternatives were estimated for four sub-project areas: 1) Wellsville East Field, 2) Wellsville Secondary System, 3) Mendon Secondary System, and 4) Lower Canal Area. The tables below show the irrigated crops, number of acres, and increase in yield with project.

Table 8: Wellsville East Field Benefited Acreage and Yield Increase by Crop

Crop	Irrigated Acres	Assumed Yield Increase with Project Per Acre
Alfalfa (ton)	1,785	1.8
Grass Hay (ton)	679	1.1
Wheat (bushel)	145	22.6
Corn Silage (ton)	123	7.2

Table 9: Wellsville Secondary Benefited Acreage and Yield Increase by Crop

Crop	Irrigated Acres	Assumed Yield Increase with Project Per Acre
Alfalfa (ton)	2,862	1.5
Grass Hay (ton)	1,089	0.7
Wheat (bushel)	233	15.8
Corn Silage (ton)	198	4.3

Table 10: Mendon Benefited Acreage and Yield Increase by Crop

Crop	Irrigated Acres	Assumed Yield Increase with Project Per Acre
Alfalfa (ton)	2,862	0.3
Grass Hay (ton)	1,089	6.9
Wheat (bushel)	233	1.9
Corn Silage (ton)	198	0.0

Table 11: Lower Canal Piping Benefited Acreage and Yield Increase by Crop

Crop	Irrigated Acres	Assumed Yield Increase with Project Per Acre
Alfalfa (ton)	2,862	2.6
Grass Hay (ton)	1,089	1.3
Wheat (bushel)	233	28.3
Corn Silage (ton)	198	7.7

The change in crop income With and Without Project was estimated by multiplying the 5-year average crop dollar value by the 5-year average crop yield by the crop acres With and Without Project.

Land Use Conversion

Irrigation pumping savings is also enabled by improved pressure in the new pipelines, affecting about 193 acres. The open canal did not provide enough pressure to charge a gravity pressurized pipeline.

Reduced Pumping Costs for In-Town Irrigation Water

The irrigation district anticipates that pumping costs for domestic water used in town to irrigation laws and gardens will be reduced.

Reduced Pump Power Costs

No on-farm irrigation pumps were replaced with the Piping Canal Alternative.

Conserved Irrigation Water

The project did not address on-farm irrigation efficiency, and no water was estimated to be conserved on-farm. However, the Piping Canal Alternative would improve water delivery and reliability for irrigators served by the pipeline system.

Conserved Conveyance Water

Replacing irrigation canals with pipelines was not estimated to reduce irrigation water delivery. Seepage loss eliminated by converted from open channel to pipeline conveyance was used to estimate increased crop yields.

Reduced Canal O&M

The irrigation district anticipates that operation and maintenance (O&M) would be reduced for the canals being converted to pipe.

Flood Protection Damages

All estimated values and damages were assessed within a customized Excel template prepared for this analysis. The Piping Canal Alternative had flood protection benefits. The Lining Canal Alternative 2 included a Relocation & Buy Out non-structural option.

Structure, Content, & Vehicle Damages

Local tax appraisal district records were used to obtain the structural values of residences, commercial and public properties, and outbuildings that would be affected by project activities. The structure damages were estimated using the methodology described in the Structural Damages Calculations Template (Tim Goody, NWMC). The value of the structures was calculated by subtracting the

depreciated replacement value (DRV) from the Tax Accessor's structure value. The structures in the project area that are affected by flooding are located in scattered rural area. The Depreciated Replacement Value was based on the year structures were built as shown below.

Table 12: Project Area Structures Depreciated Replacement Value (DRV)

Structure Built	Approx. Age	DRV
2000 - 2024	25 Years	0.20
1971 -1999	40 Years	0.18
1960 - 1970	65 Years	0.28
1941 - 1960	82 Years	0.10
1901 - 1940	100 Years	0.25
1865 - 1900	120 Years	0.30

Based on the Life Cycle Chart (Swiftestimator.com, building cost reports online 2/2007) the Depreciated Multiplier ranged from 18% to 30%. The structure value used in the flood damage analysis was estimated as: The County Tax Accessed Value * (1- Depreciated Replacement Value Factor) (see: WellsvilleBenefitsCosts.xls for calculations). This estimated Depreciated Replacement Value is also consistent with the USACE National Structure Inventory documentation: "Structure Valuation - These replacement values for structures are then depreciated in order to obtain depreciated replacement value; each structure is depreciated by 1% per year for the first 20 years, after which it is assumed that routine maintenance would keep structure values at 80% of their replacement values". (https://www.hec.usace.army.mil/confluence/nsi/technicalreferences/latest/technical-documentation).

Total value of structures in the 500-year flood plain was estimated at about $60 million. One commercial building and 266 residences were in the flood plain.

Content values were estimated as a percentage (about 75%) of assessed property values (Federal Emergency Management Agency). Estimated floodwater depths where flood damage occurs, for various storms (including the 500-year storm), for each structure were based on the results of the hydrology and hydraulics simulation modeling (Franson Civil Engineers, Logan, Utah). Floodwater data was then used with water depth to damage functions (Federal Emergency Management Agency) to estimate structural and content damages based on the point of entry where damages would begin. These depth-to-damage functions were specific for 1) different types of residences (i.e. one or two story homes with or without basements; split-level homes; mobile homes; apartments; etc.); and 2) different type of commercial and public properties. A similar analysis was conducted for vehicles located at residences, public properties, and businesses within the floodplain area. For vehicles, local project managers estimated the typical vehicle replacement dollar value. Using the same source as mentioned above, floodwater damages to vehicles located at affected properties were estimated, a conservative value of $18,000 per vehicle was used. Damages to other vehicles not located at each building but possibly in harm's way during a flood event were not included. Damage start for vehicle was 0.5 feet above ground surface elevation. It was estimated that each affected residence would have a minimum of two vehicles, public properties three, small commercial properties five and large commercial properties ten vehicles.

The number of structures that could be flooded and their total structural value are displayed below. This value does not include land values, only structure values. There are no critical facilities located within the 500-year floodplain without the dam scenario.

Table 13: Watershed Planning Area 100 yr Flooded Structures (W/O Project)

Total Structures	Residences & Apartments	Commercial Properties	Public Properties	
317	316	0	1	

Table 14: Structures Flooded in the Wellsville Watershed Project Area Without Project

Event	Home			Public		
	< 1 ft	1 to 3 ft	> 3 ft	< 1 ft	1 to 3 ft	> 3 ft
2-yr	148	6	1	0	0	0
5-yr	146	5	2	0	0	0
10-yr	211	8	2	0	0	0
25-yr	242	9	2	0	0	0
50-yr	269	12	2	1	0	0
100-yr	300	14	2	1	0	0
200-yr	319	18	2	1	0	0
500-yr	348	23	2	1	0	0

Other Damages

Road, crossings, crop, erosion and sediment damages from flooding were not analyzed because they were incidental. No additional damages (emergency aid, clean-up, sewer, debris removal, etc.) were provided or estimated by local county officials. There were no livestock or confined animal feeding operation damages identified within the project area significantly affected by storms up to and including the 500-year event.

Recreation

Recreational activities such as boating, swimming, picnicking and fishing are expected to increase significantly with the two Recreation Increments. Since there is no official or unofficial count of usage, estimated annual visitor-days was made by Scott Wells, the City manager for Wellsville City, (6/11/25).

The benefit of the proposed recreation area on the reservoir and pond was estimated as the increase in the annual per-person recreational days multiplied by the value of a recreational day. The monetary value of a recreational day came from the EPA, USFS-Pacific NW Research Station, USGS, Oregon State University, referencing a dataset of 103 recreation publications. The costs were indexed to 2025 using the Consumer Price Index.

Beneficial Effects

- About 6,000 direct beneficiaries live in the communities of Wellsville and Mendon, Utah, adjacent to the project area.
- The proposed Piping Canal project protects about 316 residences and 1 commercial structure in the 100-year flood plain. The roadways and crossing downstream have minimal flood concerns within the 500-year inundation zone.
- Leverages federal resources to install the planned works of improvement.
- Reduces the threat of property damage and possible loss of life to people who live and/or work in the affected area.
- Reduces the threat of loss of access and loss of emergency services for downstream properties and property owners.

As reflected in the Plan Annual Expected Damages table above, current average annual floodwater damages without project (No Action W/ Dam) are $7,312,493. Floodwater damages with the Preferred Alternative 1 were estimated to be $484,691.

Environmentally adverse impacts will be minimized during construction. Long-term there would be adverse, although negligible, environmental impacts.

Table 15: Summary of Annual Expected Damages

Category	Present Condition	Alt 1	Alt 2
Structure, Contents & Vehicles	$7,312,493	$484,691	$0
Total:	$7,312,493	$484,691	$0

As reflected in the Table below, the benefits to properties were estimated as the difference between with and without project damages reflect the average annual benefits. Alternative 1 would provide to downstream properties about $6,827,802average annual benefits.

Table 16: Summary of Benefits

Category	Alt 1	Alt 2
Recreation		
Increment 1. Wellsville Reservoir Boat Ramp	$7,305	$7,305
Increment 2. Mendon Cemetery Pond	$4,658	$4,658
Crop Irrigation		
Increment 3	$913,850	$913,850
Increment 4	$1,752,366	$1,752,366
Increment 5	$756,924	$756,924
Increment 6	$4,493,400	n/a
Increment 7	n/a	$3,029,426
Canal O&M		

Category	Alt 1	Alt 2
Increment 3	$3,750	$3,750
Increment 6	$11,000	$11,000
Culinary O&M		
Increment 4	$372,100	$372,100
Increment 5	$153,410	$153,410
Flood Management		
Increment 8. Structure, Contents & Vehicles	$6,827,802	$0
Increment 9. Buy-Out/Relocation	$0	$7,312,493

-

WATERSHED PROJECT COSTS

Project costs for the Piping Canal Alternative and the Recreation Sites (Alternative 1) were estimated by Franson Civil Engineers, Logan Utah in 2025. Installation and operation & maintenance costs for each activity are described in detail in the cost tabs in the project engineer's Excel worksheet.

The cost of the pipeline improvement and the recreational sites were allocated between Agricultural Water Management, Flood Protection, and Recreation purposes according to the procedure in the Resource Economics Handbook, Part 611 Water Resources Handbook for Economics, Chapter 6 Costs and Cost Allocation (NRCS 2014b). Work Plan-EIS tables were constructed based on the calculated cost allocated to these three project purposes. Within these purposes the costs were shared between NRCS and the local and state entities as specified in the NWPM (2024), in this case construction cost share is:

- **Recreation:** 50 percent Federal and 50 percent Local
- **Irrigation Water Management:** 75 percent Federal and 25 percent Local
- **Flood Protection:** 100 percent Federal and 0 percent Local

See Work Plan in the Plan-EIS for the results of the cost allocation/cost sharing process.

All costs were amortized at the Fiscal Year 2025 Federal Water Resource Discount of 3.00 percent for 55 years. Average Annual Costs are computed as the sum of the amortized construction cost and the annual operation and maintenance cost. Engineers estimate that each of the structures would last 50 years, the life of the project.

All project implementation costs were estimated by the project engineers, including installation and annual operation and maintenance. All costs were converted to Present Values by discounting each cost to the beginning of the period of analysis using the applicable project discount rate. Installation expenditures before the project is installed were brought forward to the end of the period of installation by charging compound interest at the project discount rate from the date the costs are incurred. Finally, the project discount rate was used to convert the present values to average annual equivalent terms.

Replacement costs are necessary if the installed structure's life is less that the project life. Average Annual Replacement Costs are calculated by amortizing the Present Value of the worn-out structure's construction cost, with the current FY discount rate over the project structure's life. If the physical life

of the alternative is the same as the project, replacement costs are not included and we assume the Replacement Costs are the same as the Average Annual Costs. In this project the structure's life was equal to the project life and replacement costs were not necessary and not calculated. All estimated values and damages were assessed within a customized Excel template.

Table 17: Watershed Project Annual Cost Summary

Works of Improvement	Increment	Amortization of Installation Cost	Operation, Maintenance and Replacement Cost	Total
Recreation				
Wellsville Reservoir Boat Ramp	1	$700	$0	$700
Mendon Cemetery Pond	2	$1,000	$700	$1,700
Agriculture Water Management				
Wellsville East Field Piping	3	$250,000	$3,000	$253,000
Wellsville Secondary Water System	4	$787,300	$116,920	$904,220
Mendon Secondary Water System	5	$473,200	$67,460	$540,660
WMCD Lower Canal Piping	6	$2,120,200	$10,000	$2,130,200
WMCD Lower Canal Lining	7	$1,423,000	$20,000	$1,443,000
Flood Management				
Lower Canal Flood Improvements	8	$1,468,600	$2,200	$1,470,800
Wellsville City Flood Routing	8	$138,600	$400	$139,000
Canal Spills	8	$442,100	$1,000	$443,100
Bird Canyon Channel Improvements	8	$30,800	$2,370	$33,170
100 South (Bird Crk) Flood Control Pipe	8	$40,100	$2,370	$42,470
300 North Flood Control Pipeline	8	$31,200	$2,370	$33,570
400 North Flood Control Pipeline	8	$12,200	$2,370	$14,570
Buy-Out/Relocation	9	$4,813,800	$0	$4,813,800
Total				

Works of Improvement	Increment	Amortization of Installation Cost	Operation, Maintenance and Replacement Cost	Total
Alternative 1. Piping Canal	1,2,3-6, 8	$5,796,000	$211,158	$6,007,158
Alternative 2. Lining Canal & Buy Out	1,2,3-5, 7-9	$7,749,000	$208,080	$7,957,080

Watershed Project Benefits and Costs

For the preferred Alternative 1, the average annual monetary benefits are estimated to be $11,807,525. Average annual cost is estimated at $6,007,158 resulting in net benefits of $5,800,367. Alternative 1, produces a B/C ratio of 1.97 to 1.00. Environmentally adverse impacts will be minimized during construction. Long-term there would be adverse, although negligible, environmental impacts.

Table 18: Watershed Project Benefit-Cost Summary[1/]

	Average Annual Benefits	Average Annual Costs	Benefit Cost Ratio	Net Benefits
Alternative 1. Piping Canal	$14,756,305	$6,007,158	2.46	$8,749,147
Alternative 2. Lining Canal & Buy Out	$13,777,022	$7,957,080	1.73	$5,819,942

[1/] Discount rate 3.00% with a 55-year period of analysis. Price base 2025

Economic Tables

The PR&Gs require that an economic analysis be completed. All economic tables for the Preferred Alternative are displayed below. The economic table names are defined in Title 390 – National Watershed Program Manual, Subpart B – Economic and Structural Tables. A summary of the economic analysis of the Preferred Alternative (NEE Alternative) and No Action Alternative is provided below. The full NEE Analysis can be found in Appendix D. The Preferred Alternative represents the future with federal funding through PL 83-566. The No Action Alternative represents the future if the project sponsors do not receive federal funding.

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

Economic Tables 5 and 6 (NWPM 506.20) presents the average annual watershed protection damage reduction benefits. Using the benefits and costs from Table 4 and Table 5, Table 7 presents a comparison of the NEE Analysis average annual benefits and average annual costs.

Economic Table 6-1: Estimated Installation Cost Wellsville Watershed, Utah [2025 Dollars]1

Works of Improvement	Increment	Unit	Number			Estimated Cost (2025 Dollars)[1]						
						Public Law 83-566 Funds			Other Funds			Total
			Federal Land	Non-Federal Land	Total	Federal Land	Non-Federal Land	Total	Federal Land	Non-Federal Land	Total	
Structural Measures												
Recreation												
Wellsville Reservoir Boat Ramp	1	Each		1	1		$10,000	$10,000		$8,000	$8,000	$18,000
Mendon Cemetery Pond	2	Each		1	1		$14,000	$14,000		$11,000	$11,000	$25,000
Agriculture Water Management												
Wellsville East Field Piping	3						$4,593,750	$4,593,750		$1,270,250	$1,270,250	$5,864,000
Wellsville Secondary Water System	4						$14,670,000	$14,670,000		$4,057,000	$4,057,000	$18,727,000
Mendon Secondary Water System	5						$8,814,250	$8,814,250		$2,440,750	$2,440,750	$11,255,000
WMCD Lower Canal Piping	6						$40,081,500	$40,081,500		$11,041,500	$11,041,500	$51,123,000
WMCD Lower Canal Lining	7						$26,899,250	$26,899,250		$7,413,750	$7,413,750	$34,313,000
Flood Management												
Lower Canal Flood Improvements	8						$29,595,000	$29,595,000		$5,818,000	$5,818,000	$35,413,000
Wellsville City Flood Routing	8						$2,296,000	$2,296,000		$1,046,000	$1,046,000	$3,342,000
Canal Spills	8						$10,555,000	$10,555,000		$100,000	$100,000	$10,655,000
Bird Canyon Channel Improvements	8						$276,000	$276,000		$467,000	$467,000	$743,000
100 South (Bird Crk)	8						$963,000	$963,000		$2,000	$2,000	$965,000

Works of Improvement	Increment	Unit	Number			Estimated Cost (2025 Dollars)[1]						
						Public Law 83-566 Funds			Other Funds			Total
			Federal Land	Non-Federal Land	Total	Federal Land	Non-Federal Land	Total	Federal Land	Non-Federal Land	Total	
Flood Control Pipe												
300 North Flood Control Pipeline	8						$749,000	$749,000		$2,000	$2,000	$751,000
400 North Flood Control Pipeline	8						$293,000	$293,000		$2,000	$2,000	$295,000
Buy Out	9						$120,250,000	$120,250,000		$0	$0	$120,250,000
Total												
Alternative 1. Piping Canal[2]	1,2,3-6, 8						$112,910,500	$112,910,500		$26,264,500	$26,264,500	$139,176,000
Alternative 2. Lining Canal & Buy Out	3-5, 7-9						$175,251,250	$175,251,250		$15,200,750	$15,200,750	$190,452,000
[1] Price base: 2025												
[2] Includes two recreation increments												

Economic Table 6-2: Estimated Cost Distribution – Water Resource Project Measures, Wellsville Watershed, Utah [2025 Dollars]1

Table 6-2

Estimated Cost Distribution—Water Resource Project Measures Wellsville Watershed, Utah, 2025 Dollars[1]

Works of Improvement	Increment	Installation Cost—Public Law 83-566							Installation Cost—Other Funds								Total
		Construction	Engineering	Real Property Rights	Relocation Payments	Mitigation	Project Admin.	Total Public Law 566	Construction	Engineering	Real Property Rights	Relocation Payments	Mitigation	Permits	Project Admin.	Total Other	Installation Costs
Recreation																	
Wellsville Reservoir Boat Ramp	1	$6,500	$3,000			$0	$500	$10,000	$6,500		$0		$0	$1,000	$500	$8,000	$18,000
Mendon Cemetery Pond	2	$9,500	$4,000			$0	$500	$14,000	$9,500		$0		$0	$1,000	$500	$11,000	$25,000
Agriculture Water Management																	
Wellsville East Field Piping	3	$3,739,500	$798,000			$18,750	$37,500	$4,593,750	$1,246,500		$0		$6,250	$5,000	$12,500	$1,270,250	$5,864,000
Wellsville Secondary Water System	4	$11,991,000	$2,559,000			$0	$120,000	$14,670,000	$3,997,000		$0		$0	$20,000	$40,000	$4,057,000	$18,727,000
Mendon Secondary Water System	5	$7,204,500	$1,537,000			$0	$72,750	$8,814,250	$2,401,500		$0		$0	$15,000	$24,250	$2,440,750	$11,255,000
WMCD Lower Canal Piping	6	$32,748,000	$6,987,000			$18,750	$327,750	$40,081,500	$10,916,000		$0		$6,250	$10,000	$109,250	$11,041,500	$51,123,000
WMCD Lower Canal Lining	7	$21,972,750	$4,688,000			$18,750	$219,750	$26,899,250	$7,324,250		$0		$6,250	$10,000	$73,250	$7,413,750	$34,313,000
Flood Management																	
Lower Canal Flood Improvements	8	$24,450,000	$4,842,000			$0	$303,000	$29,595,000	$5,808,000		$0		$0	$10,000	$0	$5,818,000	$35,413,000
Wellsville City Flood Routing	8	$1,810,000	$457,000			$0	$29,000	$2,296,000	$1,044,000		$0		$0	$2,000	$0	$1,046,000	$3,342,000
Canal Spills	8	$9,020,000	$1,444,000			$0	$91,000	$10,555,000	$0		$0		$0	$100,000	$0	$100,000	$10,655,000
Bird Canyon Channel Improvements	8	$168,000	$101,000			$0	$7,000	$276,000	$462,000		$0		$0	$5,000	$0	$467,000	$743,000
100 South (Bird Crk) Flood Control Pipe	8	$822,000	$132,000			$0	$9,000	$963,000	$0		$0		$0	$2,000	$0	$2,000	$965,000
300 North Flood Control Pipeline	8	$639,000	$103,000			$0	$7,000	$749,000	$0		$0		$0	$2,000	$0	$2,000	$751,000
400 North Flood Control Pipeline	8	$250,000	$40,000			$0	$3,000	$293,000	$0		$0		$0	$2,000	$0	$2,000	$295,000
Buy Out	9	$0	$0		$120,250,000	$0	$0	$120,250,000	$0		$0		$0	$0	$0	$0	$120,250,000
Total																	
Alternative 1. Piping Canal	1,2,3-6, 8	$92,858,000	$19,007,000			$37,500	$1,008,000	$112,910,500	$25,891,000		$0		$12,500	$175,000	$187,000	$26,265,500	$139,176,000
Alternative 2. Lining Canal & Buy Out	3-5, 7-9	$44,923,750	$9,589,000		$120,250,000	$37,500	$451,000	$175,251,250	$14,985,250		$0		$12,500	$52,000	$151,000	$15,200,750	$190,452,000

[1] Price base: 2025

Economic Table 6-3: Cost Allocation and Cost Sharing Summary for Multi-Purpose Watershed Project Plans, Wellsville Watershed, Utah [2025 Dollars]1

	PL-566 Funds				Other Funds				Total Funds			
	Ag Water Management	**Flood Protection**	**Recreation**	**Total**	**Ag Water Management**	**Flood Protection**	**Recreation**	**Total**	**Ag Water Management**	**Flood Protection**	**Recreation**	**Total**
Structural Measures												
Alternative 1												
Construction Costs	$55,683,000	$37,159,000	$16,000	$92,858,000	$18,561,000	$7,314,000	$16,000	$25,891,000	$74,244,000	$44,473,000	$32,000	$118,749,000
Engineering Costs	$11,881,000	$7,119,000	$7,000	$19,007,000	$0	$0	$0	$0	$11,881,000	$7,119,000	$7,000	$19,007,000
Real Property Landrights	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Relocation	$0	$0	$0	$0	$0	$0	$0				$0	
Mitigation	$37,500	$0	$0	$37,500	$12,500	$0	$0	$12,500	$50,000	$0	$0	$50,000
Permits	$0	$0	$0	$0	$50,000	$123,000	$2,000	$175,000	$50,000	$123,000	$2,000	$175,000
Project Admin. Costs	$558,000	$449,000	$1,000	$1,008,000	$186,000	$0	$1,000	$187,000	$744,000	$449,000	$2,000	$1,195,000
Total				$112,910,500				$26,264,500				$139,176,000
Alternative 2												
Construction Costs	$44,907,750	$0	$16,000	$44,923,750	$14,969,250	$0	$16,000	$14,985,250	$59,877,000	$0	$32,000	$59,909,000
Engineering Costs	$9,582,000	$0	$7,000	$9,589,000	$0	$0	$0	$0	$9,582,000	$0	$7,000	$9,589,000
Real Property Landrights	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Relocation	$0	$120,250,000	$0	$120,250,000	$0	$0	$0	$0	$0	$120,250,000	$0	$120,250,000
Mitigation	$37,500	$0	$0	$37,500	$12,500	$0	$0	$12,500	$50,000	$0	$0	$50,000
Permits	$0	$0	$0	$0	$50,000	$0	$2,000	$52,000	$50,000	$0	$2,000	$52,000
Project Admin. Costs	$450,000	$0	$1,000	$451,000	$150,000	$0	$1,000	$151,000	$600,000	$0	$2,000	$602,000
Total				$175,251,250				$15,200,750				$190,452,000

[1] Price base: 2025

Economic Table 6-4: Recreational Facilities—Estimated Construction Costs, Wellsville Watershed, Utah [2025 Dollars]1

Works of Improvement	Number[2]	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.			

Economic Table 6-4: Estimated Average Preferred Alternative Annual Costs, Wellsville Watershed, Utah (2025 Dollars)1

Works of Improvement	Increment	Amortization of Installation Cost	Operation, Maintenance and Replacement Cost[2]	Total
Recreation				
Wellsville Reservoir Boat Ramp	1	$700	$0	$700
Mendon Cemetery Pond	2	$1,000	$700	$1,700
Agriculture Water Management				
Wellsville East Field Piping	3	$250,000	$3,000	$253,000
Wellsville Secondary Water System	4	$787,300	$116,920	$904,220
Mendon Secondary Water System	5	$473,200	$67,460	$540,660
WMCD Lower Canal Piping	6	$2,120,200	$10,000	$2,130,200
WMCD Lower Canal Lining	7	$1,423,000	$20,000	$1,443,000
Flood Management				
Lower Canal Flood Improvements	8	$1,468,600	$2,200	$1,470,800
Wellsville City Flood Routing	8	$138,600	$400	$139,000
Canal Spills	8	$442,100	$1,000	$443,100
Bird Canyon Channel Improvements	8	$30,800	$2,370	$33,170
100 South (Bird Crk) Flood Control Pipe	8	$40,100	$2,370	$42,470
300 North Flood Control Pipeline	8	$31,200	$2,370	$33,570
400 North Flood Control Pipeline	8	$12,200	$2,370	$14,570
Buy-Out/Relocation	9	$4,813,800	$0	$4,813,800
Total				
Alternative 1. Piping Canal	1,2,3-6, 8	$5,796,000	$211,158	$6,007,158
Alternative 2. Lining Canal & Buy Out	3-5, 7-9	$7,749,000	$208,080	$7,957,080
1 Price base: 2025, amortized over 55-years at a discount rate of 3.00 percent.				
2 Includes $0 for operation, maintenance, and replacement for recreational development.				
3 Costs for technical assistance to install measures in this evaluation unit are included.				

Economic Table 6-5: Estimated Average Annual Flood Damage Reduction Benefits Wellsville Watershed, Utah (2025 Dollars)[1]

Item	Increment	Estimated Average Annual Damage				Damage Reduction Benefit[3,4]	
		Without Project		With Project			
		Agriculture-related[2]	Non-agriculture-related	Agriculture-related[2]	Non-agriculture-related	Agriculture-related[2]	Non-agriculture-related
Flood Protection Improvements							
Structure, Contents & Vehicles	8	$7,312,493		$484,691		$6,827,802	
Structure, Contents & Vehicles	9	$7,312,493		$0		$7,312,493	
Roads/Crossings		$0		$0		$0	
Bridges/Culverts		$0		$0		$0	
Crop/Pasture		$0		$0		$0	
Scour Soil Loss		$0		$0		$0	
Sediment Deposition		$0		$0		$0	
Grand Total							
Alternative 1. Piping Canal		$7,312,493		$484,691		$6,827,802	
Alternative 2. Lining Canal & Buy Out		$7,312,493		$0		$7,312,493	

[1] Price base: 2025

[2] Agriculture-related damage includes damage to rural communities.

[3] Includes effects of land-treatment measures.

[4] Costs and benefits for on-farmland treatment have been netted out.

Economic Table 6-6: Estimated Average Annual Watershed Protection Damage Reduction Benefits Wellsville Watershed, Utah [2025 Dollars]1

Item	Damage Reduction Benefit, Average Annual	
	Agriculture-related	Non-agriculture-related
Onsite		
Recreation		
Increment 1 Wellsville Reservoir Boat Ramp	$7,305	
Increment 2 Mendon Cemetery Pond	$4,658	
Crop Irrigation		
Increment 3 Wellsville East Field Piping	$913,850	
Increment 4 Wellsville Secondary Water System	$1,752,366	
Increment 5 Mendon Secondary Water System	$756,924	
Increment 6 WMCD Lower Canal Piping	$4,493,400	
Increment 7 WMCD Lower Canal Lining	$3,029,426	
Canal O&M		
Increment 3 Wellsville East Field Piping	$3,750	
Increment 6 WMCD Lower Canal Piping	$11,000	
Culinary O&M		
Increment 4 Wellsville Secondary Water System	$372,100	
Increment 5 Mendon Secondary Water System	$153,410	

Item	Damage Reduction Benefit, Average Annual	
	Agriculture-related	Non-agriculture-related
Flood Management		
Increment 8 Structure, Contents & Vehicles	$6,827,802	
Alt 2, Buy-Out Structure, Contents & Vehicles	$7,312,493	
Total		
Alternative 1. Piping Canal	$14,756,305	
Alternative 2. Lining Canal & Buy Out	$13,777,022	
[1] Price base: 2025		

Economic Table 6-7: Comparison of Preferred Alternative Benefits and Costs Wellsville Watershed, Utah [2025 Dollars][1]

Works of Improvement	Increment	Agricultural Damage Reduction Flood Reduction	Non-Agricultural Other	Average Annual Benefits	Average Annual Costs[2]	Benefit Cost Ratio
Recreation						
Wellsville Reservoir Boat Ramp	1	$7,305		$7,305	$700	10.44
Mendon Cemetery Pond	2	$4,658		$4,658	$1,700	2.74
Agriculture Water Management						
Wellsville East Field Piping	3	$913,850		$913,850	$253,000	3.61
Wellsville Secondary Water System	4	$1,752,366		$1,752,366	$904,220	1.94
Mendon Secondary Water System	5	$756,924		$756,924	$540,660	1.40
WMCD Lower Canal Piping	6	$4,493,400		$4,493,400	$2,130,200	2.11
WMCD Lower Canal Lining	7	$3,029,426		$3,029,426	$1,443,000	2.10
Flood Management						
Lower Canal Flood Improvements	8				$1,470,800	
Wellsville City Flood Routing	8				$139,000	
Canal Spills	8				$443,100	
Bird Canyon Channel Improvements	8				$33,170	
100 South (Bird Crk) Flood Control Pipe	8				$42,470	
300 North Flood Control Pipeline	8				$33,570	
400 North Flood Control Pipeline	8				$14,570	
Sub-Total				$6,827,802	$2,176,678	3.14
Buy-Out/Relocation	9			$7,312,493	$4,813,800	1.52
Total						
Alternative 1. Piping Canal	1,2,3-6, 8	$14,756,305		$14,756,305	$6,007,158	2.46
Alternative 2. Lining Canal & Buy Out	3-5, 7-9	$13,777,022		$13,777,022	$7,957,080	1.73
[1] Price base: 2025						
[2] From Table 4a						

PR&G Alternative Formulation & Screening Matrix

PR&G ALTERNATIVE FORMULATION AND SCREENING PROCESS FOR THE WELLSVILLE CANYON WATERSHED PLAN-ENVIRONMENTAL IMPACT STATEMENT LOCATE IN CACHE COUNTY, UTAH

LEAD AGENCY: USDA NATURAL RESOURCES CONSERVATION SERVICE (NRCS)

SPONSORING LOCAL ORGANIZATION: CACHE WATER DISTRICT (CWD)

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, WELLSVILLE EAST FIELD IRRIGATION AND CANAL COMPANY

CONSULTANTS: FRANSON CIVIL ENGINEERS, J-U-B ENGINEERS, CRS CONSULTING ENGINEERS



PHASE I: PROBLEMS & OPPORTUNITIES, DEFICIENCIES, OBJECTIVES, & PLANNING CONSTRAINTS

TABLE 1: PROBLEMS AND OPPORTUNITIES

Problem Statement(s): **Flood Prevention** **Agricultural Water Management Public Recreation**	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 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.
Opportunity 1 - Resilience to Flooding	Enhance community resilience to flooding risks through the implementation of project measures.
Opportunity 2 - Improve the Ecosystem	Enhance the local ecosystem by reducing erosion and nutrient loading to the Little Bear River.
Opportunity 3 - Improve Water Delivery	Improve water distribution efficiency and agricultural productivity in the watershed through the implementation of project measures.
Opportunity 4 - Water Conservation	Conserve water resources and optimize water use efficiency on agricultural lands in the watershed.
Opportunity 5 - Reduce Pumping Demands	Reduce community reliance on culinary water for irrigation and reduce summertime pumping demands through the implementation of project measures.
Opportunity 6 - New Access to Recreation	Provide new access to the outdoors and recreational opportunities for local residents.
Opportunity 7 - Erosion Reduction	Reduce erosion, maintain topsoil in-place, and retard bank degradation and lateral stream movement.

IDENTIFIED DEFICIENCIES	
Deficiency 1. Mendon Flooding at Deep Canyon, 300 North, Cemetery Ditch, 100 East, and Center Street	Deficiency 6. Wellsville & Mendon Cities Secondary Water Access.
Deficiency 2. Mendon 500 North Detention Basin Catch Pond Capacity , & flooding at Threemile Canyon/Yonk Loop	Deficiceny 7. Wellsville-Mendon Lower Canal Water Conveyance and seepage issues.
Deficiency 3. Mendon Pond Stream Diversion Structure & Culvert Capacities at Main Street, 100 South, 400 South, and an unnamed channel south of Bird Canyon.	Deficiency 8. Wellsville East Field Canal Water Conveyance and seepage issues.
Deficiency 4. Wellsville-Mendon Lower Canal Flood Control Capacity and Nutrient Loading/Erosion to the Little Bear River.	Deficiency 9. Lack of Recreational Opportunites & Cultural Services
Deficiency 5. Wellsville Wide Canyon Flooding.	

Federal Objective (Required by PR&G)

The Federal Objective specifies that Federal water resource investments shall reflect national priorities, encourage economic development, and protect the environment by:
1. Seeking to maximize sustainable economic development;
2. Seeking to avoid the unwise use of floodplains and flood-prone areas and minimize adverse impacts and vulnerabilities in any case in which a floodplain or flood-prone area may be used; and
3. Protecting and restoring the functions of natural systems and mitigating any unavoidable damage to natural systems.

TABLE 2: PROJECT OBJECTIVES

Objective 1 - Flood Control Problems	Address flood control infrastructure problems in Wellsville, Mendon, and unincorporated Cache County to effectively manage high flows from rain-on-snow events and prevent damage to homes, businesses, and agricultural fields through the year 2130.
Objective 2 - Ag. Water Reliability	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 - Access to Secondary Water	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 - Recreational Opportunities	Expand recreational opportunities and improve public access to nature and cultural services in the watershed through the year 2130.

TABLE 3: CONSTRAINTS AND CONSIDERATIONS

Constraint 1 - Disruptions to Property	Minimize disruptions to existing residential and commercial properties during the construction of the project in Wellsville and Mendon cities.
Constraint 2 - Cultural/Historic Impacts	Minimize adverse impacts to cultural and historic resources in the watershed to the maximum extent possible.
Constraint 3 - Transportation Impacts	Minimize impacts to existing transportation infrastructure, including roads and bridges, to ensure continued access for emergency services and residents.
Constraint 4 - Irrigation Water Access	Minimize disruptions to the ability of farmers to access their water supply during the irrigation season.
Constraint 5 - Soil Loss	Minimize soil loss and the degradation of the surrounding landscapes during project implementation.
Constraint 6 - Water Pollution	Minimize water pollution and sedimentation of waterways during construction activities to protect aquatic ecosystems in the Little Bear River and its tributaries.
Constraint 7 - Protect Listed Species	Minimize impacts that would directly adversely impact or degrade potential habitat for any Federally listed species that may be present in the watershed.

DEFICIENCY #1: MENDON FLOODING AT DEEP CANYON, 300 N, CEMETERY DITCH, 100 E, 100 S, CENTER STREET, & BIRD CANYON

TABLE 4: INITIAL APPROACHES AND MANAGEMENT MEASURES

Initial Approaches & Management Measures	Initial Qualitative Evaluation	Carried Forward?
DEEP CANYON CULVERT UPSIZING (Not Funded by PL 83-566)		
Upsizing of existing culverts and ditches above and below the canal.	Deep Canyon, located near 300 North in Mendon experienced high flood flows in large storm events generated from the large geographic area contributing to the drainage. The topography and location of the drainage path could aid in channeling flood water around the community. This management measure would upsize the existing culverts and ditches above and below the canal. This management measure would not be funded under the PL-566 program, which does not cover culverts. Not Carried Forward.	N
300 NORTH CHANNEL IMPROVEMENTS		
Installation of Flood Control Pipe Network to allow for the potential drainage along 300 North.	The area west of SR-30, east of the Lower Canal from Deep Canyon Road to the south of Willey Lane drains to the intersection of 300 North and SR-30. The culvert ditches along 300 North would be converted to a flood control conduit/pipeline network to allow for the potential drainage of these areas under this measure. The excess flow that the 100 East culvert could not handle would be diverted into the Pond Stream east of 100 East to maintain existing irrigation paths and allow excess flow to be contained. carried forward.	Y
CEMETERY DITCH CULVERT UPSIZING (Partially Funded by PL 83-566)		
Upsizing of existing culverts and ditches along 100 North to handle flow that runs down the cemetery stream area. Installation of drop inlets and culverts at SW intersections of 100 N & 200 N AT 100 East and released into the Pond Stream.	Flooding along 100 East between 100 North and 250 North in Mendon has also occurred during high runoff flood events. This measure would upsize the existing culverts and ditches along 100 North to handle the flows that run down the cemetery stream area. Drop inlets and culverts would be installed at the SW corners of the intersections of 100 North and 200 North at 100 East. These would be routed into the ditch on the east side of 100 East and released into the Pond Stream. This measure would only be partially funded by PL-566. Not Carried forward.	N
100 NORTH FLOOD CONTROL PIPELINE		
Installation of Flood Control Pipeline at intersection of 100 N and 100 E in Mendon	Flooding along 100 East between 100 North and 250 North in Mendon has also occurred during high runoff flood events. This measure would install a pipeline 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 routed to the Pond Stream near 250 North. Not Carried forward.	N
100 EAST - NORTH PIPELINE		
Installation of a collection system in the ROW to route flows to the Pond Stream.	Improvements at 100 East in Mendon that will occur soon would require the installation of a collection system in the right-of-way to route flows to the Pond Stream. Not Carried forward.	N
POND STREAM CHANNEL IMPROVEMENTS		
Installation of a flood water pipe along the east side of 100 E that would collect water in south Mendon.	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. Carried Forward	Y
100 EAST - SOUTH PIPELINE		
Installation of a flood water pipe along the east side of 100 E that would collect water in south Mendon.	A natural wetland between 200 and 300 South along 100 East that used to provide a drainage path for the southeastern portion of Mendon has dried up due to development. This measure would install a flood control pipeline along the east side of 100 East that would collect water in south Mendon. The pipe would be routed along 100 East to 250 South and run east in the existing ditch to the river bottom. 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 additional flow. Not Carried forward.	N
CENTER STREET PIPELINE & DIVERSION STRUCTURES		
Upsizing existing pipes along the north side of Mendon Center Street and the installation of inlet boxes at intersections for collection of flows to allevaite flooding issues.	Flooding into the Mendon Center Street drainage from above the Lower Canal can cause excess stress on other areas of Mendon if not contained. This measure would upsize the existing pipes along the north side of Center Street and install inlet boxes at intersections for the collection of flows to alleviate flooding concerns. This measure would be fully funded by PL-566. Not Carried Forward.	N

100 SOUTH (BIRD CREEK) FLOOD CONTROL PIPELINE		
Flood Control Pipeline to alleviate canyon flood flows	Currently, flooding problems occur along Bird Creek on the North side of 100 South in Mendon. This measure would install a flood control pipeline from 250 West to 500 East on the North side of 100 South to reduce flooding risk and damages. This would include the installation of inlets at all street crossings to collect excess floodwater from adjacent properties and would also include improvements to the existing inlet along the drainage west of the Lower Canal. Additionally, bank protection would be installed at the outlet of the pipeline where it discharges into Bird Creek.	**Y**
BIRD CANYON CHANNEL IMPROVEMENTS		
Channel Improvements instead of Pipeline	Channel improvements would be made along Bird Creek in Mendon between 100 West and Main Street. These improvements would consist of channel shaping and cleaning along that segment of the Bird Creek drainage to reduce flood risks and damages associated with this area of the city. The culvert beneath 100 West (SR-23) would be completed to accommodate the needed capacity 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 this project measure. Mendon City will increase the size of the culvert at Main Street and 100 South at 50 East (if needed) in order to pass the design storm. Additional culvert improvements to the culvert at 5400 West would be paid for by Cache County if needed to pass the design flow.	**Y**
100 SOUTH CHANNEL IMPROVEMENTS (Not Funded by PL 83-566)		
Enlarge the culvert in the 100 S drainage area to allow flows to run unobstructd through the embankment and proceed under the canal into the community.	The 100 South drainage 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 upsize the existing culverts at various locations and enlarge existing ditches and drainage swales to contain the flood flows in this area. The culverts would not be funded by PL-566. Not Carried forward.	**N**

DEFICIENCY #2: MENDON 500 N DETENTION BASIN CATCH POND CAPACITY, 400 N FLOODING & FLOODING AT THREEMILE CANYON/YONK LOOP NORTH OF MENDON		
TABLE 4: INITIAL APPROACHES AND MANAGEMENT MEASURES		
Initial Approaches & Management Measures	**Initial Qualitative Evaluation**	**Carried Forward?**
500 NORTH DETENTION BASIN INLET		
Revision of the inlet of the 500 North Detention basin.	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. Not Carried Forward.	**N**
500 NORTH DETENTION BASIN DRAINAGE PATH		
A drainage path would be installed to control flow to the river bottom.	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. Not Carried Forward.	**N**
400 NORTH FLOOD CONTROL PIPELINE		
Install inlet on drainage between 470 N and 400 N and pipeline to convey flood waters east along 400 N to existing culvert crossing. Eventually discharge into existing swale along 100 East.	During the rain events mentioned above, drainage travels east along 470 North in Mendon and concentrates at SR-23. During these large events, drainage will either overtop SR-23 or travel south to 400 North at overtop at that location. Therefore, on the west side of SR-23 at the 400 North/SR-23 intersection an inlet would be installed with piping conveying the flood waters east along the north side of 400 North to an existing culvert crossing. It would then be piped 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. Carried Forward	**Y**
RAISE 8000 WEST ROADWAY ELEVATION & SINGLE LARGE BASIN AT THREEMILE CANYON		
Raise the roadway elevation at 8000 West to prevent overtopping during flood events and Construction of one large detention basin near upper reaches of Threemile Creek to alleviate higher flow rates in the downstream channels.	This management measure would raise the roadway elevation to avoid flooding impacts at the crossing of 8000 West during flood events. The Threemile Canyon channel downstream (east) of 8000 West would also be cleared of woody vegetation/debris to alleviate restrictions that lead to flooding. High flow rates in the downstream channels would be mitigated through the construction of a detention basin along a branch of Threemile Creek north of the main channel. This measure would develop a single large detention basin near the upper reaches of this branch of Threemile Creek.Preliminary economic screening did not show enough benefits. Not Carried Forward.	**N**
UPPER DETENTION BASIN AT THREEMILE CANYON		
Construction of an upper and a lower detention basin near upper reaches of Threemile Creek to aleviate high flow rates in the downstream channels.	Under this management measure, high flow rates in the downstream channels would be mitigated through the construction of an upper and a lower detention basin near the upper reaches of this branch of Threemile Creek. These two basins would be smaller in size than the basin discussed in the measure above. The costs are higher and more land is required for this measure. It is likely more effective to construct a single detention basin rather than two smaller ones. Not carried forward.	**N**
WIDE & SHALLOW YONK LOOP SWALE		
Installation of a wide and shallow swale to act as a catchment to canyon flood flows and divert them to the north into the Threemile Canyon flood channel.	Yonk Loop, north of Mendon City, has historically seen sheet flow and concentrated flooding in and around it. The management measure to upsize the culverts in this area could be seen as a short-term solution to the problem, and so, this measure, which seeks to install a wide and shallow swale further towards the Wellsville mountains and canyon outlets was proposed. The swale would act as a catchement to all the flood flows diverting them to the north where they could be discharged into the Threemile Canyon flood channel. Not carried forward.	**N**

YONK LOOP ASI UPSTREAM DETENTION BASIN		
Installation of upstream detention basins at Yonk Loop to mitigate flooding impacts	In past rain events that caused flooding in 2005, 2011, and 2017, Yonk Loop 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. Preliminary economic screening did not show enough benefits. Not Carried Forward.	**N**
UPSIZING YONK LOOP CULVERTS (Not Funded by PL 83-566)		
Upsizing of Yonk Loop culverts to minimize flooding of adjacent cropland and reduce erosion concerns.	The slope around Yonk Loop has some elevation change from the west and then begins to flatten out as it travels east towards SR-30. The west portion of the road has historically gathered drainage from the adjacent basin but at times has had problems passing the larger storm events due to culvert sizing issues. The water has then historically traveled along the roadside swale and caused erosion concerns regularly. This management measure would upsize the culverts to acocomodate the large flood flows from the west and the roadside swale be enlarged to handle the flows that run past this location. This option was seen as a mostly short-term solution in this area. Not carried forward.	**N**
YONK LOOP DETENTION BASIN & REGIONAL SWALE		
Detention Basin at 600 N & 7200 W and Regional Swale	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 regional swale would also be constructed under this measure to further collect flood waters. Preliminary economic screening did not show enough benefits. Not Carried Forward.	**N**
YONK LOOP FLOOD CONTROL CONDUIT		
Conduit from Yonk Loop tying into the Wellsville-Mendon Lower Canal.	This management measure would seek to install a swale along the old railroad track. A flood control conduit from Yonk Loop down 600 North to approximately 700 West to the swale to the south along the old railroad track would also be constructed. The conduit would eventually tie into the Wellsville-Mendon Lower Canal. Preliminary economic screening did not show enough benefits. Not Carried Forward.	**N**
RELOCATION OF THREEMILE CANYON BEAVER POPULATION		
Relocate the Beaver Population to eliminate dams/woody debris deadfall	Removing/relocating the beaver population in Threemile Canyon was initially considered for evaluation, but was deemed to be environmentally unacceptable and damaging to the local ecosystem. Incompatible with the PR&G Guiding Principle of Healthy & Resilient Ecosystems. Not carried forward.	**N**
MAINTAIN BEAVER POPULATION FOR GROUNDWATER MANAGEMENT		
Maintain Current Beaver Population for Groundwater Benefits	Beaver dams will raise the groundwater level in the vicinity of the creek helping the riparian and adjacent ag lands, attenuate runoff, sediment, and debris; and increase the quantity and temperature of the baseflow in the creek. However, the presence of beavers also can cause flooding in undesired locations, which meant that the option to maintain the Threemile Creek population would not meet the project Purpose and Need. Not Carried Forward.	**N**
ADHERE TO STATE BEAVER MANAGEMENT PLAN		
	To manage beavers in the area, another management measure was proposed to adhere to the current Utah state	

Adhere to Utah Division of Wildlife Resources State Beaver Management Plan and seek coordination with UDWR if concerns arise.	beaver management plan which states that "there is an open trapping season, which generally runs from October through early April with unlimited take. Beaver causing damage may be taken or removed by the public during closed seasons provided a permit is obtained from UDWR". If beaver take would need to occur outside of the unlimited take open season, permitting would need to be coordinated with the Utah Division of WIldlife Resources (UDWR). Preliminary economic screening of associated measures in the area did not show enough benefits. Not Carried Forward.	**N**

DEFICIENCY #3: MENDON POND STREAM DIVERSION STRUCTURE & CULVERT CAPACITIES AT MAIN ST, 100 E, 400 S, AND UNNAMED CHANNEL		
TABLE 4: INITIAL APPROACHES AND MANAGEMENT MEASURES		
Initial Approaches & Management Measures	**Initial Qualitative Evaluation**	**Carried Forward?**
REBUILD MAIN STREET DIVERSION STRUCTURE		
Rebuilding the diversion structure at Main Street in Mendon	Currently, the Pond Stream in Mendon 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. Due to the topography, it can contain a large amount of flood runoff without restrictions. The exception to this is at road crossings. This management measure would rebuild the existing diversion structure at Main Street to allow for full flow to be routed through the Pond Stream, if needed. Carried Forward.	**Y**
100 EAST CULVERT INSTALLATION (Not Funded by PL 83-566)		
installation of an oversized culvert at 100 East.	Flooding and damages associated with road crossings near the Pond Stream in Mendon would be mitigated under this measure by the installation of an oversized culvert with an orifice plate at 100 East to maintain the existing irrigation flows through the area and allow for increase drainage flow in the future when needed. This measure could not be funded by PL-566. Not Carried Forward.	**N**
400 SOUTH CULVERT CLEANING AND UPSIZING (Not Funded by PL 83-566)		
Cleaning existing culverts and upsizing 400 South Culverts.	The 400 South drainage area receives flow from Coldwater Road that was installed by the Forest Service. These flows cross over the canal and beneath Cobblestone and the state highway. From there, the flows are diverted along the highway's eastern right-of-way to 2000 South, where it is released into an irrigation ditch. Several of the pipes along this route are silt laden and undersized. This management measure would clean all the 400 South culverts and upsize the necessary culverts to allow the flow described above to reach 2000 South without flowing into other systems. Culverts would not be funded by PL-566. Not Carried Forward.	**N**
UNNAMED CHANNEL CULVERT UPSIZING (Not Funded by PL 83-566)		
existing culverts that cross the roadway upsized so flow is not obstructed.	This management 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. This measure would upsize the culverts that cross the existing roadway to adeqautely allow drainage so that flow is not obstructed which may cause runoff to flow east through town along 200 South. Culverts not funded by PL-566. Not Carried forward.	**N**

DEFICIENCY #4: WELLSVILLE-MENDON LOWER CANAL FLOOD CONTROL CAPACITY & NUTRIENT LOADING/EROSION TO LITTLE BEAR RIVER

TABLE 4: INITIAL APPROACHES AND MANAGEMENT MEASURES

Initial Approaches & Management Measures	Initial Qualitative Evaluation	Carried Forward?
2900 SOUTH SPILL AND FLOOD CONTROL PIPELINE		
Construction of spill structure & Pipeline near 2900 South.	The Lower Canal's capacity decreases farther north toward Mendon because it's primary use is irrigation conveyance where capacities decrease as deliveries are made. However, the canal is also used for flood management purposes. During flood events, the canal capacity is exceeded and spills uncontrollably along the alignment between Wellsville and Mendon Cities. This measure would install a new spill structure near 2900 South that would discharge into a pipeline that would convey the flows from the spill down past a private residence, across Highway 23, along 2900 South, until finally discharging into the Little Bear River. Carried forward.	Y
3400 SOUTH SPILL AND FLOOD CONTROL PIPELINE		
Construction of a spill structure & Pipeline near 3400 South.	During flood events, the Lower Canal's capacity is exceeded and spills uncontrollably along the alignment between Wellsville and Mendon Cities. This measure would install a new spill structure near 3400 South that would discharge into a pipeline that would convey the flows down to the intersection of 4800 West. Here, the pipe would then flow north and discharge into an existing channel that would convey the flows back to the natural channel. Several inlets would be place in the pipeline to collect flows from along Highway 23 and 4800 West. This pipeline would also convey flows from Brushy Canyon that would collect the water before it crosses the canal. Carried forward.	Y
FLOODWATER MANAGEMENT NEAR FRANCIS FAMILY PROPERTY		
Diverting the water where it currently goes under the canal at the Francis family property near 2900 South.	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 Gibson and Coldwater canyons during these events and run under the Lower Canal through this culvert. The drainage running past the property cannot handle these flows and has historically overtopped and flooded their property. This measure would address this by diverting the water where it currently goes under the canal. The water would instead enter the canal and be managed along with the canal floodwater. Carried forward.	Y
2900 SOUTH AND FRANICS FAMILY PROPERTY CHANNEL IMPROVEMENTS		
Rehabilitation of the culverts & channel widening near 2900 South and the Francis family Property.	Another measure that was considered to address the flooding concerns at the Francis family property and along 2900 South. The culverts downstream where the drainage crosses Highway 23 do not have adequate capacity to pass flows during heavy rain-on-snow flood events. This measure would make channel improvements (widening, culvert rehabilitation, etc.). This option would not be funded as part of the PL-566 program, which led the sponsors to conclude that other management measures would need to be identified to address the problems in this area. Not carried forward.	N
2400 SOUTH CHANNEL IMPROVEMENTS AND FLOOD CONTROL PIPELINE		
Installation of a pipeline along 2400 South	This management measure would install a pipeline along 2400 South to capture flood flows that come out of Gibson and Coldwater canyons and pass under the Lower Canal through a small siphon. This pipeline would connect the culvert under the canal and convery the flows to the northeast and connect in with the 2400 South Spill pipeline to convey the flows to the Little Bear River. However, this measure also be addressed by allowing flood flows to enter the Lower Canal and be managed with the water flowing through the canal. Not carried forward.	N
3400 SOUTH CHANNEL IMPROVEMENTS		
Construction of a designated open flood channel along 3400 South.	Maple Rise Road, or 3400 South, experiences severe flooding issues during intense rain-on-snow flood events. This measure would seek to alleviate these issues by improving the existing channel along 4800 West until the channel discharges into the natural drainage channel to the north. However, the closed conduit measure was moved forward which would cause issues with a narrow county right-of-way along 3400 South that would make it difficult to construct a channel without needing to acquire easemnents and negatively impacting residential private property. Not carried forward.	N
MURRAY SPRINGS DIVERSION STRUCTURE REHABILITATION		
Rehab of Murray Springs Diversion Structure.	There is an existing overflow structure in the Lower Canal at Murray Springs. The structure would be rehabilitated under this management measure to provide operators with the ability to divert all the water out the Lower Canal during a storm event to manage flood water entering the canal. The rehabilitation would allow operators to take advantage of the capacity of the Murray Springs channel for flood management. Below the existing overflow structure, the Lower Canal's entire existing capacity would be fully available for flood flows during events. Additionally, diverting the canal water during a storm event would reduce the capacity needed at the proposed 2900 and 3400 spill locations as well.	Y

DEFICIENCY #5: WELLSVILLE WIDE CANYON, HAWBUSH, PINE CANYON, AND CANAL TAIL WATER FLOODING

TABLE 4: INITIAL APPROACHES AND MANAGEMENT MEASURES

Initial Approaches & Management Measures	Initial Qualitative Evaluation	Carried Forward?
CONVERT WIDE CANYON PONDS TO DUAL PURPOSE DETENTION BASINS		
Mitigation of flood flows in Wide canyon via the implementation of detention basins.	Development in the Wide Canyon area of Wellsville has encroached on the natural drainage channel. Flood flows exceed the current capacity of the flood channel. This measure would install detention basins along the channel and would utilize the regulating ponds installed as part of a different ag. water management measure with increased capacity to dual function as detention basins. There would be very significant property acquisition difficulties associated with this management measure. Not carried forward.	N
WIDENING WIDE CANYON CHANNEL TO PASS 100-YR FLOOD EVENT		
Widening and improving the Wide Canyon channel.	Wide Canyon, located West of Wellsville City, has had its natural channel encroached upon and rediverted through residential development efforts. As a result, several homes are flooded during flood events in the area. This measure would widen and improve the channel to increase its current capacity. However, the amount of room required for these significant channel improvements would not be possible (to pass the 100-year flood, at least) due to the insufficient space between homes and structures. Not carried forward.	N
MURRAY SPRING DRAINAGE CULVERT UPSIZING (Not Funded by PL-566)		
Upsizing culverts along the natural channel of the Murray Springs Drainage.	This measure would upsize the culverts along the natural channel of the Murray Springs Drainage in Wellsville. This would be done to better manage the higher flows and prevent the flooding of homes along the channel. Funding from the PL 83-566 program would not be used to cover the cost of culvert replacement and would come from other sources. Carried forward.	Y
WIDE CANYON FLOOD CONTROL PIPELINE		
Installation of a pipeline to address flooding issues created by the discharge from Wide Canyon.	This measure would install a pipeline to address flooding issues created by the discharge from Wide Canyon. The floodwater would be collected into the pipeline to the west of 300 West and flownorth to 500 South where it would continue along 500 South before turning north at 100 east and discharging into the Murray Springs stream. Some flows would still be allowed to pass the Murray Springs diversion structure, but the pipeline would alleviate the extreme flooding in the Wide Canyon channel caused by intense rain events. Carried forward.	Y
HAWBUSH FLOOD CHANNEL IMPROVEMENTS		
Channel improvents to the Hawbush flood channel in Wellsville Canyon (Sardine Canyon).	Wellsville Canyon, also known as Sardine Canyon, generates 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. Channel improvements were initially considered at this location until Wellsvile City completed previous efforts to mitigate flooding here, which are likely successful. Not carried forward.	N
CANAL TAIL WATER CULVERT UPSIZING (Not Funded by PL 83-566)		
Upsizing and cleaning of culverts that cross SR-30 and the Union Pacific Railroad Tracks.	At the tail water of the Lower Canal north of Mendon City, the channel turns and eventually discharges into the wetlands to the east. At this locaation, 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 railroad tracks. This measure would upsize the culverts and clear the channels in this area to allow the drainage to flow freely through the channel and discharge in the wetlands. However, other project measures would address this flooding issue without the selection of this measure. Not carried forward.	N

CANYON DETENTION PONDS		
Installation of a detention pond at the outlet of each canyon (10+) along the east face of the Wellsville Mountains	This measure would install a detention pond at the outlet of each canyon (10+ canyons) along the eastern face of the Wellsville Mountains. However, this measure would be very expensive and would not fully address the issues related to flooding as much of the flood flows during rain-on-snow flood events arte generated downstream of the canyon outlets. Not carried forward.	**N**
BUYOUTS OF PROPERTIES IN 100-YEAR FLOODPLAIN		
Nonstructural measure to buyout/conduct relocations of all properties in the 100-yr existing conditions floodplain.	This measure would be a nonstructural option to address the problems related to flooding in the project area. This measure would require purhcasing (voluntary buyouts) of all the structures and homes within the 100-year existing conditions flood inundation area. This floodplain would not be the same as the FEMA floodplain because it addresses flood impacts associated with water collected and rerouted by the canal leading to overtopping in locations not associated with the historical drainage. The PR&G process requires nonstructural measurs, if they exist, to be carried forward for Flood Prevention projects. Carried forward.	**Y**

DEFICIENCY #6: WELLSVILLE & MENDON CITIES SECONDARY WATER ACCESS

TABLE 4: INITIAL APPROACHES AND MANAGEMENT MEASURES

Initial Approaches & Management Measures	Initial Qualitative Evaluation	Carried Forward?
WELLSVILLE SECONDARY WATER SYSTEM - SUPPLIED BY TWO REGULATING PONDS		
Construction of two separate regulating ponds at different elevations on the hillside west of Wellsville City.	This measure would construct two separate regulating ponds at different elevations on the hillside west of Wellsville City. The ponds would be positioned to supply water to two separate pressure zones throughout the city, an upper and a lower pressure zone. The Upper Pond would be supplied by the Lower Canal and Murray Springs from a pump station constructed adjacent to the canal. The Lower Pond would be supplied via a gravity flow from the Wellsville-Mendon Upper Canal and Wellsville Reservoir from a pump station constructed adjacent to the reservoir. Would likely lower pumping costs by minimuzing the pressure head required to supply each zone. Carried forward.	Y
WELLSVILLE SECONDARY WATER SYSTEM - SUPPLIED BY WELLSVILLE RESERVOIR		
Supply the full water demand for the Wellsville Secondary System from the Wellsville Reservoir.	This measure would supply the full water demand for the Wellsville Secondary System from the Wellsville Reservoir. Water from the Lower Canal and Murray Springs would be diverted into Wellsville Reservoir to provide additional supply for the mid to late Summer months when the demand is usually higher. This would generate fluctuating water surface elevation and environmental impacts of warmer water from the Lower Canal discharging into the reservoir. Not carried forward.	N
WELLSVILLE SECONDARY WATER SYSTEM - SUPPLIED BY THE LOWER CANAL		
Supply the full water demand for the Wellsville Secondary System from the Lower Canal.	This management measure would supply the full water demand for the Wellsville Secondary System from the 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 Springs would be conveyed to discharge into the wet well to supply the demand in early spring and later fall when no water is in the canal. The Lower Canal is supplied by 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. A constant flow rate would not be possible due to demand fluctuations throughout the day. Pumping costs would also increase. Not carried forward.	N
WELLSVILLE SECONDARY WATER SYSTEM - SUPPLIED BY WELLSVILLE RESERVOIR AND ONE REGULATING POND		
Supply the full water demand for the Wellsville Secondary System by pumping directly from Wellsville Reservoir and an Upper Regulating Pond.	This measure would supply water for the Wellsville Secondary system by pumping from Wellsville Reservoir, rather than constructing a new regulation pond. This would require a larger pump to meet the pressure needs of the system, causing pumping costs to be higher, but capital costs to be lower. Not carried forward.	N
WELLSVILLE SECONDARY WATER SYSTEM - SUPPLIED BY ONE LARGE REGULATING POND		
Supply the full water demand for the Wellsville Secondary System from a new regulation pond constructed on the west side of Wellsville City.	This management measure would supply the Wellsville Secondary Water system from a new regulating pond constructed on the west side of Wellsville City at an elevation sufficient to provide 45 psi pressure throughout the system. All water sources 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. Pumping costs would increase significantly to convey all water sources to the pond location. Not carried forward.	N
MENDON SECONDARY WATER SYSTEM - PIPE NETWORK AND SINGLE REGULATING POND		
Construction of a regulating pond located above the Mendon City Cemetery on land owned by the city.	This measure would install a secondary water system and a regulating pond above the Mendon City Cemetery on land owned by the city. This pond would provide secondary water storage and provide services to those residents near the canal. The pond would be filled from the Lower Canal by pumping. The pipe network would include pipe diameters ranging from 24-inches down to 6-inches. The system would provide secondary water to all existing homes currently being served through multiple individual irrigation companies. Carried forward.	Y

MENDON SECONDARY WATER SYSTEM - PIPE NETWORK ONLY		
Construction of a secondary water system without a regulating pond.	This management measure would construct a secondary water system in Mendon without including a regulating pond. This would provide secondary water to many residents of the city but would not be able to supply the residents living 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. Not carried forward.	**N**
MENDON SECONDARY WATER SYSTEM - PIPE SYSTEM ONLY AND INCLUDING DEVELOPMENT		
Construction of a secondary water system without a regulating pond but built to serve future development beyond existing needs.	This measure would construct a secondary water system in Mendon without a regulating pond as well but would be constructed 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 trunklines would be available for future development to hook onto as residences are constructed within city limits. This would place a high financial burden on existing residents that would not meet the PR&G Guiding Prinviple of Sustainable Economic Development. Not carried forward.	**N**

DEFICIENCY #7: WELLSVILLE-MENDON LOWER CANAL WATER CONVEYANCE & SEEPAGE ISSUES

TABLE 4: INITIAL APPROACHES AND MANAGEMENT MEASURES

Initial Approaches & Management Measures	Initial Qualitative Evaluation	Carried Forward?
CONVERT HYRUM DAM OUTLET WORKS TO A CLOSED SYSTEM (Not Funded by PL 83-566)		
Update Hyrum Dam outlet works to a closed system.	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 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 Hyrum Reservoir. This measure is supported by the sponsors but would require improvements at Hyrum Dam, owned by the Bureau of Reclamation. PL 83-566 funding could not be used for improvements on USBR property. Not carried forward.	N
ELIMINATE OPEN CHANNEL CANAL AND RESTORE NATURAL FLOOD CHANNELS		
Eliminate the open channel canal and restore the natural flood channel flow paths.	This measure would constitute a nature-based solution to the problems associated with flood control in the project area. This measure would continue to divert the water for the WMCD from below Hyrum Reservoir at the existing diversion points. The Lower Canal would the be pressure piped. This measure would eliminate the open channel Lower Canal and restore the natural flood channel flow paths where possible. Where necessary, a combination of conduits and open channels flowing North and East to the Little Bear River floodp[lain would be used to accomplish this. Carried forward.	Y
PRESSURE PIPE THE LOWER CANAL		
Enclose the Lower Cnal and convey water with a pipeline in Wellsvile, Mendon, and part of unincorporated Cache County, Utah.	This measure would continue to diver the water for the WMCD from below Hyrum Reservoir at the existing diversion points but would then enclose the Lower Canal and convery water with a pipeline in Wellsville, Mendon, and parts 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. Carried forward.	Y
PRESSURE PIPE THE WELLSVILLE UPPER CANAL		
Pressure Pipe the Upper Canal (Wellsville Canal) in addition to the Lower Canal.	This measure woulf pressure pipe the Upper Canal in addition to the Lower Canal. This measure would have met individual criteria under the PL 83-566 prohram but was not carried forward because the sponsor used other Federal program funding to expedite the process of piping the Upper Canal. Not carried forward.	N
LINE THE LOWER CANAL		
Line the Lower Canal in Wellsville, Mendon, and part of unincorporated Cache County, Utah.	This measure would install a new liner along the Lower Canal. Currently, only about 25% of the Lower Canal is line and much this liner is damaged. This measure would increase the amount of the canal that is lined to reduce seepage losses. Carried forward.	Y

DEFICIENCY #8: WELLSVILLE EAST FIELD CANAL WATER CONVEYANCE & SEEPAGE ISSUES

TABLE 4: INITIAL APPROACHES AND MANAGEMENT MEASURES

Initial Approaches & Management Measures	Initial Qualitative Evaluation	Carried Forward?
GRAVITY PIPE WELLSVILLE EAST FIELD CANAL		
Pipe 2.5 miles of the existing Wellsville East Field Canal	This measure would pipe the existing Wellsville East Field Canal starting ~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 and evaporation. This measure would need to incorporate steps to prevent the introduction of invasive mussels during construction, as requested by the sponsors.	Y
PRESSURE PIPE THE WELLSVILLE EAST FIELD CANAL		
Utilize Hyrum Reservoir to pressure pipe the Wellsville East Field Canal to Meridian Road	This measure would utilize Hyrum Reservoir as a regulating pond and as the point of pressurization for the Wellsville East Field Canal. The canal would be piped from Hyrum Reservoir to Meridian Road. This would allow for smalle pipe sizes compared to the gravity piping measure. However, improvements would be required at Hyrum Dam, a Bureau of Reclamation property, which cannot be completed using PL 83-566 program funds. Not carried forward.	N

DEFICIENCY #9: LACK OF RECREATIONAL OPPORTUNITIES & CULTURAL SERVICES

TABLE 4: INITIAL APPROACHES AND MANAGEMENT MEASURES

Initial Approaches & Management Measures	Initial Qualitative Evaluation	Carried Forward?
WALKING TRAIL ALONG THE CANAL ALIGNMENT		
Construction of a recreational trail should the Lower Canal be piped.	This measure would involve the construction of a recreation trail along the Lower Canal alignment if it is pressure piped. The trail would only be built if the canal is piped because of the risk of drowning otherwise. The trail would be built above or adjacent to the pipeline alignement and add a new recreational opportunity in the area. There have been multiple safety concerns expressed about the public having access to the Lower Canal. Not carried forward.	N
WELLSVILLE REGULATING PONDS OPENED TO PUBLIC		
If two regulating ponds were constructed for the secondary system they would be opened up to the public for recreation.	If two new regulating ponds were constructed as a part of the project, this measure would open these ponds to the public for recreational purposes. However, the ponds would be constructed on private property where the landowners expressed concerns regarding liability related to recreational use. Not carried forward.	N
WELLSVILE RESERVOIR BOAT RAMP		
Construction of a boat ramp for non-motorized watercraft at Wellsville Reservoir.	This measure would install a boat ramp for small non-motorized watercraft (kayaks, paddleboards, canoes, etc.) on the east side of Wellsville Reservoir. This would provide easier access for residents to use Wellsville Reservoir for recreational purposes. Carried forward.	Y
WELLSVILLE RESERVOIR CAMPGROUND		
Development of a campground on the west side of Wellsville Reservoir.	This measure would develop a campground on the west side of Wellsville Reservoir. However the sponsor was not willing or able to provide matching funds for the construction of this measure. Not carried forward.	N
WELLSVILLE DUAL PURPOSE SOCCER FIELD & DETENTION BASIN		
Installation of a soccer field that could double as a detention basin in parcels owned by Wellsville City	This measure would install a detention basin on several parcels owned by Wellsville City that could dual purpose as a Soccer Field. However, the parcels are not conveniently located for secondary supply and they are not near the areas of concern for flooding during heavy rain events. Not carried forward.	N
MENDON CITY CEMETERY REFLECTING POND		
Improvement of the aesthetics of the Mendon City Cemetery by installing a small reflecting pond and walking path with benches.	In recent years, the Mendon City Cemetery has expanded and there has been a desire to improve the overall cemetery ground and the facilities aesthetics. This measure would install a small reflecting pond with a walking path and benches that could be utilized by residents of the city. This would benefit all those that visit the cemetery and provide much needed amenities. Carried forward.	Y

TABLE 5: MEASURES CONSIDERED AND SELECTED FOR INCORPORATION INTO ALTERNATIVES

C = Compatible/Combinable, M = Mutually Exclusive or Unecessarily Redundant

PHASE III & IV: PAIRWISE COMPATIBILITY FOR EACH MANAGEMENT MEASURE AND C

M = Mutually Exclusive or Incompatible C = Compatible in an alternative	Pairwise Compatibility	DEFICIENCY #1: MENDON FLOODING AT DEEP CANYON, 300 N, CEMETERY DITCH, 100 E, 100 S, CENTER STREET, &				DEFICIENCY #2	DEFICIENCY. #3	DEFICIENCY #4: WELLSVILLE-MENDON LOWER CANAL FLOOD CONTROL CAPACITY				DEFICIENCY #5: WELLSVILLE WIDE CANYON FLOODING			DEFICIENCY #6: SECONDARY WATER		DEFICIENCY #7: LOWER CANAL CONVEYANCE			DEFICIENCY #8	DEFICIENCY #9: RECREATIONAL OPPORTUNITIES		Preliminary Evaluation of Combinations	Carried Forward?
		300 North Channel Improvements	Pond Stream Channel Improvements	100 S (Bird Creek) Flood Pipeline	Bird Canyon Channel Improvements	400 North Flood Control Pipeline	Rebuild Main Street Diversion Structure	2900 South Spill & Flood Pipeline	3400 South Spill & Flood Pipeline	Flood Mgmt. at Francis Property	Abandon Murray Springs Structure	WMCD Lower Canal Crossings	Wide Canyon Flood Control Pipeline	Buyouts of Properties in 100-yr Floodplain	Wellsville Secondary Water System	Mendon Secondary Water System	Eliminate Canal & Restore Channels	Pressure Pipe the Lower Canal	Line the Lower Canal	Pipe Wellsville East Field Canal	Wellsville Reservoir Boat Ramp	Mendon City Cemetery Reflecting P...		
DEFICIENCY #1: MENDON FLOODING AT DEEP CANYON, 300 N, CEMETERY DITCH, 100 E, 100 S, CENTER STREET, & BIRD CANYON	300 North Channel Improvements	NA	C	C	C	C	C	C	C	C	C	C	C	M	C	C	M	C	C	C	C	C	Could be included in any alternative that did not (A) address flooding issues through nonstructural measures or (B) a nature-based solution that restored the natural flood channels. Carried Forward for inclusion in Alternative Plans.	Y
	Pond Stream Channel Improvements	C	NA	C	C	C	C	C	C	C	C	C	C	M	C	C	M	C	C	C	C	C	Could be included in any alternative that did not (A) address flooding issues through nonstructural measures or (B) a nature-based solution that restored the natural flood channels. Carried Forward for inclusion in Alternative Plans.	Y
	100 S (Bird Creek) Flood Control Pipeline	C	C	NA	C	C	C	C	C	C	C	C	C	M	C	C	M	C	C	C	C	C	Could be included in any alternative that did not (A) address flooding issues through nonstructural measures or (B) a nature-based solution that restored the natural flood channels. Carried Forward for inclusion in Alternative Plans.	Y
	Bird Canyon Channel Improvements	C	C	C	NA	C	C	C	C	C	C	C	C	M	C	C	M	C	C	C	C	C	Could be included in any alternative that did not (A) address flooding issues through nonstructural measures or (B) a nature-based solution that restored the natural flood channels. Carried Forward for inclusion in Alternative Plans.	Y
DEFICIENCY #2	400 North Flood Control Pipeline	C	C	C	C	NA	C	C	C	C	C	C	C	M	C	C	M	C	C	C	C	C	Could be included in any alternative that did not (A) address flooding issues through nonstructural measures or (B) a nature-based solution that restored the natural flood channels. Carried Forward for inclusion in Alternative Plans.	Y
DEFICIENCY #3	Rebuild Main Street Diversion Structure	C	C	C	C	C	NA	C	C	C	C	C	C	M	C	C	M	C	C	C	C	C	Could be included in any alternative that did not (A) address flooding issues through nonstructural measures or (B) a nature-based solution that restored the natural flood channels. Carried Forward for inclusion in Alternative Plans.	Y
DEFICIENCY #4: WELLSVILLE-MENDON LOWER CANAL FLOOD CONTROL CAPACITY & NUTRIENT LOADING/EROSION TO LITTLE BEAR RIVER	2900 South Spill & Flood Control Pipeline	C	C	C	C	C	C	NA	C	C	C	C	C	M	C	C	M	C	C	C	C	C	Could be included in any alternative that did not (A) address flooding issues through nonstructural measures or (B) a nature-based solution that restored the natural flood channels. Carried Forward for inclusion in Alternative Plans.	Y
	3400 South Spill & Flood Control Pipeline	C	C	C	C	C	C	C	NA	C	C	C	C	M	C	C	M	C	C	C	C	C	Could be included in any alternative that did not (A) address flooding issues through nonstructural measures or (B) a nature-based solution that restored the natural flood channels. Carried Forward for inclusion in Alternative Plans.	Y
	Floodwater Management near Francis Property	C	C	C	C	C	C	C	C	NA	C	C	C	M	C	C	M	C	C	C	C	C	Could be included in any alternative that did not (A) address flooding issues through nonstructural measures or (B) a nature-based solution that restored the natural flood channels. Carried Forward for inclusion in Alternative Plans.	Y
	Abandon Murray Springs Structure	C	C	C	C	C	C	C	C	C	NA	C	C	M	C	C	M	C	C	C	C	C	Could be included in any alternative that did not (A) address flooding issues through nonstructural measures or (B) a nature-based solution that restored the natural flood channels. Carried Forward for inclusion in Alternative Plans.	Y
DEFICIENCY #5: WELLSVILLE WIDE CANYON FLOODING	WMCD Lower Canal Crossings	C	C	C	C	C	C	C	C	C	C	NA	C	M	C	C	M	C	C	C	C	C	Could be included in any alternative that did not (A) address flooding issues through nonstructural measures or (B) a nature-based solution that restored the natural flood channels. Carried Forward for inclusion in Alternative Plans.	Y
	Wide Canyon Flood Control Pipeline	C	C	C	C	C	C	C	C	C	C	C	NA	M	C	C	M	C	C	C	C	C	Could be included in any alternative that did not (A) address flooding issues through nonstructural measures or (B) a nature-based solution that restored the natural flood channels. Carried Forward for inclusion in Alternative Plans.	Y
	Buyouts of Properties in 100-year floodplain	M	M	M	M	M	M	M	M	M	M	M	M	NA	C	C	M	C	C	C	C	C	Constitutes a nonstructural solution to all flood prevention issues in the watershed. Could be combined with ag water management & public recreation to form a nonstructural-structural combination alternative. Carried Forward for inclusion in alternative plans.	Y
DEFICIENCY #6: WELLSVILLE & MENDON CITIES SECONDARY WATER ACCESS	Wellsville Secondary Water System	C	C	C	C	C	C	C	C	C	C	C	C	C	NA	C	C	C	C	C	C	C	Could be included in any alternative. Carried Forward for inclusion in Alternative Plans.	Y
	Mendon Secondary Water System	C	C	C	C	C	C	C	C	C	C	C	C	C	C	NA	C	C	C	C	C	C	Could be included in any alternative. Carried Forward for inclusion in Alternative Plans.	Y
...Y #7: LOWER CANAL CONVEYANCE	Eliminate Canal & Restore Natural Flood Channels	M	M	M	M	M	M	M	M	M	M	M	M	M	C	C	NA	C	C	C	C	C	Constitutes a nature-based solution to all flood prevention issues in the watershed. Could be combined with ag water management & public recreation to form a full alternative. Carried Forward for inclusion in alternative plans.	Y
	Pressure Pipe the	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	NA	M	C	C	C	Could be included in any alternative plan as a measure to address problems associated with agricultural water management except for	Y

DEFICIENCY #7: CANAL CO	Lower Canal	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	NA	M	C	C	C	the lining of the canal. Carried forward for inclusion in alternative plans.	Y
	Line the Lower Canal	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	M	NA	C	C	C	Could be included in any alternative plan as a measure to address problems associated with agricultural water management except for the Piping of the canal. Carried forward for inclusion in alternative plans.	Y
DEFICIENCY #8: WELLSVILLE EAST FIELD	Gravity Pipe Wellsville East Field Canal	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	NA	C	C	Could be included in any alternative plan as a measure to address problems associated with agricultural water management except for piping or lining the canal. Carried forward for inclusion in alternative plans.	Y
DEFICIENCY #9: LACK OF RECREATIONAL OPPORTUNITIES & CULTURAL SERVICES	Wellsville Reservoir Boat Ramp	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	NA	C	Could be included in any alternative plan as a measure to address problems associated with Public Recreation. Carried forward for inclusion in alternative plans.	Y
	Mendon City Cemetery Reflecting Pond	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	NA	Could be included in any alternative plan as a measure to address problems associated with Public Recreation. Carried forward for inclusion in alternative plans.	Y

PHASE V: FIRST SCREENING OF THE INITIAL ARRAY AGAINST THE FEDERAL/PROJECT OBJECTIVES & PLANNING CONSTRAINTS

TABLE 6: SUMMARY OF INITIAL ALTERNATIVES AND 1ST SCREENING BASED ON OBJECTIVES AND CONSTRAINTS

N = not met, Y = met, NA = not applicable

ID	ALTERNATIVE DESCRIPTION	Federal Objective	Flood Control Objective	Ag. Water Reliability Objective	Access to Secondary Water Objective	Recreational Opportunities Objective	Property Disruptions Constraint	Cultural/Historic Impacts Constraint	Transportation Impacts Constraint	Irrigation Water Access Constraint	Soil Loss Constraint	Water Pollution Constraint	Protect Listed Species Constraint	CARRIED FORWARD Y/N?
Alternative 1 -- No Action --	No Action Alternative (FWOFI) Existing conditions would continue, the problems and opportunities would not be met and conditions would generally worsen.	N	N	N	N	N	Y	N	Y	Y	N	N	Y	Y
Alternative 2 -- Proposed Action -- Piping Alternative	Piping Alternative •Flood Prevention: 300 North Flood Control Pipeline •Flood Prevention: 100 South (Bird Creek) Flood Control Pipeline •Flood Prevention: Bird Canyon Channel Improvements •Flood Prevention: Pond Stream Channel Improvements •Flood Prevention: 400 North Flood Control Pipeline •Flood Prevention: 2900 South Spill & Flood Control Pipeline •Flood Prevention: 3400 South Spill & Flood Control Pipeline •Flood Prevention: Floodwater Management Near Francis Family Property •Flood Prevention: Murray Springs Diversion Structure Rehabilitation •Flood Prevention: Murray Springs Culvert Upsizing (not funded by PL-566) •Flood Prevention: Wide Canyon Flood Control Pipeline •Ag. Water Management: Wellsville Secondary Water System with 2 Regulating Ponds •Ag. Water Management: Mendon Secondary Water System with 1 Regulating Pond •Ag. Water Management: Pressure Pipe the Lower Canal •Ag. Water Management: Gravity Pipe the Wellsville East Field Canal •Public Recreation: Wellsville Reservoir Boat Ramp •Public Recreation: Mendon City Cemetery Reflecting Pond	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Alternative 3 -- Proposed Action -- Lining & Buyouts Alternative (Nonstructural-Structural Combination)	Lining & Buyouts Alternative (Nonstructural-Structural Combination) * Flood Prevention: Buyouts of Properties in the 100-year Floodplain * Ag. Water Management: Wellsville Secondary Water System Supplied by Two Regulating Ponds * Ag. Water Management: Mendon Secondary Water System - Pipe Network & Single Regulating Pond * Ag. Water Management: Line the Lower Canal * Ag. Water Management: Gravity Pipe the Wellsville East Field Canal * Public Recreation: Wellsville Reservoir Boat Ramp Public Recreation: Mendon City Cemetery Reflecting Pond	Y	Y	Y	Y	Y	N	N	Y	Y	N	N	N	Y
Alternative 4 -- Proposed Action -- Lining Alternative	Piping Alternative •Flood Prevention: 300 North Flood Control Pipeline •Flood Prevention: 100 South (Bird Creek) Flood Control Pipeline •Flood Prevention: Bird Canyon Channel Improvements •Flood Prevention: Pond Stream Channel Improvements •Flood Prevention: 400 North Flood Control Pipeline •Flood Prevention: 2900 South Spill & Flood Control Pipeline •Flood Prevention: 3400 South Spill & Flood Control Pipeline •Flood Prevention: Floodwater Management Near Francis Family Property •Flood Prevention: Murray Springs Diversion Structure Rehabilitation •Flood Prevention: Murray Springs Culvert Upsizing (not funded by PL-566) •Flood Prevention: Wide Canyon Flood Control Pipeline •Ag. Water Management: Wellsville Secondary Water System with 2 Regulating Ponds •Ag. Water Management: Mendon Secondary Water System with 1 Regulating Pond •Ag. Water Management: Line the Lower Canal •Ag. Water Management: Gravity Pipe the Wellsville East Field Canal •Public Recreation: Wellsville Reservoir Boat Ramp •Public Recreation: Mendon City Cemetery Reflecting Pond	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Alternative 5 -- Proposed Action -- Piping & Filling Alternative (Nature-Based Solution)	Piping and Filling Alternative (Nature-Based Solution) * Flood Prevention: Restore Natural Flood Channels * Ag. Water Management: Wellsville Secondary Water System Supplied by Two Regulating Ponds * Ag. Water Management: Mendon Secondary Water System - Pipe Network & Single Regulating Pond * Ag. Water Management: Pressure Pipe the Lower Canal * Ag. Water Management: Gravity Pipe the Wellsville East Field Canal * Public Recreation: Wellsville Reservoir Boat Ramp Public Recreation: Mendon City Cemetery Reflecting Pond	N	N	Y	Y	Y	N	N	N	N	N	N	N	N

PHASE VI: SECOND SCREENING OF THE INITIAL ARRAY AGAINST THE ECOYSTEM SERVICES AND ECONOMIC BENEFITS/B/C RATIO

TABLE 7: SUMMARY OF 2ND SCREENING OF INITIAL ARRAY OF ALTERNATIVES BY ECOSYSTEM SERVICES AND ECONOMICS

N = not met/Decreased or Did Not Increase Service Provision, Y = met/Increased Service Provision, NA = not applicable

ID	ALTERNATIVE NAME	PROVISIONING	REGULATING	CULTURAL	SUPPORTING	BCR	NET BENEFITS	CARRIED FORWARD?
Alternative 1: No Action (FWOFI)	**Alternative 1 -- No Action -- FWOFI Alternative.** Although this alternative does not improve the provision of any ecosystem service categories or meet the minimum BCR, it is carried forward into the final array because it is required under NEPA and the PR&G.	N	N	N	NA	0	$0	Y
Alternative 2: Piping Alternative	**Alternative 2 -- Proposed Action -- Piping Alternative.** The Piping Alternative would improve the provision of provisioning, regulating, and cultural ecosystem services in the watershed and would meet the BCR requirement, with a BCR of **2.19** and net benefits of **$6,452,451**.	Y	Y	Y	NA	2.01	$6,054,051	Y
Alternative 3: Lining & Buyouts	**Alternative 3 -- Proposed Action -- Lining & Buyouts Alternative (Nonstructural).** The Lining & Buyouts Alternative would improve the provision of provisioning, regulating, and cultural ecosystem services in the watershed but would meet the BCR requirement, with a BCR of **1.34** and net benefits of **$2,992,606**. However, despite the exorbitant costs and lower BCR than Alternative 2, due to this alternative being a nonstructural-structural combination alternative, which is required for flood prevention projects, it was carried forward to the final array despite its inability to meet all the screening criteria.	Y	Y	Y	NA	1.47	$3,775,647	Y
Alternative 4: Lining Alternative	**Alternative 4 -- Proposed Action -- Lining Alternative.** The Lining Alternative was eliminated based on its ability to improve the provision of the ecosystem services in the watershed and did not make it to the full economic analysis. The cost and management of a joint-irrigation and flood control system forces the channel to be larger because of the necessary control structures. Additionally, 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. For these reasons the Lining Alternative was not carried forward into the final array of alternatives	Y	Y	Y	NA	NA	NA	N

PHASE VII: IDENTIFICATION OF THE FINAL ARRAY OF ALTERNATIVES (TO BE SCREENED USING C,E,E,& A)

TABLE 8: FINAL ARRAY OF ALTERNATIVES

Alternative 1 -- No Action -- FWOFI Alternative	Taking no action would consist of activities carried out if no federal action or funding were provided. This alternative would not address flooding into the canals. The canals would be maintained in their existing condition as earthen channels and irrigation conveyance within the communities of Wellsville and Mendon and would continue to overtop during rain-on-snow events and flooding in the Wellsville Canyon Watershed would continue. Additionally, erosion and sedimentation from the alluvial plains above the canals would continue under this alternative. There would be no recreational access to Wellsville Reservoir constructed. Although there will not be any capital improvements, this alternative leaves the option of possibly altering management through the educational extension at Utah State University (USU) and/or the NRCS local office, however no guaranteed forecast can be made that any education or outreach would occur under this alternative.
Alternative 2 -- Proposed Action -- Piping Alternative	The Piping Alternative would continue to divert the water for the Wellsville-Mendon Conservation District (WMCD) from below Hyrum Reservoir at the existing diversion points. However, this alternative would then enclose the Wellsville-Mendon Canal (Lower Canal) and convey water through piping in Wellsville and Mendon cities and part of unincorporated Cache County, Utah. The existing Lower Canal would be improved with the addition of open channel overflow systems at 2900 South and 3400 South (unincorporated Cache County) and 200 South (Mendon City). This would be accomplished through a combination of conduits and channels to convey floodwaters from the west side of Cache Valley between Wellsville and Petersboro to the natural floodplain of the Little Bear River east of the communities. This would include the rehabilitation of the existing Murray Spring overflow system and the addition of overflow systems at 3400 South, 2900 South, and 200 South. This alternative would use the water rights of the Wellsville Eastfield Canal Company to enclose and pipe a portion of the Wellsville Eastfield Canal as well, 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, and Greater Mendon Irrigation companies. This alternative, if selected, 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. Finally, education and outreach efforts through the educational extension at Utah State University (USU) and/or the NRCS local office would seek to alter existing land management practices to improve water management, cropping practices, soil conservation, and the economic viability of the agricultural land within the watershed.
Alternative 3 -- Proposed Action -- Lining & Buyouts Alternative (Nonstructural)	This alternative would have funding made available through PL 83-566 allowing for lining of the canals. 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 Alternative, as described below, the problem of flood prevention would be addressed using a nonstructural measure. The principal difference between the Lining Alternative and the Piping Alternative is that this alternative would line and increase the capacity of the Hyrum-Mendon Canal to carry both irrigation and flood water from the west alluvial plains between Wellsville and Petersboro in Cache County rather than enclose and pipe it. The nonstructural element of this alternative would be to seek voluntary buyouts of the structures/properties within the 100-year existing conditions flood inundation area to eliminate the risks associated with rain-on-snow flood events. The estimated cost to buyout the property in the floodplain isextremely high. The costs to install the structural project measures under this alternative would not exceed the costs of the voluntary property buyouts, meaning the structural measures would be fewer and smaller than the nonstructural measures. 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 on the Western edge of the new Wellsville Secondary System to stabilize peaking 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.
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 a CWA Section 404 permit (any potential impacts to WOTUS) is required, the principles of the U.S. Army Corps of Engineers (USACE) Least Environmentally Damaging Practicable Alternative (LEDPA) should 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, and only then, mitigation. Action Alternative 1 – Piping Alternative is the environmentally preferable/LEDPA alternative for this Plan-EIS.
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 alternatives in Action Alternative 1 – Piping Alternative.

TABLE 9: SUMMARY AND COMPARISON OF ALTERNATIVES -- PLANNING PROCESS

Green = Met, Red = Not Met

ITEM OR CONCERN	ALTERNATIVE 1 - NO ACTION/FWOFI	ALTERNATIVE 2 - PIPING	ALTERNATIVE 3 - LINING & BUYOUTS
NEPA PURPOSE AND NEED			
NEPA PURPOSE AND NEED	This alternative would not meet the purpose and need. Flood control, ag. Water management, and public recreation problems would persist.	Flood Control, Ag. Water Mgmt., and Recreation purposes would be met. Needs would be addressed. Is the environmentally preferred and locally preferred alternative.	Flood Control, Ag. Water Mgmt., and Recreation purposes would be met using nonstructural measures for flood control. However, would relocate many residents.
PROJECT OBJECTIVES			
OBJECTIVE #1. Flood Control Problem	Would not address flood control infrastructure problems. Flood damages would not be prevented and would continue to occur.	Would install new flood control infrastructure to manage high flows from rain-on-snow flood events. Would prevent damages 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. Agricultural 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. 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.	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.	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. Recreational Opportunities	There would be no expansion of existing recreational opportunities in the watershed under this alternative.	Would construct a boat ramp at Wellsville Reservoir for non-motorized watercraft and a reflecting pond at Mendon City Cemetery to increase the recreational opportunities in the area.	Would construct a boat ramp at Wellsville Reservoir for non-motorized watercraft and a reflecting pond at Mendon City Cemetery to increase the recreational opportunities in the area.
CONSTRAINTS			
CONSTRAINT #1. Disruptions to Property	No construction would occur under this alternative, and so, no disruptions to property would occur. This alternative meets this constraint.	This alternative would meet this constraint by avoiding 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 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 damaged in this scenario.	This alternative would meet the constraint in that it states that projects should avoid 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.
CONSTRAINT #3. Transportation Impacts	No construction would occur under this alternative, and so, no existing transportation infrastructure would be impacted. This alternative meets 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, and 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.	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.
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	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 avoided to the	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

	surrounding landscape would occur.	extent practicable using construction BMPs.	does not meet this planning constraint.
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 are improved and the Lower Canal is 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 listed species suitable habitat 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 occur 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.
PR&G 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 **2.01**. This alternative constitutes an efficient solution.	This alternative has net positive benefits and a BCR of **1.47**. However, the costs would be exorbitant to conduct property buyouts in the floodplain. 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.

PR&G Ecosystem Services Framework Worksheet

PR&G Ecosystem Services Scoping and Evaluation Worksheet

Franson Civil Engineers

PROJECT NAME	Wellsville Canyon Watershed Plan-EIS
PROJECT NUMBER	20027
PROJECT MANAGER	Chad Brown

Overview of Framework

The PR&G Ecosystem Services Framework is an analysis approach that traces the pathways of natural ecosystem processes to the benefits which they grant to society in monetary and non-monetary terms. NRCS requires that an ecosystem services framework be worked within throughout the preliminary investigation and planning process. Ecosystem services are broken into four service categories which include:

(1) Provisioning Services: tangible goods for human use such as food, clean air, fresh water, energy, fuel, forage, fiber, and minerals.
(2) Regulating Services: maintain natural processes which provide buffers against environmental catastrophe such as long-term storage of carbon; climate regulation; water filtration, purification, and storage; soil stabilization; flood prevention/control; and disease regulation.
(3) Supporting Services: underlying processes maintaining conditions for life such as pollination, seed dispersal, soil formation, and nutrient cycling.
(4) Cultural Services: services related to the cultural or spiritual needs of people such as educational, aesthetic, spiritual and cultural heritage values, recreational experiences, and tourism opportunities.

Evaluation Approach

Ecosystem services are first evaluated from a qualitative perspective during scoping to identify the types of services present in the watershed, and then specifically to identify those that could interact with (impact or be impacted by) the authorized project purpose(s)/problems.

Regulatory Requirement (Level II PR&G Analysis)

The National Watershed Program Manual (NWPM) requires a level II PR&G analysis for any WSOP or REHAB program that will have a Federal construction cost-share of more than $10 million. This level of PR&G analysis requires the robust development of an ecosystem service framework and resulting ecosystem services flows.

Use of this Worksheet

This worksheet was created as a way to document our incorporation and use of the ecosystem services framework and to provide written evidence of the evaluation approach described above. Fill in all the applicable fields on this worksheet for the project you are working on. If it is not a text form or dropdown list, it should not be changed. Depending on the project, not every form or field will be applicable.

AFFECTED ENVIRONMENT: IDENTIFICATION/SCOPING FOR ECOSYSTEM SERVICES

In the tables below, identify ecosystem services that currently exist in the project area and place them under the appropriate service categories as described in the "Overview of Framework" section of this worksheet. Remember, the initial evaluation of ecosystem services should be conducted from a qualitative perspective. The services identified should be directly related to the PL-566 authorized purpose(s)/Problem(s) for the project. Incidental service benefits will be identified in a later section.

Table 1 Scoped Provisioning Services in the Project Area

PROVISIONING SERVICES
Food Production/Agriculture
Water Savings/Seepage & Evaporation Control
Drinking Water Supply

Provisioning Services: tangible goods for human use such as food, clean air, fresh water, energy, fuel, forage, fiber, and minerals.

Table 2 Scoped Regulating Services in the Project Area

REGULATING SERVICES
Flood Control
Public Safety
Water Quality
Drought Resiliency

Regulating Services: maintain natural processes which provide buffers against environmental catastrophe such as long-term storage of carbon; climate regulation; water filtration, purification, and storage; soil stabilization; flood prevention/control; and disease regulation.

Table 3 Scoped Supporting Services in the Project Area

SUPPORTING SERVICES
Evaluated as an intermediate ecosystem service, therefore it is not carried forward in this ecosystem services analysis.
NA
NA
NA

Supporting Services: underlying processes maintaining conditions for life such as pollination, seed dispersal, soil formation, and nutrient cycling.

Table 4 Scoped Cultural Services in the Project Area

CULTURAL SERVICES
Recreational experiences
Cultural/Spiritual experiences
Aesthetic Value of the watershed
Existence value of historical/cultural sites

Cultural Services: services related to the cultural or spiritual needs of people such as educational, aesthetic, spiritual and cultural heritage values, recreational experiences, and tourism opportunities.

FORECASTED FUTURE CONDITIONS (NO ACTION/FWOFI/ANALYTIC BASELINE)

In the section below, evaluate the reasonably projected changes in the ecosystem service benefits you identified in the previous section. The main focus of this projections should be on how the change in the provision of the service will alter the benefits they provide to society/human welfare. Again, this section should be qualitative and does not necessarily need to provide any specific quantities of services. This write-up (or some slight variation of it) will be included in the Plan-EA/EIS.

The projected changes in the provision of ecosystem services in the project area if no Federal Investment were made would result in overall reductions in the ecosystem service benefits that the natural systems in the project area provide to society. The following changes in ecosystem service benefits would be expected if existing conditions are to continue:

1. Food Production/Agriculture Provisioning Service:
- farmland quality would diminish with continued flooding and less access to irrigation water and continued loss of topsoil.
- Long-term trends such as increased flood and drought frequency would likely also impair this service provision.
- Crop yields in the watershed would likely decrease.

2. Water Savings/Seepage & Evaporation Provisioning Service:
- Seepage in the canals would continue and no water savings would occur.
- Late season water shortages would continue to be exasperated as canal conditions continue to degrade over time.

3. Drinking Water Supply, Provisioning Service:
- Communities would continue to deplete the culinary water supply for irrigation purposes later into the growing season.
- Groundwater quantities would be depleted as pumping demands increase reliance on groundwater for secondary water needs.
- As temperatures and climate change continues to occur, existing long-term droughts will continue to deplete groundwater supplies as residential demands exceed the ability of groundwater recharge to replenish the existing aquifer, leading to declining groundwater levels and increased arsenic concentrations.

3. Flood Control Regulating Service:
- Flood events would continue to occur, posing a risk to life, injury, structures, and agricultural fields.
- Reasonably forecasted long-term climate trends predict an increase in extreme weather events, including flooding.
- Floodplain functionality would continue to be hindered by flood events.

4. Public Safety Regulating Service:
- the public would continue to be at risk of damages from flood events
- There would still be a safety risk of potential to fall into the Lower Canal/drowning.
- Flood events will continue to impede access to emergency services including 9-1-1 services due to the limited options for access to many of the areas in the watershed.

5. Water Quality Regulating Service:
- Erosional and sedimentation processes would continue to nutrient load the Little Bear River, continuing to impede its water quality further and harming aquatic ecosystems.

6. Drought Resiliency Regulating Service:
- Reasonably forecasted long-term climate trends predict an increase in extreme weather events, including drought.

6. Recreational Experiences Cultural Service:
- There would be no change in the provision of cultural services in the watershed. Limited recreational opportunities would exist.

7. Cultural/Spiritual Experiences Cultural Service:
- There would be no change in the provision of cultural services in the watershed. Limited spiritual opportunities would exist.

8. Aesthetic Value Cultural Service:
- The aesthetic/scenic worth of the area would remain as it currently is.

9. Historic/Cultural Sites Cultural Service:
- Historic and Cultural properties would remain at risk of damages from flood events.

MONETIZING, QUANTIFYING, AND QUALIFYING ECOSYSTEM SERVICES

The decision tree below was provided by the National Watershed Management Center (NWMC) and should be a helpful reference in completing this section of the worksheet.

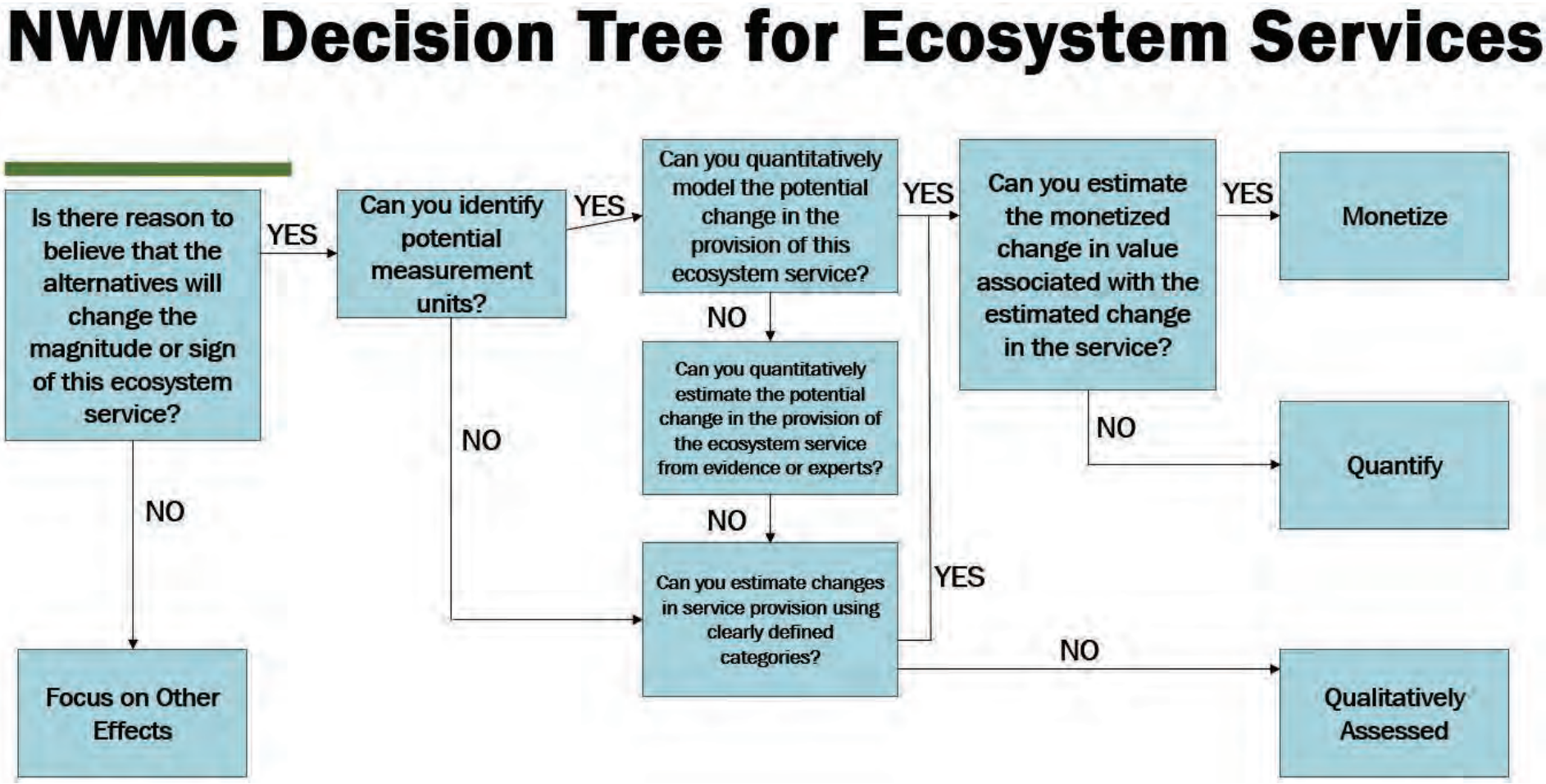


Table 5 Summary of Ecosystem Services & Their Representative Metrics

PROVISIONING SERVICES		
SERVICE	**MONETIZED/QUANTIFIED/QUALIFIED?**	**REPRESENTATIVE METRIC**
Food Production/Agriculture	Quantified	Crop Yield Value Percent Increase
Water Savings/Seepage	Quantified	Acre-Feet of Water Savings Annually
Drinking Water Supply	Quantified	Acre-Feet of Annual Groundwater Savin
NA	Not Applicable	NA
REGULATING SERVICES		
SERVICE	**MONETIZED/QUANTIFIED/QUALIFIED?**	**REPRESENTATIVE METRIC**
Flood Control	Monetized	Annual Cost of Flood Damages
Public Safety	Qualified/Non-Monetized	Qualitative Assessment of Potential for
Water Quality	Qualified/Non-Monetized	Meets TMDL Sediment Load Reduction
Drought Resiliency	Quantified	Acre-Feet of Annual Groundwater Savin
SUPPORTING SERVICES		
SERVICE	**MONETIZED/QUANTIFIED/QUALIFIED?**	**REPRESENTATIVE METRIC**
NA	Not Applicable	NA
NA	Not Applicable	NA
NA	Not Applicable	NA
NA	Not Applicable	NA
CULTURAL SERVICES		
SERVICE	**MONETIZED/QUANTIFIED/QUALIFIED?**	**REPRESENTATIVE METRIC**
Recreational Experiences	Qualified/Non-Monetized	Availability of Recreational Opportunities
Spiritual Experiences	Qualified/Non-Monetized	Availability of Spiritual Experiences
Aesthetic Value	Qualified/Non-Monetized	Subjective Changes in Viewshed
Historic/Cultural Sites	Quantified	Number of Sites at Risk from Flooding

Examples of Monetized Representative Metrics: flood damage benefits (dollars), expected tourism (dollars)

Examples of Quantified Representative Metrics: protected/restored acres of farmland, crop yields, acre-feet of saved water, WQ Index, habitat units, wildlife/fish/plant species population changes

Examples of Qualified Representative Metrics: aesthetic improvements, vegetation restoration, new recreational opportunities, improved access to the outdoors

MONETIZED ECOSYSTEM SERVICES BENEFITS SUMMARY FOR ALTERNATIVES

Fill in the table below to summarize the estimated monetized benefits of the ecosystem services you identified (if applicable). This table should be provided to the project economist to be included in the economic analysis. It should also be noted that, if necessary, the non-monetized ecosystem service benefits should be provided to the economist to serve as a tradeoff if the B/C ratio does not meet at least 1. These benefits may be used to raise the B/C ratio given subjective values.

Also note, if there were no monetized benefits identified or if any of the ecosystem service categories were eliminated during scoping, note that in the table by including a line that says, "not monetized for this plan".

Table 6 Monetized Benefits Summary for Ecosystem Services

	No Action	Piping Alternative	Buyouts Alternative
PROVISIONING SERVICES			
Food Production/Agriculture	0% Crop Yield Value Increase	174% Yield Value Increase	170% Yield Value Increase
Water Savings/Seepage	Not Monetized for this Plan	Not Monetized for this Plan	Not Monetized for this Plan
Drinking Water Supply	Not Monetized for this Plan	Not Monetized for this Plan	Not Monetized for this Plan
NA	NA	NA	NA
REGULATING SERVICES			
Flood Control	$0	$6.83 M Damage Reduction Benefit	$7.31 M Damage Reduction Benefit
Public Safety	Not Monetized for this Plan	Not Monetized for this Plan	Not Monetized for this Plan
Water Quality	Not Monetized for this Plan	Not Monetized for this Plan	Not Monetized for this Plan
Drought Resiliency	Not Monetized for this Plan	Not Monetized for this Plan	Not Monetized for this Plan
SUPPORTING SERVICES			
NA	NA	NA	NA
NA	NA	NA	NA
NA	NA	NA	NA
NA	NA	NA	NA
CULTURAL SERVICES			
Recreational Experiences	Not Monetized for this Plan	Not Monetized for this Plan	Not Monetized for this Plan
Spiritual Experiences	Not Monetized for this Plan	Not Monetized for this Plan	Not Monetized for this Plan
Aesthetic Value	Not Monetized for this Plan	Not Monetized for this Plan	Not Monetized for this Plan
Historic/Cultural Sites	Not Monetized for this Plan	Not Monetized for this Plan	Not Monetized for this Plan
Total Annual Monetized Benefits	$0	$12,061,209	$11,732,727
Total Annual Monetized Costs	$0	$6,007,158	$7,957,080
Benefit-Cost Ratio	0.0	2.01	1.47
Annual Monetized Net Benefit	$0	$6,054,051	$3,775,647

IDENTIFICATION OF INCIDENTAL ECOSYSTEM SERVICES

If necessary (usually meaning the B/C ratio for alternative(s) are not reaching 1 with the benefits of problem/authorized purpose related ecosystem benefits), incidental ecosystem services may be used to help raise the B/C ratio to 1 subjectively. The identification of incidental ecosystem services can also help support the environmental/NEPA analysis in the Plan-EA/EIS document.

If desired, fill in the tables below for incidental ecosystem services in the project area.

Table 7 Incidental Provisioning Services in the Project Area

PROVISIONING SERVICES
Clean Air/Air Quality
NA
NA
NA

Provisioning Services: tangible goods for human use such as food, clean air, fresh water, energy, fuel, forage, fiber, and minerals.

Table 8 Incidental Regulating Services in the Project Area

REGULATING SERVICES
Reduced GHG Emissions
NA
NA
NA

Regulating Services: maintain natural processes which provide buffers against environmental catastrophe such as long-term storage of carbon; climate regulation; water filtration, purification, and storage; soil stabilization; flood prevention/control; and disease regulation.

Table 9 Incidental Supporting Services in the Project Area

SUPPORTING SERVICES
NA
NA
NA
NA

Supporting Services: underlying processes maintaining conditions for life such as pollination, seed dispersal, soil formation, and nutrient cycling.

Table 10 Incidental Cultural Services in the Project Area

CULTURAL SERVICES
NA
NA
NA
NA

Cultural Services: services related to the cultural or spiritual needs of people such as educational, aesthetic, spiritual and cultural heritage values, recreational experiences, and tourism opportunities.

ENVIRONMENTAL CONSEQUENCES: IMPACTS OF ALTERNATIVES ON ECOSYSTEM SERVICES

In the environmental consequences chapter of the Plan-EA/EIS, the impacts of each alternative in the final array on ecosystem services must be evaluated. If the service is monetized or quantified, the dollars or values associated with that service under each alternative should be listed in the descriptions. In the sections below, generate write-ups for the Plan-EA/EIS that evaluate the environmental consequences/impacts to the ecosystem services in the project area.

Ecosystem Services Impact Write-Ups:

PROVISIONING SERVICES

No Action: Provisioning services would not be improved under this alternative. In fact, over time it can be predicted that they would become impaired
Action Alternative 1: • 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 yields are estimated to be [INSERT]. 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 [INSERT] 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 [INSERT] acre-feet of groundwater savings annually. These water savings would also reduce the arsenic concentrations in the groundwater and improve the groundwater quality.

Action Alternative 2: Provisioning Services would be improved, although not to the same extent as the Piping Alternative. Crop yields could increase but would still be impacted by flooding. Water quantities would also be improved.

REGULATING SERVICES

No Action: Regulating services would not be improved under this alternative. Flooding conditions would worsen over time.

Action Alternative 1: • 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 $[INSERT].
• 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 rive 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 [INSERT] acre-feet of groundwater savings annually.

Action Alternative 2: 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.

SUPPORTING SERVICES EVALUATED AS INTERMEDIATE SERVICE IN THIS PLAN, NO ADDITIONAL INFORMATION NECESSARY.

CULTURAL SERVICES

No Action: Cultural Services would not be improved under this plan. No new opportunities for cultural, spiritual, aesthetic, or recreational enjoyment would be constructed.

Action Alternative 1: • 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.

Action Alternative 2: Cultural Services would be improved under this alternative. The construction of two new recreational facilities in Wellsville & Mendon would provide new recreational and aesthetic opportunities in the watershed.

Aquatic Resources Delineation Report (ARD) – J-U-B Engineers

Aquatic Resources Delineation

Wellsville-Mendon Watershed Project

Cache County, Utah

Prepared for

U.S. Department of Agriculture's Natural Resources Conservation Service

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Table of Contents

1 Introduction 1
2 Proposed Project 2
2.1 Project Location 2
2.2 Project Description 2
3 Methods 6
3.1 Hydrophytic Vegetation 6
3.2 Wetland Hydrology 7
3.3 Hydric Soils 7
3.4 Ordinary High Water Mark 7
4 Existing Conditions 8
4.1 Landscape Setting 8
4.2 Climate 8
4.3 Soils 9
4.4 Vegetation 12
4.5 National Wetlands Inventory 13
5 Aquatic Resources 16
5.1 Type and Condition of Aquatic Resources 16
6 Conclusions 21
7 References 23

Figures

Figure 1: Vicinity Map 3
Figure 2: Study Area Map 1 of 2 4
Figure 3. Study Area Map 2 of 2 5
Figure 4. NWI Map 1 of 2 14
Figure 5. NWI Map 2 of 2 15

Tables

Table 1. Study Area Legal Description 2
Table 2. NRCS Soil Types Mapped within the Study Area 10
Table 3.Observed Plant Species 12
Table 4.Aquatic Resources Mapped in Study Area 16

Appendix A: Representative Photographs
Appendix B: Soils Report
Appendix C: Map Book
Appendix D: Data Sheets

1 Introduction

The following Aquatic Resources Delineation (ARD) report has been prepared on behalf of the City of Wellsville and the City of Mendon for the U.S. Department of Agriculture's (USDA) Natural Resources Conservation Service (NRCS) as part of the Wellsville-Mendon Watershed Project (Proposed Project), located in Cache County, Utah.

This ARD report includes the results of a delineation of wetlands and surface waters that J-U-B ENGINEERS, Inc. (J-U-B) conducted in the Proposed Project Study Area (Study Area). The delineation and report were completed for the Proposed Project to:

- Document existing site conditions;
- Determine the presence of wetlands and surface waters that occur in the Study Area using standardized diagnostic criteria; and,
- Delineate the ordinary high-water mark (OHWM) boundaries for features that may be under the jurisdictional authority of the U.S. Army Corps of Engineers (USACE).

Tasks that were completed include:

- Review of previous environmental reports, topographic maps, aerial photography, and LiDAR data;
- Review of National Wetlands Inventory (NWI) data and maps, National Hydrography Dataset (NHD) and topographic maps, and published soil survey data and maps;
- Completion of a field survey of the Study Area to locate and map all potential waters of the U.S. (WOTUS);
- Documentation of soil conditions, hydrological conditions, and plant community composition of potential wetlands in accordance with the *1987 Corps of Engineers Wetland Delineation Manual* (Environmental Laboratory 1987) and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region (Version 2.0)* (USACE 2008), and using the *National Wetland Plant List: 2022 Wetland Ratings* to determine plant wetland status (USACE 2022); and,
- Identification of potential WOTUS at the OHWM using *National Ordinary High Water Mark Field Delineation Manual for Rivers and Streams* (David et al. 2022).

This report summarizes the distribution of wetland and water features that were found in the Study Area.

2 Proposed Project

2.1 Project Location

The Study Area is located within the communities of Wellsville City, Mendon City, Hyrum City, and unincorporated county land in Cache County, Utah (Figure 1). The Study Area is 1,268 acres in size and located in multiple Townships, Ranges, and Sections (Table 1). The Study Area is bordered by the Wellsville Mountains on the west and the Little Bear River on the east, it encompasses existing irrigation canals and includes part of the adjoining unincorporated area adjacent to the towns. The Study Area falls within the Central Basin and Range Malad and Cache Valleys ecoregion and is a Cold North American Desert habitat type. This ecoregion is characterized by northerly trending, fault-block mountain ranges and intervening, drier basins. Cache Valley, where the Study Area is situated, contains wide terraces, narrow floodplains, and alluvial fans. Mountain-fed perennial streams and canals provide water to pastureland, municipalities, and hay, small grain, sugar beet, and fruit crops.

Table 1. Study Area Legal Description

Township	Range	Sections
10 North	1 West	1, 2, 3, 9, 10, 11, 12, 15
10 North	1 East	6, 7
11 North	1 West	4, 5, 7, 8, 9, 10, 17, 18, 20, 21, 22, 27, 28, 34, 35, 36
11 North	2 West	12
12 North	1 West	28, 29, 31, 32, 33

2.2 Project Description

The Proposed Project aims to improve safety and reduce potential flooding issues arising from aging drainage systems and agriculturally altered natural drainage channels in the Wellsville-Mendon Watershed (Figure 2, Figure 3).

The Proposed Project components include:

1. Repair of inefficiencies in the open canal delivery system
2. Modifications and improvements to existing conveyance channels and diversion points
3. Rehabilitation of existing open canal irrigation channels
4. Creation and improvement of existing detention basins
5. Enhancements to non-motorized watercraft access to the Wellsville Reservoir

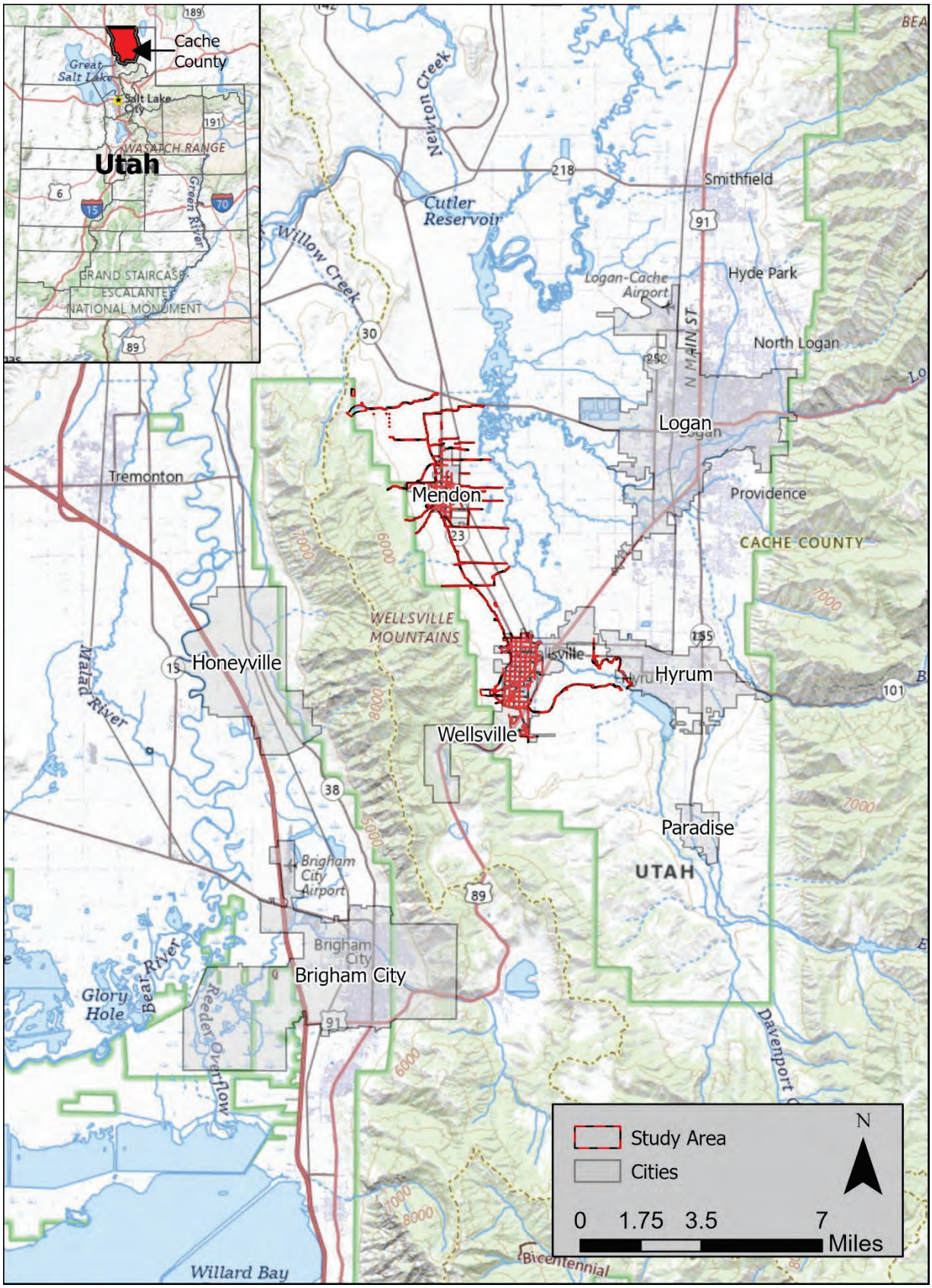


Figure 1: Vicinity Map

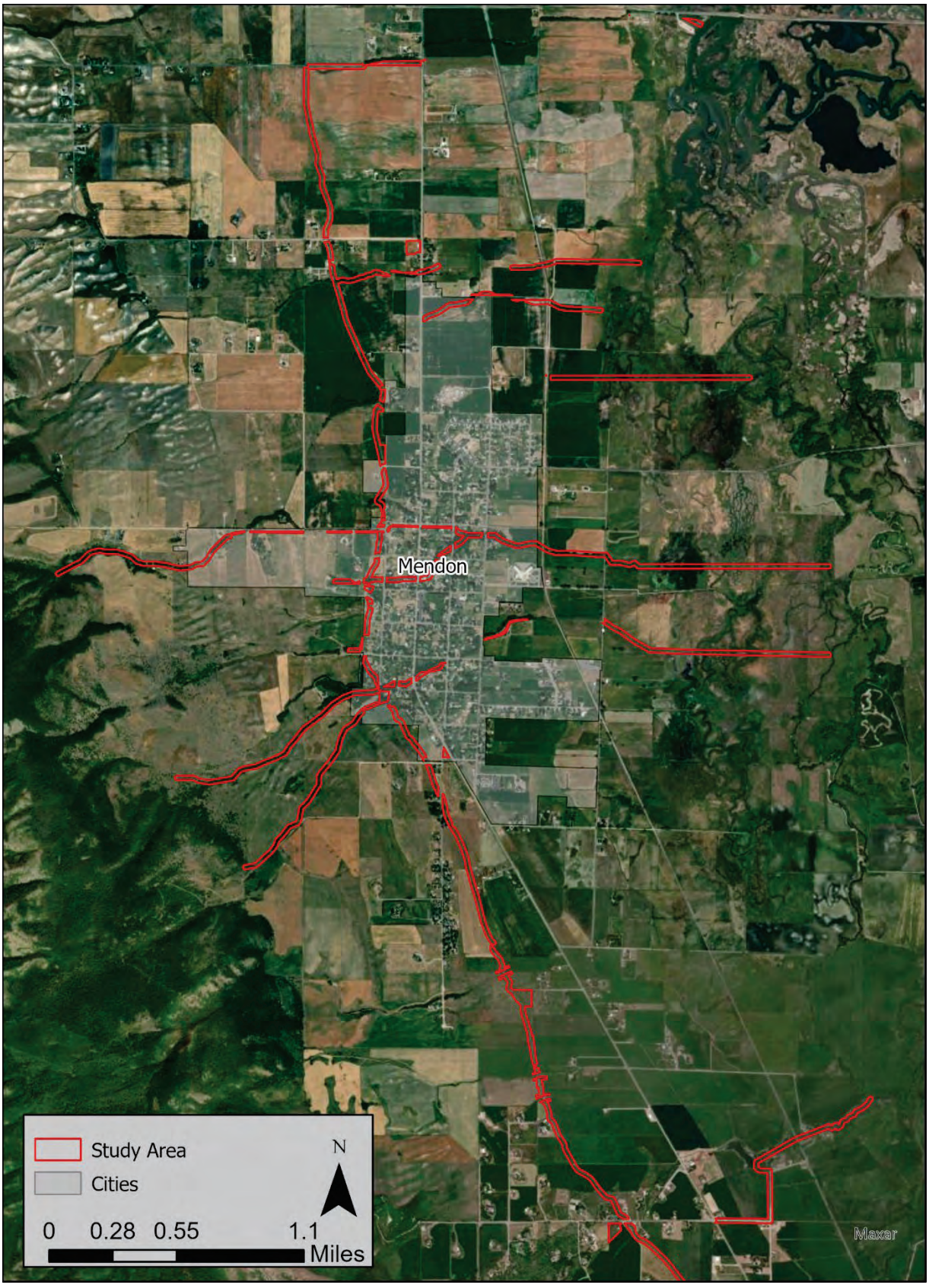


Figure 2: Study Area Map 1 of 2

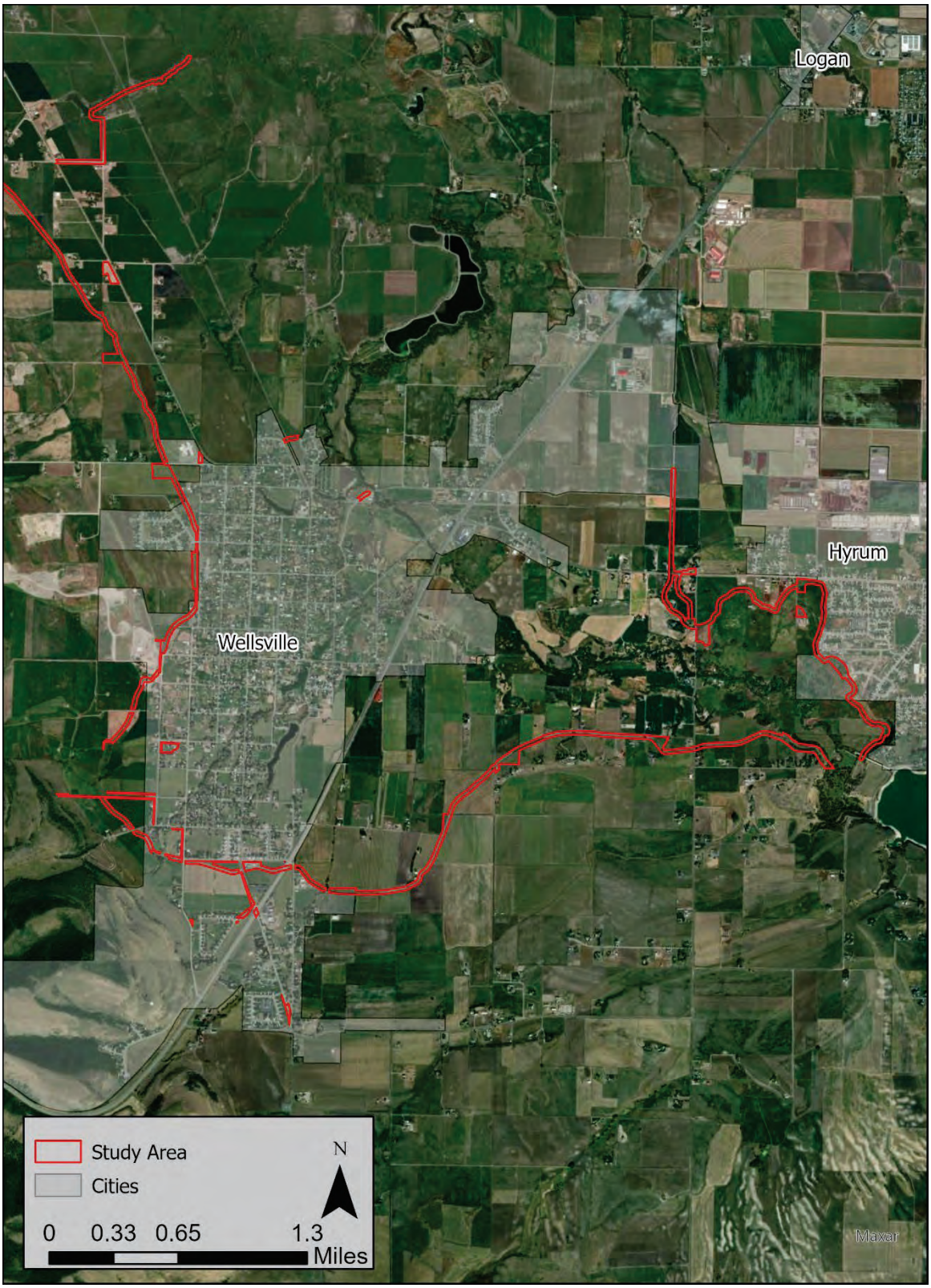


Figure 3. Study Area Map 2 of 2

3 Methods

A literature review and database search were conducted prior to performing field investigations. The U.S. Fish and Wildlife Service (USFWS) NWI (USFWS 2024) was searched for known historical and current estimated occurrences of wetlands, and U.S. Geological Survey (USGS) 7.5-minute topographic maps and the NHD were evaluated for the presence of known natural drainage features and other potential surface waters occurring in and near the Study Area (USGS 2024). Aerial imagery was reviewed to identify visual differences in vegetative cover, slope, and general terrain that can be indicative of the presence of waters (ArcGIS Online 2024; Google Earth 2024). Weather and precipitation data were obtained from the NRCS Climate Analysis for Wetlands Tables (WETS Tables) (USDA-NRCS 2024a), and soils data were obtained from the Web Soil Survey (USDA-NRCS 2024b).

Two J-U-B wetland specialists conducted field investigations on September 19, 2023, and May 6th, 7th, and 8th of 2024 to identify and delineate wetlands and waters in and near the Study Area using routine delineation methodology. The delineation was conducted in a manner to ensure 100 percent visual coverage of the Study Area. The Study Area was evaluated for the presence of wetlands and natural drainages, and the delineation was conducted in accordance with methods described in the *1987 Corps of Engineers Wetland Delineation Manual* (Environmental Laboratory 1987) and the most recent versions of the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region (Version 2.0)* (USACE 2008).

The Study Area was inspected for wetland indicators such as hydric soils, hydrophytic vegetation, and wetland hydrology. When potential wetland conditions were identified, paired sample points were established in the wetland and corresponding upland locations of the feature to characterize existing conditions and to identify and refine the wetland boundary. If a potential wetland was identified, wetland or upland points were established in addition to paired points to refine the boundary of larger wetlands. At each sample point, the presence or absence of hydrologic indicators was noted, soils were characterized, and vegetation was analyzed following standard survey procedures. Wetlands are classified according to Cowardin classifications (Cowardin et al. 1979).

Sample points, wetland boundaries, and linear features were mapped with a Juniper Geode GNS2 Multi-GNSS Geographic Positioning System (GPS) unit to collect sub-meter accurate data points. Representative photographs of delineated features were recorded (Appendix A). Delineation maps were produced by overlaying the survey GPS data with recent color aerial imagery (AGOL 2024).

3.1 Hydrophytic Vegetation

Hydrophytic plants are those adapted to wet soil conditions. Dominant plant species were identified in accordance with the USACE 50/20 Rule (USACE 2008). The *2022 National Wetland*

Plant List was used to determine the wetland indicator classification of plant species identified at the sampling points and throughout the Study Area (USACE 2022). As necessary, plant species were identified using *Weeds of the West* (Whitson et al. 2012) and descriptions from the U.S. Department of Agriculture-NRCS (USDA-NRCS) Plants Database (USDA-NRCS 2024c).

3.2 Wetland Hydrology

Analysis of wetland hydrology examines the presence, behavior, and indicators of water movement in wetlands. The regional supplement separates wetland hydrologic indicators into four groups (USACE 2008):

- Group A: direct observation of surface water or groundwater
- Group B: evidence the area is subject to flooding or ponding
- Group C: evidence the soil is, or was recently, saturated
- Group D: vegetation and soil features that indicate recent (rather than historical) wet conditions

Within each group, indicators are divided into primary or secondary. In the absence of a primary indicator, two secondary indicators must be identified. These categories were used when determining if hydrologic indicators were present.

3.3 Hydric Soils

The NRCS defines hydric soils as those that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part of the soil profile (above 12- to 20-inch depth, depending on soil texture) (NRCS 2018). Soil samples were excavated and inspected to characterize soil profiles at each sample plot, when possible. Soil horizonation, texture, moisture content, depth to saturation, and/or standing water were noted for each soil pit. The presence or absence of particulate organic matter, redoximorphic features, depleted matrices, and other diagnostic characteristics were noted, as appropriate. Soil colors were determined using Munsell soil-color charts (*sensu* Munsell 2000).

3.4 Ordinary High Water Mark

Linear water features were assessed using methodologies and diagnostic characteristics presented in identification of potential WOTUS at the OHWM using the *National Ordinary High Water Mark Field Delineation Manual for Rivers and Streams* (David et al. 2022). The OHWM is delineated by identifying a variety of physical characteristics, primarily a topographic break in slope, change in vegetation characteristics, and change in sediment characteristics. Supporting indicators include drift/wrack, erosion/scour, bank undercutting, root exposure, point bars, water staining, litter removal, silt deposits, shelving headcut, and macroinvertebrates.

4 Existing Conditions

4.1 Landscape Setting

The Wellsville Canal is an artificial watercourse that runs through Wellsville and Mendon in Cache County, Utah. It is part of the Wellsville-Mendon Canal system, which delivers irrigation water to about 7,000 acres of farmland. The canal was originally constructed in the late 1800s and early 1900s and has undergone several improvements and repairs over the years. The Wellsville-Mendon Canal is a canal system that travels through both residential and agricultural lands in the Study Area. The canal is open and lined with concrete along much of its alignment, although it is earthen in some sections. It is intermittently interrupted by irrigation diversions and headgate structures. The total canal length is approximately 14 miles and runs east from Wellsville Reservoir in Hyrum, Utah, and terminates directly into the Little Bear River, north of Mendon. Water supply to the canal is abundant throughout the irrigation season, but the canal is dry when flow ceases during non-irrigation periods of the year. The canal delivers irrigation water to more than 1,987 acres of agricultural and residential land.

The Wellsville-Mendon Canal and multiple ditches pass through pasture areas within the Study Area. Seasonal inundation of pasturelands is common, induced by irrigation and the high-water table present in Cache Valley. Irrigation canals, when conveying irrigation water, overflow during precipitation events especially in sections where sediment and vegetation have clogged the canal prism.

Throughout neighborhoods in Wellsville and Mendon, sections of the Wellsville-Mendon Canal were dry, due to controlled flows, and sometimes lined with riprap, concrete, landscaping rock, or other material. Bare ground is present along portions of the canal in residential areas, and evidence of herbicide use to control unwanted vegetation is present. For representative photos of the Study Area, see the Photo Inventory in Appendix A.

The Wellsville-Mendon Canal does not have floodplain connectivity to other waterbodies except at the north terminus where it directly joins the Little Bear River floodplain. Due to the earthen lining of some canal segments, it has a muddy substrate which dries up outside of the irrigation season each year. The elevation of the site ranges from approximately 4,410 to 5,179 feet above mean sea level (AMSL) with the highest areas occurring on the northeast portion of the site.

4.2 Climate

The NRCS WETS table for LOGAN 5 SW EXP FARM, Utah is the nearest WETS station to the Study Area with sufficient data. Total average annual precipitation for the area is approximately 18.77 inches. The average high temperature for the region is 59.8° F, and the average low temperature is 31.4° F, while the average normal temperature is 45.6° F (USDA-NRCS 2024a).

The WETS table indicated that the growing season extends from April 30 to October 6 during the normal growing period (28°F or higher @ 70 percent) (USDA-NRCS 2024a). During both the September 2023 and May 2024 survey, conditions were wetter than normal. During the September 2023 survey there was 6.46 inches of precipitation more than average and in the May 2024 survey there was 3.93 inches more than average. The maximum temperature on the day of the September 2023 survey was 81°F, which is higher than the normal maximum temperature of 75°F for that date (USDA-NRCS 2024a). The maximum temperature for the May 2024 survey was 50°F, which is lower than the normal maximum temperature of 75°F for that date (USDA-NRCS 2024a). The month-to-date average temperature for the September 2023 survey of 63.5°F was higher than the normal of 61.8°F. The month-to-date average temperature for the May 2024 survey of 43.8°F was lower than the normal of 50°F.

4.3 Soils

A review of NRCS Web Soil Survey revealed that the Study Area is comprised of 68 soil map units. The five dominant soil map units are described in the following paragraphs. All soil map units are included in detail in the attached Soil Reports (Table 2, Appendix B). The Salt Lake-Roshe Springs Complex is the only dominant soil classified as hydric.

GsA—Greenson Loam, 0 to 3 Percent Slopes: This soil spans 238.5 acres, accounting for 18.8% of the Study Area. Found predominantly on lake terraces, Greenson Loam's parent materials consist of lacustrine deposits and alluvium derived from limestone, sandstone, and quartzite. It is somewhat poorly drained with a water table approximately 30 to 60 inches deep. The typical soil profile is mainly loam with a moderately high water transmission rate. It does not flood or pond and has a high available water supply of around 10.9 inches, a calcium carbonate content up to 40%, and is slightly to moderately saline. It's part of the Semiwet Fresh Meadow ecological site and is rated as predominantly non-hydric with a hydric rating of 5.

PaB—Parleys Silt Loam, 3 to 6 Percent Slopes: This soil spans 76.2 acres, accounting for 6.0% of the Study Area. Found predominantly on lake terraces Parleys Silt Loam's parent material consists of lacustrine deposits derived from limestone and sandstone and/or lacustrine deposits derived from quartzite. The soil is well-drained, and its water table is more than 80 inches deep. It comprises a silt loam texture and has a moderately high water transmission rate. It doesn't frequently flood or pond and has a high available water supply of about 9.7 inches. The soil is nonsaline to very slightly saline, associated with the Upland Loam Bonneville Big Sagebrush and Mountain Big Sagebrush ecological site, and is rated as non-hydric with a hydric rating of 0.

ArB—Avon Silty Clay Loam, 3 to 6 Percent Slopes: Covering 71.7 acres and 5.7% of the Study Area, ArB is found on lake terraces and characterized by its well-drained condition with a water table beyond 80 inches deep. It shares a silty clay loam composition up to 60 inches, derived from limestone and sandstone lacustrine deposits, with the ArB soil. The soil's water transmission is moderately low to moderately high, with no flooding or ponding reported. It offers a high available water supply of about 10.4 inches, contains up to 40% calcium carbonate,

and is nonsaline to very slightly saline. Like ArA, it's part of the Upland Loam (Bonneville Big Sagebrush) North ecological site and isn't considered hydric.

MeA—Mendon Silt Loam, 0 to 3 Percent Slopes: This soil spans 71 acres, accounting for 5.6% of the Study Area. Found predominantly on lake terraces, Mendon Silt Loam's parent materials consist of Alluvium and colluvium derived from tuff, conglomerate, tuffaceous sandstone and limestone. The soil is well-drained with a water table over 80 inches deep. Its texture is silt loam with a moderately high water transmission rate. It doesn't experience frequent flooding or ponding and has a high available water supply, around 9.8 inches. Mendon Silt Loam is nonsaline to slightly saline and is associated with the Upland Loam Bonneville Big Sagebrush and Mountain Big Sagebrush ecological sites, and is rated as predominantly non-hydric with a hydric rating of 5.

MeC—Mendon Silt Loam, 6 to 10 Percent Slopes: Spanning 54.3 acres and accounting for 4.3% of the Study Area, MeC is found on lake terraces. This well-drained soil has a water table depth exceeding 80 inches and a silt loam texture with moderately high water transmission. It doesn't frequently flood or pond and has a high available water supply, approximately 9.8 inches. MeC is nonsaline to slightly saline and identified with the Upland Loam (Bonneville Big Sagebrush) North ecological site, and is rated as non-hydric with a hydric rating of 0.

Table 2. NRCS Soil Types Mapped within the Study Area

Map unit symbol	Map unit name	Hydric Rating	Acres in Study Area
GsA	Greenson loam, 0 to 3 percent slopes	5	238.5
PaB	Parleys silt loam, 3 to 6 percent slopes	0	76.2
ArB	Avon silty clay loam, 3 to 6 percent slopes	0	71.7
MeA	Mendon silt loam, 0 to 3 percent slopes	5	71
MeC	Mendon silt loam, 6 to 10 percent slopes	0	54.3
MfE2	Mendon-Collinston complex, 6 to 30 percent slopes, eroded	0	50.6
Sg	Salt lake-Roshe springs complex	100	43.4
NcB	Nibley silty clay loam, 3 to 6 percent slopes	5	40.6
RhB	Ricks gravelly loam, 3 to 6 percent slopes	0	39.5
MeB	Mendon silt loam, 3 to 6 percent slopes	0	39.3
Rt	Rough broken land	0	38.5
HuE	Hyrum gravelly loam, 10 to 25 percent slopes	0	37.7
RhA	Ricks gravelly loam, 0 to 3 percent slopes	0	33.6
CoA	Crookston loam, 0 to 3 percent slopes	0	31.4
PaA	Parleys silt loam, 0 to 3 percent slopes	0	29.3
Ck	Collett silty clay loam	2	28.3
CrC	Crowshaw gravelly loam, 6 to 10 percent slopes	0	26.8
Rs	Roshe springs silt loam	100	25
GsB	Greenson loam, 3 to 6 percent slopes	2	21.8

Map unit symbol	Map unit name	Hydric Rating	Acres in Study Area
HdB	Hendricks silt loam, 3 to 6 percent slopes	0	20.8
WhF2	Wheelon silt loam, 30 to 50 percent slopes, eroded	0	15.2
SwD	Sterling gravelly loam, 10 to 20 percent slopes	0	13.2
Sy	Stony alluvial land	0	12.4
HuC	Hyrum gravelly loam, 4 to 8 percent slopes	0	11.6
CrB	Crowshaw gravelly loam, 3 to 6 percent slopes	0	11
BAF	Barfuss-Leatham association	0	10.1
ArA	Avon silty clay loam, 0 to 3 percent slopes	0	9.8
McC	Mcmurdie silt loam, 6 to 10 percent slopes	0	9.8
GsC	Greenson loam, 6 to 10 percent slopes	0	9.5
WlE2	Wheelon-Collinston complex, 10 to 30 percent slopes, eroded	0	9.4
MfB	Mendon-Collinston complex, 1 to 6 percent slopes	0	8.7
CrD	Crowshaw gravelly loam, 10 to 20 percent slopes	0	7.9
HfE	Hiibner extremely stony clay loam, 1 to 30 percent slopes	0	6.8
STG2	Smarts-Hoskin association, eroded	0	6.6
AsC	Avon-Collinston complex, 6 to 10 percent slopes	0	6.2
Lr	Logan silty clay loam	96	6.2
SvA	Steed gravelly loam, 0 to 3 percent slopes	5	6.2
CmE2	Collinston loam, 10 to 30 percent slopes, eroded	0	6.1
HdC	Hendricks silt loam, 6 to 10 percent slopes	0	5.8
AhA	Airport silt loam, 0 to 3 percent slopes	4	5.5
ArD	Avon silty clay loam, 10 to 20 percent slopes	0	5.5
HeC	Hiibner gravelly clay loam, 3 to 10 percent slopes	0	5.2
DaC	Dagor silt loam, 4 to 8 percent slopes	0	4.5
HdD	Hendricks silt loam, 10 to 20 percent slopes	0	4.5
RhC	Ricks gravelly loam, 6 to 10 percent slopes	0	4.2
TrA	Trenton silty clay loam, 0 to 2 percent slopes	10	4.1
SwC	Sterling gravelly loam, 6 to 10 percent slopes	0	3.9
CoB	Crookston loam, 3 to 6 percent slopes	0	3.8
DaD	Dagor silt loam, 10 to 20 percent slopes	0	3.7
Wn	Winn silt loam	5	3.5
KdD	Kidman fine sandy loam, 8 to 15 percent slopes	0	3.4
NcA	Nibley silty clay loam, 0 to 3 percent slopes	2	3.4
ClA	Collinston loamy fine sand, 0 to 3 percent slopes	0	3.1
HdA	Hendricks silt loam, 1 to 3 percent slopes	0	3
TmB	Timpanogos silt loam, 3 to 6 percent slopes	0	3
W	Water	0	2.8
ArC	Avon silty clay loam, 6 to 10 percent slopes	0	2.4
SwF2	Sterling gravelly loam, 20 to 50 percent slopes,eroded	0	1.8
PaC	Parleys silt loam, 6 to 10 percent slopes	0	1.6
Gp	Gravel pit	0	1.2
SvC	Steed gravelly loam, 6 to 10 percent slopes	0	1

Map unit symbol	Map unit name	Hydric Rating	Acres in Study Area
Pv	Provo gravelly loam	10	0.8
WhE	Wheelon silt loam, 10 to 30 percent slopes	0	0.5
HeD	Hiibner gravelly clay loam, 10 to 30 percent slopes	0	0.4
KfC	Kidman fine sandy loam, deep water table, 4 to 8 percent slopes	0	0.3
Ak	Airport silty clay loam	3	0.1
SvB	Steed gravelly loam, 3 to 6 percent slopes	0	0.1
SSE	Smarts silt loam, 10 to 30 percent slopes	0	0

4.4 Vegetation

Vegetation occurring within the Study Area was typical for agricultural fields in the region, with wetland species occurring in low lying pastural areas adjacent to the canals. The canals and auxiliary irrigation ditches varied in hydrology and vegetation at different locations. The canals and open ditches in agricultural areas are densely vegetated with reed canary grass (*Phalaris arundinacea*), cattail (*Typha latifolia*), and other common riparian species within and on its edges (Table 3). The canals and ditches, when conveying irrigation water, overflow during precipitation events especially in sections where sediment and vegetation have filled in the canals or ditch prism. While some segments of the canals are earthen, they are generally lined with concrete. Herbicide use was evident along the canals in many locations, where maintenance has been performed to minimize unwanted vegetation.

Table 3.Observed Plant Species

Common Name	Scientific Name	Indicator Status
alfalfa	*Medicago sativa*	UPL
barnyard grass	*Echinochloa crus-galli*	FACW
big sagebrush	*Artemisia tridentata*	UPL
big toothed maple	*Acer grandidentatum*	FACU
blue wildrye	*Elymus glaucus*	FACU
box elder	*Acer negundo*	FACW
black hawthorn	*Crataegus douglasii*	FAC
burdock	*Arctium minus*	FACU
Canada thistle	*Cirsium arvense*	FACU
cattail	*Typha latifolia*	OBL
common bentgrass	*Agrostis capillaris*	FAC
common reed	*Phragmites australis*	FACW
common spikerush	*Eleocharis palustris*	OBL
common sunflower	*Helianthus annuus*	FACU
common teasel	*Dipsacus fullonum*	FAC
coyote willow	*Salix exigua*	FACW
crested wheatgrass	*Agropyron cristatum*	UPL
dandelion	*Taraxacum officinale*	FACU
bindweed	*Convolvulus arvensis*	FACU
field horsetail	*Equisetum arvense*	FAC

Common Name	Scientific Name	Indicator Status
Fremont's cottonwood	*Populus fremontii*	FAC
greater plantain	*Plantago major*	FAC
gumweed	*Grindelia camporum*	FACW
inland saltgrass	*Distichlis spicata*	FAC
meadow foxtail	*Alopecurus pratensis*	FACW
narrowleaf cottonwood	*Populus angustifolia*	FACW
Nebraska sedge	*Carex nebrascensis*	OBL
red osier dogwood	*Cornus sericea*	FAC
reed canary grass	*Phalaris arundinacea*	FACW
rubber rabbitbrush	*Ericameria nauseosa*	UPL
Russian olive	*Elaeagnus angustifolia*	FAC
silverweed	*Potentilla anserina*	OBL
soft-stem bull rush	*Schoenoplectus tabernaemontani*	OBL
tall goldenrod	*Solidago canadensis*	FACU
twisted stalk	*Streptopus amplexifolius*	FAC
wild licorice	*Glycyrrhiza lepidota*	FAC
Wood's rose	*Rosa woodsii*	FACU
yellow sweet clover	*Melilotus officinalis*	FACU

***Obligate (OBL)** – Almost always occurs in wetlands.*
***Facultative Wetland (FACW)** – Usually occurs in wetlands but may occur in non-wetlands.*
***Facultative (FAC)** – Occurs in wetlands and non-wetlands equally.*
***Facultative Upland (FACU)** – Usually occurs in non-wetlands but may occur in wetlands.*
***Upland (UPL)** – Almost never occurs in wetlands.*

4.5 National Wetlands Inventory

The NWI suggests that wetland features may be found throughout the Study Area, many of which originate from the slopes of the Wellsville Mountains (Figure 3, Figure 4). The NWI database identifies 129 features overlapping the Study Area. This includes 66 fresh water emergent wetlands, two freshwater forested/shrub wetlands, nine freshwater ponds, one lake, 47 riverine features and four features classified as other.

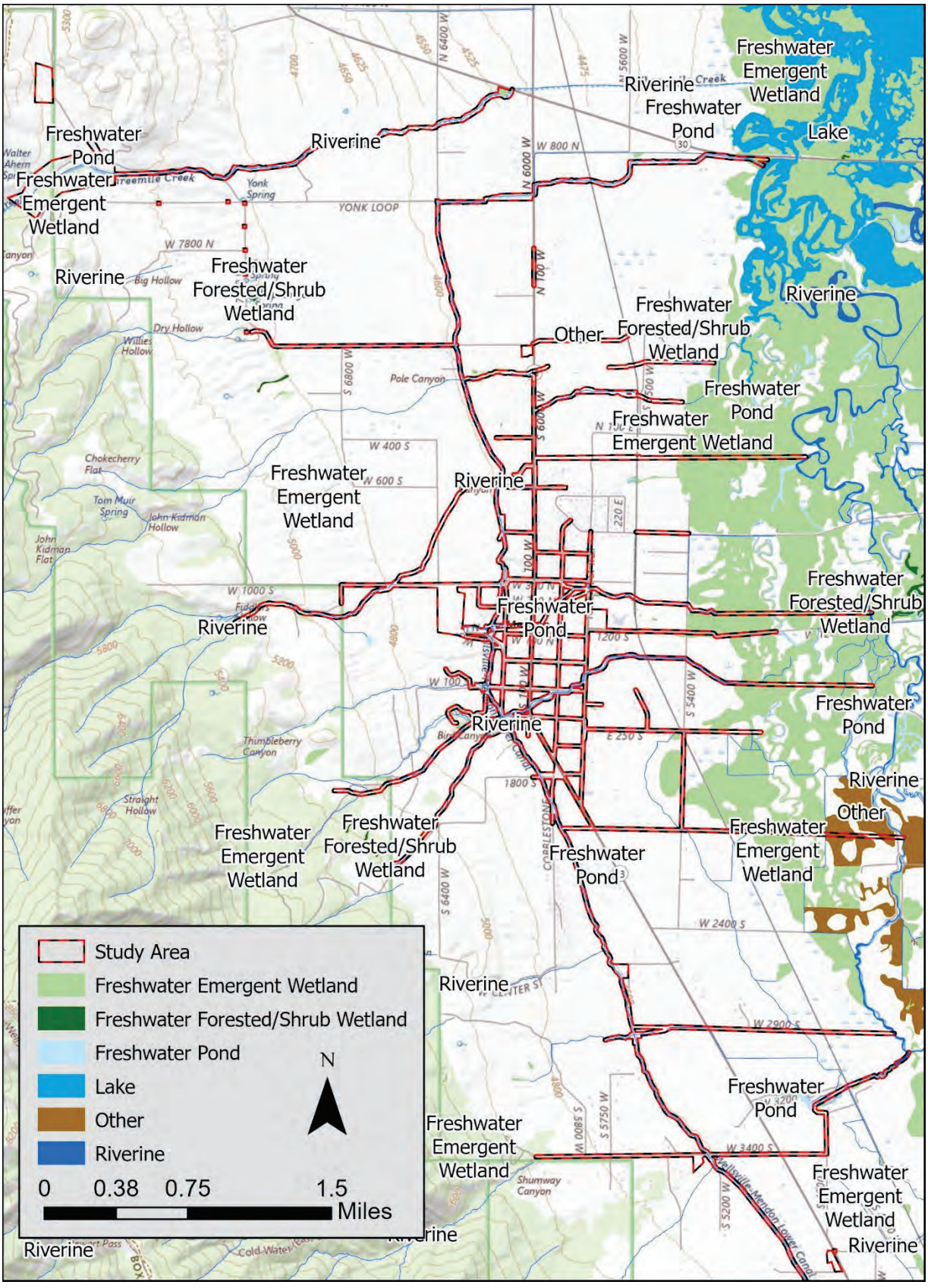


Figure 4. NWI Map 1 of 2

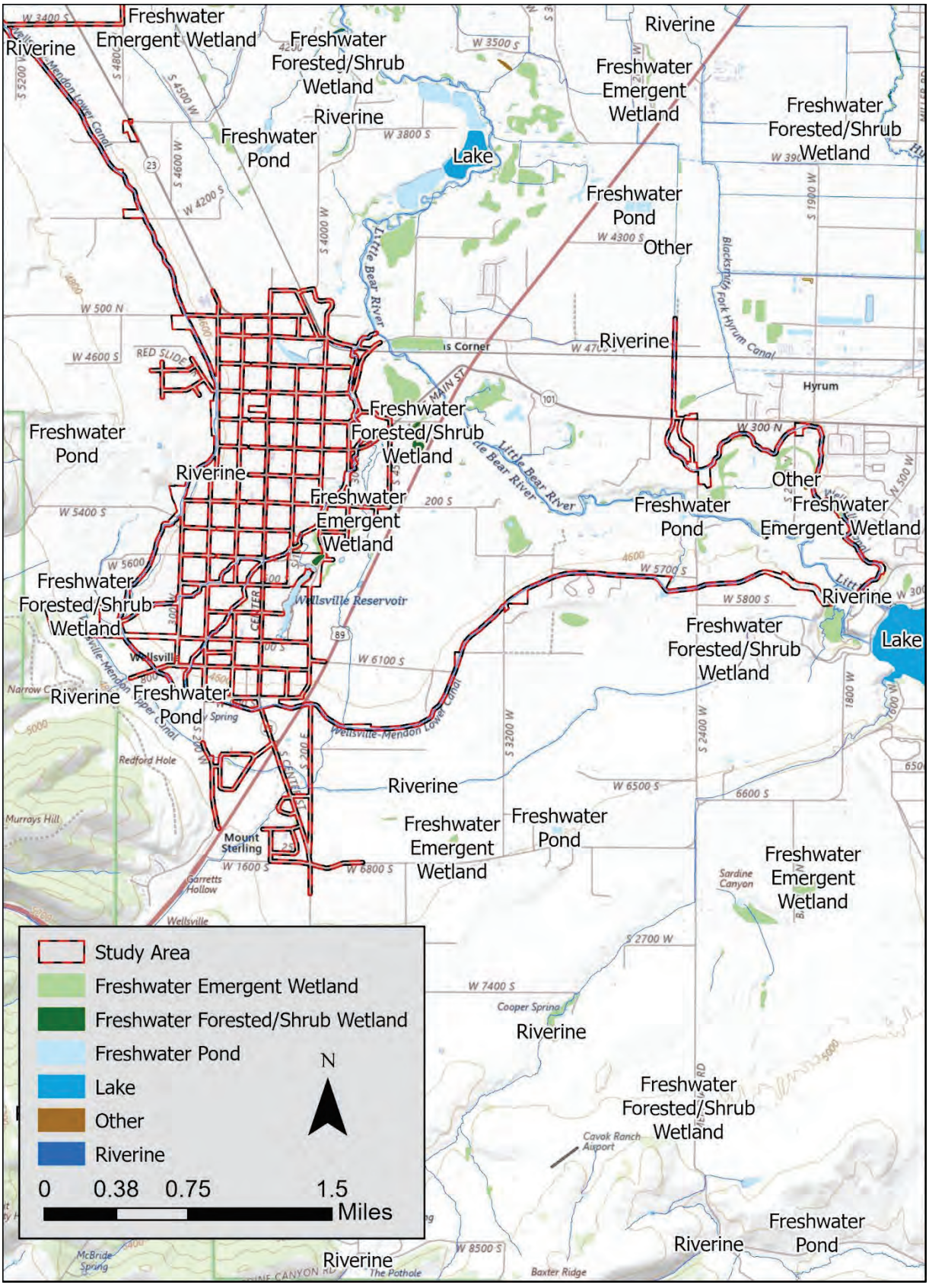


Figure 5. NWI Map 2 of 2

5 Aquatic Resources

5.1 Type and Condition of Aquatic Resources

Within the Study Area, there are twenty-seven freshwater emergent wetlands, one freshwater forested/shrub wetland, four ponds, one reservoir, and 96 linear water features present, including the Little Bear River, Three Mile Creek, Wellsville Canal, Wellsville-Mendon Lower Canal, 20 streams, and 72 ditches. All aquatic resources within the Study Area flow downstream and have a surface water connection with the Little Bear River, a known WOTUS, and therefore are jurisdictional. Collectively, 56.89 acres of wetlands and 67.59 acres (245,761 LF) of linear features were mapped within the Study Area (Table 4, Appendix C).

Table 4.Aquatic Resources Mapped in Study Area

Feature	Classification	Area (acres)	Length (linear feet)	Jurisdictional
Wetland Features				
Black Willow Pond	PABGx	0.10	-	Yes
Wellsville Reservoir	PUBHh	0.82	-	Yes
Pond 1	PABHh	0.26	-	Yes
Pond 2	PUBF	0.15	-	Yes
Pond 3	PABGh	0.26	-	Yes
Wetland 1	PEM1B	2.00	-	Yes
Wetland 2	PEM1A, PEM1E, PEM1B	8.01	-	Yes
Wetland 3	PEM1E, PEM1B	6.98	-	Yes
Wetland 4	PEM1A, PEM1B, PEM1E	8.70	-	Yes
Wetland 5	PEM1B	2.15	-	Yes
Wetland 6	PEM1Ch	1.01	-	Yes
Wetland 7	PEM1E	0.24	-	Yes
Wetland 8	PEM1B	0.25	-	Yes
Wetland 9	PEM1B	0.35	-	Yes
Wetland 10	PEM1B, PEM1E	2.39	-	Yes
Wetland 11	PEM1B, PEM1E	2.38	-	Yes
Wetland 12	PEM1B	0.95	-	Yes
Wetland 13	PEM1B,PEM1E	4.21	-	Yes
Wetland 14	PEM1A, PEM1Bf, PEM1B	1.69	-	Yes
Wetland 15	PEM1Bf	1.20	-	Yes
Wetland 16	PEM1B, PEM1E	3.04	-	Yes
Wetland 17	PEM1B, PEM1E	2.93	-	Yes
Wetland 18	PEM1E	0.04	-	Yes

Feature	Classification	Area (acres)	Length (linear feet)	Jurisdictional
Wetland 19	PEM1B, PEM1E	1.31	-	Yes
Wetland 20	PEM1E	0.13	-	Yes
Wetland 21	PEM1E	0.08	-	Yes
Wetland 22	PEM1E	0.01	-	Yes
Wetland 23	PEM1B, PEM1E	0.42	-	Yes
Wetland 24	PSS1B, PEM1B	0.94	-	Yes
Wetland 25	PEM1A	0.40	-	Yes
Wetland 26	PEM1E	0.25	-	Yes
Wetland 27	PEM1A, PEM1C	3.00	-	Yes
Wetland 28	PEM1E	0.23	-	Yes
Total		**56.89**	**N/A**	**-**
Linear Features				
Little Bear River	R2UBH	0.90	1369.62	Yes
Three Mile Creek	R4SBC	3.19	16028.94	Yes
Wellsville Canal	R4SBCx	9.00	15641.92	Yes
Wellsville-Mendon Lower Canal	R4SBCx	28.04	82709.24	Yes
Stream 1	R4SBC	1.10	5820.34	Yes
Stream 2	R4SBC	1.05	9517.79	Yes
Stream 3	R4SBC	1.19	8561.54	Yes
Stream 4	R4SBC	0.03	237.11	Yes
Stream 5	R4SBC	3.99	3344.60	Yes
Stream 6	R4SBC	0.02	86.11	Yes
Stream 7	R4SBC	0.01	66.07	Yes
Stream 8	R4SBC	0.01	60.64	Yes
Stream 9	R4SBC	0.05	480.36	Yes
Stream 10	R4SBC	0.12	604.60	Yes
Stream 11	R4SBC	0.15	1092.37	Yes
Stream 12	R4SBC	0.01	38.91	Yes
Stream 13	R4SBC	0.31	2039.29	Yes
Stream 14	R4SBC	1.62	5999.29	Yes
Stream 15	R4SBC	4.23	12100.39	Yes
Stream 16	R4SBCx	0.63	5663.48	Yes
Stream 17	R2UBF	0.02	68.19	Yes
Stream 18	R2UBF	0.09	395.71	Yes
Stream 19	R4SBC	0.18	1782.63	Yes
Stream 20	R4SBC	0.01	81.81	Yes
Ditch 1	R4SBCx	0.03	79.93	Yes
Ditch 2	R4SBCx	0.75	1169.30	Yes

Feature	Classification	Area (acres)	Length (linear feet)	Jurisdictional
Ditch 3	R4SBCx	0.02	50.28	Yes
Ditch 4	R4SBCx	0.74	4548.40	Yes
Ditch 5	R4SBCx	1.18	2957.80	Yes
Ditch 6	R4SBCx	0.04	93.59	Yes
Ditch 7	R4SBAx	0.41	2321.32	Yes
Ditch 8	R4SBAx	0.01	33.25	Yes
Ditch 9	R4SBAx	0.00	44.65	Yes
Ditch 10	R4SBAx	0.01	46.52	Yes
Ditch 11	R4SBCx	0.65	3519.46	Yes
Ditch 12	R4SBCx	0.00	30.41	Yes
Ditch 13	R4SBCx	0.01	58.51	Yes
Ditch 14	R4SBCx	0.01	50.43	Yes
Ditch 15	R4SBCx	0.01	56.21	Yes
Ditch 16	R4SBCx	0.01	60.53	Yes
Ditch 17	R4SBCx	0.18	2942.99	Yes
Ditch 18	R4SBAx	0.00	21.23	Yes
Ditch 19	R4SBAx	0.00	39.13	Yes
Ditch 20	R4SBCx	0.05	155.42	Yes
Ditch 21	R4SBCx	0.42	3459.23	Yes
Ditch 22	R4SBCx	0.68	5553.29	Yes
Ditch 23	R4SBCx	0.01	107.18	Yes
Ditch 24	R4SBCx	0.31	2255.63	Yes
Ditch 25	R4SBCx	0.10	900.90	Yes
Ditch 26	R4SBCx	0.44	3788.46	Yes
Ditch 27	R4SBCx	0.01	67.43	Yes
Ditch 28	R4SBCx	0.01	39.43	Yes
Ditch 29	R4SBCx	0.04	211.15	Yes
Ditch 30	R4SBCx	0.01	100.32	Yes
Ditch 31	R4SBCx	0.01	85.39	Yes
Ditch 32	R4SBCx	0.38	1391.93	Yes
Ditch 33	R4SBAx	0.18	889.45	Yes
Ditch 34	R4SBAx	0.17	1194.16	Yes
Ditch 35	R4SBAx	0.02	164.26	Yes
Ditch 36	R4SBCx	0.03	166.15	Yes
Ditch 37	R4SBCx	0.01	70.13	Yes
Ditch 38	R4SBAx	0.01	59.99	Yes
Ditch 39	R4SBAx	0.05	576.41	Yes
Ditch 40	R4SBCx	0.02	96.10	Yes

Feature	Classification	Area (acres)	Length (linear feet)	Jurisdictional
Ditch 41	R4SBCx	0.01	44.18	Yes
Ditch 42	R4SBCx	0.00	24.17	Yes
Ditch 43	R4SBCx	0.01	113.22	Yes
Ditch 44	R4SBCx	0.23	1416.69	Yes
Ditch 45	R4SBCx	0.20	1722.89	Yes
Ditch 46	R4SBCx	0.04	118.10	Yes
Ditch 47	R4SBCx	0.01	39.57	Yes
Ditch 48	R4SBCx	0.81	5811.65	Yes
Ditch 49	R4SBAx	0.05	367.02	Yes
Ditch 50	R4SBCx	0.02	131.54	Yes
Ditch 51	R4SBAx	0.00	23.90	Yes
Ditch 52	R4SBAx	0.72	4299.94	Yes
Ditch 53	R4SBAx	0.67	3974.79	Yes
Ditch 54	R4SBCx	0.22	1000.73	Yes
Ditch 55	R4SBCx	0.12	1142.27	Yes
Ditch 56	R4SBCx	0.42	2732.51	Yes
Ditch 57	R4SBCx	0.02	94.62	Yes
Ditch 58	R4SBCx	0.10	891.25	Yes
Ditch 59	R4SBCx	0.01	40.21	Yes
Ditch 60	R4SBCx	0.01	32.73	Yes
Ditch 61	R4SBCx	0.03	308.39	Yes
Ditch 62	R4SBAx	0.13	1550.54	Yes
Ditch 63	R4SBCx	0.20	1956.84	Yes
Ditch 64	R4SBCx	0.04	438.87	Yes
Ditch 65	R4SBCx	0.00	44.48	Yes
Ditch 66	R4SBCx	0.23	1625.67	Yes
Ditch 67	R4SBCx	0.01	133.74	Yes
Ditch 68	R4SBCx	0.12	459.73	Yes
Ditch 69	R4SBCx	0.01	57.85	Yes
Ditch 70	R4SBCx	0.10	733.94	Yes
Ditch 71	R4SBCx	0.10	1121.58	Yes
Ditch 72	R4SBCx	0.01	59.87	Yes
Total		**67.59**	**245,761**	-

4.1.1 Wetlands

Vegetation:

Twenty-seven of the wetlands have an emergent plant community and one wetland has a forested/shrub plant community; obligate (OBL), and facultative wetland (FACW) classes

represented the dominant vegetation in these features. Dominant species included: reed canary grass, Nebraska sedge, cattail, field horsetail, and soft-stem bull rush. Uplands were dominated by blue wildrye, dandelion, Canada thistle, black hawthorn and bindweed. Vegetation within all wetland plots met the dominance test, therefore the plant community is hydrophytic within all wetlands surveyed.

Soils:

Wetland soil plots met at least one hydric soil indicator. Hydric soil indicators met within wetlands in the Study Area include depleted dark surface (F7), depleted matrix (F3), redox dark surface (F6), depleted below dark surface (A11), loamy mucky mineral (F1), and hydrogen sulfide (A4), indicating hydric soil conditions within the wetlands surveyed.

Hydrology:

All wetland soil test pits met at least one hydrology primary indicator. Primary indicators met throughout the Study Area include (A1) for surface water, (A3) for saturation, (A2) high water table, and (C1) hydrogen sulfide odor. Hydrological inputs to these wetlands include groundwater, precipitation, overland flow of runoff from adjacent upland areas, and irrigation water from adjacent agriculture.

Rationale for delineations:

All three wetland parameters were present in each of the wetlands surveyed in the Study Area (See Data Sheets, Appendix D). Wetland boundaries were clearly defined based on the presence of hydrophytic vegetation, hydrology, and hydric soils. Conversely, none of the upland plots met all three wetland parameters. Hydrology and hydric soils were consistently absent in all upland plots. Some upland plots passed the dominance test due to the presence of facultative vegetation but failed to meet any hydric soil or hydrology indicators. Adjacent upland plots were all higher in elevation compared to the wetlands, with dry soil lacking saturation throughout the soil profiles. All wetlands present within the Study Area have a direct connection to the Little Bear River, a known WOTUS. Therefore, all wetlands identified in this report are jurisdictional due to a surface water connection with a known WOTUS.

4.1.2 Linear Features

Perennial Stream (R2UBF, R2UBG)

A total of 3,809 LF (4.1 acres) of perennial streams were delineated within the Study Area. Streams 5, 17, and 18 were the only perennial streams identified within the Study Area. They are all lower perennial streams characterized by low gradient and flow all year, except during periods of extreme drought. The indicators of an OHWM include the break in bank slope. Each of these stream's flow to the Little Bear River, which is a tributary to the Bear River (a WOTUS). Therefore, they are all jurisdictional due to a surface water connection with a known WOTUS.

*Intermittent Stream (*R4SBC, R4SBCx)

A total of 70,262 LF (13.88 acres) of intermittent streams were delineated within the Study Area. Eighteen streams within the Study Area (Three Mile Creek, Stream 1-4, 6-16, and 19-20) are characterized by intermittent flow and only contain flowing water for part of the year. The primary observed OHWM indicator was a break in bank slope. Each stream has a connection to the Little Bear River, which is a tributary to the Bear River (a WOTUS). Since they all have a surface water connection to a known WOTUS, they are considered jurisdictional.

Intermittent Ditches (R4SBCx, R4SACx)

A total of 71,970 LF (11.67 acres) of intermittent ditches were delineated within the Study Area. All 72 ditches were previously excavated to convey water away from farmland; their flow is intermittent and only contain flowing water for part of the year. Ditches classified as R4SBCx are seasonally flooded and surface water is present for extended periods, especially early in the growing season but is absent by the end of the growing season in most years. Ditches classified as R4SACx are only temporarily flooded and surface water is present for brief periods (from a few days to a few weeks) during the growing season. Because the ditches all flow to the Little Bear River, a tributary to the Bear River (a WOTUS), they are jurisdictional due to a surface water connection with a known WOTUS.

Little Bear River (R2UBH, R2USC, R4SBCr, R2UBG)

A total of 1,369 LF (0.90 acres) of the Little Bear River was delineated within the Study Area. This is a lower perennial stream with varying classes and water regimes. The location of the OHWM was assessed based on the following indicators: change in vegetation species, change in vegetation cover, and break in bank slope. The Little Bear River is a tributary to the Bear River (a WOTUS) and is therefore considered jurisdictional due to its surface water connection with a known WOTUS.

Canals (R4SBCx)

The Wellsville-Mendon Canal accounted for 82,709 LF (28.04 acres) and the Wellsville Canal accounted for 15,642 LF (9.0 acres) for a total of 98,351 LF (37.04 acres) of canal identified within the Study Area. The canals identified in this report carry water throughout the growing season, and exhibit indicators of an OHWM. The OHWM indicators observed include break in bank slope, change in vegetation cover, and high-water marks on canal liners. These canals have a connection to the Little Bear River, which is a tributary to the Bear River (a WOTUS). Therefore, the canals identified in this report would be considered jurisdictional due to their surface water connection with a known WOTUS.

6 Conclusions

Based on the findings of the study, a total of approximately 56.89 acres of wetlands, and 245,761 LF (67.59 acres) of linear features were delineated within the Study Area. Findings

concluded that all features have a surface water connection with the Little Bear River, a known WOTUS, and therefore are jurisdictional.

It should be noted that the final authority regarding jurisdictional determination and wetland delineations rests with the appropriate regulatory agencies.

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Appendix A: Representative Photographs



Photo 1: Wetland 1 and associated vegetation



Photo 2: Upland Area adjacent to Wetland 1



Photo 3: Wetland 2 and associated vegetation



Photo 4: Wetland 2 and associated vegetation



Photo 5: Wetland 3 and associated vegetation



Photo 6: Upland Area adjacent to Wetland 3



Photo 7: Wetland 4 and associated vegetation



Photo 8: Wetland 4 and associated vegetation



Photo 9: Wetland 5 and associated vegetation



Photo 10: Disturbed portion of Wetland 5 and adjacent uplands



Photo 11: A dry segment of the Wellsville-Mendon Canal in a residential area in Wellsville.



Photo 12: A dry segment of the Wellsville-Mendon Canal and a culvert in a residential area in Wellsville.



Photo 13: The Wellsville-Mendon Canal is flowing water as passes through a residential area. The edges have been sprayed with herbicide to control vegetative growth.



Photo 14: The Wellsville-Mendon Canal passes through an agricultural area in Wellsville. Reed canary grass populates the edges.



Photo 15: The Wellsville-Mendon Canal passes from an agricultural area into a residential zone, at the bottom of a draw.



Photo 16: An irrigation ditch is disturbed by cattle grazing. Bare ground and erosion are prominent.



Photo 17: An irrigation canal lined with riprap, passing through a residential neighborhood.



Photo 18: The Wellsville-Mendon Canal passes through a greenbelt in a residential area of Wellsville.



Photo 19: Disturbed banks of Wellsville-Mendon Canal in a greenbelt in a residential area of Wellsville.



Photo 20: The Wellsville Reservoir, within Wellsville City Park. Common reed grows along the reservoir edge.



Photo 21: A headgate structure in the Wellsville-Mendon Canal, in a Wellsville pasture.



Photo 22: The Wellsville-Mendon Canal passes through a shady greenbelt in a residential area. Narrowleaf cottonwoods flank the edges.



Photo 23: Cattail and reed canary grass growing along the Wellsville-Mendon Canal as it travels through a pasture in Wellsville.



Photo 24: The Wellsville-Mendon Canal passes through a horse pasture. Eutrophication in the water and riprap along the edges are visible.



Photo 25: Disturbed edges of an irrigation ditch where cattle have grazed, in Wellsville.



Photo 26: A dry section of an irrigation ditch in a residential area in Wellsville.



Photo 27: The incised creek channel that runs through the wildlife enhancement area and a cattle pasture, outside of Mendon.



Photo 28: The incised creek channel that runs through the wildlife enhancement area and a cattle pasture, outside of Mendon.



Photo 29: Looking down into the creek channel in the wildlife enhancement area.



Photo 30: The creek runs through a thicket of cottonwood, willow, box elder and big toothed maple in the wildlife enhancement area. The creek's edges are impacted by cattle grazing.



Photo 31: Beaver sign on the creek within the wildlife enhancement area, outside of Mendon.



Photo 32: Beaver sign on the creek within the wildlife enhancement area, outside of Mendon.



Photo 33: A culvert and irrigation ditch intersect a road on the outskirts of Mendon.



Photo 34: A rip-rap and gravel lined ditch and culvert intersect a road in a residential area of Mendon.



Photo 35: A culvert empties into a filled-in irrigation ditch in pasture in Mendon.



Photo 36: Debris and sediment crowd the opening of a culvert on a section of dry irrigation ditch.



Photo 37: The Wellsville-Mendon Canal, overflowing in a pasture in Mendon.



Photo 38: The Wellsville-Mendon Canal, overgrown with cattail and common teasel, in a pasture in Mendon.



Photo 39: The Wellsville-Mendon Canal, lined, passes through a pasture above a neighborhood in Mendon.



Photo 40: A dry auxiliary irrigation ditch that intersects the Wellsville-Mendon canal in a pasture in Mendon.



Photo 41: Location for proposed detention basin in Mendon.



Photo 42: Location of existing detention basin in Mendon, where improvements would occur under the Proposed Project



Photo 43: A location where proposed irrigation piping would pass under the road, in Wellsville.



Photo 44: A roadside location where rehabilitation would occur to an open irrigation ditch, in Wellsville.



Photo 45: Typical conditions of an irrigation ditch that is lined with riprap and heavily vegetated, and which passes through a rural residential area.



Photo 46: A heavily vegetated irrigation ditch, within a pasture location, in Mendon.



Photo 47: An unmowed agricultural field and the location proposed irrigation pipe alignment, in Mendon. Wet meadow conditions exist in some locations like this within the Action Area.



Photo 48: An irrigation ditch where cattail grow along the edges.



Photo 49: Location of a proposed irrigation pipe alignment, in a field in Mendon.



Photo 50: Location of a proposed irrigation pipe alignment, along a fence line in a field in Mendon.



Photo 51: A roadway and the location of a proposed irrigation pipe alignment.



Photo 52: Typical conditions of the Wellsville-Mendon Canal where improvements would occur.



Photo 54: Area adjacent to the Wellsville Reservoir where water conveyance improvements would occur.



Photo 55: The western edge of the Wellsville Reservoir.



Photo 56: Photo of the Wellsville Canal from an area below the Wellsville Reservoir.



Photo 57: Typical conditions of the Wellsville Canal where improvements would occur, adjacent to a horse pasture in Wellsville.



Photo 58: Typical conditions of the Wellsville Canal where improvements would occur, adjacent to a horse pasture in Wellsville.

Appendix B: Soils Report

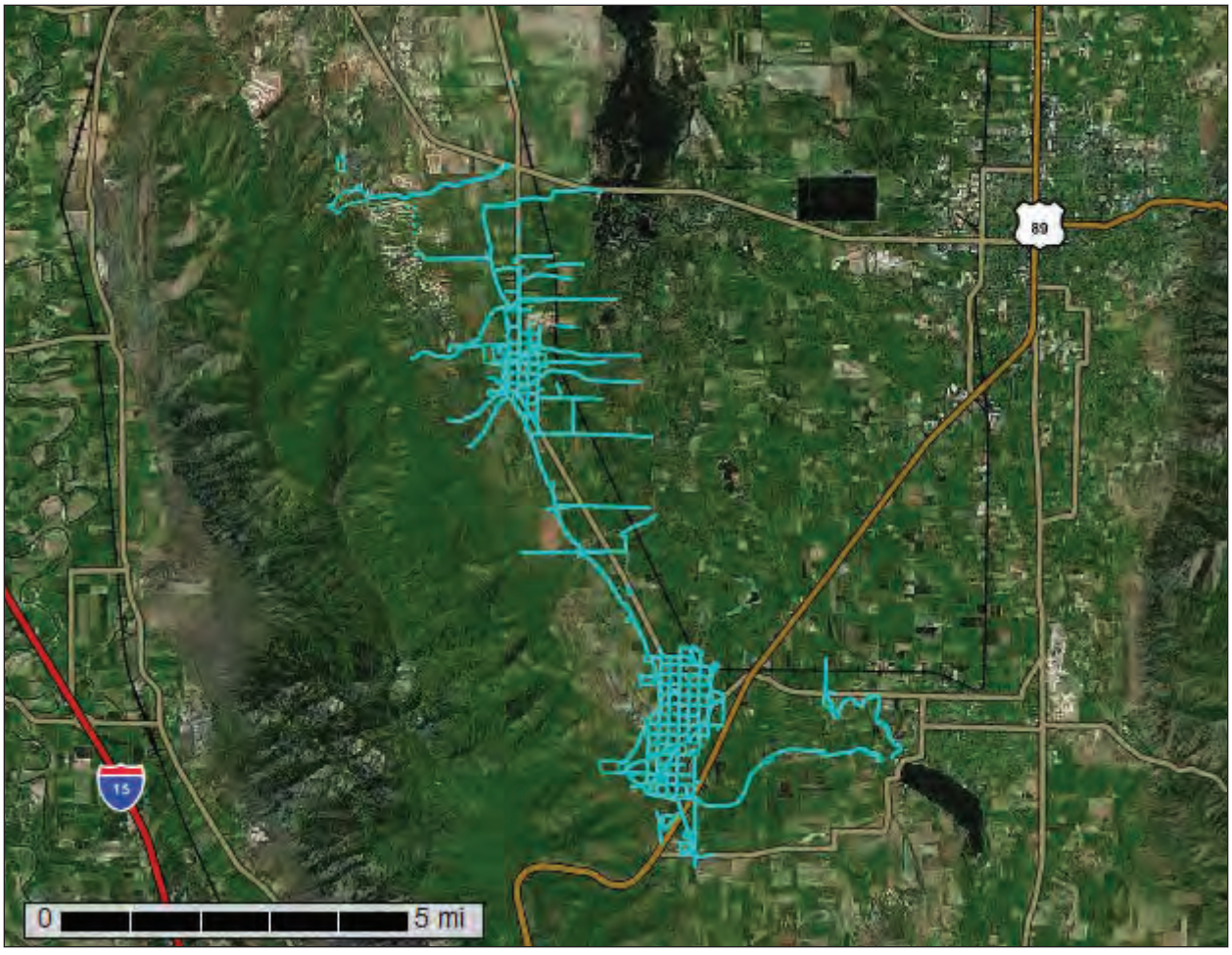
United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Cache Valley Area, Parts of Cache and Box Elder Counties, Utah



May 13, 2024

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

Preface.....2
How Soil Surveys Are Made.....6
Soil Map.....9
Soil Map.....10
Legend.....11
Map Unit Legend.....12
Map Unit Descriptions.....15
Cache Valley Area, Parts of Cache and Box Elder Counties, Utah.....17
AhA—AIRPORT SILT LOAM, 0 TO 3 PERCENT SLOPES.....17
Ak—AIRPORT SILTY CLAY LOAM.....18
ArA—AVON SILTY CLAY LOAM, 0 TO 3 PERCENT SLOPES.....19
ArB—AVON SILTY CLAY LOAM, 3 TO 6 PERCENT SLOPES.....20
ArC—AVON SILTY CLAY LOAM, 6 TO 10 PERCENT SLOPES.....22
ArD—AVON SILTY CLAY LOAM, 10 TO 20 PERCENT SLOPES.....23
AsC—AVON-COLLINSTON COMPLEX, 6 TO 10 PERCENT SLOPES.....24
BAF—BARFUSS-LEATHAM ASSOCIATION.....26
Ck—COLLETT SILTY CLAY LOAM.....29
ClA—COLLINSTON LOAMY FINE SAND, 0 TO 3 PERCENT SLOPES....30
CmE2—COLLINSTON LOAM, 10 TO 30 PERCENT SLOPES, ERODED.....31
CoA—CROOKSTON LOAM, 0 TO 3 PERCENT SLOPES.....32
CoB—CROOKSTON LOAM, 3 TO 6 PERCENT SLOPES.....34
CrB—CROWSHAW GRAVELLY LOAM, 3 TO 6 PERCENT SLOPES.....35
CrC—CROWSHAW GRAVELLY LOAM, 6 TO 10 PERCENT SLOPES.....36
CrD—CROWSHAW GRAVELLY LOAM, 10 TO 20 PERCENT SLOPES...37
DaC—DAGOR SILT LOAM, 4 TO 8 PERCENT SLOPES.....38
DaD—DAGOR SILT LOAM, 10 TO 20 PERCENT SLOPES.....39
Gp—GRAVEL PIT.....40
GsA—GREENSON LOAM, 0 TO 3 PERCENT SLOPES.....40
GsB—GREENSON LOAM, 3 TO 6 PERCENT SLOPES.....42
GsC—GREENSON LOAM, 6 TO 10 PERCENT SLOPES.....43
HdA—HENDRICKS SILT LOAM, 1 TO 3 PERCENT SLOPES.....44
HdB—HENDRICKS SILT LOAM, 3 TO 6 PERCENT SLOPES.....45
HdC—HENDRICKS SILT LOAM, 6 TO 10 PERCENT SLOPES.....46
HdD—HENDRICKS SILT LOAM, 10 TO 20 PERCENT SLOPES.....48
HeC—HIIBNER GRAVELLY CLAY LOAM, 3 TO 10 PERCENT SLOPES..49
HeD—HIIBNER GRAVELLY CLAY LOAM, 10 TO 30 PERCENT SLOPES.....50
HfE—HIIBNER EXTREMELY STONY CLAY LOAM, 1 TO 30 PERCENT SLOPES.....51
HuC—HYRUM GRAVELLY LOAM, 4 TO 8 PERCENT SLOPES.....52
HuE—HYRUM GRAVELLY LOAM, 10 TO 25 PERCENT SLOPES.....53
KdD—KIDMAN FINE SANDY LOAM, 8 TO 15 PERCENT SLOPES.....54

KfC—KIDMAN FINE SANDY LOAM, DEEP WATER TABLE, 4 TO 8 PERCENT SLOPES..... 55
Lr—LOGAN SILTY CLAY LOAM..... 57
McC—MCMURDIE SILT LOAM, 6 TO 10 PERCENT SLOPES.....58
MeA—MENDON SILT LOAM, 0 TO 3 PERCENT SLOPES..... 59
MeB—MENDON SILT LOAM, 3 TO 6 PERCENT SLOPES..... 61
MeC—MENDON SILT LOAM, 6 TO 10 PERCENT SLOPES..... 62
MfB—MENDON-COLLINSTON COMPLEX, 1 TO 6 PERCENT SLOPES.....63
MfE2—MENDON-COLLINSTON COMPLEX, 6 TO 30 PERCENT SLOPES,ERODED..... 65
NcA—NIBLEY SILTY CLAY LOAM, 0 TO 3 PERCENT SLOPES.....67
NcB—NIBLEY SILTY CLAY LOAM, 3 TO 6 PERCENT SLOPES.....69
PaA—PARLEYS SILT LOAM, 0 TO 3 PERCENT SLOPES.....70
PaB—PARLEYS SILT LOAM, 3 TO 6 PERCENT SLOPES.....71
PaC—PARLEYS SILT LOAM, 6 TO 10 PERCENT SLOPES..... 72
Pv—PROVO GRAVELLY LOAM.....74
RhA—RICKS GRAVELLY LOAM, 0 TO 3 PERCENT SLOPES.....75
RhB—RICKS GRAVELLY LOAM, 3 TO 6 PERCENT SLOPES.....76
RhC—RICKS GRAVELLY LOAM, 6 TO 10 PERCENT SLOPES..... 77
Rs—ROSHE SPRINGS SILT LOAM.....78
Rt—ROUGH BROKEN LAND..... 80
Sg—SALT LAKE-ROSHE SPRINGS COMPLEX.....80
SSE—SMARTS SILT LOAM, 10 TO 30 PERCENT SLOPES.....82
STG2—SMARTS-HOSKIN ASSOCIATION, ERODED.....83
SvA—STEED GRAVELLY LOAM, 0 TO 3 PERCENT SLOPES..... 85
SvB—STEED GRAVELLY LOAM, 3 TO 6 PERCENT SLOPES..... 86
SvC—STEED GRAVELLY LOAM, 6 TO 10 PERCENT SLOPES.....87
SwC—STERLING GRAVELLY LOAM, 6 TO 10 PERCENT SLOPES..... 88
SwD—STERLING GRAVELLY LOAM, 10 TO 20 PERCENT SLOPES..... 89
SwF2—STERLING GRAVELLY LOAM, 20 TO 50 PERCENT SLOPES,ERODED..... 90
Sy—STONY ALLUVIAL LAND.....92
TmB—TIMPANOGOS SILT LOAM, 3 TO 6 PERCENT SLOPES..... 92
TrA—TRENTON SILTY CLAY LOAM, 0 TO 2 PERCENT SLOPES..... 93
W—WATER.....95
WhE—WHEELON SILT LOAM, 10 TO 30 PERCENT SLOPES.....95
WhF2—WHEELON SILT LOAM, 30 TO 50 PERCENT SLOPES, ERODED.....96
WlE2—WHEELON-COLLINSTON COMPLEX, 10 TO 30 PERCENT SLOPES, ERODED..... 97
Wn—WINN SILT LOAM..... 99
References.....101

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

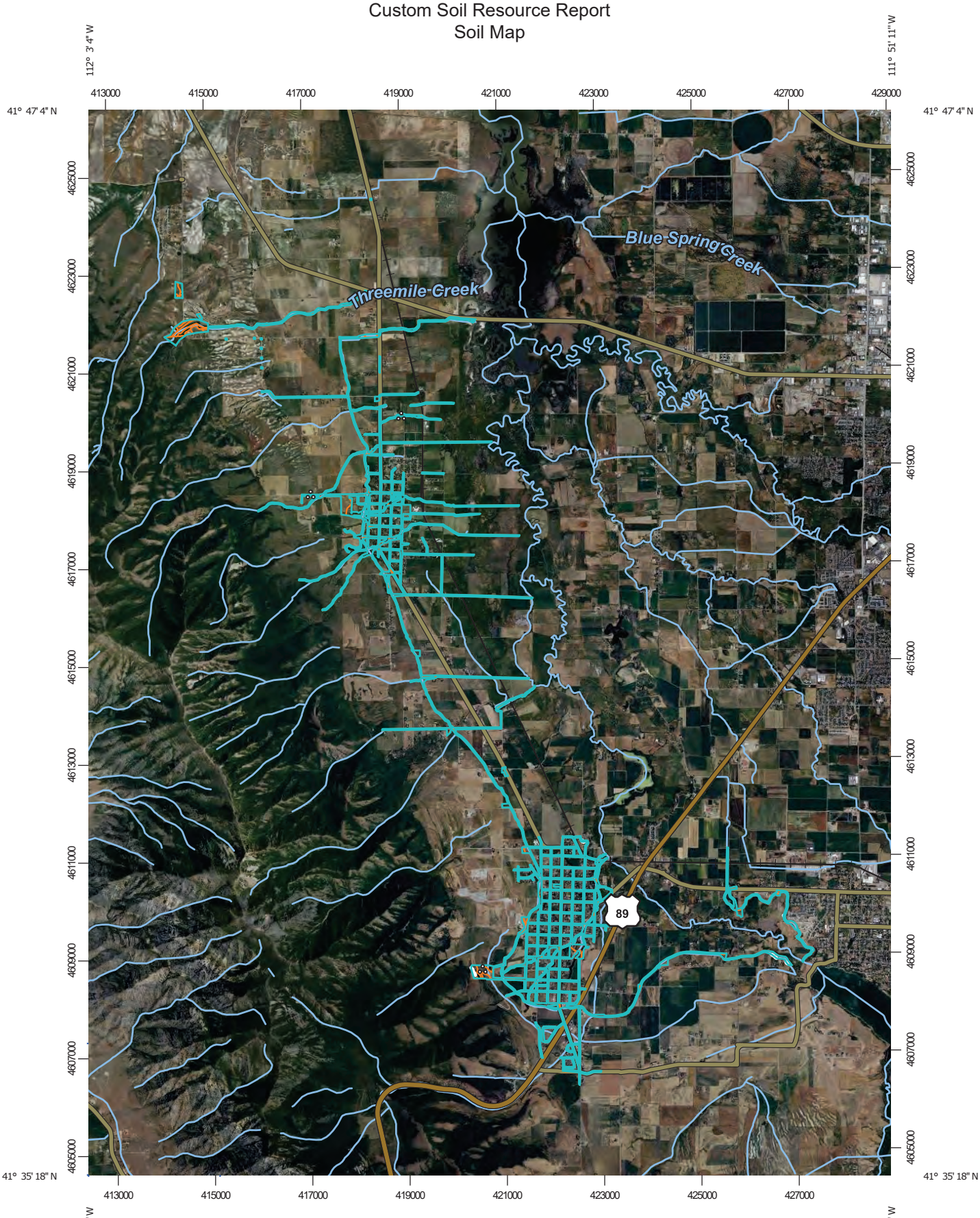
Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.


112° 3' 4" W
111° 51' 11" W
41° 47' 4" N
41° 35' 18" N
413000
415000
417000
419000
421000
423000
425000
427000
429000
4625000
4623000
4621000
4619000
4617000
4615000
4613000
4611000
4609000
4607000
4605000
Threemile Creek
Blue Spring Creek
89
Map Scale: 1:106,000 if printed on A portrait (8.5" x 11") sheet.
N
Meters
0
1500
3000
6000
9000
Feet
0
5000
10000
20000
30000
Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 12N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Cache Valley Area, Parts of Cache and Box Elder Counties, Utah
Survey Area Data: Version 16, Sep 8, 2023

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Apr 25, 2019—Jul 20, 2022

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
AhA	AIRPORT SILT LOAM, 0 TO 3 PERCENT SLOPES	5.5	0.4%
Ak	AIRPORT SILTY CLAY LOAM	0.1	0.0%
ArA	AVON SILTY CLAY LOAM, 0 TO 3 PERCENT SLOPES	9.8	0.8%
ArB	AVON SILTY CLAY LOAM, 3 TO 6 PERCENT SLOPES	71.7	5.7%
ArC	AVON SILTY CLAY LOAM, 6 TO 10 PERCENT SLOPES	2.4	0.2%
ArD	AVON SILTY CLAY LOAM, 10 TO 20 PERCENT SLOPES	5.5	0.4%
AsC	AVON-COLLINSTON COMPLEX, 6 TO 10 PERCENT SLOPES	6.2	0.5%
BAF	BARFUSS-LEATHAM ASSOCIATION	10.1	0.8%
Ck	COLLETT SILTY CLAY LOAM	28.3	2.2%
ClA	COLLINSTON LOAMY FINE SAND, 0 TO 3 PERCENT SLOPES	3.1	0.2%
CmE2	COLLINSTON LOAM, 10 TO 30 PERCENT SLOPES, ERODED	6.1	0.5%
CoA	CROOKSTON LOAM, 0 TO 3 PERCENT SLOPES	31.4	2.5%
CoB	CROOKSTON LOAM, 3 TO 6 PERCENT SLOPES	3.8	0.3%
CrB	CROWSHAW GRAVELLY LOAM, 3 TO 6 PERCENT SLOPES	11.0	0.9%
CrC	CROWSHAW GRAVELLY LOAM, 6 TO 10 PERCENT SLOPES	26.8	2.1%
CrD	CROWSHAW GRAVELLY LOAM, 10 TO 20 PERCENT SLOPES	7.9	0.6%
DaC	DAGOR SILT LOAM, 4 TO 8 PERCENT SLOPES	4.5	0.4%
DaD	DAGOR SILT LOAM, 10 TO 20 PERCENT SLOPES	3.7	0.3%
Gp	GRAVEL PIT	1.2	0.1%
GsA	GREENSON LOAM, 0 TO 3 PERCENT SLOPES	238.5	18.8%
GsB	GREENSON LOAM, 3 TO 6 PERCENT SLOPES	21.8	1.7%

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
GsC	GREENSON LOAM, 6 TO 10 PERCENT SLOPES	9.5	0.7%
HdA	HENDRICKS SILT LOAM, 1 TO 3 PERCENT SLOPES	3.0	0.2%
HdB	HENDRICKS SILT LOAM, 3 TO 6 PERCENT SLOPES	20.8	1.6%
HdC	HENDRICKS SILT LOAM, 6 TO 10 PERCENT SLOPES	5.8	0.5%
HdD	HENDRICKS SILT LOAM, 10 TO 20 PERCENT SLOPES	4.5	0.4%
HeC	HIIBNER GRAVELLY CLAY LOAM, 3 TO 10 PERCENT SLOPES	5.2	0.4%
HeD	HIIBNER GRAVELLY CLAY LOAM, 10 TO 30 PERCENT SLOPES	0.4	0.0%
HfE	HIIBNER EXTREMELY STONY CLAY LOAM, 1 TO 30 PERCENT SLOPES	6.8	0.5%
HuC	HYRUM GRAVELLY LOAM, 4 TO 8 PERCENT SLOPES	11.6	0.9%
HuE	HYRUM GRAVELLY LOAM, 10 TO 25 PERCENT SLOPES	37.7	3.0%
KdD	KIDMAN FINE SANDY LOAM, 8 TO 15 PERCENT SLOPES	3.4	0.3%
KfC	KIDMAN FINE SANDY LOAM, DEEP WATER TABLE, 4 TO 8 PERCENT SLOPES	0.3	0.0%
Lr	LOGAN SILTY CLAY LOAM	6.2	0.5%
McC	MCMURDIE SILT LOAM, 6 TO 10 PERCENT SLOPES	9.8	0.8%
MeA	MENDON SILT LOAM, 0 TO 3 PERCENT SLOPES	71.0	5.6%
MeB	MENDON SILT LOAM, 3 TO 6 PERCENT SLOPES	39.3	3.1%
MeC	MENDON SILT LOAM, 6 TO 10 PERCENT SLOPES	54.3	4.3%
MfB	MENDON-COLLINSTON COMPLEX, 1 TO 6 PERCENT SLOPES	8.7	0.7%
MfE2	MENDON-COLLINSTON COMPLEX, 6 TO 30 PERCENT SLOPES,ERODED	50.6	4.0%
NcA	NIBLEY SILTY CLAY LOAM, 0 TO 3 PERCENT SLOPES	3.4	0.3%
NcB	NIBLEY SILTY CLAY LOAM, 3 TO 6 PERCENT SLOPES	40.6	3.2%
PaA	PARLEYS SILT LOAM, 0 TO 3 PERCENT SLOPES	29.3	2.3%

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
PaB	PARLEYS SILT LOAM, 3 TO 6 PERCENT SLOPES	76.2	6.0%
PaC	PARLEYS SILT LOAM, 6 TO 10 PERCENT SLOPES	1.6	0.1%
Pv	PROVO GRAVELLY LOAM	0.8	0.1%
RhA	RICKS GRAVELLY LOAM, 0 TO 3 PERCENT SLOPES	33.6	2.6%
RhB	RICKS GRAVELLY LOAM, 3 TO 6 PERCENT SLOPES	39.5	3.1%
RhC	RICKS GRAVELLY LOAM, 6 TO 10 PERCENT SLOPES	4.2	0.3%
Rs	ROSHE SPRINGS SILT LOAM	25.0	2.0%
Rt	ROUGH BROKEN LAND	38.5	3.0%
Sg	SALT LAKE-ROSHE SPRINGS COMPLEX	43.4	3.4%
SSE	SMARTS SILT LOAM, 10 TO 30 PERCENT SLOPES	0.0	0.0%
STG2	SMARTS-HOSKIN ASSOCIATION, ERODED	6.6	0.5%
SvA	STEED GRAVELLY LOAM, 0 TO 3 PERCENT SLOPES	6.2	0.5%
SvB	STEED GRAVELLY LOAM, 3 TO 6 PERCENT SLOPES	0.1	0.0%
SvC	STEED GRAVELLY LOAM, 6 TO 10 PERCENT SLOPES	1.0	0.1%
SwC	STERLING GRAVELLY LOAM, 6 TO 10 PERCENT SLOPES	3.9	0.3%
SwD	STERLING GRAVELLY LOAM, 10 TO 20 PERCENT SLOPES	13.2	1.0%
SwF2	STERLING GRAVELLY LOAM, 20 TO 50 PERCENT SLOPES,ERODED	1.8	0.1%
Sy	STONY ALLUVIAL LAND	12.4	1.0%
TmB	TIMPANOGOS SILT LOAM, 3 TO 6 PERCENT SLOPES	3.0	0.2%
TrA	TRENTON SILTY CLAY LOAM, 0 TO 2 PERCENT SLOPES	4.1	0.3%
W	WATER	2.8	0.2%
WhE	WHEELON SILT LOAM, 10 TO 30 PERCENT SLOPES	0.5	0.0%
WhF2	WHEELON SILT LOAM, 30 TO 50 PERCENT SLOPES, ERODED	15.2	1.2%
WlE2	WHEELON-COLLINSTON COMPLEX, 10 TO 30 PERCENT SLOPES, ERODED	9.4	0.7%
Wn	WINN SILT LOAM	3.5	0.3%

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
Totals for Area of Interest		**1,268.1**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Cache Valley Area, Parts of Cache and Box Elder Counties, Utah

AhA—AIRPORT SILT LOAM, 0 TO 3 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j67s
Elevation: 4,420 to 4,460 feet
Mean annual precipitation: 14 to 17 inches
Mean annual air temperature: 45 to 47 degrees F
Frost-free period: 120 to 140 days
Farmland classification: Farmland of local importance

Map Unit Composition

Airport and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Airport

Setting

Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Lacustrine deposits derived from quartzite and/or lacustrine deposits derived from limestone

Typical profile

A1 - 0 to 4 inches: silt loam
B2t - 4 to 11 inches: silty clay loam
B3ca - 11 to 16 inches: silty clay loam
C1ca - 16 to 25 inches: silty clay loam
C2 - 25 to 60 inches: silt loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 24 to 36 inches
Frequency of flooding: Rare
Frequency of ponding: None
Calcium carbonate, maximum content: 60 percent
Maximum salinity: Slightly saline to strongly saline (4.0 to 32.0 mmhos/cm)
Sodium adsorption ratio, maximum: 60.0
Available water supply, 0 to 60 inches: High (about 10.2 inches)

Interpretive groups

Land capability classification (irrigated): 4w
Land capability classification (nonirrigated): 6w
Hydrologic Soil Group: D
Ecological site: R028AY001UT - Alkali Bottom (Alkali Sacaton)
Hydric soil rating: No

Minor Components

Alkali soils

Percent of map unit: 2 percent
Landform: Depressions
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Ponded soils

Percent of map unit: 2 percent
Landform: Depressions
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Hardpan soils

Percent of map unit: 1 percent

Ak—AIRPORT SILTY CLAY LOAM

Map Unit Setting

National map unit symbol: j67t
Elevation: 4,420 to 4,460 feet
Mean annual precipitation: 14 to 17 inches
Mean annual air temperature: 45 to 47 degrees F
Frost-free period: 120 to 140 days
Farmland classification: Farmland of local importance

Map Unit Composition

Airport and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Airport

Setting

Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Lacustrine deposits derived from limestone and/or lacustrine deposits derived from quartzite

Typical profile

A1 - 0 to 4 inches: silty clay loam
B2t - 4 to 11 inches: silty clay loam
B3ca - 11 to 16 inches: silty clay loam

C1ca - 16 to 25 inches: silty clay loam
C2 - 25 to 60 inches: silt loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 24 to 36 inches
Frequency of flooding: Rare
Frequency of ponding: None
Calcium carbonate, maximum content: 60 percent
Maximum salinity: Slightly saline to strongly saline (4.0 to 32.0 mmhos/cm)
Sodium adsorption ratio, maximum: 60.0
Available water supply, 0 to 60 inches: High (about 10.2 inches)

Interpretive groups

Land capability classification (irrigated): 4w
Land capability classification (nonirrigated): 6w
Hydrologic Soil Group: D
Ecological site: R028AY001UT - Alkali Bottom (Alkali Sacaton)
Hydric soil rating: No

Minor Components

Payson

Percent of map unit: 2 percent

Ponded soils

Percent of map unit: 2 percent
Landform: Depressions
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Alkali soils

Percent of map unit: 1 percent
Landform: Depressions
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

ArA—AVON SILTY CLAY LOAM, 0 TO 3 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j67w
Elevation: 4,600 to 5,100 feet
Mean annual precipitation: 17 to 20 inches

Mean annual air temperature: 45 to 47 degrees F
Frost-free period: 110 to 140 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Avon and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Avon

Setting

Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Lacustrine deposits derived from limestone and sandstone

Typical profile

A1 - 0 to 9 inches: silty clay loam
B1 - 9 to 12 inches: silty clay loam
B21t - 12 to 18 inches: silty clay
B22t - 18 to 27 inches: silty clay
Cca - 27 to 34 inches: silt loam
C - 34 to 60 inches: silt loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 40 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 10.4 inches)

Interpretive groups

Land capability classification (irrigated): 2c
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

ArB—AVON SILTY CLAY LOAM, 3 TO 6 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j67x
Elevation: 4,600 to 5,100 feet

Mean annual precipitation: 17 to 20 inches
Mean annual air temperature: 45 to 47 degrees F
Frost-free period: 110 to 140 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Avon and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Avon

Setting

Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Lacustrine deposits derived from limestone and sandstone

Typical profile

A1 - 0 to 9 inches: silty clay loam
B1 - 9 to 12 inches: silty clay loam
B21t - 12 to 18 inches: silty clay
B22t - 18 to 27 inches: silty clay
Cca - 27 to 34 inches: silt loam
C - 34 to 60 inches: silt loam

Properties and qualities

Slope: 3 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 40 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 10.4 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

Minor Components

Collinston

Percent of map unit: 5 percent

ArC—AVON SILTY CLAY LOAM, 6 TO 10 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j67y
Elevation: 4,600 to 5,100 feet
Mean annual precipitation: 17 to 20 inches
Mean annual air temperature: 45 to 47 degrees F
Frost-free period: 110 to 140 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Avon and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Avon

Setting

Landform: Lake terraces, escarpments
Landform position (three-dimensional): Tread
Down-slope shape: Linear, concave
Across-slope shape: Linear
Parent material: Lacustrine deposits derived from limestone and sandstone

Typical profile

A1 - 0 to 9 inches: silty clay loam
B1 - 9 to 12 inches: silty clay loam
B21t - 12 to 18 inches: silty clay
B22t - 18 to 27 inches: silty clay
Cca - 27 to 34 inches: silt loam
C - 34 to 60 inches: silt loam

Properties and qualities

Slope: 6 to 10 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 40 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 10.4 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North

Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

Minor Components

Wheelon
Percent of map unit: 5 percent

Mendon
Percent of map unit: 5 percent

ArD—AVON SILTY CLAY LOAM, 10 TO 20 PERCENT SLOPES

Map Unit Setting
National map unit symbol: j67z
Elevation: 4,600 to 5,100 feet
Mean annual precipitation: 17 to 20 inches
Mean annual air temperature: 45 to 46 degrees F
Frost-free period: 110 to 140 days
Farmland classification: Farmland of local importance

Map Unit Composition
Avon and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Avon

Setting
Landform: Lake terraces, escarpments
Landform position (three-dimensional): Riser
Down-slope shape: Linear, concave
Across-slope shape: Linear
Parent material: Lacustrine deposits derived from limestone and sandstone

Typical profile
A1 - 0 to 9 inches: silty clay loam
B1 - 9 to 12 inches: silty clay loam
B21t - 12 to 18 inches: silty clay
B22t - 18 to 27 inches: silty clay
Cca - 27 to 34 inches: silt loam
C - 34 to 60 inches: silt loam

Properties and qualities
Slope: 10 to 20 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches

Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 40 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 10.4 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

Minor Components

Wheelon

Percent of map unit: 5 percent

AsC—AVON-COLLINSTON COMPLEX, 6 TO 10 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j680
Elevation: 4,600 to 5,100 feet
Mean annual precipitation: 17 to 20 inches
Mean annual air temperature: 45 to 47 degrees F
Frost-free period: 110 to 140 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Avon and similar soils: 65 percent
Collinston and similar soils: 30 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Avon

Setting

Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Lacustrine deposits derived from limestone and sandstone

Typical profile

A1 - 0 to 9 inches: silty clay loam
B1 - 9 to 12 inches: silty clay loam
B21t - 12 to 18 inches: silty clay
B22t - 18 to 27 inches: silty clay
Cca - 27 to 34 inches: silt loam

C - 34 to 60 inches: silt loam

Properties and qualities

Slope: 6 to 10 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 40 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 10.4 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

Description of Collinston

Setting

Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve, crest
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Lacustrine deposits derived from limestone and sandstone and/or lacustrine deposits derived from tuff

Typical profile

A11 - 0 to 8 inches: loam
A12 - 8 to 15 inches: loam
C1ca - 15 to 25 inches: clay loam
C2 - 25 to 35 inches: silt loam
C3 - 35 to 60 inches: silt loam

Properties and qualities

Slope: 6 to 10 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 60 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 10.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

Minor Components

Wheelon, eroded
Percent of map unit: 5 percent

BAF—BARFUSS-LEATHAM ASSOCIATION

Map Unit Setting
National map unit symbol: j682
Elevation: 5,000 to 7,000 feet
Mean annual precipitation: 17 to 25 inches
Mean annual air temperature: 40 to 45 degrees F
Frost-free period: 80 to 110 days
Farmland classification: Not prime farmland

Map Unit Composition
Barfuss and similar soils: 40 percent
Leatham and similar soils: 30 percent
Laplatta and similar soils: 20 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Barfuss

Setting
Landform: Hills, mountain slopes
Landform position (three-dimensional): Mountainflank, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum and colluvium derived from tuff conglomerate, sandstone and limestone

Typical profile
A1 - 0 to 10 inches: silt loam
B21t - 10 to 19 inches: silty clay loam
B22t - 19 to 27 inches: silty clay loam
Cca - 27 to 60 inches: silt loam

Properties and qualities
Slope: 30 to 50 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained

Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 25 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 11.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: C
Ecological site: R047XA434UT - Mountain Loam (shrub)
Hydric soil rating: No

Description of Leatham

Setting

Landform: Mountain slopes, hills
Landform position (three-dimensional): Mountainflank, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum and colluvium derived from tuffs, conglomerate, tuffaceous sandstone, and limestone

Typical profile

A11 - 0 to 4 inches: silt loam
A12 - 4 to 10 inches: silt loam
AC - 10 to 15 inches: silty clay loam
C1ca - 15 to 25 inches: silt loam
C2ca - 25 to 39 inches: silty clay loam
C3ca - 39 to 60 inches: silty clay loam

Properties and qualities

Slope: 30 to 50 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 60 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 10.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: C
Ecological site: R047XA430UT - Mountain Loam (mountain big sagebrush)
Hydric soil rating: No

Description of Laplatta

Setting

Landform: Mountain slopes, hills
Landform position (three-dimensional): Mountainflank, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum derived from tuff, conglomerate, tuffaceous sandstone and limestone

Typical profile

A1 - 0 to 8 inches: silty clay loam
B21t - 8 to 12 inches: silty clay
B22t - 12 to 26 inches: clay
B23t - 26 to 35 inches: clay
B3ca - 35 to 48 inches: silty clay loam
Cca - 48 to 60 inches: silt loam

Properties and qualities

Slope: 30 to 50 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 40 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 10.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: C
Ecological site: R047XA434UT - Mountain Loam (shrub)
Hydric soil rating: No

Minor Components

Wheelon, eroded

Percent of map unit: 5 percent

Obran

Percent of map unit: 5 percent

Ck—COLLETT SILTY CLAY LOAM

Map Unit Setting

National map unit symbol: j68q
Elevation: 4,450 to 4,700 feet
Mean annual precipitation: 14 to 17 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 120 to 140 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Collett and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Collett

Setting

Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Lacustrine deposits derived from limestone, sandstone, and shale

Typical profile

Ap - 0 to 7 inches: silty clay loam
A1 - 7 to 12 inches: silty clay loam
B2 - 12 to 17 inches: silty clay loam
C1ca - 17 to 24 inches: silty clay loam
C2ca - 24 to 34 inches: silty clay loam
C3 - 34 to 60 inches: silty clay loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 60 percent
Maximum salinity: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum: 5.0
Available water supply, 0 to 60 inches: High (about 11.4 inches)

Interpretive groups

Land capability classification (irrigated): 3w
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: C
Ecological site: R028AY012UT - Semiwet Fresh Meadow
Hydric soil rating: No

Minor Components

Greenson

Percent of map unit: 3 percent

Poorly drained soils

Percent of map unit: 2 percent
Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

CIA—COLLINSTON LOAMY FINE SAND, 0 TO 3 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j68r
Elevation: 4,600 to 5,300 feet
Mean annual precipitation: 15 to 22 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 100 to 160 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Collinston and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Collinston

Setting

Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Lacustrine deposits derived from tuff and/or lacustrine deposits derived from limestone and sandstone

Typical profile

A11 - 0 to 8 inches: loamy fine sand
A12 - 8 to 15 inches: loam
C1ca - 15 to 25 inches: clay loam
C2 - 25 to 35 inches: silt loam

C3 - 35 to 60 inches: silt loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 60 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 10.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

Minor Components

Crookston

Percent of map unit: 5 percent

CmE2—COLLINSTON LOAM, 10 TO 30 PERCENT SLOPES, ERODED

Map Unit Setting

National map unit symbol: j68v
Elevation: 4,600 to 5,300 feet
Mean annual precipitation: 15 to 22 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 100 to 160 days
Farmland classification: Not prime farmland

Map Unit Composition

Collinston and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Collinston

Setting

Landform: Lake terraces
Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Linear

Parent material: Lacustrine deposits derived from limestone and sandstone and/or lacustrine deposits derived from tuff

Typical profile

A11 - 0 to 8 inches: loam
A12 - 8 to 15 inches: loam
C1ca - 15 to 25 inches: clay loam
C2 - 25 to 35 inches: silt loam
C3 - 35 to 60 inches: silt loam

Properties and qualities

Slope: 10 to 30 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 60 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 10.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

Minor Components

Mendon

Percent of map unit: 5 percent

Wheelon

Percent of map unit: 5 percent

CoA—CROOKSTON LOAM, 0 TO 3 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j68w
Elevation: 4,500 to 5,100 feet
Mean annual precipitation: 15 to 17 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 120 to 150 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Crookston and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Crookston

Setting

Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Lacustrine deposits derived from tuff, tuffaceous sandstone and limestone

Typical profile

Ap - 0 to 6 inches: loam
A1 - 6 to 14 inches: loam
B2t - 14 to 27 inches: loam
C1ca - 27 to 48 inches: loam
C2ca - 48 to 60 inches: fine sandy loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 35 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 8.9 inches)

Interpretive groups

Land capability classification (irrigated): 2c
Land capability classification (nonirrigated): 3c
Hydrologic Soil Group: B
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Hydric soil rating: No

Minor Components

Mendon

Percent of map unit: 5 percent

CoB—CROOKSTON LOAM, 3 TO 6 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j68x
Elevation: 4,500 to 5,100 feet
Mean annual precipitation: 15 to 17 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 120 to 150 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Crookston and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Crookston

Setting

Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Lacustrine deposits derived from tuff, tuffaceous sandstone and limestone

Typical profile

Ap - 0 to 6 inches: loam
A1 - 6 to 14 inches: loam
B2t - 14 to 27 inches: loam
C1ca - 27 to 48 inches: loam
C2ca - 48 to 60 inches: fine sandy loam

Properties and qualities

Slope: 3 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 35 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 8.9 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North

Hydric soil rating: No

Minor Components

Collinston

Percent of map unit: 5 percent

CrB—CROWSHAW GRAVELLY LOAM, 3 TO 6 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j68z
Elevation: 4,500 to 5,000 feet
Mean annual precipitation: 15 to 17 inches
Mean annual air temperature: 45 to 47 degrees F
Frost-free period: 120 to 140 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Crowshaw and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Crowshaw

Setting

Landform: Alluvial fans
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Alluvium derived from sandstone

Typical profile

Ap - 0 to 10 inches: gravelly loam
A1 - 10 to 16 inches: gravelly loam
B2 - 16 to 30 inches: gravelly loam
C - 30 to 60 inches: gravelly loam

Properties and qualities

Slope: 3 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 7.9 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 3e

Hydrologic Soil Group: B
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

Minor Components

Hendricks
Percent of map unit: 5 percent

CrC—CROWSHAW GRAVELLY LOAM, 6 TO 10 PERCENT SLOPES

Map Unit Setting
National map unit symbol: j690
Elevation: 4,500 to 5,000 feet
Mean annual precipitation: 15 to 17 inches
Mean annual air temperature: 45 to 47 degrees F
Frost-free period: 120 to 140 days
Farmland classification: Farmland of statewide importance

Map Unit Composition
Crowshaw and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Crowshaw

Setting
Landform: Alluvial fans
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Alluvium derived from sandstone

Typical profile
Ap - 0 to 10 inches: gravelly loam
A1 - 10 to 16 inches: gravelly loam
B2 - 16 to 30 inches: gravelly loam
C - 30 to 60 inches: gravelly loam

Properties and qualities
Slope: 6 to 10 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 7.9 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

Minor Components

Hendricks

Percent of map unit: 5 percent

CrD—CROWSHAW GRAVELLY LOAM, 10 TO 20 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j691
Elevation: 4,500 to 5,000 feet
Mean annual precipitation: 15 to 17 inches
Mean annual air temperature: 45 to 47 degrees F
Frost-free period: 120 to 140 days
Farmland classification: Farmland of local importance

Map Unit Composition

Crowshaw and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Crowshaw

Setting

Landform: Alluvial fans
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Alluvium derived from sandstone

Typical profile

Ap - 0 to 10 inches: gravelly loam
A1 - 10 to 16 inches: gravelly loam
B2 - 16 to 30 inches: gravelly loam
C - 30 to 60 inches: gravelly loam

Properties and qualities

Slope: 10 to 20 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None

Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 7.9 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

DaC—DAGOR SILT LOAM, 4 TO 8 PERCENT SLOPES

Map Unit Setting
National map unit symbol: j698
Elevation: 4,900 to 5,150 feet
Mean annual precipitation: 17 to 18 inches
Mean annual air temperature: 46 to 47 degrees F
Frost-free period: 120 to 140 days
Farmland classification: Farmland of statewide importance

Map Unit Composition
Dagor and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Dagor

Setting
Landform: Alluvial fans
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Alluvium derived from sandstone; residuum weathered from sandstone

Typical profile
Ap - 0 to 5 inches: silt loam
A11 - 5 to 14 inches: silt loam
A12 - 14 to 34 inches: silt loam
AC - 34 to 46 inches: silt loam
C - 46 to 60 inches: silt loam

Properties and qualities
Slope: 4 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None

Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 9.7 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

Minor Components

Crowshaw

Percent of map unit: 5 percent

Hendricks

Percent of map unit: 5 percent

DaD—DAGOR SILT LOAM, 10 TO 20 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j699
Elevation: 4,900 to 5,150 feet
Mean annual precipitation: 17 to 18 inches
Mean annual air temperature: 46 to 47 degrees F
Frost-free period: 120 to 140 days
Farmland classification: Farmland of local importance

Map Unit Composition

Dagor and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Dagor

Setting

Landform: Alluvial fans
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Alluvium derived from sandstone

Typical profile

Ap - 0 to 5 inches: silt loam
A11 - 5 to 14 inches: silt loam
A12 - 14 to 34 inches: silt loam
AC - 34 to 46 inches: silt loam
C - 46 to 60 inches: silt loam

Properties and qualities

Slope: 10 to 20 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Rare
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 9.7 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

Gp—GRAVEL PIT

Map Unit Composition

Gravel pit: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Gravel Pit

Setting

Landform: Lake terraces
Landform position (three-dimensional): Riser
Down-slope shape: Concave
Across-slope shape: Concave

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydric soil rating: No

GsA—GREENSON LOAM, 0 TO 3 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j69q
Elevation: 4,450 to 4,650 feet
Mean annual precipitation: 14 to 17 inches
Mean annual air temperature: 45 to 48 degrees F

Frost-free period: 120 to 140 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Greenson and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Greenson

Setting

Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Lacustrine deposits and alluvium derived from limestone, sandstone, and quartzite

Typical profile

Ap - 0 to 7 inches: loam
A1 - 7 to 16 inches: loam
B2 - 16 to 23 inches: loam
C1ca - 23 to 39 inches: loam
C2ca - 39 to 51 inches: loam
C3 - 51 to 72 inches: loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: About 30 to 60 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 40 percent
Maximum salinity: Slightly saline to moderately saline (4.0 to 8.0 mmhos/cm)
Sodium adsorption ratio, maximum: 20.0
Available water supply, 0 to 60 inches: High (about 10.9 inches)

Interpretive groups

Land capability classification (irrigated): 3w
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: C
Ecological site: R028AY012UT - Semiwet Fresh Meadow
Hydric soil rating: No

Minor Components

Logan

Percent of map unit: 5 percent
Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R028AY020UT - Wet Fresh Meadow
Hydric soil rating: Yes

Collett

Percent of map unit: 5 percent

GsB—GREENSON LOAM, 3 TO 6 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j69r
Elevation: 4,450 to 4,650 feet
Mean annual precipitation: 14 to 17 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 120 to 140 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Greenson and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Greenson

Setting

Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Lacustrine deposits and alluvium derived from limestone, sandstone, and quartzite

Typical profile

Ap - 0 to 7 inches: loam
A1 - 7 to 16 inches: loam
B2 - 16 to 23 inches: loam
C1ca - 23 to 39 inches: loam
C2ca - 39 to 51 inches: loam
C3 - 51 to 72 inches: loam

Properties and qualities

Slope: 3 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: About 30 to 60 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 40 percent
Maximum salinity: Slightly saline to moderately saline (4.0 to 8.0 mmhos/cm)
Sodium adsorption ratio, maximum: 20.0
Available water supply, 0 to 60 inches: High (about 10.9 inches)

Interpretive groups

Land capability classification (irrigated): 3w
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: C
Ecological site: R028AY012UT - Semiwet Fresh Meadow
Hydric soil rating: No

Minor Components

Collett

Percent of map unit: 5 percent

Greenson, 6-10% slopes

Percent of map unit: 3 percent

Poorly drained soils, hydric, not correlated

Percent of map unit: 2 percent
Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

GsC—GREENSON LOAM, 6 TO 10 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j69s
Elevation: 4,450 to 4,650 feet
Mean annual precipitation: 14 to 17 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 120 to 140 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Greenson and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Greenson

Setting

Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Lacustrine deposits and alluvium derived from limestone, sandstone, and quartzite

Typical profile

Ap - 0 to 7 inches: loam
A1 - 7 to 16 inches: loam

B2 - 16 to 23 inches: loam
C1ca - 23 to 39 inches: loam
C2ca - 39 to 51 inches: loam
C3 - 51 to 72 inches: loam

Properties and qualities

Slope: 6 to 10 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: About 30 to 60 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 40 percent
Maximum salinity: Slightly saline to moderately saline (4.0 to 8.0 mmhos/cm)
Sodium adsorption ratio, maximum: 20.0
Available water supply, 0 to 60 inches: High (about 10.9 inches)

Interpretive groups

Land capability classification (irrigated): 3w
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: C
Ecological site: R028AY012UT - Semiwet Fresh Meadow
Hydric soil rating: No

Minor Components

Nibley

Percent of map unit: 5 percent

HdA—HENDRICKS SILT LOAM, 1 TO 3 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j6b3
Elevation: 4,800 to 5,400 feet
Mean annual precipitation: 17 to 20 inches
Mean annual air temperature: 44 to 48 degrees F
Frost-free period: 120 to 140 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Hendricks and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hendricks

Setting

Landform: Alluvial fans
Down-slope shape: Concave

Across-slope shape: Convex
Parent material: Alluvium derived from sandstone and/or alluvium derived from quartzite

Typical profile
Ap - 0 to 5 inches: silt loam
B1 - 5 to 15 inches: silt loam
B21t - 15 to 27 inches: silty clay loam
B22t - 27 to 47 inches: silty clay loam
B23t - 47 to 66 inches: silty clay loam

Properties and qualities
Slope: 1 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 10.2 inches)

Interpretive groups
Land capability classification (irrigated): 2c
Land capability classification (nonirrigated): 2c
Hydrologic Soil Group: C
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

Minor Components

Ricks
Percent of map unit: 5 percent

HdB—HENDRICKS SILT LOAM, 3 TO 6 PERCENT SLOPES

Map Unit Setting
National map unit symbol: j6b4
Elevation: 4,800 to 5,400 feet
Mean annual precipitation: 17 to 20 inches
Mean annual air temperature: 44 to 48 degrees F
Frost-free period: 120 to 140 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition
Hendricks and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hendricks

Setting

Landform: Alluvial fans
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Alluvium derived from sandstone and/or alluvium derived from quartzite

Typical profile

Ap - 0 to 5 inches: silt loam
B1 - 5 to 15 inches: silt loam
B21t - 15 to 27 inches: silty clay loam
B22t - 27 to 47 inches: silty clay loam
B23t - 47 to 66 inches: silty clay loam

Properties and qualities

Slope: 3 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 10.2 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

Minor Components

Ricks

Percent of map unit: 5 percent

HdC—HENDRICKS SILT LOAM, 6 TO 10 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j6b5
Elevation: 4,800 to 5,400 feet
Mean annual precipitation: 17 to 20 inches
Mean annual air temperature: 44 to 48 degrees F
Frost-free period: 120 to 140 days

Farmland classification: Farmland of statewide importance

Map Unit Composition

Hendricks and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hendricks

Setting

Landform: Alluvial fans
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Alluvium derived from quartzite and/or alluvium derived from sandstone

Typical profile

Ap - 0 to 5 inches: silt loam
B1 - 5 to 15 inches: silt loam
B21t - 15 to 27 inches: silty clay loam
B22t - 27 to 47 inches: silty clay loam
B23t - 47 to 66 inches: silty clay loam

Properties and qualities

Slope: 6 to 10 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 10.2 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

Minor Components

Crowshaw

Percent of map unit: 5 percent

HdD—HENDRICKS SILT LOAM, 10 TO 20 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j6b6
Elevation: 4,800 to 5,400 feet
Mean annual precipitation: 17 to 20 inches
Mean annual air temperature: 44 to 48 degrees F
Frost-free period: 120 to 140 days
Farmland classification: Farmland of local importance

Map Unit Composition

Hendricks and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hendricks

Setting

Landform: Alluvial fans
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Alluvium derived from quartzite and/or alluvium derived from sandstone

Typical profile

Ap - 0 to 5 inches: silt loam
B1 - 5 to 15 inches: silt loam
B21t - 15 to 27 inches: silty clay loam
B22t - 27 to 47 inches: silty clay loam
B23t - 47 to 66 inches: silty clay loam

Properties and qualities

Slope: 10 to 20 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 10.2 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Ecological site: R047XA430UT - Mountain Loam (mountain big sagebrush)
Hydric soil rating: No

Minor Components

Sterling

Percent of map unit: 5 percent

HeC—HIIBNER GRAVELLY CLAY LOAM, 3 TO 10 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j6b7
Elevation: 4,500 to 6,000 feet
Mean annual precipitation: 17 to 20 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 100 to 140 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Hiibner and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hiibner

Setting

Landform: Alluvial fans
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Colluvium and alluvium derived from sandstone and quartzite

Typical profile

A11 - 0 to 3 inches: gravelly clay loam
A12 - 3 to 6 inches: gravelly clay loam
B21t - 6 to 12 inches: very cobbly clay
B22t - 12 to 27 inches: very cobbly clay
B23t - 27 to 60 inches: very cobbly clay

Properties and qualities

Slope: 3 to 10 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 4.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e

Hydrologic Soil Group: C
Ecological site: R047XA454UT - Mountain Stony Clay (slender wheatgrass)
Hydric soil rating: No

Minor Components

Nebeker
Percent of map unit: 5 percent

HeD—HIIBNER GRAVELLY CLAY LOAM, 10 TO 30 PERCENT SLOPES

Map Unit Setting
National map unit symbol: j6b8
Elevation: 4,500 to 6,000 feet
Mean annual precipitation: 17 to 20 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 100 to 140 days
Farmland classification: Not prime farmland

Map Unit Composition
Hiibner and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hiibner

Setting
Landform: Alluvial fans
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Colluvium and alluvium derived from sandstone and quartzite

Typical profile
A11 - 0 to 3 inches: gravelly clay loam
A12 - 3 to 6 inches: gravelly clay loam
B21t - 6 to 12 inches: very cobbly clay
B22t - 12 to 27 inches: very cobbly clay
B23t - 27 to 60 inches: very cobbly clay

Properties and qualities
Slope: 10 to 20 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 4.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Ecological site: R047XA454UT - Mountain Stony Clay (slender wheatgrass)
Hydric soil rating: No

Minor Components

Nebeker

Percent of map unit: 5 percent

HfE—HIIBNER EXTREMELY STONY CLAY LOAM, 1 TO 30 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j6bb
Elevation: 4,500 to 6,000 feet
Mean annual precipitation: 17 to 20 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 100 to 140 days
Farmland classification: Not prime farmland

Map Unit Composition

Hiibner and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hiibner

Setting

Landform: Alluvial fans
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Alluvium and colluvium from sandstone and quartzite

Typical profile

A11 - 0 to 3 inches: cobbly clay loam
A12 - 3 to 6 inches: cobbly clay loam
B21t - 6 to 12 inches: very cobbly clay
B22t - 12 to 27 inches: very cobbly clay
B23t - 27 to 60 inches: very cobbly clay

Properties and qualities

Slope: 1 to 30 percent
Surface area covered with cobbles, stones or boulders: 0.1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)

Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 4.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Ecological site: R047XA454UT - Mountain Stony Clay (slender wheatgrass)
Hydric soil rating: No

Minor Components

Nebeker

Percent of map unit: 5 percent

HuC—HYRUM GRAVELLY LOAM, 4 TO 8 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j6bf
Elevation: 4,600 to 5,000 feet
Mean annual precipitation: 15 to 17 inches
Mean annual air temperature: 45 to 47 degrees F
Frost-free period: 130 to 150 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Hyrum and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hyrum

Setting

Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium and lacustrine deposits derived from sandstone, quartzite, and lesser amounts of limestone

Typical profile

A1 - 0 to 8 inches: gravelly loam
B1 - 8 to 17 inches: gravelly loam
B21t - 17 to 31 inches: very cobbly clay loam
B22t - 31 to 42 inches: very cobbly clay loam
C - 42 to 60 inches: very cobbly loam

Properties and qualities

Slope: 4 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 5.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: R028AY334UT - Upland Stony Loam (Wyoming Big Sagebrush)
Other vegetative classification: Upland Stony Loam (Mountain Big Sagebrush) (028AY334UT)
Hydric soil rating: No

Minor Components

Hendricks

Percent of map unit: 5 percent

HuE—HYRUM GRAVELLY LOAM, 10 TO 25 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j6bg
Elevation: 4,600 to 5,000 feet
Mean annual precipitation: 15 to 17 inches
Mean annual air temperature: 45 to 47 degrees F
Frost-free period: 130 to 150 days
Farmland classification: Farmland of local importance

Map Unit Composition

Hyrum and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hyrum

Setting

Landform: Lake terraces
Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium and lacustrine deposits derived from sandstone, quartzite, and lesser amounts of limestone

Typical profile

A1 - 0 to 8 inches: gravelly loam
B1 - 8 to 17 inches: gravelly loam
B21t - 17 to 31 inches: very cobbly clay loam
B22t - 31 to 42 inches: very cobbly clay loam
C - 42 to 60 inches: very cobbly loam

Properties and qualities

Slope: 10 to 25 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 5.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Ecological site: R028AY334UT - Upland Stony Loam (Wyoming Big Sagebrush)
Other vegetative classification: Upland Stony Loam (Mountain Big Sagebrush) (028AY334UT)
Hydric soil rating: No

Minor Components

Crowshaw

Percent of map unit: 5 percent

KdD—KIDMAN FINE SANDY LOAM, 8 TO 15 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j6bm
Elevation: 4,450 to 4,550 feet
Mean annual precipitation: 15 to 17 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 130 to 150 days
Farmland classification: Farmland of local importance

Map Unit Composition

Kidman and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kidman

Setting

Landform: Lake terraces
Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Lacustrine deposits derived from limestone and sandstone

Typical profile

Ap - 0 to 8 inches: fine sandy loam
B1 - 8 to 12 inches: fine sandy loam
B2 - 12 to 20 inches: fine sandy loam
C1 - 20 to 27 inches: fine sandy loam
C2ca - 27 to 43 inches: fine sandy loam
IIC3 - 43 to 60 inches: fine sand

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 7.2 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

KfC—KIDMAN FINE SANDY LOAM, DEEP WATER TABLE, 4 TO 8 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j6bq
Elevation: 4,450 to 4,550 feet
Mean annual precipitation: 15 to 17 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 130 to 150 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Kidman and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kidman

Setting

Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Lacustrine deposits derived from limestone and sandstone

Typical profile

Ap - 0 to 8 inches: fine sandy loam
B1 - 8 to 12 inches: fine sandy loam
B2 - 12 to 20 inches: fine sandy loam
C1 - 20 to 27 inches: fine sandy loam
C2ca - 27 to 43 inches: fine sandy loam
IIC3 - 43 to 60 inches: fine sand

Properties and qualities

Slope: 4 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: About 42 to 60 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 7.2 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: A
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

Minor Components

Layton

Percent of map unit: 5 percent

Lr—LOGAN SILTY CLAY LOAM

Map Unit Setting

National map unit symbol: j6c7
Elevation: 4,420 to 4,500 feet
Mean annual precipitation: 14 to 17 inches
Mean annual air temperature: 45 to 47 degrees F
Frost-free period: 120 to 140 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Logan and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Logan

Setting

Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium and lacustrine deposits derived from limestone, sandstone and quartzite

Typical profile

A1 - 0 to 13 inches: silty clay loam
C1cag - 13 to 26 inches: silty clay loam
C2g - 26 to 45 inches: silty clay
C3g - 45 to 60 inches: silty clay

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 10 to 30 inches
Frequency of flooding: Rare
Frequency of ponding: None
Calcium carbonate, maximum content: 45 percent
Maximum salinity: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum: 2.0
Available water supply, 0 to 60 inches: High (about 10.3 inches)

Interpretive groups

Land capability classification (irrigated): 3w
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: C/D
Ecological site: R028AY020UT - Wet Fresh Meadow

Hydric soil rating: Yes

Minor Components

Greenson

Percent of map unit: 4 percent

Salt lake

Percent of map unit: 4 percent
Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R028AY024UT - Wet Saline Meadow (Saltgrass)
Hydric soil rating: Yes

Alkali soils

Percent of map unit: 2 percent
Landform: Depressions
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

McC—MCMURDIE SILT LOAM, 6 TO 10 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j6cg
Elevation: 4,800 to 5,150 feet
Mean annual precipitation: 17 to 20 inches
Mean annual air temperature: 45 to 47 degrees F
Frost-free period: 130 to 150 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Mcmurdie and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Mcmurdie

Setting

Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Lacustrine deposits derived from limestone and sandstone and/or lacustrine deposits derived from quartzite

Typical profile

Ap - 0 to 7 inches: silt loam

B1 - 7 to 14 inches: silty clay loam
B2t - 14 to 33 inches: silty clay
B3ca - 33 to 43 inches: silty clay loam
C1ca - 43 to 50 inches: loam
IIC2 - 50 to 60 inches: sandy loam

Properties and qualities

Slope: 6 to 10 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 30 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 9.3 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

Minor Components

Hillfield

Percent of map unit: 5 percent

MeA—MENDON SILT LOAM, 0 TO 3 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j6cj
Elevation: 4,450 to 5,100 feet
Mean annual precipitation: 14 to 20 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 120 to 150 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Mendon and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Mendon

Setting

Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium and colluvium derived from tuff, conglomerate, tuffaceous sandstone and limestone

Typical profile

Ap - 0 to 7 inches: silt loam
B2t - 7 to 24 inches: clay loam
B3ca - 24 to 28 inches: clay loam
C1ca - 28 to 34 inches: loam
C2 - 34 to 40 inches: loam
C3 - 40 to 60 inches: loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 45 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 10.8 inches)

Interpretive groups

Land capability classification (irrigated): 2c
Land capability classification (nonirrigated): 2c
Hydrologic Soil Group: C
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

Minor Components

Roshe springs

Percent of map unit: 5 percent
Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R028AY020UT - Wet Fresh Meadow
Hydric soil rating: Yes

MeB—MENDON SILT LOAM, 3 TO 6 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j6ck
Elevation: 4,500 to 5,100 feet
Mean annual precipitation: 17 to 20 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 120 to 150 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Mendon and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Mendon

Setting

Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium and colluvium derived from tuff, conglomerate, tuffaceous sandstone and limestone

Typical profile

Ap - 0 to 7 inches: silt loam
B2t - 7 to 24 inches: clay loam
B3ca - 24 to 28 inches: clay loam
C1ca - 28 to 34 inches: loam
C2 - 34 to 40 inches: loam
C3 - 40 to 60 inches: loam

Properties and qualities

Slope: 3 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 45 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 10.8 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C

Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

Minor Components

Collinston
Percent of map unit: 5 percent

Wheelon
Percent of map unit: 5 percent

MeC—MENDON SILT LOAM, 6 TO 10 PERCENT SLOPES

Map Unit Setting
National map unit symbol: j6cl
Elevation: 4,500 to 5,100 feet
Mean annual precipitation: 17 to 20 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 120 to 150 days
Farmland classification: Farmland of statewide importance

Map Unit Composition
Mendon and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Mendon

Setting
Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium and colluvium derived from tuff, conglomerate, tuffaceous sandstone and limestone

Typical profile
Ap - 0 to 7 inches: silt loam
B2t - 7 to 24 inches: clay loam
B3ca - 24 to 28 inches: clay loam
C1ca - 28 to 34 inches: loam
C2 - 34 to 40 inches: loam
C3 - 40 to 60 inches: loam

Properties and qualities
Slope: 6 to 10 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained

Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 45 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 10.8 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

Minor Components

Wheelon

Percent of map unit: 5 percent

MfB—MENDON-COLLINSTON COMPLEX, 1 TO 6 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j6cm
Elevation: 4,500 to 5,300 feet
Mean annual precipitation: 15 to 22 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 100 to 160 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Mendon and similar soils: 50 percent
Collinston and similar soils: 40 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Mendon

Setting

Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium and colluvium derived from tuff, conglomerate, tuffaceous sandstone and limestone

Typical profile

Ap - 0 to 7 inches: silt loam

B2t - 7 to 24 inches: clay loam
B3ca - 24 to 28 inches: clay loam
C1ca - 28 to 34 inches: loam
C2 - 34 to 40 inches: loam
C3 - 40 to 60 inches: loam

Properties and qualities

Slope: 3 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 45 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 10.8 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

Description of Collinston

Setting

Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Lacustrine deposits derived from tuff and/or lacustrine deposits derived from limestone and sandstone

Typical profile

A11 - 0 to 8 inches: loam
A12 - 8 to 15 inches: loam
C1ca - 15 to 25 inches: clay loam
C2 - 25 to 35 inches: silt loam
C3 - 35 to 60 inches: silt loam

Properties and qualities

Slope: 1 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 60 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 10.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

Minor Components

Wheelon

Percent of map unit: 10 percent

MfE2—MENDON-COLLINSTON COMPLEX, 6 TO 30 PERCENT SLOPES,ERODED

Map Unit Setting

National map unit symbol: j6cn
Elevation: 4,500 to 5,300 feet
Mean annual precipitation: 14 to 22 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 100 to 160 days
Farmland classification: Not prime farmland

Map Unit Composition

Mendon and similar soils: 45 percent
Collinston and similar soils: 35 percent
Wheelon and similar soils: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Mendon

Setting

Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium and colluvium derived from tuff, conglomerate, tuffaceous sandstone and limestone

Typical profile

Ap - 0 to 7 inches: silt loam
B2t - 7 to 24 inches: clay loam
B3ca - 24 to 28 inches: clay loam
C1ca - 28 to 34 inches: loam
C2 - 34 to 40 inches: loam
C3 - 40 to 60 inches: loam

Properties and qualities

Slope: 6 to 10 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 45 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 10.8 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

Description of Collinston

Setting

Landform: Lake terraces
Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Lacustrine deposits derived from tuff and/or lacustrine deposits derived from limestone and sandstone

Typical profile

A11 - 0 to 8 inches: loam
A12 - 8 to 15 inches: loam
C1ca - 15 to 25 inches: clay loam
C2 - 25 to 35 inches: silt loam
C3 - 35 to 60 inches: silt loam

Properties and qualities

Slope: 10 to 30 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 60 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 10.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C

Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

Description of Wheelon

Setting
Landform: Lake terraces
Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Lacustrine deposits derived from tuff and/or lacustrine deposits derived from limestone and sandstone

Typical profile
Ap - 0 to 6 inches: silt loam
AC - 6 to 12 inches: silt loam
C1ca - 12 to 23 inches: silt loam
C2ca - 23 to 43 inches: silt loam
C3 - 43 to 66 inches: silt loam

Properties and qualities
Slope: 30 to 50 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 35 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 10.2 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: B
Ecological site: R028AY325UT - Upland Shallow Loam (Black Sagebrush)
Hydric soil rating: No

NcA—NIBLEY SILTY CLAY LOAM, 0 TO 3 PERCENT SLOPES

Map Unit Setting
National map unit symbol: j6cx
Elevation: 4,450 to 4,700 feet
Mean annual precipitation: 14 to 17 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 120 to 150 days

Farmland classification: Farmland of statewide importance

Map Unit Composition

Nibley and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Nibley

Setting

Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Lacustrine deposits derived from quartzite and/or lacustrine deposits derived from limestone and sandstone

Typical profile

Ap - 0 to 7 inches: silty clay loam
A1 - 7 to 13 inches: silty clay loam
B21t - 13 to 20 inches: silty clay
B22tca - 20 to 32 inches: silty clay
B3ca - 32 to 43 inches: silty clay
C - 43 to 60 inches: silty clay

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 30 to 48 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 50 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 10.9 inches)

Interpretive groups

Land capability classification (irrigated): 3w
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: D
Ecological site: R028AY012UT - Semiwet Fresh Meadow
Hydric soil rating: No

Minor Components

Collett

Percent of map unit: 5 percent

Greenson

Percent of map unit: 3 percent

Poorly drained soils, hydric, not correlated

Percent of map unit: 2 percent
Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear

Across-slope shape: Linear
Hydric soil rating: Yes

NcB—NIBLEY SILTY CLAY LOAM, 3 TO 6 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j6cy
Elevation: 4,450 to 4,700 feet
Mean annual precipitation: 14 to 17 inches
Mean annual air temperature: 45 to 46 degrees F
Frost-free period: 120 to 150 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Nibley and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Nibley

Setting

Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Lacustrine deposits derived from limestone and sandstone and/or lacustrine deposits derived from quartzite

Typical profile

Ap - 0 to 7 inches: silty clay loam
A1 - 7 to 13 inches: silty clay loam
B21t - 13 to 20 inches: silty clay
B22tca - 20 to 32 inches: silty clay
B3ca - 32 to 43 inches: silty clay
C - 43 to 60 inches: silty clay

Properties and qualities

Slope: 3 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 30 to 48 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 50 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 10.9 inches)

Interpretive groups

Land capability classification (irrigated): 3w

Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: D
Ecological site: R028AY012UT - Semiwet Fresh Meadow
Hydric soil rating: No

Minor Components

Greenson
Percent of map unit: 5 percent

Poorly drained soils, hydric, not correlated
Percent of map unit: 5 percent
Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

PaA—PARLEYS SILT LOAM, 0 TO 3 PERCENT SLOPES

Map Unit Setting
National map unit symbol: j6d3
Elevation: 4,500 to 5,100 feet
Mean annual precipitation: 15 to 17 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 120 to 160 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition
Parleys and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Parleys

Setting
Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Lacustrine deposits derived from quartzite and/or lacustrine deposits derived from limestone and sandstone

Typical profile
Ap - 0 to 8 inches: silt loam
B1 - 8 to 12 inches: loam
B21t - 12 to 19 inches: clay loam
B22t - 19 to 31 inches: clay loam
B3ca - 31 to 36 inches: silt loam
C1ca - 36 to 52 inches: silt loam
C2ca - 52 to 68 inches: silt loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 30 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 9.8 inches)

Interpretive groups

Land capability classification (irrigated): 2c
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

Minor Components

Timpanogos

Percent of map unit: 5 percent

Parleys

Percent of map unit: 5 percent

PaB—PARLEYS SILT LOAM, 3 TO 6 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j6d4
Elevation: 4,500 to 5,100 feet
Mean annual precipitation: 15 to 17 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 120 to 160 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Parleys and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Parleys

Setting

Landform: Lake terraces
Landform position (three-dimensional): Tread

Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Lacustrine deposits derived from limestone and sandstone and/or lacustrine deposits derived from quartzite

Typical profile

Ap - 0 to 8 inches: silt loam
B1 - 8 to 12 inches: loam
B21t - 12 to 19 inches: clay loam
B22t - 19 to 31 inches: clay loam
B3ca - 31 to 36 inches: silt loam
C1ca - 36 to 52 inches: silt loam
C2ca - 52 to 68 inches: silt loam

Properties and qualities

Slope: 3 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 30 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 9.8 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

Minor Components

Hillfield, eroded

Percent of map unit: 5 percent

PaC—PARLEYS SILT LOAM, 6 TO 10 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j6d5
Elevation: 4,500 to 5,100 feet
Mean annual precipitation: 15 to 17 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 120 to 160 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Parleys and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Parleys

Setting

Landform: Lake plains
Landform position (three-dimensional): Talf, rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Lacustrine deposits derived from quartzite and/or lacustrine deposits derived from limestone and sandstone

Typical profile

Ap - 0 to 8 inches: silt loam
B1 - 8 to 12 inches: loam
B21t - 12 to 19 inches: clay loam
B22t - 19 to 31 inches: clay loam
B3ca - 31 to 36 inches: silt loam
C1ca - 36 to 52 inches: silt loam
C2ca - 52 to 68 inches: silt loam

Properties and qualities

Slope: 6 to 10 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 30 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 9.8 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

Minor Components

Hillfield, eroded

Percent of map unit: 5 percent

Pv—PROVO GRAVELLY LOAM

Map Unit Setting

National map unit symbol: j6dd
Elevation: 4,450 to 4,650 feet
Mean annual precipitation: 14 to 17 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 120 to 140 days
Farmland classification: Farmland of local importance

Map Unit Composition

Provo and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Provo

Setting

Landform: Flood plains
Landform position (three-dimensional): Talf, dip
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Alluvium derived from limestone and sandstone and/or alluvium derived from quartzite

Typical profile

A11 - 0 to 7 inches: gravelly loam
A12 - 7 to 13 inches: gravelly loam
C1ca - 13 to 19 inches: extremely gravelly loam
C2ca - 19 to 27 inches: extremely gravelly loam
C3ca - 27 to 60 inches: extremely gravelly sandy loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 26 to 60 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Calcium carbonate, maximum content: 40 percent
Available water supply, 0 to 60 inches: Low (about 4.7 inches)

Interpretive groups

Land capability classification (irrigated): 3w
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: B
Ecological site: R028AY020UT - Wet Fresh Meadow
Hydric soil rating: No

Minor Components

Roshe springs

Percent of map unit: 5 percent
Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R028AY020UT - Wet Fresh Meadow
Hydric soil rating: Yes

Ponded soils

Percent of map unit: 5 percent
Landform: Depressions
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

RhA—RICKS GRAVELLY LOAM, 0 TO 3 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j6dn
Elevation: 4,500 to 5,700 feet
Mean annual precipitation: 15 to 17 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 130 to 160 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Ricks and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ricks

Setting

Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium and deltaic sediments derived from limestone, sandstone and quartzite

Typical profile

Ap - 0 to 4 inches: gravelly loam
A1 - 4 to 9 inches: gravelly loam
B2 - 9 to 14 inches: gravelly loam
B3ca - 14 to 18 inches: gravelly sandy loam
IIC1ca - 18 to 24 inches: very gravelly sand

IIC2ca - 24 to 60 inches: very gravelly sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 25 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.4 inches)

Interpretive groups

Land capability classification (irrigated): 4s
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: B
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

Minor Components

Timpanogos

Percent of map unit: 5 percent

RhB—RICKS GRAVELLY LOAM, 3 TO 6 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j6dp
Elevation: 4,500 to 5,700 feet
Mean annual precipitation: 15 to 17 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 130 to 160 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Ricks and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ricks

Setting

Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear

Parent material: Alluvium and deltaic sediments derived from limestone, sandstone and quartzite

Typical profile

Ap - 0 to 4 inches: gravelly loam
A1 - 4 to 9 inches: gravelly loam
B2 - 9 to 14 inches: gravelly loam
B3ca - 14 to 18 inches: gravelly sandy loam
IIC1ca - 18 to 24 inches: very gravelly sand
IIC2ca - 24 to 60 inches: very gravelly sand

Properties and qualities

Slope: 3 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 25 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.4 inches)

Interpretive groups

Land capability classification (irrigated): 4s
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: B
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

Minor Components

Timpanogos

Percent of map unit: 5 percent

Sterling

Percent of map unit: 5 percent

RhC—RICKS GRAVELLY LOAM, 6 TO 10 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j6dq
Elevation: 4,500 to 5,700 feet
Mean annual precipitation: 15 to 17 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 130 to 160 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Ricks and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ricks

Setting

Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium and deltaic sediments derived from limestone, sandstone and quartzite

Typical profile

Ap - 0 to 4 inches: gravelly loam
A1 - 4 to 9 inches: gravelly loam
B2 - 9 to 14 inches: gravelly loam
B3ca - 14 to 18 inches: gravelly sandy loam
IIC1ca - 18 to 24 inches: very gravelly sand
IIC2ca - 24 to 60 inches: very gravelly sand

Properties and qualities

Slope: 6 to 10 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 25 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.4 inches)

Interpretive groups

Land capability classification (irrigated): 4s
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: B
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

Rs—ROSHE SPRINGS SILT LOAM

Map Unit Setting

National map unit symbol: j6ds
Elevation: 4,450 to 4,600 feet
Mean annual precipitation: 14 to 17 inches
Mean annual air temperature: 45 to 48 degrees F

Frost-free period: 120 to 140 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Roshe springs and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Roshe Springs

Setting

Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

A1 - 0 to 8 inches: silt loam
C1ca - 8 to 14 inches: silt loam
C2ca - 14 to 23 inches: silt loam
C3ca - 23 to 35 inches: silt loam
C4 - 35 to 60 inches: silt loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 10 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 55 percent
Maximum salinity: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum: 5.0
Available water supply, 0 to 60 inches: High (about 10.8 inches)

Interpretive groups

Land capability classification (irrigated): 3w
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: B/D
Ecological site: R028AY020UT - Wet Fresh Meadow
Hydric soil rating: Yes

Minor Components

Logan

Percent of map unit: 5 percent
Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R028AY020UT - Wet Fresh Meadow
Hydric soil rating: Yes

Ponded soils

Percent of map unit: 5 percent
Landform: Depressions
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Rt—ROUGH BROKEN LAND

Map Unit Composition

Rough broken land: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Rough Broken Land

Setting

Landform: Drainageways
Down-slope shape: Linear
Across-slope shape: Concave

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydric soil rating: No

Sg—SALT LAKE-ROSHE SPRINGS COMPLEX

Map Unit Setting

National map unit symbol: j6fb
Elevation: 4,420 to 4,600 feet
Mean annual precipitation: 14 to 17 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 120 to 140 days
Farmland classification: Farmland of local importance

Map Unit Composition

Salt lake and similar soils: 55 percent
Roshe springs and similar soils: 40 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Salt Lake

Setting

Landform: Lake terraces
Landform position (three-dimensional): Tread

Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Lacustrine deposits derived from limestone and/or lacustrine deposits derived from quartzite

Typical profile

A1 - 0 to 7 inches: silty clay
ACcag - 7 to 15 inches: silty clay
C1cag - 15 to 36 inches: silty clay
C2 - 36 to 66 inches: silty clay

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 0 to 30 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Calcium carbonate, maximum content: 50 percent
Maximum salinity: Very slightly saline to slightly saline (2.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum: 5.0
Available water supply, 0 to 60 inches: High (about 10.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: D
Ecological site: R028AY024UT - Wet Saline Meadow (Saltgrass)
Hydric soil rating: Yes

Description of Roshe Springs

Setting

Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

A1 - 0 to 8 inches: silt loam
C1ca - 8 to 14 inches: silt loam
C2ca - 14 to 23 inches: silt loam
C3ca - 23 to 35 inches: silt loam
C4 - 35 to 60 inches: silt loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 10 to 36 inches
Frequency of flooding: None
Frequency of ponding: None

Calcium carbonate, maximum content: 55 percent
Maximum salinity: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum: 5.0
Available water supply, 0 to 60 inches: High (about 10.8 inches)

Interpretive groups

Land capability classification (irrigated): 3w
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: B/D
Ecological site: R028AY020UT - Wet Fresh Meadow
Hydric soil rating: Yes

Minor Components

Airport

Percent of map unit: 5 percent
Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R028AY001UT - Alkali Bottom (Alkali Sacaton)
Hydric soil rating: Yes

SSE—SMARTS SILT LOAM, 10 TO 30 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j6f4
Elevation: 5,200 to 9,000 feet
Mean annual precipitation: 20 to 30 inches
Mean annual air temperature: 37 to 45 degrees F
Frost-free period: 80 to 110 days
Farmland classification: Not prime farmland

Map Unit Composition

Smarts and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Smarts

Setting

Landform: Alluvial fans
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Alluvium and colluvium derived from sandstone, quartzite and limestone

Typical profile

A11 - 0 to 15 inches: silt loam
A12 - 15 to 22 inches: gravelly silt loam
B21t - 22 to 49 inches: extremely cobbly loam

C - 49 to 60 inches: extremely cobbly loam

Properties and qualities

Slope: 10 to 30 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 6.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: R047XA418UT - Mountain Loam (bigtooth maple)
Hydric soil rating: No

STG2—SMARTS-HOSKIN ASSOCIATION, ERODED

Map Unit Setting

National map unit symbol: j6f5
Elevation: 5,200 to 9,000 feet
Mean annual precipitation: 20 to 30 inches
Mean annual air temperature: 37 to 45 degrees F
Frost-free period: 70 to 110 days
Farmland classification: Not prime farmland

Map Unit Composition

Smarts and similar soils: 50 percent
Hoskin and similar soils: 40 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Smarts

Setting

Landform: Alluvial fans
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Alluvium and colluvium derived from sandstone, quartzite and limestone

Typical profile

A11 - 0 to 15 inches: gravelly loam
A12 - 15 to 22 inches: gravelly silt loam
B21t - 22 to 49 inches: extremely cobbly loam
C - 49 to 60 inches: extremely cobbly loam

Properties and qualities

Slope: 30 to 70 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 6.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: B
Ecological site: R047XA418UT - Mountain Loam (bigtooth maple)
Hydric soil rating: No

Description of Hoskin

Setting

Landform: Mountain slopes
Landform position (three-dimensional): Mountainflank
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum and colluvium derived from conglomerate and sandstone

Typical profile

A1 - 0 to 7 inches: cobbly loam
B2t - 7 to 16 inches: very cobbly loam
C - 16 to 28 inches: extremely cobbly loam
R - 28 to 32 inches: unweathered bedrock

Properties and qualities

Slope: 30 to 70 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): Low to moderately high (0.01 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Very low (about 1.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: C
Ecological site: R047XA461UT - Mountain Stony Loam (mountain big sagebrush)
Hydric soil rating: No

Minor Components

Rock outcrop
Percent of map unit: 10 percent

SvA—STEED GRAVELLY LOAM, 0 TO 3 PERCENT SLOPES

Map Unit Setting
National map unit symbol: j6ff
Elevation: 4,550 to 5,700 feet
Mean annual precipitation: 15 to 17 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 120 to 160 days
Farmland classification: Farmland of statewide importance

Map Unit Composition
Steed and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Steed

Setting
Landform: Alluvial fans
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Alluvium derived from limestone and sandstone and/or alluvium derived from quartzite

Typical profile
Ap - 0 to 5 inches: gravelly loam
A11 - 5 to 11 inches: gravelly loam
A12 - 11 to 17 inches: extremely gravelly sandy loam
C - 17 to 60 inches: extremely gravelly loamy sand

Properties and qualities
Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 48 inches
Frequency of flooding: Rare
Frequency of ponding: None
Calcium carbonate, maximum content: 40 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.2 inches)

Interpretive groups

Land capability classification (irrigated): 4s
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: B
Ecological site: R028AY334UT - Upland Stony Loam (Wyoming Big Sagebrush)
Other vegetative classification: Upland Stony Loam (Mountain Big Sagebrush) (028AY334UT)
Hydric soil rating: No

Minor Components

Poorly drained soils, hydric, not correlated

Percent of map unit: 5 percent
Landform: Flood plains
Landform position (three-dimensional): Talf, dip
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: Yes

Stony alluvial land

Percent of map unit: 5 percent
Landform: Flood plains
Landform position (three-dimensional): Talf, dip
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: No

SvB—STEED GRAVELLY LOAM, 3 TO 6 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j6fg
Elevation: 4,550 to 5,700 feet
Mean annual precipitation: 15 to 17 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 120 to 160 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Steed and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Steed

Setting

Landform: Alluvial fans
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Alluvium derived from quartzite and/or alluvium derived from limestone and sandstone

Typical profile

Ap - 0 to 5 inches: gravelly loam
A11 - 5 to 11 inches: gravelly loam
A12 - 11 to 17 inches: extremely gravelly sandy loam
C - 17 to 60 inches: extremely gravelly loamy sand

Properties and qualities

Slope: 3 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 48 inches
Frequency of flooding: Rare
Frequency of ponding: None
Calcium carbonate, maximum content: 40 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.2 inches)

Interpretive groups

Land capability classification (irrigated): 4s
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: B
Ecological site: R028AY334UT - Upland Stony Loam (Wyoming Big Sagebrush)
Other vegetative classification: Upland Stony Loam (Mountain Big Sagebrush) (028AY334UT)
Hydric soil rating: No

SvC—STEED GRAVELLY LOAM, 6 TO 10 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j6fh
Elevation: 4,550 to 5,700 feet
Mean annual precipitation: 15 to 17 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 120 to 160 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Steed and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Steed

Setting

Landform: Alluvial fans
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Alluvium derived from quartzite and/or alluvium derived from limestone and sandstone

Typical profile

Ap - 0 to 5 inches: gravelly loam
A11 - 5 to 11 inches: gravelly loam
A12 - 11 to 17 inches: extremely gravelly sandy loam
C - 17 to 60 inches: extremely gravelly loamy sand

Properties and qualities

Slope: 6 to 10 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 48 inches
Frequency of flooding: Rare
Frequency of ponding: None
Calcium carbonate, maximum content: 40 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.2 inches)

Interpretive groups

Land capability classification (irrigated): 4s
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: B
Ecological site: R028AY334UT - Upland Stony Loam (Wyoming Big Sagebrush)
Other vegetative classification: Upland Stony Loam (Mountain Big Sagebrush) (028AY334UT)
Hydric soil rating: No

SwC—STERLING GRAVELLY LOAM, 6 TO 10 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j6fj
Elevation: 4,600 to 5,500 feet
Mean annual precipitation: 15 to 17 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 130 to 160 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Sterling and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sterling

Setting

Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear

Parent material: Alluvium and lacustrine deposits derived from limestone, quartzite and sandstone

Typical profile

A11 - 0 to 9 inches: gravelly loam
A12 - 9 to 16 inches: very gravelly loam
C1ca - 16 to 27 inches: extremely gravelly sandy loam
C2 - 27 to 60 inches: extremely gravelly loamy sand

Properties and qualities

Slope: 6 to 10 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 60 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.1 inches)

Interpretive groups

Land capability classification (irrigated): 4s
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: B
Ecological site: R028AY334UT - Upland Stony Loam (Wyoming Big Sagebrush)
Other vegetative classification: Upland Stony Loam (Mountain Big Sagebrush) (028AY334UT)
Hydric soil rating: No

Minor Components

Sterling

Percent of map unit: 5 percent

Timpanogos

Percent of map unit: 5 percent

SwD—STERLING GRAVELLY LOAM, 10 TO 20 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j6fk
Elevation: 4,600 to 5,500 feet
Mean annual precipitation: 15 to 17 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 130 to 160 days
Farmland classification: Farmland of local importance

Map Unit Composition

Sterling and similar soils: 95 percent

Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sterling

Setting
Landform: Lake terraces
Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium and lacustrine deposits derived from limestone, quartzite and sandstone

Typical profile
A11 - 0 to 9 inches: gravelly loam
A12 - 9 to 16 inches: very gravelly loam
C1ca - 16 to 27 inches: extremely gravelly sandy loam
C2 - 27 to 60 inches: extremely gravelly loamy sand

Properties and qualities
Slope: 10 to 20 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 60 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.1 inches)

Interpretive groups
Land capability classification (irrigated): 4s
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: B
Ecological site: R028AY334UT - Upland Stony Loam (Wyoming Big Sagebrush)
Other vegetative classification: Upland Stony Loam (Mountain Big Sagebrush) (028AY334UT)
Hydric soil rating: No

Minor Components

Timpanogos, eroded
Percent of map unit: 5 percent

SwF2—STERLING GRAVELLY LOAM, 20 TO 50 PERCENT SLOPES,ERODED

Map Unit Setting
National map unit symbol: j6fl

Elevation: 4,600 to 5,500 feet
Mean annual precipitation: 15 to 17 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 130 to 160 days
Farmland classification: Not prime farmland

Map Unit Composition

Sterling and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sterling

Setting

Landform: Lake terraces
Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium and lacustrine deposits derived from limestone, quartzite and sandstone

Typical profile

A11 - 0 to 9 inches: gravelly loam
A12 - 9 to 16 inches: very gravelly loam
C1ca - 16 to 27 inches: extremely gravelly sandy loam
C2 - 27 to 60 inches: extremely gravelly loamy sand

Properties and qualities

Slope: 20 to 50 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 60 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: B
Ecological site: R028AY334UT - Upland Stony Loam (Wyoming Big Sagebrush)
Other vegetative classification: Upland Stony Loam (Mountain Big Sagebrush) (028AY334UT)
Hydric soil rating: No

Minor Components

Hillfield, eroded

Percent of map unit: 5 percent

Sy—STONY ALLUVIAL LAND

Map Unit Composition

Stony alluvial land: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Stony Alluvial Land

Setting

Landform: Flood plains
Landform position (three-dimensional): Talf, dip
Down-slope shape: Linear
Across-slope shape: Concave

Properties and qualities

Frequency of flooding: Rare

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8w
Hydric soil rating: No

TmB—TIMPANOGOS SILT LOAM, 3 TO 6 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j6fp
Elevation: 4,450 to 5,100 feet
Mean annual precipitation: 15 to 17 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 140 to 160 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Timpanogos and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Timpanogos

Setting

Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Lacustrine deposits derived from quartzite and/or lacustrine deposits derived from limestone and sandstone

Typical profile

Ap1 - 0 to 4 inches: silt loam
Ap2 - 4 to 9 inches: loam
B21t - 9 to 13 inches: loam
B22tca - 13 to 18 inches: loam
C1ca - 18 to 29 inches: loam
C2ca - 29 to 42 inches: loam
C3 - 42 to 60 inches: very fine sandy loam

Properties and qualities

Slope: 3 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 45 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 15.0
Available water supply, 0 to 60 inches: High (about 10.1 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

Minor Components

Ricks

Percent of map unit: 5 percent

Parleys

Percent of map unit: 5 percent

TrA—TRENTON SILTY CLAY LOAM, 0 TO 2 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j6ft
Elevation: 4,400 to 4,700 feet
Mean annual precipitation: 14 to 17 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 120 to 150 days
Farmland classification: Farmland of local importance

Map Unit Composition

Trenton and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Trenton

Setting

Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Lacustrine deposits derived from quartzite and/or lacustrine deposits derived from limestone and sandstone

Typical profile

Ap - 0 to 8 inches: silty clay loam
B21t - 8 to 15 inches: silty clay
B21t - 15 to 26 inches: silty clay
B21t - 26 to 34 inches: silty clay
B21t - 34 to 60 inches: silty clay
B21t - 60 to 72 inches: silty clay

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 42 to 60 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 40 percent
Maximum salinity: Very slightly saline to strongly saline (2.0 to 16.0 mmhos/cm)
Sodium adsorption ratio, maximum: 30.0
Available water supply, 0 to 60 inches: High (about 10.7 inches)

Interpretive groups

Land capability classification (irrigated): 4w
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: D
Ecological site: R028AY001UT - Alkali Bottom (Alkali Sacaton)
Hydric soil rating: No

Minor Components

Slickspots

Percent of map unit: 5 percent
Landform: Depressions
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Cache

Percent of map unit: 5 percent

Landform: Lake plains
Landform position (three-dimensional): Talf, dip
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R028AY024UT - Wet Saline Meadow (Saltgrass)
Hydric soil rating: Yes

W—WATER

Map Unit Composition

Water: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

WhE—WHEELON SILT LOAM, 10 TO 30 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j6g0
Elevation: 4,500 to 5,300 feet
Mean annual precipitation: 14 to 17 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 110 to 140 days
Farmland classification: Not prime farmland

Map Unit Composition

Wheelon and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Wheelon

Setting

Landform: Terraces
Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Lacustrine deposits derived from tuff and/or limestone & sandstone; lacustrine deposits derived from tuff and/or lacustrine deposits derived from limestone and sandstone

Typical profile

Ap - 0 to 6 inches: silt loam
AC - 6 to 12 inches: silt loam
C1ca - 12 to 23 inches: silt loam
C2ca - 23 to 43 inches: silt loam
C3 - 43 to 66 inches: silt loam

Properties and qualities

Slope: 10 to 30 percent
Depth to restrictive feature: More than 80 inches

Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 35 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 10.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: R028AY325UT - Upland Shallow Loam (Black Sagebrush)
Hydric soil rating: No

Minor Components

Collinston

Percent of map unit: 5 percent

WhF2—WHEELON SILT LOAM, 30 TO 50 PERCENT SLOPES, ERODED

Map Unit Setting

National map unit symbol: j6g1
Elevation: 4,500 to 5,300 feet
Mean annual precipitation: 14 to 17 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 110 to 140 days
Farmland classification: Not prime farmland

Map Unit Composition

Wheelon and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Wheelon

Setting

Landform: Terraces
Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Lacustrine deposits derived from tuff and/or lacustrine deposits derived from limestone and sandstone

Typical profile

Ap - 0 to 6 inches: silt loam
AC - 6 to 12 inches: silt loam
C1ca - 12 to 23 inches: silt loam

C2ca - 23 to 43 inches: silt loam
C3 - 43 to 66 inches: silt loam

Properties and qualities

Slope: 30 to 50 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 35 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 10.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: B
Ecological site: R028AY325UT - Upland Shallow Loam (Black Sagebrush)
Hydric soil rating: No

Minor Components

Collinston

Percent of map unit: 5 percent

WIE2—WHEELON-COLLINSTON COMPLEX, 10 TO 30 PERCENT SLOPES, ERODED

Map Unit Setting

National map unit symbol: j6g2
Elevation: 4,500 to 5,300 feet
Mean annual precipitation: 14 to 22 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 100 to 160 days
Farmland classification: Not prime farmland

Map Unit Composition

Wheelon and similar soils: 55 percent
Collinston and similar soils: 40 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Wheelon

Setting

Landform: Terraces
Landform position (three-dimensional): Riser
Down-slope shape: Linear

Across-slope shape: Linear
Parent material: Lacustrine deposits derived from tuff and/or lacustrine deposits derived from limestone and sandstone

Typical profile

Ap - 0 to 6 inches: silt loam
AC - 6 to 12 inches: silt loam
C1ca - 12 to 23 inches: silt loam
C2ca - 23 to 43 inches: silt loam
C3 - 43 to 66 inches: silt loam

Properties and qualities

Slope: 10 to 30 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 35 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 10.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: R028AY325UT - Upland Shallow Loam (Black Sagebrush)
Hydric soil rating: No

Description of Collinston

Setting

Landform: Lake terraces
Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Lacustrine deposits derived from tuff and/or lacustrine deposits derived from limestone and sandstone

Typical profile

A11 - 0 to 8 inches: loam
A12 - 8 to 15 inches: loam
C1ca - 15 to 25 inches: clay loam
C2 - 25 to 35 inches: silt loam
C3 - 35 to 60 inches: silt loam

Properties and qualities

Slope: 10 to 30 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Calcium carbonate, maximum content: 60 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 10.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

Minor Components

Mendon

Percent of map unit: 5 percent

Wn—WINN SILT LOAM

Map Unit Setting

National map unit symbol: j6g3
Elevation: 4,450 to 4,900 feet
Mean annual precipitation: 14 to 17 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 120 to 150 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Winn and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Winn

Setting

Landform: Flood plains
Landform position (three-dimensional): Talf, dip
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Alluvium derived from limestone and sandstone and/or alluvium derived from quartzite

Typical profile

A11 - 0 to 6 inches: silt loam
A12 - 6 to 13 inches: loam
AC - 13 to 18 inches: loam
C1 - 18 to 40 inches: loam
C2 - 40 to 60 inches: silt loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 30 to 42 inches
Frequency of flooding: Rare
Frequency of ponding: None
Calcium carbonate, maximum content: 30 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 10.8 inches)

Interpretive groups

Land capability classification (irrigated): 3w
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: C
Ecological site: R028AY012UT - Semiwet Fresh Meadow
Hydric soil rating: No

Minor Components

Kirkham

Percent of map unit: 5 percent

Provo

Percent of map unit: 5 percent
Landform: Flood plains
Landform position (three-dimensional): Talf, dip
Down-slope shape: Linear
Across-slope shape: Concave
Ecological site: R028AY020UT - Wet Fresh Meadow
Hydric soil rating: No

Poorly drained soils, hydric, not correlated

Percent of map unit: 5 percent
Landform: Lake plains
Landform position (three-dimensional): Dip, talf
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

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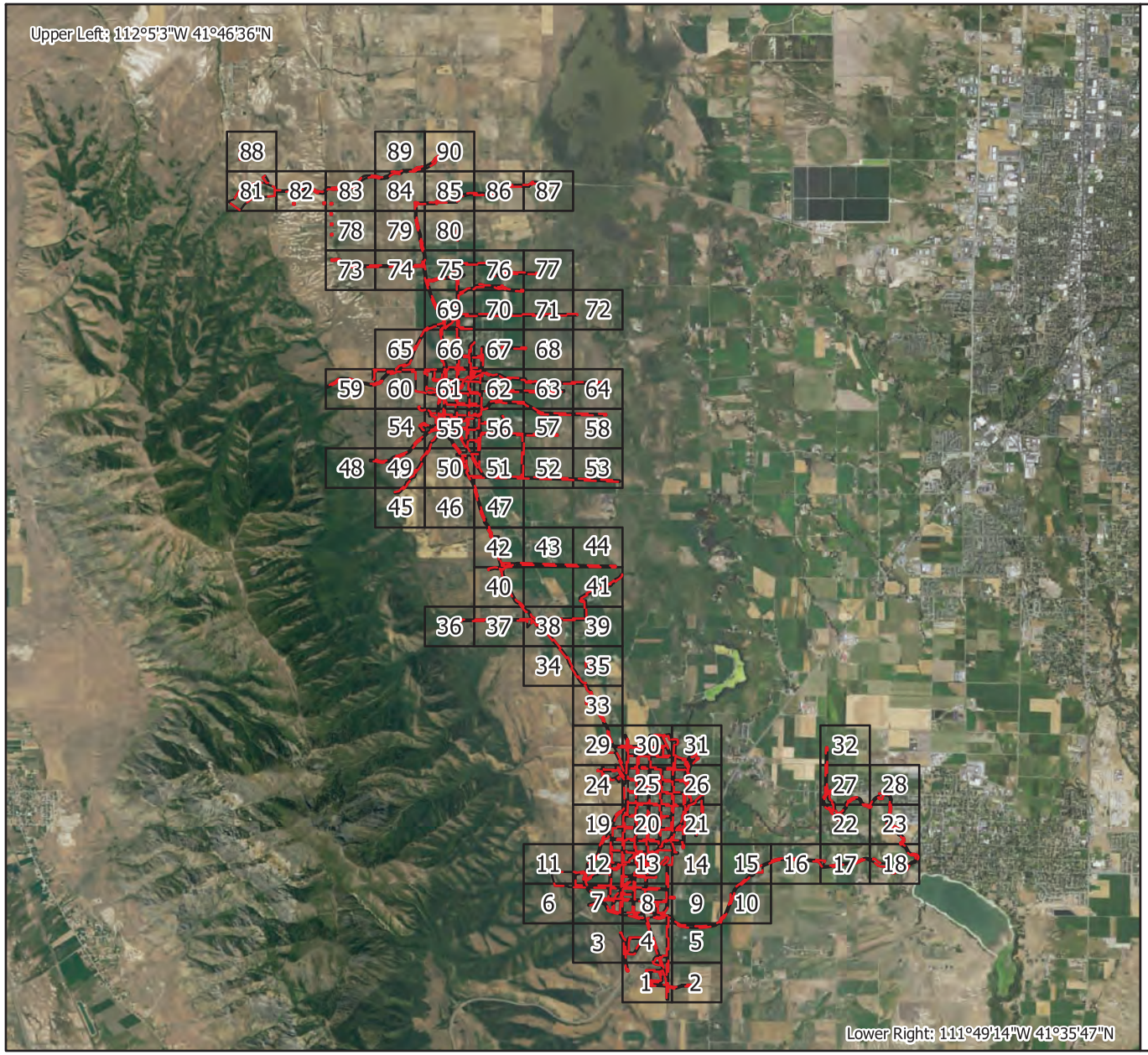
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Appendix C: Map Book



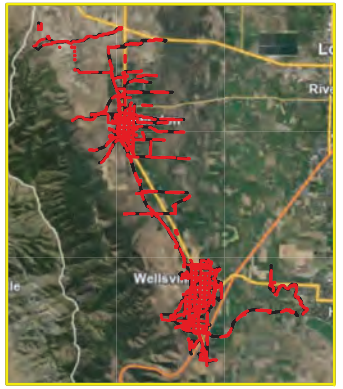
Wellsville-Mendon Watershed Plan Project Aquatic Resources Map Book

Study Area

Map Locations

0 0.75 1.5 Miles

N



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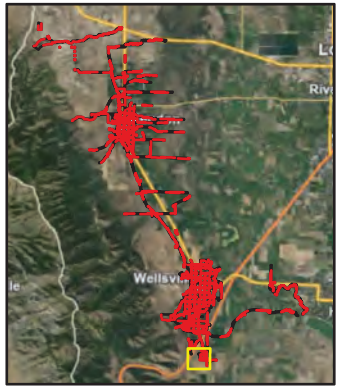
Wellsville-Mendon Watershed Plan Project Aquatic Resources Map Book

- Wetland Plots
- Upland Plots

- Study Area
- OHWM (67.59 acres)
- Wetlands (56.89 acres)

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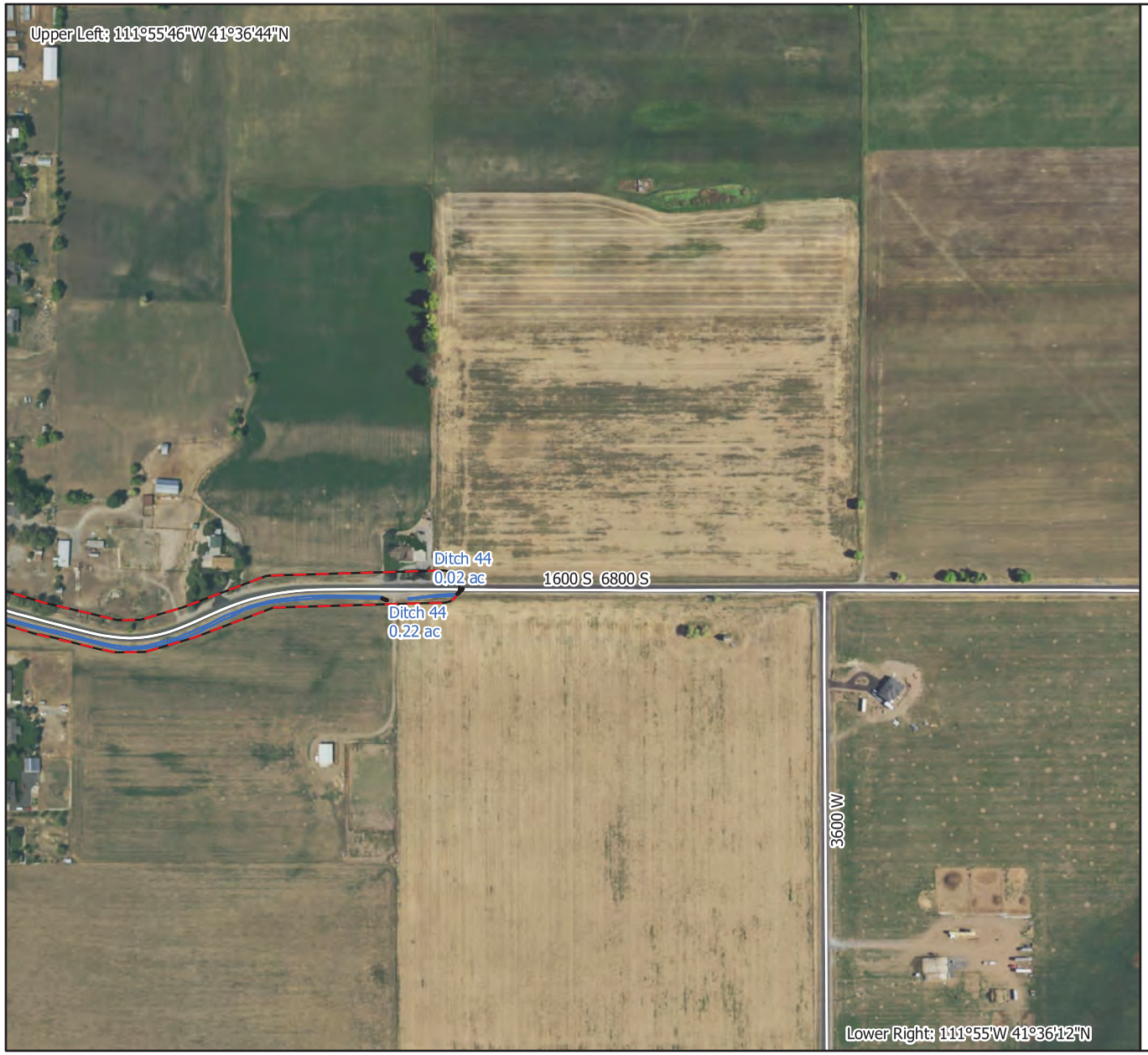
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Map 1 of 90

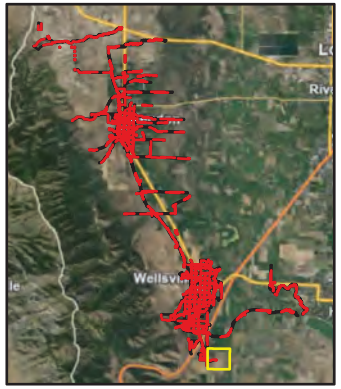


Wellsville-Mendon Watershed Plan Project Aquatic Resources Map Book

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0 0.04 0.09 Miles

N



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Map 2 of 90



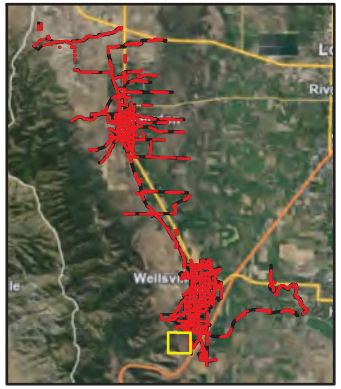
Wellsville-Mendon Watershed Plan Project Aquatic Resources Map Book

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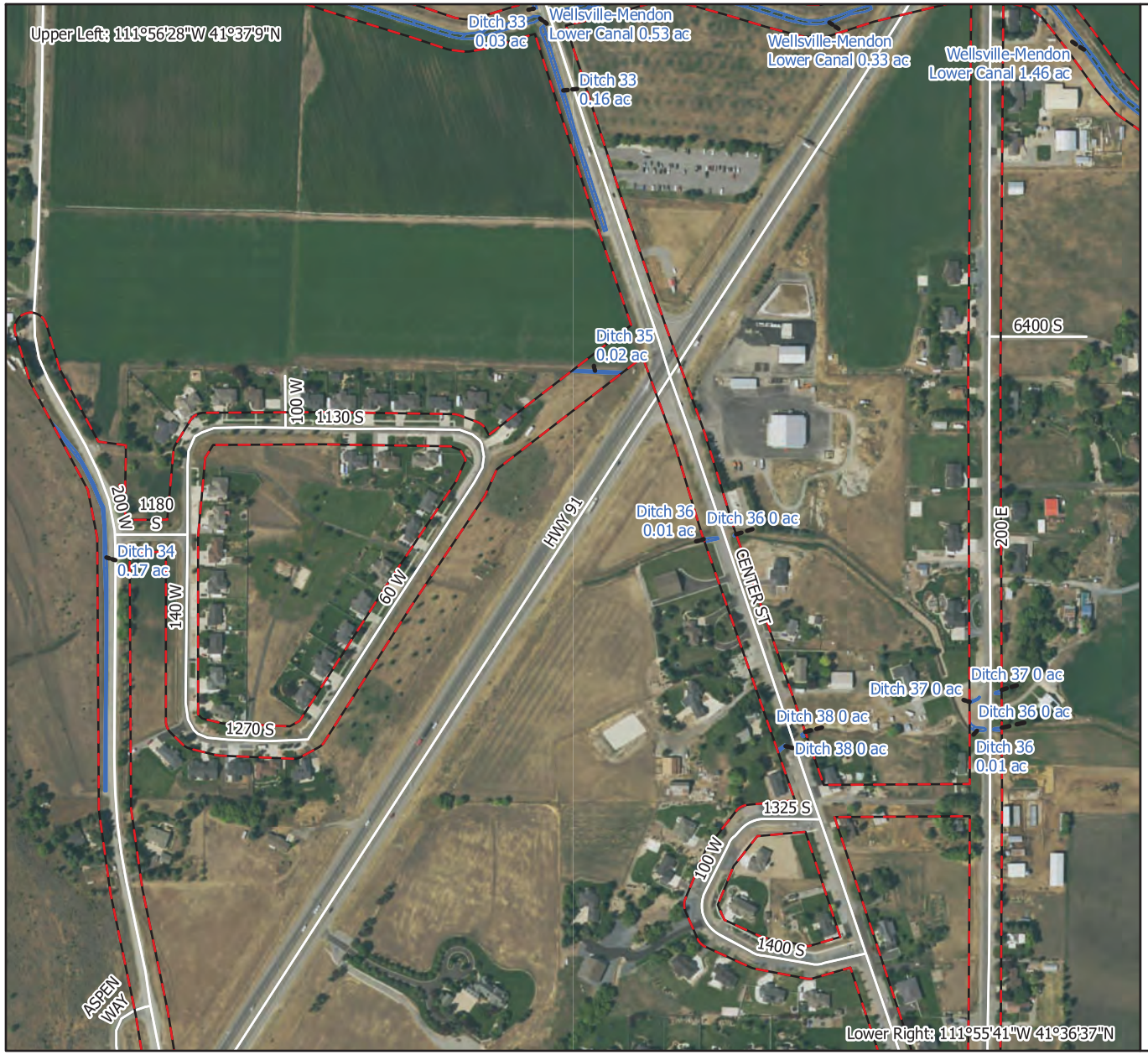
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Map 3 of 90

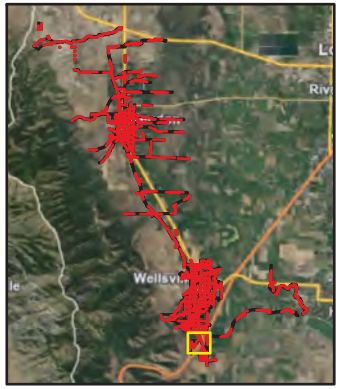


Wellsville-Mendon Watershed Plan Project Aquatic Resources Map Book

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0 0.04 0.09 Miles

N



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Map 4 of 90

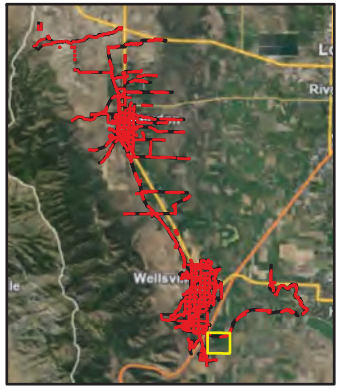


Wellsville-Mendon Watershed Plan Project Aquatic Resources Map Book

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0 0.04 0.09 Miles

N



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Map 5 of 90

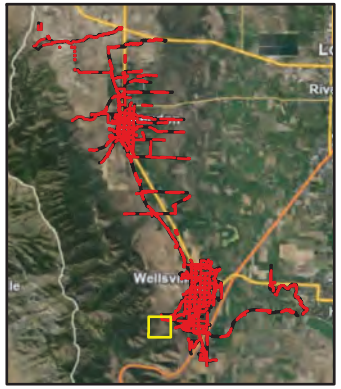


Wellsville-Mendon Watershed Plan Project Aquatic Resources Map Book

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0 0.04 0.09 Miles

N



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Map 6 of 90



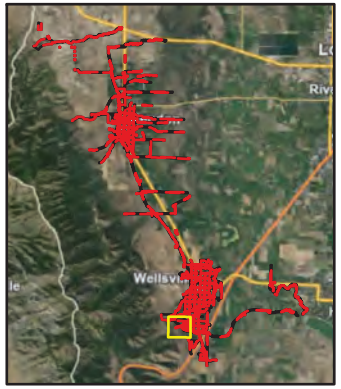
Wellsville-Mendon Watershed Plan Project Aquatic Resources Map Book

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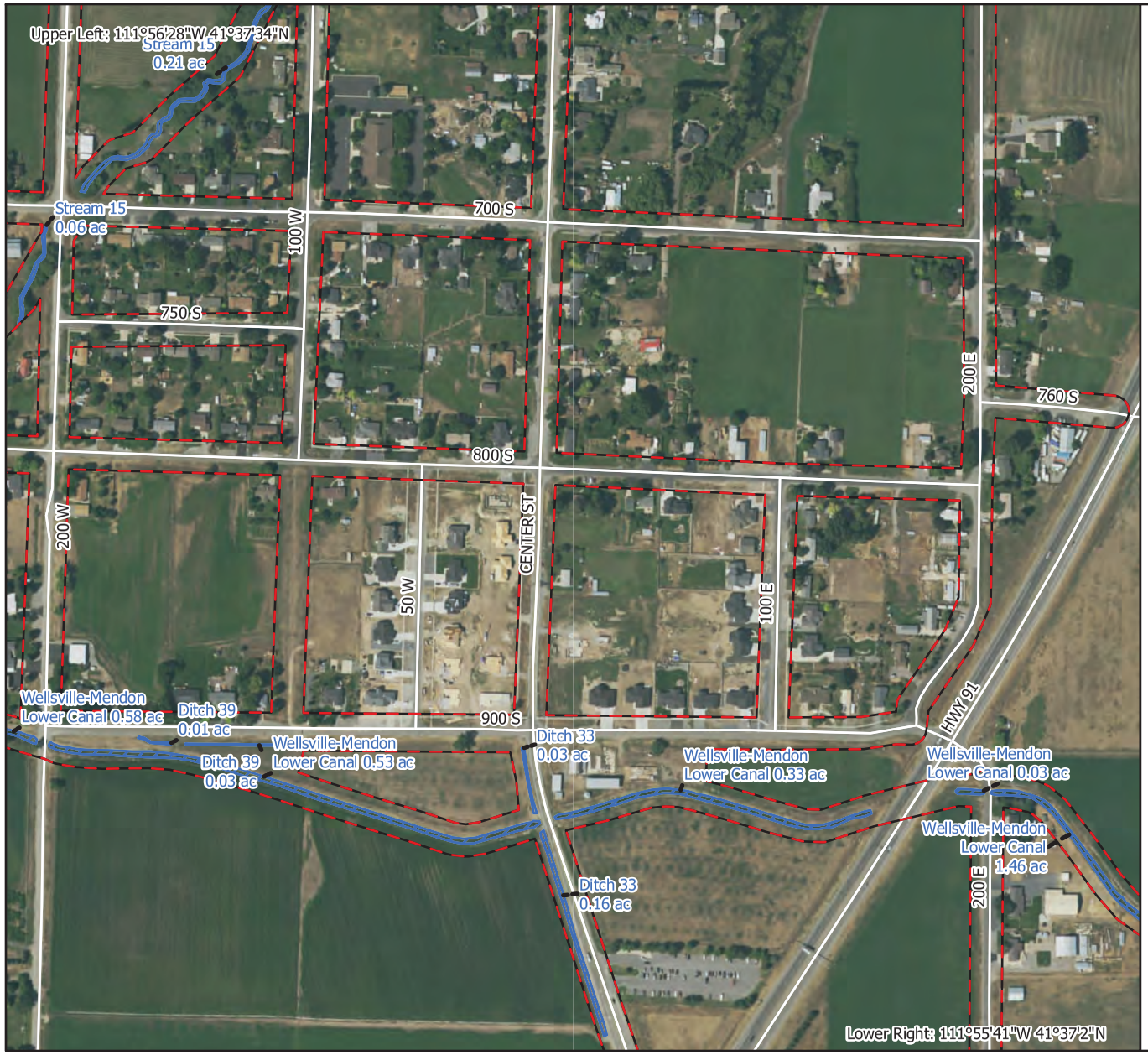
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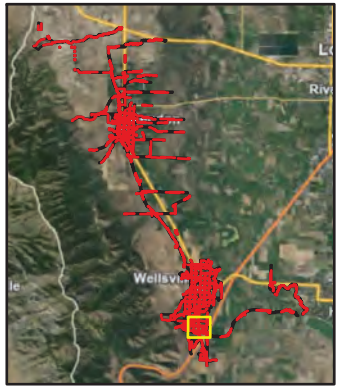


Wellsville-Mendon Watershed Plan Project Aquatic Resources Map Book

- Wetland Plots
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0 0.04 0.09 Miles

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Map 8 of 90



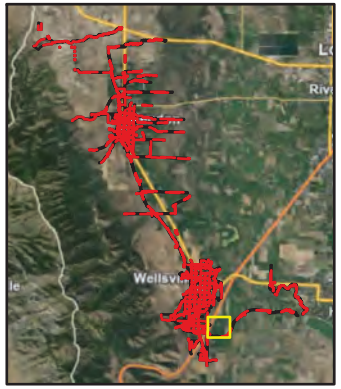
Wellsville-Mendon Watershed Plan Project Aquatic Resources Map Book

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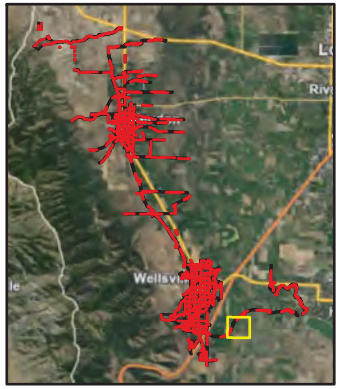


Wellsville-Mendon Watershed Plan Project Aquatic Resources Map Book

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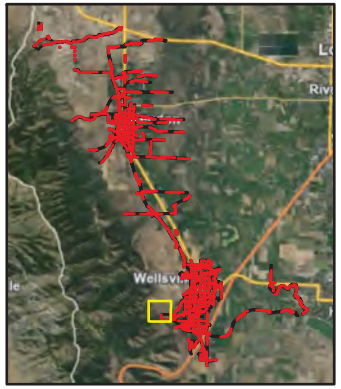


Wellsville-Mendon Watershed Plan Project Aquatic Resources Map Book

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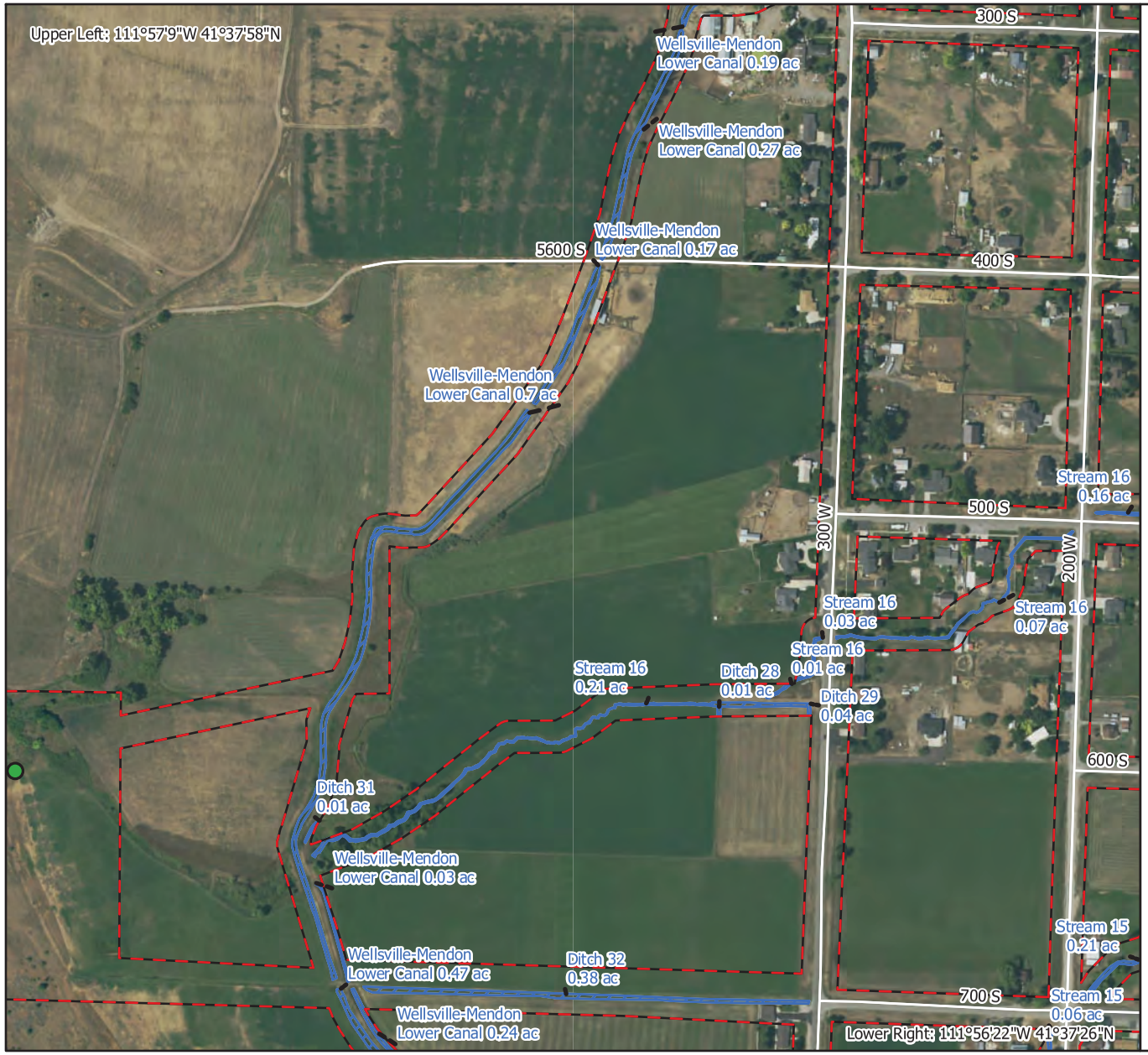
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Map 11 of 90



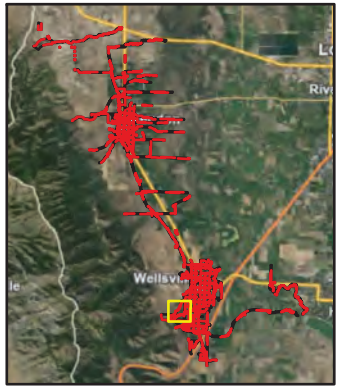
Wellsville-Mendon Watershed Plan Project Aquatic Resources Map Book

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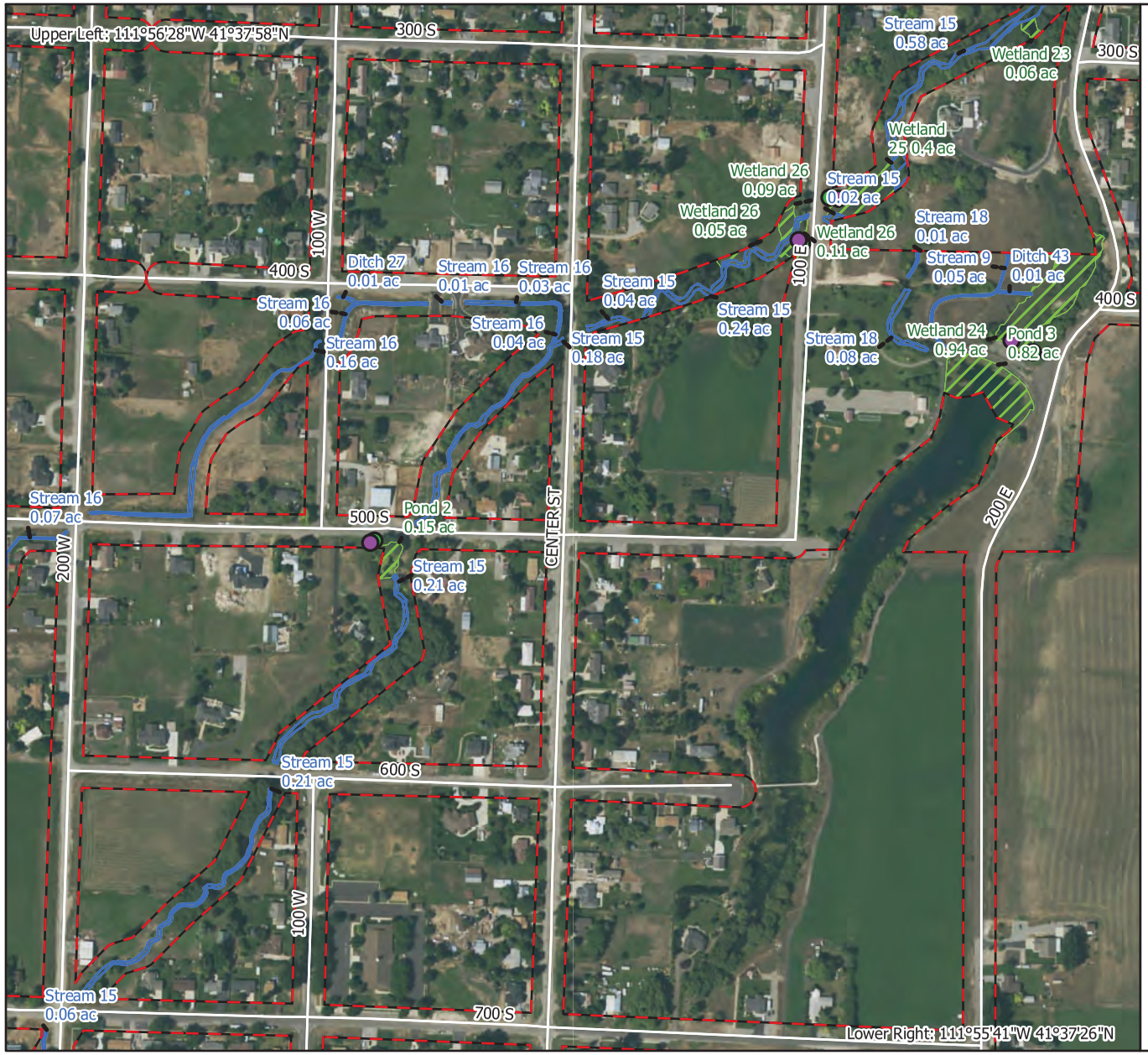
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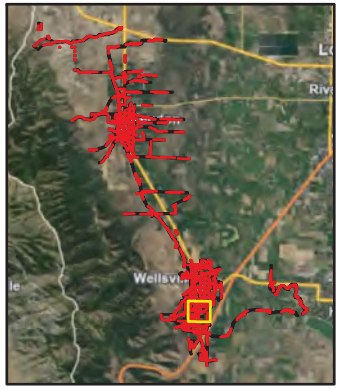
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0 0.04 0.09 Miles

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Map 13 of 90



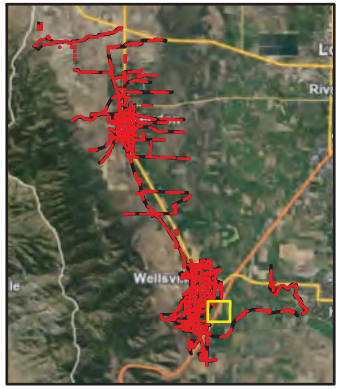
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Map 14 of 90



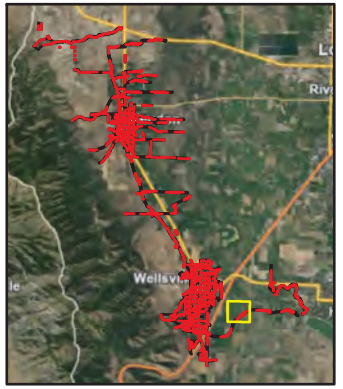
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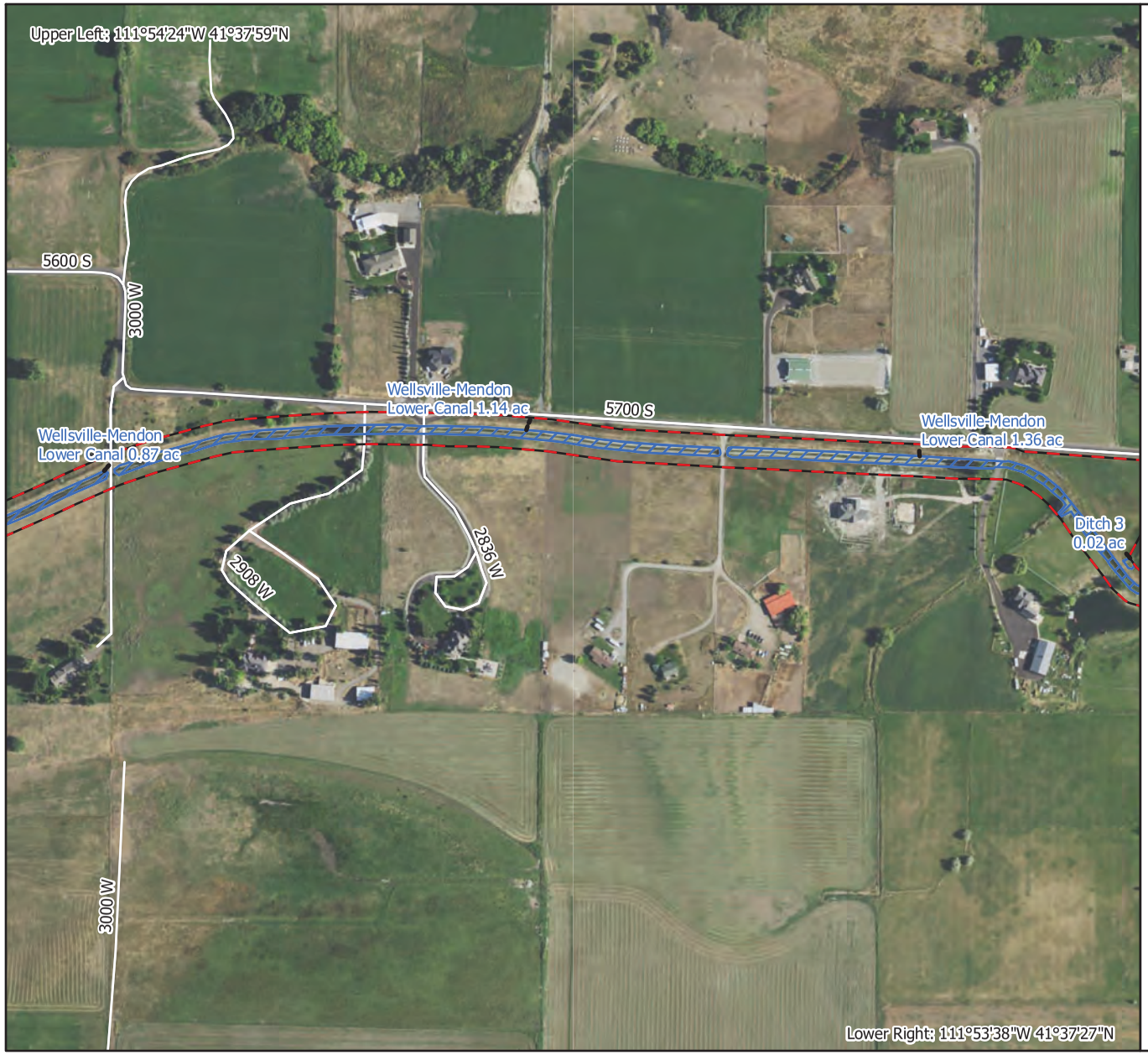
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Map 15 of 90



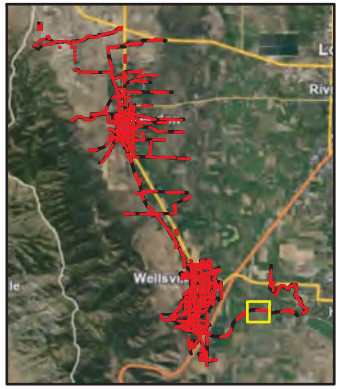
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Map 16 of 90



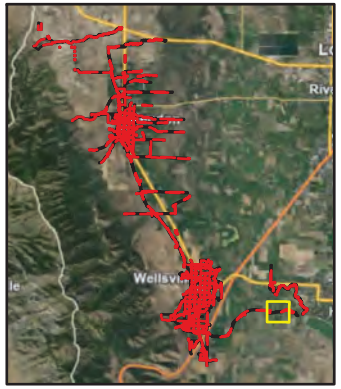
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0 0.04 0.09 Miles

N



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Map 17 of 90



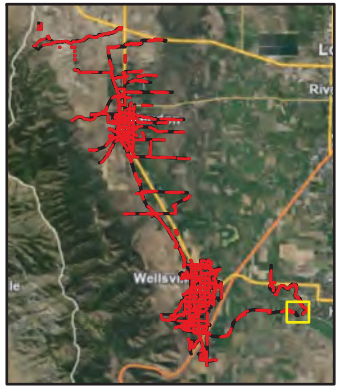
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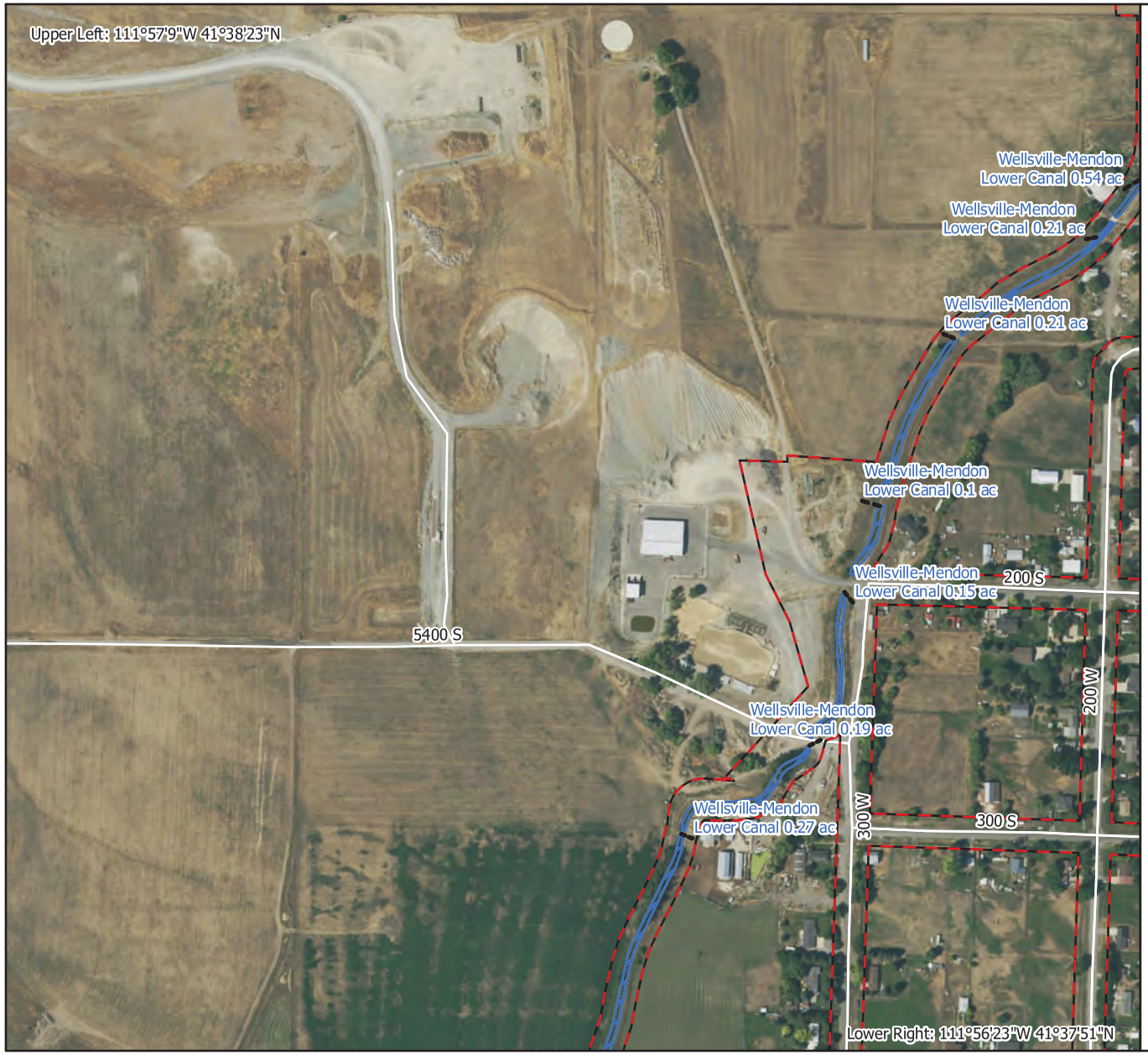
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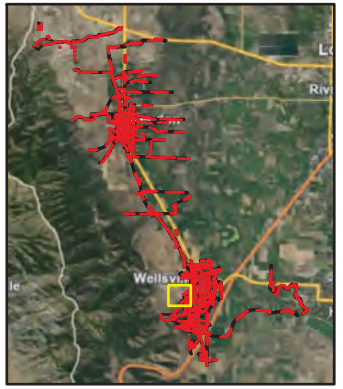
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0 0.04 0.09 Miles

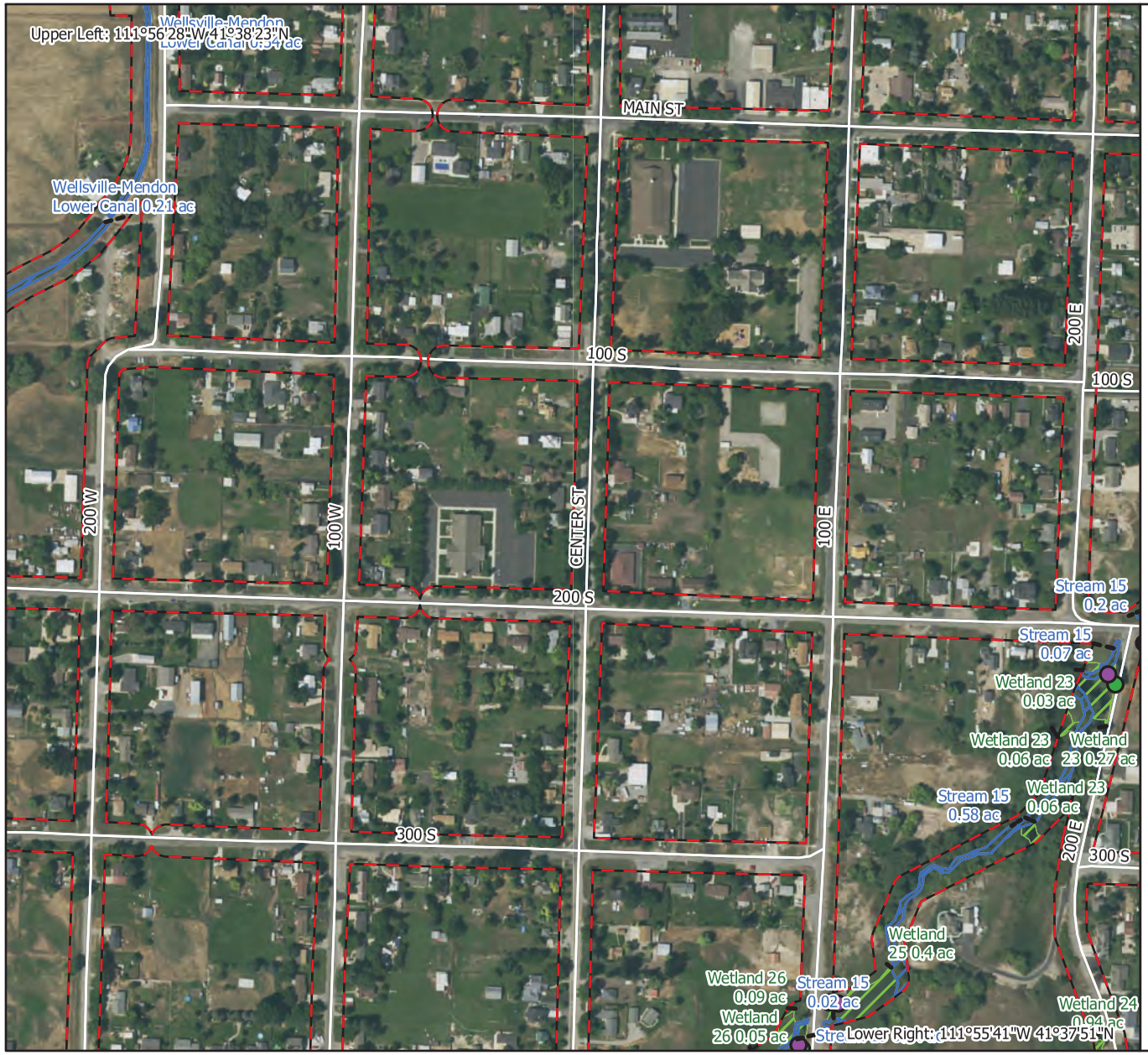
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Map 19 of 90

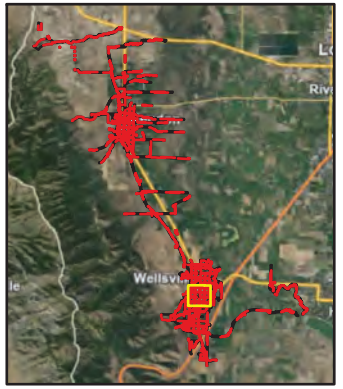


Wellsville-Mendon Watershed Plan Project Aquatic Resources Map Book

- Wetland Plots
- Upland Plots
- Study Area
- OHWM (67.59 acres)
- Wetlands (56.89 acres)

0 0.04 0.09 Miles

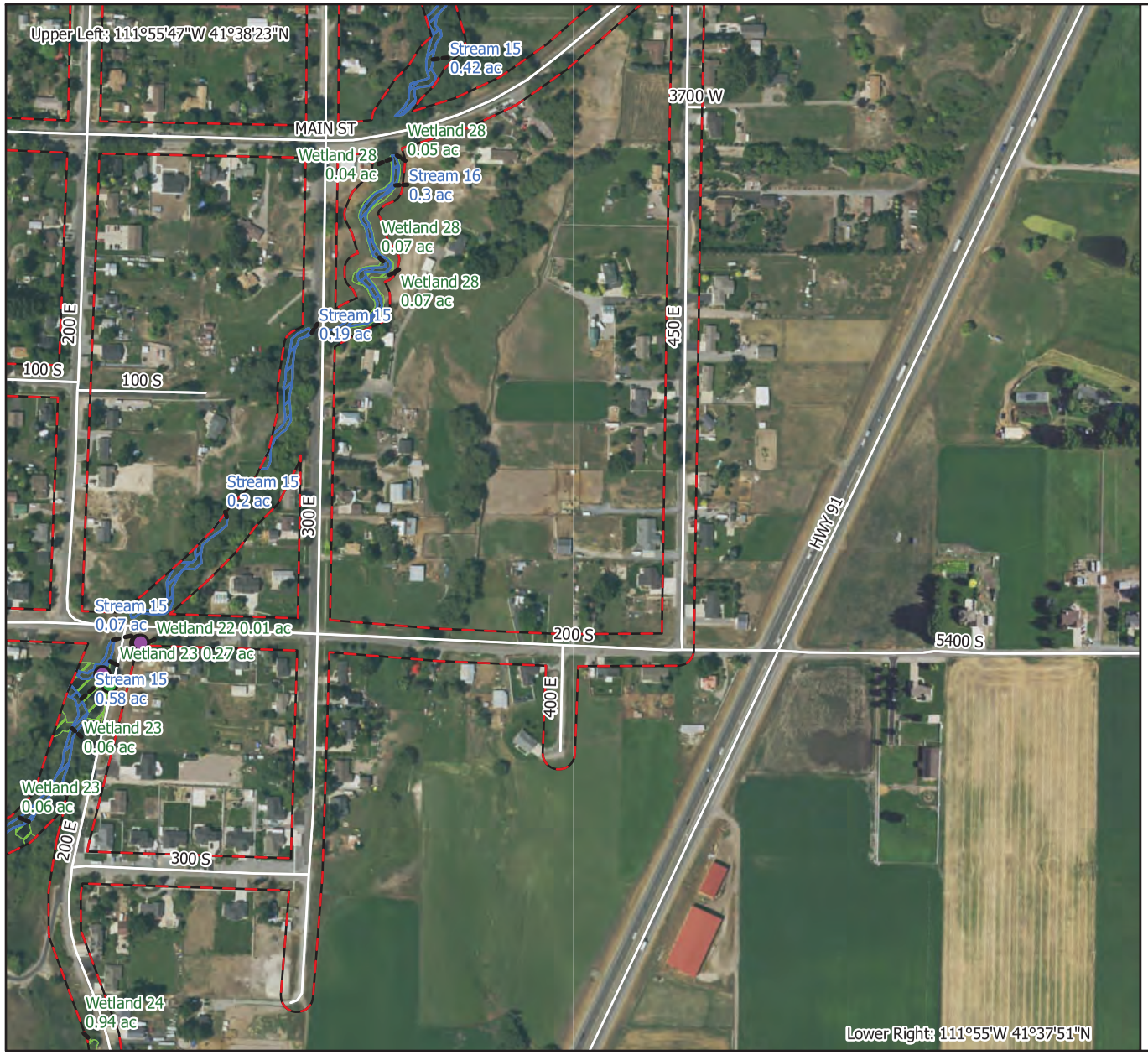
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Map 20 of 90



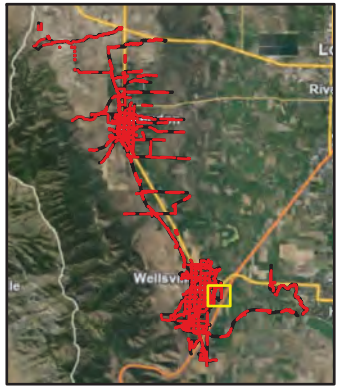
Wellsville-Mendon Watershed Plan Project Aquatic Resources Map Book

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0 0.04 0.09 Miles

N



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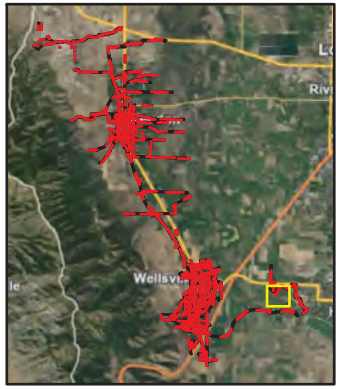
Wellsville-Mendon Watershed Plan Project Aquatic Resources Map Book

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N



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Map 22 of 90

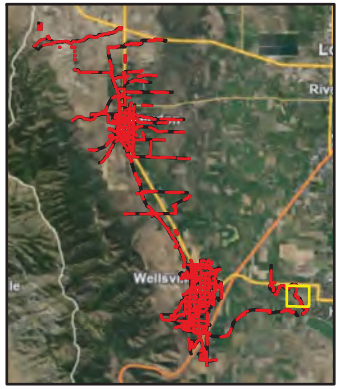


Wellsville-Mendon Watershed Plan Project Aquatic Resources Map Book

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0 0.04 0.09 Miles

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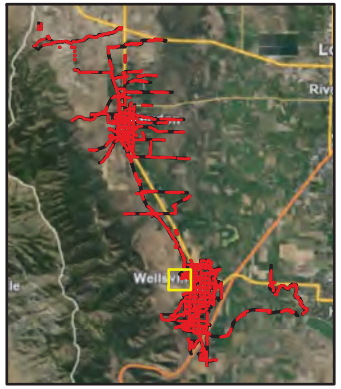
Wellsville-Mendon Watershed Plan Project Aquatic Resources Map Book

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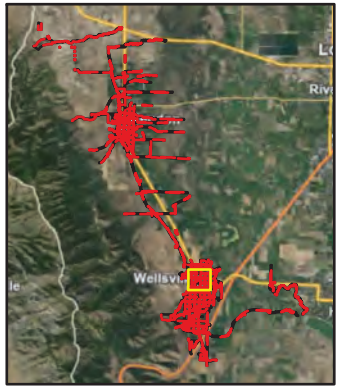
Wellsville-Mendon Watershed Plan Project Aquatic Resources Map Book

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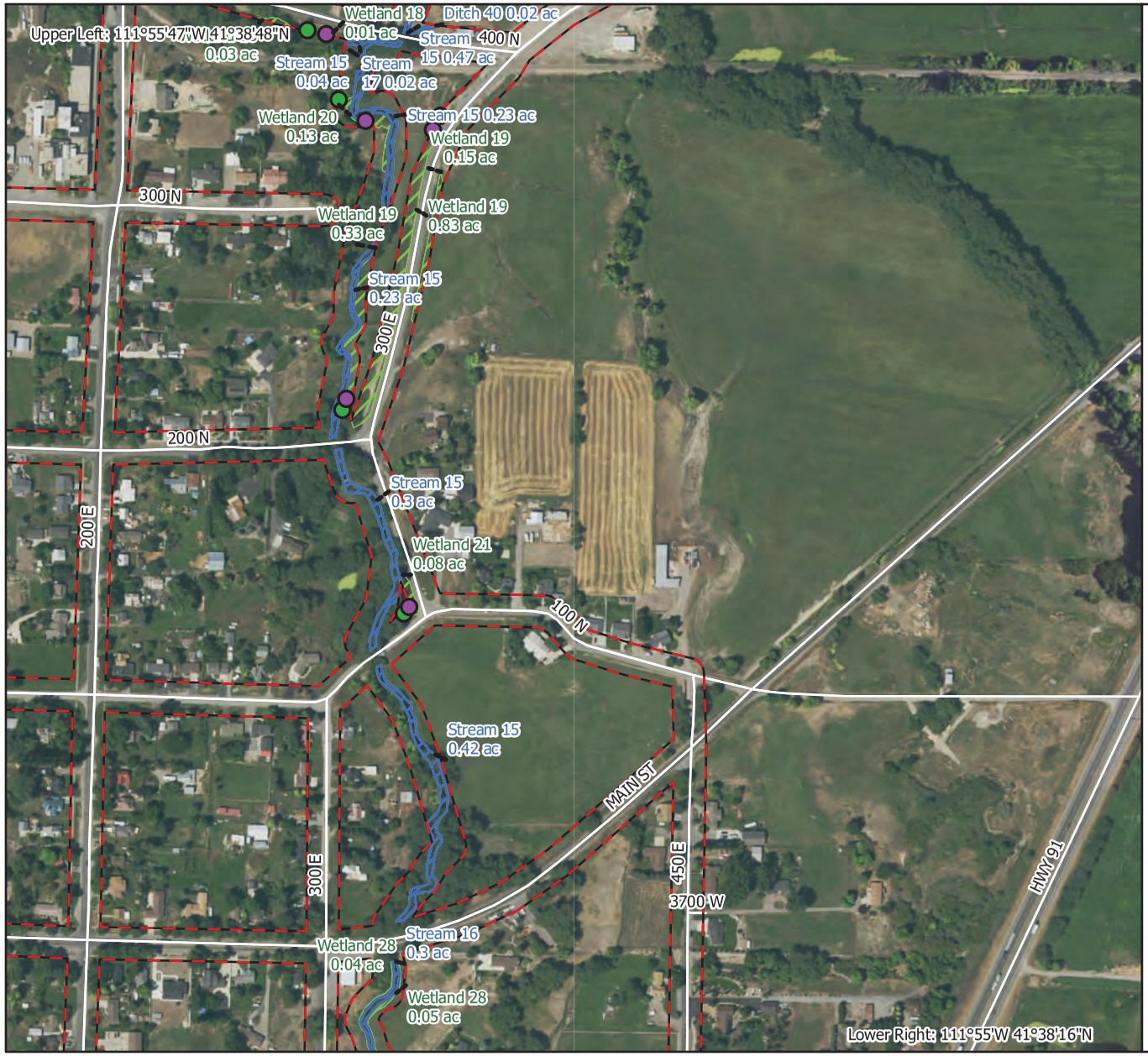
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Map 25 of 90



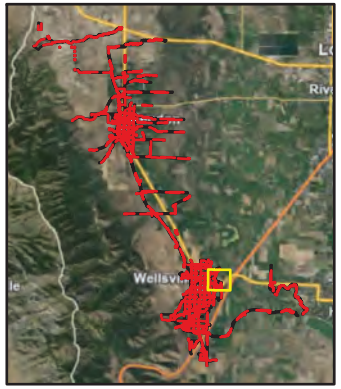
Wellsville-Mendon Watershed Plan Project Aquatic Resources Map Book

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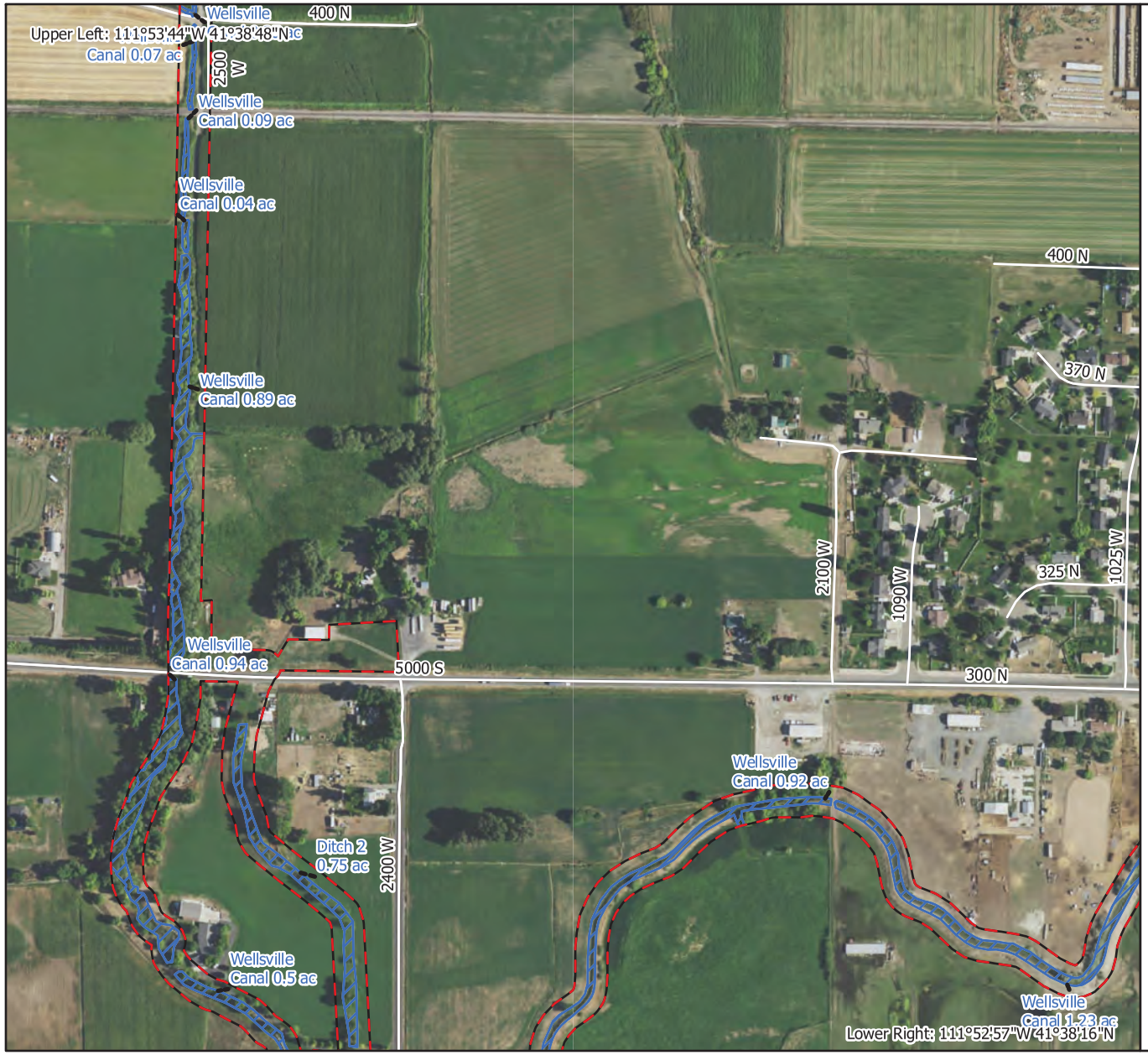
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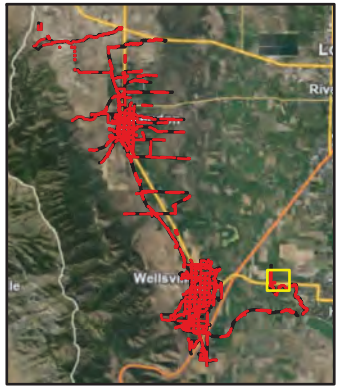


Wellsville-Mendon Watershed Plan Project Aquatic Resources Map Book

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Map 27 of 90



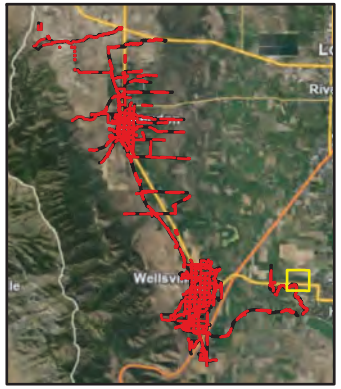
Wellsville-Mendon Watershed Plan Project Aquatic Resources Map Book

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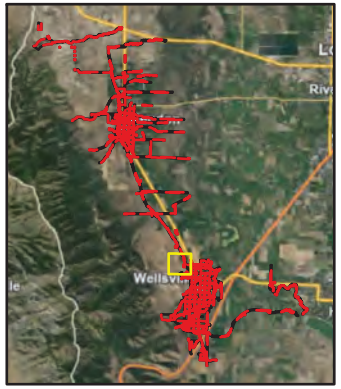
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July 15, 2024

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Map 29 of 90

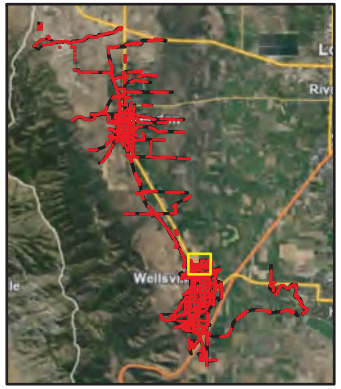


Wellsville-Mendon Watershed Plan Project Aquatic Resources Map Book

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Map 30 of 90



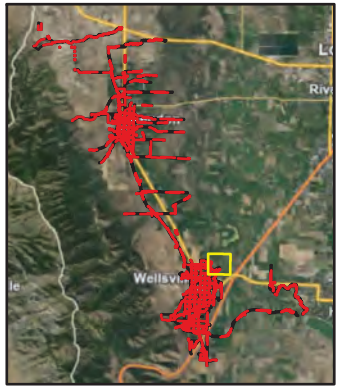
Wellsville-Mendon Watershed Plan Project Aquatic Resources Map Book

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Map 31 of 90

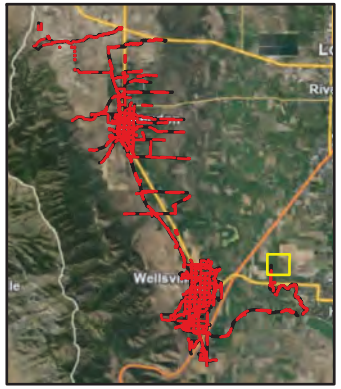


Wellsville-Mendon Watershed Plan Project Aquatic Resources Map Book

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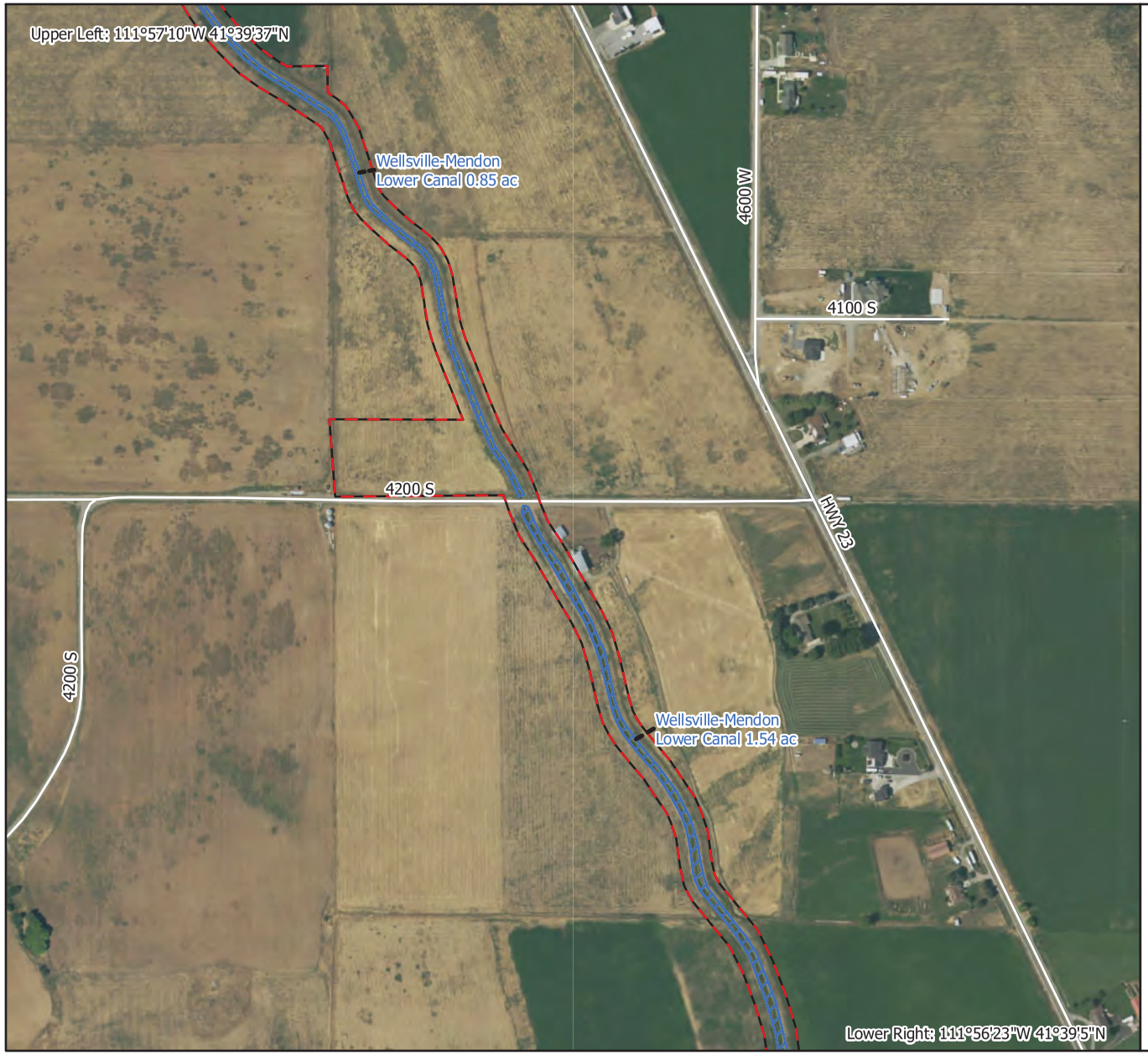
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Map 32 of 90

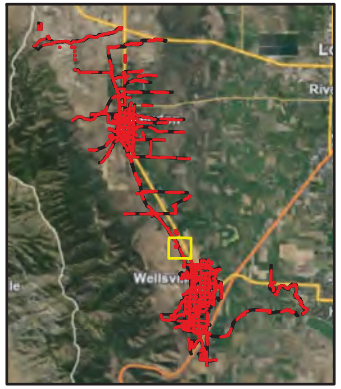


Wellsville-Mendon Watershed Plan Project Aquatic Resources Map Book

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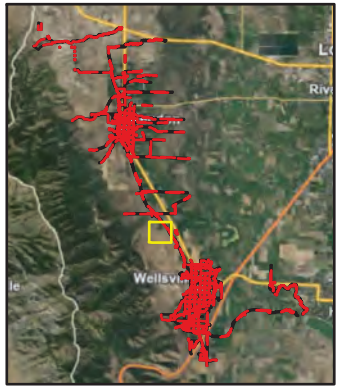


Wellsville-Mendon Watershed Plan Project Aquatic Resources Map Book

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July 15, 2024

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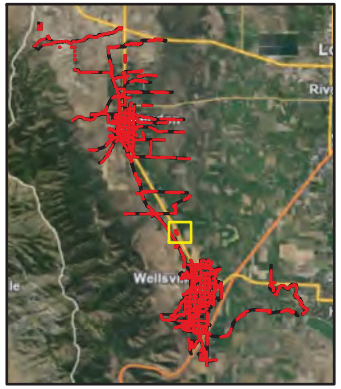


Wellsville-Mendon Watershed Plan Project Aquatic Resources Map Book

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July 15, 2024

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Map 35 of 90

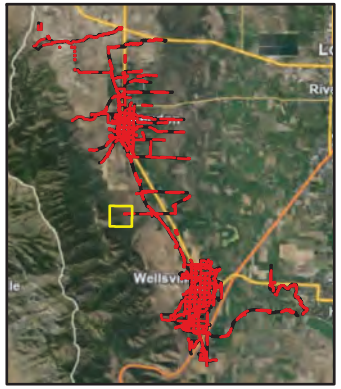


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Map 36 of 90

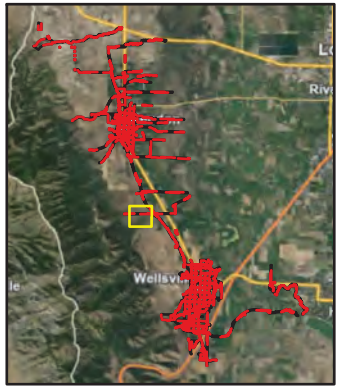


Wellsville-Mendon Watershed Plan Project Aquatic Resources Map Book

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Map 37 of 90



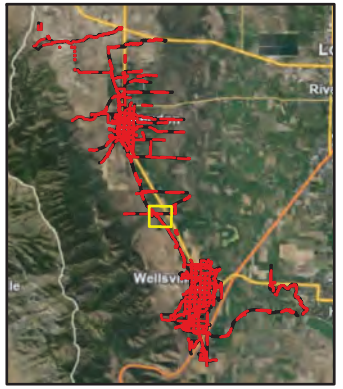
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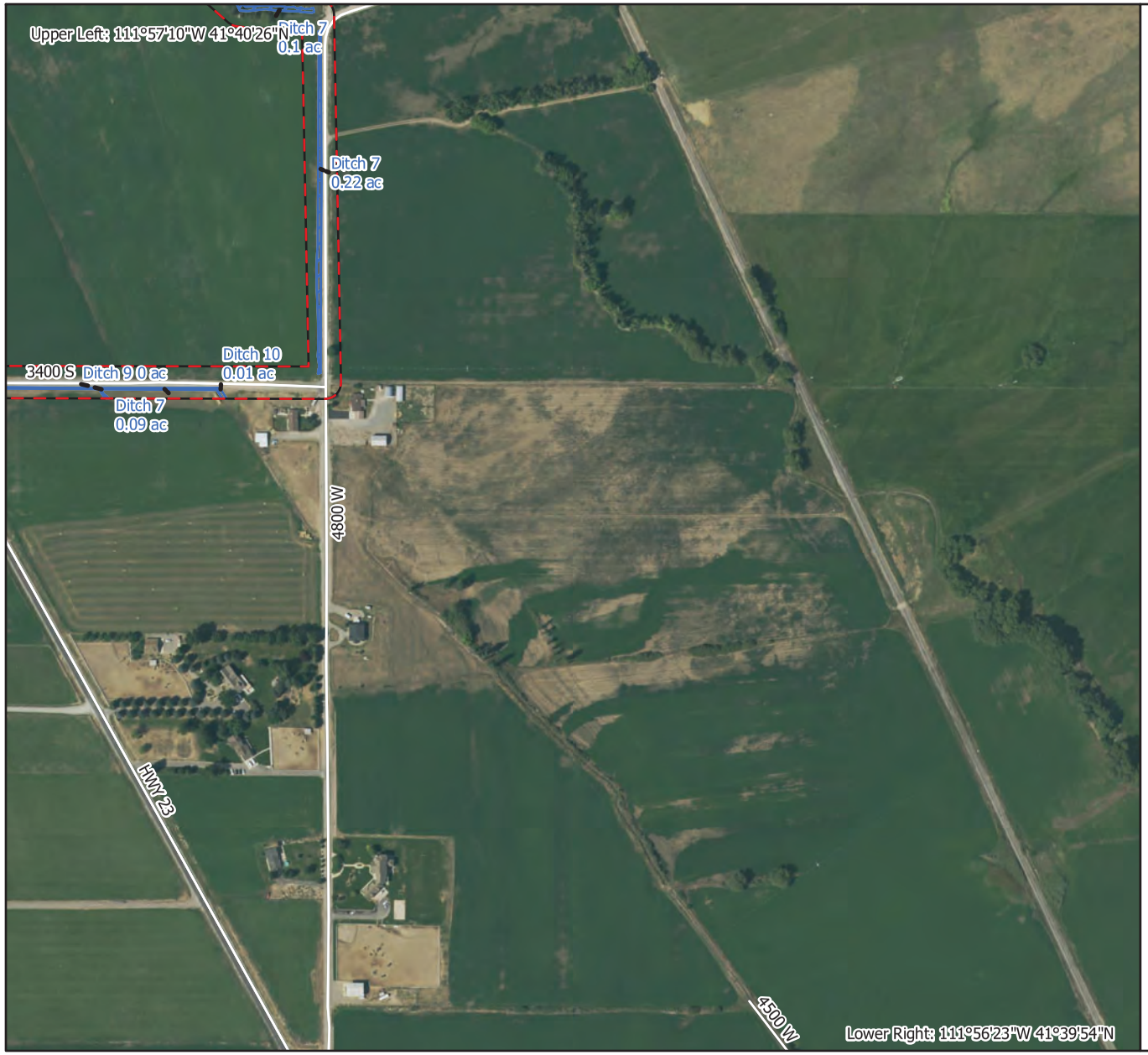
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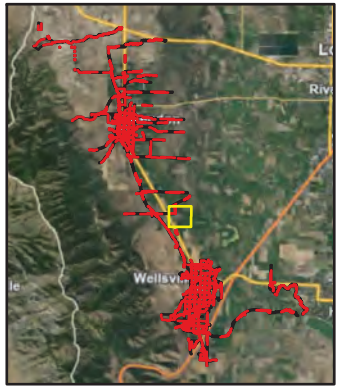


Wellsville-Mendon Watershed Plan Project Aquatic Resources Map Book

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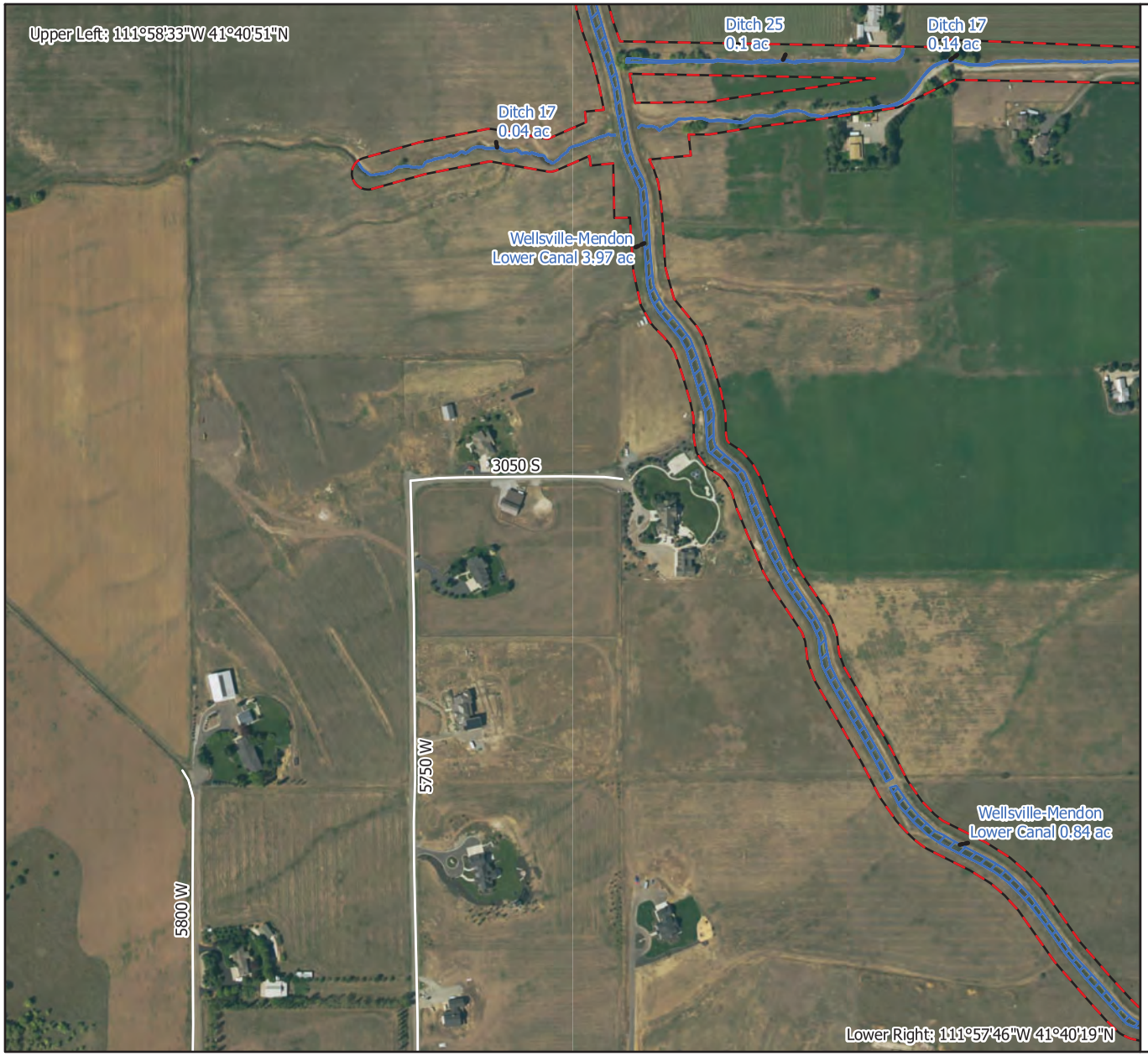
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Map 39 of 90



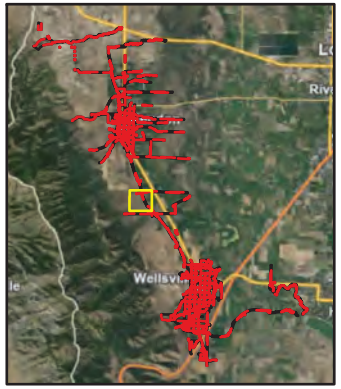
Wellsville-Mendon Watershed Plan Project Aquatic Resources Map Book

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Map 40 of 90



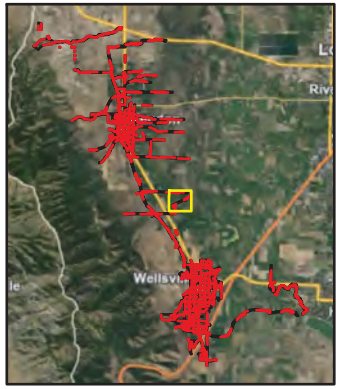
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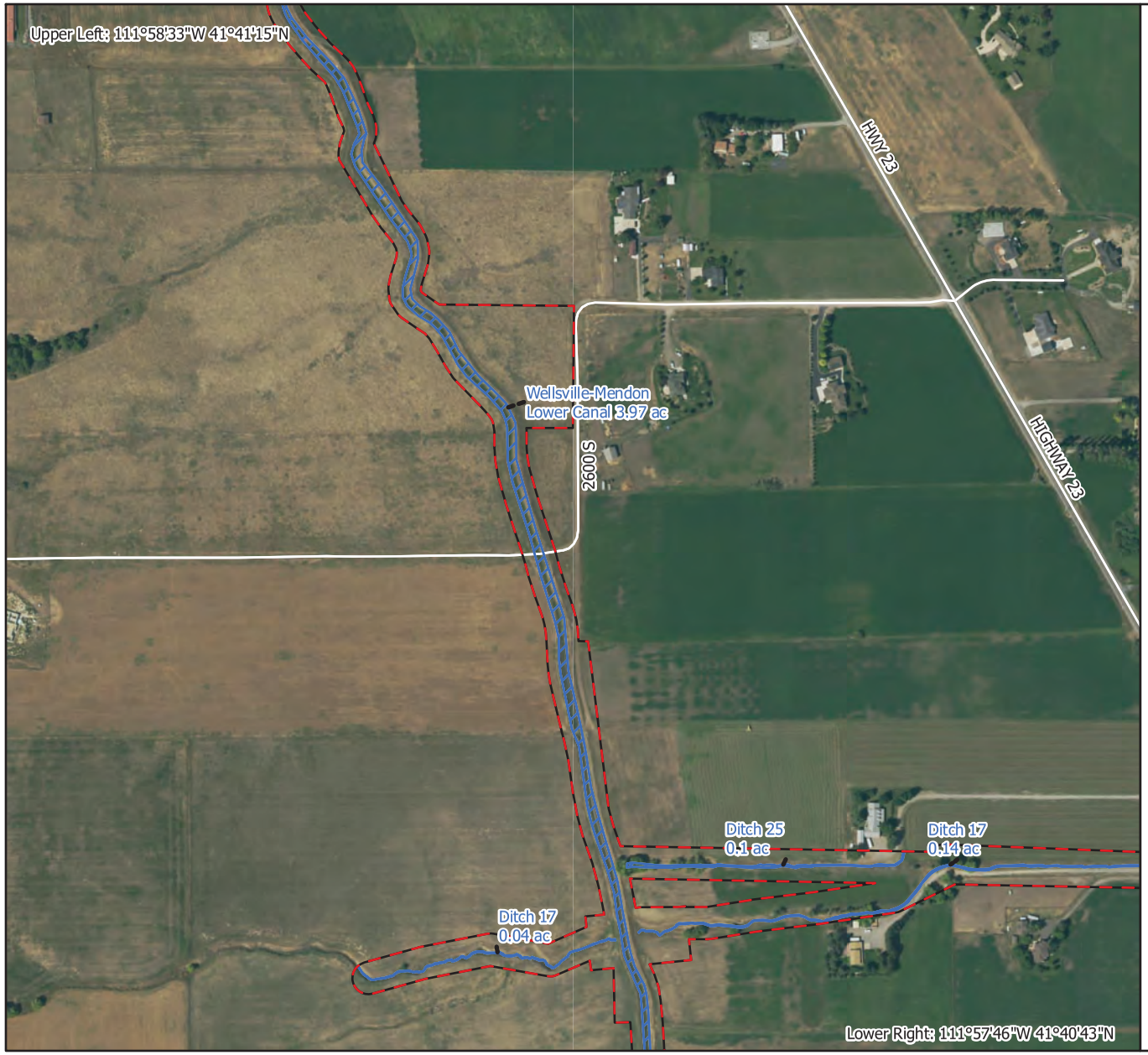
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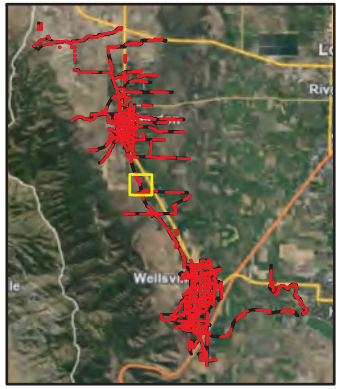


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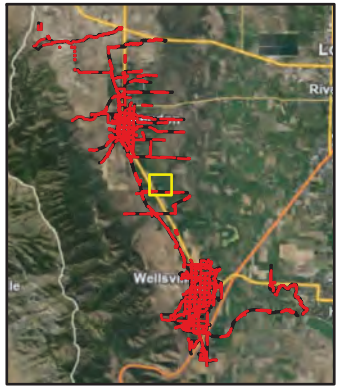
Wellsville-Mendon Watershed Plan Project Aquatic Resources Map Book

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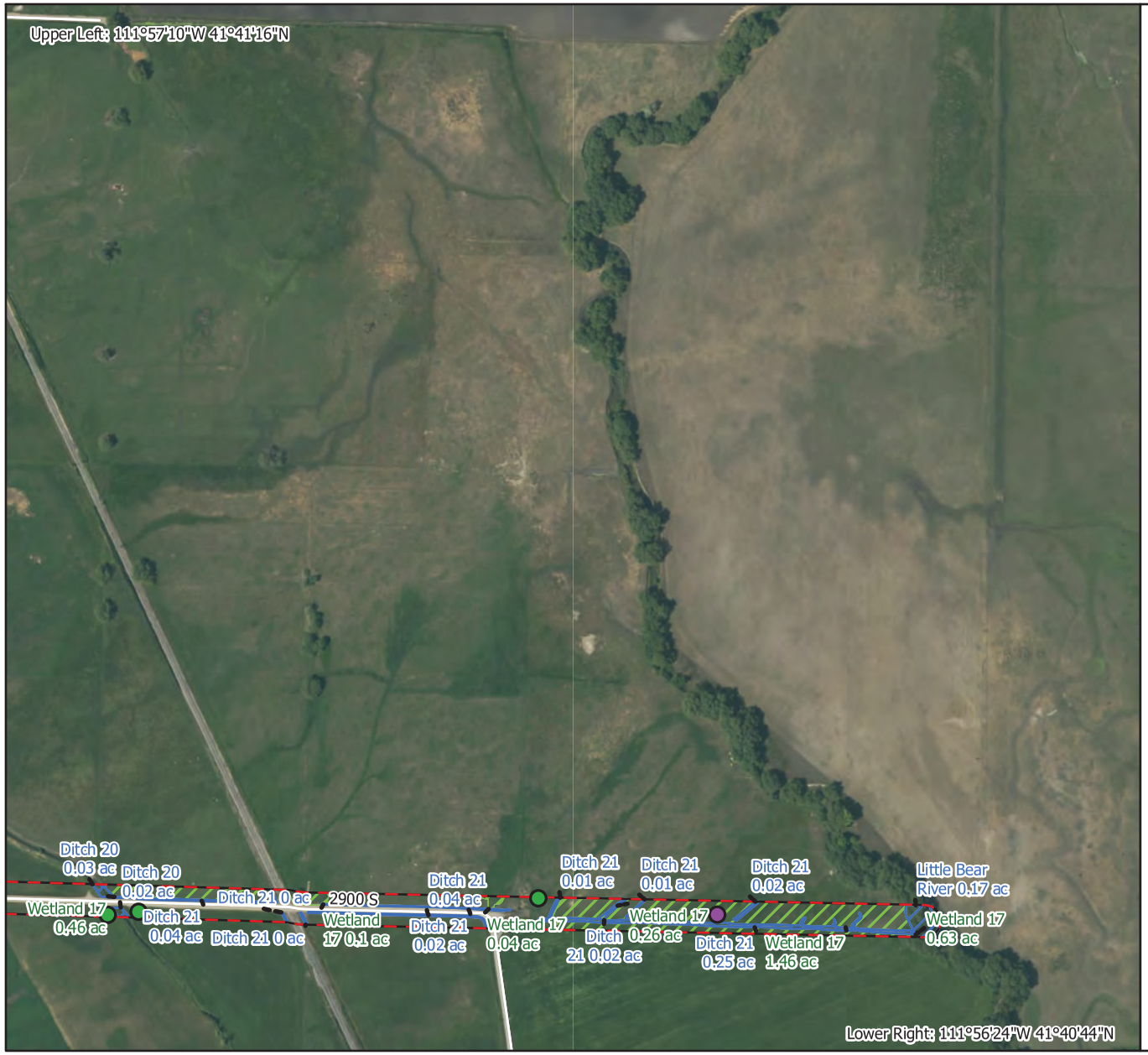
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Map 43 of 90

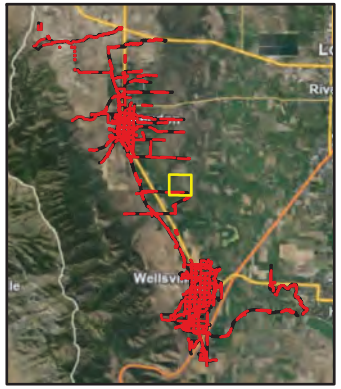


Wellsville-Mendon Watershed Plan Project Aquatic Resources Map Book

- Wetland Plots
- Upland Plots
- Study Area
- OHWM (67.59 acres)
- Wetlands (56.89 acres)

0 0.04 0.09 Miles

N



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Datum: GCS North American 1983
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Map 44 of 90

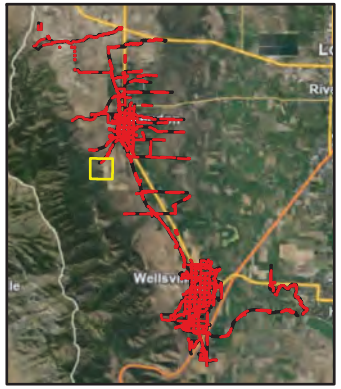


Wellsville-Mendon Watershed Plan Project Aquatic Resources Map Book

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Map 45 of 90

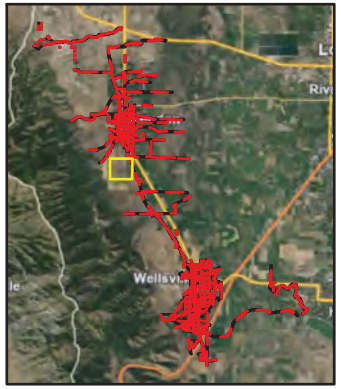


Wellsville-Mendon Watershed Plan Project Aquatic Resources Map Book

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Map 46 of 90



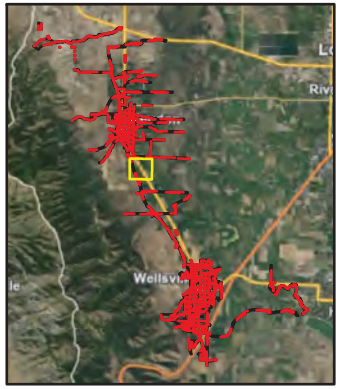
Wellsville-Mendon Watershed Plan Project Aquatic Resources Map Book

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Map 47 of 90



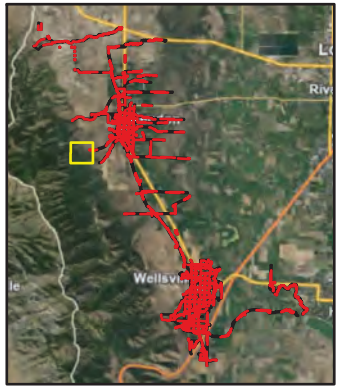
Wellsville-Mendon Watershed Plan Project Aquatic Resources Map Book

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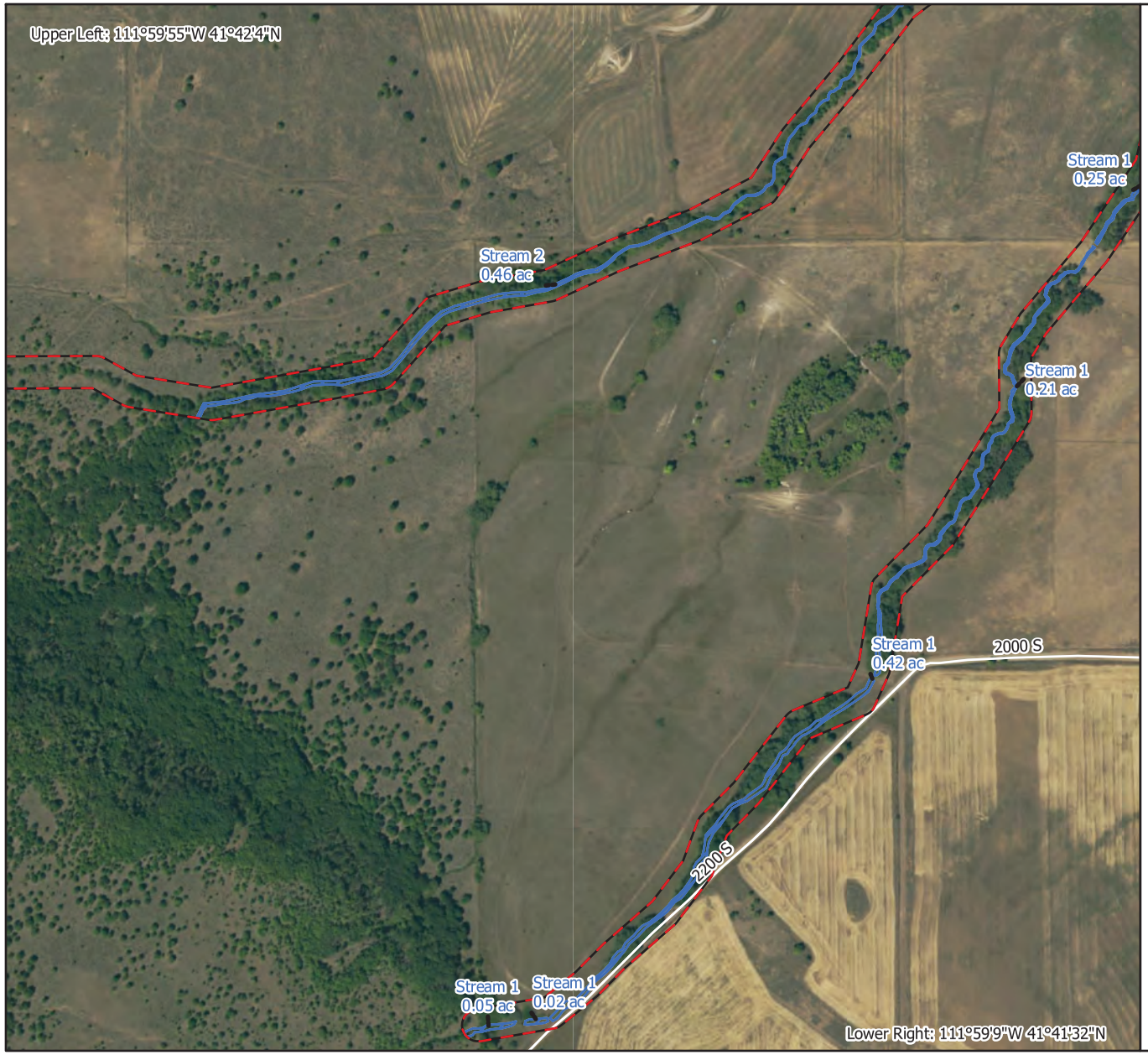
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Map 48 of 90

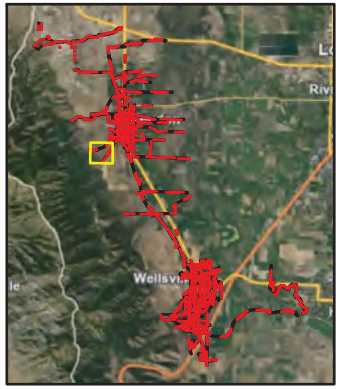


Wellsville-Mendon Watershed Plan Project Aquatic Resources Map Book

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Map 49 of 90



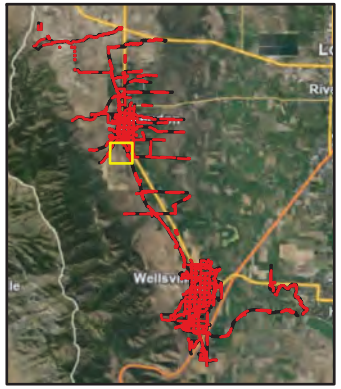
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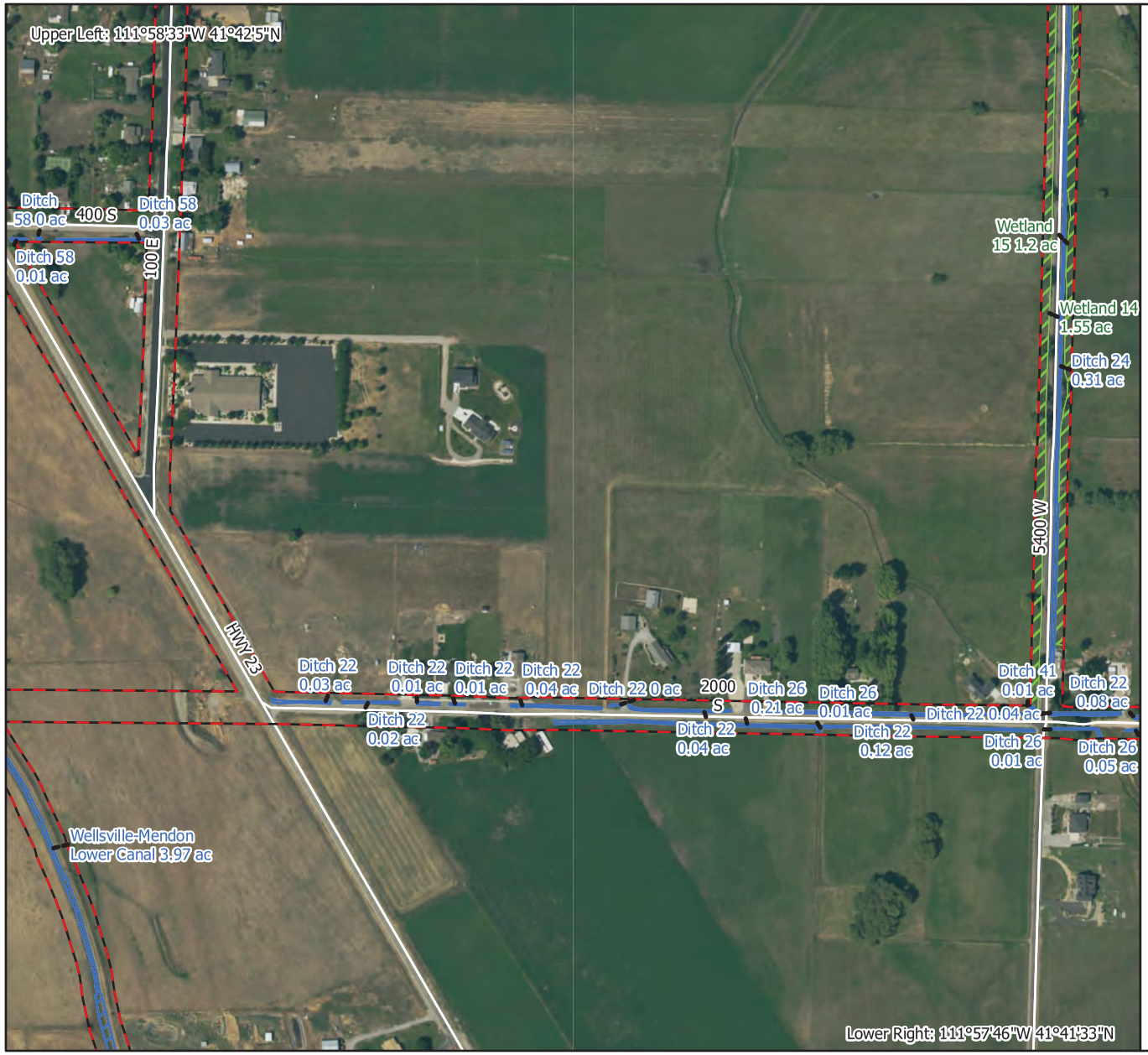
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Map 50 of 90



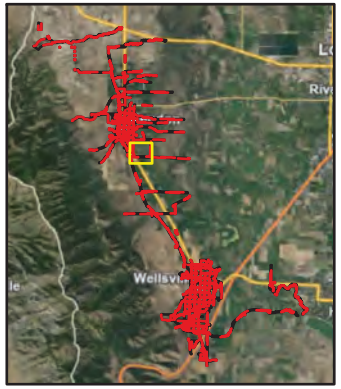
Wellsville-Mendon Watershed Plan Project Aquatic Resources Map Book

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Map 51 of 90

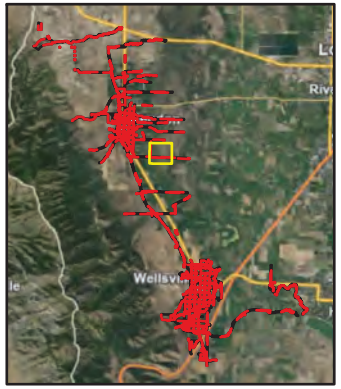


Wellsville-Mendon Watershed Plan Project Aquatic Resources Map Book

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Map 52 of 90



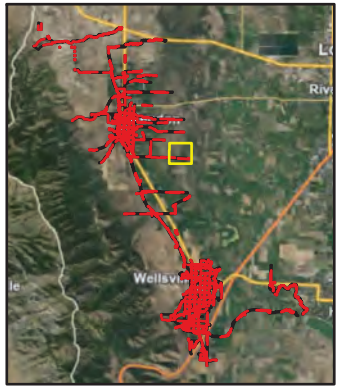
Wellsville-Mendon Watershed Plan Project Aquatic Resources Map Book

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0 0.04 0.09 Miles

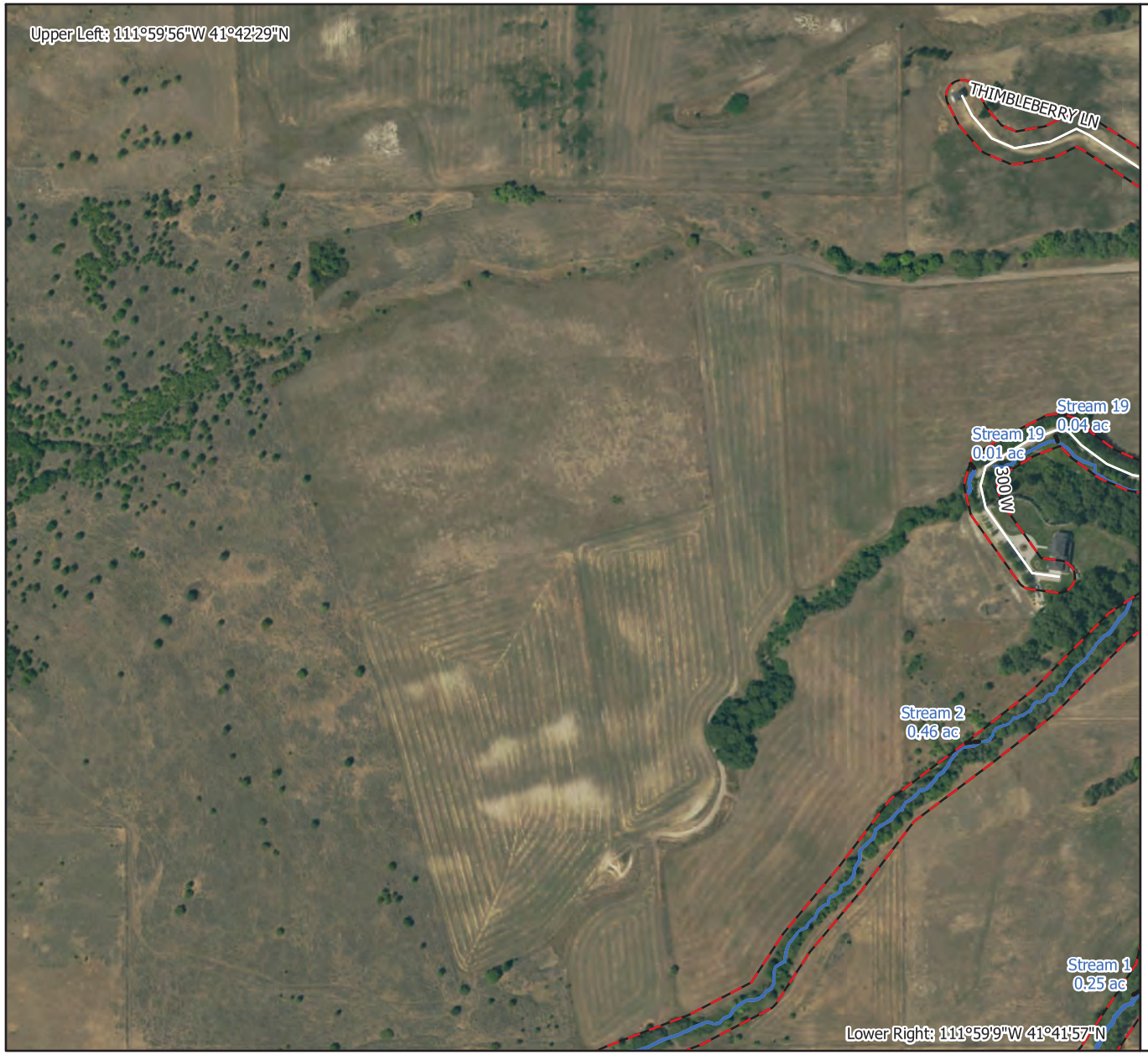
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Map 53 of 90

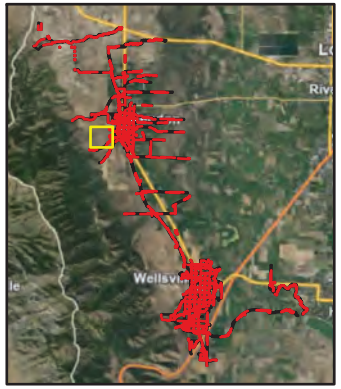


Wellsville-Mendon Watershed Plan Project Aquatic Resources Map Book

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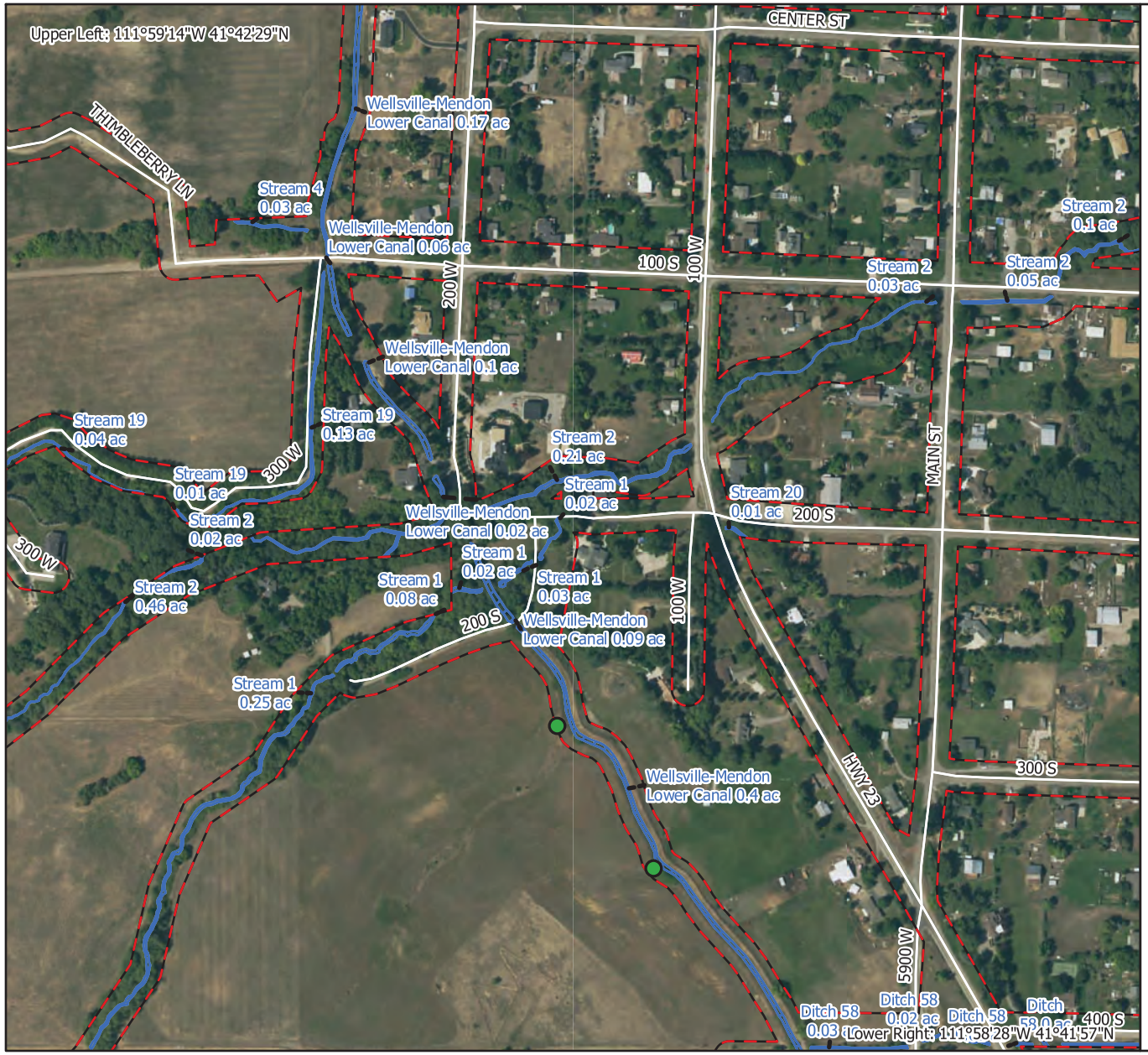
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Map 54 of 90



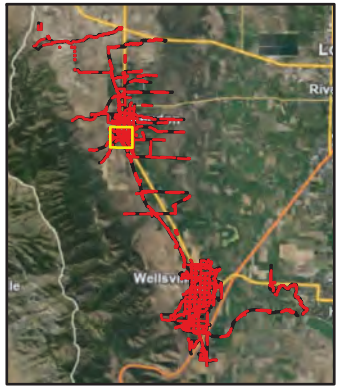
Wellsville-Mendon Watershed Plan Project Aquatic Resources Map Book

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July 15, 2024

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Map 55 of 90



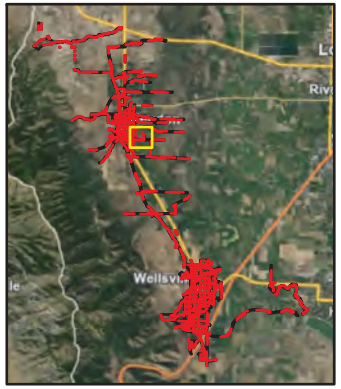
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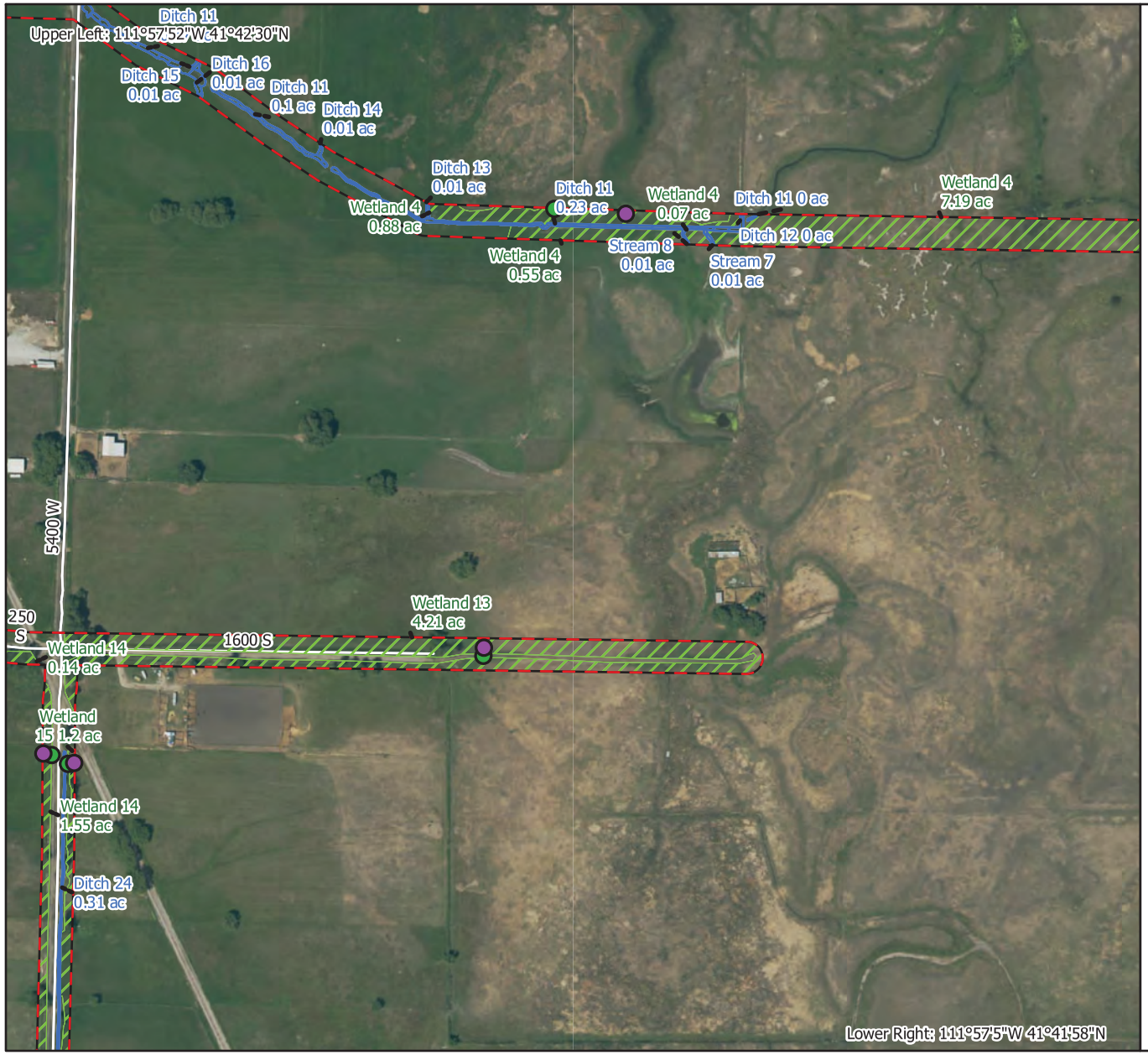
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Map 56 of 90



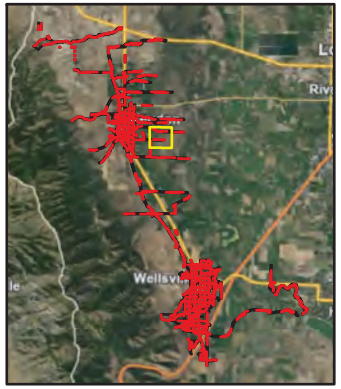
Wellsville-Mendon Watershed Plan Project Aquatic Resources Map Book

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Map 57 of 90



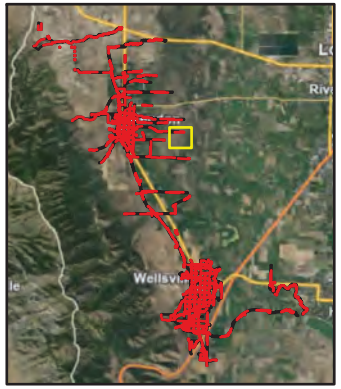
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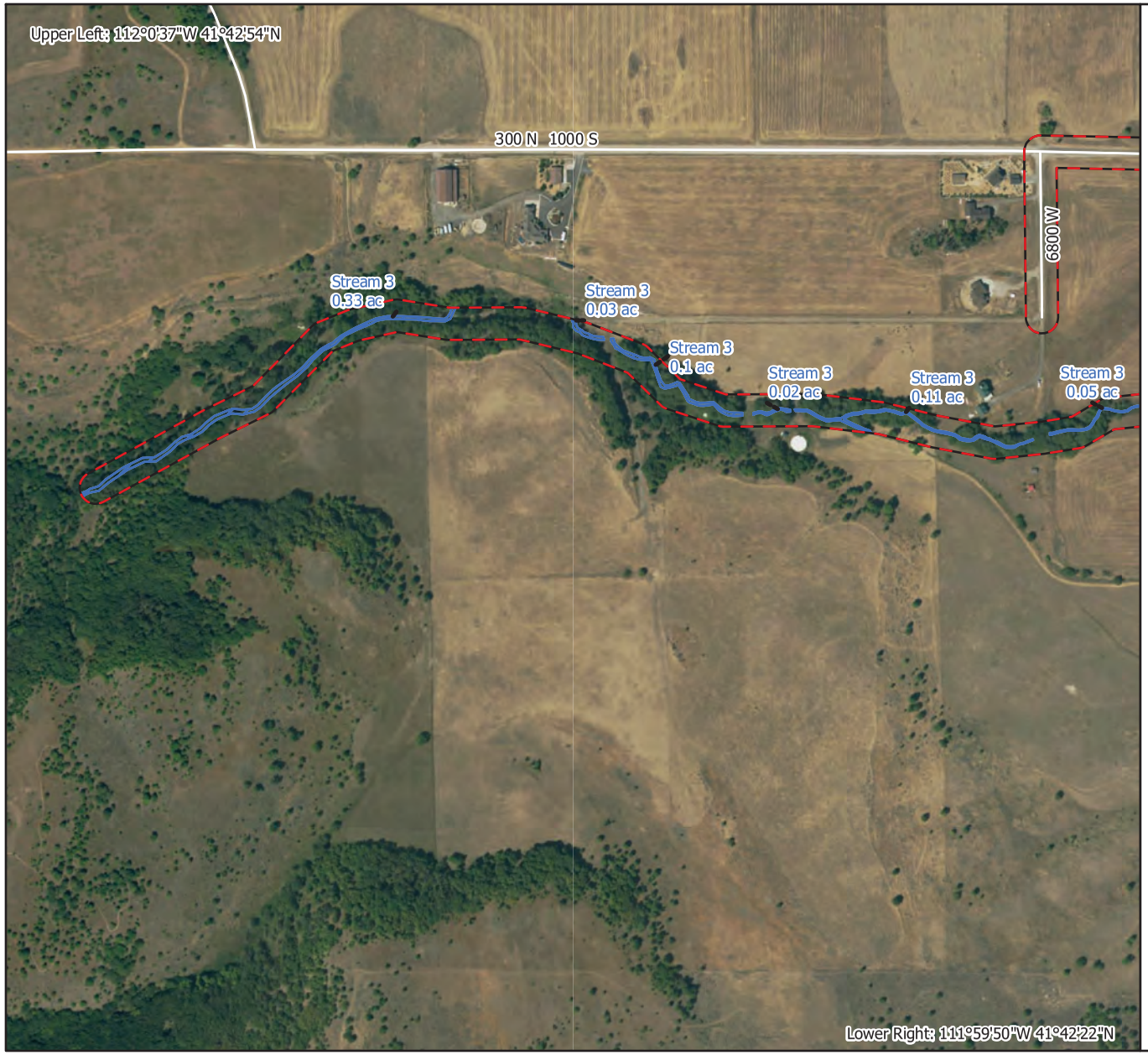
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Map 58 of 90

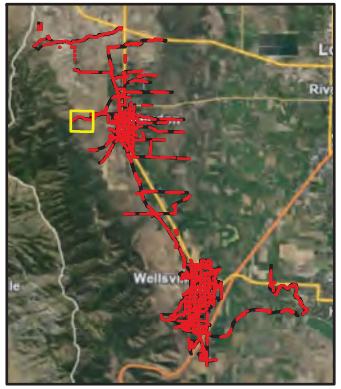


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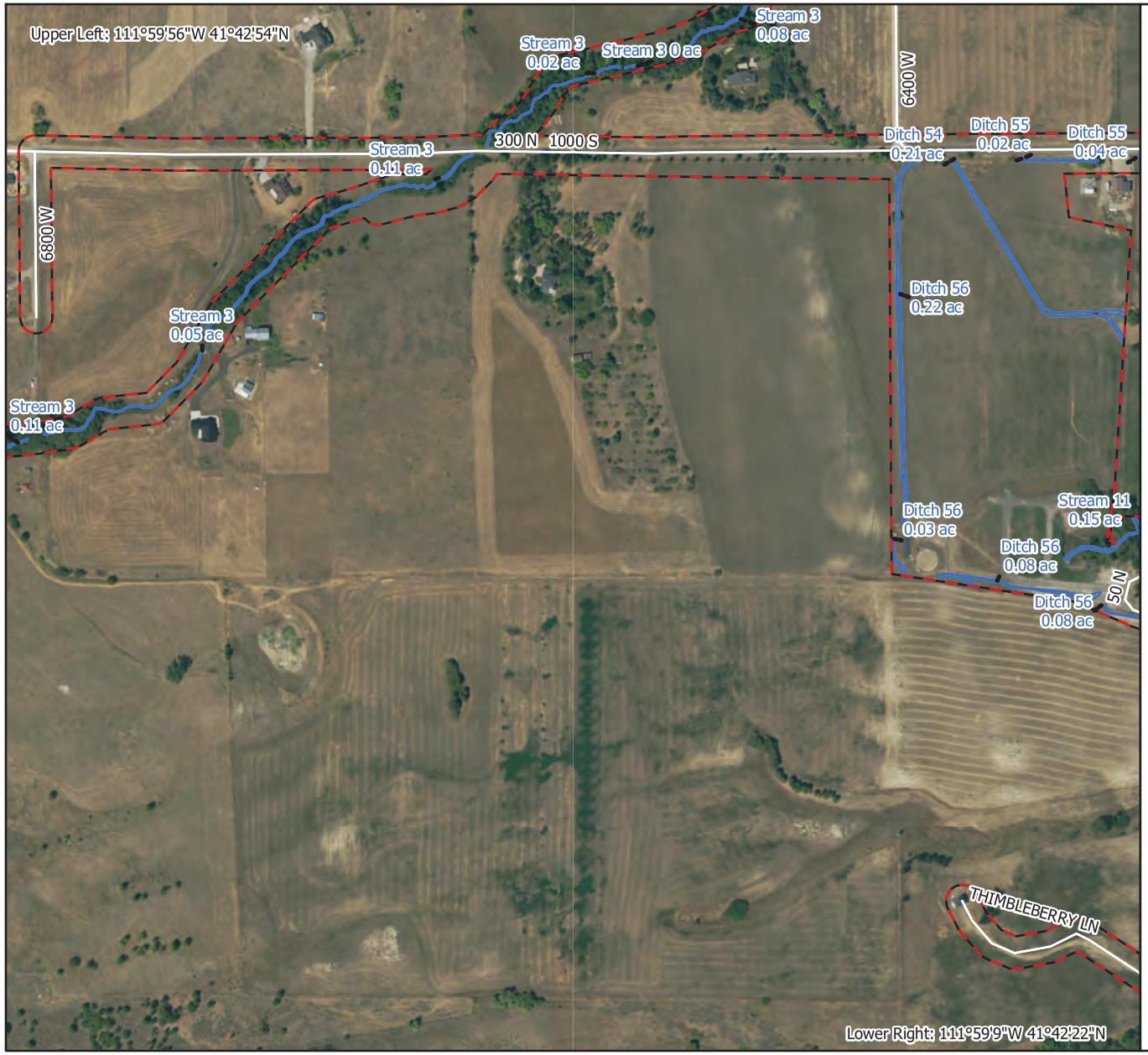
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Map 59 of 90

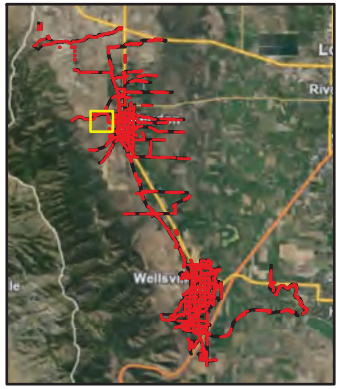


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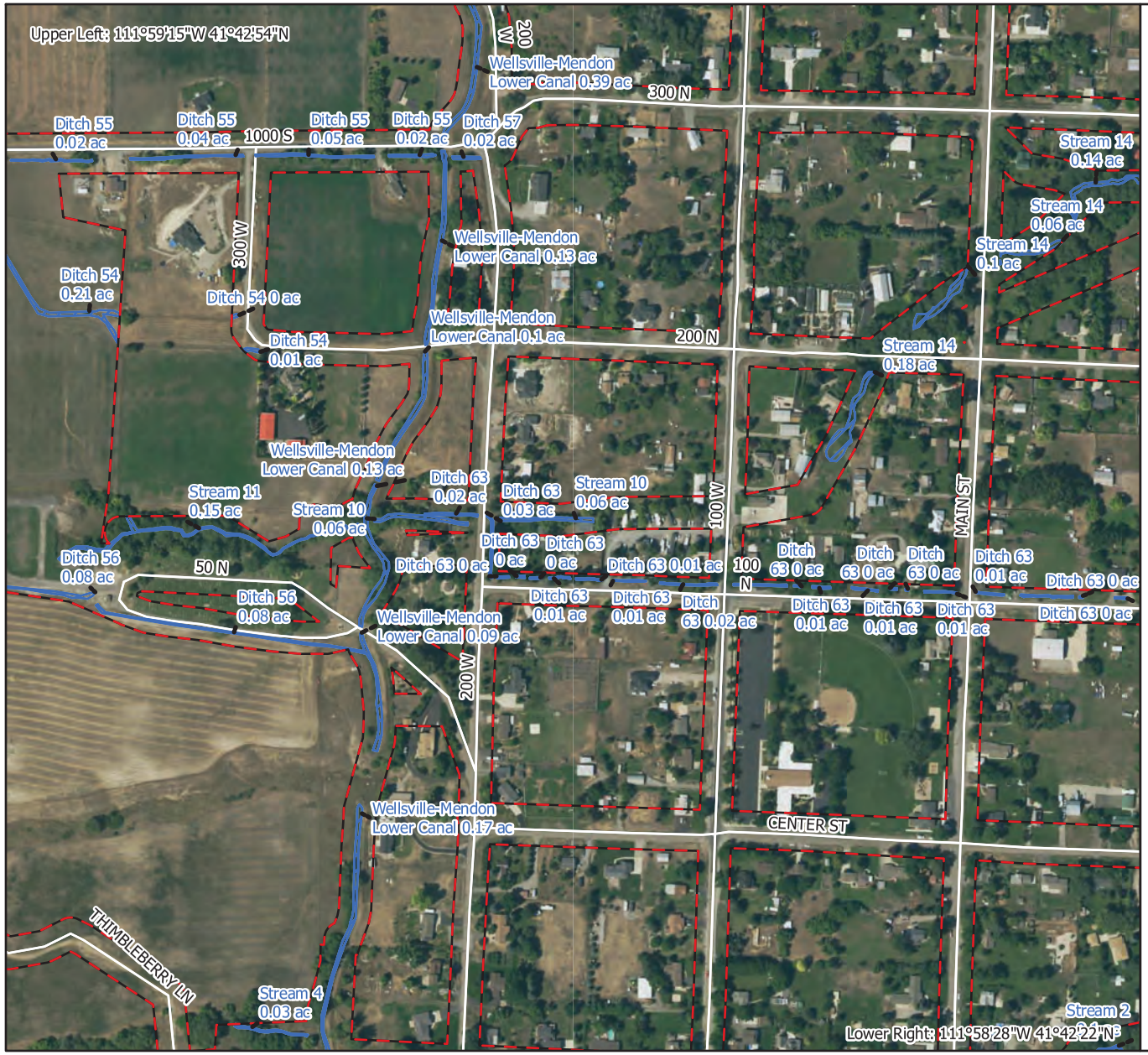
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Map 60 of 90

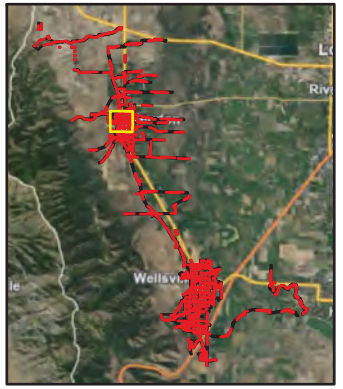


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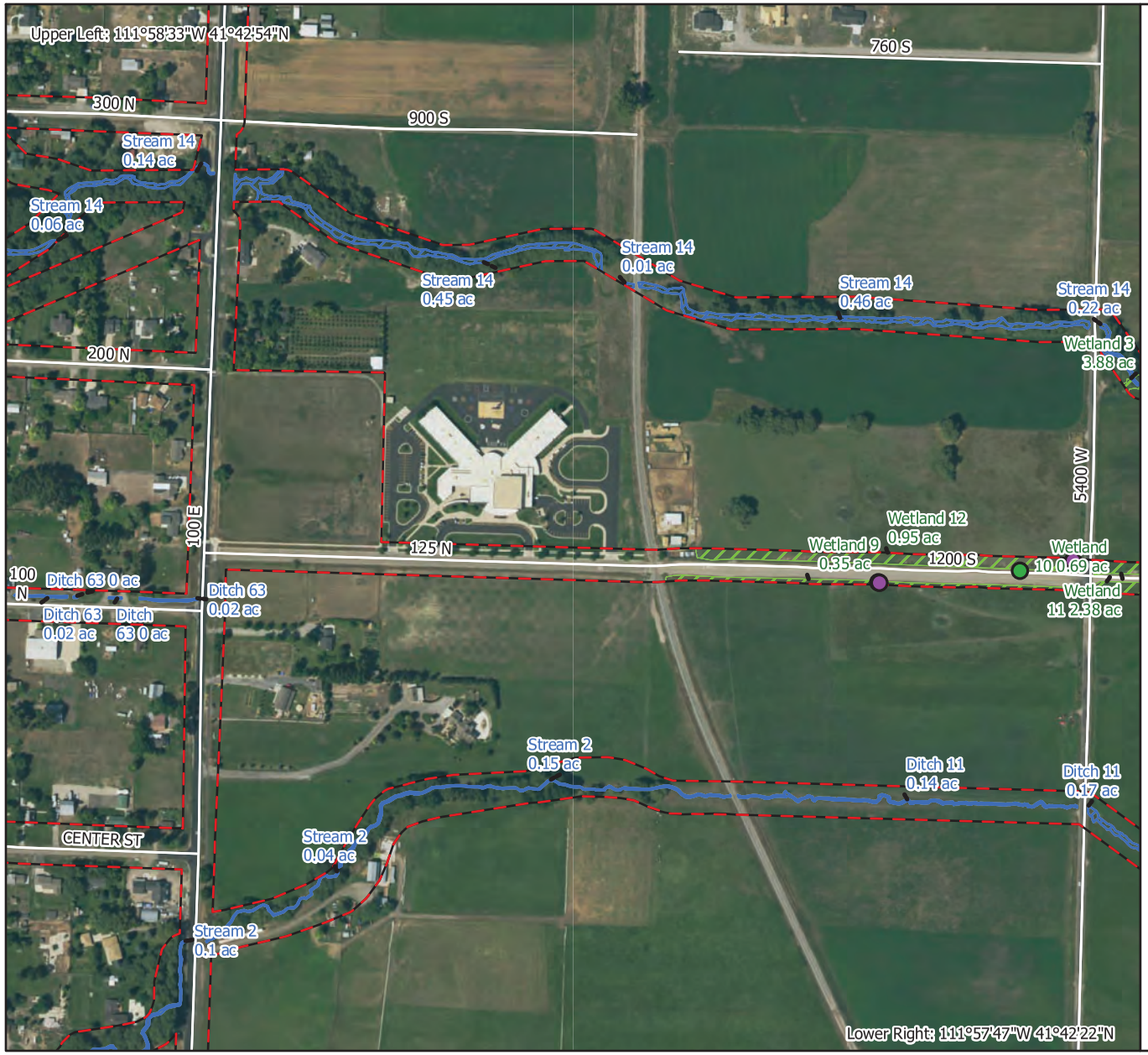
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Map 61 of 90



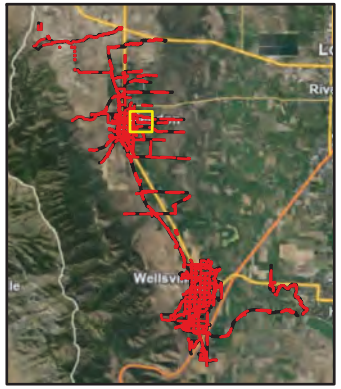
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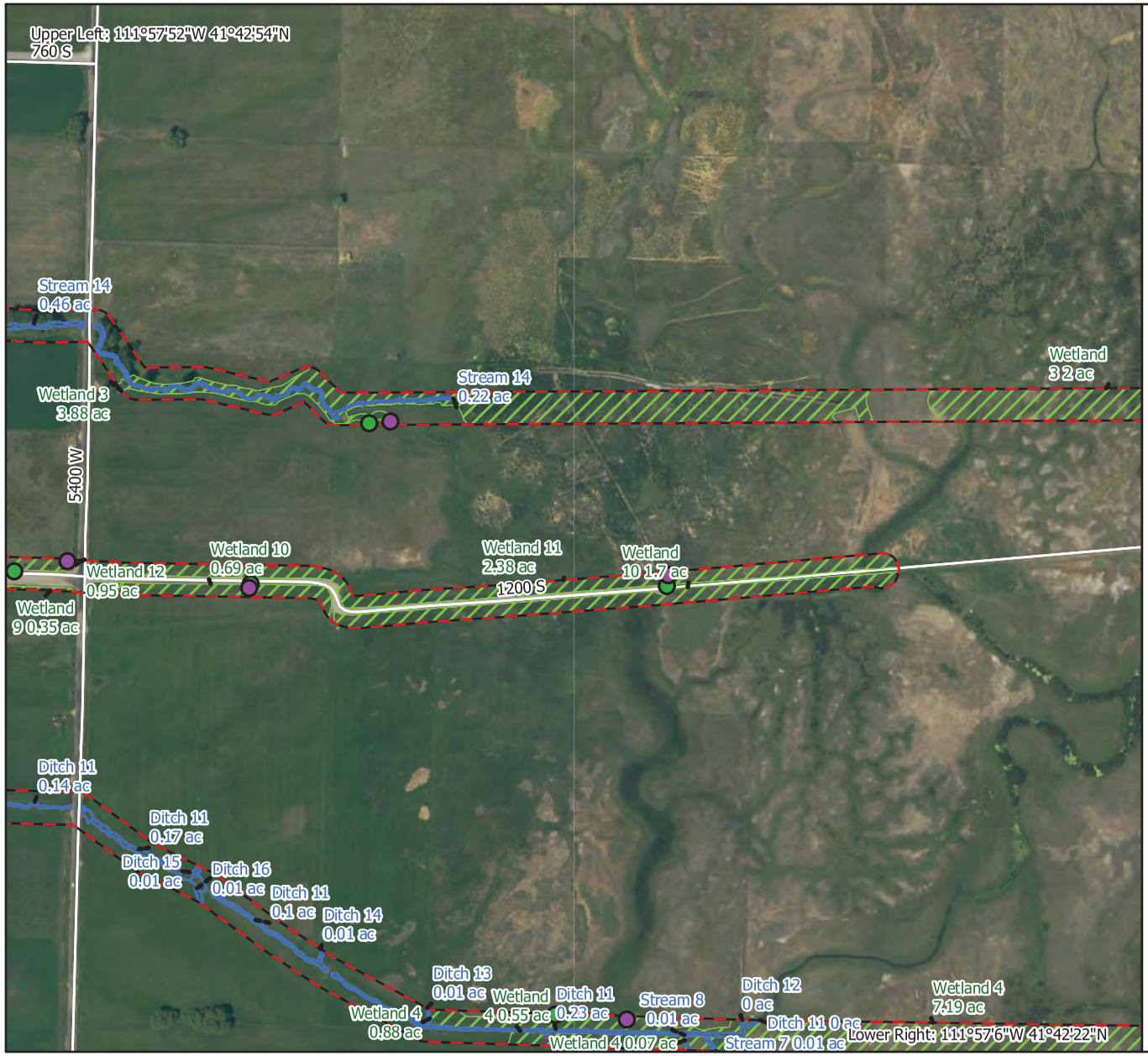
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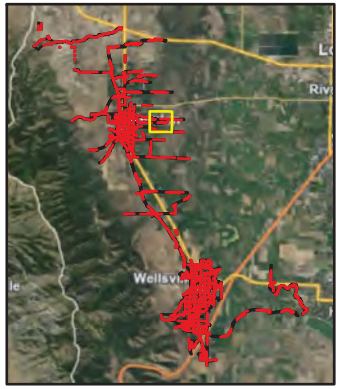
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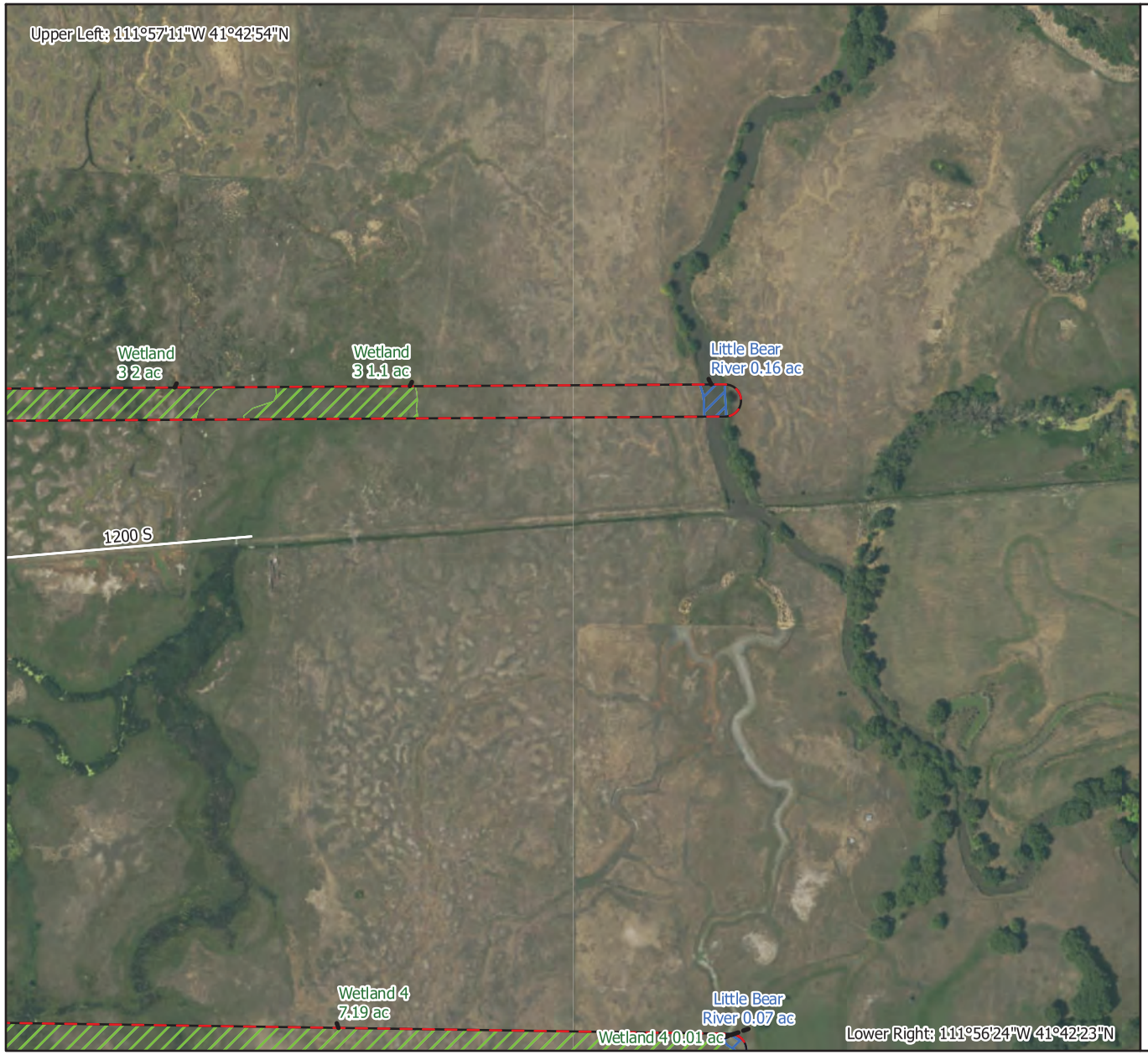
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Map 63 of 90

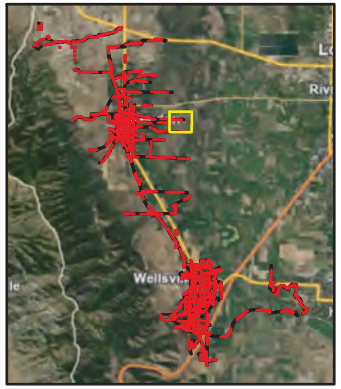


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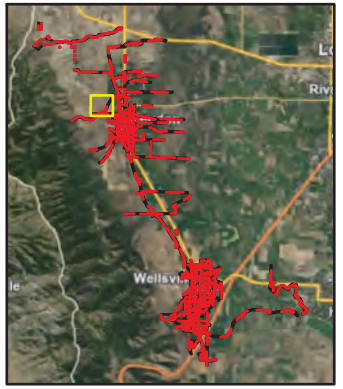
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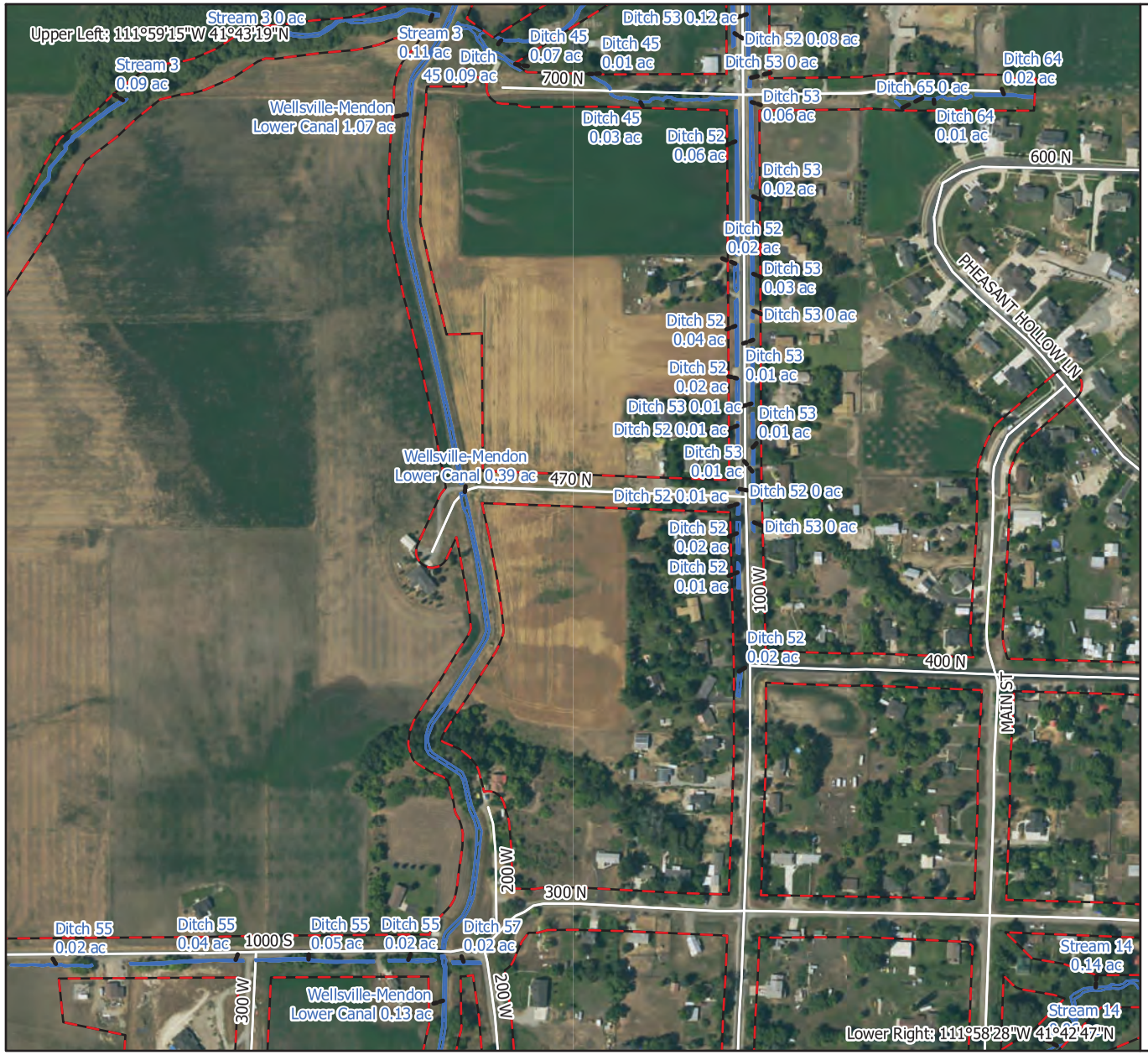
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Map 65 of 90

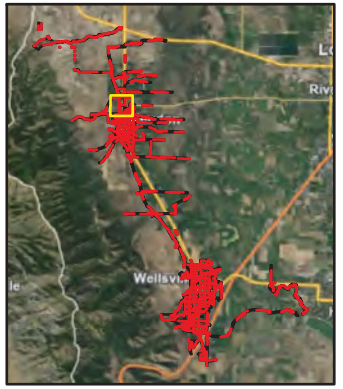


Wellsville-Mendon Watershed Plan Project Aquatic Resources Map Book

- Wetland Plots
- Upland Plots
- Study Area
- OHWM (67.59 acres)
- Wetlands (56.89 acres)

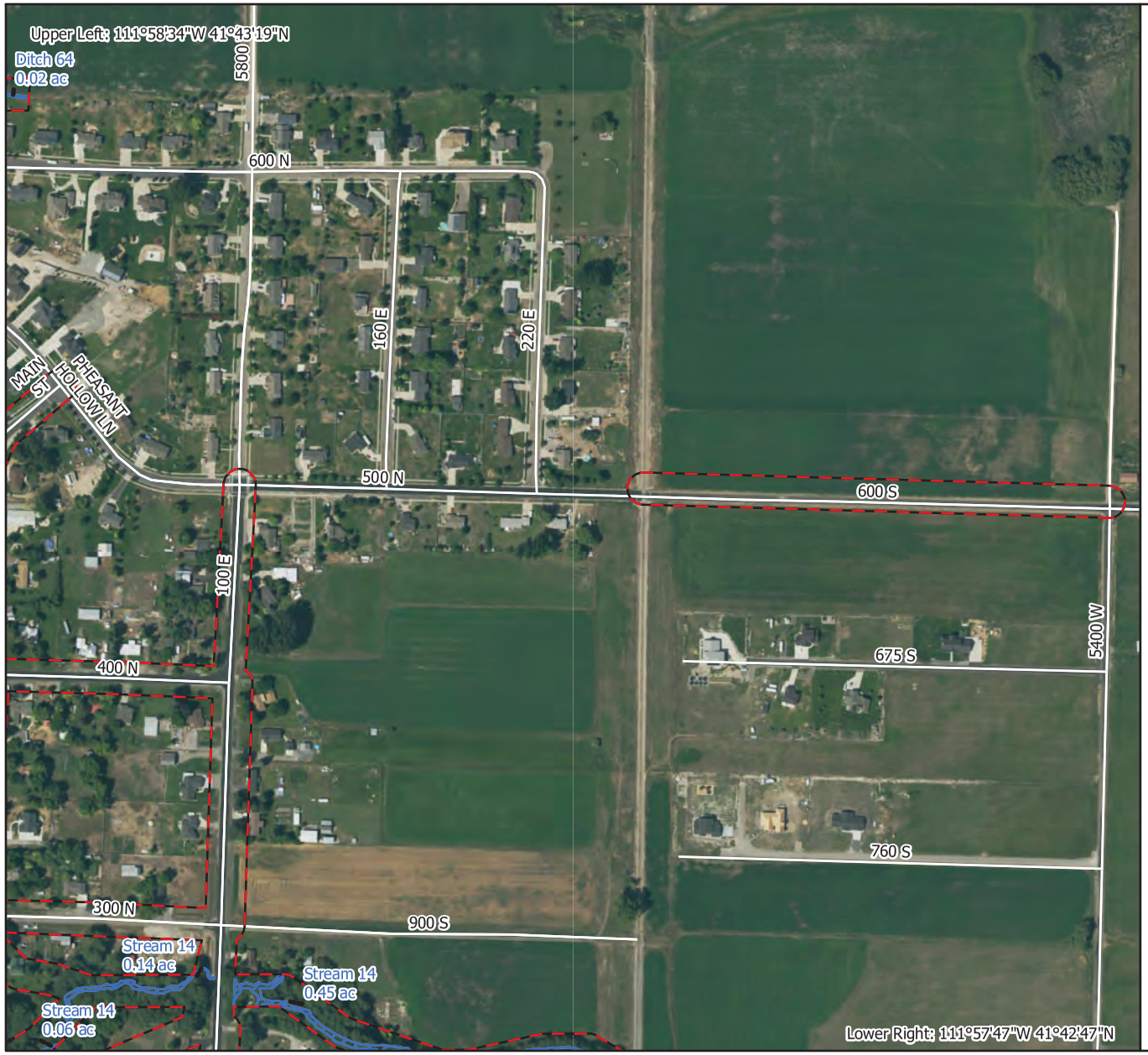
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Projected Coordinate System: NAO_ 1983 State Plane Utah North FIPS 4301 Feet
Datum: GCS North American 1983
Map prepared by J-U-B ENGINEERS, INC.
July 15, 2024

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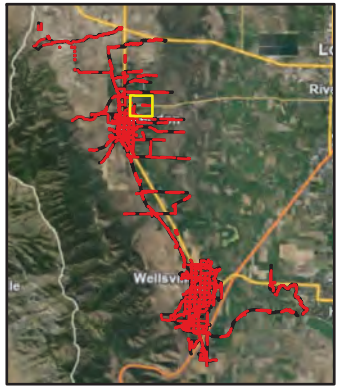
Wellsville-Mendon Watershed Plan Project Aquatic Resources Map Book

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0 0.04 0.09 Miles

N



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Map prepared by J-U-B ENGINEERS, INC.
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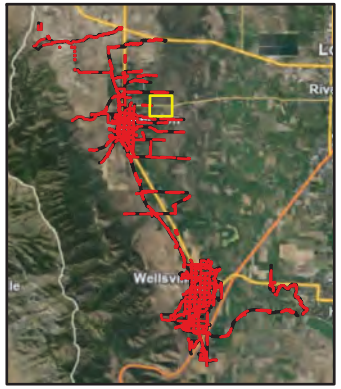


Wellsville-Mendon Watershed Plan Project Aquatic Resources Map Book

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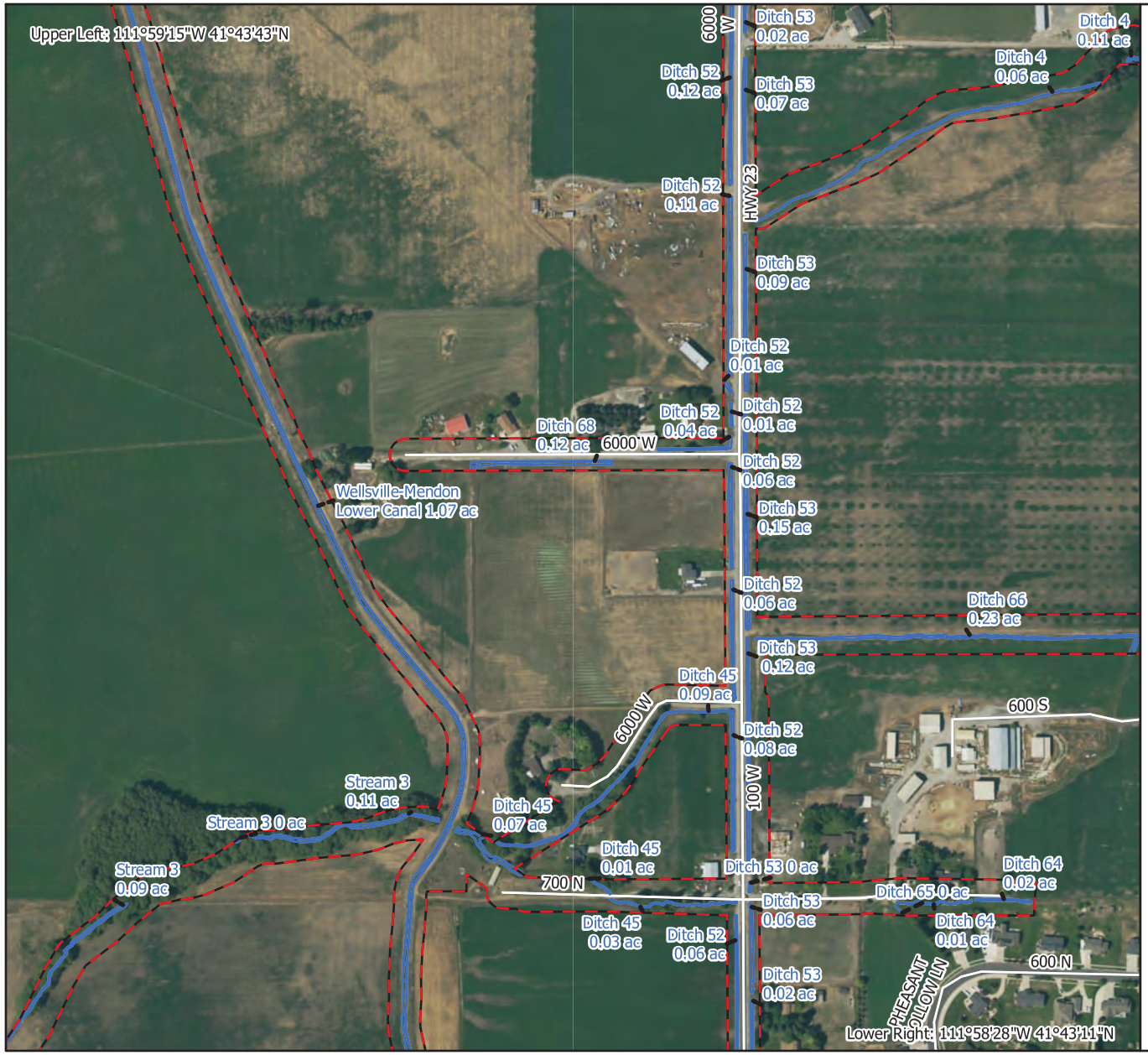
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Map 68 of 90



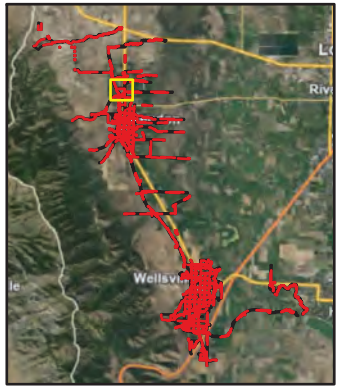
Wellsville-Mendon Watershed Plan Project Aquatic Resources Map Book

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0 0.04 0.09 Miles

N



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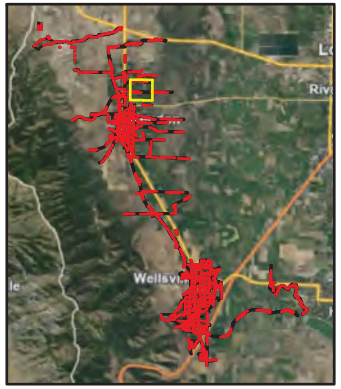
Wellsville-Mendon Watershed Plan Project Aquatic Resources Map Book

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0 0.04 0.09 Miles

N



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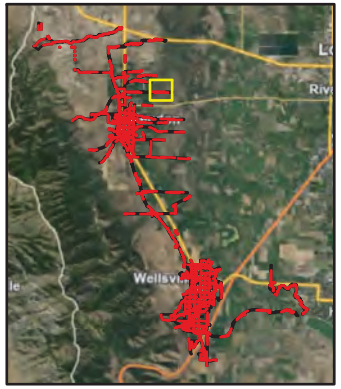


Wellsville-Mendon Watershed Plan Project Aquatic Resources Map Book

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0 0.04 0.09 Miles

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Map 71 of 90

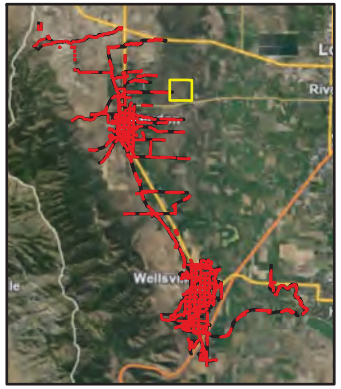


Wellsville-Mendon Watershed Plan Project Aquatic Resources Map Book

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0 0.04 0.09 Miles

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Map 72 of 90



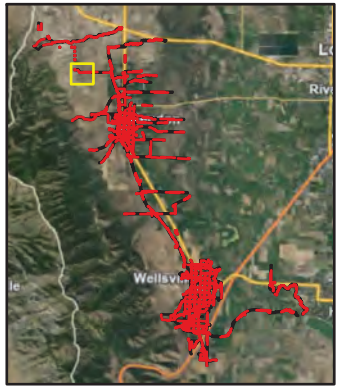
Wellsville-Mendon Watershed Plan Project Aquatic Resources Map Book

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0 0.04 0.09 Miles

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Map 73 of 90



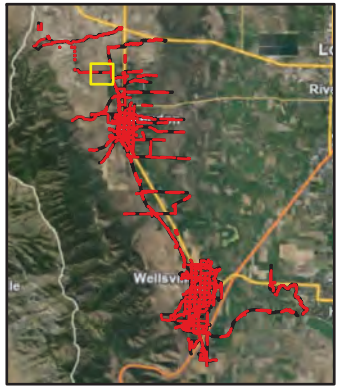
Wellsville-Mendon Watershed Plan Project Aquatic Resources Map Book

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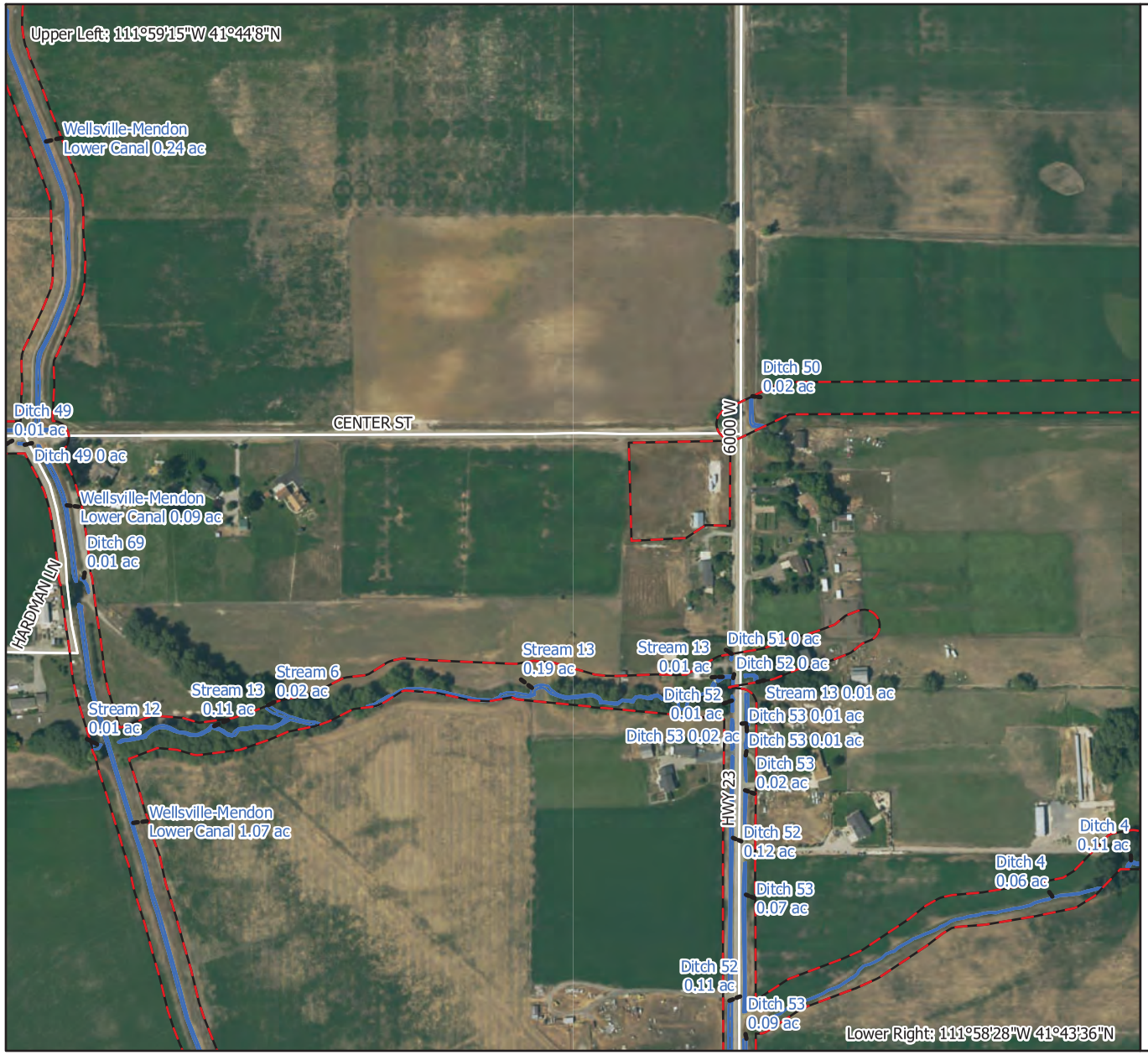
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July 15, 2024

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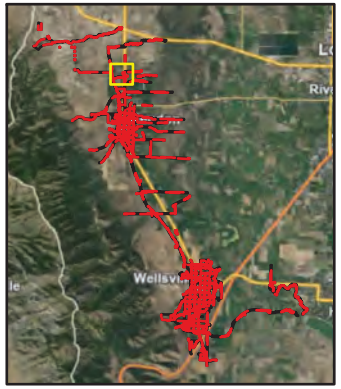


Wellsville-Mendon Watershed Plan Project Aquatic Resources Map Book

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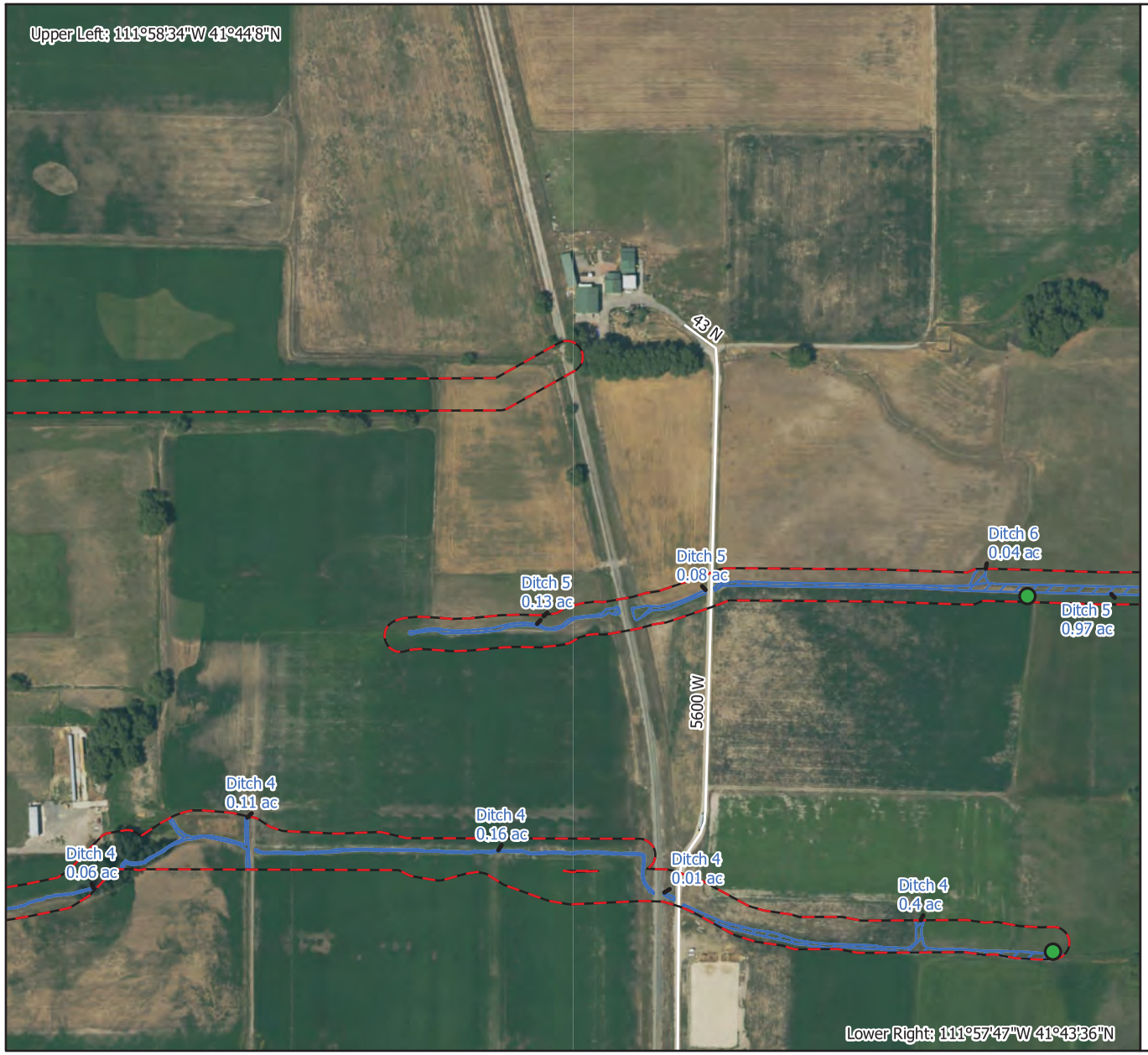
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Map 75 of 90



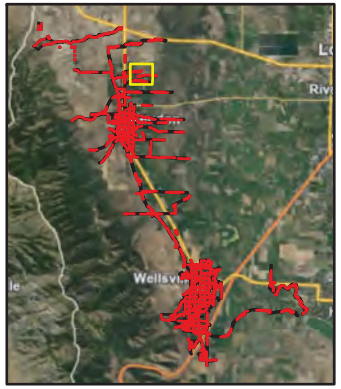
Wellsville-Mendon Watershed Plan Project Aquatic Resources Map Book

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0 0.04 0.09 Miles

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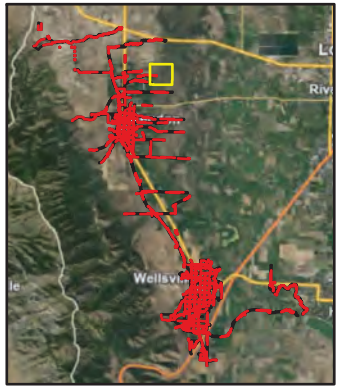
Wellsville-Mendon Watershed Plan Project Aquatic Resources Map Book

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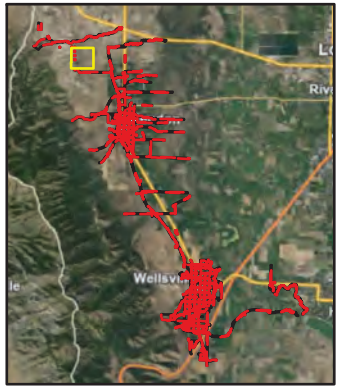
Wellsville-Mendon Watershed Plan Project Aquatic Resources Map Book

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Map 78 of 90

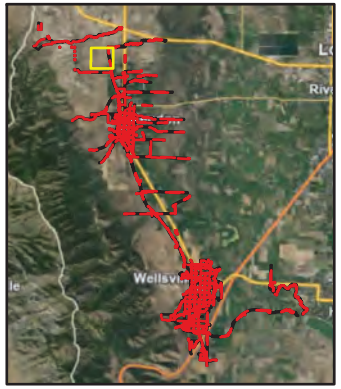


Wellsville-Mendon Watershed Plan Project Aquatic Resources Map Book

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July 15, 2024

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Map 79 of 90



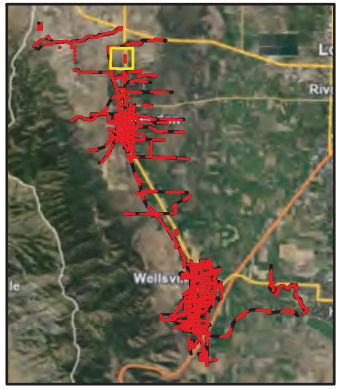
Wellsville-Mendon Watershed Plan Project Aquatic Resources Map Book

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0 0.04 0.09 Miles

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Map 80 of 90

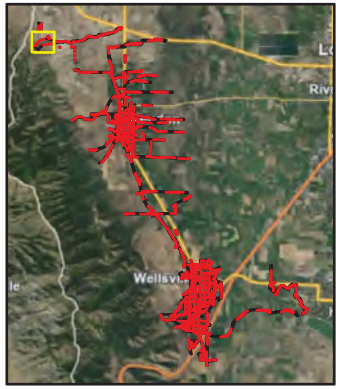


Wellsville-Mendon Watershed Plan Project Aquatic Resources Map Book

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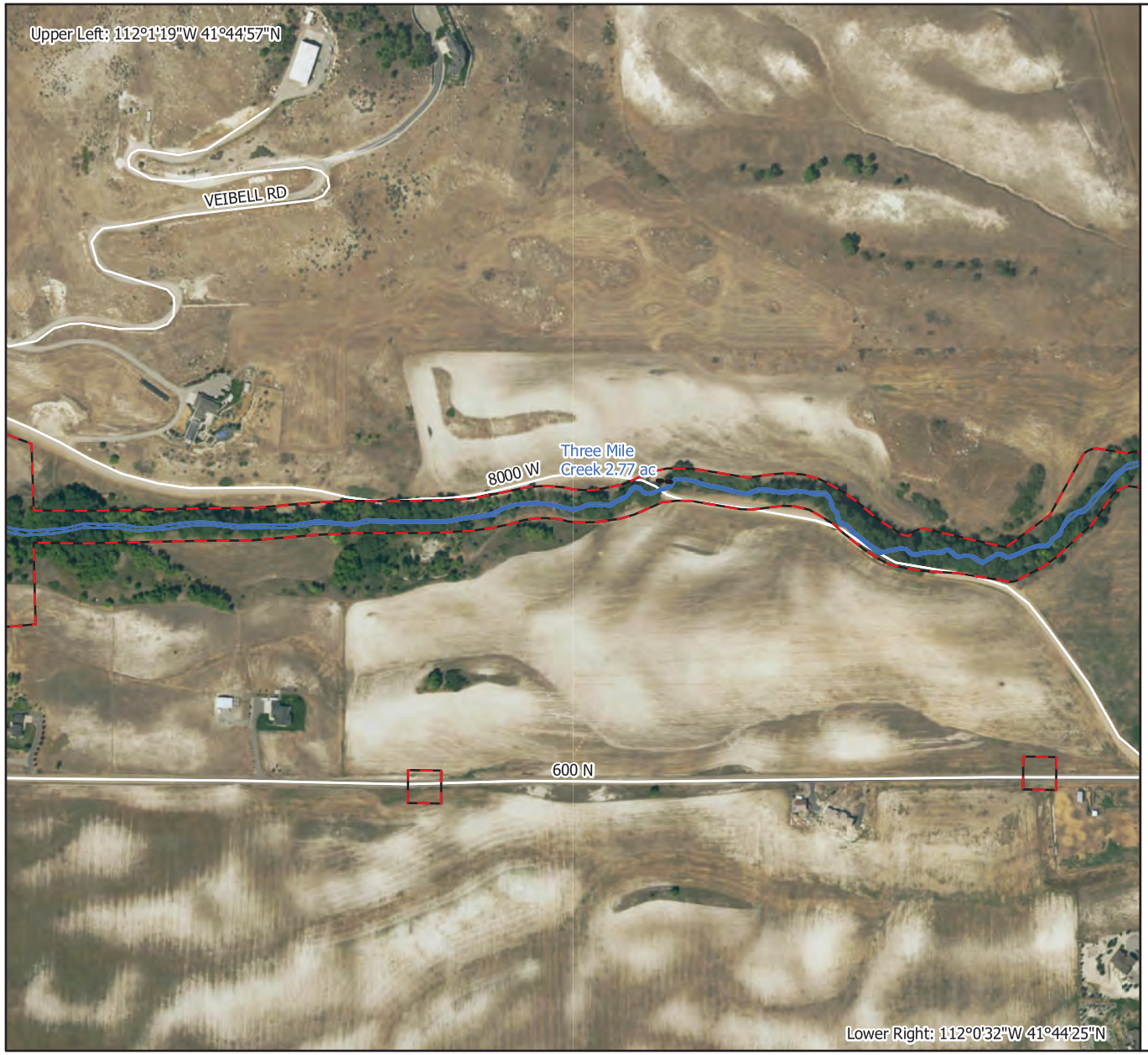
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Map 81 of 90



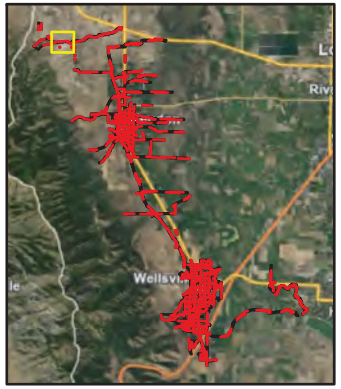
Wellsville-Mendon Watershed Plan Project Aquatic Resources Map Book

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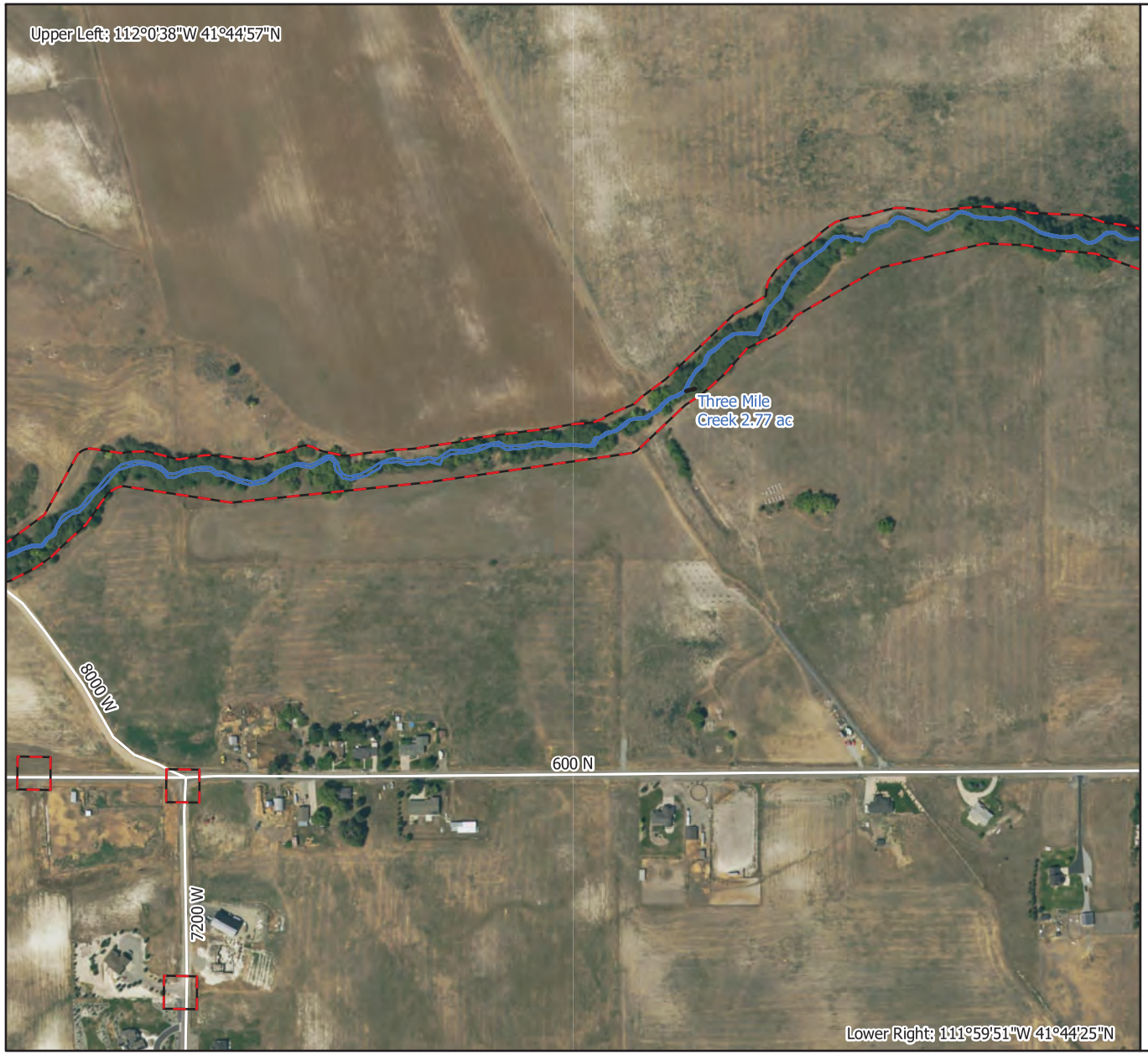
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Map 82 of 90

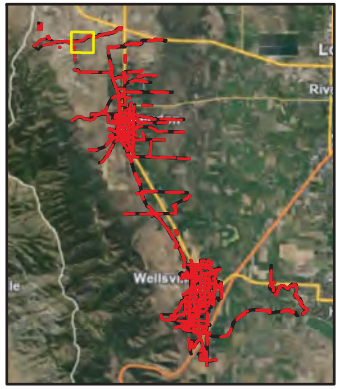


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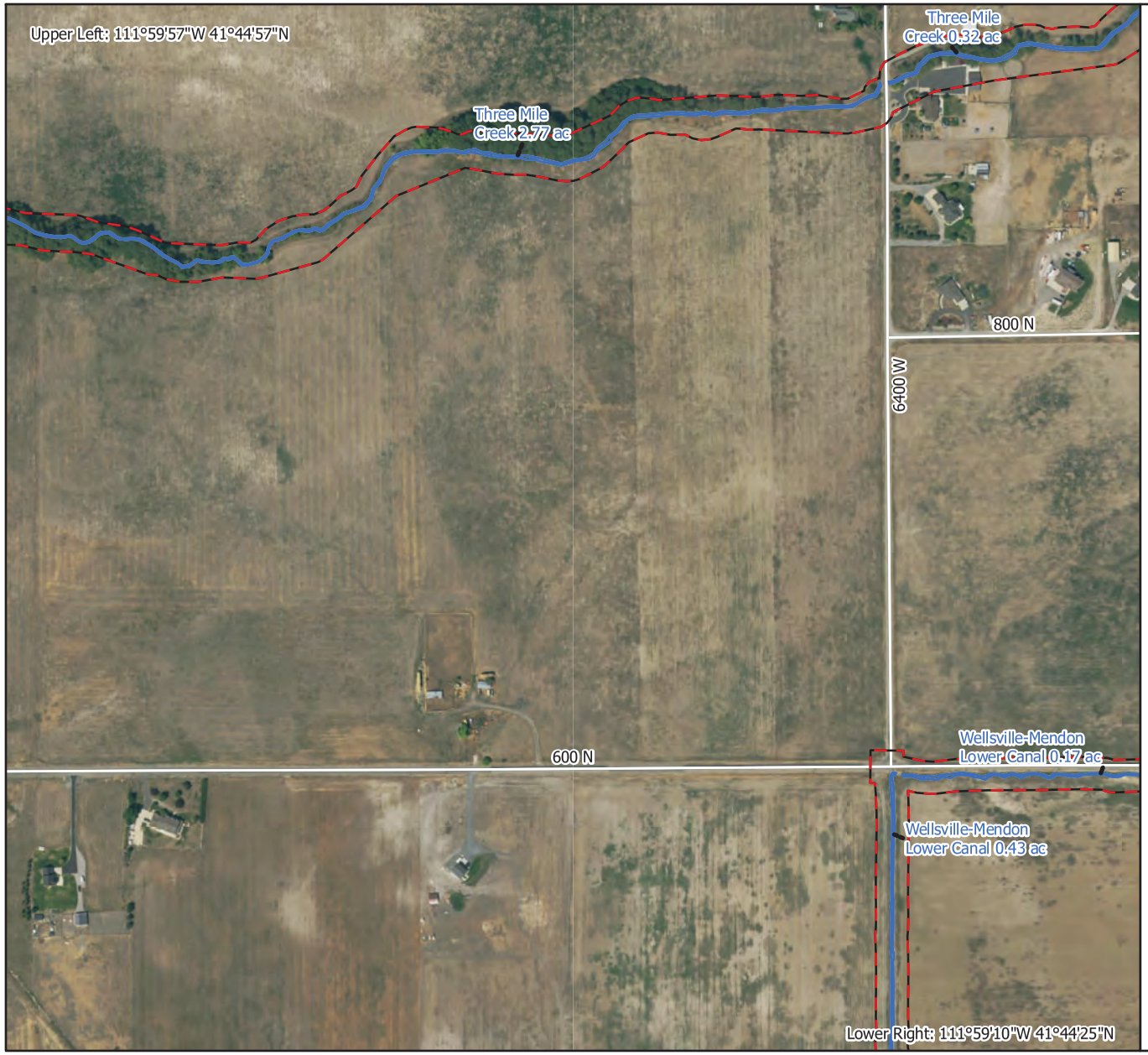
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Map 83 of 90



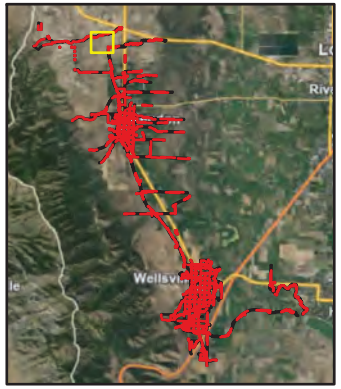
Wellsville-Mendon Watershed Plan Project Aquatic Resources Map Book

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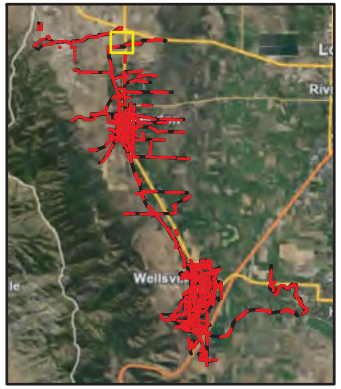


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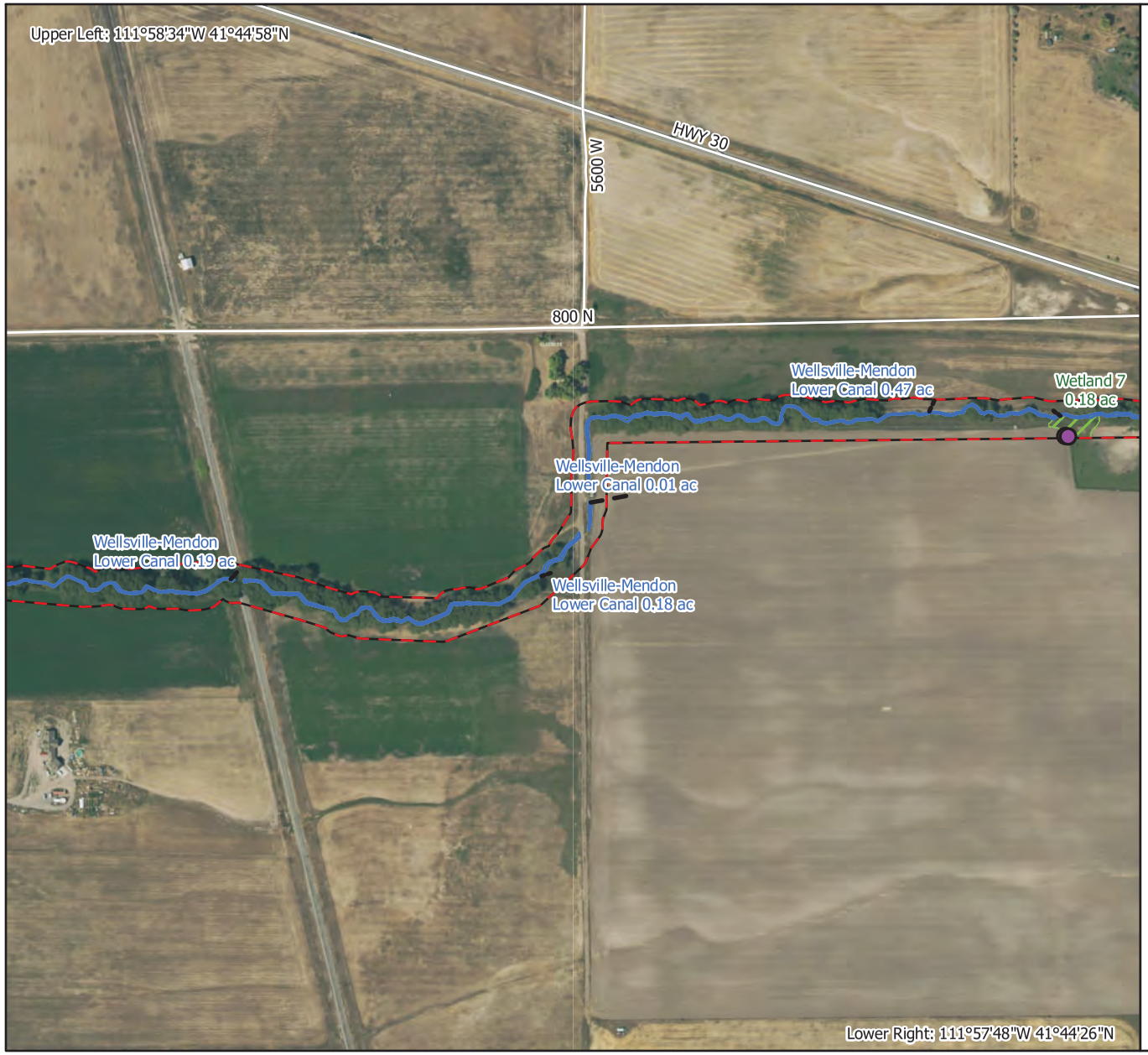
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Map 85 of 90

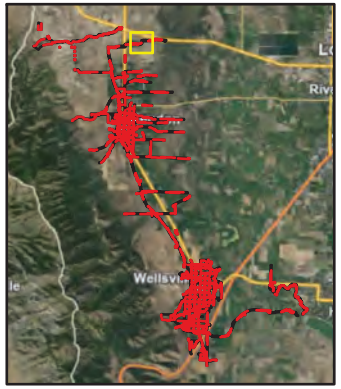


Wellsville-Mendon Watershed Plan Project Aquatic Resources Map Book

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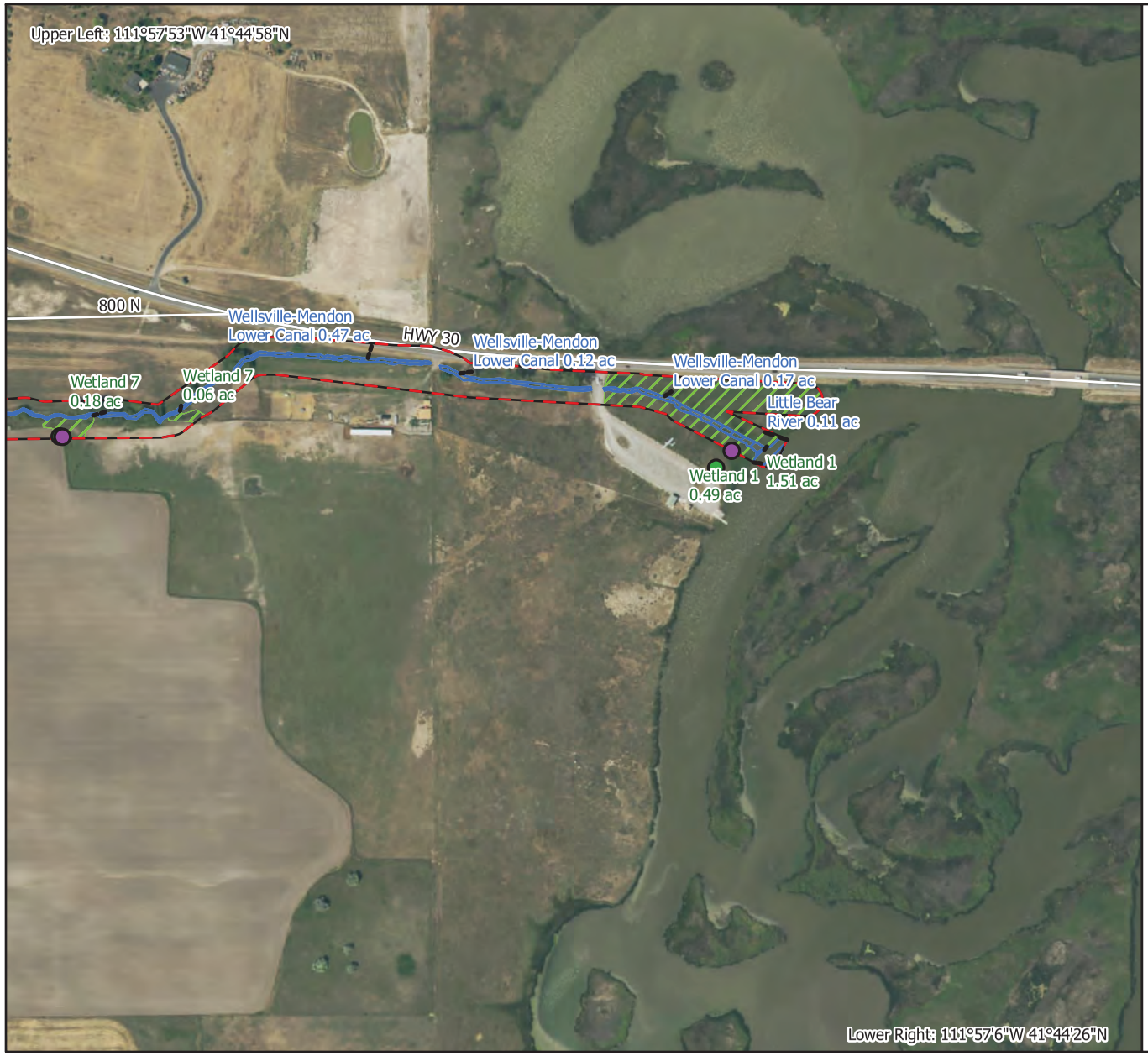
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Map 86 of 90

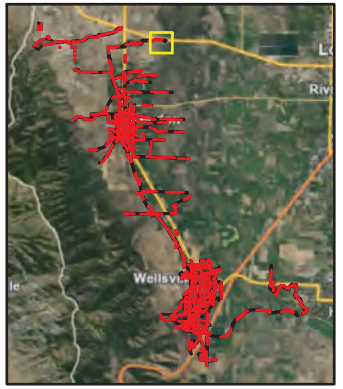


Wellsville-Mendon Watershed Plan Project Aquatic Resources Map Book

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0 0.04 0.09 Miles

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Map 87 of 90

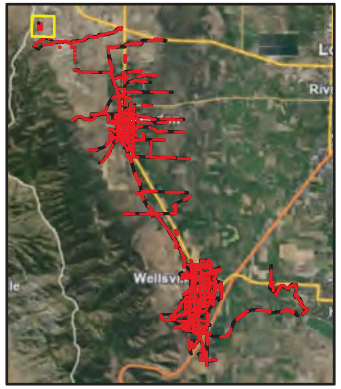


Wellsville-Mendon Watershed Plan Project Aquatic Resources Map Book

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0 0.04 0.09 Miles

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July 15, 2024

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Map 88 of 90



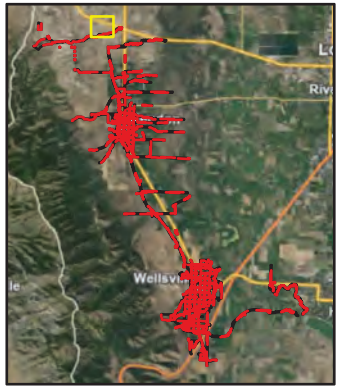
Wellsville-Mendon Watershed Plan Project Aquatic Resources Map Book

- Wetland Plots
- Upland Plots

- Study Area
- OHWM (67.59 acres)
- Wetlands (56.89 acres)

0 0.04 0.09 Miles

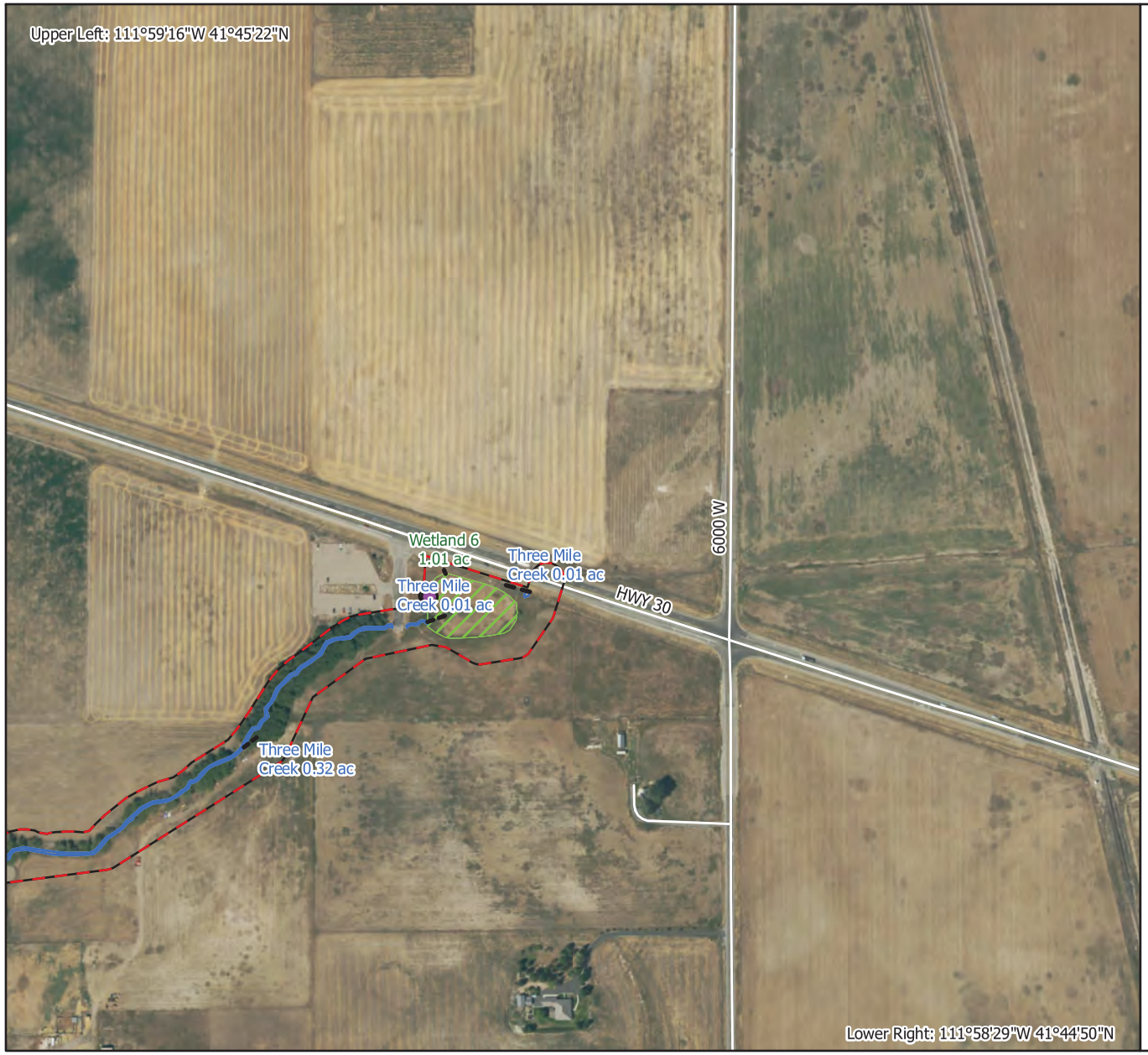
N



Service Layer Credits: ESRI and contributors;
Projected Coordinate System: NAO_ 1983 State Plane Utah North FIPS 4301 Feet
Datum: GCS North American 1983
Map prepared by J-U-B ENGINEERS, INC.
July 15, 2024

J-U-B ENGINEERS, INC.

Map 89 of 90

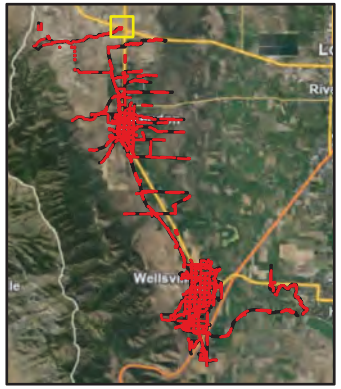


Wellsville-Mendon Watershed Plan Project Aquatic Resources Map Book

- Wetland Plots
- Upland Plots
- Study Area
- OHWM (67.59 acres)
- Wetlands (56.89 acres)

0 0.04 0.09 Miles

N



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Datum: GCS North American 1983
Map prepared by J-U-B ENGINEERS, INC.
July 15, 2024

J-U-B ENGINEERS, INC.

Map 90 of 90

Appendix D: Data Sheets

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Arid West Region
See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Franson Wellsville Watershed Project City/County: Wellsville, Cache County Sampling Date: 9/19/23

Applicant/Owner: Franson Civil Engineers State: UT Sampling Point: W1sp1

Investigator(s): Jason Lewis, Becky Miller Section, Township, Range: S28 T12N R1W

Landform (hillside, terrace, etc.): Terrace Local relief (concave, convex, none): none Slope (%): 0

Subregion (LRR): LRR D Lat: 41.7454630 Long: -111.9566508 Datum: NAD1983

Soil Map Unit Name: SALT LAKE-ROSHE SPRINGS COMPLEX NWI classification: PEM1B

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No ____
Hydric Soil Present? Yes ____ No X
Wetland Hydrology Present? Yes ____ No X

Is the Sampled Area within a Wetland? **Yes** ____ **No** X

Remarks:

VEGETATION – Use scientific names of plants.

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: ____)			
1.			
2.			
3.			
4.			
	____ =Total Cover		
Sapling/Shrub Stratum (Plot size: ____)			
1.			
2.			
3.			
4.			
5.			
	____ =Total Cover		
Herb Stratum (Plot size: 5x5')			
1.			
2. *Leymus cinereus*	85	Yes	FAC
3. *Atriplex prostrata*	2	No	FACW
4.			
5.			
6.			
7.			
8.			
	87 =Total Cover		
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
	____ =Total Cover		

% Bare Ground in Herb Stratum 15 % Cover of Biotic Crust ____

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	2	x 2 =	4
FAC species	85	x 3 =	255
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	87 (A)		259 (B)

Prevalence Index = B/A = 2.98

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%
____ Prevalence Index is ≤3.0[1]
____ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
____ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** X **No** ____

Remarks:

SOIL

Sampling Point: W1sp1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-14	10YR 2/1	100					Loamy/Clayey	Clay

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Iron-Manganese Masses (F12) **(LRR D)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** ___ **No** X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No x Depth (inches): ___

Water Table Present? Yes ___ No x Depth (inches): ___

Saturation Present? Yes ___ No x Depth (inches): ___

(includes capillary fringe)

Wetland Hydrology Present? **Yes** ___ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Arid West Region
See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Wellsville Watershed Project City/County: Cache County Sampling Date: 9/19/23
Applicant/Owner: Franson Civil Engineers State: UT Sampling Point: W1-SP2
Investigator(s): Jason Lewis, Becky Miller Section, Township, Range: S28 T12N R1W
Landform (hillside, terrace, etc.): Terrace Local relief (concave, convex, none): none Slope (%): 0
Subregion (LRR): LRR D Lat: 41.7455987 Long: 111.9564845 Datum: NAD1983
Soil Map Unit Name: SALT LAKE-ROSHE SPRINGS COMPLEX NWI classification: PEM
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)
Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____
Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No ____
Hydric Soil Present? Yes X No ____
Wetland Hydrology Present? Yes X No ____

Is the Sampled Area within a Wetland? **Yes** X **No** ____

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	____ =Total Cover		
Sapling/Shrub Stratum (Plot size: ____)			
1.			
2.			
3.			
4.			
5.			
	____ =Total Cover		
Herb Stratum (Plot size: 5x5')			
1. *Carex nebrascensis*	80	Yes	OBL
2. *Typha latifolia*	5	No	OBL
3. *Juncus balticus*	30	No	FACW
4. *Phalaris arundinacea*	25	No	FACW
5. *Schoenoplectus tabernaemontani*	15	No	OBL
6.			
7.			
8.			
	155 =Total Cover		
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
	____ =Total Cover		

% Bare Ground in Herb Stratum 1 % Cover of Biotic Crust ____

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	100	x 1 =	100
FACW species	55	x 2 =	110
FAC species	0	x 3 =	0
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	155 (A)		210 (B)

Prevalence Index = B/A = 1.35

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%
X Prevalence Index is ≤3.0[1]
____ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
____ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** X **No** ____

Remarks:

SOIL

Sampling Point: W1-SP2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-8	10YR 3/1	100					Loamy/Clayey	
8-14	10YR 3/2	20	7.5YR 5/1	80	D	M	Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Iron-Manganese Masses (F12) **(LRR D)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** X **No** ___

Remarks:
Depletion present at 8 inches

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- x High Water Table (A2)
- x Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ___	No x	Depth (inches): ___		
Water Table Present?	Yes x	No ___	Depth (inches): 8		
Saturation Present? (includes capillary fringe)	Yes x	No ___	Depth (inches): 0	**Wetland Hydrology Present?**	**Yes** X **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
Saturated to surface, high water table present at 8 inches

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Arid West Region
See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Franson Wellsville Watershed Project City/County: Cache County Sampling Date: 9/19/23

Applicant/Owner: Franson Civil Engineers State: UT Sampling Point: W2sp1

Investigator(s): Jason Lewis, Becky Miller Section, Township, Range: S04 T11N R1W

Landform (hillside, terrace, etc.): Terrace Local relief (concave, convex, none): none Slope (%): 0

Subregion (LRR): LRR D Lat: 41.7235546 Long: -111.9642718 Datum: NAD1983

Soil Map Unit Name: SALT LAKE-ROSHE SPRINGS COMPLEX NWI classification: PEM1B

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes ____ No X
Hydric Soil Present? Yes ____ No X
Wetland Hydrology Present? Yes ____ No X

Is the Sampled Area within a Wetland? **Yes** ____ **No** X

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	____ =Total Cover		
Sapling/Shrub Stratum (Plot size: ____)			
1.			
2.			
3.			
4.			
5.			
	____ =Total Cover		
Herb Stratum (Plot size: 5x5')			
1. *Carex nebrascensis*	50	Yes	OBL
2. *actuca serriola*	2	No	FACU
3. *ipsacus fullonum*	2	No	FAC
4. *Phalaris arundinacea*	10	No	FACW
5. *Cirsium ar ense*	2	No	FACU
6. *Taraxacum officinale*	40	Yes	FACU
7.			
8.			
	106 =Total Cover		
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
	____ =Total Cover		

% Bare Ground in Herb Stratum ____ % Cover of Biotic Crust ____

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	50	x 1 =	50
FACW species	10	x 2 =	20
FAC species	2	x 3 =	6
FACU species	44	x 4 =	176
UPL species	0	x 5 =	0
Column Totals:	106 (A)		252 (B)

Prevalence Index = B/A = 2.38

Hydrophytic Vegetation Indicators:

____ Dominance Test is >50%
____ Prevalence Index is ≤3.0[1]
____ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
____ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** ____ **No** X

Remarks:

SOIL

Sampling Point: W2sp1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-14	10YR 2/1	100					Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Iron-Manganese Masses (F12) **(LRR D)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** ___ **No** X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No x Depth (inches): ___

Water Table Present? Yes ___ No x Depth (inches): ___

Saturation Present? Yes ___ No x Depth (inches): ___

(includes capillary fringe)

Wetland Hydrology Present? **Yes** ___ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Arid West Region
See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Franson Wellsville Watershed Project City/County: Wellsville, Cache County Sampling Date: 9/19/23
Applicant/Owner: Franson Civil Engineers State: UT Sampling Point: W2sp2
Investigator(s): Jason Lewis, Becky Miller Section, Township, Range: S04 T11N R1W
Landform (hillside, terrace, etc.): Terrace Local relief (concave, convex, none): none Slope (%): 0
Subregion (LRR): LRR D Lat: 41.7235522 Long: 111.9637810 Datum: NAD1983
Soil Map Unit Name: SALT LAKE-ROSHE SPRINGS COMPLEX NWI classification: PEM1E
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)
Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____
Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No ____
Hydric Soil Present? Yes X No ____
Wetland Hydrology Present? Yes X No ____

Is the Sampled Area within a Wetland? **Yes** X **No** ____

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	____	=Total Cover	
Sapling/Shrub Stratum (Plot size: ____)			
1.			
2.			
3.			
4.			
5.			
	____	=Total Cover	
Herb Stratum (Plot size: 5x5')			
1. *Typha latifolia*	90	Yes	OBL
2. *eymus cinereus*	85	Yes	FAC
3. *entha canadensis*	5	No	FACW
4. *Solida o canadensis*	30	No	FACW
5. *Solanum dulcamara*	5	No	FAC
6. *Carex nebrascensis*	40	No	OBL
7. *Schoenoplectus tabernaemontani*	5	No	OBL
8. *bilobium ciliatum*	2	No	FACW
	262	=Total Cover	
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
	____	=Total Cover	

% Bare Ground in Herb Stratum ____ % Cover of Biotic Crust ____

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	135	x 1 =	135
FACW species	37	x 2 =	74
FAC species	90	x 3 =	270
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	262 (A)		479 (B)

Prevalence Index = B/A = 1.83

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%
X Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** X **No** ____

Remarks:

SOIL

Sampling Point: W2sp2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-13	10YR 3/2	100					Loamy/Clayey	Loam
13-14	10YR 2/1	70					Loamy/Clayey	Loam
13-14	10YR 3/2	30					Loamy/Clayey	Loam

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- x Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Iron-Manganese Masses (F12) **(LRR D)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ___

Depth (inches): ___

Hydric Soil Present? **Yes** X **No** ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- x High Water Table (A2)
- x Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- x Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ___	No x	Depth (inches): ___		
Water Table Present?	Yes x	No ___	Depth (inches): 10		
Saturation Present? (includes capillary fringe)	Yes x	No ___	Depth (inches): 0	**Wetland Hydrology Present?**	**Yes** X **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Arid West Region
See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Franson Wellsville Watershed Project City/County: Wellsville, Cache County Sampling Date: 9/19/23

Applicant/Owner: Franson Civil Engineers State: UT Sampling Point: W3sp1

Investigator(s): Jason Lewis, Becky Miller Section, Township, Range: S09 T11N R1W

Landform (hillside, terrace, etc.): Terrace Local relief (concave, convex, none): none Slope (%): 0

Subregion (LRR): LRR D Lat: 41.7115316 Long: -111.9603537 Datum: NAD1983

Soil Map Unit Name: SALT LAKE-ROSHE SPRINGS COMPLEX NWI classification: PEM

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes ____ No X
Hydric Soil Present? Yes ____ No X
Wetland Hydrology Present? Yes ____ No X

Is the Sampled Area within a Wetland? **Yes** ____ **No** X

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	____	=Total Cover	
Sapling/Shrub Stratum (Plot size: ____)			
1.			
2.			
3.			
4.			
5.			
	____	=Total Cover	
Herb Stratum (Plot size: 5x5')			
1.			
2. *Cirsium ar ense*	40	Yes	FACU
3. *umex crispus*	1	No	FAC
4. *Poa pratensis*	20	No	FAC
5. *Con ol ulus ar ensis*	30	No	UPL
6. *eymus cinereus*	60	Yes	FAC
7.			
8.			
	151	=Total Cover	
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
	____	=Total Cover	

% Bare Ground in Herb Stratum ____ % Cover of Biotic Crust ____

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	81	x 3 =	243
FACU species	40	x 4 =	160
UPL species	30	x 5 =	150
Column Totals:	151 (A)		553 (B)

Prevalence Index = B/A = 3.66

Hydrophytic Vegetation Indicators:

____ Dominance Test is >50%
____ Prevalence Index is ≤3.0[1]
____ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
____ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** ____ **No** X

Remarks:

SOIL

Sampling Point: W3sp1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-6	10YR 3/1	100					Loamy/Clayey	Loam
6-14	10YR 4/1	100					Loamy/Clayey	Loam

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Iron-Manganese Masses (F12) **(LRR D)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** ___ **No** X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No x Depth (inches): ___

Water Table Present? Yes ___ No x Depth (inches): ___

Saturation Present? Yes ___ No x Depth (inches): ___

(includes capillary fringe)

Wetland Hydrology Present? **Yes** ___ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Arid West Region
See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Franson Wellsville Watershed Project City/County: Cache County Sampling Date: 9/19/23
Applicant/Owner: Franson Civil Engineers State: UT Sampling Point: W3sp2
Investigator(s): Jason Lewis, Becky Miller Section, Township, Range: S09 T11N R1W
Landform (hillside, terrace, etc.): Terrace Local relief (concave, convex, none): none Slope (%): 0
Subregion (LRR): LRR D Lat: 41.7115467 Long: -111.9601138 Datum: NAD1983
Soil Map Unit Name: SALT LAKE-ROSHE SPRINGS COMPLEX NWI classification: PEM
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)
Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____
Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No ____
Hydric Soil Present? Yes X No ____
Wetland Hydrology Present? Yes X No ____

Is the Sampled Area within a Wetland? **Yes** X **No** ____

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	____ =Total Cover		
Sapling/Shrub Stratum (Plot size: ____)			
1.			
2.			
3.			
4.			
5.			
	____ =Total Cover		
Herb Stratum (Plot size: 5x5')			
1. *Carex nebrascensis*	30	Yes	OBL
2. *Schoenoplectus tabernaemontani*	15	No	OBL
3. *Juncus balticus*	30	Yes	FACW
4. *Phalaris arundinacea*	50	Yes	FACW
5. *alea purpurea*	30	Yes	UPL
6.			
7.			
8.			
	155 =Total Cover		
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
	____ =Total Cover		

% Bare Ground in Herb Stratum ____ % Cover of Biotic Crust ____

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 75.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	45	x 1 =	45
FACW species	80	x 2 =	160
FAC species	0	x 3 =	0
FACU species	0	x 4 =	0
UPL species	30	x 5 =	150
Column Totals:	155 (A)		355 (B)

Prevalence Index = B/A = 2.29

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%
X Prevalence Index is ≤3.0[1]
____ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
____ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** X **No** ____

Remarks:

SOIL

Sampling Point: W3sp2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-6	10YR 2/1	100					Loamy/Clayey	
6-8	10YR 2/1	80	10YR 6/3	20	C	M	Loamy/Clayey	
8-14	10YR 2/1	60	10YR 6/3	40	C	M	Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- X Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Iron-Manganese Masses (F12) **(LRR D)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ___

Depth (inches): ___

Hydric Soil Present? **Yes** X **No** ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- x High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- X Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ___	No x	Depth (inches): ___		
Water Table Present?	Yes x	No ___	Depth (inches): 9		
Saturation Present? (includes capillary fringe)	Yes x	No ___	Depth (inches): 0	**Wetland Hydrology Present?**	**Yes** X **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Arid West Region
See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Franson Wellsville Watershed Project City/County: Wellsville, Cache County Sampling Date: 9/19/23

Applicant/Owner: Franson Civil Engineers State: UT Sampling Point: W4sp1

Investigator(s): Jason Lewis, Becky Miller Section, Township, Range: S09 T11N R1W

Landform (hillside, terrace, etc.): Terrace Local relief (concave, convex, none): none Slope (%): 0

Subregion (LRR): LRR D Lat: 41.7065098 Long: -111.9582101 Datum: NAD1983

Soil Map Unit Name: SALT LAKE-ROSHE SPRINGS COMPLEX NWI classification: PEM1B

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No ____
Hydric Soil Present? Yes ____ No X
Wetland Hydrology Present? Yes ____ No X

Is the Sampled Area within a Wetland? **Yes** ____ **No** X

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	____ =Total Cover		
Sapling/Shrub Stratum (Plot size: ____)			
1.			
2.			
3.			
4.			
5.			
	____ =Total Cover		
Herb Stratum (Plot size: 5x5')			
1. *ipsacus fullonum*	1	No	FAC
2. *eymus cinereus*	80	Yes	FAC
3. *Carex nebrascensis*	20	No	OBL
4.			
5.			
6.			
7.			
8.			
	101 =Total Cover		
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
	____ =Total Cover		

% Bare Ground in Herb Stratum ____ % Cover of Biotic Crust ____

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	20	x 1 =	20
FACW species	0	x 2 =	0
FAC species	81	x 3 =	243
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	101 (A)		263 (B)

Prevalence Index = B/A = 2.60

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%
____ Prevalence Index is ≤3.0[1]
____ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
____ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** X **No** ____

Remarks:

SOIL

Sampling Point: W4sp1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-14	10YR 3/1	100					Sandy	Sandy Loam

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Iron-Manganese Masses (F12) **(LRR D)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ___

Depth (inches): ___

Hydric Soil Present? **Yes** ___ **No** X

Remarks:
Dry soil.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No x Depth (inches): ___

Water Table Present? Yes ___ No x Depth (inches): ___

Saturation Present? Yes ___ No x Depth (inches): ___

(includes capillary fringe)

Wetland Hydrology Present? **Yes** ___ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Arid West Region
See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Franson Wellsville Watershed Project City/County: Wellsville Cache County Sampling Date: 9/19/23

Applicant/Owner: Franson Civil Engineers State: UT Sampling Point: W4sp2

Investigator(s): Jason Lewis, Becky Miller Section, Township, Range: S09 T11N R1W

Landform (hillside, terrace, etc.): Terrace Local relief (concave, convex, none): none Slope (%): 0

Subregion (LRR): LRR D Lat: 41.706480 Long: 111.9573945 Datum: NAD1983

Soil Map Unit Name: SALT LAKE-ROSHE SPRINGS COMPLEX NWI classification: PEM

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No ____
Hydric Soil Present? Yes X No ____
Wetland Hydrology Present? Yes X No ____

Is the Sampled Area within a Wetland? **Yes** X **No** ____

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	____	=Total Cover	
Sapling/Shrub Stratum (Plot size: ____)			
1.			
2.			
3.			
4.			
5.			
	____	=Total Cover	
Herb Stratum (Plot size: 5x5')			
1.			
2. *Cirsium ar ense*	2	No	FACU
3. *umex crispus*	2	No	FAC
4. *actuca serriola*	5	No	FACU
5. *Phalaris arundinacea*	99	Yes	FACW
6. *Carex nebrascensis*	20	No	OBL
7.			
8.			
	128	=Total Cover	
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
	____	=Total Cover	

% Bare Ground in Herb Stratum ____ % Cover of Biotic Crust ____

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	20	x 1 =	20
FACW species	99	x 2 =	198
FAC species	2	x 3 =	6
FACU species	7	x 4 =	28
UPL species	0	x 5 =	0
Column Totals:	128 (A)		252 (B)

Prevalence Index = B/A = 1.97

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%
X Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** X **No** ____

Remarks:

SOIL

Sampling Point: W4sp2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-14	10YR 2/1	100					Loamy/Clayey	Sandy Loam

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- x Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- x Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Iron-Manganese Masses (F12) **(LRR D)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ___

Depth (inches): ___

Hydric Soil Present? **Yes** ___ **No** X

Remarks:
Redox is masked

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- x High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- x Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ___	No x	Depth (inches): ___		
Water Table Present?	Yes x	No ___	Depth (inches): 9		
Saturation Present? (includes capillary fringe)	Yes x	No ___	Depth (inches): 0	**Wetland Hydrology Present?**	**Yes** X **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Arid West Region
See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Franson Wellsville Watershed Project City/County: Cache County Sampling Date: 9/19/23

Applicant/Owner: Franson Civil Engineers State: UT Sampling Point: W5sp1

Investigator(s): Jason Lewis, Becky Miller Section, Township, Range: S06 T10N R1E

Landform (hillside, terrace, etc.): Terrace Local relief (concave, convex, none): none Slope (%): 0

Subregion (LRR): LRR D Lat: 41.6341752 Long: -111.8811457 Datum: NAD1983

Soil Map Unit Name: SALT LAKE-ROSHE SPRINGS COMPLEX NWI classification: none

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No X	**Is the Sampled Area within a Wetland?** **Yes** ____ **No** X
Hydric Soil Present?	Yes ____	No X	
Wetland Hydrology Present?	Yes ____	No X	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	____ =Total Cover		
Sapling/Shrub Stratum (Plot size: ____)			
1.			
2.			
3.			
4.			
5.			
	____ =Total Cover		
Herb Stratum (Plot size: 5x5')			
1.			
2. *al a ne lecta*	10	No	UPL
3. *Con ol ulus ar ensis*	40	Yes	UPL
4. *romus inermis*	30	Yes	FACU
5.			
6.			
7.			
8.			
	80 =Total Cover		
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
	____ =Total Cover		

% Bare Ground in Herb Stratum 70 % Cover of Biotic Crust ____

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	30	x 4 =	120
UPL species	50	x 5 =	250
Column Totals:	80 (A)		370 (B)

Prevalence Index = B/A = 4.63

Hydrophytic Vegetation Indicators:

____ Dominance Test is >50%

____ Prevalence Index is ≤3.0[1]

____ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

____ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** ____ **No** X

Remarks:

SOIL

Sampling Point: W5sp1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-3	10YR 3/2	100					Loamy/Clayey	Gravelly; Fill

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Iron-Manganese Masses (F12) **(LRR D)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: Gravel and Fill

Depth (inches): 3

Hydric Soil Present? **Yes** ___ **No** X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No x Depth (inches): ___

Water Table Present? Yes ___ No x Depth (inches): ___

Saturation Present? Yes ___ No x Depth (inches): ___

(includes capillary fringe)

Wetland Hydrology Present? **Yes** ___ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Arid West Region
See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Franson Wellsville Watershed Project City/County: Wellsville, Cache County Sampling Date: 9/19/23

Applicant/Owner: Fransoon Civil Engineers State: UT Sampling Point: W5sp2

Investigator(s): Jason Lewis, Becky Miller Section, Township, Range: S06 T10N R1E

Landform (hillside, terrace, etc.): Terrace Local relief (concave, convex, none): none Slope (%): 0

Subregion (LRR): LRR D Lat: 41.6340427 Long: -111.8764401 Datum: NAD1983

Soil Map Unit Name: SALT LAKE-ROSHE SPRINGS COMPLEX NWI classification: PEM

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No ____
Hydric Soil Present? Yes X No ____
Wetland Hydrology Present? Yes X No ____

Is the Sampled Area within a Wetland? **Yes** X **No** ____

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	____ =Total Cover		
Sapling/Shrub Stratum (Plot size: ____)			
1.			
2.			
3.			
4.			
5.			
	____ =Total Cover		
Herb Stratum (Plot size: 5x5')			
1. *Carex nabrascensis*	40	Yes	OBL
2. *Typha latifolia*	40	Yes	OBL
3. *Phalaris arundinacea*	80	Yes	FACW
4.			
5.			
6.			
7.			
8.			
	160 =Total Cover		
Woody Vine Stratum (Plot size: ____)			
1.			
2.			
	____ =Total Cover		

% Bare Ground in Herb Stratum ____ % Cover of Biotic Crust ____

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	80	x 1 =	80
FACW species	80	x 2 =	160
FAC species	0	x 3 =	0
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	160 (A)		240 (B)

Prevalence Index = B/A = 1.50

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%
X Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** X **No** ____

Remarks:

SOIL

Sampling Point: W5sp2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-14	10YR 2/1	100					Loamy/Clayey	1-2 inch is loam; 3-14 inch is clay

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- x Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Iron-Manganese Masses (F12) **(LRR D)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ___

Depth (inches): ___

Hydric Soil Present? **Yes** X **No** ___

Remarks:
Redox is masked

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- x High Water Table (A2)
- x Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- x Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ___	No x	Depth (inches): ___		
Water Table Present?	Yes x	No ___	Depth (inches): 8		
Saturation Present? (includes capillary fringe)	Yes x	No ___	Depth (inches): 0	**Wetland Hydrology Present?**	**Yes** X **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Arid West Region
See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Franson Wellsville Watershed Project City/County: Wellsville, Cache County Sampling Date: 5/06/2024
Applicant/Owner: Franson Civil Engineers State: UT Sampling Point: W6Sp1
Investigator(s): Jason Lewis, Rebecca Miller Section, Township, Range: S29 T12N R1W
Landform (hillside, terrace, etc.): Terrace Local relief (concave, convex, none): Concave Slope (%): 2
Subregion (LRR): LRR D Lat: 41.75112044 Long: -111.98286299 Datum: NAD 1983
Soil Map Unit Name: MeA MENDON SILT LOAM, 0 TO 3 PERCENT SLOPES NWI classification: None
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)
Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____
Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No ____
Hydric Soil Present? Yes ____ No X
Wetland Hydrology Present? Yes ____ No X

Is the Sampled Area within a Wetland? **Yes** ____ **No** X

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5ft)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	____ =Total Cover		
Sapling/Shrub Stratum (Plot size: 5ft)			
1.			
2.			
3.			
4.			
5.			
	____ =Total Cover		
Herb Stratum (Plot size: 5ft)			
1. *Con ol ulus ar ensis*	10	Yes	UPL
2. *Phalaris arundinacea*	10	Yes	FACW
3. *Poa pratensis*	15	Yes	FAC
4.			
5.			
6.			
7.			
8.			
	35 =Total Cover		
Woody Vine Stratum (Plot size: 5ft)			
1.			
2.			
	____ =Total Cover		

% Bare Ground in Herb Stratum 60 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 66.7% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	10	x 2 =	20
FAC species	15	x 3 =	45
FACU species	0	x 4 =	0
UPL species	10	x 5 =	50
Column Totals:	35 (A)		115 (B)

Prevalence Index = B/A = 3.29

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%
____ Prevalence Index is ≤3.0[1]
____ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
____ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** X **No** ____

Remarks:

SOIL

Sampling Point: W6Sp1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-16	10YR 3/1	100					Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Iron-Manganese Masses (F12) **(LRR D)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** ___ **No** X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? Yes ___ No X Depth (inches): ___

(includes capillary fringe)

Wetland Hydrology Present? **Yes** ___ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Arid West Region
See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Franson Wellsville Watershed Project City/County: Wellsville, Cache County Sampling Date: 5/06/2024

Applicant/Owner: Franson Civil Engineers State: UT Sampling Point: W6Sp2

Investigator(s): Jason Lewis, Rebecca Miller Section, Township, Range: S29 T12N R1W

Landform (hillside, terrace, etc.): Terrace Local relief (concave, convex, none): Concave Slope (%): 0

Subregion (LRR): LRR D Lat: 41.75111114 Long: -111.98283586 Datum: NAD 1983

Soil Map Unit Name: MeA MENDON SILT LOAM, 0 TO 3 PERCENT SLOPES NWI classification: PEM

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No ____
Hydric Soil Present? Yes X No ____
Wetland Hydrology Present? Yes X No ____

Is the Sampled Area within a Wetland? **Yes** X **No** ____

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5ft)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	=Total Cover		
Sapling/Shrub Stratum (Plot size: 5ft)			
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
Herb Stratum (Plot size: 5ft)			
1. *Phalaris arundinacea*	100	Yes	FACW
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	100 =Total Cover		
Woody Vine Stratum (Plot size: 5ft)			
1.			
2.			
	=Total Cover		

% Bare Ground in Herb Stratum 0 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	100	x 2 =	200
FAC species	0	x 3 =	0
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	100 (A)		200 (B)

Prevalence Index = B/A = 2.00

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%
X Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** X **No** ____

Remarks:

SOIL

Sampling Point: W6Sp2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-16	10YR 3/1	100					Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- X Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Iron-Manganese Masses (F12) **(LRR D)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ___

Depth (inches): ___

Hydric Soil Present? **Yes** X **No** ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- X Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes	X	No	___	Depth (inches): 0
Water Table Present?	Yes	X	No	___	Depth (inches): 0
Saturation Present? (includes capillary fringe)	Yes	X	No	___	Depth (inches): 0

Wetland Hydrology Present? **Yes** X **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Arid West Region
See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Franson Wellsville Watershed Project City/County: Wellsville, Cache County Sampling Date: 5/06/2024
Applicant/Owner: Franson Civil Engineers State: UT Sampling Point: W7Sp1
Investigator(s): Jason Lewis, Rebecca Miller Section, Township, Range: S28 T12N R1W
Landform (hillside, terrace, etc.): Terrace Local relief (concave, convex, none): None Slope (%): 0
Subregion (LRR): LRR D Lat: 41.7456980 Long: -111.9641143 Datum: NAD 1983
Soil Map Unit Name: MeA MENDON SILT LOAM, 0 TO 3 PERCENT SLOPES NWI classification: None
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)
Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____
Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No ____
Hydric Soil Present? Yes ____ No X
Wetland Hydrology Present? Yes ____ No X

Is the Sampled Area within a Wetland? **Yes** ____ **No** X

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5ft)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	____ =Total Cover		
Sapling/Shrub Stratum (Plot size: 5ft)			
1.			
2.			
3.			
4.			
5.			
	____ =Total Cover		
Herb Stratum (Plot size: 5ft)			
1. *aphanus raphanistrum*	1	No	UPL
2. *Phalaris arundinacea*	35	Yes	FACW
3. *Cicuta maculata*	1	No	OBL
4.			
5.			
6.			
7.			
8.			
	37 =Total Cover		
Woody Vine Stratum (Plot size: 5ft)			
1.			
2.			
	____ =Total Cover		

% Bare Ground in Herb Stratum 45 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	1	x 1 =	1
FACW species	35	x 2 =	70
FAC species	0	x 3 =	0
FACU species	0	x 4 =	0
UPL species	1	x 5 =	5
Column Totals:	37 (A)		76 (B)

Prevalence Index = B/A = 2.05

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%
____ Prevalence Index is ≤3.0[1]
____ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
____ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** X **No** ____

Remarks:

SOIL

Sampling Point: W7Sp1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-16	10YR 3/1	100					Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Iron-Manganese Masses (F12) **(LRR D)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** ___ **No** X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? Yes ___ No X Depth (inches): ___

(includes capillary fringe)

Wetland Hydrology Present? **Yes** ___ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

No hydrology, soil was very dry

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Arid West Region
See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Franson Wellsville Watershed Project City/County: Wellsville, Cache County Sampling Date: 5/20/2024

Applicant/Owner: Franson Civil Engineers State: UT Sampling Point: W7Sp2

Investigator(s): Jason Lewis, Rebecca Miller, Henry Schroeder Section, Township, Range: S28 T12N R1W

Landform (hillside, terrace, etc.): Lake terrace Local relief (concave, convex, none): Concave Slope (%): 0

Subregion (LRR): LRR D Lat: 41.7456965 Long: -111.9640838 Datum: NAD 1983

Soil Map Unit Name: MeA MENDON SILT LOAM, 0 TO 3 PERCENT SLOPES NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No ____	**Is the Sampled Area within a Wetland?** **Yes** X **No** ____
Hydric Soil Present?	Yes X	No ____	
Wetland Hydrology Present?	Yes X	No ____	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5ft)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	=Total Cover		
Sapling/Shrub Stratum (Plot size: 5ft)			
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
Herb Stratum (Plot size: 5ft)			
1. *Taraxacum officinale*	15	No	FACU
2. *Phalaris arundinacea*	65	Yes	FACW
3. *ipsacus fullonum*	10	No	FAC
4. *aphanus raphanistrum*	1	No	UPL
5.			
6.			
7.			
8.			
	91 =Total Cover		
Woody Vine Stratum (Plot size: 5ft)			
1.			
2.			
	=Total Cover		

% Bare Ground in Herb Stratum 0 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	65	x 2 =	130
FAC species	10	x 3 =	30
FACU species	15	x 4 =	60
UPL species	1	x 5 =	5
Column Totals:	91 (A)		225 (B)
Prevalence Index = B/A =			2.47

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%

X Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** X **No** ____

Remarks:

SOIL

Sampling Point: W7Sp2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-16	10YR 3/1						Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Iron-Manganese Masses (F12) **(LRR D)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- X Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** X **No** ___

Remarks:

Redox masked due to highly saturated soil conditions.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- X Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ___	No X	Depth (inches): ___		
Water Table Present?	Yes X	No ___	Depth (inches): 8		
Saturation Present? (includes capillary fringe)	Yes X	No ___	Depth (inches): 0	**Wetland Hydrology Present?**	**Yes** X **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Arid West Region
See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Franson Wellsville Watershed Project City/County: Wellsville, Cache County Sampling Date: 5/06/2024

Applicant/Owner: Franson Civil Engineers State: UT Sampling Point: W8Sp1

Investigator(s): Jason Lewis, Rebecca Miller Section, Township, Range: S26 T12N R2W

Landform (hillside, terrace, etc.): Terrace Local relief (concave, convex, none): Convex Slope (%): 2

Subregion (LRR): LRR D Lat: 41.74375286 Long: -112.02935776 Datum: NAD 1983

Soil Map Unit Name: ArB AVON SILTY CLAY LOAM, 3 TO 6 PERCENT SLOPES NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No ____	**Is the Sampled Area within a Wetland?** Yes ____ No X
Hydric Soil Present?	Yes ____	No X	
Wetland Hydrology Present?	Yes ____	No X	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5ft)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	____ =Total Cover		
Sapling/Shrub Stratum (Plot size: 5ft)			
1.			
2.			
3.			
4.			
5.			
	____ =Total Cover		
Herb Stratum (Plot size: 5ft)			
1. *Poa pratensis*	65	Yes	FAC
2. *rctium lappa*	10	No	UPL
3. *Poa annua*	15	No	FAC
4.			
5.			
6.			
7.			
8.			
	90 =Total Cover		
Woody Vine Stratum (Plot size: 5ft)			
1.			
2.			
	____ =Total Cover		

% Bare Ground in Herb Stratum 20 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	80	x 3 =	240
FACU species	0	x 4 =	0
UPL species	10	x 5 =	50
Column Totals:	90 (A)		290 (B)

Prevalence Index = B/A = 3.22

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No ____

Remarks:

SOIL

Sampling Point: W8Sp1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-16	10YR 2/1	100						

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Iron-Manganese Masses (F12) **(LRR D)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** ___ **No** X

Remarks:
Soil was very dry

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? Yes ___ No X Depth (inches): ___
(includes capillary fringe)

Wetland Hydrology Present? **Yes** ___ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Arid West Region
See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Franson Wellsville Watershed Project City/County: Wellsville, Cache County Sampling Date: 5/06/2024

Applicant/Owner: Franson Civil Engineers State: UT Sampling Point: W8Sp2

Investigator(s): Jason Lewis, Rebecca Miller Section, Township, Range: S26 T12N R2W

Landform (hillside, terrace, etc.): Terrace Local relief (concave, convex, none): Concave Slope (%): 2

Subregion (LRR): LRR D Lat: 41.74364503 Long: -112.02918602 Datum: NAD 1983

Soil Map Unit Name: ArB AVON SILTY CLAY LOAM, 3 TO 6 PERCENT SLOPES NWI classification: PEM

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No ____
Hydric Soil Present? Yes X No ____
Wetland Hydrology Present? Yes X No ____

Is the Sampled Area within a Wetland? **Yes** X **No** ____

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5ft)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	=Total Cover		
Sapling/Shrub Stratum (Plot size: 5ft)			
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
Herb Stratum (Plot size: 5ft)			
1. *Phalaris arundinacea*	15	Yes	FACW
2. *anunculus sceleratus*	5	Yes	OBL
3.			
4.			
5.			
6.			
7.			
8.			
	20 =Total Cover		
Woody Vine Stratum (Plot size: 5ft)			
1.			
2.			
	=Total Cover		

% Bare Ground in Herb Stratum 65 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	5	x 1 =	5
FACW species	15	x 2 =	30
FAC species	0	x 3 =	0
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	20 (A)		35 (B)

Prevalence Index = B/A = 1.75

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%
X Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** X **No** ____

Remarks:

SOIL

Sampling Point: W8Sp2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-4	10YR 2/1	100					Loamy/Clayey	Loam
4-14	10YR 2/1	80	10YR 8/2	20	D	M	Loamy/Clayey	Clay

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- X Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Iron-Manganese Masses (F12) **(LRR D)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ___

Depth (inches): ___

Hydric Soil Present? **Yes** X **No** ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- X Surface Water (A1)
- ___ High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes X	No ___	Depth (inches): 0		
Water Table Present?	Yes ___	No X	Depth (inches): ___		
Saturation Present? (includes capillary fringe)	Yes X	No ___	Depth (inches): 0	**Wetland Hydrology Present?**	**Yes** X **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Saturation present within first 4 inches of soil. Clay layer from 4-14 inches creates an aquitard that restricsts water from flowing underground.

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Arid West Region
See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Franson Wellsville Watershed Project City/County: Wellsville, Cache County Sampling Date: 5/06/2024

Applicant/Owner: Franson Civil Engineers State: UT Sampling Point: W9Sp1

Investigator(s): Jason Lewis, Rebecca Miller Section, Township, Range: S9 T11N R1W

Landform (hillside, terrace, etc.): Terrace Local relief (concave, convex, none): Convex Slope (%): 0

Subregion (LRR): LRR D Lat: 41.71015006 Long: -111.96598811 Datum: NAD 1983

Soil Map Unit Name: Rs ROSHE SPRINGS SILT LOAM NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No ____
Hydric Soil Present? Yes ____ No X
Wetland Hydrology Present? Yes ____ No X

Is the Sampled Area within a Wetland? **Yes** ____ **No** X

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5ft)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	=Total Cover		
Sapling/Shrub Stratum (Plot size: 5ft)			
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
Herb Stratum (Plot size: 5ft)			
1. *Phalaris arundinacea*	100	Yes	FACW
2. *Taraxacum officinale*	1	No	FACU
3.			
4.			
5.			
6.			
7.			
8.			
	101 =Total Cover		
Woody Vine Stratum (Plot size: 5ft)			
1.			
2.			
	=Total Cover		

% Bare Ground in Herb Stratum 0 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	100	x 2 =	200
FAC species	0	x 3 =	0
FACU species	1	x 4 =	4
UPL species	0	x 5 =	0
Column Totals:	101 (A)		204 (B)

Prevalence Index = B/A = 2.02

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%
____ Prevalence Index is ≤3.0[1]
____ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
____ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** X **No** ____

Remarks:

SOIL

Sampling Point: W9Sp1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-4	10YR 3/1	100					Sandy	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Iron-Manganese Masses (F12) **(LRR D)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: Gravel/Road Prism

Depth (inches): 4

Hydric Soil Present? **Yes** ___ **No** X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? Yes ___ No X Depth (inches): ___

(includes capillary fringe)

Wetland Hydrology Present? **Yes** ___ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Arid West Region
See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Franson Wellsville Watershed Project City/County: Wellsville, Cache County Sampling Date: 5/06/2024

Applicant/Owner: Franson Civil Engineers State: UT Sampling Point: W9Sp2

Investigator(s): Jason Lewis, Rebecca Miller Section, Township, Range: S9 T11N R1W

Landform (hillside, terrace, etc.): Terrace Local relief (concave, convex, none): Concave Slope (%): 0

Subregion (LRR): LRR D Lat: 41.71014573 Long: -111.9659758 Datum: NAD 1983

Soil Map Unit Name: Rs ROSHE SPRINGS SILT LOAM NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No ____
Hydric Soil Present? Yes X No ____
Wetland Hydrology Present? Yes X No ____

Is the Sampled Area within a Wetland? **Yes** X **No** ____

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5ft)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	=Total Cover		
Sapling/Shrub Stratum (Plot size: 5ft)			
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
Herb Stratum (Plot size: 5ft)			
1. *Carex prae racilis*	60	Yes	FACW
2. *Phalaris arundinacea*	15	No	FACW
3. *Carex obnupta*	40	Yes	OBL
4.			
5.			
6.			
7.			
8.			
	115 =Total Cover		
Woody Vine Stratum (Plot size: 5ft)			
1.			
2.			
	=Total Cover		

% Bare Ground in Herb Stratum 0 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	40	x 1 =	40
FACW species	75	x 2 =	150
FAC species	0	x 3 =	0
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	115 (A)		190 (B)

Prevalence Index = B/A = 1.65

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%
X Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** X **No** ____

Remarks:

SOIL

Sampling Point: W9Sp2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-3	10YR 3/2	100					Loamy/Clayey	Clay
3-16	10YR 2/1	98	2.5YR 4/6	2	C	PL	Loamy/Clayey	Prominent redox concentrations

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- X Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Iron-Manganese Masses (F12) **(LRR D)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ___

Depth (inches): ___

Hydric Soil Present? **Yes** X **No** ___

Remarks:

Oxidized Rhizospheres present on Living Roots, redox xoncentration present along pore linings.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- X Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ___	No ___	Depth (inches): ___		
Water Table Present?	Yes X	No ___	Depth (inches): 8		
Saturation Present? (includes capillary fringe)	Yes X	No ___	Depth (inches): 0	**Wetland Hydrology Present?**	**Yes** X **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Arid West Region
See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Franson Wellsville Watershed Project City/County: Wellsville, Cache County Sampling Date: 5/06/2024

Applicant/Owner: Franson Civil Engineers State: UT Sampling Point: W10Sp1

Investigator(s): Jason Lewis, Rebecca Miller Section, Township, Range: S9 T11N R1W

Landform (hillside, terrace, etc.): Terrace Local relief (concave, convex, none): Convex Slope (%): 0

Subregion (LRR): LRR D Lat: 41.71017449 Long: -111.96168949 Datum: NAD 1983

Soil Map Unit Name: Rs ROSHE SPRINGS SILT LOAM NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No ____
Hydric Soil Present? Yes ____ No X
Wetland Hydrology Present? Yes ____ No X

Is the Sampled Area within a Wetland? **Yes** ____ **No** X

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5ft)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	=Total Cover		
Sapling/Shrub Stratum (Plot size: 5ft)			
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
Herb Stratum (Plot size: 5ft)			
1. *Carex obnupta*	90	Yes	OBL
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	90 =Total Cover		
Woody Vine Stratum (Plot size: 5ft)			
1.			
2.			
	=Total Cover		

% Bare Ground in Herb Stratum 10 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	90	x 1 =	90
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	90 (A)		90 (B)

Prevalence Index = B/A = 1.00

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%
___ Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** X **No** ____

Remarks:

SOIL

Sampling Point: W10Sp1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-14	10YR 3/1	100						

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Iron-Manganese Masses (F12) **(LRR D)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** ___ **No** X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? Yes ___ No X Depth (inches): ___

(includes capillary fringe)

Wetland Hydrology Present? **Yes** ___ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Arid West Region
See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Franson Wellsville Watershed Project City/County: Wellsville, Cache County Sampling Date: 5/06/2024

Applicant/Owner: Franson Civil Engineers State: UT Sampling Point: W10Sp2

Investigator(s): Jason Lewis, Rebecca Miller Section, Township, Range: S9 T11N R1W

Landform (hillside, terrace, etc.): Terrace Local relief (concave, convex, none): None Slope (%): 0

Subregion (LRR): LRR D Lat: 41.71012323 Long: -111.96170866 Datum: NAD 1983

Soil Map Unit Name: Rs ROSHE SPRINGS SILT LOAM NWI classification: PEM

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No ____
Hydric Soil Present? Yes X No ____
Wetland Hydrology Present? Yes X No ____

Is the Sampled Area within a Wetland? **Yes** X **No** ____

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5ft)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	=Total Cover		
Sapling/Shrub Stratum (Plot size: 5ft)			
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
Herb Stratum (Plot size: 5ft)			
1. *Typha latifolia*	15	Yes	OBL
2. *ipsacus fullonum*	5	No	FAC
3. *Carex obnupta*	40	Yes	OBL
4. *pilobium ciliatum*	10	No	FACW
5.			
6.			
7.			
8.			
	70 =Total Cover		
Woody Vine Stratum (Plot size: 5ft)			
1.			
2.			
	=Total Cover		

% Bare Ground in Herb Stratum 30 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	55	x 1 =	55
FACW species	10	x 2 =	20
FAC species	5	x 3 =	15
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	70 (A)		90 (B)

Prevalence Index = B/A = 1.29

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%
X Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** X **No** ____

Remarks:

SOIL

Sampling Point: W10Sp2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-4	10YR 4/2	100					Loamy/Clayey	
4-14	7.5YR 3/1	98	2.5YR 4/6	2	C	PL	Loamy/Clayey	Prominent redox concentration

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- X Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Iron-Manganese Masses (F12) **(LRR D)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ___

Depth (inches): ___

Hydric Soil Present? **Yes** X **No** ___

Remarks:

Oxidized Rhizospheres present on Living Roots, redox xoncentration present along pore linings.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- X Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ___	No X	Depth (inches): ___		
Water Table Present?	Yes X	No ___	Depth (inches): 6		
Saturation Present? (includes capillary fringe)	Yes X	No ___	Depth (inches): 0	**Wetland Hydrology Present?**	**Yes** X **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Arid West Region
See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Franson Wellsville Watershed Project City/County: Wellsville, Cache County Sampling Date: 5/06/2024

Applicant/Owner: Franson Civil Engineers State: UT Sampling Point: W11Sp1

Investigator(s): Jason Lewis, Rebecca Miller Section, Township, Range: S9 T11N R1W

Landform (hillside, terrace, etc.): Terrace Local relief (concave, convex, none): Convex Slope (%): 0

Subregion (LRR): LRR D Lat: 41.7101586 Long: -111.95696552 Datum: NAD 1983

Soil Map Unit Name: Sg SALT LAKE-ROSHE SPRINGS COMPLEX NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No ____
Hydric Soil Present? Yes ____ No X
Wetland Hydrology Present? Yes ____ No X

Is the Sampled Area within a Wetland? **Yes** ____ **No** X

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5ft)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	=Total Cover		
Sapling/Shrub Stratum (Plot size: 5ft)			
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
Herb Stratum (Plot size: 5ft)			
1. *Phalaris arundinacea*	90	Yes	FACW
2. *lopecurus pratensis*	5	No	FACW
3. *Con ol ulus ar ensis*	1	No	UPL
4. *chillea millefolium*	1	No	FACU
5.			
6.			
7.			
8.			
	97 =Total Cover		
Woody Vine Stratum (Plot size: 5ft)			
1.			
2.			
	=Total Cover		

% Bare Ground in Herb Stratum 0 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	95	x 2 =	190
FAC species	0	x 3 =	0
FACU species	1	x 4 =	4
UPL species	1	x 5 =	5
Column Totals:	97 (A)		199 (B)

Prevalence Index = B/A = 2.05

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%
____ Prevalence Index is ≤3.0[1]
____ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
____ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** X **No** ____

Remarks:

SOIL

Sampling Point: W11Sp1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-7	10YR 2/1	100					Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Iron-Manganese Masses (F12) **(LRR D)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: Gravel/Road Prism

Depth (inches): 7

Hydric Soil Present? **Yes** ___ **No** X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? Yes ___ No X Depth (inches): ___

(includes capillary fringe)

Wetland Hydrology Present? **Yes** ___ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Arid West Region
See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Franson Wellsville Watershed Project City/County: Wellsville, Cache County Sampling Date: 5/06/2024

Applicant/Owner: Franson Civil Engineers State: UT Sampling Point: W11Sp2

Investigator(s): Jason Lewis, Rebecca Miller Section, Township, Range: S9 T11N R1W

Landform (hillside, terrace, etc.): Terrace Local relief (concave, convex, none): Concave Slope (%): 0

Subregion (LRR): LRR D Lat: 41.71025092 Long: -111.95695093 Datum: NAD 1983

Soil Map Unit Name: Sg SALT LAKE-ROSHE SPRINGS COMPLEX NWI classification: PEM

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No ____	**Is the Sampled Area within a Wetland?** **Yes** X **No** ____
Hydric Soil Present?	Yes X	No ____	
Wetland Hydrology Present?	Yes X	No ____	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5ft)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	____ =Total Cover		
Sapling/Shrub Stratum (Plot size: 5ft)			
1.			
2.			
3.			
4.			
5.			
	____ =Total Cover		
Herb Stratum (Plot size: 5ft)			
1. *lopecurus pratensis*	75	Yes	FACW
2. *leocharis palustris*	15	No	OBL
3. *Schoenoplectus acutus*	20	No	OBL
4.			
5.			
6.			
7.			
8.			
	110 =Total Cover		
Woody Vine Stratum (Plot size: 5ft)			
1.			
2.			
	____ =Total Cover		

% Bare Ground in Herb Stratum 10 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	35	x 1 =	35
FACW species	75	x 2 =	150
FAC species	0	x 3 =	0
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	110 (A)		185 (B)

Prevalence Index = B/A = 1.68

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%

X Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** X **No** ____

Remarks:

SOIL

Sampling Point: W11Sp2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-8	10YR 2/1	100					Loamy/Clayey	
8-14	10YR 2/1	90	7.5YR 5/1	10	D	M	Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- X Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- X Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Iron-Manganese Masses (F12) **(LRR D)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** X **No** ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- X Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ___	No X	Depth (inches): ___		
Water Table Present?	Yes X	No ___	Depth (inches): 8		
Saturation Present? (includes capillary fringe)	Yes X	No ___	Depth (inches): 0	**Wetland Hydrology Present?**	**Yes** X **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Arid West Region
See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Franson Wellsville Watershed Project City/County: Wellsville, Cache County Sampling Date: 5/06/2024

Applicant/Owner: Franson Civil Engineers State: UT Sampling Point: W12Sp1

Investigator(s): Jason Lewis, Rebecca Miller Section, Township, Range: S9 T11N R1W

Landform (hillside, terrace, etc.): Terrace Local relief (concave, convex, none): Convex Slope (%): 0

Subregion (LRR): LRR D Lat: 41.71025466 Long: -111.96437834 Datum: NAD 1983

Soil Map Unit Name: Rs ROSHE SPRINGS SILT LOAM NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No ____	**Is the Sampled Area within a Wetland?** Yes ____ No X
Hydric Soil Present?	Yes ____	No X	
Wetland Hydrology Present?	Yes ____	No X	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5ft)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	____ =Total Cover		
Sapling/Shrub Stratum (Plot size: 5ft)			
1.			
2.			
3.			
4.			
5.			
	____ =Total Cover		
Herb Stratum (Plot size: 5ft)			
1. *Phalaris arundinacea*	80	Yes	FACW
2. *actuca serriola*	5	No	FACU
3.			
4.			
5.			
6.			
7.			
8.			
	85 =Total Cover		
Woody Vine Stratum (Plot size: 5ft)			
1.			
2.			
	____ =Total Cover		

% Bare Ground in Herb Stratum 20 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	80	x 2 =	160
FAC species	0	x 3 =	0
FACU species	5	x 4 =	20
UPL species	0	x 5 =	0
Column Totals:	85 (A)		180 (B)

Prevalence Index = B/A = 2.12

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%

____ Prevalence Index is ≤3.0[1]

____ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

____ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No ____

Remarks:

SOIL

Sampling Point: W12Sp1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-3	10YR 3/2	100						

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Iron-Manganese Masses (F12) **(LRR D)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: Gravel/Road Prism

Depth (inches): 3

Hydric Soil Present? **Yes** ___ **No** X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? Yes ___ No X Depth (inches): ___

(includes capillary fringe)

Wetland Hydrology Present? **Yes** ___ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Arid West Region
See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Franson Wellsville Watershed Project City/County: Wellsville, Cache County Sampling Date: 5/06/2024

Applicant/Owner: Franson Civil Engineers State: UT Sampling Point: W12Sp2

Investigator(s): Jason Lewis, Rebecca Miller Section, Township, Range: S9 T11N R1W

Landform (hillside, terrace, etc.): Terrace Local relief (concave, convex, none): none Slope (%): 0

Subregion (LRR): LRR D Lat: 41.7103400 Long: -111.9637717 Datum: NAD 1983

Soil Map Unit Name: Rs ROSHE SPRINGS SILT LOAM NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No ____
Hydric Soil Present? Yes X No ____
Wetland Hydrology Present? Yes X No ____

Is the Sampled Area within a Wetland? **Yes** X **No** ____

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5ft)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	=Total Cover		
Sapling/Shrub Stratum (Plot size: 5ft)			
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
Herb Stratum (Plot size: 5ft)			
1. *leocharis palustris*	40	Yes	OBL
2. *Taraxacum officinale*	5	No	FACU
3. *Carex obnupta*	15	Yes	OBL
4.			
5.			
6.			
7.			
8.			
	60 =Total Cover		
Woody Vine Stratum (Plot size: 5ft)			
1.			
2.			
	=Total Cover		

% Bare Ground in Herb Stratum 40 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	55	x 1 =	55
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	5	x 4 =	20
UPL species	0	x 5 =	0
Column Totals:	60 (A)		75 (B)

Prevalence Index = B/A = 1.25

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%
X Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** X **No** ____

Remarks:

SOIL

Sampling Point: W12Sp2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-4	10YR 2/1	100					Loamy/Clayey	
4-14	10YR 2/1	70	7.5YR 5/1	30	D	M	Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- X Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Iron-Manganese Masses (F12) **(LRR D)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** X **No** ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ___	No X	Depth (inches): ___		
Water Table Present?	Yes X	No ___	Depth (inches): 9		
Saturation Present? (includes capillary fringe)	Yes X	No ___	Depth (inches): 6	**Wetland Hydrology Present?**	**Yes** X **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Arid West Region
See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Franson Wellsville Watershed Project City/County: Wellsville, Cache County Sampling Date: 5/06/2024

Applicant/Owner: Franson Civil Engineers State: UT Sampling Point: W13Sp1

Investigator(s): Jason Lewis, Rebecca Miller Section, Township, Range: S9 T11N R1W

Landform (hillside, terrace, etc.): Terrace Local relief (concave, convex, none): Convex Slope (%): 0

Subregion (LRR): LRR D Lat: 41.70269266 Long: -111.95898878 Datum: NAD 1983

Soil Map Unit Name: Rs ROSHE SPRINGS SILT LOAM NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No X	**Is the Sampled Area within a Wetland?** **Yes** ____ **No** X
Hydric Soil Present?	Yes ____	No X	
Wetland Hydrology Present?	Yes ____	No X	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5ft)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	=Total Cover		
Sapling/Shrub Stratum (Plot size: 5ft)			
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
Herb Stratum (Plot size: 5ft)			
1. *lopecurus pratensis*	5	Yes	FACW
2. *mbrosia artemisiifolia*	5	Yes	FACU
3.			
4.			
5.			
6.			
7.			
8.			
	10 =Total Cover		
Woody Vine Stratum (Plot size: 5ft)			
1.			
2.			
	=Total Cover		

% Bare Ground in Herb Stratum 90 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	5	x 2 =	10
FAC species	0	x 3 =	0
FACU species	5	x 4 =	20
UPL species	0	x 5 =	0
Column Totals:	10 (A)		30 (B)

Prevalence Index = B/A = 3.00

Hydrophytic Vegetation Indicators:

____ Dominance Test is >50%

____ Prevalence Index is ≤3.0[1]

____ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

____ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** ____ **No** X

Remarks:

SOIL

Sampling Point: W13Sp1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-1	10YR 3/2	100						

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Iron-Manganese Masses (F12) **(LRR D)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: Gravel/Road Prism

Depth (inches): 1

Hydric Soil Present? **Yes** ___ **No** X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? Yes ___ No X Depth (inches): ___

(includes capillary fringe)

Wetland Hydrology Present? **Yes** ___ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Arid West Region
See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Franson Wellsville Watershed Project City/County: Wellsville, Cache County Sampling Date: 5/06/2024

Applicant/Owner: Franson Civil Engineers State: UT Sampling Point: W13Sp2

Investigator(s): Jason Lewis, Rebecca Miller Section, Township, Range: S9 T11N R1W

Landform (hillside, terrace, etc.): Terrace Local relief (concave, convex, none): None Slope (%): 0

Subregion (LRR): LRR D Lat: 41.70276201 Long: -111.95898334 Datum: NAD 1983

Soil Map Unit Name: Rs ROSHE SPRINGS SILT LOAM NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No ____
Hydric Soil Present? Yes X No ____
Wetland Hydrology Present? Yes X No ____

Is the Sampled Area within a Wetland? **Yes** X **No** ____

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5ft)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	=Total Cover		
Sapling/Shrub Stratum (Plot size: 5ft)			
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
Herb Stratum (Plot size: 5ft)			
1. *lopecurus pratensis*	95	Yes	FACW
2. *Trifolium repens*	15	No	FACU
3. *Taraxacum officinale*	5	No	FACU
4.			
5.			
6.			
7.			
8.			
	115 =Total Cover		
Woody Vine Stratum (Plot size: 5ft)			
1.			
2.			
	=Total Cover		

% Bare Ground in Herb Stratum 0 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	95	x 2 =	190
FAC species	0	x 3 =	0
FACU species	20	x 4 =	80
UPL species	0	x 5 =	0
Column Totals:	115 (A)		270 (B)

Prevalence Index = B/A = 2.35

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%
X Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** X **No** ____

Remarks:

SOIL

Sampling Point: W13Sp2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-5	10YR 2/1	100					Loamy/Clayey	
5-14	7.5YR 5/1	100					Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- X Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Iron-Manganese Masses (F12) **(LRR D)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** X **No** ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ___	No X	Depth (inches): ___		
Water Table Present?	Yes X	No ___	Depth (inches): 12		
Saturation Present? (includes capillary fringe)	Yes X	No ___	Depth (inches): 8	**Wetland Hydrology Present?**	**Yes** X **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Arid West Region
See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Franson Wellsville Watershed Project City/County: Wellsville, Cache County Sampling Date: 5/06/2024

Applicant/Owner: Franson Civil Engineers State: UT Sampling Point: W14Sp1

Investigator(s): Jason Lewis, Rebecca Miller Section, Township, Range: S9 T11N R1W

Landform (hillside, terrace, etc.): Terrace Local relief (concave, convex, none): Convex Slope (%): 0

Subregion (LRR): LRR D Lat: 41.70182772 Long: -111.96389228 Datum: NAD 1983

Soil Map Unit Name: Rs ROSHE SPRINGS SILT LOAM NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No ____	**Is the Sampled Area within a Wetland?** Yes ____ No X
Hydric Soil Present?	Yes ____	No X	
Wetland Hydrology Present?	Yes ____	No X	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5ft)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	____ =Total Cover		
Sapling/Shrub Stratum (Plot size: 5ft)			
1.			
2.			
3.			
4.			
5.			
	____ =Total Cover		
Herb Stratum (Plot size: 5ft)			
1. *lopecurus pratensis*	40	Yes	FACW
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	40 =Total Cover		
Woody Vine Stratum (Plot size: 5ft)			
1.			
2.			
	____ =Total Cover		

% Bare Ground in Herb Stratum 70 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	40	x 2 =	80
FAC species	0	x 3 =	0
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	40 (A)		80 (B)

Prevalence Index = B/A = 2.00

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No ____

Remarks:

SOIL

Sampling Point: W14Sp1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-4	10YR 2/1	100					Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Iron-Manganese Masses (F12) **(LRR D)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: Gravel/Road Prism

Depth (inches): 4

Hydric Soil Present? **Yes** ___ **No** X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? Yes ___ No X Depth (inches): ___

(includes capillary fringe)

Wetland Hydrology Present? **Yes** ___ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Arid West Region
See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Franson Wellsville Watershed Project City/County: Wellsville, Cache County Sampling Date: 5/06/2024

Applicant/Owner: Franson Civil Engineers State: UT Sampling Point: W14Sp2

Investigator(s): Jason Lewis, Rebecca Miller Section, Township, Range: S9 T11N R1W

Landform (hillside, terrace, etc.): Terrace Local relief (concave, convex, none): None Slope (%): 0

Subregion (LRR): LRR D Lat: 41.7018401 Long: -E111.9639851 Datum: NAD 1983

Soil Map Unit Name: Rs ROSHE SPRINGS SILT LOAM NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No ____
Hydric Soil Present? Yes X No ____
Wetland Hydrology Present? Yes X No ____

Is the Sampled Area within a Wetland? **Yes** X **No** ____

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5ft)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	=Total Cover		
Sapling/Shrub Stratum (Plot size: 5ft)			
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
Herb Stratum (Plot size: 5ft)			
1. *lopecurus pratensis*	90	Yes	FACW
2. *Trifolium repens*	1	No	FACU
3. *Taraxacum officinale*	1	No	FACU
4.			
5.			
6.			
7.			
8.			
	92 =Total Cover		
Woody Vine Stratum (Plot size: 5ft)			
1.			
2.			
	=Total Cover		

% Bare Ground in Herb Stratum 0 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	90	x 2 =	180
FAC species	0	x 3 =	0
FACU species	2	x 4 =	8
UPL species	0	x 5 =	0
Column Totals:	92 (A)		188 (B)

Prevalence Index = B/A = 2.04

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%
X Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** X **No** ____

Remarks:

SOIL

Sampling Point: W14Sp2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-14	10YR 2/1	100					Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- X Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Iron-Manganese Masses (F12) **(LRR D)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** X **No** ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- X Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ___	No X	Depth (inches): ___		
Water Table Present?	Yes X	No ___	Depth (inches): 7		
Saturation Present? (includes capillary fringe)	Yes X	No ___	Depth (inches): 0	**Wetland Hydrology Present?**	**Yes** X **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Arid West Region
See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Franson Wellsville Watershed Project City/County: Wellsville, Cache County Sampling Date: 5/06/2024

Applicant/Owner: Franson Civil Engineers State: UT Sampling Point: W15Sp1

Investigator(s): Jason Lewis, Rebecca Miller Section, Township, Range: S9 T11N R1W

Landform (hillside, terrace, etc.): Terrace Local relief (concave, convex, none): None Slope (%): 0

Subregion (LRR): LRR D Lat: 41.70175305 Long: -111.96370622 Datum: NAD 1983

Soil Map Unit Name: Rs ROSHE SPRINGS SILT LOAM NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes ____ No X
Hydric Soil Present? Yes ____ No X
Wetland Hydrology Present? Yes ____ No X

Is the Sampled Area within a Wetland? **Yes** ____ **No** X

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5ft)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	____ =Total Cover		
Sapling/Shrub Stratum (Plot size: 5ft)			
1.			
2.			
3.			
4.			
5.			
	____ =Total Cover		
Herb Stratum (Plot size: 5ft)			
1. *osa oodsii*	20	No	FACU
2. *nopordum acanthium*	5	No	UPL
3. *aphanus raphanistrum*	1	No	UPL
4. *Con ol ulus ar ensis*	25	Yes	UPL
5. *actuca serriola*	10	No	FACU
6. *Cirsium ar ense*	40	Yes	FACU
7. *Phalaris arundinacea*	20	No	FACW
8.			
	121 =Total Cover		
Woody Vine Stratum (Plot size: 5ft)			
1.			
2.			
	____ =Total Cover		

% Bare Ground in Herb Stratum 30 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	20	x 2 =	40
FAC species	0	x 3 =	0
FACU species	70	x 4 =	280
UPL species	31	x 5 =	155
Column Totals:	121 (A)		475 (B)
Prevalence Index = B/A =			3.93

Hydrophytic Vegetation Indicators:

____ Dominance Test is >50%
____ Prevalence Index is ≤3.0[1]
____ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
____ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** ____ **No** X

Remarks:

SOIL

Sampling Point: W15Sp1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-4	10YR 3/3	100					Loamy/Clayey	
4-14	10YR 2/1	100					Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Iron-Manganese Masses (F12) **(LRR D)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** ___ **No** X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? Yes ___ No X Depth (inches): ___

(includes capillary fringe)

Wetland Hydrology Present? **Yes** ___ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Arid West Region
See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Franson Wellsville Watershed Project City/County: Wellsville, Cache County Sampling Date: 5/06/2024

Applicant/Owner: Franson Civil Engineers State: UT Sampling Point: W15Sp2

Investigator(s): Jason Lewis, Rebecca Miller Section, Township, Range: S9 T11N R1W

Landform (hillside, terrace, etc.): Terrace Local relief (concave, convex, none): Concave Slope (%): 0

Subregion (LRR): LRR D Lat: 41.7017614 Long: -111.9636359 Datum: NAD 1983

Soil Map Unit Name: Rs ROSHE SPRINGS SILT LOAM NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No ____	**Is the Sampled Area within a Wetland?** Yes ____ No X
Hydric Soil Present?	Yes ____	No X	
Wetland Hydrology Present?	Yes X	No ____	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5ft)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	____	=Total Cover	
Sapling/Shrub Stratum (Plot size: 5ft)			
1.			
2.			
3.			
4.			
5.			
	____	=Total Cover	
Herb Stratum (Plot size: 5ft)			
1. *Carex prae racilis*	25	No	FACW
2. *Poa pratensis*	90	Yes	FAC
3. *lopecurus pratensis*	15	No	FACW
4.			
5.			
6.			
7.			
8.			
	130	=Total Cover	
Woody Vine Stratum (Plot size: 5ft)			
1.			
2.			
	____	=Total Cover	

% Bare Ground in Herb Stratum 0 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	40	x 2 =	80
FAC species	90	x 3 =	270
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	130 (A)		350 (B)

Prevalence Index = B/A = 2.69

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No ____

Remarks:

SOIL

Sampling Point: W15Sp2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-4	10YR 2/1	100					Loamy/Clayey	
4-14	10YR 2/1	90	10YR 5/1	10	D	M	Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- X Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Iron-Manganese Masses (F12) **(LRR D)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ___

Depth (inches): ___

Hydric Soil Present? **Yes** ___ **No** X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ___	No X	Depth (inches): ___
Water Table Present?	Yes X	No ___	Depth (inches): 10
Saturation Present? (includes capillary fringe)	Yes X	No ___	Depth (inches): 8

Wetland Hydrology Present? **Yes** X **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Arid West Region
See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Franson Wellsville Watershed Project City/County: Wellsville, Cache County Sampling Date: 5/06/2024

Applicant/Owner: Franson Civil Engineers State: UT Sampling Point: W16Sp1

Investigator(s): Jason Lewis, Rebecca Miller Section, Township, Range: S16 T11N R1W

Landform (hillside, terrace, etc.): Terrace Local relief (concave, convex, none): None Slope (%): 0

Subregion (LRR): LRR D Lat: 41.6952952 Long: -111.9585941 Datum: NAD 1983

Soil Map Unit Name: Lr LOGAN SILTY CLAY LOAM NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No ____	**Is the Sampled Area within a Wetland?** Yes ____ No X
Hydric Soil Present?	Yes ____	No X	
Wetland Hydrology Present?	Yes ____	No X	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5ft)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	=Total Cover		
Sapling/Shrub Stratum (Plot size: 5ft)			
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
Herb Stratum (Plot size: 5ft)			
1. *Taraxacum officinale*	5	No	FACU
2. *Cirsium ar ense*	1	No	FACU
3. *Cicuta maculata*	15	No	OBL
4. *Phalaris arundinacea*	85	Yes	FACW
5. *ipsacus fullonum*	20	No	FAC
6. *actuca serriola*	20	No	FACU
7.			
8.			
	146 =Total Cover		
Woody Vine Stratum (Plot size: 5ft)			
1.			
2.			
	=Total Cover		

% Bare Ground in Herb Stratum 5 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	15	x 1 =	15
FACW species	85	x 2 =	170
FAC species	20	x 3 =	60
FACU species	26	x 4 =	104
UPL species	0	x 5 =	0
Column Totals:	146 (A)		349 (B)
Prevalence Index = B/A =			2.39

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No ____

Remarks:

SOIL

Sampling Point: W16Sp1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-14	10YR 2/1	100					Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Iron-Manganese Masses (F12) **(LRR D)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** ___ **No** X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? Yes ___ No X Depth (inches): ___

(includes capillary fringe)

Wetland Hydrology Present? **Yes** ___ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Arid West Region
See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Franson Wellsville Watershed Project City/County: Wellsville, Cache County Sampling Date: 5/06/2024

Applicant/Owner: Franson Civil Engineers State: UT Sampling Point: W16Sp2

Investigator(s): Jason Lewis, Rebecca Miller Section, Township, Range: S16 T11N R1W

Landform (hillside, terrace, etc.): Terrace Local relief (concave, convex, none): None Slope (%): 0

Subregion (LRR): LRR D Lat: 41.6952715 Long: -111.9577296 Datum: NAD 1983

Soil Map Unit Name: Lr LOGAN SILTY CLAY LOAM NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No ____
Hydric Soil Present? Yes X No ____
Wetland Hydrology Present? Yes X No ____

Is the Sampled Area within a Wetland? **Yes** X **No** ____

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5ft)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	=Total Cover		
Sapling/Shrub Stratum (Plot size: 5ft)			
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
Herb Stratum (Plot size: 5ft)			
1. *lopecurus pratensis*	100	Yes	FACW
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	100 =Total Cover		
Woody Vine Stratum (Plot size: 5ft)			
1.			
2.			
	=Total Cover		

% Bare Ground in Herb Stratum 0 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	100	x 2 =	200
FAC species	0	x 3 =	0
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	100 (A)		200 (B)

Prevalence Index = B/A = 2.00

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%
X Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** X **No** ____

Remarks:

SOIL

Sampling Point: W16Sp2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-8	10YR 2/1	100					Loamy/Clayey	
8-14	10YR 2/1	100					Mucky Loam/Clay	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- X Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Iron-Manganese Masses (F12) **(LRR D)**
- ? Reduced Vertic (F18)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ___

Depth (inches): ___

Hydric Soil Present? **Yes** X **No** ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- X Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ___	No X	Depth (inches): ___		
Water Table Present?	Yes X	No ___	Depth (inches): 10		
Saturation Present? (includes capillary fringe)	Yes X	No ___	Depth (inches): 0	**Wetland Hydrology Present?**	**Yes** X **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Arid West Region
See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Franson Wellsville Watershed Project City/County: Wellsville, Cache County Sampling Date: 5/07/2024

Applicant/Owner: Franson Civil Engineers State: UT Sampling Point: W16Sp3

Investigator(s): Jason Lewis, Rebecca Miller Section, Township, Range: S16 T11N R1W

Landform (hillside, terrace, etc.): Terrace Local relief (concave, convex, none): None Slope (%): 0

Subregion (LRR): LRR D Lat: 41.69510505 Long: -111.95100785 Datum: NAD 1983

Soil Map Unit Name: Sg SALT LAKE-ROSHE SPRINGS COMPLEX NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No ____
Hydric Soil Present? Yes ____ No X
Wetland Hydrology Present? Yes ____ No X

Is the Sampled Area within a Wetland? **Yes** ____ **No** X

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5ft)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	=Total Cover		
Sapling/Shrub Stratum (Plot size: 5ft)			
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
Herb Stratum (Plot size: 5ft)			
1. *Poa pratensis*	95	Yes	FAC
2. *Taraxacum officinale*	1	No	FACU
3. *Cirsium ar ense*	1	No	FACU
4. *Carex obnupta*	2	No	OBL
5.			
6.			
7.			
8.			
	99 =Total Cover		
Woody Vine Stratum (Plot size: 5ft)			
1.			
2.			
	=Total Cover		

% Bare Ground in Herb Stratum 5 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	2	x 1 =	2
FACW species	0	x 2 =	0
FAC species	95	x 3 =	285
FACU species	2	x 4 =	8
UPL species	0	x 5 =	0
Column Totals:	99 (A)		295 (B)

Prevalence Index = B/A = 2.98

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%
____ Prevalence Index is ≤3.0[1]
____ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
____ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** X **No** ____

Remarks:

SOIL

Sampling Point: W16Sp3

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-4	10YR 2/1	100					Loamy/Clayey	
4-8	10YR 2/1	50					Loamy/Clayey	
4-8	7.5YR 3/1	50					Loamy/Clayey	
8-14	10YR 4/1	100					Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Iron-Manganese Masses (F12) **(LRR D)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ___

Depth (inches): ___

Hydric Soil Present? **Yes** ___ **No** X

Remarks:
Soil was very dry

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? Yes ___ No X Depth (inches): ___
(includes capillary fringe)

Wetland Hydrology Present? **Yes** ___ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Arid West Region
See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Franson Wellsville Watershed Project City/County: Wellsville, Cache County Sampling Date: 5/07/2024

Applicant/Owner: Franson Civil Engineers State: UT Sampling Point: W16Sp4

Investigator(s): Rebecca Miller Section, Township, Range: S16 T11N R1W

Landform (hillside, terrace, etc.): Terrace Local relief (concave, convex, none): None Slope (%): 0

Subregion (LRR): LRR D Lat: 41.69508368 Long: -111.95096539 Datum: NAD 1983

Soil Map Unit Name: Sg SALT LAKE-ROSHE SPRINGS COMPLEX NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No ____
Hydric Soil Present? Yes X No ____
Wetland Hydrology Present? Yes X No ____

Is the Sampled Area within a Wetland? **Yes** X **No** ____

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5ft)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	=Total Cover		
Sapling/Shrub Stratum (Plot size: 5ft)			
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
Herb Stratum (Plot size: 5ft)			
1. *Schoenoplectus americanus*	30	Yes	OBL
2. *Carex obnupta*	40	Yes	OBL
3. *Carex prae racilis*	30	Yes	FACW
4.			
5.			
6.			
7.			
8.			
	100 =Total Cover		
Woody Vine Stratum (Plot size: 5ft)			
1.			
2.			
	=Total Cover		

% Bare Ground in Herb Stratum 0 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	70	x 1 =	70
FACW species	30	x 2 =	60
FAC species	0	x 3 =	0
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	100 (A)		130 (B)

Prevalence Index = B/A = 1.30

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%
X Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** X **No** ____

Remarks:

SOIL

Sampling Point: W16Sp4

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-14	10YR 3/1	100					Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- X Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Iron-Manganese Masses (F12) **(LRR D)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ___

Depth (inches): ___

Hydric Soil Present? **Yes** X **No** ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- X Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ___	No X	Depth (inches): ___		
Water Table Present?	Yes X	No ___	Depth (inches): 10		
Saturation Present? (includes capillary fringe)	Yes X	No ___	Depth (inches): 0	**Wetland Hydrology Present?**	**Yes** X **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Arid West Region
See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Franson Wellsville Watershed Project City/County: Wellsville, Cache County Sampling Date: 5/07/2024

Applicant/Owner: Franson Civil Engineers State: UT Sampling Point: W16Sp5

Investigator(s): Jason Lewis, Rebecca Miller Section, Township, Range: S16 T11N R1W

Landform (hillside, terrace, etc.): Terrace Local relief (concave, convex, none): None Slope (%): 0

Subregion (LRR): LRR D Lat: 41.69514563 Long: -111.95259066 Datum: NAD 1983

Soil Map Unit Name: Sg SALT LAKE-ROSHE SPRINGS COMPLEX NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No ____
Hydric Soil Present? Yes ____ No X
Wetland Hydrology Present? Yes ____ No X

Is the Sampled Area within a Wetland? **Yes** ____ **No** X

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5ft)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	____ =Total Cover		
Sapling/Shrub Stratum (Plot size: 5ft)			
1.			
2.			
3.			
4.			
5.			
	____ =Total Cover		
Herb Stratum (Plot size: 5ft)			
1. *Poa pratensis*	95	Yes	FAC
2. *Cirsium ar ense*	2	No	FACU
3. *Taraxacum officinale*	2	No	FACU
4. *chillea millefolium*	1	No	FACU
5. *Carex obnupta*	1	No	OBL
6.			
7.			
8.			
	101 =Total Cover		
Woody Vine Stratum (Plot size: 5ft)			
1.			
2.			
	____ =Total Cover		

% Bare Ground in Herb Stratum 0 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	1	x 1 =	1
FACW species	0	x 2 =	0
FAC species	95	x 3 =	285
FACU species	5	x 4 =	20
UPL species	0	x 5 =	0
Column Totals:	101 (A)		306 (B)
Prevalence Index = B/A =			3.03

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%
____ Prevalence Index is ≤3.0[1]
____ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
____ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** X **No** ____

Remarks:

SOIL

Sampling Point: W16Sp5

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-14	10YR 2/1	100					Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Iron-Manganese Masses (F12) **(LRR D)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** ___ **No** X

Remarks:
Soil is very dry

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? Yes ___ No X Depth (inches): ___
(includes capillary fringe)

Wetland Hydrology Present? **Yes** ___ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Arid West Region
See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Franson Wellsville Watershed Project City/County: Wellsville, Cache County Sampling Date: 5/07/2024

Applicant/Owner: Franson Civil Engineers State: UT Sampling Point: W16Sp6

Investigator(s): Jason Lewis, Rebecca Miller Section, Township, Range: S16 T11N R1W

Landform (hillside, terrace, etc.): Terrace Local relief (concave, convex, none): None Slope (%): 0

Subregion (LRR): LRR D Lat: 41.69516186 Long: -111.95270171 Datum: NAD 1983

Soil Map Unit Name: Sg SALT LAKE-ROSHE SPRINGS COMPLEX NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No ____
Hydric Soil Present? Yes X No ____
Wetland Hydrology Present? Yes X No ____

Is the Sampled Area within a Wetland? **Yes** X **No** ____

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5ft)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	=Total Cover		
Sapling/Shrub Stratum (Plot size: 5ft)			
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
Herb Stratum (Plot size: 5ft)			
1. *anunculus repens*	1	No	FAC
2. *Schoenoplectus americanus*	2	No	OBL
3. *Carex prae racilis*	80	Yes	FACW
4. *Carex obnupta*	29	Yes	OBL
5. *Taraxacum officinale*	1	No	FACU
6.			
7.			
8.			
	113 =Total Cover		
Woody Vine Stratum (Plot size: 5ft)			
1.			
2.			
	=Total Cover		

% Bare Ground in Herb Stratum 0 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	31	x 1 =	31
FACW species	80	x 2 =	160
FAC species	1	x 3 =	3
FACU species	1	x 4 =	4
UPL species	0	x 5 =	0
Column Totals:	113 (A)		198 (B)

Prevalence Index = B/A = 1.75

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%
X Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** X **No** ____

Remarks:

SOIL

Sampling Point: W16Sp6

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-3	10YR 3/1	100					Loamy/Clayey	
3-9	10YR 2/1	100					Loamy/Clayey	
9-14	10YR 2/1	20	7.5YR 5/1	80	D	M	Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- X Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Iron-Manganese Masses (F12) **(LRR D)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** X **No** ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- X Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ___	No X	Depth (inches): ___		
Water Table Present?	Yes X	No ___	Depth (inches): 8		
Saturation Present? (includes capillary fringe)	Yes X	No ___	Depth (inches): 0	**Wetland Hydrology Present?**	**Yes** X **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Arid West Region
See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Franson Wellsville Watershed Project City/County: Wellsville, Cache County Sampling Date: 5/07/2024

Applicant/Owner: Franson Civil Engineers State: UT Sampling Point: W17Sp1

Investigator(s): Jason Lewis, Rebecca Miller Section, Township, Range: S22 T11N R1W

Landform (hillside, terrace, etc.): Terrace Local relief (concave, convex, none): None Slope (%): 0

Subregion (LRR): LRR D Lat: 41.68009793 Long: -111.94677155 Datum: NAD 1983

Soil Map Unit Name: Ck COLLETT SILTY CLAY LOAM NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No ____	**Is the Sampled Area within a Wetland?** Yes ____ No X
Hydric Soil Present?	Yes ____	No X	
Wetland Hydrology Present?	Yes ____	No X	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5ft)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	=Total Cover		
Sapling/Shrub Stratum (Plot size: 5ft)			
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
Herb Stratum (Plot size: 5ft)			
1. *Poa pratensis*	55	Yes	FAC
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	55 =Total Cover		
Woody Vine Stratum (Plot size: 5ft)			
1.			
2.			
	=Total Cover		

% Bare Ground in Herb Stratum 45 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	55	x 3 =	165
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	55 (A)		165 (B)

Prevalence Index = B/A = 3.00

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No ____

Remarks:

SOIL

Sampling Point: W17Sp1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-5	10YR 3/2	100					Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Iron-Manganese Masses (F12) **(LRR D)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: Gravel/Cobble

Depth (inches): 5

Hydric Soil Present? **Yes** ___ **No** X

Remarks:
Fill material with lots of gravel/cobble

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? Yes ___ No X Depth (inches): ___
(includes capillary fringe)

Wetland Hydrology Present? **Yes** ___ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Arid West Region
See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Franson Wellsville Watershed Project City/County: Wellsville, Cache County Sampling Date: 5/07/2024

Applicant/Owner: Franson Civil Engineers State: UT Sampling Point: W17Sp2

Investigator(s): Jason Lewis, Rebecca Miller Section, Township, Range: S22 T11N R1W

Landform (hillside, terrace, etc.): Terrace Local relief (concave, convex, none): None Slope (%): 0

Subregion (LRR): LRR D Lat: 41.67996661 Long: -111.94473649 Datum: NAD 1983

Soil Map Unit Name: Sg SALT LAKE-ROSHE SPRINGS COMPLEX NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No ____
Hydric Soil Present? Yes X No ____
Wetland Hydrology Present? Yes X No ____

Is the Sampled Area within a Wetland? **Yes** X **No** ____

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5ft)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	=Total Cover		
Sapling/Shrub Stratum (Plot size: 5ft)			
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
Herb Stratum (Plot size: 5ft)			
1. *Carex obnupta*	55	Yes	OBL
2. *Carex prae racilis*	55	Yes	FACW
3.			
4.			
5.			
6.			
7.			
8.			
	110 =Total Cover		
Woody Vine Stratum (Plot size: 5ft)			
1.			
2.			
	=Total Cover		

% Bare Ground in Herb Stratum 0 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	55	x 1 =	55
FACW species	55	x 2 =	110
FAC species	0	x 3 =	0
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	110 (A)		165 (B)

Prevalence Index = B/A = 1.50

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%
X Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** X **No** ____

Remarks:

SOIL

Sampling Point: W17Sp2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-3	10YR 3/1	100					Loamy/Clayey	
3-5	10YR 4/1	100					Loamy/Clayey	
5-14	7.5YR 4/1	100					Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- X Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Iron-Manganese Masses (F12) **(LRR D)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ___

Depth (inches): ___

Hydric Soil Present? **Yes** X **No** ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- X Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ___	No X	Depth (inches): ___		
Water Table Present?	Yes ___	No X	Depth (inches): ___		
Saturation Present? (includes capillary fringe)	Yes X	No ___	Depth (inches): 0	**Wetland Hydrology Present?**	**Yes** X **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Arid West Region
See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Franson Wellsville Watershed Project City/County: Wellsville, Cache County Sampling Date: 5/07/2024

Applicant/Owner: Franson Civil Engineers State: UT Sampling Point: W18Sp1

Investigator(s): Rebecca Miller Section, Township, Range: S35 T11N R1W

Landform (hillside, terrace, etc.): hillside Local relief (concave, convex, none): Convex Slope (%): 3

Subregion (LRR): LRR D Lat: 41.6464187 Long: -111.9263114 Datum: NAD 1983

Soil Map Unit Name: GsA GREENSON LOAM, 0 TO 3 PERCENT SLOPES NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes ____ No X
Hydric Soil Present? Yes ____ No X
Wetland Hydrology Present? Yes ____ No X

Is the Sampled Area within a Wetland? **Yes** ____ **No** X

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5ft)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	____ =Total Cover		
Sapling/Shrub Stratum (Plot size: 5ft)			
1.			
2.			
3.			
4.			
5.			
	____ =Total Cover		
Herb Stratum (Plot size: 5ft)			
1.			
2. *Taraxacum officinale*	15	Yes	FACU
3. *chillea millefolium*	20	Yes	FACU
4. *Con ol ulus ar ensis*	15	Yes	UPL
5. *Phalaris arundinacea*	5	No	FACW
6.			
7.			
8.			
	55 =Total Cover		
Woody Vine Stratum (Plot size: 5ft)			
1.			
2.			
	____ =Total Cover		

% Bare Ground in Herb Stratum 50 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	5	x 2 =	10
FAC species	0	x 3 =	0
FACU species	35	x 4 =	140
UPL species	15	x 5 =	75
Column Totals:	55 (A)		225 (B)

Prevalence Index = B/A = 4.09

Hydrophytic Vegetation Indicators:

____ Dominance Test is >50%
____ Prevalence Index is ≤3.0[1]
____ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
____ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** ____ **No** X

Remarks:

SOIL

Sampling Point: W18Sp1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-14	10YR 3/2	100					Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Iron-Manganese Masses (F12) **(LRR D)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** ___ **No** X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? Yes ___ No X Depth (inches): ___

(includes capillary fringe)

Wetland Hydrology Present? **Yes** ___ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Arid West Region
See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Franson Wellsville Watershed Project City/County: Wellsville, Cache County Sampling Date: 5/07/2024

Applicant/Owner: Franson Civil Engineers State: UT Sampling Point: W18Sp2

Investigator(s): Jason Lewis, Rebecca Miller Section, Township, Range: S35 T11N R1W

Landform (hillside, terrace, etc.): Terrace Local relief (concave, convex, none): None Slope (%): 0

Subregion (LRR): LRR D Lat: 41.6463867 Long: -111.9261004 Datum: NAD 1983

Soil Map Unit Name: GsA GREENSON LOAM, 0 TO 3 PERCENT SLOPES NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No ____	**Is the Sampled Area within a Wetland?** **Yes** X **No** ____
Hydric Soil Present?	Yes X	No ____	
Wetland Hydrology Present?	Yes X	No ____	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5ft)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	=Total Cover		
Sapling/Shrub Stratum (Plot size: 5ft)			
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
Herb Stratum (Plot size: 5ft)			
1. *leocharis palustris*	50	Yes	OBL
2. *ipsacus fullonum*	20	Yes	FAC
3. *Phalaris arundinacea*	15	No	FACW
4.			
5.			
6.			
7.			
8.			
	85 =Total Cover		
Woody Vine Stratum (Plot size: 5ft)			
1.			
2.			
	=Total Cover		

% Bare Ground in Herb Stratum 25 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	50	x 1 =	50
FACW species	15	x 2 =	30
FAC species	20	x 3 =	60
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	85 (A)		140 (B)

Prevalence Index = B/A = 1.65

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%

X Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** X **No** ____

Remarks:

SOIL

Sampling Point: W18Sp2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-4	10YR 3/2	100					Loamy/Clayey	
4-14	7.5YR 4/1	100					Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- X Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Iron-Manganese Masses (F12) **(LRR D)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ___

Depth (inches): ___

Hydric Soil Present? **Yes** X **No** ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- X Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ___	No X	Depth (inches): ___		
Water Table Present?	Yes X	No ___	Depth (inches): 8		
Saturation Present? (includes capillary fringe)	Yes X	No ___	Depth (inches): 0	**Wetland Hydrology Present?**	**Yes** X **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Arid West Region
See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Franson Wellsville Watershed Project City/County: Wellsville, Cache County Sampling Date: 5/07/2024

Applicant/Owner: Franson Civil Engineers State: UT Sampling Point: W19Sp1

Investigator(s): Jason Lewis, Rebecca Miller Section, Township, Range: S35 T11N R1W

Landform (hillside, terrace, etc.): Terrace Local relief (concave, convex, none): None Slope (%): 0

Subregion (LRR): LRR D Lat: 41.6456973 Long: -111.9248005 Datum: NAD 1983

Soil Map Unit Name: Wn WINN SILT LOAM NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No ____
Hydric Soil Present? Yes ____ No X
Wetland Hydrology Present? Yes ____ No X

Is the Sampled Area within a Wetland? **Yes** ____ **No** X

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5ft)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	=Total Cover		
Sapling/Shrub Stratum (Plot size: 5ft)			
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
Herb Stratum (Plot size: 5ft)			
1. *Phalaris arundinacea*	98	Yes	FACW
2. *ipsacus fullonum*	2	No	FAC
3.			
4.			
5.			
6.			
7.			
8.			
	100 =Total Cover		
Woody Vine Stratum (Plot size: 5ft)			
1.			
2.			
	=Total Cover		

% Bare Ground in Herb Stratum 0 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	98	x 2 =	196
FAC species	2	x 3 =	6
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	100 (A)		202 (B)

Prevalence Index = B/A = 2.02

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%
____ Prevalence Index is ≤3.0[1]
____ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
____ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** X **No** ____

Remarks:

SOIL

Sampling Point: W19Sp1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-10	10YR 3/1	100					Loamy/Clayey	
10-14	10YR 3/1	95	10YR 5/1	5	D	M	Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Iron-Manganese Masses (F12) **(LRR D)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** ___ **No** X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? Yes ___ No X Depth (inches): ___

(includes capillary fringe)

Wetland Hydrology Present? **Yes** ___ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Arid West Region
See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Franson Wellsville Watershed Project City/County: Wellsville, Cache County Sampling Date: 5/07/2024

Applicant/Owner: Franson Civil Engineers State: UT Sampling Point: W19Sp2

Investigator(s): Jason Lewis, Rebecca Miller Section, Township, Range: S35 T11N R1W

Landform (hillside, terrace, etc.): Terrace Local relief (concave, convex, none): None Slope (%): 0

Subregion (LRR): LRR D Lat: 41.6455748 Long: -111.9248843 Datum: NAD 1983

Soil Map Unit Name: Lr LOGAN SILTY CLAY LOAM NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No ____	**Is the Sampled Area within a Wetland?** **Yes** X **No** ____
Hydric Soil Present?	Yes X	No ____	
Wetland Hydrology Present?	Yes X	No ____	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5ft)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	____	=Total Cover	
Sapling/Shrub Stratum (Plot size: 5ft)			
1.			
2.			
3.			
4.			
5.			
	____	=Total Cover	
Herb Stratum (Plot size: 5ft)			
1. *Typha latifolia*	45	Yes	OBL
2. *ipsacus fullonum*	20	No	FAC
3. *Phalaris arundinacea*	40	Yes	FACW
4.			
5.			
6.			
7.			
8.			
	105	=Total Cover	
Woody Vine Stratum (Plot size: 5ft)			
1.			
2.			
	____	=Total Cover	

% Bare Ground in Herb Stratum 0 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	45	x 1 =	45
FACW species	40	x 2 =	80
FAC species	20	x 3 =	60
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	105 (A)		185 (B)

Prevalence Index = B/A = 1.76

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%

X Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** X **No** ____

Remarks:

SOIL

Sampling Point: W19Sp2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-4	10YR 2/1	100					Loamy/Clayey	
4-10	10YR 3/1	100					Loamy/Clayey	
10-16	10YR 5/1	100			D	M	Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- X Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Iron-Manganese Masses (F12) **(LRR D)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** X **No** ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ___	No X	Depth (inches): ___		
Water Table Present?	Yes ___	No X	Depth (inches): ___		
Saturation Present? (includes capillary fringe)	Yes X	No ___	Depth (inches): 0	**Wetland Hydrology Present?**	**Yes** X **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Arid West Region
See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Franson Wellsville Watershed Project City/County: Wellsville, Cache County Sampling Date: 5/07/2024

Applicant/Owner: Franson Civil Engineers State: UT Sampling Point: W19Sp3

Investigator(s): Jason Lewis, Rebecca Miller Section, Township, Range: S35 T11N R1W

Landform (hillside, terrace, etc.): Terrace Local relief (concave, convex, none): None Slope (%): 0

Subregion (LRR): LRR D Lat: 41.64318884 Long: -111.92589662 Datum: NAD 1983

Soil Map Unit Name: Rt ROUGH BROKEN LAND NWI classification: Riverine

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No ____	**Is the Sampled Area within a Wetland?** Yes ____ No X
Hydric Soil Present?	Yes ____	No X	
Wetland Hydrology Present?	Yes ____	No X	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5ft)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	____ =Total Cover		
Sapling/Shrub Stratum (Plot size: 5ft)			
1.			
2.			
3.			
4.			
5.			
	____ =Total Cover		
Herb Stratum (Plot size: 5ft)			
1. *Phalaris arundinacea*	45	Yes	FACW
2. *Taraxacum officinale*	5	No	FACU
3. *Cyno lossum officinale*	1	No	FACU
4.			
5.			
6.			
7.			
8.			
	51 =Total Cover		
Woody Vine Stratum (Plot size: 5ft)			
1.			
2.			
	____ =Total Cover		

% Bare Ground in Herb Stratum 50 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	45	x 2 =	90
FAC species	0	x 3 =	0
FACU species	6	x 4 =	24
UPL species	0	x 5 =	0
Column Totals:	51 (A)		114 (B)

Prevalence Index = B/A = 2.24

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No ____

Remarks:

SOIL

Sampling Point: W19Sp3

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-14	10YR 3/1	100					Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Iron-Manganese Masses (F12) **(LRR D)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** ___ **No** X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? Yes ___ No X Depth (inches): ___

(includes capillary fringe)

Wetland Hydrology Present? **Yes** ___ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Arid West Region
See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Franson Wellsville Watershed Project City/County: Wellsville, Cache County Sampling Date: 5/07/2024

Applicant/Owner: Franson Civil Engineers State: UT Sampling Point: W19Sp4

Investigator(s): Jaosn Lewis, Rebecca Miller Section, Township, Range: S35 T11N R1W

Landform (hillside, terrace, etc.): Terrace Local relief (concave, convex, none): None Slope (%): 0

Subregion (LRR): LRR D Lat: 41.64328299 Long: -111.92585259 Datum: NAD 1983

Soil Map Unit Name: Rt ROUGH BROKEN LAND NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No ____
Hydric Soil Present? Yes X No ____
Wetland Hydrology Present? Yes X No ____

Is the Sampled Area within a Wetland? **Yes** X **No** ____

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5ft)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	=Total Cover		
Sapling/Shrub Stratum (Plot size: 5ft)			
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
Herb Stratum (Plot size: 5ft)			
1. *leocharis palustris*	50	Yes	OBL
2. *Carex prae racilis*	50	Yes	FACW
3.			
4.			
5.			
6.			
7.			
8.			
	100 =Total Cover		
Woody Vine Stratum (Plot size: 5ft)			
1.			
2.			
	=Total Cover		

% Bare Ground in Herb Stratum 0 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	50	x 1 =	50
FACW species	50	x 2 =	100
FAC species	0	x 3 =	0
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	100 (A)		150 (B)

Prevalence Index = B/A = 1.50

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%
X Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** X **No** ____

Remarks:

SOIL

Sampling Point: W19Sp4

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-14	10YR 3/2	100					Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- X Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Iron-Manganese Masses (F12) **(LRR D)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ___

Depth (inches): ___

Hydric Soil Present? **Yes** X **No** ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- X Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ___	No X	Depth (inches): ___		
Water Table Present?	Yes X	No ___	Depth (inches): 8		
Saturation Present? (includes capillary fringe)	Yes X	No ___	Depth (inches): 0	**Wetland Hydrology Present?**	**Yes** X **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Arid West Region
See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Franson Wellsville Watershed Project City/County: Wellsville, Cache County Sampling Date: 5/07/2024

Applicant/Owner: Franson Civil Engineers State: UT Sampling Point: W20Sp1

Investigator(s): Jason Lewis, Rebecca Miller Section, Township, Range: S35 T11N R1W

Landform (hillside, terrace, etc.): Terrace Local relief (concave, convex, none): None Slope (%): 0

Subregion (LRR): LRR D Lat: 41.6458308 Long: -111.9259540 Datum: NAD 1983

Soil Map Unit Name: Rt ROUGH BROKEN LAND NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes ____ No X
Hydric Soil Present? Yes ____ No X
Wetland Hydrology Present? Yes ____ No X

Is the Sampled Area within a Wetland? **Yes** ____ **No** X

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5ft)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	=Total Cover		
Sapling/Shrub Stratum (Plot size: 5ft)			
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
Herb Stratum (Plot size: 5ft)			
1. *Poa pratensis*	30	Yes	FAC
2. *pilobium ciliatum*	5	No	FACW
3. *actuca serriola*	20	Yes	FACU
4.			
5.			
6.			
7.			
8.			
	55 =Total Cover		
Woody Vine Stratum (Plot size: 5ft)			
1.			
2.			
	=Total Cover		

% Bare Ground in Herb Stratum 40 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	5	x 2 =	10
FAC species	30	x 3 =	90
FACU species	20	x 4 =	80
UPL species	0	x 5 =	0
Column Totals:	55 (A)		180 (B)

Prevalence Index = B/A = 3.27

Hydrophytic Vegetation Indicators:

____ Dominance Test is >50%
____ Prevalence Index is ≤3.0[1]
____ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
____ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** ____ **No** X

Remarks:

SOIL

Sampling Point: W20Sp1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-14	10YR 3/1	100					Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Iron-Manganese Masses (F12) **(LRR D)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** ___ **No** X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? Yes ___ No X Depth (inches): ___

(includes capillary fringe)

Wetland Hydrology Present? **Yes** ___ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Arid West Region
See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Franson Wellsville Watershed Project City/County: Wellsville, Cache County Sampling Date: 5/07/2024

Applicant/Owner: Franson Civil Engineers State: UT Sampling Point: W20Sp2

Investigator(s): Jason Lewis, Rebecca Miller Section, Township, Range: S35 T11N R1W

Landform (hillside, terrace, etc.): Terrace Local relief (concave, convex, none): None Slope (%): 0

Subregion (LRR): LRR D Lat: 41.64565047 Long: -111.92564951 Datum: NAD 1983

Soil Map Unit Name: Rt ROUGH BROKEN LAND NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No ____
Hydric Soil Present? Yes X No ____
Wetland Hydrology Present? Yes X No ____

Is the Sampled Area within a Wetland? **Yes** X **No** ____

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5ft)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	=Total Cover		
Sapling/Shrub Stratum (Plot size: 5ft)			
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
Herb Stratum (Plot size: 5ft)			
1. *Phalaris arundinacea*	85	Yes	FACW
2. *Typha latifolia*	40	Yes	OBL
3. *leocharis palustris*	10	No	OBL
4. *osa oodsii*	1	No	FACU
5.			
6.			
7.			
8.			
	136 =Total Cover		
Woody Vine Stratum (Plot size: 5ft)			
1.			
2.			
	=Total Cover		

% Bare Ground in Herb Stratum 0 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	50	x 1 =	50
FACW species	85	x 2 =	170
FAC species	0	x 3 =	0
FACU species	1	x 4 =	4
UPL species	0	x 5 =	0
Column Totals:	136 (A)		224 (B)

Prevalence Index = B/A = 1.65

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%
X Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** X **No** ____

Remarks:

SOIL

Sampling Point: W20Sp2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-14	10YR 3/1	100					Mucky Loam/Clay	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- X Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- X Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Iron-Manganese Masses (F12) **(LRR D)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ___

Depth (inches): ___

Hydric Soil Present? **Yes** X **No** ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- X Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ___	No X	Depth (inches): ___		
Water Table Present?	Yes X	No ___	Depth (inches): 10		
Saturation Present? (includes capillary fringe)	Yes X	No ___	Depth (inches): 0	**Wetland Hydrology Present?**	**Yes** X **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Arid West Region
See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Franson Wellsville Watershed Project City/County: Wellsville, Cache County Sampling Date: 5/07/2024

Applicant/Owner: Franson Civil Engineers State: UT Sampling Point: W21Sp1

Investigator(s): Jason Lewis, Rebecca Miller Section, Township, Range: S2 T10N R1W

Landform (hillside, terrace, etc.): Terrace Local relief (concave, convex, none): None Slope (%): 0

Subregion (LRR): LRR D Lat: 41.6414586 Long: -111.92518734 Datum: NAD 1983

Soil Map Unit Name: Lr LOGAN SILTY CLAY LOAM NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No ____	**Is the Sampled Area within a Wetland?** Yes ____ No X
Hydric Soil Present?	Yes ____	No X	
Wetland Hydrology Present?	Yes ____	No X	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5ft)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	____ =Total Cover		
Sapling/Shrub Stratum (Plot size: 5ft)			
1.			
2.			
3.			
4.			
5.			
	____ =Total Cover		
Herb Stratum (Plot size: 5ft)			
1. *Phalaris arundinacea*	100	Yes	FACW
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	100 =Total Cover		
Woody Vine Stratum (Plot size: 5ft)			
1.			
2.			
	____ =Total Cover		

% Bare Ground in Herb Stratum 0 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	100	x 2 =	200
FAC species	0	x 3 =	0
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	100 (A)		200 (B)

Prevalence Index = B/A = 2.00

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No ____

Remarks:

SOIL

Sampling Point: W21Sp1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-14	10YR 2/1	100					Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Iron-Manganese Masses (F12) **(LRR D)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** ____ **No** ____

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ____ No X Depth (inches): ____

Water Table Present? Yes ____ No X Depth (inches): ____

Saturation Present? Yes ____ No X Depth (inches): ____

(includes capillary fringe)

Wetland Hydrology Present? **Yes** ____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Arid West Region
See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Franson Wellsville Watershed Project City/County: Wellsville, Cache County Sampling Date: 5/07/2024

Applicant/Owner: Franson Civil Engineers State: UT Sampling Point: W21Sp2

Investigator(s): Jason Lewis, Rebecca Miller Section, Township, Range: S35 T11N R1W

Landform (hillside, terrace, etc.): Terrace Local relief (concave, convex, none): None Slope (%): 0

Subregion (LRR): LRR D Lat: 41.64151364 Long: -111.92512809 Datum: NAD 1983

Soil Map Unit Name: Lr LOGAN SILTY CLAY LOAM NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No ____
Hydric Soil Present? Yes X No ____
Wetland Hydrology Present? Yes X No ____

Is the Sampled Area within a Wetland? **Yes** X **No** ____

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5ft)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	=Total Cover		
Sapling/Shrub Stratum (Plot size: 5ft)			
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
Herb Stratum (Plot size: 5ft)			
1. *Typha latifolia*	99	Yes	OBL
2. *Phalaris arundinacea*	20	No	FACW
3.			
4.			
5.			
6.			
7.			
8.			
	119 =Total Cover		
Woody Vine Stratum (Plot size: 5ft)			
1.			
2.			
	=Total Cover		

% Bare Ground in Herb Stratum 0 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	99	x 1 =	99
FACW species	20	x 2 =	40
FAC species	0	x 3 =	0
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	119 (A)		139 (B)

Prevalence Index = B/A = 1.17

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%
X Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** X **No** ____

Remarks:

SOIL

Sampling Point: W21Sp2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-3	10YR 3/1	100					Loamy/Clayey	
3-14	10YR 5/1	100					Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- X Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- X Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Iron-Manganese Masses (F12) **(LRR D)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ___

Depth (inches): ___

Hydric Soil Present? **Yes** X **No** ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- X Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ___	No X	Depth (inches): ___		
Water Table Present?	Yes X	No ___	Depth (inches): 4		
Saturation Present? (includes capillary fringe)	Yes X	No ___	Depth (inches): 0	**Wetland Hydrology Present?**	**Yes** X **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Arid West Region
See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Franson Wellsville Watershed Project City/County: Wellsville, Cache County Sampling Date: 5/07/2024

Applicant/Owner: Franson Civil Engineers State: UT Sampling Point: W22Sp1

Investigator(s): Jason Lewis, Rebecca Miller Section, Township, Range: S2 T10N R1W

Landform (hillside, terrace, etc.): hillside Local relief (concave, convex, none): Convex Slope (%): 0

Subregion (LRR): LRR D Lat: 41.63433095 Long: -111.92815031 Datum: NAD 1983

Soil Map Unit Name: Rt ROUGH BROKEN LAND NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No ____
Hydric Soil Present? Yes ____ No X
Wetland Hydrology Present? Yes ____ No X

Is the Sampled Area within a Wetland? **Yes** ____ **No** X

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5ft)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	=Total Cover		
Sapling/Shrub Stratum (Plot size: 5ft)			
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
Herb Stratum (Plot size: 5ft)			
1. *esperis matronalis*	5	No	FACU
2. *Cyno lossum officinale*	30	Yes	FACU
3. *Phalaris arundinacea*	20	Yes	FACW
4.			
5.			
6.			
7.			
8.			
	55 =Total Cover		
Woody Vine Stratum (Plot size: 5ft)			
1.			
2.			
	=Total Cover		

% Bare Ground in Herb Stratum 40 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	20	x 2 =	40
FAC species	0	x 3 =	0
FACU species	35	x 4 =	140
UPL species	0	x 5 =	0
Column Totals:	55 (A)		180 (B)

Prevalence Index = B/A = 3.27

Hydrophytic Vegetation Indicators:

____ Dominance Test is >50%
____ Prevalence Index is ≤3.0[1]
____ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
____ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** X **No** ____

Remarks:

SOIL

Sampling Point: W22Sp1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-3	10YR 3/4	100					Loamy/Clayey	
3-14	10YR 3/4	95	10YR 5/8	5	C	M	Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Iron-Manganese Masses (F12) **(LRR D)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** ___ **No** X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? Yes ___ No X Depth (inches): ___

(includes capillary fringe)

Wetland Hydrology Present? **Yes** ___ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Arid West Region
See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Franson Wellsville Watershed Project City/County: Wellsville, Cache County Sampling Date: 5/07/2024

Applicant/Owner: Franson Civil Engineers State: UT Sampling Point: W22Sp2

Investigator(s): Jason Lewis, Rebecca Miller Section, Township, Range: S2 T10N R1W

Landform (hillside, terrace, etc.): Terrace Local relief (concave, convex, none): Concave Slope (%): 0

Subregion (LRR): LRR D Lat: 41.63433382 Long: -111.92812557 Datum: NAD 1983

Soil Map Unit Name: Rt ROUGH BROKEN LAND NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No ____
Hydric Soil Present? Yes X No ____
Wetland Hydrology Present? Yes X No ____

Is the Sampled Area within a Wetland? **Yes** X **No** ____

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5ft)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	=Total Cover		
Sapling/Shrub Stratum (Plot size: 5ft)			
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
Herb Stratum (Plot size: 5ft)			
1. *esperis matronalis*	15	No	FACU
2. *Phalaris arundinacea*	15	No	FACW
3. *Typha latifolia*	40	Yes	OBL
4. *asturtium officinale*	20	Yes	OBL
5.			
6.			
7.			
8.			
	90 =Total Cover		
Woody Vine Stratum (Plot size: 5ft)			
1.			
2.			
	=Total Cover		

% Bare Ground in Herb Stratum 0 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	60	x 1 =	60
FACW species	15	x 2 =	30
FAC species	0	x 3 =	0
FACU species	15	x 4 =	60
UPL species	0	x 5 =	0
Column Totals:	90 (A)		150 (B)

Prevalence Index = B/A = 1.67

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%
X Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** X **No** ____

Remarks:

SOIL

Sampling Point: W22Sp2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-3	10YR 3/2	100					Loamy/Clayey	
3-14	7.5YR 4/1	95					Loamy/Clayey	
3-14	10YR 2/1	5					Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- X Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Iron-Manganese Masses (F12) **(LRR D)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ___

Depth (inches): ___

Hydric Soil Present? **Yes** X **No** ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- X Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ___	No X	Depth (inches): ___		
Water Table Present?	Yes X	No ___	Depth (inches): 12		
Saturation Present? (includes capillary fringe)	Yes X	No ___	Depth (inches): 0	**Wetland Hydrology Present?**	**Yes** X **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Arid West Region
See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Franson Wellsville Watershed Project City/County: Wellsville, Cache County Sampling Date: 5/07/2024

Applicant/Owner: Franson Civil Engineers State: UT Sampling Point: W23Sp1

Investigator(s): Jason Lewis, Rebecca Miller Section, Township, Range: S2 T10N R1W

Landform (hillside, terrace, etc.): Hillside Local relief (concave, convex, none): Convex Slope (%): 0

Subregion (LRR): LRR D Lat: 41.63397701 Long: -111.92847489 Datum: NAD 1983

Soil Map Unit Name: Rt ROUGH BROKEN LAND NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No ____
Hydric Soil Present? Yes ____ No X
Wetland Hydrology Present? Yes ____ No X

Is the Sampled Area within a Wetland? **Yes** ____ **No** X

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5ft)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	=Total Cover		
Sapling/Shrub Stratum (Plot size: 5ft)			
1. *Salix sp*	15	Yes	
2.			
3.			
4.			
5.			
	15 =Total Cover		
Herb Stratum (Plot size: 5ft)			
1. *osa oodsii*	30	Yes	FACU
2. *Phalaris arundinacea*	10	Yes	FACW
3.			
4.			
5.			
6.			
7.			
8.			
	40 =Total Cover		
Woody Vine Stratum (Plot size: 5ft)			
1.			
2.			
	=Total Cover		

% Bare Ground in Herb Stratum 50 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 33.3% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	10	x 2 =	20
FAC species	0	x 3 =	0
FACU species	30	x 4 =	120
UPL species	0	x 5 =	0
Column Totals:	40 (A)		140 (B)

Prevalence Index = B/A = 3.50

Hydrophytic Vegetation Indicators:

____ Dominance Test is >50%
____ Prevalence Index is ≤3.0[1]
X Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
____ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** X **No** ____

Remarks:
Willows have an affinity twoards moist soils.

SOIL

Sampling Point: W23Sp1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-2	10YR 3/2	100					Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Iron-Manganese Masses (F12) **(LRR D)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: Gravel/Road Prism

Depth (inches): 2

Hydric Soil Present? **Yes** ___ **No** X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? Yes ___ No X Depth (inches): ___

(includes capillary fringe)

Wetland Hydrology Present? **Yes** ___ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Arid West Region
See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Franson Wellsville Watershed Project City/County: Wellsville, Cache County Sampling Date: 5/07/2024

Applicant/Owner: Franson Civil Engineers State: UT Sampling Point: W23Sp2

Investigator(s): Jason Lewis, Rebecca Miller Section, Township, Range: S2 T10N R1W

Landform (hillside, terrace, etc.): Terrace Local relief (concave, convex, none): Concave Slope (%): 0

Subregion (LRR): LRR D Lat: 41.63406275 Long: -111.92855667 Datum: NAD 1983

Soil Map Unit Name: Rt ROUGH BROKEN LAND NWI classification: Riverine

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No ____
Hydric Soil Present? Yes X No ____
Wetland Hydrology Present? Yes X No ____

Is the Sampled Area within a Wetland? **Yes** X **No** ____

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5ft)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	=Total Cover		
Sapling/Shrub Stratum (Plot size: 5ft)			
1. *Salix alba*	10	Yes	FACW
2.			
3.			
4.			
5.			
	10 =Total Cover		
Herb Stratum (Plot size: 5ft)			
1. *rtica dioica*	15	Yes	FAC
2. *Typha latifolia*	15	Yes	OBL
3.			
4.			
5.			
6.			
7.			
8.			
	30 =Total Cover		
Woody Vine Stratum (Plot size: 5ft)			
1.			
2.			
	=Total Cover		

% Bare Ground in Herb Stratum 60 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	15	x 1 =	15
FACW species	10	x 2 =	20
FAC species	15	x 3 =	45
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	40 (A)		80 (B)

Prevalence Index = B/A = 2.00

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%
X Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** X **No** ____

Remarks:

SOIL

Sampling Point: W23Sp2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-14	10YR 3/1	100					Loamy/Clayey	Redox masked

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- X Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Iron-Manganese Masses (F12) **(LRR D)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ___

Depth (inches): ___

Hydric Soil Present? **Yes** X **No** ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- X Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ___	No X	Depth (inches): ___
Water Table Present?	Yes X	No ___	Depth (inches): ___
Saturation Present? (includes capillary fringe)	Yes X	No ___	Depth (inches): ___

Wetland Hydrology Present? **Yes** X **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Arid West Region
See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Franson Wellsville Watershed Project City/County: Wellsville, Cache County Sampling Date: 5/07/2024

Applicant/Owner: Franson Civil Engineers State: UT Sampling Point: W24Sp1

Investigator(s): Jason Lewis, Rebecca Miller Section, Township, Range: S2 T10N R1W

Landform (hillside, terrace, etc.): Hillside Local relief (concave, convex, none): Convex Slope (%): 7

Subregion (LRR): LRR D Lat: 41.62994572 Long: -111.92938431 Datum: NAD 1983

Soil Map Unit Name: Rt ROUGH BROKEN LAND NWI classification: PEM

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No ____	**Is the Sampled Area within a Wetland?** Yes ____ No X
Hydric Soil Present?	Yes ____	No X	
Wetland Hydrology Present?	Yes ____	No X	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5ft)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	=Total Cover		
Sapling/Shrub Stratum (Plot size: 5ft)			
1. *Cratae us dou lasii*	30	Yes	FAC
2.			
3.			
4.			
5.			
	30 =Total Cover		
Herb Stratum (Plot size: 5ft)			
1. *uisetum ar ense*	1	No	FAC
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	1 =Total Cover		
Woody Vine Stratum (Plot size: 5ft)			
1.			
2.			
	=Total Cover		

% Bare Ground in Herb Stratum 99 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	31	x 3 =	93
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	31 (A)		93 (B)

Prevalence Index = B/A = 3.00

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No ____

Remarks:

SOIL

Sampling Point: W24Sp1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-8	10YR 3/3	100					Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Iron-Manganese Masses (F12) **(LRR D)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: Gravel/rock

Depth (inches): 8

Hydric Soil Present? **Yes** ___ **No** ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? Yes ___ No X Depth (inches): ___

(includes capillary fringe)

Wetland Hydrology Present? **Yes** ___ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Arid West Region
See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Franson Wellsville Watershed Project City/County: Wellsville, Cache County Sampling Date: 5/07/2024

Applicant/Owner: Franson Civil Engineers State: UT Sampling Point: W24Sp2

Investigator(s): Jason Lewis, Rebecca Miller Section, Township, Range: S2 T10N R1W

Landform (hillside, terrace, etc.): Terrace Local relief (concave, convex, none): Concave Slope (%): 0

Subregion (LRR): LRR D Lat: 41.63004487 Long: -111.92962741 Datum: NAD 1983

Soil Map Unit Name: Rt ROUGH BROKEN LAND NWI classification: PEM

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No ____
Hydric Soil Present? Yes X No ____
Wetland Hydrology Present? Yes X No ____

Is the Sampled Area within a Wetland? **Yes** X **No** ____

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5ft)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	=Total Cover		
Sapling/Shrub Stratum (Plot size: 5ft)			
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
Herb Stratum (Plot size: 5ft)			
1. *Typha latifolia*	85	Yes	OBL
2. *ipsacus fullonum*	15	No	FAC
3. *osa oodsii*	1	No	FACU
4.			
5.			
6.			
7.			
8.			
	101 =Total Cover		
Woody Vine Stratum (Plot size: 5ft)			
1.			
2.			
	=Total Cover		

% Bare Ground in Herb Stratum 0 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	85	x 1 =	85
FACW species	0	x 2 =	0
FAC species	15	x 3 =	45
FACU species	1	x 4 =	4
UPL species	0	x 5 =	0
Column Totals:	101 (A)		134 (B)

Prevalence Index = B/A = 1.33

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%
X Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** X **No** ____

Remarks:

SOIL

Sampling Point: W24Sp2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-4	10YR 3/1	100					Loamy/Clayey	
4-14	7.5YR 4/1	100					Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- X Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Iron-Manganese Masses (F12) **(LRR D)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ___

Depth (inches): ___

Hydric Soil Present? **Yes** X **No** ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- X Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ___	No X	Depth (inches): ___		
Water Table Present?	Yes X	No ___	Depth (inches): 5		
Saturation Present? (includes capillary fringe)	Yes X	No ___	Depth (inches): 0	**Wetland Hydrology Present?**	**Yes** X **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Arid West Region
See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Franson Wellsville Watershed Project City/County: Wellsville, Cache County Sampling Date: 5/07/2024

Applicant/Owner: Franson Civil Engineers State: UT Sampling Point: W25Sp1

Investigator(s): Jason Lewis, Rebecca Miller Section, Township, Range: S3 T10N R1W

Landform (hillside, terrace, etc.): hillside Local relief (concave, convex, none): Convex Slope (%): 0

Subregion (LRR): LRR D Lat: 41.63125525 Long: -111.93170425 Datum: NAD 1983

Soil Map Unit Name: Rt ROUGH BROKEN LAND NWI classification: PEM

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No ____
Hydric Soil Present? Yes ____ No X
Wetland Hydrology Present? Yes ____ No X

Is the Sampled Area within a Wetland? **Yes** ____ **No** X

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5ft)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	____ =Total Cover		
Sapling/Shrub Stratum (Plot size: 5ft)			
1.			
2.			
3.			
4.			
5.			
	____ =Total Cover		
Herb Stratum (Plot size: 5ft)			
1. *Poa pratensis*	100	Yes	FAC
2. *ipsacus fullonum*	20	No	FAC
3. *Phalaris arundinacea*	15	No	FACW
4.			
5.			
6.			
7.			
8.			
	135 =Total Cover		
Woody Vine Stratum (Plot size: 5ft)			
1.			
2.			
	____ =Total Cover		

% Bare Ground in Herb Stratum 0 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	15	x 2 =	30
FAC species	120	x 3 =	360
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	135 (A)		390 (B)

Prevalence Index = B/A = 2.89

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%
____ Prevalence Index is ≤3.0[1]
____ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
____ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** X **No** ____

Remarks:

SOIL

Sampling Point: W25Sp1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-14	10YR 3/1	100					Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Iron-Manganese Masses (F12) **(LRR D)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** ___ **No** X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? Yes ___ No X Depth (inches): ___

(includes capillary fringe)

Wetland Hydrology Present? **Yes** ___ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Arid West Region
See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Franson Wellsville Watershed Project City/County: Wellsville, Cache County Sampling Date: 5/07/2024

Applicant/Owner: Franson Civil Engineers State: UT Sampling Point: W25Sp2

Investigator(s): Jason Lewis, Rebecca Miller Section, Township, Range: S3 T10N R1W

Landform (hillside, terrace, etc.): Terrace Local relief (concave, convex, none): Concave Slope (%): 0

Subregion (LRR): LRR D Lat: 41.63124564 Long: -111.93160418 Datum: NAD 1983

Soil Map Unit Name: Rt ROUGH BROKEN LAND NWI classification: PEM

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No ____
Hydric Soil Present? Yes X No ____
Wetland Hydrology Present? Yes X No ____

Is the Sampled Area within a Wetland? **Yes** X **No** ____

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5ft)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	=Total Cover		
Sapling/Shrub Stratum (Plot size: 5ft)			
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
Herb Stratum (Plot size: 5ft)			
1. *Typha latifolia*	90	Yes	OBL
2. *ipsacus fullonum*	25	Yes	FAC
3. *entha ar ensis*	2	No	FACW
4.			
5.			
6.			
7.			
8.			
	117 =Total Cover		
Woody Vine Stratum (Plot size: 5ft)			
1.			
2.			
	=Total Cover		

% Bare Ground in Herb Stratum 0 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	90	x 1 =	90
FACW species	2	x 2 =	4
FAC species	25	x 3 =	75
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	117 (A)		169 (B)

Prevalence Index = B/A = 1.44

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%
X Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** X **No** ____

Remarks:

SOIL

Sampling Point: W25Sp2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-14	10YR 3/1	100					Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- X Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Iron-Manganese Masses (F12) **(LRR D)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ___

Depth (inches): ___

Hydric Soil Present? **Yes** X **No** ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- X Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ___	No X	Depth (inches): ___		
Water Table Present?	Yes X	No ___	Depth (inches): 8		
Saturation Present? (includes capillary fringe)	Yes X	No ___	Depth (inches): 0	**Wetland Hydrology Present?**	**Yes** X **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Arid West Region
See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Franson Wellsville Watershed Project City/County: Wellsville, Cache County Sampling Date: 5/07/2024

Applicant/Owner: Franson Civil Engineers State: UT Sampling Point: W26Sp1

Investigator(s): Jason Lewis, Rebecca Miller Section, Township, Range: S3 T10N R1W

Landform (hillside, terrace, etc.): hillside Local relief (concave, convex, none): convex Slope (%): 3

Subregion (LRR): LRR D Lat: 41.63085873 Long: -111.93201528 Datum: NAD 1983

Soil Map Unit Name: Rt ROUGH BROKEN LAND NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No ____
Hydric Soil Present? Yes ____ No X
Wetland Hydrology Present? Yes ____ No X

Is the Sampled Area within a Wetland? **Yes** ____ **No** X

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5ft)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	____ =Total Cover		
Sapling/Shrub Stratum (Plot size: 5ft)			
1.			
2.			
3.			
4.			
5.			
	____ =Total Cover		
Herb Stratum (Plot size: 5ft)			
1. *Poa pratensis*	98	Yes	FAC
2. *ipsacus fullonum*	5	No	FAC
3. *Solida o spathulata*	10	No	FACU
4. *osa oodsii*	5	No	FACU
5.			
6.			
7.			
8.			
	118 =Total Cover		
Woody Vine Stratum (Plot size: 5ft)			
1.			
2.			
	____ =Total Cover		

% Bare Ground in Herb Stratum 0 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	103	x 3 =	309
FACU species	15	x 4 =	60
UPL species	0	x 5 =	0
Column Totals:	118 (A)		369 (B)

Prevalence Index = B/A = 3.13

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%
____ Prevalence Index is ≤3.0[1]
____ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
____ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** X **No** ____

Remarks:

SOIL

Sampling Point: W26Sp1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-8	10YR 3/3	95	10YR 3/6	4			Loamy/Clayey	
			10YR 4/6	1				

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Iron-Manganese Masses (F12) **(LRR D)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: Rock

Depth (inches): 8

Hydric Soil Present? **Yes** ___ **No** X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? Yes ___ No X Depth (inches): ___

(includes capillary fringe)

Wetland Hydrology Present? **Yes** ___ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Arid West Region
See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Franson Wellsville Watershed Project City/County: Wellsville, Cache County Sampling Date: 5/07/2024

Applicant/Owner: Franson Civil Engineers State: UT Sampling Point: W26Sp2

Investigator(s): Jason Lewis, Rebecca Miller Section, Township, Range: S3 T10N R1W

Landform (hillside, terrace, etc.): Terrace Local relief (concave, convex, none): None Slope (%): 0

Subregion (LRR): LRR D Lat: 41.63089103 Long: -111.93205227 Datum: NAD 1983

Soil Map Unit Name: Rt ROUGH BROKEN LAND NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No ____
Hydric Soil Present? Yes X No ____
Wetland Hydrology Present? Yes X No ____

Is the Sampled Area within a Wetland? **Yes** X **No** ____

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5ft)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	=Total Cover		
Sapling/Shrub Stratum (Plot size: 5ft)			
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
Herb Stratum (Plot size: 5ft)			
1. *Typha latifolia*	99	Yes	OBL
2. *osa oodsii*	1	No	FACU
3. *ipsacus fullonum*	10	No	FAC
4. *rtica dioica*	5	No	FAC
5.			
6.			
7.			
8.			
	115 =Total Cover		
Woody Vine Stratum (Plot size: 5ft)			
1.			
2.			
	=Total Cover		

% Bare Ground in Herb Stratum 0 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	99	x 1 =	99
FACW species	0	x 2 =	0
FAC species	15	x 3 =	45
FACU species	1	x 4 =	4
UPL species	0	x 5 =	0
Column Totals:	115 (A)		148 (B)

Prevalence Index = B/A = 1.29

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%
X Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** X **No** ____

Remarks:

SOIL

Sampling Point: W26Sp2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-4	10YR 3/2	100					Loamy/Clayey	
4-14	10YR 5/1	100					Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- X Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- X Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Iron-Manganese Masses (F12) **(LRR D)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** X **No** ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- X Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ___	No X	Depth (inches): ___		
Water Table Present?	Yes ___	No X	Depth (inches): ___		
Saturation Present? (includes capillary fringe)	Yes X	No ___	Depth (inches): 0	**Wetland Hydrology Present?**	**Yes** X **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Arid West Region
See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Franson Wellsville Watershed Project City/County: Wellsville, Cache County Sampling Date: 5/07/2024

Applicant/Owner: Franson Civil Engineers State: UT Sampling Point: W27Sp1

Investigator(s): Jason Lewis, Rebecca Miller Section, Township, Range: S3 T10N R1W

Landform (hillside, terrace, etc.): Terrace Local relief (concave, convex, none): None Slope (%): 1

Subregion (LRR): LRR D Lat: 41.62831279 Long: -111.93685443 Datum: NAD 1983

Soil Map Unit Name: GsA GREENSON LOAM, 0 TO 3 PERCENT SLOPES NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No ____
Hydric Soil Present? Yes ____ No X
Wetland Hydrology Present? Yes ____ No X

Is the Sampled Area within a Wetland? **Yes** ____ **No** X

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5ft)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	____	=Total Cover	
Sapling/Shrub Stratum (Plot size: 5ft)			
1.			
2.			
3.			
4.			
5.			
	____	=Total Cover	
Herb Stratum (Plot size: 5ft)			
1. *Phalaris arundinacea*	40	Yes	FACW
2. *Poa pratensis*	50	Yes	FAC
3. *uisetum ar ense*	15	No	FAC
4. *Taraxacum officinale*	5	No	FACU
5.			
6.			
7.			
8.			
	110	=Total Cover	
Woody Vine Stratum (Plot size: 5ft)			
1.			
2.			
	____	=Total Cover	

% Bare Ground in Herb Stratum 0 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	40	x 2 =	80
FAC species	65	x 3 =	195
FACU species	5	x 4 =	20
UPL species	0	x 5 =	0
Column Totals:	110 (A)		295 (B)

Prevalence Index = B/A = 2.68

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%
____ Prevalence Index is ≤3.0[1]
____ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
____ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** X **No** ____

Remarks:

SOIL

Sampling Point: W27Sp1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-14	10YR 3/2	100					Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Iron-Manganese Masses (F12) **(LRR D)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** ___ **No** X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? Yes ___ No X Depth (inches): ___

(includes capillary fringe)

Wetland Hydrology Present? **Yes** ___ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Arid West Region
See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Franson Wellsville Watershed Project City/County: Wellsville, Cache County Sampling Date: 5/07/2024

Applicant/Owner: Franson Civil Engineers State: UT Sampling Point: W27Sp2

Investigator(s): Jason Lewis, Rebecca Miller Section, Township, Range: S3 T10N R1W

Landform (hillside, terrace, etc.): terrace Local relief (concave, convex, none): concave Slope (%): 0

Subregion (LRR): LRR D Lat: 41.62830346 Long: -111.93690326 Datum: NAD 1983

Soil Map Unit Name: GsA GREENSON LOAM, 0 TO 3 PERCENT SLOPES NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No ____
Hydric Soil Present? Yes X No ____
Wetland Hydrology Present? Yes X No ____

Is the Sampled Area within a Wetland? **Yes** X **No** ____

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5ft)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	=Total Cover		
Sapling/Shrub Stratum (Plot size: 5ft)			
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
Herb Stratum (Plot size: 5ft)			
1. *Typha latifolia*	40	Yes	OBL
2. *pilobium brachycarpum*	20	No	FAC
3. *Poa pratensis*	40	Yes	FAC
4. *uisetum hyemale*	2	No	FACW
5. *asturtium officinale*	20	No	OBL
6. *Phalaris arundinacea*	15	No	FACW
7.			
8.			
	137 =Total Cover		
Woody Vine Stratum (Plot size: 5ft)			
1.			
2.			
	=Total Cover		

% Bare Ground in Herb Stratum 0 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	60	x 1 =	60
FACW species	17	x 2 =	34
FAC species	60	x 3 =	180
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	137 (A)		274 (B)

Prevalence Index = B/A = 2.00

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%
X Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** X **No** ____

Remarks:

SOIL

Sampling Point: W27Sp2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-7	10YR 2/1	100					Loamy/Clayey	
7-14	7.5YR 3/1	100					Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- X Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Iron-Manganese Masses (F12) **(LRR D)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ___

Depth (inches): ___

Hydric Soil Present? **Yes** X **No** ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- X Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ___	No X	Depth (inches): ___		
Water Table Present?	Yes X	No ___	Depth (inches): 8		
Saturation Present? (includes capillary fringe)	Yes X	No ___	Depth (inches): 0	**Wetland Hydrology Present?**	**Yes** X **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Arid West Region
See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Franson Wellsville Watershed Project City/County: Wellsville, Cache County Sampling Date: 5/08/2024

Applicant/Owner: Franson Civil Engineers State: UT Sampling Point: W28Sp1

Investigator(s): Jason Lewis, Rebecca Miller Section, Township, Range: S22 T11N R1W

Landform (hillside, terrace, etc.): hillside Local relief (concave, convex, none): None Slope (%): 4

Subregion (LRR): LRR D Lat: 41.6758668 Long: -111.9468894 Datum: NAD 1983

Soil Map Unit Name: GsB GREENSON LOAM, 3 TO 6 PERCENT SLOPES NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No X	**Is the Sampled Area within a Wetland?** **Yes** ____ **No** X
Hydric Soil Present?	Yes ____	No X	
Wetland Hydrology Present?	Yes ____	No X	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5ft)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	____ =Total Cover		
Sapling/Shrub Stratum (Plot size: 5ft)			
1.			
2.			
3.			
4.			
5.			
	____ =Total Cover		
Herb Stratum (Plot size: 5ft)			
1. *osa oodsii*	70	Yes	FACU
2. *umulus lupulus*	20	Yes	FACU
3. *aianthemum racemosum*	10	No	FAC
4.			
5.			
6.			
7.			
8.			
	100 =Total Cover		
Woody Vine Stratum (Plot size: 5ft)			
1.			
2.			
	____ =Total Cover		

% Bare Ground in Herb Stratum 0 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	10	x 3 =	30
FACU species	90	x 4 =	360
UPL species	0	x 5 =	0
Column Totals:	100 (A)		390 (B)

Prevalence Index = B/A = 3.90

Hydrophytic Vegetation Indicators:

___ Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** ____ **No** X

Remarks:

SOIL

Sampling Point: W28Sp1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-16	10YR 3/1	100					Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Iron-Manganese Masses (F12) **(LRR D)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** ___ **No** X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? Yes ___ No X Depth (inches): ___

(includes capillary fringe)

Wetland Hydrology Present? **Yes** ___ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Arid West Region
See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Franson Wellsville Watershed Project City/County: Wellsville, Cache County Sampling Date: 5/08/2024

Applicant/Owner: Franson Civil Engineers State: UT Sampling Point: W28Sp2

Investigator(s): Jason Lewis, Rebecca Miller Section, Township, Range: S22 T11N R1W

Landform (hillside, terrace, etc.): terrace Local relief (concave, convex, none): None Slope (%): 0

Subregion (LRR): LRR D Lat: 41.6758621 Long: -111.9468132 Datum: NAD 1983

Soil Map Unit Name: GsB GREENSON LOAM, 3 TO 6 PERCENT SLOPES NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No ____
Hydric Soil Present? Yes X No ____
Wetland Hydrology Present? Yes X No ____

Is the Sampled Area within a Wetland? **Yes** X **No** ____

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5ft)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	=Total Cover		
Sapling/Shrub Stratum (Plot size: 5ft)			
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
Herb Stratum (Plot size: 5ft)			
1. *Phra mites australis*	60	Yes	FACW
2. *Typha latifolia*	20	No	OBL
3. *asturtium officinale*	20	No	OBL
4. *aianthemum racemosum*	5	No	FAC
5. *umulus lupulus*	1	No	FACU
6. *eum macrophyllum*	1	No	FACW
7.			
8.			
	107 =Total Cover		
Woody Vine Stratum (Plot size: 5ft)			
1.			
2.			
	=Total Cover		

% Bare Ground in Herb Stratum 0 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	40	x 1 =	40
FACW species	61	x 2 =	122
FAC species	5	x 3 =	15
FACU species	1	x 4 =	4
UPL species	0	x 5 =	0
Column Totals:	107 (A)		181 (B)

Prevalence Index = B/A = 1.69

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%
X Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** X **No** ____

Remarks:

SOIL

Sampling Point: W28Sp2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-14	10YR 3/1	100					Sandy	Sandy loam

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- X Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Iron-Manganese Masses (F12) **(LRR D)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ___

Depth (inches): ___

Hydric Soil Present? **Yes** X **No** ___

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- X Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ___	No X	Depth (inches): ___		
Water Table Present?	Yes ___	No X	Depth (inches): ___		
Saturation Present? (includes capillary fringe)	Yes X	No ___	Depth (inches): 0	**Wetland Hydrology Present?**	**Yes** X **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Arid West Region
See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Franson Wellsville Watershed Project City/County: Wellsville, Cache County Sampling Date: 5/07/2024

Applicant/Owner: Franson Civil Engineers State: UT Sampling Point: Upland 1

Investigator(s): Jason Lewis, Rebecca Miller Section, Township, Range: S8 T11N R1W

Landform (hillside, terrace, etc.): Terrace Local relief (concave, convex, none): Convex Slope (%): 3

Subregion (LRR): LRR D Lat: 41.7007961 Long: -111.97991427 Datum: NAD 1983

Soil Map Unit Name: MeC MENDON SILT LOAM, 6 TO 10 PERCENT SLOPES NWI classification: PEM

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No ____
Hydric Soil Present? Yes ____ No X
Wetland Hydrology Present? Yes ____ No X

Is the Sampled Area within a Wetland? **Yes** ____ **No** X

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5ft)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	=Total Cover		
Sapling/Shrub Stratum (Plot size: 5ft)			
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
Herb Stratum (Plot size: 5ft)			
1. *Phalaris arundinacea*	100	Yes	FACW
2. *Poa pratensis*	10	No	FAC
3.			
4.			
5.			
6.			
7.			
8.			
	110 =Total Cover		
Woody Vine Stratum (Plot size: 5ft)			
1.			
2.			
	=Total Cover		

% Bare Ground in Herb Stratum 0 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	100	x 2 =	200
FAC species	10	x 3 =	30
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	110 (A)		230 (B)

Prevalence Index = B/A = 2.09

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%
____ Prevalence Index is ≤3.0[1]
____ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
____ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** X **No** ____

Remarks:

SOIL

Sampling Point: Upland 1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-14	10YR 3/2	100					Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Iron-Manganese Masses (F12) **(LRR D)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** ___ **No** X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? Yes ___ No X Depth (inches): ___

(includes capillary fringe)

Wetland Hydrology Present? **Yes** ___ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Arid West Region
See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Franson Wellsville Watershed Project City/County: Wellsville, Cache County Sampling Date: 5/07/2024

Applicant/Owner: Franson Civil Engineers State: UT Sampling Point: Upland 2

Investigator(s): Jason Lewis, Rebecca Miller Section, Township, Range: S8 T11N R1W

Landform (hillside, terrace, etc.): Lake terrace Local relief (concave, convex, none): Convex Slope (%): 6

Subregion (LRR): LRR D Lat: 41.70200624 Long: -111.98101937 Datum: NAD 1983

Soil Map Unit Name: MeC MENDON SILT LOAM, 6 TO 10 PERCENT SLOPES NWI classification: PEM

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No ____
Hydric Soil Present? Yes ____ No X
Wetland Hydrology Present? Yes ____ No X

Is the Sampled Area within a Wetland? **Yes** ____ **No** X

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5ft)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	=Total Cover		
Sapling/Shrub Stratum (Plot size: 5ft)			
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
Herb Stratum (Plot size: 5ft)			
1. *Phalaris arundinacea*	95	Yes	FACW
2. *satis tinctoria*	5	No	UPL
3. *Con ol ulus ar ensis*	5	No	UPL
4. *umex crispus*	2	No	FAC
5.			
6.			
7.			
8.			
	107 =Total Cover		
Woody Vine Stratum (Plot size: 5ft)			
1.			
2.			
	=Total Cover		

% Bare Ground in Herb Stratum 0 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	95	x 2 =	190
FAC species	2	x 3 =	6
FACU species	0	x 4 =	0
UPL species	10	x 5 =	50
Column Totals:	107 (A)		246 (B)

Prevalence Index = B/A = 2.30

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%
____ Prevalence Index is ≤3.0[1]
____ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
____ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** X **No** ____

Remarks:

SOIL

Sampling Point: Upland 2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-14	10YR 3/2	100					Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Iron-Manganese Masses (F12) **(LRR D)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** ___ **No** X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? Yes ___ No X Depth (inches): ___

(includes capillary fringe)

Wetland Hydrology Present? **Yes** ___ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Arid West Region
See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Franson Wellsville Watershed Project City/County: Wellsville, Cache County Sampling Date: 5/08/2024

Applicant/Owner: Franson Civil Engineers State: UT Sampling Point: Upland 3

Investigator(s): Jason Lewis, Rebecca Miller Section, Township, Range: S9 T10N R1W

Landform (hillside, terrace, etc.): Hillside Local relief (concave, convex, none): None Slope (%): 6

Subregion (LRR): LRR D Lat: 41.6262899 Long: -111.95234531 Datum: NAD 1983

Soil Map Unit Name: CrC CROWSHAW GRAVELLY LOAM, 6 TO 10 PERCENT SLOPES NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No ____	**Is the Sampled Area within a Wetland?** Yes ____ No X
Hydric Soil Present?	Yes ____	No X	
Wetland Hydrology Present?	Yes ____	No X	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5ft)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	____ =Total Cover		
Sapling/Shrub Stratum (Plot size: 5ft)			
1.			
2.			
3.			
4.			
5.			
	____ =Total Cover		
Herb Stratum (Plot size: 5ft)			
1. *Phalaris arundinacea*	90	Yes	FACW
2. *ipsacus fullonum*	15	No	FAC
3. *epidium latifolium*	20	No	FAC
4. *Juncus effusus*	50	Yes	FACW
5.			
6.			
7.			
8.			
	175 =Total Cover		
Woody Vine Stratum (Plot size: 5ft)			
1.			
2.			
	____ =Total Cover		

% Bare Ground in Herb Stratum 0 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	140	x 2 =	280
FAC species	35	x 3 =	105
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	175 (A)		385 (B)

Prevalence Index = B/A = 2.20

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No ____

Remarks:

SOIL

Sampling Point: Upland 3

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-12	10YR 2/1	100					Loamy/Clayey	
12-15	7.5YR 3/1	100					Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Iron-Manganese Masses (F12) **(LRR D)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** ___ **No** X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? Yes ___ No X Depth (inches): ___

(includes capillary fringe)

Wetland Hydrology Present? **Yes** ___ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Arid West Region
See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Franson Wellsville Watershed Project City/County: Wellsville, Cache County Sampling Date: 5/08/2024

Applicant/Owner: Franson Civil Engineers State: UT Sampling Point: Upland 4

Investigator(s): Jason Lewis, Rebecca Miller Section, Township, Range: S4 T11N R1W

Landform (hillside, terrace, etc.): terrace Local relief (concave, convex, none): None Slope (%): 0

Subregion (LRR): LRR D Lat: 41.72756249 Long: -111.9641238 Datum: NAD 1983

Soil Map Unit Name: GsA GREENSON LOAM, 0 TO 3 PERCENT SLOPES NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No ____
Hydric Soil Present? Yes ____ No X
Wetland Hydrology Present? Yes ____ No X

Is the Sampled Area within a Wetland? **Yes** ____ **No** X

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5ft)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	=Total Cover		
Sapling/Shrub Stratum (Plot size: 5ft)			
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
Herb Stratum (Plot size: 5ft)			
1. *lopecurus pratensis*	100	Yes	FACW
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	100 =Total Cover		
Woody Vine Stratum (Plot size: 5ft)			
1.			
2.			
	=Total Cover		

% Bare Ground in Herb Stratum 0 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	100	x 2 =	200
FAC species	0	x 3 =	0
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	100 (A)		200 (B)

Prevalence Index = B/A = 2.00

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%
___ Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** X **No** ____

Remarks:

SOIL

Sampling Point: Upland 4

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-16	10YR 3/1	100					Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Iron-Manganese Masses (F12) **(LRR D)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** ___ **No** X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? Yes ___ No X Depth (inches): ___

(includes capillary fringe)

Wetland Hydrology Present? **Yes** ___ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Arid West Region
See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Franson Wellsville Watershed Project City/County: Wellsville, Cache County Sampling Date: 5/08/2024

Applicant/Owner: Franson Civil Engineers State: UT Sampling Point: Upland 5

Investigator(s): Jason Lewis, Rebecca Miller Section, Township, Range: S33 T12N R1W

Landform (hillside, terrace, etc.): terrace Local relief (concave, convex, none): None Slope (%): 0

Subregion (LRR): LRR D Lat: 41.73061459 Long: -111.96443838 Datum: NAD 1983

Soil Map Unit Name: GsA GREENSON LOAM, 0 TO 3 PERCENT SLOPES NWI classification: Riverine

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____	No X	**Is the Sampled Area within a Wetland?** **Yes** ____ **No** X
Hydric Soil Present?	Yes ____	No X	
Wetland Hydrology Present?	Yes ____	No X	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5ft)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	=Total Cover		
Sapling/Shrub Stratum (Plot size: 5ft)			
1.			
2.			
3.			
4.			
5.			
	=Total Cover		
Herb Stratum (Plot size: 5ft)			
1. *Cicuta maculata*	20	Yes	OBL
2. *Taraxacum officinale*	20	Yes	FACU
3. *edica o sati a*	20	Yes	UPL
4.			
5.			
6.			
7.			
8.			
	60 =Total Cover		
Woody Vine Stratum (Plot size: 5ft)			
1.			
2.			
	=Total Cover		

% Bare Ground in Herb Stratum 0 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 33.3% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	20	x 1 =	20
FACW species	0	x 2 =	0
FAC species	0	x 3 =	0
FACU species	20	x 4 =	80
UPL species	20	x 5 =	100
Column Totals:	60 (A)		200 (B)

Prevalence Index = B/A = 3.33

Hydrophytic Vegetation Indicators:

___ Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? **Yes** ____ **No** X

Remarks:

SOIL

Sampling Point: Upland 5

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-16	10YR 2/1	100					Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Iron-Manganese Masses (F12) **(LRR D)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** ___ **No** X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? Yes ___ No X Depth (inches): ___

(includes capillary fringe)

Wetland Hydrology Present? **Yes** ___ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Arid West Region
See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Franson Wellsville Watershed Project City/County: Wellsville, Cache County Sampling Date: 5/07/2024

Applicant/Owner: Franson Civil Engineers State: UT Sampling Point: Upland 6

Investigator(s): Jason Lewis, Rebecca Miller Section, Township, Range: S21 T11N R1W

Landform (hillside, terrace, etc.): Terrace Local relief (concave, convex, none): None Slope (%): 0

Subregion (LRR): LRR D Lat: 41.6799651 Long: -111.95131446 Datum: NAD 1983

Soil Map Unit Name: Ck COLLETT SILTY CLAY LOAM NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No ____	**Is the Sampled Area within a Wetland?** Yes ____ No X
Hydric Soil Present?	Yes ____	No X	
Wetland Hydrology Present?	Yes ____	No X	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5ft)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	____ =Total Cover		
Sapling/Shrub Stratum (Plot size: 5ft)			
1.			
2.			
3.			
4.			
5.			
	____ =Total Cover		
Herb Stratum (Plot size: 5ft)			
1. *lopecurus pratensis*	95	Yes	FACW
2. *Poa pratensis*	30	Yes	FAC
3.			
4.			
5.			
6.			
7.			
8.			
	125 =Total Cover		
Woody Vine Stratum (Plot size: 5ft)			
1.			
2.			
	____ =Total Cover		

% Bare Ground in Herb Stratum 1 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	95	x 2 =	190
FAC species	30	x 3 =	90
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	125 (A)		280 (B)

Prevalence Index = B/A = 2.24

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%

____ Prevalence Index is ≤3.0[1]

____ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

____ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No ____

Remarks:

SOIL

Sampling Point: Upland 6

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-14	10YR 3/2	100					Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Iron-Manganese Masses (F12) **(LRR D)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** ___ **No** X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ___	No X	Depth (inches): ___
Water Table Present?	Yes X	No ___	Depth (inches): 13
Saturation Present? (includes capillary fringe)	Yes ___	No X	Depth (inches): ___

Wetland Hydrology Present? **Yes** ___ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

U.S. Army Corps of Engineers
WETLAND DETERMINATION DATA SHEET – Arid West Region
See ERDC/EL TR-08-28; the proponent agency is CECW-CO-R

OMB Control #: 0710-0024, Exp: 11/30/2024
Requirement Control Symbol EXEMPT:
(Authority: AR 335-15, paragraph 5-2a)

Project/Site: Franson Wellsville Watershed Project City/County: Wellsville, Cache County Sampling Date: 5/07/2024

Applicant/Owner: Franson Civil Engineers State: UT Sampling Point: Upland 7

Investigator(s): Jason Lewis, Rebecca Miller Section, Township, Range: S21 T11N R1W

Landform (hillside, terrace, etc.): Terrace Local relief (concave, convex, none): None Slope (%): 0

Subregion (LRR): LRR D Lat: 41.6799382 Long: -111.9516676 Datum: NAD 1983

Soil Map Unit Name: Ck COLLETT SILTY CLAY LOAM NWI classification: None

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No ____	**Is the Sampled Area within a Wetland?** Yes ____ No X
Hydric Soil Present?	Yes ____	No X	
Wetland Hydrology Present?	Yes ____	No X	

Remarks:

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: 5ft)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	____ =Total Cover		
Sapling/Shrub Stratum (Plot size: 5ft)			
1.			
2.			
3.			
4.			
5.			
	____ =Total Cover		
Herb Stratum (Plot size: 5ft)			
1. *Poa pratensis*	95	Yes	FAC
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	95 =Total Cover		
Woody Vine Stratum (Plot size: 5ft)			
1.			
2.			
	____ =Total Cover		

% Bare Ground in Herb Stratum 5 % Cover of Biotic Crust 0

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	95	x 3 =	285
FACU species	0	x 4 =	0
UPL species	0	x 5 =	0
Column Totals:	95 (A)		285 (B)

Prevalence Index = B/A = 3.00

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No ____

Remarks:

SOIL

Sampling Point: Upland 7

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-14	10YR 3/1	100					Loamy/Clayey	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Iron-Manganese Masses (F12) **(LRR D)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (F21)
- ___ Very Shallow Dark Surface (F22)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** ___ **No** X

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? Yes ___ No X Depth (inches): ___

(includes capillary fringe)

Wetland Hydrology Present? **Yes** ___ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Biological Assessment (BA) – J-U-B Engineers

Biological Assessment for the Wellsville Canyon Project

Cache County, Utah

Prepared for:

USDA Natural Resources Conservation Service-Utah
City of Wellsville
and
City of Mendon

Prepared b

J·U·B ENGINEERS, INC.

1047 South 100
West Logan, UT 84321

June 2025

1 Contents

1 Introduction 1

1.1 Action Area 1

2 Proposed Action 3

2.1 Channel Improvements 3

2.1.1 Lower Canal Channel Improvements – Wellsville, Mendon, and Unincorporated Cache County 3

2.1.2 Bird Canyon (Culverts not Funded by PL 83-566) – Mendon City 3

2.1.3 Pond Stream – Mendon City 3

2.2 Culverts 3

2.2.1 Murray Spring Drainage (Not Funded by PL 83-566) – Wellsville City 3

2.2.2 Bird Canyon Culverts (Not Funded by PL 83-566) – Mendon City 4

2.3 Spills and Pipelines 4

2.3.1 2900 and 3400 South Spill and Pipeline & Murray Springs Rehabilitation – Wellsville City 4

2.3.2 Wide Canyon Pipeline – Wellsville City 4

2.3.3 400 North Pipeline – Mendon City 4

2.3.4 300 North Pipeline – Mendon City 4

2.3.5 100 South (Bird Creek) Pipeline – Mendon City 5

2.4 Secondary Water Systems 5

2.4.1 Secondary Water System Supplied by Two Regulating Ponds – Wellsville City 5

2.4.2 Secondary Water System – Mendon City 5

2.5 Wellsville-Mendon Lower Canal Conveyance 5

2.5.1 Lower Canal Pressurized Pipeline – Wellsville, Mendon, and Unincorporated Cache County 5

2.6 Wellsville East Field Canal Conveyance 5

2.6.1 Canal Enclosure – Wellsville City 5

2.7 Public Recreation 5

2.7.1 Wellsville Reservoir Boat Ramp – Wellsville City 5

2.7.2 Mendon Cemetery Reflecting Pond – Mendon City 6

2.8 Best Management Practices and Conservation Measures 8

3 Existing Habitat Conditions 10

3.1 Climate and Ecoregion 10

3.2 Landscape Setting 10

3.3 Vegetation and Site Conditions 10
4 Agency Coordination & Methodology 12
5 Species Descriptions and Determinations 13
5.1 Yellow-billed Cuckoo 13
5.2 Ute Ladies'-tresses 14
5.3 Monarch Butterfly 17
5.4 Suckley's Cuckoo Bumble Bee 17
6 Summary & Conclusion 19
7 References 20

Tables

Table 1. Dominant Vegetation Observed in the Action Area 12
Table 2. Endangered Species Act-protected species with potential to occur within the Action Area. 13
Table 3. Summary of Effects Analysis for the Wellsville Watershed Project. 19

Figures

Figure 1. Map of the Action Area Vicinity 2
Figure 2. Map of the Action Area. 7

Appendices

Appendix A–USFWS IPaC Report
Appendix B–Photo Inventory
Appendix C–ULT Memo

1 Introduction

The following Biological Assessment (BA) has been prepared by J-U-B Engineers, Inc. (J-U-B) on behalf of the City of Wellsville and City of Mendon for the U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS) for the Wellsville Canyon Project (Proposed Action) located in Cache County, Utah. The purpose of this BA is to provide technical information and to review the area of potential impact in and around the Proposed Action 's footprint (Action Area) in sufficient detail to determine to what extent the Proposed Action may affect federally threatened or endangered species or species proposed for listing, designated and proposed critical habitat and State Sensitive Species under Conservation Agreements. This BA is prepared in accordance with 50 CFR 402 and legal requirements found in Section 7(a)(2) of the Endangered Species Act (ESA) (16 U.S.C. 1536(c)).

1.1 Action Area

The Proposed Action would occur within the communities of Wellsville City, Mendon City, and unincorporated county land in Cache County, Utah. The Action Area includes the footprint of the Proposed Action, including staging areas, a 50-foot construction buffer, and potential impact buffers for two species. The U.S. Fish and Wildlife Service (USFWS) requires a 300-foot survey buffer around the project footprint for potential effects to the Ute ladies'-tresses (*Spiranthes diluvialis*), and a 0.5-mile buffer for the yellow-billed cuckoo (*Coccyzus americanus*). The size of the Action Area, inclusive of all species buffers around the project footprint, is approximately 23,772 acres. The Action Area Vicinity is presented in Figure 1, and the Action Area is shown in Figure 2.

The Action Area is located in portions of the following Townships, Ranges, and Sections:

- Township 10 North, Range 1 West, Sections 1, 2, 3, 9, 10, 11, 12, and 15;
- Township 11 North, Range 1 East, Sections 6 and 7;
- Township 11 North, Range 1 West, Sections 4, 5, 7, 8, 9, 10, 17, 18, 20, 21, 22, 27, 28, 34, 35, 36;
- Township 12 North, Range 1 West, Sections 28, 29, 31, 32, and 33; and,
- Township 12 North, Range 2 West, Sections 12.

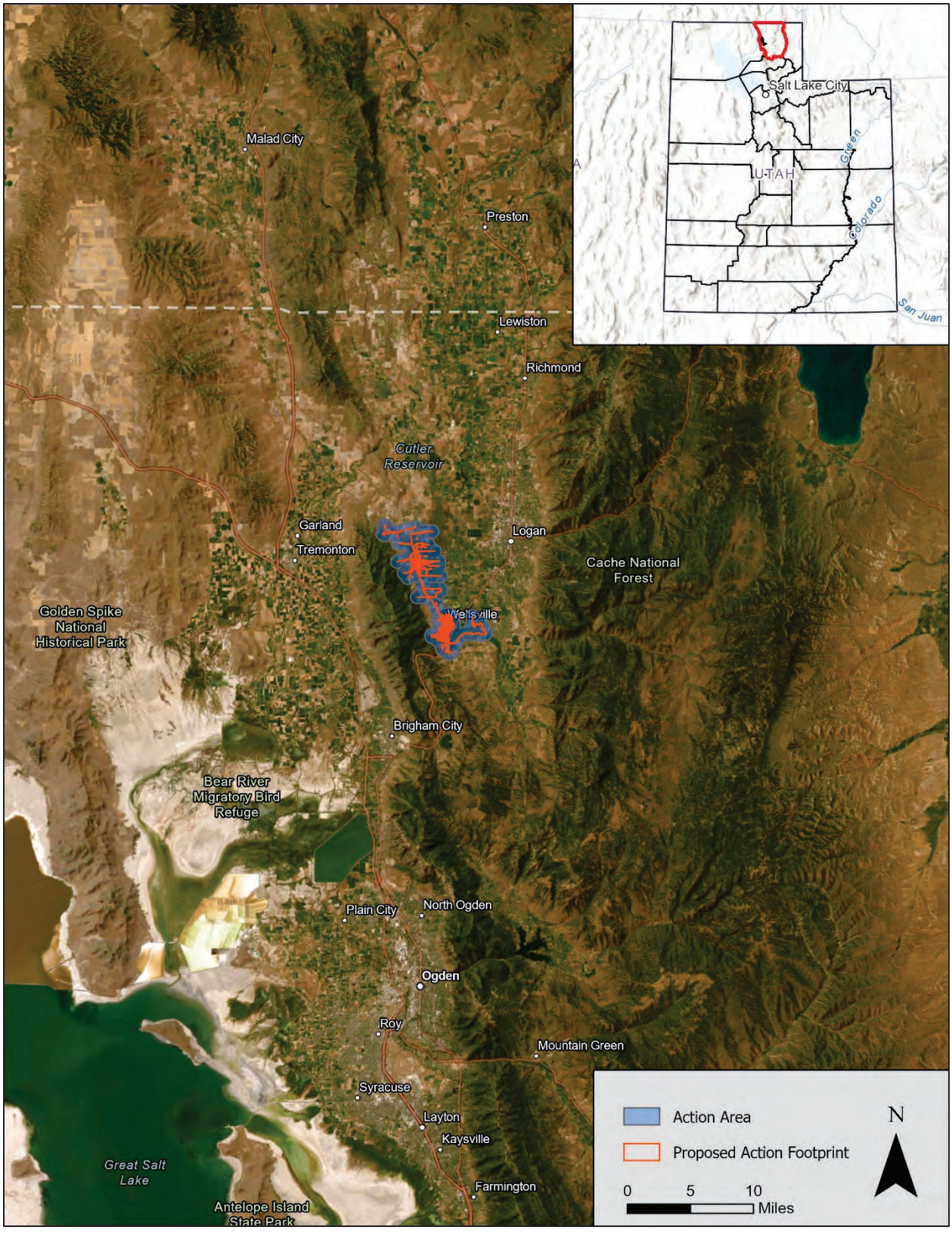


Figure 1. Map of the Action Area Vicinity

2 Proposed Action

The objectives of the Proposed Action are to improve public safety and reduce potential flooding issues due to aging drainage systems and agriculturally altered natural drainage channels in portions of the Wellsville Canyon Watershed, and to improve floodwater conveyance channels throughout Wellsville and Mendon including within the Wellsville-Mendon Canal– composed of the Wellsville-Mendon Lower Canal and the Wellsville-Mendon Upper Canal. Inefficiencies in the open canal delivery system would be addressed under the Proposed Action, which would reduce demand on the culinary water systems and improve both culinary and agricultural water reliability and quality.

The specific management measures included in the Proposed Action are as follows:

2.1 Channel Improvements

2.1.1 Lower Canal Channel Improvements – Wellsville, Mendon, and Unincorporated Cache County

The Proposed Action involves leaving the existing Lower Canal open for flood management if irrigation flow in the Lower Canal are delivered in a pipeline. Additionally, some channel improvements would be completed to improve the capacity of the Lower Canal for flood conveyance because the existing irrigation canal has less capacity further downstream. Some of these improvements would include increasing channel capacity and new spill locations to allow the canal to be maintained as a flood management channel, especially at the north end of the canal alignment where the capacity of the canal is significantly smaller.

2.1.2 Bird Canyon (Culverts not Funded by PL 83-566) – Mendon City

The Proposed Action would complete channel improvements along Bird Creek in Mendon between 100 West and 100 East. These improvements would consist of channel shaping and clearing along that segment of Bird Creek to reduce risk of flood damages for this area of the city. Upsized culverts would be installed at road crossings by Mendon City, if necessary.

2.1.3 Pond Stream – Mendon City

Currently, Pond Stream carries a base flow from several springs located near the center of town. The Proposed Action would improve the channel by clearing debris and fallen trees along with channel reshaping and resizing at the 100 East location.

2.2 Culverts

Although the PL 83-566 Program does not fund culverts, the project sponsors have decided to include them as part of the watershed plan and fund them using other sources.

2.2.1 Murray Spring Drainage (Not Funded by PL 83-566) – Wellsville City

The Proposed Action would replace existing culverts along the Murray Springs drainage. The culverts along the natural channel would be upsized to better manage the higher flows and prevent the flooding of homes along the channel.

2.2.2 Bird Canyon Culverts (Not Funded by PL 83-566) – Mendon City

The Proposed Action would enlarge a culvert beneath 100 West (SR-23) to accommodate design storm flow. 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 flow. If needed, additional culvert improvements to the culvert at 5400 West would be paid for by Cache County in order to pass the design storm flow.

2.3 Spills and Pipelines

2.3.1 2900 and 3400 South Spill and Pipeline & Murray Springs Rehabilitation – Wellsville City

The Proposed Action would construct new spill structures near 2900 South and 3400 South to alleviate the limited capacity of the canal. The following describe these measures in greater detail:

- The 3400 South spill structure would discharge into a pipeline that would convey flood waters down to the intersection of 4800 West. At the intersection, the pipeline would then flow to the north and discharge into an existing channel that would convey floodwater back to the Little Bear River. Several inlets would be placed in the pipeline along the alignment that would collect flood flow from along Highway 23 and along 4800 West. This pipeline would also convey flow from Brushy Canyon, collecting water before it crosses the canal.
- The 2900 South spill would discharge into a pipeline that would convey flow from the spill down past a private residence, across Highway 23, along 2900 South, until finally discharging into the Little Bear River.

2.3.2 Wide Canyon Pipeline – Wellsville City

The Proposed Action would install a pipeline to address flooding issues created by the discharge from Wide Canyon. The floodwater would be collected into the pipeline to the west of 300 West in Wellsville and flow north to 500 South where it would then turn east and cross the road until discharging into the Murray Spring Stream just below Wellsville Reservoir. Some flow would still be allowed to pass the diversion structure, but the pipeline would alleviate the extreme flooding in the Wide Canyon channel caused by intense rain events.

2.3.3 400 North Pipeline – Mendon City

The Proposed Action would install an inlet would on the west side of SR-23 at the 400 North/SR-23 intersection, with piping to convey floodwater east along the north side of 400 North to an existing culvert crossing. It would then be piped 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.

2.3.4 300 North Pipeline – Mendon City

The Proposed Action would install a pipeline system from the canal, or 100 West, along 300 North going east on the north side of the road would be installed to convey this floodwater. Inlets at street crossings would be installed to collect excess flows from adjacent properties. The pipe would continue under 300 North and collect Pond Stream. The conduit would then continue under 100 East and discharge into the natural channel.

2.3.5 100 South (Bird Creek) Pipeline – Mendon City

The Proposed Action would install a flood control pipeline from 250 West to 500 East (Bird Creek) on the North side of 100 South. This would include the installation of inlets at all street crossings to collect excess floodwater from adjacent properties and would also include improvements to the existing inlet along the drainage west of the Lower Canal. Additionally, bank protection would be installed at the outlet of the pipeline where it discharges into Bird Creek.

2.4 Secondary Water Systems

2.4.1 Secondary Water System Supplied by Two Regulating Ponds – Wellsville City

The Proposed Action 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 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 pipe from the Wellsville-Mendon Upper Canal and Wellsville Reservoir from a pump station constructed adjacent to the reservoir.

2.4.2 Secondary Water System – Mendon City

This measure included in the Proposed Action would replace the existing irrigation water delivery system, which is aged and difficult to maintain, with a piped and pressurized secondary system to improve water usage within Mendon City. 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. Additionally, a pump station and equalization pond would be constructed.

2.5 Wellsville-Mendon Lower Canal Conveyance

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

The Proposed Action 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 diameter would get progressively smaller as it goes north because of reduced water volume as shares are delivered.

2.6 Wellsville East Field Canal Conveyance

2.6.1 Canal Enclosure – Wellsville City

The Proposed Action would pipe the existing Wellsville East Field Canal starting approximately 300 feet downstream of the existing Hyrum Reservoir Spillway and ending 2.5 miles later. This would provide users with a closed system which would prevent losses due to seepage.

2.7 Public Recreation

2.7.1 Wellsville Reservoir Boat Ramp – Wellsville City

The Proposed Action would include a measure to install a boat ramp for small watercraft (kayaks, paddleboards, etc.) on the east side of Wellsville Reservoir.

2.7.2 Mendon Cemetery Reflecting Pond – Mendon City

The Proposed Action would construct a walking area, benches, and a water feature for the public within a newer section of the cemetery in Mendon City.

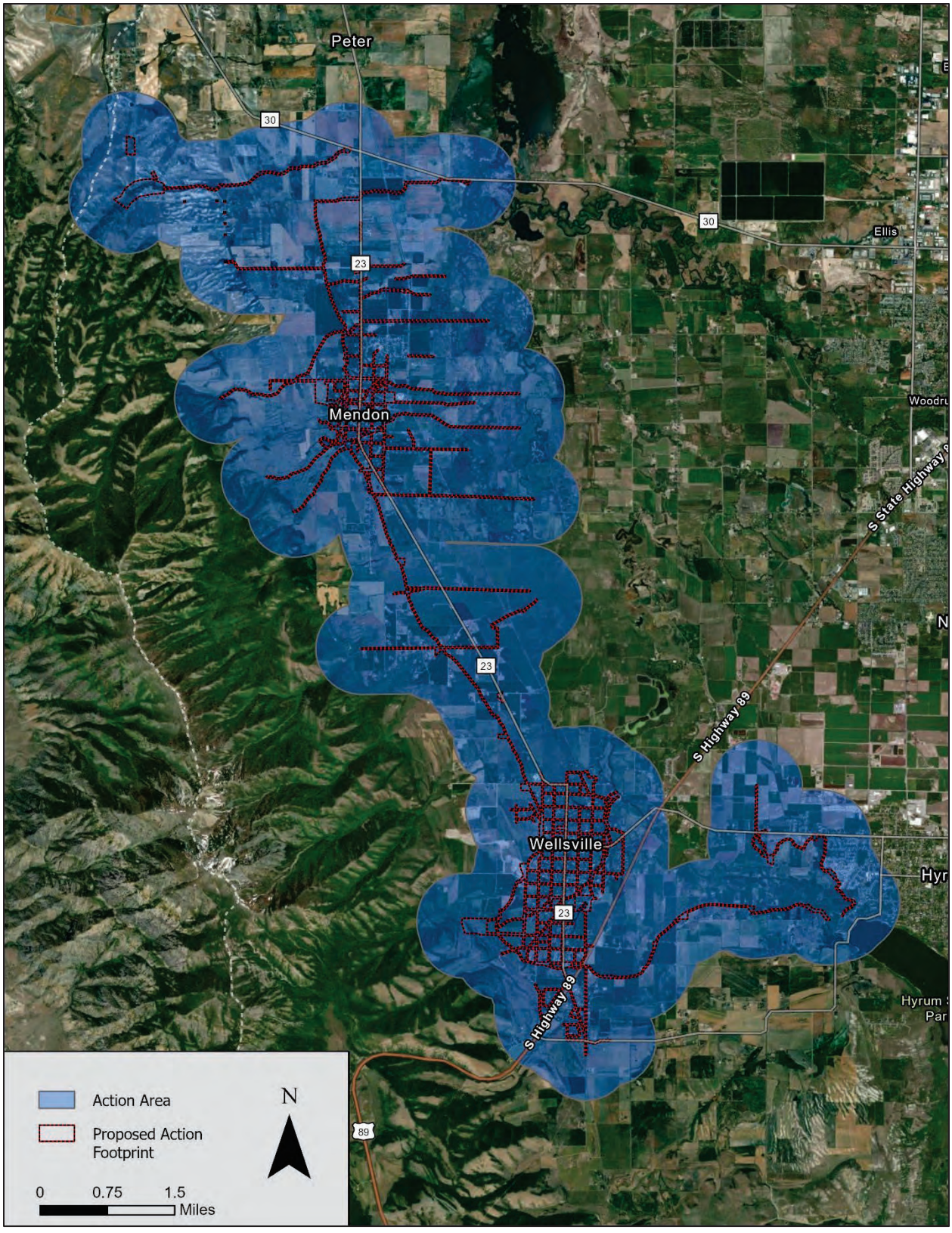


Figure 2. Map of the Action Area.

2.8 Best Management Practices and Conservation Measures

Construction Best Management Practices (BMPs) are standard requirements and would be required during the implementation of the Proposed Action. BMPs would include, but are not limited to, soil and erosion control devices, noxious weed prevention and control, and construction timing to minimize or avoid breeding and nesting season for migratory birds. The following BMPs and conservation measures are intended to minimize effects on listed species and their habitats, as well as to protect water quality and minimize disturbance to soil and vegetation.

1. Complete all work within the designated Action Area during established working hours.
2. Contain all work activities, including those within staging areas, to upland areas to minimize potential impacts to surface water quality, whenever feasible.
3. 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.
4. Ensure the contractor develops and follows an approved Stormwater Pollution Prevention Plan (SWPPP) and a Spill Prevention, Control and Countermeasure (SPCC) plan or other similar plan.
5. Comply with all measures in the associated SWPPP and SPCC plan when fueling, performing cleaning and maintenance, and storing or disposing of hazardous materials.
6. 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.
7. 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 within the Action Area, halt construction and/or vegetation removal and contact the NRCS Biologist for guidance.
8. 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 the lead agency (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.
    a. 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.

9. 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 weed seeds before arriving at the Action Area. Ensure this cleaning occurs each time equipment is brought into the Action Area from a different location.

    a. 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.

10. 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.

Ute ladies-tresses Suitable Habitat Conservation Measures

11. Ensure that the potential suitable habitat site for ULTs within Mendon is clearly marked.

12. Avoid ground disturbance and soil compaction within the marked potential suitable habitat, including limiting vehicle use as is practical.

13. Utilize existing nearby roads for staging and access.

14. Adhere to all previously listed BMPs for work adjacent to the suitable habitat area and within the suitable habitat area, including:

    a. Use only water (no chemicals, reclaimed production water, or oil field brine) for dust abatement measures.
    b. Clean vehicles and equipment prior to entering suitable habitat.
    c. Control noxious weeds within suitable habitat with herbicides or manual treatments. If using herbicides within a suitable habitat area:
        i. A Pesticide Use Permit (PUP) will be approved through authorizing federal or state agency,
        ii. Herbicides will be used with reduced application rates and with reduced pump pressure, per label instructions.
        iii. No aerial or broadcast herbicide treatments will be applied for vegetation management within 2,500 feet of suitable or occupied Ute ladies'-tresses habitat.
        iv. For noxious weed control within 2,500 feet of suitable or occupied Ute ladies'-tresses habitat, manual spot treatments (i.e., backpack sprayers) shall be used.
        v. All those involved in the herbicide application shall be accompanied by a qualified botanist/ecologist familiar with Ute ladies'-tresses to help herbicide applicators identify Ute ladies'-tresses and avoid impacts on individual plants.
        vi. Treatments would not be done when wind speeds exceed 6 miles per hour.
        vii. Herbicides shall be stored in spill proof containers away from special status plant habitats.

15. 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 potential suitable habitat will need to be completed.

    a. 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).

3 Existing Habitat Conditions

3.1 Climate and Ecoregion

The Action Area has elevations ranging from 4,410 to 5,179 above mean sea level (AMSL). Land uses in the surrounding area consist mainly of residential, agricultural, and open grazing uses. The region is considered a warm summer continental climate with an average high temperature of 59.6^{o} F and an average low temperature of 31.6^{o} F. Extreme temperatures are not uncommon. The highest recorded temperature was 104^{o} F, which occurred in July, and the coldest temperature was -44^{o} F, which occurred in December (CantyMedia 2021).

The average annual precipitation for the region is 70.4 inches, much of which comes in the form of snow. There is an average of 95 days of rain per year, with most precipitation occurring in January, April, May, and December. There is an average of 32.5 days of snow per year, with the most snow occurring in December, January, and February (CantyMedia 2021).

3.2 Landscape Setting

The Canal is a system that travels through both residential and agricultural lands in the Action Area. The Wellsville-Mendon Canal is open and lined with concrete along much of its alignment, although it is earthen in some sections. It is intermittently interrupted by irrigation diversions and headgate structures. The Wellsville-Mendon Canal is earthen and has a muddy substrate, which dries up outside of the irrigation season each year.

The entire Canal is approximately 14 miles in length, and runs east from Wellsville Reservoir in Hyrum, Utah, and terminates directly into the Little Bear River, north of Mendon. A total of 0.353 acres of the Little Bear River was delineated within the Action Area. The Little Bear River is a lower perennial stream with an unconsolidated bed composed of cobble and gravel. Water supply to the Canal is abundant throughout the irrigation season and becomes dry when flow ceases during non-irrigation periods of the year. The Canal delivers irrigation water to more than 1,987 acres of agricultural and residential land.

3.3 Vegetation and Site Conditions

Vegetation occurring within the Action Area was typical for agricultural fields in the region, with wetland species occurring in low lying pastural areas adjacent to the Canal. The Canal and auxiliary irrigation ditches varied in hydrology and vegetation at different locations. The Canal and open ditches in agricultural areas are densely vegetated with reed canary grass (*Phalaris arundinacea*), cattail (*Typha sp.*), and other common riparian species within and on its edges. The Canal and ditches, when conveying irrigation water, overflow during precipitation events especially in sections where sediment and vegetation have filled in the canal or ditch prism. While some segments of the Canal are earthen,

the Canal is generally lined with concrete. Herbicide use was evident along the Canal in many locations, where maintenance has been performed to minimize unwanted vegetation.

The Action Area includes pasture areas where the Canal and ditches pass through. Seasonal inundation of pasturelands is common in this area, induced by irrigation and the high-water table present in Cache Valley. Irrigation canals, when conveying irrigation water, overflow during precipitation events especially in sections of the canal where sediment and vegetation have clogged the canal prism. Characteristic of the high-water table within the Action Area, and due to heavy precipitation events occurring at the time of the field surveys in August 2021, surveyed pasture areas were saturated and standing water was observed in some locations. In August of 2023, standing water was observed in fewer locations.

Throughout neighborhoods in Wellsville and Mendon, sections of the Canal were dry, due to controlled flows, and sometimes lined with riprap, concrete, landscaping rock, or other material. Bare ground is present along portions of the canal in residential areas, and evidence of herbicide use to control unwanted vegetation is present. For representative photos of the Action Area, see the Photo Inventory in Appendix B. Dominant vegetation within the Action Area is described in Table 1.

Table 1. Dominant Vegetation Observed in the Action Area

Common Name	Scientific Name
alfalfa	*Medicago sativa*
barnyard grass	*Echinochloa crus-galli*
big sagebrush	*Artemisia tridentata*
bog toothed maple	*Acer grandidentatum*
box elder	*Acer negundo*
burdock	*Arctium minus*
Canada thistle	*Cirsium arvense*
cattail	*Typha sp.*
common bentgrass	*Agrostis capillaris*
common reed	*Phragmites australis*
common spikerush	*Eleocharis palustris*
common sunflower	*Helianthus annuus*
common teasel	*Dipsacus fullonum*
coyote willow	*Salix exigua*
crested wheatgrass	*Agropyron cristatum*
field horsetail	*Equisetum arvense*
Fremont's cottonwood	*Populus fremontii*
grater plantain	*Plantago major*
gumweed	*Grindelia camporum*
inland saltgrass	*Distichlis spicata*
meadow foxtail	*Alopecurus pratensis*
narrowleaf cottonwood	*Populus angustifolia*
red osier dogwood	*Cornus serecia*
reed canarygrass	*Phalaris arundinacea*
rubber rabbitbrush	*Ericameria nauseosa*
silverweed	*Potentilla anserina*
tall goldenrod	*Solidago canadensis*
twisted stalk	*Streptopus amplexifolius*
wild licorice	*Glycyrrhiza lepidota*
Wood's rose	*Rosa woodsii*
yellow sweet clover	*Melilotus officinalis*

4 Agency Coordination & Methodology

As part of the inventory completed for the Proposed Action, a species list from the USFWS Information for Planning and Consultation (IPaC) system was generated for the Proposed Action on August 15, 2021, and updated on April 8,2025 (see USFWS IPaC Report in Appendix A; USFWS 2025). Four Endangered Species Act (ESA) protected species may occur within the Action Area: Two ESA threatened species, one ESA proposed threatened species, and one ESA proposed endangered species. Additionally, 24 Migratory Bird Treaty Act (MBTA) protected species, including two Bald and Golden Eagle Protection Act (BGEPA) protected species, were identified by the IPaC Report. The report did not identify any proposed or designated critical habitat or refuge lands within the Action Area. A species occurrence report was

generated for the Action Area from the Utah Natural Heritage Program on December 29, 2023 (UNHP 2023).

A field survey of the Action Area was conducted by a J-U-B biologist on August 16 and 17, 2021, August 10, 2023, and August 13, 2024. ESA-protected species that may occur in the Action Area are carried forward for further analysis in the following sections and are listed in Table 2.

Table 2. Endangered Species Act-protected species with potential to occur within the Action Area.

Common Name	Scientific Name	Critical Habitat present?	ESA Designation
yellow-billed cuckoo	*Coccyzus americanus*	No	Threatened
Ute ladies'-tresses	*Spiranthes diluvialis*	No	Threatened
monarch butterfly	*Danaus plexippus*	No	Proposed Threatened
Suckley's cuckoo bumble bee	*Bombus suckleyi*	No	Proposed Endangered

5 Species Descriptions and Determinations

The Action Area was assessed for suitable habitat and potential impacts from the Proposed Action. Species descriptions, effect analyses and determinations for each species evaluated are presented below. Table 3 summarizes the ESA-listed species and critical habitat identified by the IPaC Report, and the effect determinations analyzed for each species or critical habitat within the Action Area.

5.1 Yellow-billed Cuckoo

The yellow-billed cuckoo (YBCU) was listed as threatened by the USFWS on November 3, 2014. YBCU are considered a riparian obligate and are usually found in large tracts of multi-layered cottonwood and willow habitat with dense sub-canopies (below 33 feet). In the state of Utah, populations of the YBCU are rare. Patches of suitable breeding and nesting habitat for the species must be at least 12 acres or larger and separated from other patches by at least 300 meters (Utah DWR 2020). The YBCU is dependent on large areas of woody, riparian vegetation that combine a dense shrubby understory for nesting and a cottonwood overstory for foraging. (USFWS 2021a).

In May of 2021, the USFWS updated the designation of 298,845 acres of critical habitat for the YBCU western distinct population segment (DPS) in Arizona, California, Colorado, Idaho, New Mexico, Texas, Utah and Wyoming (86 FR 20798). Primary threats to the YBCU include conversion of riparian habitat to agriculture and other uses, dam construction, stream channelization and stabilization, and livestock grazing (USFWS 2017). The USFWS IPaC Report did not identify any proposed or designated final critical habitat for the species in the Action Area. The UNHP report documented an occurrence of the YBCU within 0.5-miles of the Action Area, but this singular observation was made in 1938 (UNHP 2023).

Methodology

Habitat suitability assessment surveys for the YBCU, and an incidental nesting and bird survey for raptors and migratory birds, including YBCU, was performed within the Action Area on August 16 and 17, 2021 and August 10, 2023. A habitat suitability assessment for YBCU within the Action Area was completed, which included a 0.5-mile YBCU survey buffer around the project footprint. This assessment

utilized available aerial imagery and local regional data for a desktop analysis to identify potentially suitable habitat.

Habitat Suitability Assessment Survey Results

Within the Action Area, which includes the 0.5-mile YBCU survey buffer around the project footprint, no location supported a riparian corridor with the appropriate cover, vegetation stratification, and acreage to constitute suitable habitat for the YBCU. Suburban and agricultural areas dominate the landscape and limit the extent of contiguous riparian habitat within the communities of Wellsville and Mendon.

Direct and Indirect Effects

No YBCU individuals or nests were incidentally identified during field surveys. The Action Area lacks suitable habitat for the species and the proposed timing of construction would occur outside breeding and nesting season for the YBCU. The Proposed Action would not cause mortality or harass individual YBCU and will not result in significant habitat removal. Therefore, the Proposed Action would result in **No Effect** to the YBCU.

5.2 Ute Ladies'-tresses

Ute ladies'-tresses (ULT) was listed as federally threatened by the USFWS on January 17, 1992. No critical habitat has been proposed or designated for the ULT. The ULT is a perennial, terrestrial herb that is a member of *Orchidaceae*, the Orchid Plant Family. The current known distribution of ULT extends from the eastern slope of the Rocky Mountains in southeastern Wyoming to the eastern Great Basin area, and can be found in Colorado, Utah, Idaho, Montana, Washington and far eastern Nevada (USFWS 2021b).

ULTs occur in riparian areas, usually along edges of stabilized perennial streams and high flow channels, and gravel bars. It can also occur in wet meadows, stable wetlands and seepy areas, especially in historical or active floodplain landscapes, or near freshwater lakes or streams. Ute ladies'-tresses requires open habitat and is not tolerant of standing water, or of competition with aggressive plant species (NRCS 2009). Occurrences of ULT are documented within 0.5-miles of the Action Area (UNHP 2023), including the nearby ULT reference population (see Existing Habitat Conditions). Threats to ULT include loss of riparian and wetland habitat resulting from urban development, flooding and de-watering of habitat from dam control and stream channel re-routing for agricultural development (USFWS 2021b).

Methodology

Habitat suitability assessment surveys for ULTs occurred within the Action Area during the accepted flowering period for the ULT in August 2021, August 2023 and August 2024. The Action Area includes a 300-foot ULT survey buffer around the project footprint. Biologists with J-U-B visited the Mendon ULT reference population on August 17, 2021, on August 10, 2023, and on August 13, 2024, during field surveys of the Action Area. Throughout the Action Area, in both Wellsville and Mendon, habitat suitability assessments were performed, and zero vegetative or blooming ULTs were observed.

Habitat Suitability Assessment Survey Results

The canal and ditches throughout Wellsville and Mendon are highly disturbed and regularly maintained to discourage noxious weeds and excessive vegetative growth. Canal segments in many locations exhibit steep, barren and eroded slopes, and elsewhere the bank slopes are densely vegetated and there is competition from tall growing species along open water edges including reed canarygrass, cattail, and common reed. Many ditches are lined with riprap and were dry at the time of field surveys. The location of these ditches is alongside roads, behind and through residential areas, and along the edges of agricultural areas. These ditches annually run dry as irrigation flows cease outside the irrigation season. Where ditches pass through grazed pastures, sign of bank erosion caused by cattle grazing is commonly evident. No canal or ditch edge habitat was observed to be suitable for ULTs. Additionally, regular use of herbicide along sections of the canal and ditches decreases the habitat suitability for ULTs. Wellsville Reservoir, located within the Action Area, also does not provide suitable edge habitat, and is host to an abundance of the same commonly observed wetland species found within the canal and ditches (see Photo Inventory in Appendix D).

Within pasture lands and along the unlined Wellsville-Mendon Canal and auxiliary irrigation ditches, wet meadow and streamside areas exist. Within some pastures in the Action Area, mesic meadow locations that were surveyed in August 2021 and August 2023, vegetation was also dominated by tall aggressive species, including inland saltgrass, timothy grass, and reed canary grass. Some of these locations are actively grazed, decreasing vegetative competition, but increasing the risk of trampling and grazing pressure by livestock. Standing water was observed in pastures within the Action Area near irrigation ditches that were overflowing. While ULT require hydric conditions of moisture within the top 18 inches of soil, they do not tolerate standing water.

Additionally, the preferred soil type for ULT includes gravely, cobbly alluvial soils and substrates. Clay soils are not typically suitable for ULT. Soils across the Action Area, including on the banks of the canals, contain high levels of clay and silt, and are absent of gravel or cobble substrate. As a result, the soil type and composition are not suitable for ULT growth and persistence, even where hydrology may be suitable within or along the irrigation canal and ditches.

Potential Suitable Habitat Findings

Approximately 18.45 acres of potentially suitable habitat were identified within 300 feet of the project footprint inside the Action Area in Mendon on August 10, 2023. A protocol level ULT survey was completed for this location on August 10, 2023, and August 13, 2024. No ULTs were identified during these surveys. One additional consecutive year of survey should be performed for this potential suitable habitat area, pursuant to USFWS survey guidelines (USFWS 1992). See the attached ULT Memo in Appendix C for a map of the potentially suitable habitat, and results of the ULT surveys.

The potential suitable habitat was identified adjacent to a ditch alignment within the Action Area. The project footprint is limited to the prism of an irrigation ditch within this location, which totals 6.35 acres in size. The size of the habitat area is approximately 18.45 acres in size and flanks the ditch on the north and south sides, within 300 feet of the ditch. The location of this habitat is approximately 0.97 miles northeast of the existing ULT reference population. Condition of the site is a maintained pastureland with a similar vegetation assemblage, hydrology, and disturbance regime to the nearby ULT reference population site. The pasture is irrigated and mowed, which reduces competition from tall growing grass species and other common weeds.

The irrigation ditch alignment is not mowed like the adjacent pasture habitat. Within the prism of the ditch, densely growing species like reed canarygrass and common teasel grow, similar to other ditches within the Action Area. This ditch seasonally runs dry, and experiences disturbance from maintenance and use activities. Overall, the Proposed Action footprint that lies within the potentially suitable habitat location does not contain suitable habitat for ULTs.

The Proposed Action in this location include channel clearing and grading to remove excess vegetation and sediment from the irrigation ditch. While the footprint of the Proposed Action encompasses the irrigation ditch alignment and staging of equipment, construction activities would be contained on the paved road 5800 W running north to south, west of the suitable habitat location.

Ute Ladies'-tresses Reference Population Site

A Ute ladies'-tresses reference population is located in Mendon, Utah. The location is a protected wet pasture, owned by the Bear River Land Conservancy, and is one of a few locations where ULT are known occur in Cache County. The plants are marked and monitored by researchers with Utah State University. The pasture is routinely mowed and maintained. At the time of field surveys, approximately a dozen individual ULTs were blooming in this location, confirming the appropriate phenological condition of the local population and allowing appropriate field identification (see Photo Inventory in Appendix B).

The maintained pasture where the reference ULT population occurs differed from other pastural areas in the Action Area because its haying regime, natural wet meadow hydrology, and planned grazing regime helps prevent competition from tall grasses, which would reduce light, moisture, and nutrient availability that would also preclude suitable habitat for the species. While an irrigation ditch runs along one edge of the pasture, no ULT grow on the banks of the ditch. However, conditions at this site are similar to those identified within the potential suitable habitat location described above.

Blooming and non-blooming ULT individuals were observed growing centrally within reference site pasture area. Because the ULT reference population in Mendon was actively flowering during field surveys, it is reasonable to assume that potentially occurring ULTs may have been blooming in the Action Area and therefore visible for field identification, if present.

Direct and Indirect Effects

Outside of the Mendon reference population location, which is not included in the Action Area and will not be disturbed by Proposed Action activities, one location containing potential suitable habitat for ULT was identified and zero ULT individuals were observed during the site survey.

All other areas within the Action Area were surveyed and do not contain suitable habitat for ULTs due to competition from aggressive plant species, incompatible soil and hydric conditions, including water inundation, heavy grazing pressure, Wellsville-Mendon Canal and ditch maintenance activities, and concrete and riprap lined areas. Because potentially suitable habitat was identified within the 300-foot ULT survey buffer which is included in the Action Area, and this habitat has similar conditions to the Mendon ULT reference population site, an effect determination of **May Affect, Not Likely to Adversely Affect** is warranted even though the Proposed Action activities are not likely to impact the potential habitat for ULTs, and no individuals have been identified within the habitat area.

5.3 Monarch Butterfly

The monarch butterfly was designated as a candidate species under the ESA on December 15, 2020. This species has black and orange wings that span 4 inches on average, with black veins and white spots along wing margins. These butterflies migrate across approximately 1,200 to 2,800 miles from breeding grounds in Canada and the United States to hibernation grounds in central Mexico and southern California. Primary threats to the monarch butterfly include climate change, which affects weather conditions in both the wintering grounds and summer breeding grounds. Climate change-influenced patterns of drought and rainfall can increase adult butterfly mortality and reduce food availability for monarch caterpillars (WWF 2021). Habitat loss and fragmentation from development and pesticide use, which impacts milkweed abundance (the primary food plant for the monarch) also contribute to decline in populations of the monarch butterfly (USFWS 2021c).

Methodology

Habitat suitability assessment surveys for the monarch butterfly occurred within the Action Area on August 17, 2021, on August 10, 2023, and on August 13, 2024.

Direct and Indirect Effects

Milkweed was not identified within the Action Area during field surveys, indicating that potential breeding habitat for the monarch butterfly is not present. Vegetation will be disturbed and removed along the banks of the irrigation ditches during construction activities, and long-term vegetation loss will likely occur due to loss of hydrology when the ditches are piped. However, implementation of BMPs and conservation measures would reduce effects to vegetation. Disturbed areas within riparian zones or wetland areas would be revegetated with native seeds and plantings, including milkweed species, where it can be supported by hydrology. Native site vegetation and plant communities, including milkweed, if found, would be protected whenever practicable using flagging. Because measures are in place to protect native vegetation and revegetate areas with seed that will include milkweed species, the Proposed Action will not jeopardize the exitance of the monarch and will cause **No Effect** to the monarch butterfly.

5.4 Suckley's Cuckoo Bumble Bee

The Suckley's cuckoo bumble bee was proposed for listing as Endangered under the ESA on December 17th, 2024. This species is a parasitic bee that usurps nests of other bees, where host workers provide for their young. Hosts include Western bumble bees (*Bombus occidentalis*) and Nevada bumble bees (*Bombus nevadensis*), and other potential hosts occur in subgenus *Bombus*. The Suckley's cuckoo bumble bee has been sampled in different habitats across various elevations, ranging from 6 feet to 10,500 feet AMSL. This species faces a population decline due loss of habitat due to livestock grazing and fire management, pesticide and herbicide use, and climate change, which affects their host species by changing temperatures that create unsuitable conditions for bees to complete their lifecycles (USFWS 2024).

Methodology

A habitat suitability assessment occurred throughout the Action Area for the Suckley's cuckoo bumble bee. Desktop analyses were also performed, using aerial imagery and available range and occurrence data.

Direct and Indirect Effects

The Suckley's cuckoo bumble bee could occur within the Action Area, because of the presence of nectarous plants and other bumble bee species. Bumble bees prefer to breed in undisturbed habitat areas with logs, bunch grass, or other natural debris they can utilize for nesting sites (USDA 2012). Habitat within the Action Area is highly disturbed by agricultural activities, including herbicide and pesticide use. For these reasons, habitat quality for the Suckley's cuckoo bumble bee is low within the Action Area. No individuals of this species were identified during field surveys, and project BMPs will protect native vegetation to the greatest extent practicable. Project BMPs will also reseed disturbed areas with native seed mix, which will enhance habitat for the Suckley's cuckoo bumble bee and its hosts in the long term. Therefore, the Proposed Action will have **No Effect** to the Suckley's cuckoo bumble bee.

6 Summary & Conclusion

After considering the available scientific information regarding the biological requirements and the status of ESA-listed species considered in this BA in conjunction with the evaluation of present habitat conditions and the Proposed Action and winter construction schedule, the following effect determinations for the yellow-billed cuckoo, Ute ladies'-tresses, monarch butterfly and Suckley's cuckoo bumble bee are summarized in Table 3.

Table 3. Summary of Effects Analysis for the Wellsville Watershed Project.

Species	**ESA Designation**	**Determination**
yellow-billed cuckoo (*Coccyzus americanus*)	Threatened	No Effect
Ute ladies'-tresses (*Spiranthes diluvialis*)	Threatened	MANLAA
monarch butterfly (*Danaus plexippus*)	Proposed Threatened	No Effect
Suckley's cuckoo bumble see (*Bombus suckleyi*)	Proposed Endangered	No Effect

If additional species are listed or proposed, or if critical habitat is designated prior to completion of construction, and the species or designated habitat occur within the Action Area, or may be affected by the Proposed Action, construction would be paused, and a species evaluation would be prepared. Species for which a no effect determination has been previously prepared would not be readdressed unless the scope of the Proposed Action were changed. It should be noted that the final authority with regard to effect determinations rests with the appropriate regulatory agency.

7 References

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Appendix A

USFWS IPaC Report

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Utah Ecological Services Field Office
2369 West Orton Circle, Suite 50
West Valley City, UT 84119-7603
Phone: (801) 975-3330 Fax: (801) 975-3331

In Reply Refer To: 04/08/2025 22:13:19 UTC
Project Code: 2023-0129508
Project Name: Wellsville Watershed Project

Subject: List of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed, and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological

evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

https://www.fws.gov/sites/default/files/documents/endangered-species-consultation-handbook.pdf

Migratory Birds: In addition to responsibilities to protect threatened and endangered species under the Endangered Species Act (ESA), there are additional responsibilities under the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (BGEPA) to protect native birds from project-related impacts. Any activity, intentional or unintentional, resulting in take of migratory birds, including eagles, is prohibited unless otherwise permitted by the U.S. Fish and Wildlife Service (50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)). For more information regarding these Acts, see https://www.fws.gov/program/migratory-bird-permit/what-we-do.

The MBTA has no provision for allowing take of migratory birds that may be unintentionally killed or injured by otherwise lawful activities. It is the responsibility of the project proponent to comply with these Acts by identifying potential impacts to migratory birds and eagles within applicable NEPA documents (when there is a federal nexus) or a Bird/Eagle Conservation Plan (when there is no federal nexus). Proponents should implement conservation measures to avoid or minimize the production of project-related stressors or minimize the exposure of birds and their resources to the project-related stressors. For more information on avian stressors and recommended conservation measures, see https://www.fws.gov/library/collections/threats-birds.

In addition to MBTA and BGEPA, Executive Order 13186: *Responsibilities of Federal Agencies to Protect Migratory Birds*, obligates all Federal agencies that engage in or authorize activities that might affect migratory birds, to minimize those effects and encourage conservation measures that will improve bird populations. Executive Order 13186 provides for the protection of both migratory birds and migratory bird habitat. For information regarding the implementation of Executive Order 13186, please visit https://www.fws.gov/partner/council-conservation-migratory-birds.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Code in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List

OFFICIAL SPECIES LIST

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Utah Ecological Services Field Office
2369 West Orton Circle, Suite 50
West Valley City, UT 84119-7603
(801) 975-3330

PROJECT SUMMARY

Project Code: 2023-0129508
Project Name: Wellsville Watershed Project
Project Type: Irrigation
Project Description: Irrigation improvements.
Project Location:

The approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@41.7323276,-111.9744356268743,14z



Counties: Cache County, Utah

ENDANGERED SPECIES ACT SPECIES

There is a total of 4 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

BIRDS

NAME	STATUS
Yellow-billed Cuckoo *Coccyzus americanus* Population: Western U.S. DPS There is **final** critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/3911	Threatened

INSECTS

NAME	STATUS
Monarch Butterfly *Danaus plexippus* There is **proposed** critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/9743	Proposed Threatened
Suckley's Cuckoo Bumble Bee *Bombus suckleyi* Population: No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/10885	Proposed Endangered

FLOWERING PLANTS

NAME	STATUS
Ute Ladies'-tresses *Spiranthes diluvialis* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/2159	Threatened

CRITICAL HABITATS

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

YOU ARE STILL REQUIRED TO DETERMINE IF YOUR PROJECT(S) MAY HAVE EFFECTS ON ALL ABOVE LISTED SPECIES.

IPAC USER CONTACT INFORMATION

Agency: J-U-B Engineers, Inc.
Name: Rebecca Hendricks Miller
Address: 400 Memorial Drive
City: Idaho Falls
State: ID
Zip: 83402
Email rhmiller@jub.com
Phone: 2082703169

LEAD AGENCY CONTACT INFORMATION

Lead Agency: Natural Resources Conservation Service

Appendix B

Photo Inventory

Photo Inventory

Photos taken during site visits on August 16 & August 17, 2021, August 10, 2023 and August 13, 2024.



Photo 1: A dry segment of the Wellsville-Mendon Canal in a residential area in Wellsville.



Photo 2: A dry segment of the Wellsville-Mendon Canal and a culvert in a residential area in Wellsville.



Photo 3: The Wellsville-Mendon Canal is flowing water as passes through a residential area. The edges have been sprayed with herbicide to control vegetative growth.



Photo 4: The Wellsville-Mendon Canal passes through an agricultural area in Wellsville. Reed canary grass populates the edges.



Photo 5: The Wellsville-Mendon Canal passes from an agricultural area into a residential zone, at the bottom of a draw.



Photo 6: An irrigation ditch is disturbed by cattle grazing. Bare ground and erosion are prominent.



Photo 7: An irrigation canal lined with riprap, passing through a residential neighborhood.



Photo 8: The Wellsville-Mendon Canal passes through a greenbelt in a residential area of Wellsville.



Photo 9: Disturbed banks of Wellsville-Mendon Canal in a greenbelt in a residential area of Wellsville.



Photo 10: The Wellsville Reservoir, within Wellsville City Park. Common reed grows along the reservoir edge.



Photo 11: A headgate structure in the Wellsville-Mendon Canal, in a Wellsville pasture.



Photo 12: The Wellsville-Mendon Canal passes through a shady greenbelt in a residential area. Narrowleaf cottonwoods flank the edges.



Photo 13: Cattail and common reed grow along the Wellsville-Mendon Canal as it travels through a pasture in Wellsville.



Photo 14: The Wellsville-Mendon Canal passes through a horse pasture. Eutrophication in the water and riprap along the edges are visible.



Photo 15: Disturbed edges of an irrigation ditch where cattle have grazed, in Wellsville.



Photo 16: A dry section of an irrigation ditch in a residential area in Wellsville.



Photo 17: A culvert and irrigation ditch intersect a road on the outskirts of Mendon.



Photo 18: A rip-rap and gravel lined ditch and culvert intersect a road in a residential area of Mendon.



Photo 19: A culvert empties into a filled-in irrigation ditch in pasture in Mendon.



Photo 20: Debris and sediment crowd the opening of a culvert on a section of dry irrigation ditch.

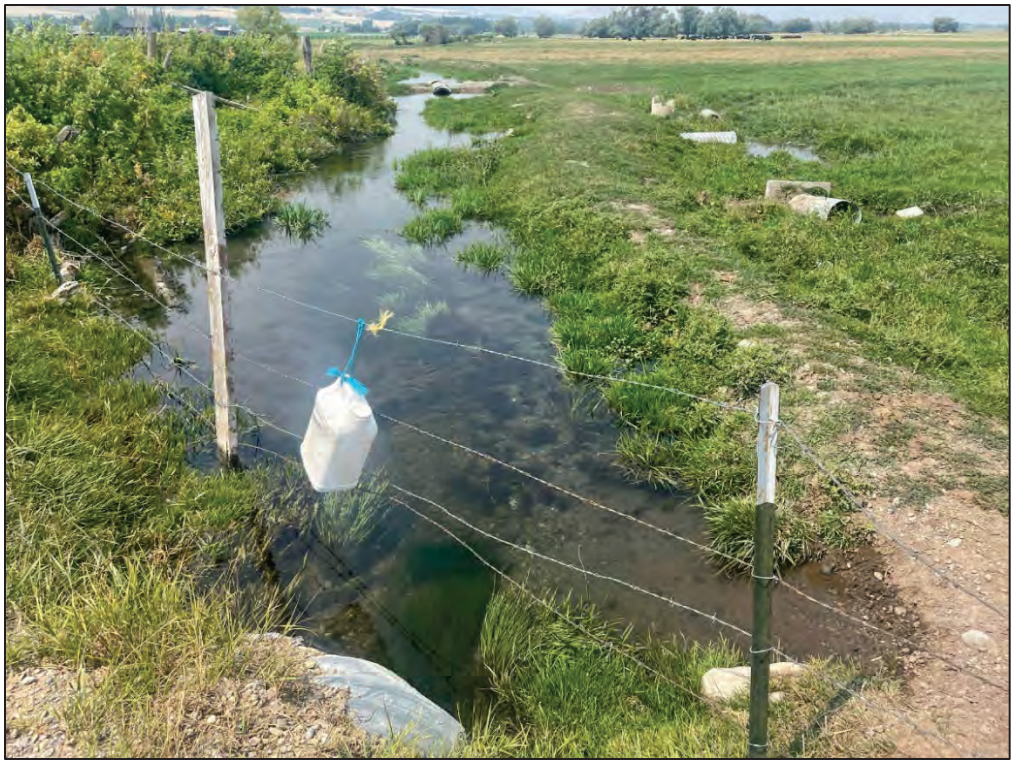


Photo 21: The Wellsville-Mendon Canal, overflowing in a pasture in Mendon.



Photo 22: The Wellsville-Mendon Canal, overgrown with cattail and common teasel, in a pasture in Mendon.



Photo 23: The Wellsville-Mendon Canal, lined, passes through a pasture above a neighborhood in Mendon.



Photo 24: A dry auxiliary irrigation ditch that intersects the Wellsville-Mendon canal in a pasture in Mendon.



Photo 25: Location for proposed detention basin in Mendon.



Photo 26: Location of existing detention basin in Mendon, where improvements would occur under the Proposed Project



Photo 27: A location where proposed irrigation piping would pass under the road, in Wellsville.



Photo 28: A roadside location where rehabilitation would occur to an open irrigation ditch, in Wellsville.



Photo 29: Typical conditions of an irrigation ditch that is lined with riprap and heavily vegetated, and which passes through a rural residential area.



Photo 30: A heavily vegetated irrigation ditch, within a pasture location, in Mendon.



Photo 31: An unmowed agricultural field and the location proposed irrigation pipe alignment, in Mendon. Wet meadow conditions exist in some locations like this within the Action Area.



Photo 32: An irrigation ditch where cattail grow along the edges.



Photo 33: Location of a proposed irrigation pipe alignment, in a field in Mendon.



Photo 34: Location of a proposed irrigation pipe alignment, along a fence line in a field in Mendon.



Photo 35: A roadway and the location of a proposed irrigation pipe alignment.



Photo 36: Typical conditions of the Wellsville-Mendon Canal where improvements would occur.



Photo 37: Typical conditions of the Wellsville-Mendon Canal where improvements would occur.



Photo 38: Area adjacent to the Wellsville Reservoir where water conveyance improvements would occur.



Photo 39: The western edge of the Wellsville Reservoir.



Photo 40: Photo of the Wellsville Canal from an area below the Wellsville Reservoir.



Photo 41: Typical conditions of the Wellsville Canal where improvements would occur, adjacent to a horse pasture in Wellsville.



Photo 42: Typical conditions of the Wellsville Canal where improvements would occur, adjacent to a horse pasture in Wellsville.



Photo 43: A blooming Ute ladies'-tresses plant, located within the maintained reference population in Mendon, in August 2021.



Photo 44: Two blooming Ute ladies'-tresses plants, located within the maintained reference population in Mendon, in August 2021.



Photo 45: Blooming Ute ladies'-tresses plants, located within the maintained reference population in Mendon, in August 2023.



Photo 46: Site conditions at the Mendon ULT reference population location in August 2023



Photo 47: Site conditions at the Mendon ULT reference population location in August 2023.



Photo 48: Irrigation ditch alignment within the Action Area, where it passes through potentially suitable ULT habitat in Mendon.



Photo 49: Potentially suitable ULT habitat, located in Mendon, and the adjacent irrigation ditch and associated vegetation.



Photo 50: Irrigation ditch alignment within the Action Area, where it passes through potentially suitable ULT habitat in Mendon.



Photo 51: Irrigation ditch alignment within the Action Area, where it passes through potentially suitable ULT habitat in Mendon.



Photo 52: Potentially suitable ULT habitat, located in Mendon, and the adjacent irrigation ditch and associated vegetation, photographed in August 2023.



Photo 53: Potentially suitable ULT habitat, located in Mendon, and the adjacent irrigation ditch and associated vegetation, photographed in August 2023.



Photo 54: Potentially suitable ULT habitat, located in Mendon, and the adjacent irrigation ditch where reed canarygrass is dominant. Photographed in August 2024.



Photo 55: Potentially suitable ULT habitat, located in Mendon. Photographed in August 2024.

Appendix E

ULT Memo

MEMORANDUM

DATE:	June 1, 2025
TO:	Derek Hamilton, Water Resources Coordinator (U.S. Natural Resources Conservation Service)
CC:	Quinn Dance, Project Manager (J-U-B ENGINEERS, Inc.)
FROM:	Autumn Foushee Davies, Natural Resources Technical Lead (J-U-B ENGINEERS, Inc.); Becky Hendricks Miller, Biologist (J-U-B ENGINEERS, Inc.)
SUBJECT:	Cache County, UT – Wellsville-Mendon Watershed Project: Ute ladies'-tresses Survey Findings

In August 2021, August 2023 and August 2024, habitat suitability surveys were completed for Ute ladies'-tresses (ULT) (*Spiranthes diluvialis*), for the Wellsville-Mendon Watershed Project (Proposed Project). During these survey periods, protocol-level clearance surveys were completed for ULT within a potentially suitable habitat area adjacent to the Proposed Project Footprint (Project Footprint), located in Mendon, Utah, to satisfy ULT survey requirements for the Proposed Project. The suitable habitat totaled approximately 18.45-acres located on private property within a 300-foot buffer from the centerline of the Project Footprint (Action Area).

J-U-B ENGINEERS, Inc. (J-U-B) Biologist, Becky Hendricks Miller, conducted the field investigation and Ute Ladies'-tresses surveys on August 16 and 17, 2021, August 10, 2023, and August 13, 2024. All three surveys were done within the accepted, open ULT flowering period, per USFWS survey protocol. Becky Hendricks Miller holds an MS degree in Organismal Biology, with a concentration on Plant Physiology, and has over a dozen years of experience in field botany and plant ecology experience, and conducted the survey under the supervision of Natural Resources Technical Lead, Autumn Foushee Davies, who is an accepted ULT surveyor and who holds a MS degree in Botany and has over 18 years of field biology and plant ecology experience.

Proposed Project Description

The objectives of the Proposed Project are to improve safety and reduce potential flooding issues due to aging drainage systems and agriculturally altered natural drainage channels in the

Wellsville Canyon Watershed area, and to improve floodwater conveyance channels throughout Wellsville and Mendon. The purpose of the Proposed Project is to reduce risk of personal injury and flood damage, specifically to residents, commercial buildings, farmland, parks, trails, and roads in western Cache County. Inefficiencies in the open canal delivery system would be repaired under the Proposed Project, which would reduce demand on the culinary water systems and improve water reliability and quality. Actions under the Proposed Project include modifications and improvements to existing conveyance channels and diversion points, rehabilitation of existing open canal irrigation channels, creation of and improvements to existing detention basins, and improvements to non-motorized watercraft access to the Wellsville Reservoir.

Funding for the planning phase of the Proposed Project has been provided from the NRCS under the Watershed Protection and Flood Prevention Act (PL83-566). This ULT survey has been completed to meet the environmental compliance requirements of the Proposed Project, and to provide documentation of survey results in accordance with the USFWS *Utah Field Office Guidelines for Conducting and Reporting Botanical Inventories and Monitoring of Federally Listed, Proposed and Candidate Plants* (USFWS 2011) and the USFWS *Interim Survey Requirements for Ute Ladies'-tresses Orchid* (USFWS 1992).

Because of the listing of ULT by the USFWS Utah Ecological Services Office IPaC (Information for Planning and Consultation) species list, a ULT habitat suitability survey was conducted in habitat identified within 300 feet of the Project Footprint. The Utah Natural Heritage Program (UNHP) also documented occurrences of the ULT within a 0.5-mile radius of the Action Area.

Site Location

The Proposed Project would occur within the communities of Wellsville City, Mendon City, and unincorporated county land in Cache County, Utah. The Action Area is located within two watersheds: the Wellsville Canyon Watershed, which is 57,231 acres in size and the Threemile Creek Watershed, which is 9,664 acres in size. The Action Area is bordered by the Wellsville Mountains on the west and the Little Bear River on the east. The Action Area encompasses existing irrigation canals in both Wellsville and Mendon cities, and includes part of the adjoining unincorporated area adjacent to the towns.

The Action Area encompasses private agricultural areas in a downstream section of Threemile Creek, and tributaries of Spring Creek and Little Bear River north and south of Highway 89, east and west of State Highway 23, and south of State Highway 30 (See Project Action Area Map and ULT Survey Area Map in Appendix 1). A proposed staging area is located in a quarry on the east side of Wellsville, off W 5400 S Rd. The Action Area is bounded on the north by State Highway 30, Glad Mountain in the south, the Wellsville Mountain Range to the west, and the Logan Valley to the east. In total, the Project Footprint encompasses approximately 1,266 acres. The size of the Action Area for the ULT, inclusive of the ULT survey buffer around the Project Footprint, is approximately 6,072 acres.

The Action Area is in portions of the following Townships, Ranges, and Sections:

- Township 10 North, Range 1 West, Sections 1, 2, 3, 4, 9, 10, 11, 12, 14, and 15
- Township 11 North, Range 1 East, Sections 6 and 7
- Township 11 North, Range 1 West, Sections 4, 5, 6, 7, 8, 9, 10, 15, 16, 17, 18, 20, 21, 22, 27, 28, 29, 34, 35, and 36
- Township 12 North, Range 1 West, Sections 28, 29, 30, 31, 32, and 33
- Township 12 North, Range 2 West, Sections 25, 26, 35, and 36.

Site Features

The Wellsville-Mendon Canal (Canal) – composed of the Wellsville-Mendon Lower Canal and the Wellsville-Mendon Upper Canal – is a canal system that travels through both residential and agricultural lands in the Action Area. The Canal is open and lined with concrete along much of its alignment, although it is earthen in some sections. It is intermittently interrupted by irrigation diversions and headgate structures. The total Canal is approximately 14 miles in length, and runs east from Wellsville Reservoir in Hyrum, Utah, and terminates directly into the Little Bear River, north of Mendon. A total of 0.353 acres of the Little Bear River was delineated within the Action Area. This is a lower perennial stream with an unconsolidated bed composed of cobble and gravel. Water supply to the Canal is abundant throughout the irrigation season and becomes dry when flow ceases during non-irrigation periods of the year.

Vegetation occurring within the Action Area was typical for agricultural fields in the region with wetland species occurring in low lying pastural areas adjacent to the Canal. The Canal and auxiliary irrigation ditches varied in hydrology and vegetation at different locations. The Canal and open ditches in agricultural areas are densely vegetated with reed canary grass (*Phalaris arundinacea*), broadleaf cattail (*Typha latifolia.*), and other common riparian species within and on its edges. The Canal and ditches, when conveying irrigation water, overflow during precipitation events especially in sections where sediment and vegetation have filled in the canal or ditch prism. While some segments of the Canal are earthen, the Canal is generally lined with concrete. Herbicide use was evident along the Canal in many locations, where maintenance has been performed to minimize unwanted vegetation.

The Action Area includes pasture areas where the Canal and ditches pass through. Seasonal inundation of pasturelands is common in this area, induced by irrigation and the high-water table present in Cache Valley. Irrigation canals, when conveying irrigation water, overflow during precipitation events especially in sections of the canal where sediment and vegetation have clogged the canal prism. Characteristic of the high-water table within the Action Area, and due to heavy precipitation events occurring at the time of the field surveys in August 2021, surveyed pasture areas were saturated and standing water was observed in some locations. In August of 2023, standing water was observed in fewer locations.

Throughout neighborhoods in Wellsville and Mendon, sections of the Canal were dry, due to controlled flows, and sometimes lined with riprap, concrete, landscaping rock, or other material. Bare ground is present along portions of the canal in residential areas, and evidence of herbicide use to control unwanted vegetation is present. For representative photos of the Action Area, see the Photo Inventory in Appendix 2.

The Wellsville-Mendon Canal does not have floodplain connectivity to other waterbodies except at the northern terminus where it joins the Little Bear River floodplain directly. Due to the earthen lining of segments of the Wellsville-Mendon Canal, the canal has a muddy substrate which dries up outside of the irrigation season each year.

Surveys

Approximately 18.45 acres of potentially suitable habitat were identified within 300 feet of the Project Footprint, within Mendon in August 2021. A protocol level ULT survey was previously

completed for this location on August 17, 2021, after an initial habitat suitability assessment, and again on August 10, 2023, and August 13, 2024.

This acreage falls outside of the Project Footprint, but within the 300-foot buffer of the Action Area. The Project Footprint is limited to the prism of an irrigation ditch within this location, and totals 6.35 acres in size. The habitat area flanks the ditch on the north and south sides. The location of this habitat is approximately 0.97 miles northeast of the existing ULT reference population. The area is a maintained pastureland with a similar vegetation assemblage, hydrology, and disturbance regime to the reference site. The habitat at this location exhibits the following qualities:

- An open, wet meadow near an irrigation ditch, within an actively grazed horse pasture;
- An irrigated and frequently mowed pasture, which reduces competition from tall growing grass species and other common weeds.
- Well-drained soils that are composed of a sandy-loam type; and
- A seasonally high-water table, which is exacerbated by flood irrigation during the growing season.

The hydrology present, the soil type, and a maintenance regime of mowing which inhibits tall species from growing support the potential suitability of the habitat in this pasture. Within the potentially suitable habitat, no vegetative or flowering ULTs were observed at the time of survey in August 2021, 2023, and 2024.

While the Action Area includes the prism of the irrigation ditch that passes through this pasture, the impacts from Proposed Project actions would not disturb or reduce the quality of this potential habitat that lies in the pasture on either side of the Action Area. The footprint of the Proposed Project in this location is not mowed like the adjacent pasture habitat. Within the prism of the ditch, densely growing species like reed canarygrass (*Phalaris arundinacea*) and common teasel grow (*Dipsacus fullonum*), similar to other ditches within the Action Area. This ditch seasonally runs dry, and experiences disturbance from maintenance and use activities. Overall, the ditch that passes through the potentially suitable habitat location does not contain suitable habitat for ULTs.

Proposed Project actions in this location include channel clearing and clean up, to remove excess vegetation and sediment from the irrigation ditch. While the Action Area encompasses the irrigation ditch alignment that passes through potentially suitable ULT habitat, staging of equipment and Proposed Project construction actions would be contained on the paved road 5800 W, which runs north to south, west of the suitable habitat location.

All other areas within the Action Area were previously surveyed and do not contain suitable habitat for ULTs due to competition from aggressive plant species, incompatible soil and hydric conditions, including water inundation, heavy grazing pressure, canal and ditch maintenance activities, and concrete and riprap lined areas. The attached ULT Survey Area Map illustrates the extent of the ULT survey area, and the ULT Survey: Suitable Habitat Map details the location of suitable habitat observed in Mendon, adjacent to the Action Area. The attached Photo Inventory captures the pertinent conditions encountered during the survey.

Conclusion

The Action Area was evaluated for potentially suitable ULT habitat in August 2021, August 2023 and August 2024. Approximately 18.45 acres of suitable habitat was identified within the 300-foot survey buffer in the eastern portion of the Action Area, less than one mile north of the existing ULT reference population in Mendon, Utah, and was surveyed at a clearance level for the presence of ULTs. The suitable habitat contained the existing hydrology, soil type, and mowing regime that provide conditions which may support ULTs. Conditions at this site were similar to those at the Mendon ULT reference population site, which lies approximately 0.97 miles to the south. This suitable habitat fell outside the prism of the Project Footprint, but within the 300-foot survey buffer of the Action Area. No ULTs were identified within this suitable habitat area during any of the survey years.

The Canal, irrigation ditches, and pasture areas around the Canal and ditches where sufficient hydrology is present to support ULTs within the Action Area were surveyed. No suitable habitat was identified within the remainder of the Action Area. Incidentally, no ULTs were observed in the Action Area within the suitable habitat area survey. Most of the Action Area does not contain suitable conditions to support preferred habitat for ULT due to several factors. These include the vegetative assemblage (e.g. aggressive plant species), water inundation, maintenance activities along the canals, grazing pressure, and bare or lined areas of the Canal and ditches, and Canal and ditch edges that do not support vegetative growth. The suitable ULT

habitat area was surveyed in 2021, 2023, and 2024, which represent three years of surveys to be performed for ULTs within the accepted blooming period. If you have any questions regarding the information presented herein, please contact me at: rhmiller@jub.com or via phone at 208-270-3169.

Appendices

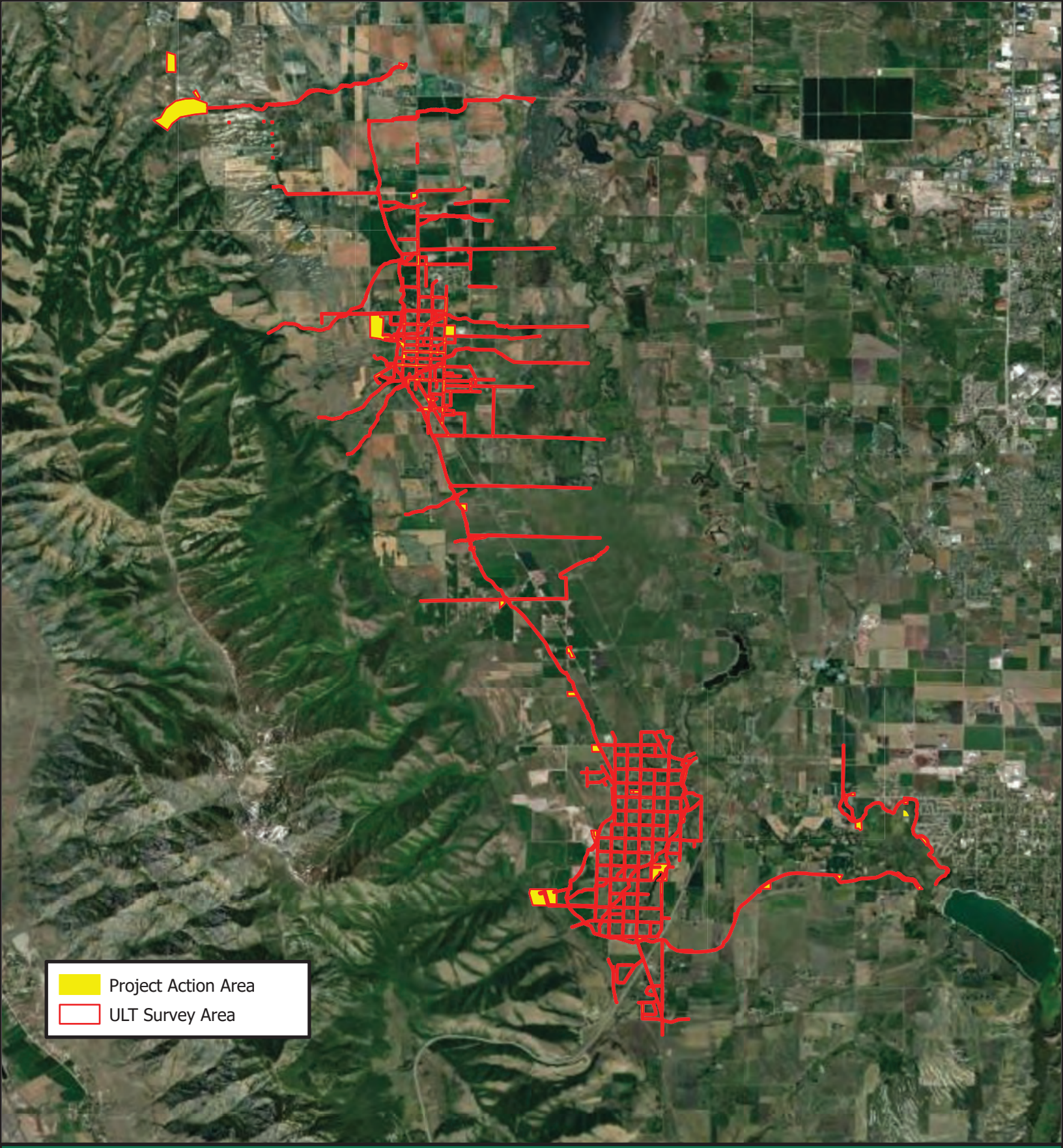
Appendix 1: ULT Survey Area Map and Suitable Habitat Map

Appendix 2: ULT Survey Photo Inventory

References

USFWS. 1992. Interim Survey Requirements for Ute Ladies'-tresses Orchid (Spiranthes diluvialis). https://www.fws.gov/utahfieldoffice/Documents/Plants/SPDI_interimSurveyRequirements_1992.pdf. Accessed 17 October 2023.

USFWS. 2011. USFWS Utah Field Office Guidelines for Conducting and Reporting Botanical Inventories and Monitoring of Federally Listed, Proposed, and Candidate Plants. https://www.fws.gov/utahfieldoffice/Documents/Plants/USFWS%20UtahFO%20Plant%20Survey%20Guidelines%20Final.pdf. Accessed 17 October 2023.



J·U·B ENGINEERS, INC.

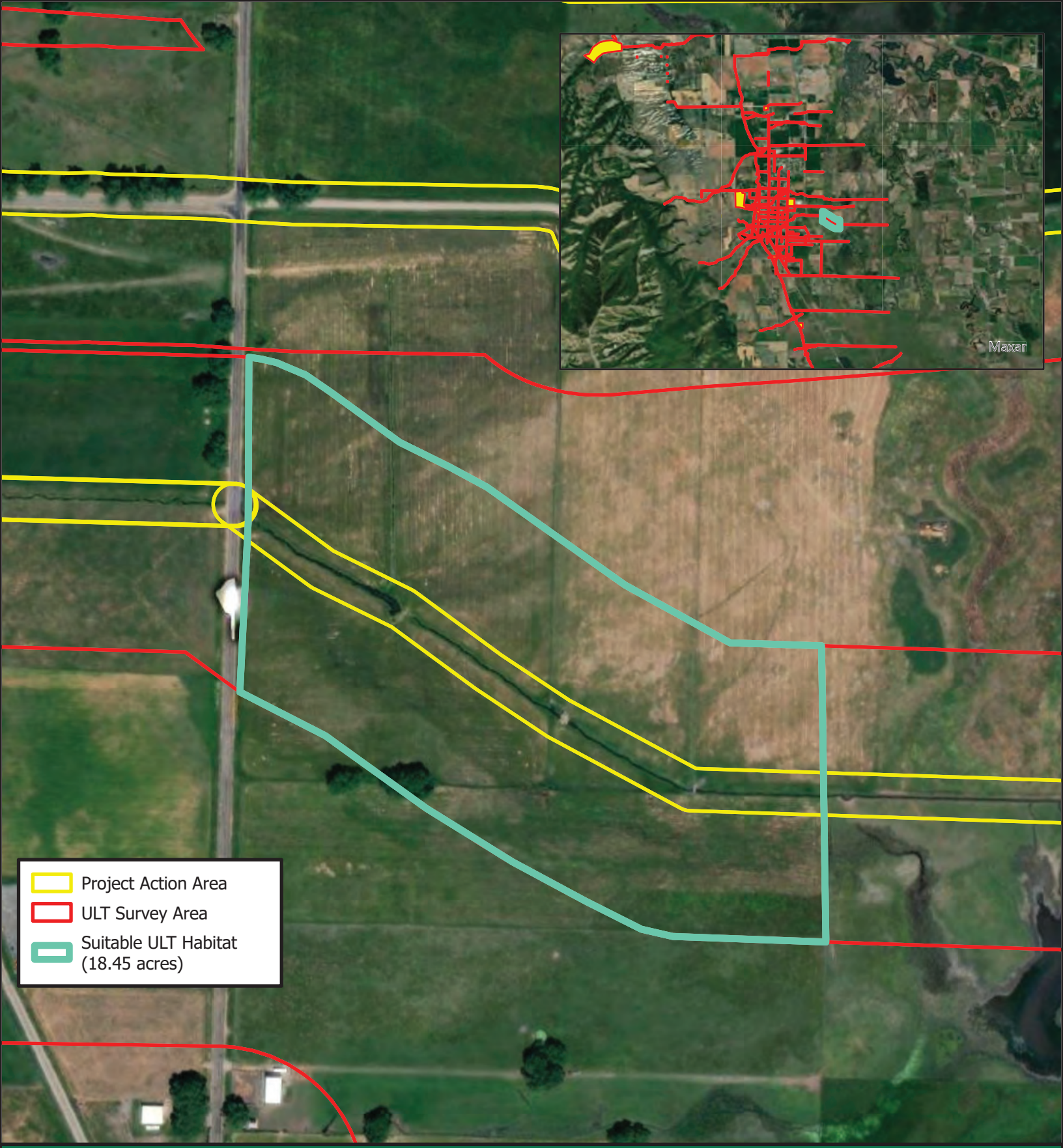
ULT Survey Area
Wellsville-Mendon Watershed Project

Cache County, Utah

0 1 2
Miles

N

December 2023



J·U·B ENGINEERS, INC.

ULT Survey Area
Suitable Habitat Map
Wellsville-Mendon Watershed Project

Cache County, Utah

0 0.04 0.07
Miles

N

December 2023

ULT Memo Photo Inventory

Photos taken during field surveys for ULT habitat suitability on August 16 & August 17, 2021 and August 10, 2023 and August 13, 2024.



Photo 1: A dry segment of the Wellsville-Mendon Canal in a residential area in Wellsville.



Photo 2: A dry segment of the Wellsville-Mendon Canal and a culvert in a residential area in Wellsville.



Photo 3: The Wellsville-Mendon Canal is flowing water as passes through a residential area. The edges have been sprayed with herbicide to control vegetative growth.



Photo 4: The Wellsville-Mendon Canal passes through an agricultural area in Wellsville. Reed canary grass grows densely along the edges.



Photo 5: An irrigation ditch is disturbed by cattle grazing. Bare ground and erosion are prominent.



Photo 6: An irrigation ditch lined with riprap, passing through a residential neighborhood.



Photo 7: Disturbed banks of Wellsville-Mendon Canal in a greenbelt in a residential area of Wellsville.



Photo 8: The Wellsville Reservoir, within Wellsville City Park. Common reed grows along the reservoir edge.



Photo 9: Cattail and common reed grow along the Wellsville-Mendon Canal as it travels through a pasture in Wellsville.



Photo 10: Disturbed edges of an irrigation ditch where cattle have grazed, in Wellsville.



Photo 11: A dry section of an irrigation ditch in a residential area in Wellsville.



Photo 12: The incised Threemile Creek channel that runs through the wildlife enhancement area and a cattle pasture, outside of Mendon.



Photo 13: Threemile Creek runs through a thicket of cottonwood, willow, box elder and big toothed maple in the wildlife enhancement area. The creek's edges are impacted by cattle grazing.



Photo 14: A culvert and irrigation ditch intersect a road on the outskirts of Mendon.



Photo 15: A riprap and gravel lined ditch and culvert intersect a road in a residential area of Mendon.



Photo 16: The Wellsville-Mendon Canal with standing water in a pasture in Mendon.



Photo 17: The Wellsville-Mendon Canal, overgrown with cattail and common teasel, in a pasture in Mendon.



Photo 18: The Wellsville-Mendon Canal, lined, passes through a pasture above a neighborhood in Mendon.



Photo 19: Location for proposed detention basin in Mendon.



Photo 20: Location of existing detention basin in Mendon, where improvements would occur under the Proposed Project



Photo 21: An unmowed agricultural field and the location proposed irrigation pipe alignment, in Mendon. Wet meadow conditions exist in some locations like this within the Action Area.



Photo 22: An irrigation ditch where cattail grow along the edges.



Photo 23: Location of a proposed irrigation pipe alignment, in a field in Mendon.



Photo 24: Location of a proposed irrigation pipe alignment, along a fence line in a field in Mendon.



Photo 25: A roadway and the location of a proposed irrigation pipe alignment.



Photo 26: Typical conditions of the Wellsville-Mendon Canal where improvements would occur.



Photo 27: Typical conditions of the Wellsville-Mendon Canal where improvements would occur.



Photo 28: Typical conditions of the Wellsville-Mendon Canal where improvements would occur, adjacent to a horse pasture in Wellsville.



Photo 29: A blooming Ute ladies'-tresses plant, located within the maintained reference population in Mendon, in August 2021.



Photo 30: Two blooming Ute ladies'-tresses plants, located within the maintained reference population in Mendon, in August 2021.



Photo 31: Blooming Ute ladies'-tresses plants, located within the maintained reference population in Mendon, in August 2023.



Photo 32: Site conditions at the Mendon ULT reference population location in August 2023



Photo 33: Site conditions at the Mendon ULT reference population location in August 2023.



Photo 34: Irrigation ditch alignment within the Action Area, where it passes through potentially suitable ULT habitat in Mendon.



Photo 35: Potentially suitable ULT habitat, located in Mendon, and the adjacent irrigation ditch and associated vegetation.



Photo 36: Irrigation ditch alignment within the Action Area, where it passes through potentially suitable ULT habitat in Mendon.



Photo 37: Irrigation ditch alignment within the Action Area, where it passes through potentially suitable ULT habitat in Mendon.



Photo 38: Potentially suitable ULT habitat, located in Mendon, and the adjacent irrigation ditch and associated vegetation.



Photo 39: Potentially suitable ULT habitat, located in Mendon, and the adjacent irrigation ditch and associated vegetation.

USFWS IPaC Official Species List (OSL)

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Utah Ecological Services Field Office
2369 West Orton Circle, Suite 50
West Valley City, UT 84119-7603
Phone: (801) 975-3330 Fax: (801) 975-3331

In Reply Refer To: 06/19/2025 19:36:30 UTC
Project Code: 2023-0084670
Project Name: Wellsville Canyon Watershed Plan and EIS for Improvements in the Wellsville Mountains Watershed, UT

Subject: List of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed, and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)

(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

https://www.fws.gov/sites/default/files/documents/endangered-species-consultation-handbook.pdf

Migratory Birds: In addition to responsibilities to protect threatened and endangered species under the Endangered Species Act (ESA), there are additional responsibilities under the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (BGEPA) to protect native birds from project-related impacts. Any activity resulting in take of migratory birds, including eagles, is prohibited unless otherwise permitted by the U.S. Fish and Wildlife Service (50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)). For more information regarding these Acts, see https://www.fws.gov/program/migratory-bird-permit/what-we-do.

It is the responsibility of the project proponent to comply with these Acts by identifying potential impacts to migratory birds and eagles within applicable NEPA documents (when there is a federal nexus) or a Bird/Eagle Conservation Plan (when there is no federal nexus). Proponents should implement conservation measures to avoid or minimize the production of project-related stressors or minimize the exposure of birds and their resources to the project-related stressors. For more information on avian stressors and recommended conservation measures, see https://www.fws.gov/library/collections/threats-birds.

In addition to MBTA and BGEPA, Executive Order 13186: *Responsibilities of Federal Agencies to Protect Migratory Birds*, obligates all Federal agencies that engage in or authorize activities that might affect migratory birds, to minimize those effects and encourage conservation measures that will improve bird populations. Executive Order 13186 provides for the protection of both migratory birds and migratory bird habitat. For information regarding the implementation of Executive Order 13186, please visit https://www.fws.gov/partner/council-conservation-migratory-birds.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Code in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List
- USFWS National Wildlife Refuges and Fish Hatcheries
- Bald & Golden Eagles
- Migratory Birds

OFFICIAL SPECIES LIST

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Utah Ecological Services Field Office
2369 West Orton Circle, Suite 50
West Valley City, UT 84119-7603
(801) 975-3330

PROJECT SUMMARY

Project Code: 2023-0084670

Project Name: Wellsville Canyon Watershed Plan and EIS for Improvements in the Wellsville Mountains Watershed, UT

Project Type: Flooding

Project Description: The purpose for the project is to address concerns of flooding in the Wellsville, Mendon, and unincorporated Cache County areas nearby as well as to address agricultural water management improvements and recreation enhancement in the project area. The project 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 events. Earthen canal irrigation distribution systems in the area experience significant seepage losses. Improvements to water-related infrastructure are needed to reduce risks to residents of the project area. The IPaC reports need to be accessed to create an EIS document fully compliant with NEPA and PR&G requirements. As this project is still ongoing, timing, cost, and alternatives remain forthcoming.

Project Location:

The approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@41.693626699999996,-111.97065218831371,14z



Counties: Box Elder and Cache counties, Utah

ENDANGERED SPECIES ACT SPECIES

There is a total of 4 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

BIRDS

NAME	STATUS
Yellow-billed Cuckoo *Coccyzus americanus* Population: Western U.S. DPS There is **final** critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/3911	Threatened

INSECTS

NAME	STATUS
Monarch Butterfly *Danaus plexippus* There is **proposed** critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/9743	Proposed Threatened
Suckley's Cuckoo Bumble Bee *Bombus suckleyi* Population: No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/10885	Proposed Endangered

FLOWERING PLANTS

NAME	STATUS
Ute Ladies'-tresses *Spiranthes diluvialis* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/2159	Threatened

CRITICAL HABITATS

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

YOU ARE STILL REQUIRED TO DETERMINE IF YOUR PROJECT(S) MAY HAVE EFFECTS ON ALL ABOVE LISTED SPECIES.

USFWS NATIONAL WILDLIFE REFUGE LANDS AND FISH HATCHERIES

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

THERE ARE NO REFUGE LANDS OR FISH HATCHERIES WITHIN YOUR PROJECT AREA.

BALD & GOLDEN EAGLES

Bald and Golden Eagles are protected under the Bald and Golden Eagle Protection Act [2] and the Migratory Bird Treaty Act (MBTA) [1]. Any person or organization who plans or conducts activities that may result in impacts to Bald or Golden Eagles, or their habitats, should follow appropriate regulations and consider implementing appropriate avoidance and minimization measures, as described in the various links on this page.

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1. The Bald and Golden Eagle Protection Act of 1940.
2. The Migratory Birds Treaty Act of 1918.
3. 50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)

There are Bald Eagles and/or Golden Eagles in your project area.

Measures for Proactively Minimizing Eagle Impacts
For information on how to best avoid and minimize disturbance to nesting bald eagles, please review the National Bald Eagle Management Guidelines. You may employ the timing and activity-specific distance recommendations in this document when designing your project/ activity to avoid and minimize eagle impacts. For bald eagle information specific to Alaska, please refer to Bald Eagle Nesting and Sensitivity to Human Activity.

The FWS does not currently have guidelines for avoiding and minimizing disturbance to nesting Golden Eagles. For site-specific recommendations regarding nesting Golden Eagles, please consult with the appropriate Regional Migratory Bird Office or Ecological Services Field Office.

If disturbance or take of eagles cannot be avoided, an incidental take permit may be available to authorize any take that results from, but is not the purpose of, an otherwise lawful activity. For assistance making this determination for Bald Eagles, visit the Do I Need A Permit Tool. For assistance making this determination for golden eagles, please consult with the appropriate Regional Migratory Bird Office or Ecological Services Field Office.

Ensure Your Eagle List is Accurate and Complete
If your project area is in a poorly surveyed area in IPaC, your list may not be complete and you may need to rely on other resources to determine what species may be present (e.g. your local FWS field office, state surveys, your own surveys). Please review the Supplemental Information on Migratory Birds and Eagles, to help you properly interpret the report for your specified location, including determining if there is sufficient data to ensure your list is accurate.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to bald or golden eagles on your list, see the "Probability of Presence Summary" below to see when these bald or golden eagles are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
Bald Eagle *Haliaeetus leucocephalus* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1626	Breeds Dec 1 to Aug 31
Golden Eagle *Aquila chrysaetos* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1680	Breeds Jan 1 to Aug 31

PROBABILITY OF PRESENCE SUMMARY

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read "Supplemental Information on Migratory Birds and Eagles", specifically the FAQ section titled "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

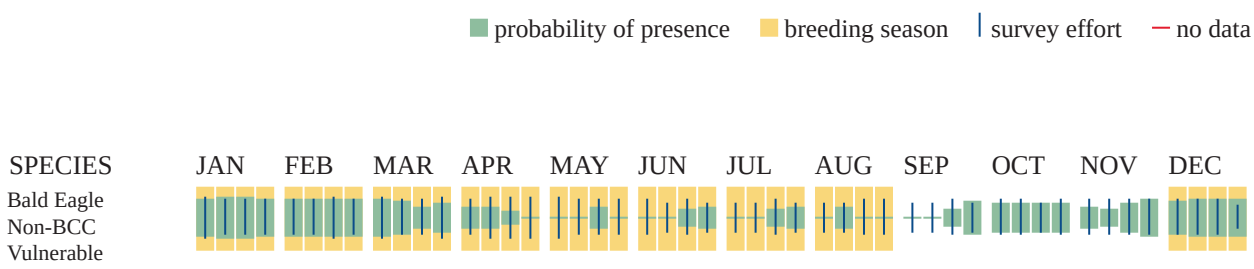
Probability of Presence (■)

Green bars; the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during that week of the year.

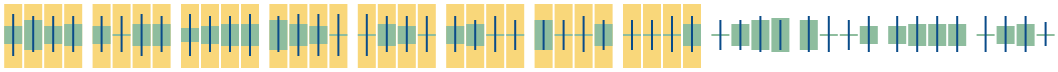
Breeding Season (■)
Yellow bars; liberal estimate of the timeframe inside which the bird breeds across its entire range.

Survey Effort (|)
Vertical black lines; the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps.

No Data (–)
A week is marked as having no data if there were no survey events for that week.



Golden Eagle
Non-BCC
Vulnerable



Additional information can be found using the following links:

- Eagle Management https://www.fws.gov/program/eagle-management
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide avoidance and minimization measures for birds https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf
- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

MIGRATORY BIRDS

The Migratory Bird Treaty Act (MBTA) [1] prohibits the take (including killing, capturing, selling, trading, and transport) of protected migratory bird species without prior authorization by the Department of Interior U.S. Fish and Wildlife Service (Service).

1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.
3. 50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, see the "Probability of Presence Summary" below to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
American Avocet *Recurvirostra americana* This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/11927	Breeds Apr 21 to Aug 10
American White Pelican *pelecanus erythrorhynchos* This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/6886	Breeds Apr 1 to Aug 31

NAME	BREEDING SEASON
Bald Eagle *Haliaeetus leucocephalus* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1626	Breeds Dec 1 to Aug 31
Black Rosy-finch *Leucosticte atrata* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9460	Breeds Jun 15 to Aug 31
Black Tern *Chlidonias niger surinamenisis* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/3093	Breeds May 15 to Aug 20
Bobolink *Dolichonyx oryzivorus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9454	Breeds May 20 to Jul 31
Broad-tailed Hummingbird *Selasphorus platycercus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/11935	Breeds May 25 to Aug 21
California Gull *Larus californicus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/10955	Breeds Mar 1 to Jul 31
Calliope Hummingbird *Selasphorus calliope* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9526	Breeds May 1 to Aug 15
Cassin's Finch *Haemorhous cassinii* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9462	Breeds May 15 to Jul 15
Clark's Grebe *Aechmophorus clarkii* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/10575	Breeds Jun 1 to Aug 31
Evening Grosbeak *Coccothraustes vespertinus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9465	Breeds May 15 to Aug 10

NAME	BREEDING SEASON
Flammulated Owl *Psiloscops flammeolus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/7728	Breeds May 10 to Aug 15
Forster's Tern *Sterna forsteri* This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/11953	Breeds Mar 1 to Aug 15
Franklin's Gull *Leucophaeus pipixcan* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/10567	Breeds May 1 to Jul 31
Golden Eagle *Aquila chrysaetos* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1680	Breeds Jan 1 to Aug 31
Lesser Yellowlegs *Tringa flavipes* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9679	Breeds elsewhere
Lewis's Woodpecker *Melanerpes lewis* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9408	Breeds Apr 20 to Sep 30
Long-eared Owl *asio otus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/3631	Breeds Mar 1 to Jul 15
Marbled Godwit *Limosa fedoa* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9481	Breeds elsewhere
Northern Harrier *Circus hudsonius* This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/8350	Breeds Apr 1 to Sep 15
Olive-sided Flycatcher *Contopus cooperi* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/3914	Breeds May 20 to Aug 31

NAME	BREEDING SEASON
Pectoral Sandpiper *Calidris melanotos* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9561	Breeds elsewhere
Pinyon Jay *Gymnorhinus cyanocephalus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9420	Breeds Feb 15 to Jul 15
Rufous Hummingbird *Selasphorus rufus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/8002	Breeds Apr 15 to Jul 15
Sage Thrasher *Oreoscoptes montanus* This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/9433	Breeds Apr 15 to Aug 10
Virginia's Warbler *Leiothlypis virginiae* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9441	Breeds May 1 to Jul 31
Western Grebe *aechmophorus occidentalis* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/6743	Breeds Jun 1 to Aug 31
Willet *Tringa semipalmata* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/10669	Breeds Apr 20 to Aug 5

PROBABILITY OF PRESENCE SUMMARY

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read "Supplemental Information on Migratory Birds and Eagles", specifically the FAQ section titled "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Green bars; the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during that week of the year.

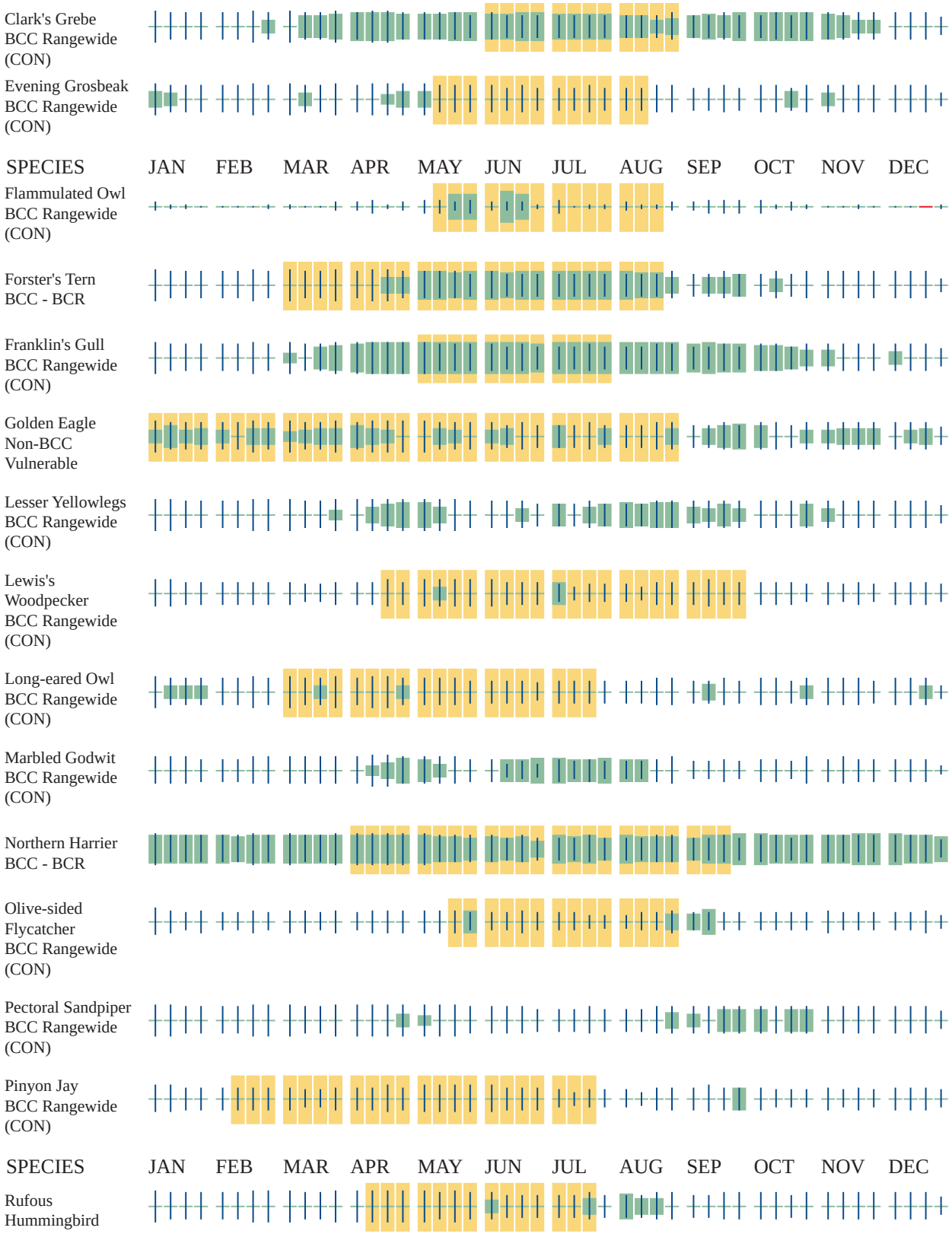
Breeding Season (■)

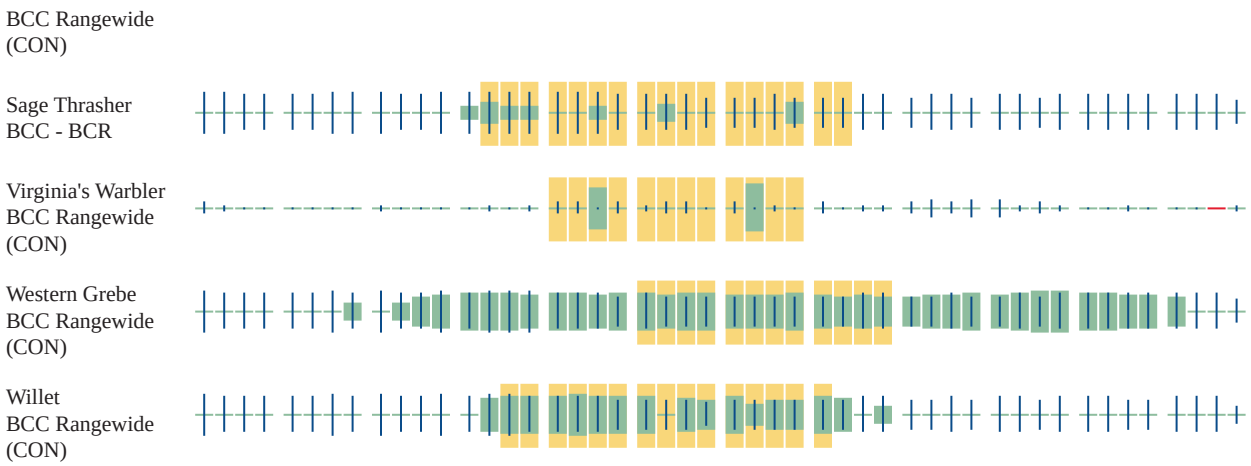
Yellow bars; liberal estimate of the timeframe inside which the bird breeds across its entire range.

Survey Effort (|)
Vertical black lines; the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps.

No Data (–)
A week is marked as having no data if there were no survey events for that week.




Clark's Grebe BCC Rangewide (CON)
Evening Grosbeak BCC Rangewide (CON)
SPECIES JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
Flammulated Owl BCC Rangewide (CON)
Forster's Tern BCC - BCR
Franklin's Gull BCC Rangewide (CON)
Golden Eagle Non-BCC Vulnerable
Lesser Yellowlegs BCC Rangewide (CON)
Lewis's Woodpecker BCC Rangewide (CON)
Long-eared Owl BCC Rangewide (CON)
Marbled Godwit BCC Rangewide (CON)
Northern Harrier BCC - BCR
Olive-sided Flycatcher BCC Rangewide (CON)
Pectoral Sandpiper BCC Rangewide (CON)
Pinyon Jay BCC Rangewide (CON)
SPECIES JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
Rufous Hummingbird



Additional information can be found using the following links:

- Eagle Management https://www.fws.gov/program/eagle-management
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide avoidance and minimization measures for birds
- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

IPAC USER CONTACT INFORMATION

Agency: Franson Civil Engineers
Name: Landon Richins
Address: 1276 South 820 East Suite 100
City: American Fork
State: UT
Zip: 84003
Email lrichins@fransoncivil.com
Phone: 8017560309

LEAD AGENCY CONTACT INFORMATION

Lead Agency: Natural Resources Conservation Service
Name: Derek Hamilton
Email: derek.hamilton@usda.gov
Phone: 8015244560

USFWS IPaC Full Resource List

IPaC resource list

This report is an automatically generated list of species and other resources such as critical habitat (collectively referred to as *trust resources*) under the U.S. Fish and Wildlife Service's (USFWS) jurisdiction that are known or expected to be on or near the project area referenced below. The list may also include trust resources that occur outside of the project area, but that could potentially be directly or indirectly affected by activities in the project area. However, determining the likelihood and extent of effects a project may have on trust resources typically requires gathering additional site-specific (e.g., vegetation/species surveys) and project-specific (e.g., magnitude and timing of proposed activities) information.

Below is a summary of the project information you provided and contact information for the USFWS office(s) with jurisdiction in the defined project area. Please read the introduction to each section that follows (Endangered Species, Migratory Birds, USFWS Facilities, and NWI Wetlands) for additional information applicable to the trust resources addressed in that section.

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Project information

NAME

Wellsville Canyon Watershed Plan and EIS for Improvements in the Wellsville Mountains Watershed, UT

LOCATION

Box Elder and Cache counties, Utah



DESCRIPTION

Some(The purpose for the project is to address concerns of flooding in the Wellsville, Mendon, and unincorporated Cache County areas nearby as well as to address

agricultural water management improvements and recreation enhancement in the project area. The project 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 events. Earthen canal irrigation distribution systems in the area experience significant seepage losses. Improvements to water-related infrastructure are needed to reduce risks to residents of the project area. The IPaC reports need to be accessed to create an EIS document fully compliant with NEPA and PR&G requirements. As this project is still ongoing, timing, cost, and alternatives remain forthcoming.)

Local office

Utah Ecological Services Field Office

(801) 975-3330
(801) 975-3331

2369 West Orton Circle, Suite 50
West Valley City, UT 84119-7603

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Endangered species

This resource list is for informational purposes only and does not constitute an analysis of project level impacts.

The primary information used to generate this list is the known or expected range of each species. Additional areas of influence (AOI) for species are also considered. An AOI includes areas outside of the species range if the species could be indirectly affected by activities in that area (e.g., placing a dam upstream of a fish population even if that fish does not occur at the dam site, may indirectly impact the species by reducing or eliminating water flow downstream). Because species can move, and site conditions can change, the species on this list are not guaranteed to be found on or near the project area. To fully determine any potential effects to species, additional site-specific and project-specific information is often required.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency. A letter from the local office and a species list which fulfills this requirement can **only** be obtained by requesting an official species list from either the Regulatory Review section in IPaC (see directions below) or from the local field office directly.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list by doing the following:

1. Log in to IPaC.
2. Go to your My Projects list.
3. Click PROJECT HOME for this project.
4. Click REQUEST SPECIES LIST.

Listed species[1] and their critical habitats are managed by the Ecological Services Program of the U.S. Fish and Wildlife Service (USFWS) and the fisheries division of the National Oceanic and Atmospheric Administration (NOAA Fisheries[2]).

Species and critical habitats under the sole responsibility of NOAA Fisheries are **not** shown on this list. Please contact NOAA Fisheries for species under their jurisdiction.

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1. Species listed under the Endangered Species Act are threatened or endangered; IPaC also shows species that are candidates, or proposed, for listing. See the listing status page for more information. IPaC only shows species that are regulated by USFWS (see FAQ).
2. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of

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Commerce.

The following species are potentially affected by activities in this location:

Birds

NAME	STATUS
Yellow-billed Cuckoo Coccyzus americanus There is **final** critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/3911	Threatened

Insects

NAME	STATUS
Monarch Butterfly Danaus plexippus Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/9743	Candidate

Flowering Plants

NAME	STATUS
Ute Ladies'-tresses Spiranthes diluvialis Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/2159	Threatened

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Critical habitats

Potential effects to critical habitat(s) in this location must be analyzed along with the endangered species themselves.

There are no critical habitats at this location.

You are still required to determine if your project(s) may have effects on all above listed species.

Migratory birds

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats should follow appropriate regulations and consider implementing appropriate conservation measures, as described below.

1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.

Additional information can be found using the following links:

- Birds of Conservation Concern https://www.fws.gov/program/migratory-birds/species
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf

The birds listed below are birds of particular concern either because they occur on the USFWS Birds of Conservation Concern (BCC) list or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ below. This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the E-bird data mapping tool (Tip: enter your location, desired date range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found below.

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
American White Pelican pelecanus erythrorhynchos This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/6886	Breeds Apr 1 to Aug 31

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Bald Eagle *Haliaeetus leucocephalus* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.	Breeds Dec 1 to Aug 31
Black Rosy-finch *Leucosticte atrata* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9460	Breeds Jun 15 to Aug 31
Black Tern *Chlidonias niger* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/3093	Breeds May 15 to Aug 20
Bobolink *Dolichonyx oryzivorus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 20 to Jul 31
California Gull *Larus californicus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Mar 1 to Jul 31
Cassin's Finch *Carpodacus cassinii* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9462	Breeds May 15 to Jul 15
Clark's Grebe *Aechmophorus clarkii* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Jun 1 to Aug 31
Evening Grosbeak *Coccothraustes vespertinus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 15 to Aug 10
Franklin's Gull *Leucophaeus pipixcan* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 1 to Jul 31

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Golden Eagle Aquila chrysaetos — Breeds Jan 1 to Aug 31

This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities.
https://ecos.fws.gov/ecp/species/1680

Lesser Yellowlegs Tringa flavipes — Breeds elsewhere

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9679

Lewis's Woodpecker Melanerpes lewis — Breeds Apr 20 to Sep 30

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9408

Long-eared Owl asio otus — Breeds Mar 1 to Jul 15

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/3631

Marbled Godwit Limosa fedoa — Breeds elsewhere

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9481

Olive-sided Flycatcher Contopus cooperi — Breeds May 20 to Aug 31

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/3914

Pinyon Jay Gymnorhinus cyanocephalus — Breeds Feb 15 to Jul 15

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9420

Rufous Hummingbird selasphorus rufus — Breeds Apr 15 to Jul 15

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/8002

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Sage Thrasher Oreoscoptes montanus — Breeds Apr 15 to Aug 10

This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA
https://ecos.fws.gov/ecp/species/9433

Virginia's Warbler Vermivora virginiae — Breeds May 1 to Jul 31

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/9441

Western Grebe aechmophorus occidentalis — Breeds Jun 1 to Aug 31

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.
https://ecos.fws.gov/ecp/species/6743

Willet Tringa semipalmata — Breeds Apr 20 to Aug 5

This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.

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Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum

probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is 0.25/0.25 = 1; at week 20 it is 0.05/0.25 = 0.2.

3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

To see a bar's probability of presence score, simply hover your mouse cursor over the bar.

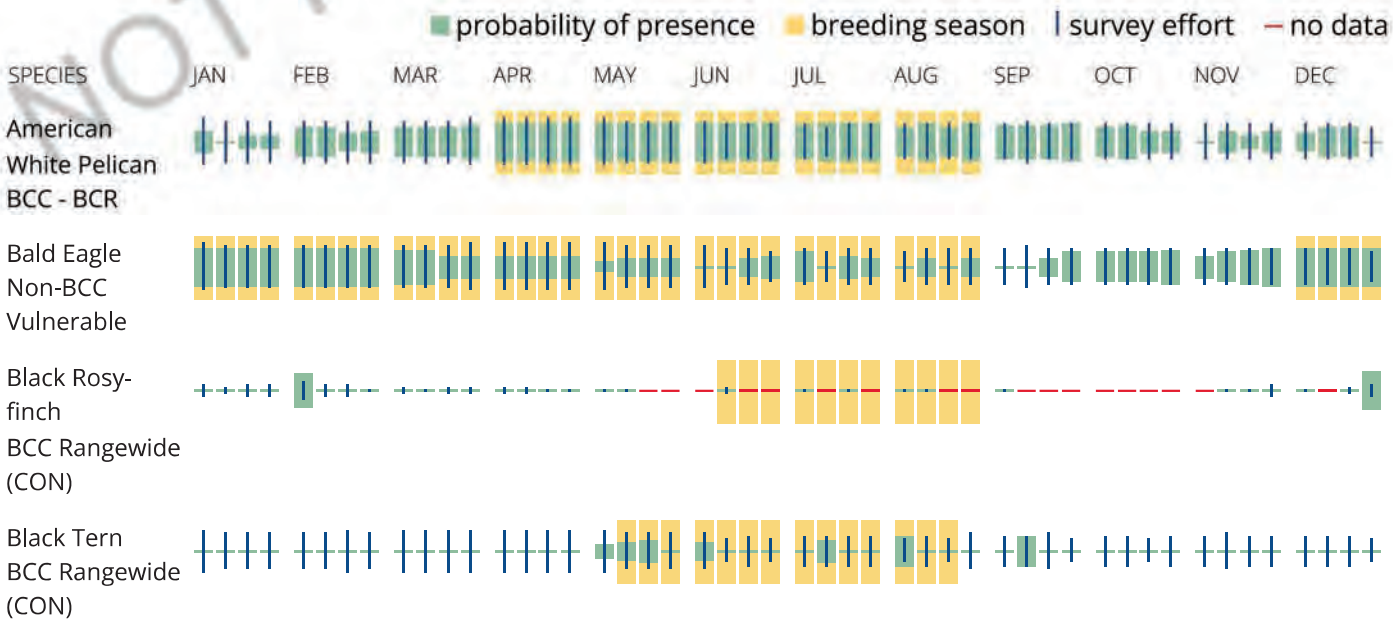
Breeding Season (■)
Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

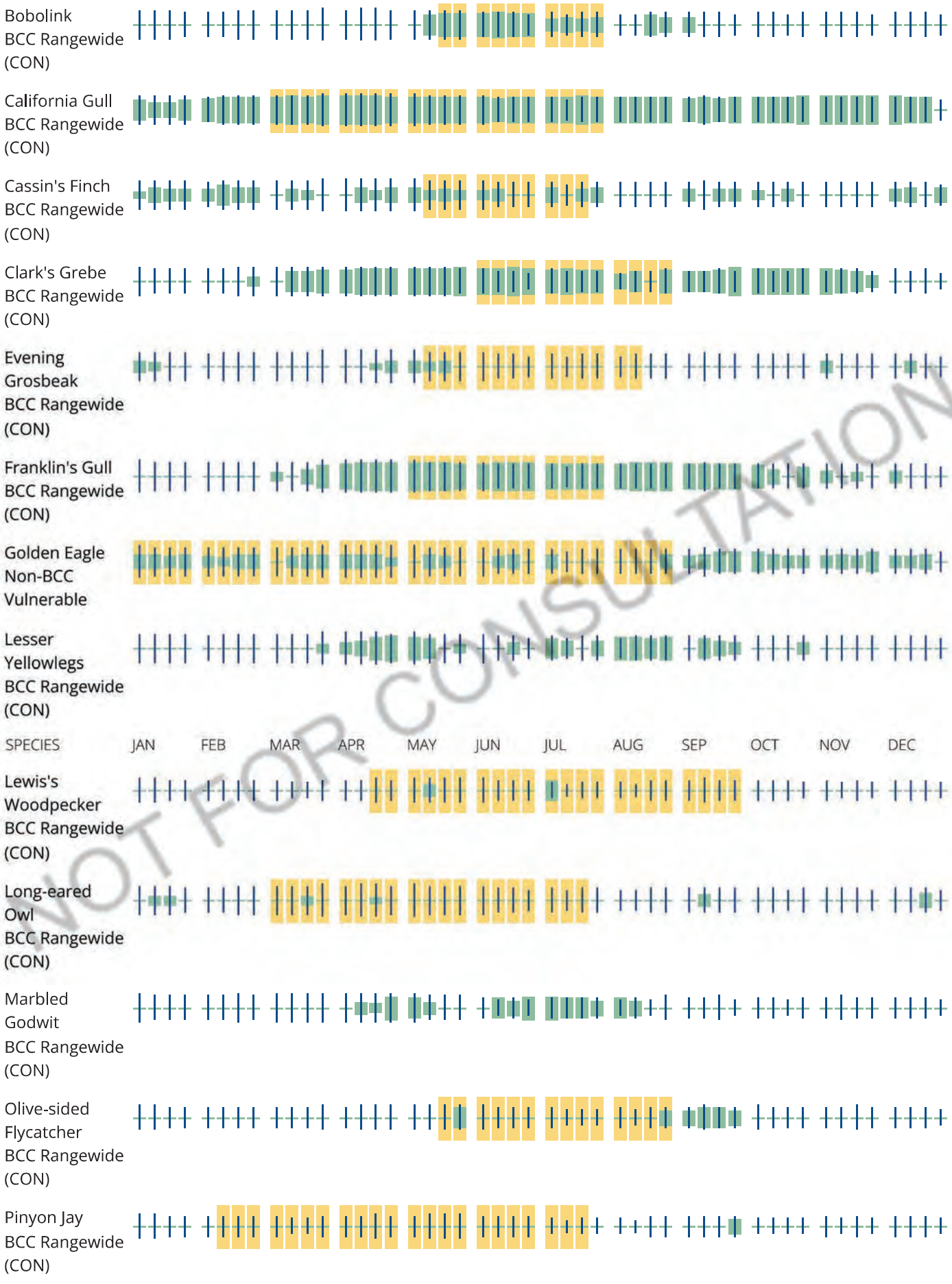
To see a bar's survey effort range, simply hover your mouse cursor over the bar.

No Data (–)
A week is marked as having no data if there were no survey events for that week.

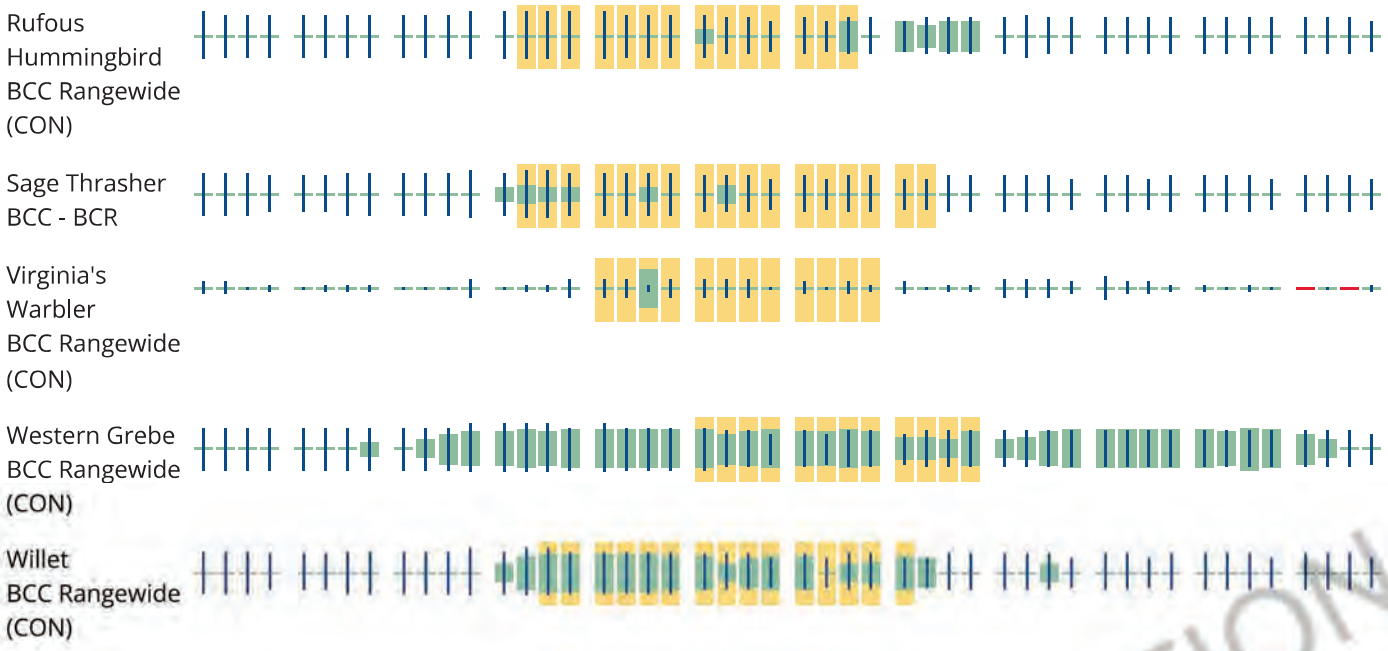
Survey Timeframe
Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.



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Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.

Nationwide Conservation Measures describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. Additional measures or permits may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the list of migratory birds that potentially occur in my specified location?

The Migratory Bird Resource List is comprised of USFWS Birds of Conservation Concern (BCC) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the Avian Knowledge Network (AKN). The AKN data is based on a growing collection of survey, banding, and citizen science datasets and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle (Eagle Act requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the Rapid Avian Information Locator (RAIL) Tool.

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?

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The probability of presence graphs associated with your migratory bird list are based on data provided by the Avian Knowledge Network (AKN). This data is derived from a growing collection of survey, banding, and citizen science datasets.

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering or migrating in my area?

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may query your location using the RAIL Tool and look at the range maps provided for birds in your area at the bottom of the profiles provided for each bird in your results. If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?

Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are Birds of Conservation Concern (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the Eagle Act requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

Details about birds that are potentially affected by offshore projects

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the Diving Bird Study and the nanotag studies or contact Caleb Spiegel or Pam Loring.

What if I have eagles on my list?

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If your project has the potential to disturb or kill eagles, you may need to obtain a permit to avoid violating the Eagle Act should such impacts occur.

Proper Interpretation and Use of Your Migratory Bird Report

The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please also look carefully at the survey effort (indicated by the black vertical bar) and for the existence of the "no data" indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be confirmed. To learn more about conservation measures, visit the FAQ "Tell me about conservation measures I can implement to avoid or minimize impacts to migratory birds" at the bottom of your migratory bird trust resources page.

NOT FOR CONSULTATION

Facilities

National Wildlife Refuge lands

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

There are no refuge lands at this location.

Fish hatcheries

There are no fish hatcheries at this location.

Wetlands in the National Wetlands Inventory (NWI)

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

Please note that the NWI data being shown may be out of date. We are currently working to update our NWI data set. We recommend you verify these results with a site visit to determine the actual extent of wetlands on site.

This location overlaps the following wetlands:

FRESHWATER EMERGENT WETLAND

- PEM1B
- PEM1E
- PEM1A
- PEM1Fh
- PEM1Bf
- PEM5A
- PEM1Bd
- PEM1F
- PEM1C
- PEM1Ah
- PEM1Ch
- PEM1Jx
- PEM1Ax
- PEM5B
- PEM1Bx

FRESHWATER FORESTED/SHRUB WETLAND

- PFO1B
- PSS1B
- PSS1C
- PFO1C
- PSS1A

FRESHWATER POND

- PABKx
- PUBHh
- PABGx
- PUSC

NOT FOR CONSULTATION

- PABG
- PUBG
- PUBKx
- PABHh
- PABGh
- PUBGx
- PUBFx
- PUSAx
- PUBF
- PABH
- PABF
- PUSCx
- PABFx
- PUSCh
- PUSJx
- PABFh
- PUBGh

LAKE

- L2UBHh
- L2ABKx

OTHER

- Pf
- PRBHr

RIVERINE

- R4SBCx
- R4SBC
- R2UBH
- R4SBA
- R2UBG
- R2UBF
- R2USC
- R4SBCr

A full description for each wetland code can be found at the National Wetlands Inventory website

NOTE: This initial screening does **not** replace an on-site delineation to determine whether wetlands occur. Additional information on the NWI data is provided below.

Data limitations

NOT FOR CONSULTATION

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

Data exclusions

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

Data precautions

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate Federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

NOT FOR CONSULTATION

USFWS Email Correspondence – ULT Survey Requirements

From: Reisor, Rita S
To: Landon Richins; Hamilton, Derek - NRCS, Salt Lake City, UT
Cc: Chad Brown; Martilyn Neilsen; Rebecca Hendricks Miller; Adelsbach, Terrence (Terry)
Subject: Re: [EXTERNAL] Wellsville Canyon Watershed Plan-EIS Biological Assessment
Date: Friday, April 25, 2025 10:41:27 AM

Hi Landon,

Thank you for reminding me of this conversation. I agree with this as long as all three years (2021, 2023 and 2024) were clearance level surveys for ULT. The BA and survey report indicate that habitat assessments were conducted in 2021, 2023 and2024. But only identify clearance level protocol surveys for 2023 and 2024. That situation is different than what I was understanding in our previous conversation. If clearance level protocol survey were in fact completed all there of those years, please clarify this in the BA and survey report. Here are some sections from the BA and the survey report with slightly inconsistent information, which is why I am confused. If 2021, was only a habitat assessment and not a clearance survey, then we do need one more year of clearance survey. Let me know if you want to have a call to discuss.

From the BA section 5.2 Methodology

Habitat suitability assessment surveys for ULTs occurred within the Action Area during the accepted
flowering period for the ULT in August 2021, August 2023 and August 2024. The Action Area includes a
300-foot ULT survey buffer around the project footprint. Biologists with J-U-B visited the Mendon ULT
reference population on August 17, 2021, on August 10, 2023, and on August 13, 2024, during field
surveys of the Action Area. Throughout the Action Area, in both Wellsville and Mendon, habitat
suitability assessments were performed, and zero vegetative or blooming ULTs were observed.

From the BA section 5.2: Potential Suitable Habitat Findings

Approximately 18.45 acres of potentially suitable habitat were identified within 300 feet of the project
footprint inside the Action Area in Mendon on August 10, 2023. A protocol level ULT survey was
completed for this location on August 10, 2023, and August 13, 2024. No ULTs were identified during
these surveys. One additional consecutive year of survey should be performed for this

potential suitable
habitat area, pursuant to USFWS survey guidelines (USFWS 1992). See the attached ULT Memo in
Appendix C for a map of the potentially suitable habitat, and results of the ULT surveys.

Appendix C Survey report
Surveys
Approximately 18.45 acres of potentially suitable habitat were identified within 300 feet of the project footprint inside the Action Area in Mendon on August 10, 2023. A protocol level ULT survey was completed for this location on August 10, 2023, and August 13, 2024.

Conclusion
The potentially suitable ULT habitat area was surveyed in 2023 as year one of three consecutive years of surveys to be performed for ULTs within the accepted blooming period.

Thank you,
Rita Reisor

Deputy State Supervisor
USFWS Utah Ecological Services Field Office
Teams: (801)239-0564
Work Cell: (385)491-7505
Main Office: (801)975-3330

https://www.fws.gov/utahfieldoffice/
Submit project requests to: utahfieldoffice_esa@fws.gov

From: Landon Richins <lrichins@fransoncivil.com>
Sent: Thursday, April 24, 2025 2:22 PM
To: Reisor, Rita S <rita_reisor@fws.gov>; Hamilton, Derek - NRCS, Salt Lake City, UT <derek.hamilton@usda.gov>
Cc: Chad Brown <cbrown@fransoncivil.com>; Martilyn Neilsen <mneilsen@fransoncivil.com>; Rebecca Hendricks Miller <rhmiller@jub.com>; Adelsbach, Terrence (Terry) <terrence_adelsbach@fws.gov>
Subject: RE: [EXTERNAL] Wellsville Canyon Watershed Plan-EIS Biological Assessment

Rita,

Thanks for your response!

Yes, this is a one-time treatment. We did complete 3-years already, although the first year was not consecutive to the other two (i.e., surveys completed in 2021, 2023, and 2024). We had previously

coordinated with you on accepting the non-consecutive survey as being acceptable. See the attached screenshot of your response to my email on 7/22/2024 where you state “A third survey this year with the missed 2022 year will suffice in this instance”. I believe we should be all good on the survey front, correct?

I will work with Becky Hendricks, the BA author, to incorporate appropriate CMs for ULTs based on the guidance you provided. Thank you.

-Landon

Landon Richins

Franson Civil Engineers
Office: 801.756.0309 | Direct: 801.938.7585

From: Reisor, Rita S <rita_reisor@fws.gov>
Sent: Thursday, April 24, 2025 2:14 PM
To: Landon Richins <lrichins@fransoncivil.com>; Hamilton, Derek - NRCS, Salt Lake City, UT <derek.hamilton@usda.gov>
Cc: Chad Brown <cbrown@fransoncivil.com>; Martilyn Neilsen <mneilsen@fransoncivil.com>; Rebecca Hendricks Miller <rhmiller@jub.com>; Adelsbach, Terrence (Terry) <terrence_adelsbach@fws.gov>
Subject: Re: [EXTERNAL] Wellsville Canyon Watershed Plan-EIS Biological Assessment

Hi Landon and Derek,

I did a very quick look at this project. We can't sign on on a MANLAA unless there are additional ULT specific conservation measures included, as well as a commitment to complete a 3rd year of clearance surveys, and a reinitiation clause should ULT be found on site in the 3rd year of survey or as the project is being implemented. Are the actions being implemented over many years or is this a one time treatment.

Please use the attached Conservation Measures as a *guide* to add appropriate measures to the BA.

I'm adding Terry Adelsbach to this email as hew is taking over as the new ULT lead.

Thank you,
Rita Reisor

Deputy State Supervisor

USFWS Utah Ecological Services Field Office
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Work Cell: (385)491-7505
Main Office: (801)975-3330

https://www.fws.gov/utahfieldoffice/
Submit project requests to: utahfieldoffice_esa@fws.gov

From: Landon Richins <lrichins@fransoncivil.com>
Sent: Thursday, April 24, 2025 9:16 AM
To: Reisor, Rita S <rita_reisor@fws.gov>
Cc: Hamilton, Derek - NRCS, Salt Lake City, UT <derek.hamilton@usda.gov>; Chad Brown <cbrown@fransoncivil.com>; Martilyn Neilsen <mneilsen@fransoncivil.com>; Rebecca Hendricks Miller <rhmiller@jub.com>
Subject: [EXTERNAL] Wellsville Canyon Watershed Plan-EIS Biological Assessment

This email has been received from outside of DOI - Use caution before clicking on links, opening attachments, or responding.

Good morning, Rita!

I hope you are doing well and that you had a Happy Easter! I have attached a Word and PDF copy of the Biological Assessment for the NRCS's Wellsville Canyon Watershed Plan-EIS project. NRCS asked that I send this to you and ask for your review/comments before NRCS makes a formal request for concurrence. Would you be able to provide us a review of this BA? This is the most recent version, incorporating reviews from NRCS and our 2 cooperating agencies (EPA/USBR).

Only the PDF copy has the attachments referenced in the main body of the text. However, we felt you would likely prefer to review/comment on a Word version as opposed to a PDF. If possible, would you please return your comments to us by the end of the day May 1st? If you need more time than that just let me know. It is just helpful to have a general idea of how long it will take to get this through review.

Let me know if you have any questions! I am looking forward to getting together in a couple of weeks to visit the Utaba Dam project site, should be good to catch up.

Thanks, as usual, for your help!

Sincerely,

Landon

Landon Richins | lrichins@fransoncivil.com

Franson Civil Engineers
1276 South 820 East, Suite 100, American Fork, Utah 84003
Office: 801.756.0309 | Direct: 801.938.7585

Any use or reuse of original or altered files by the owner or others without the express written verification of Franson Civil Engineers or any CADD adaptation from the specific purpose originally intended shall be at the owner's risk and full legal responsibility.

Utah Natural Heritage Program Online Species Search Report

Utah Division of Wildlife Resources
Utah Natural Heritage Program
1594 W. North Temple
PO Box 146301
Salt Lake City, UT 84116

Report Number: 14675
August 21, 2023

Utah Natural Heritage Program Online Species Search Report

Project Information

Project Name

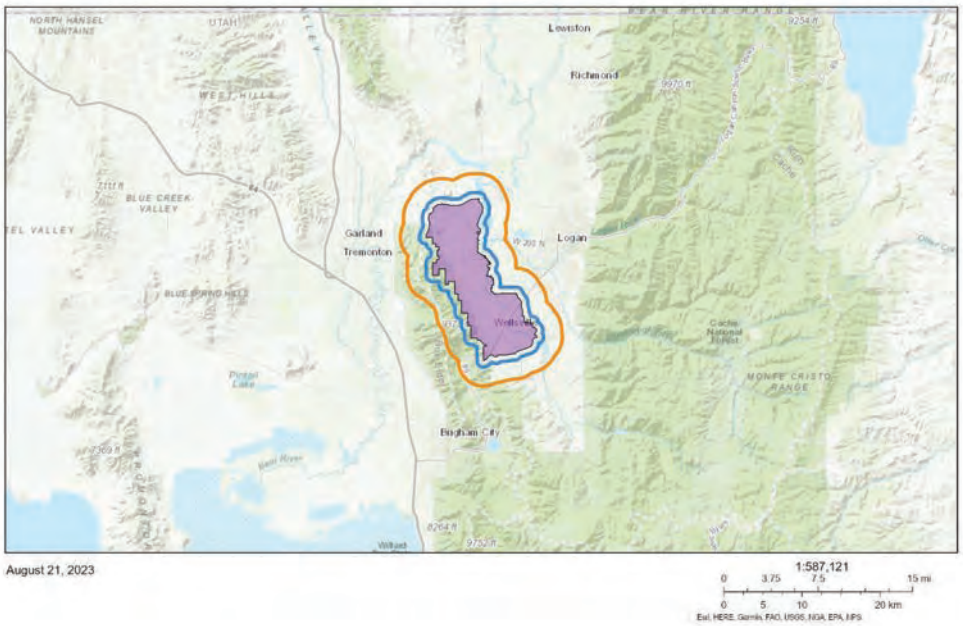
Wellsville Canyon Watershed Plan and Environmental Impact Statement for Improvements in the Wellsville Mountains Watershed, Cache County, Utah

Project Description

The purpose for the project is to address concerns of flooding in the Wellsville, Mendon, and unincorporated Cache County areas nearby as well as to address agricultural water management improvements and recreation enhancement in the project area. The project 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 events. Earthen canal irrigation distribution systems in the area experience significant seepage losses. Improvements to water-related infrastructure are needed to reduce risks to residents of the project area.

Location Description

Utah, First Congressional District, Cache County



Animals within a ½ mile radius

Common Name	Scientific Name	State Status	U.S. ESA Status	Last Observation Year
American Bittern	Botaurus lentiginosus	SGCN		2022
American White Pelican	Pelecanus erythrorhynchos	SGCN		1990
Bald Eagle	Haliaeetus leucocephalus	SGCN		2005
Burrowing Owl	Athene cunicularia	SGCN		1992
Columbian Sharp-tailed Grouse	Tympanuchus phasianellus columbianus	SGCN		2005
Green River Pebblesnail	Fluminicola coloradoensis	SGCN		2022
Lewis's Woodpecker	Melanerpes lewis	SGCN		1993
Little Brown Myotis	Myotis lucifugus	SGCN		1993
Northern Leopard Frog	Lithobates pipiens	SGCN		2020
Pilose Crayfish	Pacifastacus gambelii	SGCN		1982
Western Toad	Anaxyrus boreas	SGCN		1926
Western Yellow-billed Cuckoo	Coccyzus americanus occidentalis	SGCN	LT	1938

Plants within a ½ mile radius

Common Name	Scientific Name	State Status	U.S. ESA Status	Last Observation Year
Ute Ladies' Tresses	Spiranthes diluvialis		LT	2013

Animals within a 2 mile radius

Common Name	Scientific Name	State Status	U.S. ESA Status	Last Observation Year
American Bittern	Botaurus lentiginosus	SGCN		2022
American White Pelican	Pelecanus erythrorhynchos	SGCN		1990
Bald Eagle	Haliaeetus leucocephalus	SGCN		2005
Brown (Grizzly) Bear	Ursus arctos		LT	1924
Burrowing Owl	Athene cunicularia	SGCN		1992
Columbian Sharp-tailed Grouse	Tympanuchus phasianellus columbianus	SGCN		2005
Golden Eagle	Aquila chrysaetos	SGCN		2018
Green River Pebblesnail	Fluminicola coloradoensis	SGCN		2022
Lewis's Woodpecker	Melanerpes lewis	SGCN		2021
Little Brown Myotis	Myotis lucifugus	SGCN		1993
Long-eared Myotis	Myotis evotis	SGCN		1993
Long-legged Myotis	Myotis volans	SGCN		1993
Northern Leopard Frog	Lithobates pipiens	SGCN		2020
Pilose Crayfish	Pacifastacus gambelii	SGCN		1982
Western Toad	Anaxyrus boreas	SGCN		1926
Western Yellow-billed Cuckoo	Coccyzus americanus occidentalis	SGCN	LT	1938
Western bumble bee	Bombus occidentalis	SGCN		2007
Whooping Crane	Grus americana		LE; XN	1981

Plants within a 2 mile radius

Common Name	Scientific Name	State Status	U.S. ESA Status	Last Observation Year
Ute Ladies' Tresses	Spiranthes diluvialis		LT	2013
Maguire Primrose	Primula maguirei		LT	1961

Definitions

State Status

SGCN	Species of greatest conservation need listed in the Utah Wildlife Action Plan

U.S. Endangered Species Act

LE	A taxon that is listed by the U.S. Fish and Wildlife Service as "endangered" with the probability of worldwide extinction
LT	A taxon that is listed by the U.S. Fish and Wildlife Service as "threatened" with becoming endangered
LE;XN	An "endangered" taxon that is considered by the U.S. Fish and Wildlife Service to be "experimental and nonessential" in its designated use areas in Utah
C	A taxon for which the U.S. Fish and Wildlife Service has on file sufficient information on biological vulnerability and threats to justify it being a "candidate" for listing as endangered or threatened
PT/PE	A taxon "proposed" to be listed as "endangered" or "threatened" by the U.S. Fish and Wildlife Service

Disclaimer

The information provided in this report is based on data existing in the Utah Division of Wildlife Resources' central database at the time of the request. It should not be regarded as a final statement on the occurrence of any species on or near the designated site, nor should it be considered a substitute for on-the-ground biological surveys. Moreover, because the Utah Division of Wildlife Resources' central database is continually updated, any given response is only appropriate for its respective request.

The UDWR provides no warranty, nor accepts any liability, occurring from any incorrect, incomplete, or misleading data, or from any incorrect, incomplete, or misleading use of these data.

The results are a query of species tracked by the Utah Natural Heritage Program, which includes all species listed under the U.S. Endangered Species Act and species on the Utah Wildlife Action Plan. Other significant wildlife values might also be present on the designated site. Please contact UDWR's regional habitat manager if you have any questions.

For additional information about species listed under the Endangered Species Act and their Critical Habitats that may be affected by activities in this area or for information about Section 7 consultation under the Endangered Species Act, please visit https://ecos.fws.gov/ipac/ or contact the U.S. Fish and Wildlife Service Utah Ecological Services Field Office at (801) 975-3330 or utahfieldoffice_esa@fws.gov.

Please contact our office at (801) 538-4759 or habitat@utah.gov if you require further assistance.

Your project is located in the following UDWR region(s): Northern region

---

Report generated for:
Landon Richins
Franson Civil Engineers
1276 South 820 East, Suite 100
American Fork, UT 84003
(801) 756-0309
lrichins@fransoncivil.com

Redacted Cultural Resources Inventory Report – Certus Environmental Solutions, LLC

COVER PAGE

Must Accompany All Project Reports Submitted to the Utah SHPO

Report Title: *A Cultural Resource Assessment for the Wellsville Canyon Watershed Plan-EIS, Cache County, Utah*

UDSH Project Number: U21HY0960
Report Date: October 10, 2024
Report Author(s): Sheri Murray Ellis
Record Search Date(s): 11/01/2021, 05/15/2024
Intensive Acres Surveyed (<15m intervals): 975 acres
Org. Project Number: FRA03
County(ies): Cache
Principal Investigator: Sheri Murray Ellis
Field Supervisor(s): Sheri Murray Ellis
Recon Acres Surveyed (<15m intervals): 0 acres

USGS 7.5' Series Map Reference(s): Newton, UT; Cutler Dam, UT; Honeyville, UT; Wellsville, UT; Logan, UT; Mount Pisgah, UT

Sites Reported	Count	Smithsonian Trinomials
Revisits (no updated site forms)	3	42CA174, 42CA184, 42CA322
Updates (updated site forms attached)	2	42CA88, 42CA198
New recordings (site forms attached)	6	42CA337, 42CA338, 42CA339, 42CA340, 42CA341, 42CA342
Total Count of Archaeological Sites in APE	11	42CA88, 42CA174, 42CA184, 42CA198, 42CA322, 42CA337, 42CA338, 42CA339, 42CA340, 42CA341, 42CA342
Historic Structures (structures forms Attached)	2	Structure 005051D, 200 East Culvert
Total National Register Eligible Sites	9	42CA88, 42CA174, 42CA184, 42CA198, 42CA322, 42CA337, 42CA338, 42CA339, 42CA341

*Please list all site numbers per category. Number strings are acceptable (e.g. "42TO1-13; 42TO15"). Cells should expand to accommodate extensive lists.

Checklist of Required Items for Submittal to SHPO

- ☒ "Born Digital" Report in a PDF/A format
  - ☒ SHPO Cover Sheet
  - ☐ File Name is the UDSH Project Number with no hyphens or landowner suffixes
- ☒ "Born Digital" Site forms in PDF/A format
  - ☒ UASF with embedded maps and photos
  - ☒ File name is Smithsonian Trinomial without leading zeros (e.g. 42TO13 not 42TO00013)
  - ☒ Photo requirements (including size and quality)
- ☒ Archaeological Site Tabular Data
  - ☒ Single spreadsheet for each project
  - ☒ Follows UTSHPO template (info here: https://goo.gl/7SLMqj)
- ☒ GIS data
  - ☒ Zipped polygon shapefile or geodatabase of survey (if different from APE) or other activity area with required field names and variable intensity denoted
  - ☒ Zipped polygon shapefile or geodatabase of site boundaries with a the required field name

REDACTED

A Cultural Resource Assessment for the Wellsville Canyon Watershed Plan-EIS, Cache County, Utah

Prepared for

Franson Civil Engineers
and
Natural Resources Conservation Service, State Office

Prepared by

Sheri Murray Ellis, MS, RPA
Owner/Consultant

Certus Environmental Solutions, LLC
Salt Lake City, Utah
801.230.7260

PLPCO Permit No. 176
Utah Antiquities Report No. U21HY0960

Certus Project Number FRA03

October 10, 2024

PROJECT SUMMARY SHEET

Report Title: *A Cultural Resource Assessment for the Wellsville Canyon Watershed Plan-EIS, Cache County, Utah*

State Report No.: U21HY0960

Agencies: Natural Resources Conservation Service; U.S. Bureau of Reclamation; Cache Water District

Project Description: The Cache Water District (the District) proposes improvements within the Wellsville Canyon Watershed to address flooding, reduce irrigation water loss, and enhance recreational facilities in broader Wellsville and Mendon area. The District would receive at least partial funding for the projects from the Natural Resources Conservation Service (NRCS) under the Watershed Protection and Flood Prevention Act of 1954 (P.L. 83-566). Issuance of such federal funding by the NRCS invokes the National Historic Preservation Act and its implementing regulations at 36 CFR §800 for the consideration of historic properties in project planning and execution. The NRCS is working in cooperation with the U.S. Bureau of Reclamation (Reclamation) for the undertaking.

Franson Civil Engineers, under contract to the project sponsors, is assisting in the design and National Environmental Policy Act (NEPA) evaluation for the project. Franson subcontracted to Certus Environmental Solutions (Certus) to assist in conducting a cultural resource assessment for the projects to be used by the NRCS in compliance with 36 CFR §800. The results of the assessment by Certus are presented herein.

Survey Area and Area of Potential Effects: The NRCS, as the lead agency for the purpose of 36 CFR §800, has defined the area of potential effects (APE) for the projects as a series of linear corridors and polygons within which the proposed projects would occur. These corridors and polygons are scattered throughout the communities of Wellsville and Mendon and lands in between. Collectively, the APE contains 975 acres. The survey area is equal to the APE.

Location: Cache County, Utah

- T. 10N, R. 1E, Sec. 6;
- T. 10N, R. 1W, Sec. 1–4, 9–12, 14, and 15;
- T. 11N, R. 1W, Sec. 4–10, 15–18, 20–22, 27, 28,and 34–36;
- T. 11N, R. 2W, Sec. 12;
- T. 12N, R. 1W, Sec. 20, 28–33; and
- T. 12N, R. 2W, 25, 26, 35, and 36

Land Ownership: Private, Municipal, U.S. Forest Service; U.S. Bureau of Reclamation

Date(s) of Fieldwork: November 18–December 5, 2021 and June 11–17, 2024

Methods: Intensive-level archaeological survey; no buildings will be impacted, even if in the survey area

Acres Surveyed: 975 acres

Cultural Resource Sites in Survey Area: 13 (42CA88, 42CA174, 42CA184, 42CA198, 42CA322, 42CA337, 42CA339, 42CA340, 42CA341, 42CA342, Structure 005051D, 200 East Culvert)

Resources Recommended Eligible for the NRHP: 8 (42CA88, 42CA174, 42CA184, 42CA198, 42CA322, 42CA337, 42CA338, 42CA339, 42CA341)

Table of Contents

Project Summary Sheet i
Table of Contents ii
List of Tables iii
List of Figures iii
Project Description 1
Project Alternatives 1
Fieldwork 3
Personnel Qualifications 4
Cultural Resources Survey Area and Area of Potential Effects 4
Project Setting 10
File Search 10
Field Methods 11
Resource Evaluation Methods 12
Findings for the Survey Area 12
Resources Noted but Not Documented 14
Archaeological Sites 14
Site 42CA88—Utah Northern Railroad 14
Site 42CA174—Wellsville-Mendon Lower Canal 15
Site 42CA184—Wellsville-Mendon Upper Canal 16
Site 42CA198—Wellsville Canal/East Field Lateral 17
Site 42CA322—Mendon South Canal 18
Site 42CA337—Ogden, Logan & Idaho Railway 19
Site 42CA338—Stone Foundation & Fire Ring 20
Site 42CA339—Mendon Cemetery 22
Site 42CA340—Wellsville Dam & Reservoir 22
Site 42CA341—Wellsville City Cemetery 23
Site 42CA342—Mendon Main Street Culvert & Rock Wall 24
Structures 25
Wellsville 200 East Culvert 25
Wellsville Canyon Creek Bridge (Structure 005051D) 26
Visual Impact Analysis for Canal Piping 26

No Action Impact Area/APE 27
Summary and Recommendations 28
Anticipated Effects from the Proposed Action 29
References Cited 31

List of Tables

Table 1. Previous sites in the current survey area 11
Table 2. Sites in the current survey area 14
Table 3. Sites in the current survey area 28
Table 4. Anticipated impacts and recommended findings of effect for eligible sites under the Action Alternatives 29

List of Figures

Figure 1. General location of the Wellsville Canyon Watershed Plan-EIS Survey Area 2
Figure 2. Location of survey area; Map 1 of 4 5
Figure 3. Location of survey area; Map 2 of 4 6
Figure 4. Location of survey area; Map 3 of 4 7
Figure 5. Location of survey area; Map 4 of 4 8
Figure 6. No Action impact area/APE 9
Figure 7. Survey results; Map 1 of 4 13
Figure 8. Survey results; Map 2 of 4 13
Figure 9. Survey results; Map 3 of 4 13
Figure 10. Survey results; Map 4 of 4 13
Figure 11. Kidman Farmstead (42CA185) showing setting with trees along canal 26

PROJECT DESCRIPTION

The Cache Water District (the District) proposes improvements within the Wellsville Canyon Watershed to address flooding, reduce irrigation water loss, and enhance recreational facilities in broader Wellsville and Mendon area (see **Figure 1** for general location). The District would receive at least partial funding for the projects from the Natural Resources Conservation Service (NRCS) under the Watershed Protection and Flood Prevention Act of 1954 (P.L. 83-566). Issuance of such federal funding by the NRCS invokes the National Historic Preservation Act and its implementing regulations at 36 CFR §800 for the consideration of historic properties in project planning and execution. The NRCS is working in cooperation with the U.S. Bureau of Reclamation (Reclamation) for the undertaking.

Part of the funding for the projects would come from the Natural Resources Conservation Service (NRCS) under the Watershed Protection and Flood Prevention Act. Issuance of such federal funding by the NRCS invokes the National Historic Preservation Act and its implementing regulations at 36 CFR §800 for the consideration of historic properties in project planning and execution.

Franson Civil Engineers, under contract to the project sponsors, is assisting in the design and National Environmental Policy Act (NEPA) evaluation for the project. Specifically, Franson is assisting in the preparation of the environmental impact statement (EIS) on behalf of the NRCS and other agencies. Franson subcontracted to Certus Environmental Solutions (Certus) to assist in conducting a cultural resource assessment for the projects to be used by the NRCS in compliance with 36 CFR §800. The results of the assessment by Certus are presented herein.

Project Alternatives

Three action alternatives are being considered in the watershed EIS: Alternative 1: No Action, Alternative 2: Proposed Action, and Alternative 3: Lining Alternative. A No Action alternative is also being considered and is discussed in more detail elsewhere in this report. The alternatives are described as follows:

Alternative 1—No Action Alternative

Taking no action would consist of activities carried out if no federal action or funding were provided. This alternative would not address flooding into the canals. The canals would continue to overtop during rain-on-snow events, and flooding in the project area would continue. The canals would be maintained in their existing condition as earthen channels, and irrigation conveyance within the communities of Wellsville and Mendon would continue unchanged. The recreational access to Wellsville Reservoir would not be built. Additionally, erosion and sedimentation from the alluvial plains above the canals would continue unaltered under this alternative. The existing project infrastructure would continue to operate in its current condition and would not improve flood control, conserve irrigation water, improve recreational access, or reduce watershed erosion as described above. Residents would continue to use culinary water for irrigation (i.e., watering lawns and gardens), putting stress on existing water supply and infrastructure.

Alternative 2—Proposed Action

The proposed action is also referred to as the Piping Alternative. It would continue to divert the water for the Wellsville-Mendon Conservation District (WMCD) from below Hyrum Reservoir at the existing diversion points. However, this alternative would then enclose the Wellsville-

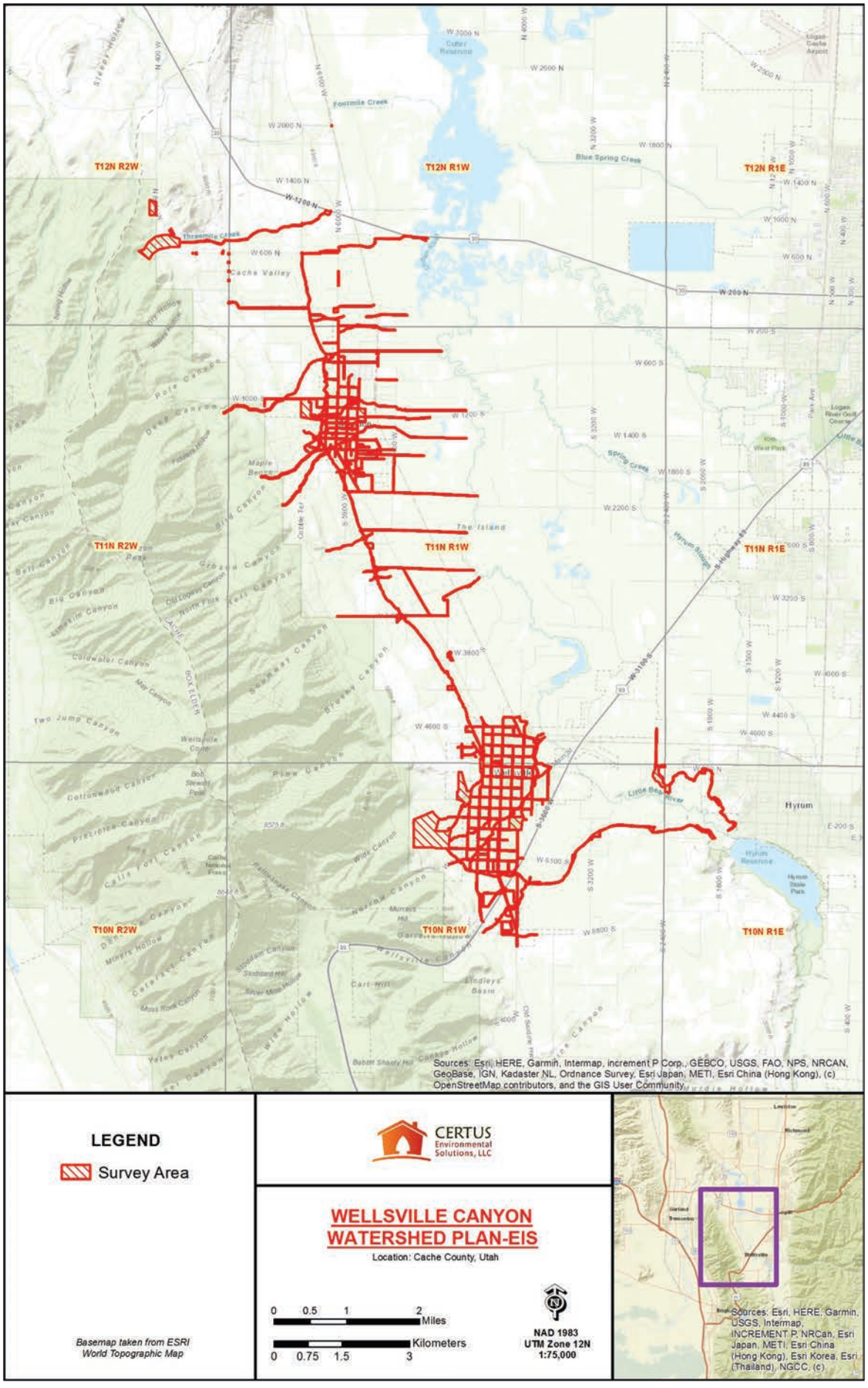


Figure 1. General location of the Wellsville Canyon Watershed Plan-EIS Survey Area

Mendon Canal (Lower Canal) and convey water through piping in Wellsville and Mendon cities and part of unincorporated Cache County, Utah. The existing Lower Canal would be improved with the addition of open channel overflow systems at 2900 South and 3400 South (unincorporated Cache County) and 200 South (Mendon City). This would be accomplished through a combination of conduits and channels to convey floodwaters from the west side of Cache Valley between Wellsville and Petersboro to the natural floodplain of the Little Bear River east of the communities. This would include the rehabilitation of the existing Murray Spring overflow system and the addition of overflow systems at 3400 South, 2900 South, and 200 South.

This alternative would use the water rights of the Wellsville Eastfield Canal Company to enclose and pipe a portion of the Wellsville Eastfield Canal as well, 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, and Greater Mendon Irrigation companies. This alternative, if selected, 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.

Finally, education and outreach efforts through the educational extension at Utah State University (USU) and/or the NRCS local office would seek to alter existing land management practices to improve water management, cropping practices, soil conservation, and the economic viability of the agricultural land within the watershed.

Alternative 3—Lining Alternative

This alternative would have funding made available through PL 83-566 allowing for lining of the canals. 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 Alternative, as described below, the problem of flood prevention would be addressed using a nonstructural measure.

The principal difference between the Lining Alternative and the Piping Alternative is that this alternative would line and increase the capacity of the Hyrum-Mendon Canal to carry both irrigation and flood water from the west alluvial plains between Wellsville and Petersboro in Cache County rather than enclose and pipe it.

The nonstructural element of this alternative would be to seek voluntary buyouts of the structures/properties within the 100-year existing conditions flood inundation area to eliminate the risks associated with rain-on-snow flood events. The costs to install the structural project measures under this alternative would not exceed the costs of the voluntary property buyouts, meaning the structural measures would be fewer and smaller than the nonstructural measures.

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 on the Western edge of the new Wellsville Secondary System to stabilize peaking 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.

Fieldwork

Fieldwork was carried out by the author over a period of several years based on project area and schedule changes as well as a change from preparing an environmental assessment (EA) in 2021 and 2022 to preparing the current EIS in 2023. Field surveys occurred November 18–December 5, 2021 and June 11–17, 2024. Because no buildings or structures, beyond those directly associated with the canals or culverts that are the subject of the undertaking or those located in construction staging areas, would be altered, demolished, moved, or otherwise directly impacted by the project, only such resources known to be potentially affected were inventoried. Cultural resource survey work was carried out under Utah State Antiquities Project No. U21HY0960 and Utah Public Lands Policy Coordination Office (PLPCO) Principal Investigator Permit No. 176 issued to the author.

PERSONNEL QUALIFICATIONS

Sheri Murray Ellis, Principal Investigator for Certus under State of Utah PLPCO Permit No. 176, conducted fieldwork for the project. Ms. Ellis meets all standards for professional qualifications for both archaeology and architectural history and for both prehistoric and historic period resources. Ms. Ellis holds an M.S. in American Studies (a multi-disciplinary degree that includes archaeology and history). Ms. Ellis has more than 33 years of professional experience in cultural resource assessments in Utah and the western United States.

CULTURAL RESOURCES SURVEY AREA AND AREA OF POTENTIAL EFFECTS

The NRCS, as the lead agency for the purpose of 36 CFR §800, has defined the area of potential effects (APE) for the projects as a series of linear corridors and polygons within which the proposed projects would occur as well as the area that could be impacted under No Action alternative under consideration in the EIS (see **Figures 2–6**). The project-specific corridors and polygons are scattered throughout the communities of Wellsville and Mendon and lands in between. These corridors and polygons comprise the survey area for cultural resources. The No Action impact area was not surveyed for cultural resources except for those areas that overlap with the aforementioned survey corridors and polygons. Collectively, the APE contains 24,422 acres while the survey area contains 975 acres. Of the 975 survey areas, approximately 921 acres are located on private or municipal land, 5 acres on U.S. Forest Service land, and approximately 49 acres are located within rights-of-way administered by Reclamation. Both the APE and the survey area are larger than the anticipated project footprints.

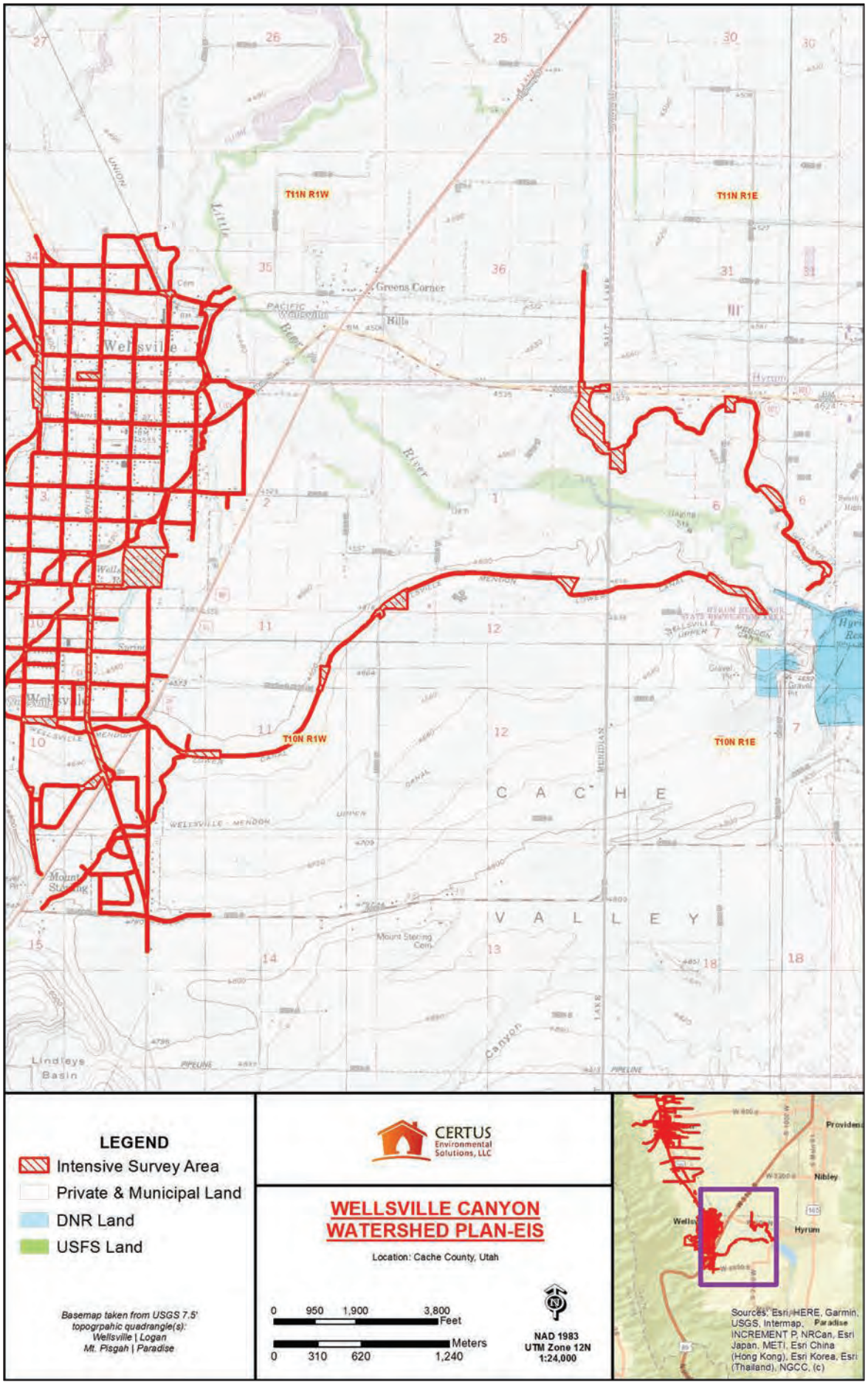


Figure 2. Location of survey area; Map 1 of 4

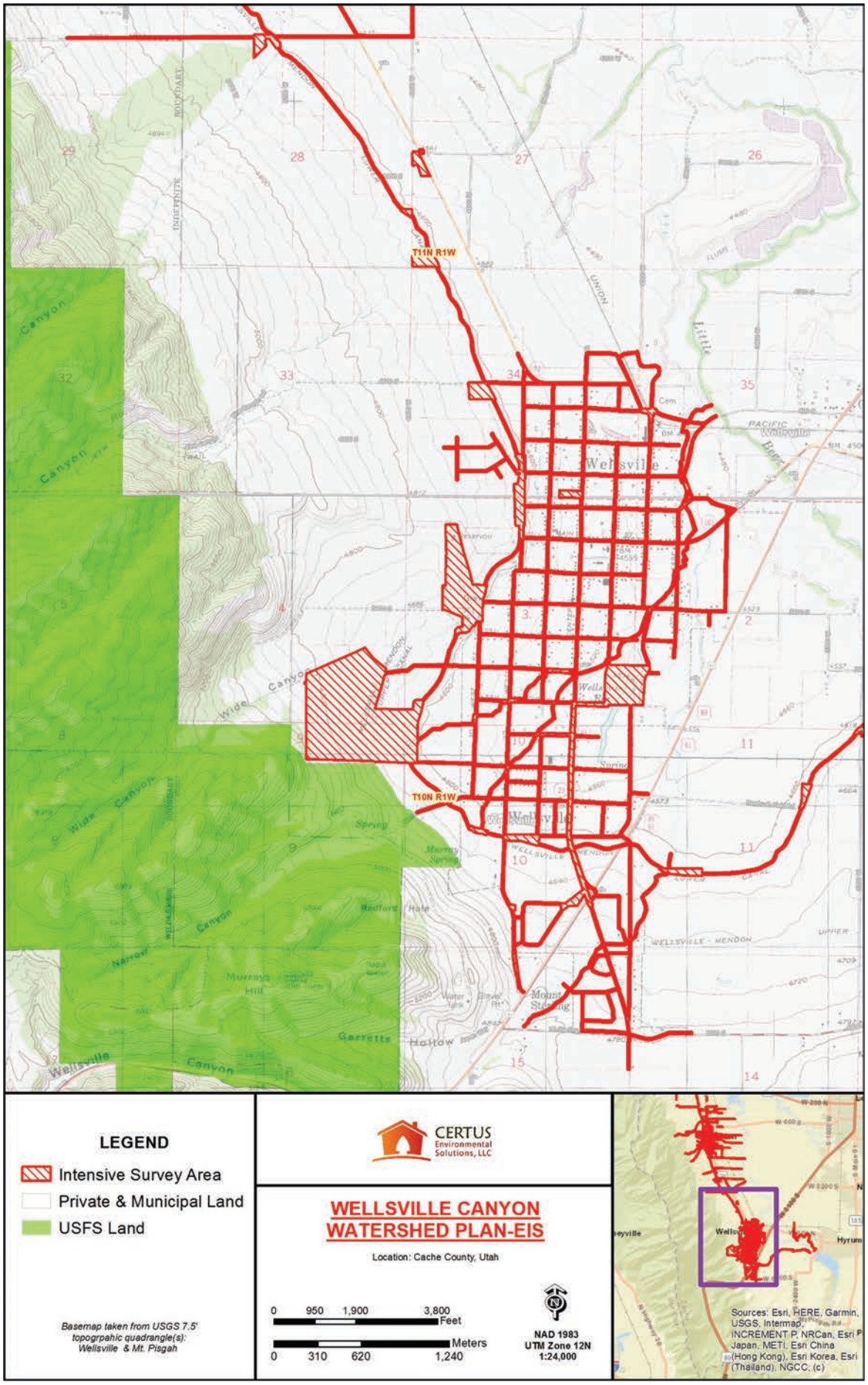


Figure 3. Location of survey area; Map 2 of 4

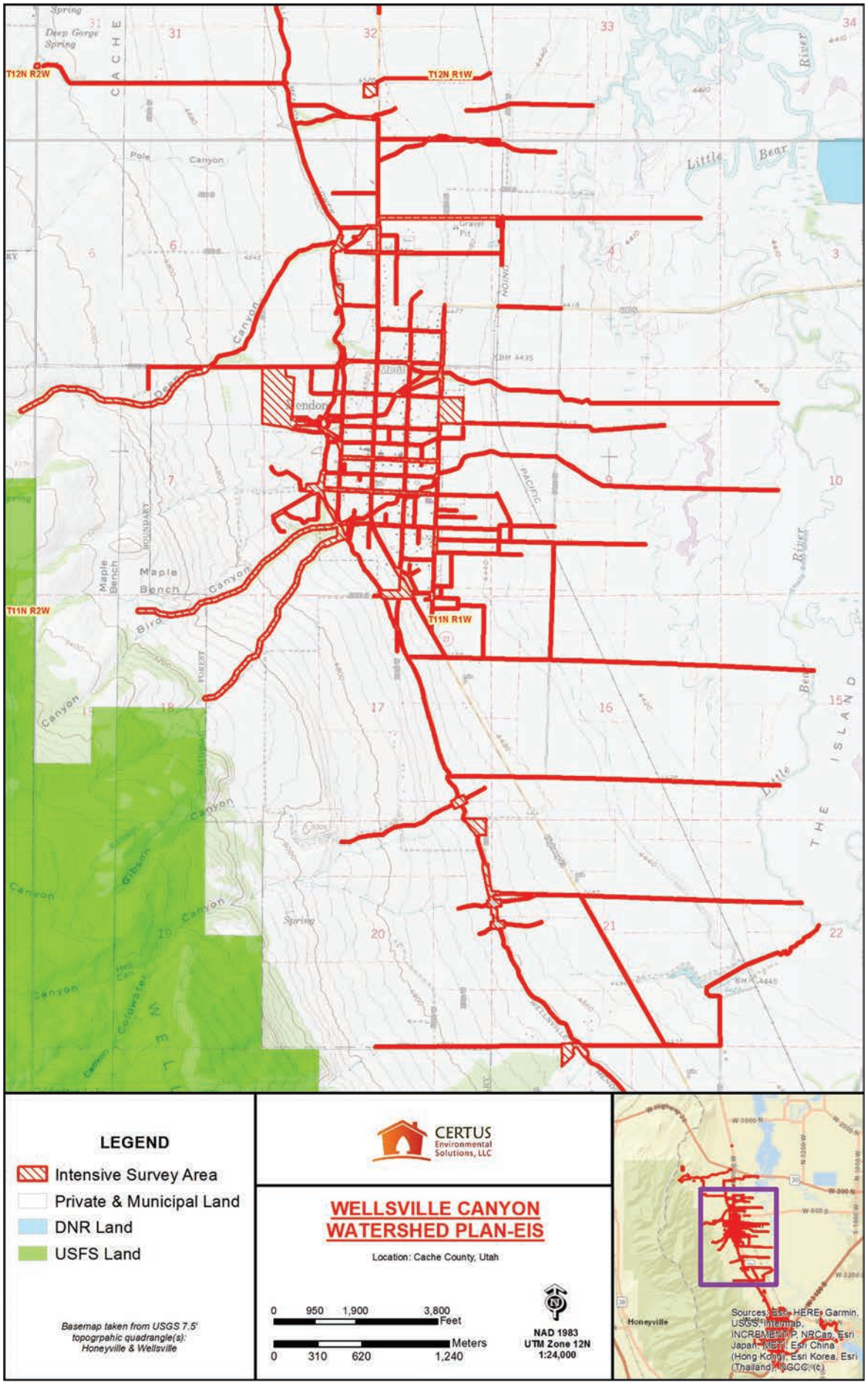


Figure 4. Location of survey area; Map 3 of 4

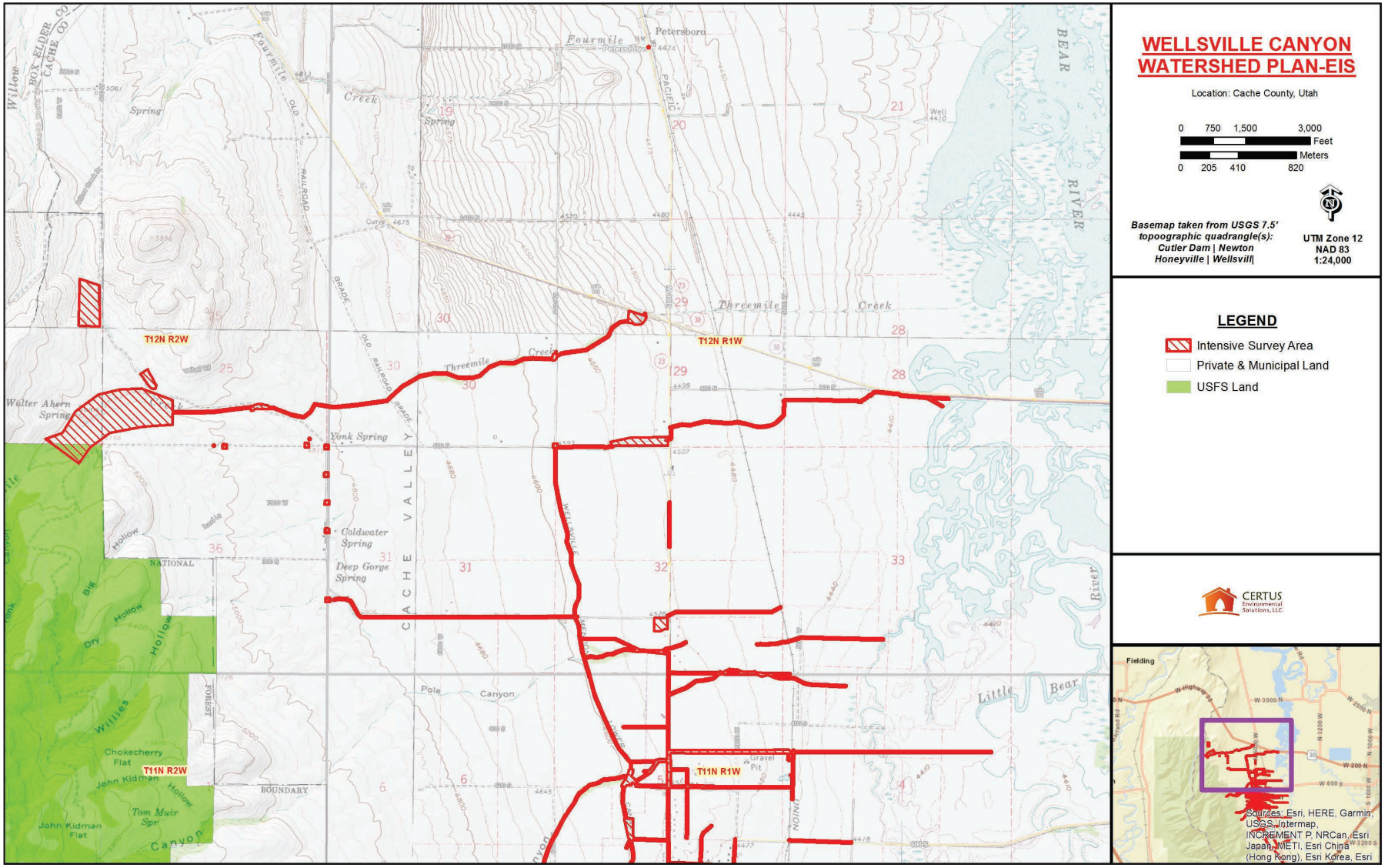


Figure 5. Location of survey area; Map 4 of 4

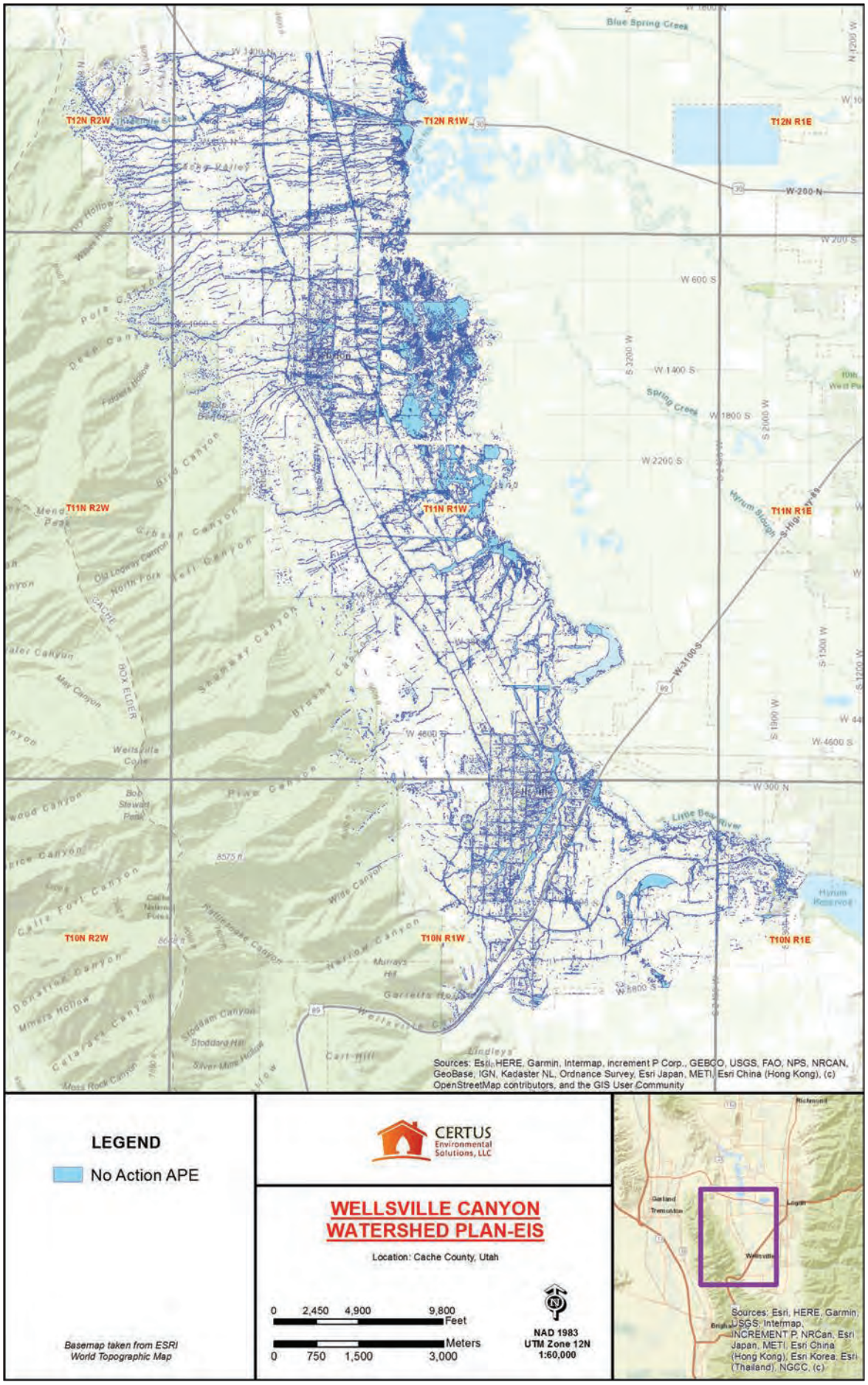


Figure 6. No Action impact area/APE

Lands within the survey area are mostly owned by private parties and the local municipal government, but facilities owned by Reclamation are present in the area. The linear corridors of the survey area generally range from 15 to 30 meters (50 to 100 feet) wide depending on the nature of the proposed improvements. Where existing ditches would be altered or where no ditches are currently located, the corridor width is generally limited to 15 meters wide. Where new pipelines would be installed adjacent to existing ditches, the corridor width was as much as 30 meters wide.

The legal locations of the survey area are as follows:

- Township 10 North, Range 1 East, Sec. 6;
- Township 10 North, Range 1 West, Sec. 1–4, 9–12, 14, and 15;
- Township. 11 North, Range 1 West, Sec. 4–10, 15–18, 20–22, 27, 28,and 34–36;
- Township 11 North, Range 2 West, Sec. 12;
- Township. 12 North, Range 1 West, Sec. 20, 28–33; and
- Township 12 North, Range 2 West, 25, 26, 35, and 36

The survey area is found on the following USGS 7.5 minute Utah topographic quadrangles: Newton; Cutler Dam; Honeyville; Wellsville; Logan; Mount Pisgah.

PROJECT SETTING

The project area is located in the southwestern and western parts of the Cache Valley around the communities of Wellsville and Mendon with a smaller component near the community of Hyrum. Elevation of the survey area ranges from a high of 5200 feet above sea level to a low of 4480 feet above sea level.

Vegetation in the survey area varies by location. Riparian plants are found along the natural creek channels and several of the open ditch/canal channels while native sagebrush community species are found away from these waterways and outside of the developed communities. Within Wellsville and Mendon proper, vegetation large comprises introduced agricultural cultigens, ornamental landscaping (e.g., introduced lawns, trees, and shurbs), and invasive weeds deriving from past ground disturbance. Soils across the area are light to medium brown silty loam. Lands outside the core areas of Wellsville and Mendon are lightly developed and primary used for agricultural purposes—growing corn, alfalfa, and other crops and grazing livestock. In town, lands are developed with typical suburban lots with single-family dwellings and introduced landscaping.

FILE SEARCH

Certus conducted a search of the online site and project files of the Utah State Historic Preservation Office (SHPO) on November 1, 2021, prior to the first set of field sessions and one May 15, 2024., prior to the second field session The file search encompassed an area extending 1/2 mile in all directions from the edge of each survey area. The No Action APE was searched separately and is discussed elsewhere in this report. The file search was conducted to:

a) identify any areas of the survey area that may not require additional field inventory;

b) identify any previously documented sites in the survey area that should be considered relative to potential project impacts; and

c) assess the potential for encountering cultural resources during the field survey for the project and obtain information about the types of cultural resources likely to be present.

SHPO records indicate that 45 prior cultural resource surveys have been undertaken in the vicinity of the current survey area. These inventories occurred between 1980 and 2023 with most occurring after 2000. Most of the surveys were small, linear corridors focused on canals and roadways, though a few larger polygon surveys have occurred, particularly near Hyrum Reservoir and parts of Wellsville. Approximately 33 of the prior projects encompassed some portion of the current survey area, though most (well over 70-percent) of the survey area was uninventoried prior to fieldwork for the current undertaking.

Thirteen archaeological sites have been previously documented in the file search area according to Sego map records. The majority are linear historical sites, including canals and railroads, though several prehistoric temporary camps and an indigenous burial have been reported near Hyrum Reservoir. An additional prehistoric camp was reported on the edge of the file search area near The Island and Pelican Pond between Wellsville and Mendon, and a historic period homestead was reported north of Mendon. Of the 13 previously reported sites, five are located wholly or partially within the current survey area (see **Table 1**). These five sites are discussed further in the **Findings** section of this report.

Table 1. Previous sites in the current survey area

Site Number	Description	Eligibility Status
42CA88	Utah Northern Railroad/Union Pacific Railroad	Eligible
42CA174	Wellsville-Mendon Lower Canal system	Eligible
42CA184	Wellsville-Mendon Upper Canal system	Eligible
42CA198	Wellsville Canal/East Field Lateral	Eligible
42CA322	Mendon South Canal	Eligible

Given the extensive nature of modern land development and ground disturbance in the survey area, historical features depicted on General Land Office (GLO) maps have a low probability of still being present except for canals and irrigation networks, which remain in use today. Historical GLOs for the survey area depict several of the current canal systems (including the main canals and a few distribution ditches), roads that have been incorporated into the modern road system, the core plats for the Wellsville and Mendon townsites, several agricultural fields, and the Utah & Northern Railroad (42CA88). The location of each man-made feature depicted on the GLO maps as being located in or potentially in the current survey area was visited in an effort to discover evidence thereof. Those features (all canals and railroads) that were verified to still exist are discussed in more detail in the **Findings** section of this report.

FIELD METHODS

Certus applied intensive-level archaeological survey methods accepted by the Utah SHPO and other agencies in Utah to identify cultural resources that could be affected by the undertaking. Intensive-level methods consisted of Sheri Murray Ellis of Certus inventorying the area by walking multiple transects spaced no more than 15 meters (50 feet) apart.

Navigation within the survey areas was accomplished using a handheld GPS unit capable of sub-meter accuracy, air photos, and physical landmarks. A cutoff age of 50 years using 2024 as the base year (i.e., created during or before 1974) was used to identify resources requiring documentation and evaluation under 36 CFR §800.

Because no buildings or structures unrelated to the canals that are one of the subjects of the project will be physical altered, moved, demolished, or otherwise directly impacted by the proposed undertaking, historical resources of this type were not documented as part of the survey reported herein.

No field survey was carried out within the No Action impact area/APE save for those locations that overlap with the project-specific survey areas. The No Action impact area/APE was assessed via file search.

Resource Evaluation Methods

Certus employed regulatory standard methods for evaluating the historical significance of cultural resources encountered during the field inventory. To that end, Certus evaluated all identified cultural resources for their eligibility for listing on the National Register of Historic Places (the National Register). The evaluation considered the four criteria of the National Register as listed in 36 CFR §60.4 and followed the guidelines issued by the National Park Service (NPS) in Bulletin 15, *How to Apply the National Register Criteria for Evaluation* (NPS). The National Register criteria state that a resource may be considered eligible for listing on the Register if it:

Criterion A – is associated with events that have made a significant contribution to the broad patterns of our history; OR

Criterion B – is associated with the lives of persons significant in our past; OR

Criterion C – embodies the distinctive characteristics of a type, period, or method of construction, or represents the work of a master, or possesses high artistic values, or represents a significant and distinguishable entity whose components may lack individual distinction; OR

Criterion D – has yielded, or may be likely to yield, information important in prehistory or history.

Resources considered potentially eligible for the National Register pursuant to one of the above criteria are also to be assessed for integrity of location, design, setting, materials, workmanship, feeling, and association. To be eligible for listing on the National Register, the resource must possess integrity of those elements directly related to the criterion or criteria under which it would be determined eligible.

Findings for the Survey Area

Certus identified 13 cultural resource sites in the survey area for the Wellsville Canyon Watershed Plan (see **Table 2**). Their locations are shown in **Figures 7–10.** All of the sites date to the historic period, and most are linear historical features, such as canals and railroads. Others are associated with infrastructure, while others include two cemeteries and the remains of what may have been a historical dugout. Descriptions of the sites are discussed in more detail in the sections below.

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Figure 7. Survey results; Map 1 of 4

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Figure 8. Survey results; Map 2 of 4

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Figure 9. Survey results; Map 3 of 4

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Figure 10. Survey results; Map 4 of 4

Table 2. Sites in the current survey area

Site Number	Description	Recommended Eligibility
42CA88	Utah Northern Railroad/Union Pacific Railroad	Eligible
42CA174	Wellsville-Mendon Lower Canal system	Eligible
42CA184	Wellsville-Mendon Upper Canal system	Eligible
42CA198	Wellsville Canal/East Field Lateral	Eligible
42CA322	Mendon South Canal	Eligible
42CA337	Ogden, Logan & Idaho Railroad	Eligible
42CA338	Stone Foundation & Fire Ring	Ineligible
42CA339	Mendon Cemetery	Eligible
42CA340	Wellsville Dam & Reservoir	Ineligible
42CA341	Wellsville Cemetery	Eligible
42CA342	Mendon Main Street Culvert & Rock Wall	Ineligible
N/A	Wellsville 200 East Culvert	Ineligible
N/A	Wellsville Canyon Creek Bridge (Structure 005051D)	Ineligible

Resources Noted but Not Documented

As noted previously, buildings and structures not related to the water management and distribution features such as canals, culverts, etc. but located within the survey area were not documented in detail as they will not be altered, demolished, or otherwise directly affected by the proposed projects even if they are located within the survey area. Those structures that would be altered, such as culverts and canal water control features, were documented. Buildings located within 660 feet of the Wellsville-Mendon Lower Canal (42CA174), which would be piped as part of the proposed project, were assessed for visual impacts from the piping. These resources are discussed below.

Archaeological Sites

As mentioned previously, Certus identified 13 cultural resource sites in the survey area (see **Table 2**). Descriptions of the sites are provided below along with discussions of their eligibility for the National Register.

Site 42CA88—Utah Northern Railroad

Site 42CA88 is the Utah Northern Railroad (sometimes referred to as the Utah & Northern Railroad). Certus documented 11,436 meters (7.1 miles) of the railroad during fieldwork for the present undertaking. Most of this length occurs in a single long segment extending from northeast of Mendon to a point southeast of Mendon. A second, shorter segment extends through the northeast part of Wellsville, and a third documented segment is located between Wellsville and Hyrum. Numerous segments of this railroad have been documented previously in Cache County and other counties, including two short segments of the site included in the current documentation update.

Along nearly the entire portion of the site reported herein, the railroad consists of a single track on a low gravel ballast berm that is consistently less than 1 meter tall. One short segment of a siding located near Wellsville was also documented. The tracks throughout the documented portion of the site are standard gauge with typical segmented rails (compared to modern seamless rails) and creosote-treated wooden ties. Occasional culverts, signal boxes, and switches are present along the rail line, but their ages remain suspect in most cases. Many of the culverts are small, simple boxes constructed of railroad ties or other lumber, though a few concrete and corrugated metal pipe culverts were observed.

Construction of the rail line (as a single-gauge line) by the Utah Northern Railway Corporation began in 1871 at Three Mile Creek, now modern-day Perry, Utah. Initially, construction of the line continued north to the Collinston Divide, then east into Cache Valley. It reached Logan in 1873. The railroad was sold to the Utah and Northern Railway, a subsidiary of Union Pacific Railroad, and was later organized as the Union Pacific's Oregon Short Line and Utah Northern Railway. The main line of the railroad served multiple branch lines in the Cache and Bear River valleys that primarily supported the sugar beet industry. Around 1877, the rail line was converted to a standard gauge line, and additional changes to the line occurred until about 1900.

National Register Eligibility Review

Site 42CA88 has been ***determined eligible*** for the National Register under Criteria A and C as a result of multiple past documentation efforts, including those for segments included in the current updated documentation. The basis of this determination was the important role the railroad played in transportation, industry, and the economy of the Cache Valley (Criterion A) as well as for its retention of specific notable engineering features (Criterion C). The portion of the railroad discussed herein retains integrity of location, materials, design, workmanship, setting, feeling, and association. Certus recommends the current determination that the site is eligible for the National Register be retained and the site qualify as a historic property under 36 CFR §800.

Site 42CA174—Wellsville-Mendon Lower Canal

Site 42CA174 is the Wellsville-Mendon Lower Canal. It is also sometimes referred to as the Hyrum-Mendon Canal or just the Lower Canal. The entire canal from the Hyrum Dam to the Cutler Wash where the canal terminates was documented by the Bureau of Reclamation in 2020 (Nelson 2020). This previous documentation, therefore, covers all portions of the canal that would be subject to impacts from the proposed undertaking.

The overall canal is 15.6 miles long and was part of the federal Hyrum Project that began with the construction of the Hyrum Dam and reservoir in 1934 and 1935. Construction of the canal reportedly occurred during this same timeframe under the efforts of the Knowlton & Rupert company (Nelson 2020). Excavated soils from the canal channel were placed on the downhill side (generally the east and north sides of the channel), and a maintenance access road was established on top of the berm. The berm stands as much as 8 feet tall in some locations. The canal was rehabilitated in 1976. This effort included replacing deteriorated water control features and steel flumes.

The existing canal channel consists of lined and unlined segments. Where lined, the channel has a maximum section bottom width of 4 feet, a water depth of 3 feet, and 1.5:1 side slopes (Nelson 2020). The top of the channel measures approximately 7 feet wide.

In their 2020 documentation, Reclamation reported more than 100 features along the length of the canal. Most represent turnouts, culverts, and diversion structures, though a variety of crossings (e.g., slab bridges), pipes crossing the canal, siphons, trash racks, and similar features were also reported.

The Wellsville-Mendon Lower Canal is associated with a very large network of field-level distribution ditches, many of which presumably date to the historic period. These ditches tend to be small—usually less than 1 meter wide and 50 centimeters deep—unlined, and routinely dredged, recut, and relocated depending on the needs of the individual landowner and to accommodate new development occurring throughout the area. The majority of these ditches lack water control features and are not visible in aerial images. They are also not depicted on topographic maps. As such, it is all but impossible to tell from their physical features whether they date to the historic period or modern era. Given this, Certus did not map every associated field-level ditch. The most extensive network of these ditches is found along the street grids of Wellsville and Mendon, where shallow ditches often appearing as little more than swales extend along one side or the other of each roadway. Most of these ditches would be replaced with a piped pressurized irrigation, though that piping would largely be confined to existing roadways and would not necessarily impact the ditches themselves.

National Register Eligibility Review

Site 42CA174 was ***determined eligible*** for the National Register under Criterion A as a result of its past documentation, including the 2020 documentation by Reclamation. The basis of this determination was the important role the canal, and the associated Hyrum Project, had on the historical development of the Cache Valley. The canal was a key factor in opening lands in the southwest part of the valley for enhanced agricultural production, which, in turn, brought more land under irrigation and boosted the local economy. Given that agriculture formed the core of the economy in the area during the historic period and continues form a large portion of the economy today, it is difficult to overestimate the role the canal played for the communities of Wellsville and Mendon.

Site 42CA184—Wellsville-Mendon Upper Canal

Site 42CA184 is the Wellsville-Mendon Upper Canal. It is also sometimes referred to simply as the Upper Canal. The entire canal through the current project area, a length of 4,450 meters (2.76 miles), was documented by the Bureau of Reclamation in 2015 as part of their documentation of the site from its origin at Hyrum Reservoir (Nelson 2015).

The canal was constructed in the 1930s as part of Reclamation's larger Hyrum Project and measured 5.4 miles long in total. It was operated by the Wellsville Irrigation Company and was intended to bring water to dry lands in the southwest part of Wellsville that lie above the Wellsville-Mendon Lower Canal. Through the current project area, the canal is a combination of piped and open channel. Where the channel is open, it measures roughly 5 feet wide across the top and 3 feet wide across the bottom. It is unlined and 3 to 4 feet deep. Occasional modern turnouts are found along the north and east sides of the canal where the channel is open, but most such features have been removed as a result of piping. More than half of the 4,450-meter long segment in and near the current project area has been piped underground.

The Wellsville-Mendon Upper Canal is associated with a small network of field-level distribution ditches, many of which likely date to the historic period. These ditches tend to be small—usually less than 1 meter wide and 50 centimeters deep—and are routinely dredged, recut, and relocated depending on the

needs of the individual landowner and to accommodate new development occurring throughout the area. These ditches lack water control features. They are also not depicted on topographic maps and often cannot be distinguished from fencelines and similar features in aerial images due to their small size. As such, it is all but impossible to tell from their physical features whether they date to the historic period or modern era. Given this, Certus did not map every associated field-level ditch.

National Register Eligibility Review

Site 42CA184 was ***determined eligible*** for the National Register under Criterion A as a result of its past documentation, including the 2015 documentation by Reclamation of the segment in the current project area. The basis of this determination was the important role the canal, and the associated Hyrum Project, had on the historical development of the Cache Valley. Although this evaluation is accurate, and Certus agrees the site has significance under Criterion A in the area of agriculture and economics, the canal segment discussed here generally lacks integrity of design, workmanship, feeling, and association due to the piping of so much of the formerly open channel. Because of this lack of integrity, Certus recommends this portion of the site be considered non-contributing to the eligibility of the overall canal.

Site 42CA198—Wellsville Canal/East Field Lateral

Site 42CA198 is the Wellsville Canal, also known as the East Field Canal. The site intersects the current survey area at the base of the Hyrum Dam and extends north and northwest through the western Hyrum area. A roughly 5,454-meter (3.4-mile) long segment of the 5.4-mile long canal is addressed here as is one segment of a field distribution ditch associated with the canal. The southernmost portion of the segment has been documented twice, once in 2015 and again in 2023. The remaining portion of the segment had not been previously documented.

Along the documented segment, the canal channel is primarily open and unlined. It has a U-shaped cross-section and measures between 9 and 12 feet wide and roughly 4 feet deep. Several turnouts, culverts, and siphons are located along the canal channel. Most appear to be modern replacements of historical features or modern additions to the canal site. Several lateral ditches associated with the main canal were also noted. The field distribution ditch in the survey area is located near Hyrum Dam. It is a small ditch measuring no more than 2 meters wide (and generally less than 1 meter wide) and less than 50 centimeters deep. This ditch segment includes a turnout and a Parshall flume, both of which were documented previously in 2015 and 2023 along with portions of the main canal.

The Wellsville/East Field Canal was initially constructed as a 5-mile long irrigation ditch in the late 1850s by local settlers with water first turned into the ditch in 1860 (Fortier 1897:28). The ditch was formally incorporated under the name of the Wellsville East Field Irrigation Canal Company in 1881 (Fortier 1897:29). At that time, the ditch was estimated to be approximately 2.7 meters (9 feet) wide and was unlined (i.e.., earthen). The ditch drew water directly from the Little Bear River. When the Hyrum Project was constructed by the Bureau of Reclamation in 1933 and 1934, the path of the river was interrupted by the new reservoir, and the water for the Wellsville-East Field Canal was diverted from a new location—the Wellsville Pumping Plant—below (west of) the new dam. Reclamation's description of the Hyrum Project implies the Wellsville Canal and Wellsville/East Field Canal were two separate systems. The description states:

> Water diverted into the pump plant penstock would drive the turbine connected to a pump to raise water to the Wellsville Canal. Just upstream from the pump, the penstock

> would split into two pipes, one to drive the turbine and one to supply the pump. The pump would discharge water into a steel pipe which would carry it across the valley to the canal. The canal would be about 5.4 miles long and run generally westward. Water discharged from the turbine would be released into the existing Wellsville-Eastfield (sic) Canal to satisfy pre-existing water rights cut-off (sic) by construction of the dam (Simonds 1998:6).

Current topographic maps, as well as modern texts, refer now only to the Wellsville Canal, with no reference to the Wellsville/East Field Canal. At the time of construction of the Hyrum Project, the canal referred to as the Wellsville Canal is the feature shown on modern maps as the Wellsville-Mendon Upper Canal (Simmonds 1998). The Wellsville-East Field Canal appears to be the canal feature now shown on modern maps and referred to as the Wellsville Canal. In 1898, the Wellsville-East Field Canal was referred to as "the largest and most important of the lower canals taking water from Little Bear river (sic)" and was responsible for the irrigation of more than 1700 acres of lucerne (alfalfa), wheat, oats, and other vegetables and fruits (Fortier 1897:28).

National Register Eligibility Review

Site 42CA198 was ***determined eligible*** for the National Register under Criterion A as a result of its past documentation, including the 2015 and 2023 documentation. The basis of this determination was the important role the canal, and the associated Hyrum Project, had on the historical development of the Cache Valley. Certus agrees the site has significance under Criterion A in the area of agriculture and economics and recommends this portion of the site be considered contributing to the eligibility of the overall canal.

Site 42CA322—Mendon South Canal

Site 42CA322 is the Mendon South Canal. A roughly 3,494-meter (2.2-mile) long segment is addressed here. This entire segment of the canal, which comprises almost the entirety of the main channel, was documented most recently in 2023 by the Utah Department of Agriculture and Food (UDAF) (Haycock 2023). In that documentation, the UDAF wrote:

> The Mendon South Canal is an unlined earthen canal that has been maintained and re-dug by local landowners for at least 30 years. It is connected to 42CA174, the Wellsville-Mendon Lower Canal, which was constructed in 1934, though the Mendon South Canal does not appear to have been constructed until the 1950s at the earliest. There is not a water rights date associated with the canal directly, but it is depicted on a 1961 topographic map of Logan, Utah. It pulls water from a diversion on the Little Bear River.
>
> The canal is approximately 2 meters at its widest, and 4 feet deep, but gets progressively smaller as it heads north, narrowing down to less than [1 foot] deep by [2 feet] wide at the northern end. The earthen banks have been re-dug and maintained, but the bank is still eroding due to water erosions, agricultural practices, and vegetation disturbance. The only head gates in the recorded system were installed in the 1980s, but they have not impacted the overall integrity of the site.

Certus revisited the portions of the canal in and near the current survey area and found them to be as described by the UDAF in 2023. Several small field-level ditches are associated with this canal system,

but they are not located within the current survey area and were not, therefore, documented. These ditches are generally unlined, no more than 1 meter wide, and less than 50 centimeters deep.

Additional research into the canal's history indicates a water right was issued to the Mendon South Canal Company for water from Gardner Creek in May 1860 (Utah Division of Water Rights 2024). This right was not certified until the 1950s. Aerial photographs from 1937 also provide information about the age of the canal. Specifically, the canal is visible in these images, indicating the canal was not constructed during the 1950s as the UDAF indicated in their original documentation. GLO maps are, unfortunately, unhelpful as the available maps do not provide illustration of the relevant landscape for the period around or after the time the water right was granted. These maps date to 1856 and 1878, but the latter map does not include illustration of the area containing the canal. While no definitive construction date could be found through the additional research, the preponderance of evidence available suggests the canal was constructed earlier than indicated by the UDAF in their 2021 site form and that the canal very likely dates to the settlement period in the Mendon and Wellsville area.

National Register Eligibility Review

Site 42CA322 was determined eligible for the National Register under Criterion C as a result of the 2023 documentation by UDAF. The basis of this determination was that the canal "does represent the construction methods of agricultural canals in the mid 1900s (sic) and maintains integrity in this aspect" (Haycock 2023). The Utah SHPO appears to have concurred with this determination.

Certus disagrees with the current determination and recommends the site ineligible under Criteria B, C, and D and ***eligible under Criterion A***. The site was most likely constructed much earlier in the historic period than indicated in the original site record and evaluation and. Therefore, cannot "represent the construction methods of agricultural canals" during the mid-1900s as indicated therein. Rather, the canal was, most likely, present during the pioneer period. As such, the canal would have facilitated settlement and both subsistence and for-profit agriculture during this time. The canal appears to have become less significant in the local economy over time.

No significant associations between the canal and historically important persons could be established through the paper trail. Regarding the construction nature of the site, Certus disagrees the current channel is a significant representative of a type, style, or manner of construction. Rather, the channel is a simple shallow trench, likely excavated with heavy equipment, and generally indistinguishable from irrigation channels excavated today using similar methods. The current channel does not represent any adaptations to meet engineering challenges, any notable construction techniques, or any notable water control features. Additionally, the site has not yielded and does not have the potential to yield information important to improving our understanding of the past.

Site 42CA337—Ogden, Logan & Idaho Railway

Site 42CA337 is the Ogden, Logan & Idaho Railway, also known as the Utah-Idaho Central Railroad. This site intersects the current survey area north of Mendon. The original alignment extended throughout the current project area, but only the segment reported here was identifiable on the ground and in the survey area. This segment measures approximately 930 meters (3,051 feet) long. This segment of the site appears as little more than a low, deflated earthen berm that is heavily overgrown with

vegetation. No features other than the berm were observed. The ties and rails were removed after the rail line was abandoned in 1947. It does not appear any segments of the railroad have been documented previously in Cache County, though several segments have been documented in Weber and Box Elder counties.

The Ogden, Logan & Idaho Railway began as a combination of urban streetcar and suburban lines of the Ogden Rapid Transit Company and the Logan Rapid Transit Company in 1914. The two lines were connected via the construction of a new line in the Brigham City area to connect the established systems. The segment discussed here was constructed around 1915 using the abandoned route of the Utah Northern Railroad, which was built in 1873 and abandoned in 1890. When completed, the railroad's total length was 94.63 miles, excluding branch lines. The railroad company specialized in transporting freight, which was a major factor in boosting the local agricultural industry by providing a direct connection for farmers and ranchers to outside markets, but still provided passenger service, generally by a single car amongst numerous freight cars. The rail company began to falter during the mid-1900s as buses began to replace railroads for passenger transportation. In 1947, the company filed for and was granted permission to abandon the railroad and dissolve the company.

National Register Eligibility Review

The Ogden, Logan & Idaho Railroad, in its entirety, has been ***determined eligible*** for the National Register under Criteria A and B as a result of its past documentation. This determination was based on the important role the railroad played in connecting the Cache Valley to the rest of the Wasatch Front and to the broader national markets, which greatly boosted the local economy by increasing agricultural exports. The site is also directly associated with David Eccles, who was an important local/regional businessman who rose to notoriety because of his business exploits, including his involvement in railroading along the Wasatch Front. The site was determined ineligible for the National Register under Criteria C and D. Certus agrees with the existing determination of eligibility for this site and recommends it be retained for the purpose of the current undertaking. Certus does recommend the segment of ***the site documented here be considered non-contributing*** due to a lack of overall integrity. The site along this segment consists solely of a deflated berm that is overgrown with vegetation and isolated from the rest of the former railroad site by land development and destruction of the berm to accommodate agricultural activity.

Site 42CA338—Stone Foundation & Fire Ring

Site 42CA338 is an apparent foundation located along Threemile Creek northwest of Mendon. The site consists of a shallow, rock-lined depression and a metal fire ring. The age of the site could not be confirmed through research with local residents and archival records, but the rocks of the foundation exhibit weathering and sediment accumulation that suggests the feature could be more than 50 years old. No artifacts were observed at the site—only modern items, such as pallets and a 55-gallon drum) were observed. These materials could easily be associated with camping activity associated with the metal fire ring, which appears more recent than the depression. The depression measures roughly 7 meters long by 2.5 to 3 meters wide by less than 50 centimeters deep. The apparent fire ring is located roughly 5 meters north of the foundation and consists of what appears to be part of a 55-gallon drum buried in the ground.

The site is located near Walter Ahern Spring. Topographic maps depict "Ruins" in the area very near the depression and could well represent the depression, as no other features that could meet that definition

were observed. Land patent records indicate the land where the site is located was patented by John H. Yonk in 1892. An 1878 GLO map shows a structure, labeled as "Herd House," located in the vicinity of the site. It is unclear if "Herd" refers to a person's last name or a livestock shelter. Biographical records for John H. Yonk do not suggest he constructed a dugout in the area where the site is located. Rather, they identify a specific house and farmstead, still standing, in nearby Petersboro as his primary construction. Although several parties with the surname of Herd were found in genealogical records for Utah, none could be matched to the site in question here. Walter Ahern, after whom the adjacent spring was named, moved to the Petersboro area in 1893 with his parents and sister, where the family "homesteaded on 140 acres of land and built a small two room rock house." The house was given to Walter after his marriage in 1897. The house is described in family records as follows and appears to match the location of the site discussed here:

> Nestled in these hills is where John and Dorthea had homesteaded on 140 acres of land and built their home. It was a small rectangular house built in a hollow a little closer to the mountains than everyone else. It had four thick rock walls for warmth in the winter and coolness in the summer. A large single room and front door were on the south and a kitchen and pantry with a single large window on the north side. Two small bedrooms were upstairs. Not far from the front door was a small creek called Three Mile Creek. Nearby was a small spring that was later officially named by the US Forest Service, the Walter Ahrens Spring, and is still shown on many of the maps of the area. (M. Young 2024)

Although the location of the Ahern house appears to match that of the present site, it is unclear if the rock feature identified there represents the Ahern house or another structure associated with the homestead.

National Register Eligibility Review

Site 42CA338 is ***recommended eligible*** for the National Register under Criteria A and D. The site retains integrity of location, setting, feeling, and association. Its integrity of materials, design, and workmanship has been compromised by the demolition of the superstructure associated with the foundation.

The site appears to be directly associated with pre-1900 settlement in the Cache Valley broadly and the Petersboro area specifically and is representative of the nature of such settlement during the pioneer era. This would render the site eligible for the National Register under Criterion A.

The site appears to be associated with Walter Ahern and his family. Neither Mr. Ahern nor his spouse or children rise to the level of historical significance that is needed to find the site eligible under Criterion B. The Aherns were farmers on what appears to have been a relatively small scale and were not important players in that or other economic or social sectors.

The site does not represent a type, style, or manner of construction, is not the work of a master, and does not possess high artistic value. It also does not appear to be associated with a larger cultural entity (such as a district or landscape) to which it may contribute. Thus, the site is considered ineligible for the National Register under Criterion C.

Given the timing of when this apparent homestead was occupied, an accumulation of cultural deposits through a subsurface trash dump or privy vault may well be present in the area but

obscured by the thick duff layer on the ground surface at the time of fieldwork. The homestead was occupied for a long enough period of time that refuse disposal would have occurred without organized municipal trash removal. As such, this site has the potential to yield information that could improve our understanding of such topics as access to goods, cultural practices, and economic status during the settlement period in Petersboro. As such, Certus recommends this site eligible for the National Register under Criterion D.

Site 42CA339—Mendon Cemetery

Site 42CA339 is the historical Mendon City Cemetery. The cemetery was established in 1861 with the first burial—a man named John H. Richard. This came a little over a year after the first settlers began settling in the area. The cemetery sits on a gentle east-facing slope on the western margin of the Mendon community. A loop road provides access through the property. The road has a 12-foot wide travel surface, and there are 288 grave lots in the original cemetery section. The cemetery was expanded further west with a new loop road and burial plat in 2019 and 2020. This new section is excluded from the site at this time. Historical grave markers are present on the property and largely consist of sandstone slabs, short obelisk-like structures, occasional cross-shaped markers, and weathered wooden markers. Landscaping is largely limited to a combination of native and introduced trees along a drainage on the north edge of the site and introduced lawn grasses where the graves are located.

National Register Eligibility Review

Site 42CA339 is ***recommended eligible*** for the National Register under Criterion D. The site retains integrity of location, materials, workmanship, setting, feeling, and association. Lacking specific original design information, the integrity of design cannot be assessed.

As a general rule, cemeteries are not ordinarily considered eligible for the National Register and are one category of cultural resource type that must meet certain additional criteria considerations to be determined eligible for listing on the Register. The specific consideration for cemeteries states that to be listed, a cemetery must derive its primary importance from graves of persons of transcendent importance, from the age of the cemetery, from distinctive design features, or from association with historic events. Cemeteries can also be considered eligible for the National Register under Criterion D, and, if so, do not need to meet the conditions of the criteria considerations.

Certus recommends the Mendon City Cemetery eligible under Criterion D. This recommendation is based on the fact that the first burials in the cemetery occurred during the pioneer/settlement period of the community, when burial practices are not well documented in publicly available records and were more likely to include traditions from the native countries or native cultures of the deceased than later burials where such practices became more standardized as the community grew more homogenous in its cultural identity. Examination of the burials could provide information about the burial practices of the settlers before standardization occurred. Additionally, examination of burials could yield information about individual and community health conditions, nutrition, and related characteristics of the settler population.

Site 42CA340—Wellsville Dam & Reservoir

Site 42CA340 is the Wellsville Dam and Reservoir, located on the eastern fringe of the Wellsville community. The site, as defined here, begins on the south where the edge of the reservoir is shown in

topographic maps and ends on the north at the foot of the dam. The site includes a concrete post-and-cable "fence" along a portion of the east side of the reservoir, apparently to prevent parking in an agricultural field located between the 200 East roadway and the bank of the reservoir. The dam measures approximately 175 feet long and stands up to 20 feet tall. The base of the earthen dam is estimated at 40 feet wide. The reservoir appears to be fed by a natural spring located at its south end and shown on topographic maps. There is no named creek or other waterway associated with the reservoir.

Very little information could be found about the history of the Wellsville Reservoir. At least the beginnings of the reservoir are visible in a 1937 aerial image, the earliest available online for the area. The reservoir is not depicted on GLO maps from the 1870s though the spring feeding it is shown. A newspaper article from 1916 regarding fishing in Utah mentions the Wellsville Dam. Thus, we can assume the original dam, which does not appear to be the same as the current dam, was constructed sometime between the late-1800s and 1916. The Utah Division of Water Rights indicates the current dam was constructed ca. 1957 and that it was altered in 1988 through rehabilitation of the downstream slope. The Wellsville City Irriigation Company owns the property according to the water rights record. It is extremely likely the dam was constructed as a municipal project and not a private undertaking. Today, the reservoir is routinely stalked with fish and used for recreational fishing and other activities.

National Register Eligibility Review

Site 42CA340 is ***recommended ineligible*** for the National Register under all criteria. The site retains integrity of location, design, materials, workmanship, setting, feeling, and association but appears to lack historical significance.

Available information about the reservoir suggests its purpose is recreation as opposed to culinary or irrigation water provision or hydroelectric generation—the most common functions of reservoirs in the general area. The site is currently managed as a community fishery and part of a recreational complex including a park on the west bank and a trail circumnavigating the reservoir. While the reservoir may be popular with local citizens, it does not appear to have played a significant role in community history and is not associated with any known historical events of note. As such, the site would be ineligible for the National Register under Criterion A.

The site appears to be associated with the municipal government of Wellsville and not with any person or persons of historical importance. Thus, the site is ineligible under Criterion B.

The site includes an engineered and constructed historical feature in the form of the earthen dam. The dam does not exhibit any notable engineering or construction character and is not representative of a type, style, or manner of construction, is not the work of a master, and does not exhibit high artistic value. It also is not associated with a larger cultural entity, such as a district or landscape, to which it may contribute. As such, the site is ineligible under Criterion C.

This site has not yielded information important to improving our understanding of the past and does not appear to have the potential to do so with additional investigation. Therefore, the site would be ineligible for the National Register under Criterion D.

Site 42CA341—Wellsville City Cemetery

Site 42CA341 is the historical Wellsville City Cemetery. The cemetery site, as defined here, encompasses only that portion of the land currently used for burials and not the full land parcel, which has yet to be developed. The cemetery sits on a low rise with a slope downward to the south and southwest. The main

entry is found in the southwest corner of the site and is flanked by two short mortared stone columns. The cemetery was established in 1856 as settlers were beginning to homestead the area.

At present, the cemetery contains at least 3,674 burials found in a series of rectangular blocks separated by one-lane paved roads. Introduced mature pine trees as well as oak and maple trees are found throughout the cemetery but are largely limited to the westernmost blocks and one block in the eastern half of the site where pine trees are arranged in a north-south line. Grave markers are fairly typical and include sandstone and granite slabs, short obelisks, and similar forms.

National Register Eligibility Review

Site 42CA341 is ***recommended eligible*** for the National Register under Criterion D. The site retains integrity of location, materials, workmanship, setting, feeling, and association. Lacking specific original design information, the integrity of design cannot be assessed.

As a general rule, cemeteries are not ordinarily considered eligible for the National Register and are one category of cultural resource type that must meet certain additional criteria considerations to be determined eligible for listing on the Register. The specific consideration for cemeteries states that to be listed, a cemetery must derive its primary importance from graves of persons of transcendent importance, from the age of the cemetery, from distinctive design features, or from association with historic events. Cemeteries can also be considered eligible for the National Register under Criterion D, and, if so, do not need to meet the conditions of the criteria considerations.

Certus recommends the Wellsville City Cemetery eligible under Criterion D. This recommendation is based on the fact that the first burials in the cemetery occurred during the pioneer/settlement period of the community, when burial practices are not well documented in publicly available records and were more likely to include traditions from the native countries or native cultures of the deceased than later burials where such practices became more standardized as the community grew more homogenous in its cultural identity. Examination of the burials could provide information about the burial practices of the settlers before standardization occurred. Additionally, examination of burials could yield information about individual and community health conditions, nutrition, and related characteristics of the settler population.

Site 42CA342—Mendon Main Street Culvert & Rock Wall

Site 42CA342 is a historical rock wall and possible historical culvert under Main Street in Mendon. The site is only visible on the east side of Main Street and is found on an unnamed drainage channel between 200 North and 300 North. The rock wall measures approximately 47 meters (154 feet) long and ranges in height from roughly 3 feet to 5 feet. The stones appear to be locally procured and unaltered but selected and placed based on their angular (square and rectangular) shapes. They are dry laid, and the one is one stone thick. Portions of the wall have deteriorated and collapsed.

The culvert is found at the base of the wall in a relatively shallow drainage. It consists of two 24-inch diameter concrete culvert pipes placed side-by-side. A few feet above them is a small, 10-inch diameter corrugated metal pipe that appears newer than the concrete pipes.

National Register Eligibility Review

Site 42CA342 is ***recommended ineligible*** for the National Register under all criteria. The site retains integrity of location, materials, setting, feeling, and association. Lacking specific original design information, the integrity of design and workmanship cannot be accurately assessed.

The culvert is part of simple municipal infrastructure to retain the Main Street roadway and provide for water drainage. It is not associated with any important historical events or patterns of history, which indicates it is not eligible for the National Register under Criterion A.

No official information about the site could be located, but it is very likely it was constructed by and under the auspices of the local municipal government. As such, it is not considered to be associated with a person or persons of historical importance and would, therefore, be ineligible for the National Register under Criterion B.

Although the site comprises a constructed feature, it is not representative of a type, style, or manner of construction, is not the work of a master, and does not possess high artistic value. It also does not appear to be associated with a larger cultural entity, such as a district or landscape, to which it may contribute. Therefore, the site is ineligible for the National Register under Criterion C.

This site has not yielded information important to improving our understanding of the past and does not appear to have the potential to do so with further investigation. Thus, the site is ineligible for the National Register under Criterion D.

Structures

Two structures were documented in the survey area. These comprise a culvert and a bridge that could potentially be altered to address flooding concerns in Wellsville.

Wellsville 200 East Culvert

This culvert is located on 200 East in Wellsville near the city cemetery. The culvert extends diagonally under 200 East with the east end located further north than the south end. The north headwall is located on the east side of historical Utah Northern Railroad. The culvert consists of a 36- to 48-inch diameter concrete pipe with concrete headwalls on each end. Based on the locations of the headwalls, the culvert pipe is up to 150 feet long. The headwalls have flared and slightly tapered wing-walls that were cast-in-place as evidenced by board form marks on the concrete. The headwall on the east side is stamped with the date 1926.

National Register Eligibility Review

Culverts and bridges in Utah are generally reviewed under criteria established in the *Utah Historic Bridge Inventory* (Mead & Hunt 2011), which state that for concrete culverts to be eligible for the National Register, they should be constructed between 1913 and 1923 (the early years of standard plans). Large skews and concrete pipe length are not considered important characteristics of such culverts. Given this culvert was constructed in 1926, according to the date stamp on the structure itself, it would not meet the criteria noted in the Inventory. As such, this culvert would be ***ineligible*** for the National Register under all criteria.

Wellsville Canyon Creek Bridge (Structure 005051D)

This bridge is located at 200 North and 300 East in Wellsville and carries traffic over Wellsville Canyon Creek. It is referred to as Structure 005051D by the Utah Department of Transportation (UDOT), which owns and maintains it. The culvert was built ca. 1920 and is a concrete frame type structure. It has a single span measuring 20 feet long and a total structure length of 23 feet. The parapet comprises a combination concrete post/pillar and steel pipe railing. UDOT records indicate the bridge was widened in 1940. The *Utah Historic Bridge Inventory* (Mead & Hunt 2011) indicates that the bridge is considered an early example of this bridge type in Utah.

National Register Eligibility Review

Structure 005051D appears in the *Utah Historic Bridge Inventory* (Mead & Hunt 2011) and was ***determined ineligible*** for the National Register under all criteria. The evaluation in the Inventory notes that although the bridge is considered significant for its early use of the structure type, alteration in 1940 to widen it compromised its integrity, thereby rendering it ineligible.

Visual Impact Analysis for Canal Piping

The proposed piping of the Wellsville-Mendon Lower Canal would change the viewshed for properties near the currently open channel. These changes would result from the visual loss of trees along the canal that may exist solely because of seepage from the canal and could die from the loss of that seepage. To account for these possible visual changes, the NRCS instructed Certus to assess the impact to setting and feeling for historic properties located within 1/8 mile (660 feet). The NRCS also instructed Certus to consider only those historic properties for which viewshed is or may be a component of their historical significance, which generally limits the evaluation to historical buildings and select sites for which setting is a character-defining feature.

Within the canal viewshed (i.e., 660 feet from each bank of the channel) are the following archaeological sites: the Utah Northern Railroad (42CA88), Wellsville-Mendon Upper Canal (42CA184), the Kidman Farmstead (42CA185), the Wellsville Canal/East Field Lateral (42CA198), and the Hyrum Reservoir Spillway (42CA200). Of these, only the Kidman Farmstead (42CA185) would include setting as a key component of site eligibility. Specifically, the homestead is located directly adjacent to the Wellsville-Mendon Lower Canal channel and a tall row of trees lining it (see **Figure 11**). The loss of trees adjacent to the site would result in a substantial change in the viewshed to and from the property. That said, the site has been undergoing changes by the property owner since 2020, when building debris and other materials were removed from the site. The main structure, the dwelling, was in the process of collapsing at that time and was being considered for removal by the property owner. Should the adjacent trees die



Figure 11. Kidman Farmstead (42CA185) showing setting with trees along canal

due to canal piping and be either intentionally removed or fall over on their own, the change in setting could be considered an adverse effect to the site.

The Utah SHPO HUB database identifies 74 buildings as having been documented within the canal viewshed. Of these, 33 have been determined eligible for the National Register. Certus evaluated visual impacts to these properties from piping the canal and the potential loss of trees. In assessing the potential impacts to the setting and feeling of nearby historic properties, one must consider the view as it currently stands and the view that may exist if the canal is piped. The Wellsville-Mendon Lower Canal is located on the gentle slope west of Wellsville and Mendon except for the extreme northern section, which runs east-west in the area north of Mendon. Because the terrain in the area of the canal slopes downward to the east, those properties located east of the canal are situated below the top of the canal and do not have a view of the open canal channel. Rather, the view of the canal comprises the flat-topped berm on the downhill side of the canal, which forms a linear bench-like visual feature. Current project plans call for leaving the berm intact and essentially unaltered (the new pipeline would be buried in the existing berm). Of the 33 eligible properties within the viewshed, all are located below the elevation of the canal. As such, piping the canal would have no visual impact on these properties as it relates to the channel or the berm. Additionally, very few trees are located along the canal in the areas of these eligible properties. Those trees that are present do not appear to be dependent on canal seepage to survive but are related to residential properties whereupon private landowners control the existence and health of the trees. As such, tree loss for elimination of seepage through piping the canal would not result in any adverse visual impacts to historic properties known to exist within the canal viewshed.

No Action Impact Area/APE

The NRCS instructed Certus to prepare an assessment of cultural resources that could be impacted under the No Action alternative considered in the EIS. Under this alternative, none of the watershed improvement measures proposed under the action alternatives would be implemented. As such, flooding in the project area would continue at current levels and as created by natural and man-made conditions outside the scope of the Wellsville Canyon Watershed Plan-EIS.

To assess impacts to cultural resources under the No Action alternative, Certus conducted a file search of SHPO records for known archaeological sites and historical structures within the area that would continue to experience flooding at current or naturally increasing levels (see **Figure 6**). This file search indicates that 18 archaeological sites and approximately 753 buildings and structures (most of them of historical age) have been reported within the No Action alternative APE. Of these, 11 archaeological sites and 341 buildings and structures have been determined eligible for the National Register. Three other archaeological sites and three buildings/structures in the area have not been evaluated for the National Register and may qualify as eligible for listing with further evaluation. It is important to note that many of these resources were documented several years ago, and their conditions may have changed such that they are no longer eligible for the National Register. Additionally, many of the buildings and structures that were identified as "out-of-period" (i.e., not at least 50 years old) when previously documented may now meet that age criterion and be considered eligible for the National Register. Lastly, many buildings and structures in the area have never been surveyed or evaluated for the National Register. Given the nature of the communities and their history, a substantial percentage of these resources are likely to be of historical age. As such, the number of National Register-eligible buildings and structures stated above should be understood within this context.

Under the No Action alternative, the cultural resources in that APE would be exposed to the same levels of flood and erosion impact as they have experienced to date. Over the last 10 years, the Wellsville and Mendon communities have seen several instances of notable flooding that resulted in road closures and water damage to select buildings and landscapes. No information could be found to indicate any historical structures or known archaeological sites were adversely affected by said flooding. Several of the archaeological sites in the No Action alternative area were documented during surveys for the current undertaking. Of these, none exhibited explicit evidence of flood damage. One would expect this level of impact to continue under the No Action alternative unless natural conditions (e.g., climate shifts) or anthropogenic factors outside the scope of the Watershed Plan-EIS create conditions for increased flood frequency or severity. Such changes cannot currently be predicted.

SUMMARY AND RECOMMENDATIONS

Certus conducted a cultural resources inventory for the Wellsville Canyon Watershed Plan-EIS under the jurisdiction of the NRCS. A file search for known historic properties in the viewshed of the Wellsville-Mendon Lower Canal was also conducted.

Eleven archaeological sites and two structures were documented in the survey area (see **Table 3**). Certus has recommended nine of these resources eligible for the National Register.

Table 3. Sites in the current survey area

Site Number	Description	Recommended Eligibility
42CA88	Utah Northern Railroad/Union Pacific Railroad	Eligible
42CA174	Wellsville-Mendon Lower Canal system	Eligible
42CA184	Wellsville-Mendon Upper Canal system	Eligible
42CA198	Wellsville Canal/East Field Lateral	Eligible
42CA322	Mendon South Canal	Eligible
42CA337	Ogden, Logan & Idaho Railroad	Eligible
42CA338	Stone Foundation & Fire Ring	Eligible
42CA339	Mendon Cemetery	Eligible
42CA340	Wellsville Dam & Reservoir	Ineligible
42CA341	Wellsville Cemetery	Eligible
42CA342	Mendon Main Street Culvert & Rock Wall	Ineligible
N/A	Wellsville 200 East Culvert	Ineligible
N/A	Wellsville Canyon Creek Bridge (Structure 005051D)	Ineligible

A total of 33 previously reported eligible buildings and 5 archaeological sites are located in the viewshed of the Wellsville-Mendon Lower Canal (42CA174), which would be piped as part of the planned watershed improvements. This piping could lead to loss of trees that exist along the canal due solely to seepage from the channel. Certus conducted an analysis of the impacts of this tree loss on the eligible resources and recommends that only one resource—the Kidman Farmstead (42CA185)—has the potential to by impacted due to its proximity to the canal and a mature line of trees along the canal. Tree

loss in this location would adversely affect the setting and feeling of the site; however, the owner of the land on which the site is located noted in 2024 that he intends to remove the dwelling at the site when it deteriorates further. While the building was still present at the time of fieldwork discussed herein, it may be removed at any time. The landowner has already removed other components of the site, including other structural debris and artifacts. If the dwelling is not present at the time the proposed canal piping occurs or at the time of any tree loss, the site would become ineligible for the National Register, and impacts to the site would become meaningless under 36 CFR §800.

Anticipated Effects from the Proposed Action

The proposed watershed improvement projects would involve piping of extensive portions of some of the historical irrigation site networks documented in the survey area, the placement of buried pipes for pressurized irrigation, creek bank improvements, and recreational improvements, among other activities. Where the canals and ditches are piped, historical water control features would be removed or buried. More specific information about the anticipated impacts to the eligible sites listed in **Table 3** and recommended findings of effect under 36 CFR §800 are provided in **Table 4**. As can be seen from this table, Certus is recommending a finding of **adverse effect** for two of the eligible sites due to the extent the systems would be altered through replacement with underground pipelines.

Table 4. Anticipated impacts and recommended findings of effect for eligible sites under the Action Alternatives

Site Number	Description of Impact	Recommended Finding of Effect
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 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.	**Adverse Effect**
42CA184	The Wellsville-Mendon Upper Canal passes through a staging area, and several proposed pipelines would cross the canal. These crossings would 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

Table 4. Anticipated impacts and recommended findings of effect for eligible sites under the Action Alternatives

Site Number	Description of Impact	Recommended Finding of 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.	**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
42CA338	The site would be avoided. Originally proposed project actions in the site area have been eliminated from the undertaking.	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 visual intrusions that would alter the setting or feeling of the site.	No Adverse Effect
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

The information presented herein reflects the opinions and recommendations of the author. The NRCS, in consultation with the cooperating agencies and other consulting parties, will issue all final determinations of eligibility for all documented sites and a finding of effect relative to those sites. These determinations will be issued under separate cover.

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NRCS Web Soil Survey Custom Soil Resource Report

United States Department of Agriculture

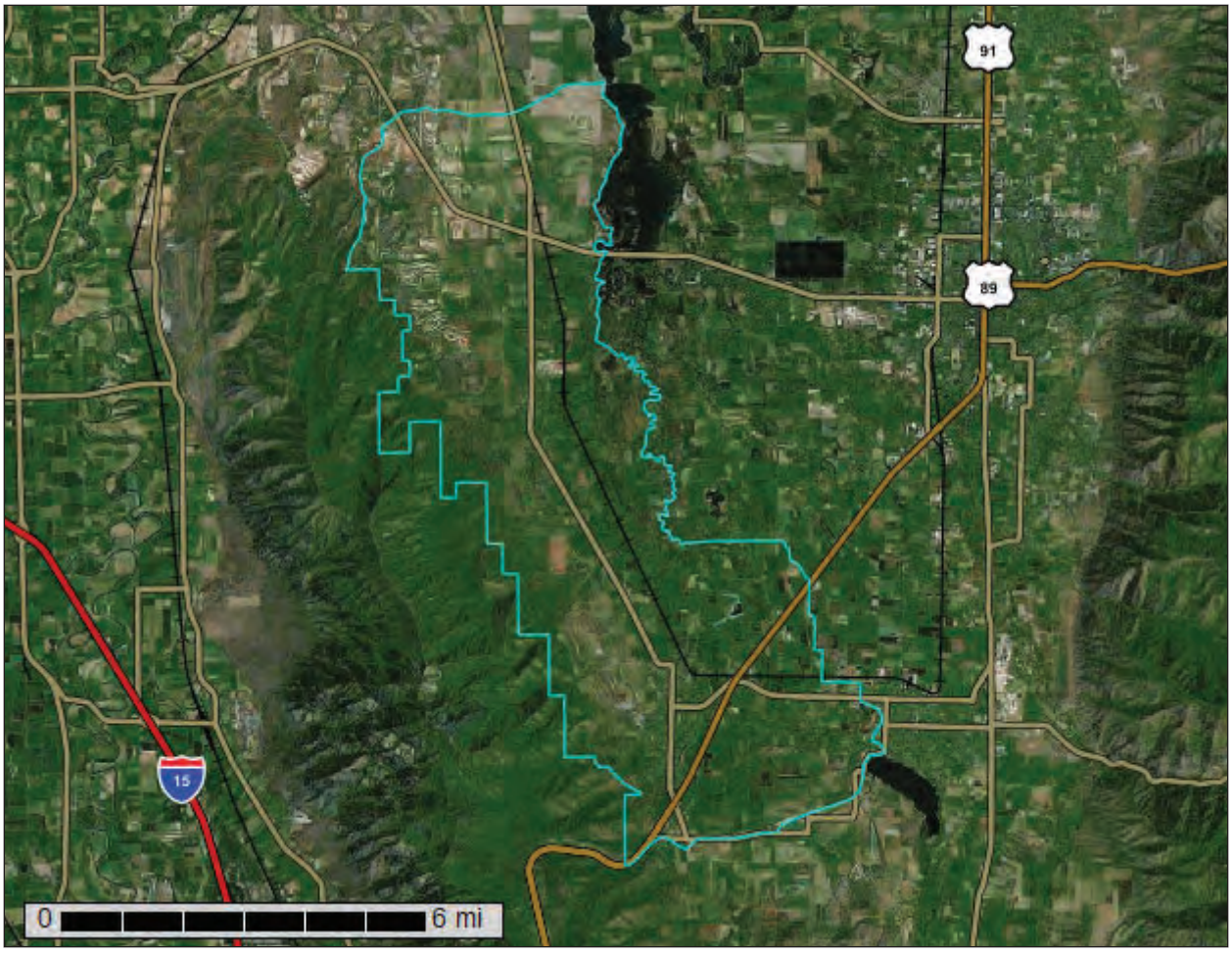
NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Cache Valley Area, Parts of Cache and Box Elder Counties, Utah

Wellsville Canyon Plan-EIS Study Area



September 17, 2024

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

Preface.....2
How Soil Surveys Are Made.....7
Soil Map.....10
Soil Map.....11
Legend.....12
Map Unit Legend.....13
Map Unit Descriptions.....16
Cache Valley Area, Parts of Cache and Box Elder Counties, Utah.....19
AhA—AIRPORT SILT LOAM, 0 TO 3 PERCENT SLOPES.....19
Ak—AIRPORT SILTY CLAY LOAM.....20
ArA—AVON SILTY CLAY LOAM, 0 TO 3 PERCENT SLOPES.....21
ArB—AVON SILTY CLAY LOAM, 3 TO 6 PERCENT SLOPES.....22
ArC—AVON SILTY CLAY LOAM, 6 TO 10 PERCENT SLOPES.....24
ArD—AVON SILTY CLAY LOAM, 10 TO 20 PERCENT SLOPES.....25
AsC—AVON-COLLINSTON COMPLEX, 6 TO 10 PERCENT SLOPES.....26
BAF—BARFUSS-LEATHAM ASSOCIATION.....28
BmB—BLACKROCK GRAVELLY LOAM, 3 TO 6 PERCENT SLOPES.....31
Cd—CARDON SILTY CLAY.....32
Ck—COLLETT SILTY CLAY LOAM.....33
ClA—COLLINSTON LOAMY FINE SAND, 0 TO 3 PERCENT SLOPES....34
CmC—COLLINSTON LOAM, 1 TO 6 PERCENT SLOPES.....35
CmD—COLLINSTON LOAM, 6 TO 10 PERCENT SLOPES.....36
CmE2—COLLINSTON LOAM, 10 TO 30 PERCENT SLOPES, ERODED.....38
CoA—CROOKSTON LOAM, 0 TO 3 PERCENT SLOPES.....39
CoB—CROOKSTON LOAM, 3 TO 6 PERCENT SLOPES.....40
CrB—CROWSHAW GRAVELLY LOAM, 3 TO 6 PERCENT SLOPES.....41
CrC—CROWSHAW GRAVELLY LOAM, 6 TO 10 PERCENT SLOPES.....42
CrD—CROWSHAW GRAVELLY LOAM, 10 TO 20 PERCENT SLOPES...43
DaC—DAGOR SILT LOAM, 4 TO 8 PERCENT SLOPES.....44
DaD—DAGOR SILT LOAM, 10 TO 20 PERCENT SLOPES.....45
DNG—DATWYLER-ELZINGA-MAUGHAN ASSOCIATION.....46
Gp—GRAVEL PIT.....49
GsA—GREENSON LOAM, 0 TO 3 PERCENT SLOPES.....49
GsB—GREENSON LOAM, 3 TO 6 PERCENT SLOPES.....51
GsC—GREENSON LOAM, 6 TO 10 PERCENT SLOPES.....52
GuA—GREENSON LOAM, DEEP OVER CLAY, 0 TO 1 PERCENT SLOPES.....53
HdA—HENDRICKS SILT LOAM, 1 TO 3 PERCENT SLOPES.....54
HdB—HENDRICKS SILT LOAM, 3 TO 6 PERCENT SLOPES.....56
HdC—HENDRICKS SILT LOAM, 6 TO 10 PERCENT SLOPES.....57
HdD—HENDRICKS SILT LOAM, 10 TO 20 PERCENT SLOPES.....58
HeC—HIIBNER GRAVELLY CLAY LOAM, 3 TO 10 PERCENT SLOPES..59

HeD—HIIBNER GRAVELLY CLAY LOAM, 10 TO 30 PERCENT SLOPES....60
HfE—HIIBNER EXTREMELY STONY CLAY LOAM, 1 TO 30 PERCENT SLOPES....61
HLG2—HOSKIN-DATWYLER ASSOCIATION, ERODED....62
HuC—HYRUM GRAVELLY LOAM, 4 TO 8 PERCENT SLOPES....64
HuE—HYRUM GRAVELLY LOAM, 10 TO 25 PERCENT SLOPES....65
KdA—KIDMAN FINE SANDY LOAM, 0 TO 2 PERCENT SLOPES....66
KdD—KIDMAN FINE SANDY LOAM, 8 TO 15 PERCENT SLOPES....68
KfB—KIDMAN FINE SANDY LOAM, DEEP WATER TABLE, 2 TO 4 PERCENT SLOPES....69
KfC—KIDMAN FINE SANDY LOAM, DEEP WATER TABLE, 4 TO 8 PERCENT SLOPES....70
Ks—KIRKHAM-SHAY COMPLEX....71
La—LAKEWIN GRAVELLY COARSE SANDY LOAM....73
Lr—LOGAN SILTY CLAY LOAM....74
McB—MCMURDIE SILT LOAM, 3 TO 6 PERCENT SLOPES....76
McC—MCMURDIE SILT LOAM, 6 TO 10 PERCENT SLOPES....77
MeA—MENDON SILT LOAM, 0 TO 3 PERCENT SLOPES....78
MeB—MENDON SILT LOAM, 3 TO 6 PERCENT SLOPES....79
MeC—MENDON SILT LOAM, 6 TO 10 PERCENT SLOPES....81
MfB—MENDON-COLLINSTON COMPLEX, 1 TO 6 PERCENT SLOPES....82
MfE2—MENDON-COLLINSTON COMPLEX, 6 TO 30 PERCENT SLOPES,ERODED....84
MoG2—MUNK-BLACKROCK GRAVELLY LOAMS, 30 TO 70 PERCENT SLOPES, ERODED....86
NbE—NEBEKER SILT LOAM, 10 TO 25 PERCENT SLOPES....88
NcA—NIBLEY SILTY CLAY LOAM, 0 TO 3 PERCENT SLOPES....89
NcB—NIBLEY SILTY CLAY LOAM, 3 TO 6 PERCENT SLOPES....90
PaA—PARLEYS SILT LOAM, 0 TO 3 PERCENT SLOPES....92
PaB—PARLEYS SILT LOAM, 3 TO 6 PERCENT SLOPES....93
PaC—PARLEYS SILT LOAM, 6 TO 10 PERCENT SLOPES....94
Pu—PROVO LOAM....95
Pv—PROVO GRAVELLY LOAM....97
RhA—RICKS GRAVELLY LOAM, 0 TO 3 PERCENT SLOPES....98
RhB—RICKS GRAVELLY LOAM, 3 TO 6 PERCENT SLOPES....99
RhC—RICKS GRAVELLY LOAM, 6 TO 10 PERCENT SLOPES....100
RO—ROCK LAND....101
Rs—ROSHE SPRINGS SILT LOAM....102
Rt—ROUGH BROKEN LAND....103
Sg—SALT LAKE-ROSHE SPRINGS COMPLEX....104
SSE—SMARTS SILT LOAM, 10 TO 30 PERCENT SLOPES....106
STG2—SMARTS-HOSKIN ASSOCIATION, ERODED....107
SUG—SMARTS-LUCKY STAR-POLELINE ASSOCIATION....108
SvA—STEED GRAVELLY LOAM, 0 TO 3 PERCENT SLOPES....111
SvB—STEED GRAVELLY LOAM, 3 TO 6 PERCENT SLOPES....112
SvC—STEED GRAVELLY LOAM, 6 TO 10 PERCENT SLOPES....113
SwC—STERLING GRAVELLY LOAM, 6 TO 10 PERCENT SLOPES....114
SwD—STERLING GRAVELLY LOAM, 10 TO 20 PERCENT SLOPES....115
SwF2—STERLING GRAVELLY LOAM, 20 TO 50 PERCENT SLOPES,ERODED....116
Sy—STONY ALLUVIAL LAND....118
TmB—TIMPANOGOS SILT LOAM, 3 TO 6 PERCENT SLOPES....118

TrA—TRENTON SILTY CLAY LOAM, 0 TO 2 PERCENT SLOPES..... 119
TtA—TRENTON SILTY CLAY LOAM, MODERATELY DEEP WATER TABLE, 0 TO 2 PERCENT SLOPES..... 121
W—WATER..... 122
WhE—WHEELON SILT LOAM, 10 TO 30 PERCENT SLOPES..... 122
WhF2—WHEELON SILT LOAM, 30 TO 50 PERCENT SLOPES, ERODED..... 124
WlE2—WHEELON-COLLINSTON COMPLEX, 10 TO 30 PERCENT SLOPES, ERODED..... 125
Wn—WINN SILT LOAM..... 127
References..... 129

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

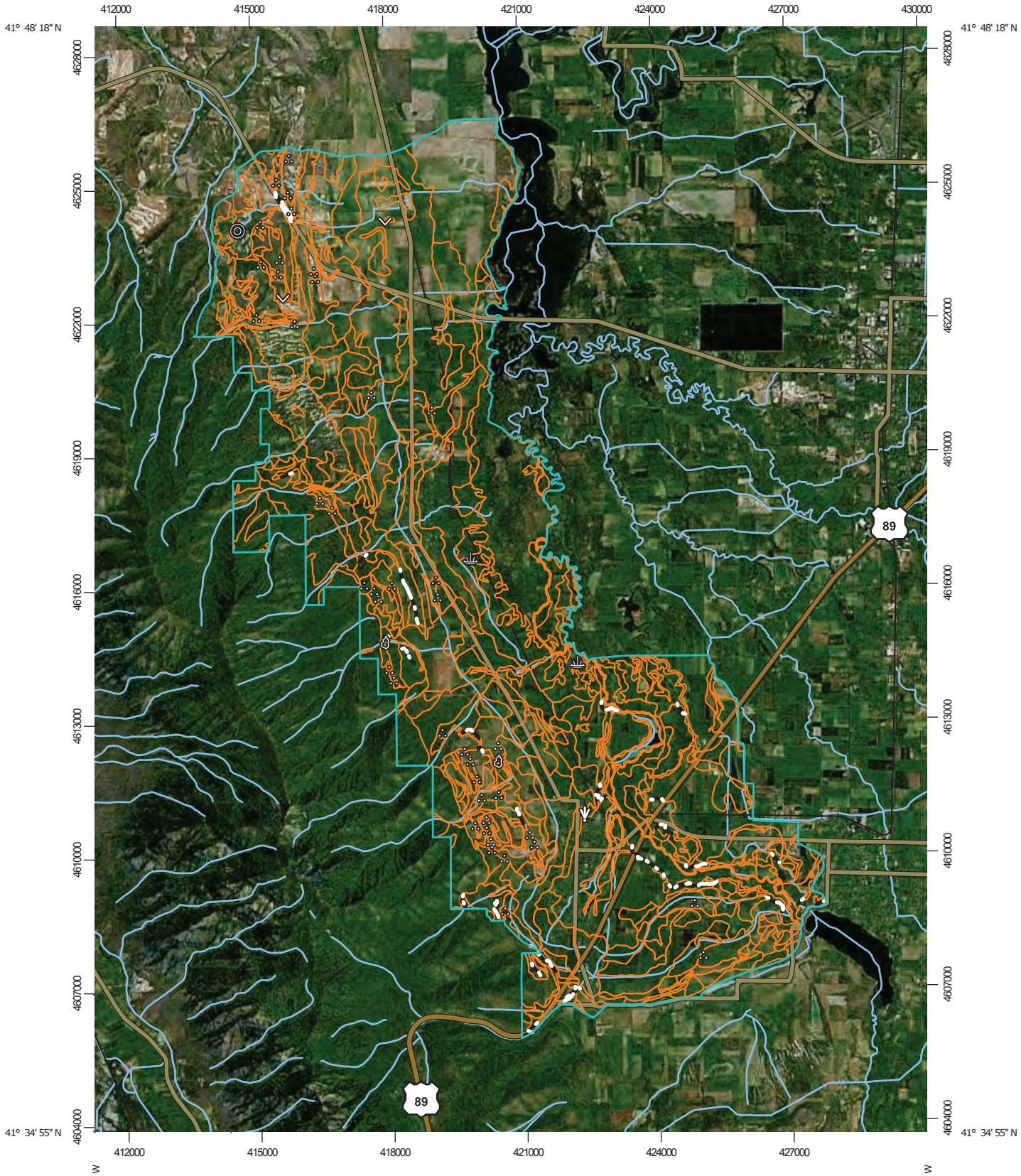
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



Map Scale: 1:121,000 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 1500 3000 6000 9000

Feet
0 5000 10000 20000 30000

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 12N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Cache Valley Area, Parts of Cache and Box Elder Counties, Utah
Survey Area Data: Version 16, Sep 8, 2023

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Apr 25, 2019—Jul 20, 2022

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
AhA	AIRPORT SILT LOAM, 0 TO 3 PERCENT SLOPES	145.1	0.5%
Ak	AIRPORT SILTY CLAY LOAM	53.9	0.2%
ArA	AVON SILTY CLAY LOAM, 0 TO 3 PERCENT SLOPES	175.5	0.6%
ArB	AVON SILTY CLAY LOAM, 3 TO 6 PERCENT SLOPES	558.0	1.8%
ArC	AVON SILTY CLAY LOAM, 6 TO 10 PERCENT SLOPES	18.2	0.1%
ArD	AVON SILTY CLAY LOAM, 10 TO 20 PERCENT SLOPES	81.9	0.3%
AsC	AVON-COLLINSTON COMPLEX, 6 TO 10 PERCENT SLOPES	88.9	0.3%
BAF	BARFUSS-LEATHAM ASSOCIATION	372.4	1.2%
BmB	BLACKROCK GRAVELLY LOAM, 3 TO 6 PERCENT SLOPES	50.3	0.2%
Cd	CARDON SILTY CLAY	39.5	0.1%
Ck	COLLETT SILTY CLAY LOAM	965.8	3.1%
ClA	COLLINSTON LOAMY FINE SAND, 0 TO 3 PERCENT SLOPES	52.2	0.2%
CmC	COLLINSTON LOAM, 1 TO 6 PERCENT SLOPES	174.3	0.6%
CmD	COLLINSTON LOAM, 6 TO 10 PERCENT SLOPES	259.0	0.8%
CmE2	COLLINSTON LOAM, 10 TO 30 PERCENT SLOPES, ERODED	181.4	0.6%
CoA	CROOKSTON LOAM, 0 TO 3 PERCENT SLOPES	914.9	2.9%
CoB	CROOKSTON LOAM, 3 TO 6 PERCENT SLOPES	174.0	0.6%
CrB	CROWSHAW GRAVELLY LOAM, 3 TO 6 PERCENT SLOPES	280.9	0.9%
CrC	CROWSHAW GRAVELLY LOAM, 6 TO 10 PERCENT SLOPES	1,037.8	3.3%
CrD	CROWSHAW GRAVELLY LOAM, 10 TO 20 PERCENT SLOPES	516.0	1.7%

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
DaC	DAGOR SILT LOAM, 4 TO 8 PERCENT SLOPES	58.8	0.2%
DaD	DAGOR SILT LOAM, 10 TO 20 PERCENT SLOPES	165.4	0.5%
DNG	DATWYLER-ELZINGA-MAUGHAN ASSOCIATION	0.4	0.0%
Gp	GRAVEL PIT	39.1	0.1%
GsA	GREENSON LOAM, 0 TO 3 PERCENT SLOPES	4,036.6	13.0%
GsB	GREENSON LOAM, 3 TO 6 PERCENT SLOPES	268.9	0.9%
GsC	GREENSON LOAM, 6 TO 10 PERCENT SLOPES	134.4	0.4%
GuA	GREENSON LOAM, DEEP OVER CLAY, 0 TO 1 PERCENT SLOPES	165.1	0.5%
HdA	HENDRICKS SILT LOAM, 1 TO 3 PERCENT SLOPES	72.2	0.2%
HdB	HENDRICKS SILT LOAM, 3 TO 6 PERCENT SLOPES	188.9	0.6%
HdC	HENDRICKS SILT LOAM, 6 TO 10 PERCENT SLOPES	298.0	1.0%
HdD	HENDRICKS SILT LOAM, 10 TO 20 PERCENT SLOPES	158.5	0.5%
HeC	HIIBNER GRAVELLY CLAY LOAM, 3 TO 10 PERCENT SLOPES	76.2	0.2%
HeD	HIIBNER GRAVELLY CLAY LOAM, 10 TO 30 PERCENT SLOPES	39.5	0.1%
HfE	HIIBNER EXTREMELY STONY CLAY LOAM, 1 TO 30 PERCENT SLOPES	571.0	1.8%
HLG2	HOSKIN-DATWYLER ASSOCIATION, ERODED	16.5	0.1%
HuC	HYRUM GRAVELLY LOAM, 4 TO 8 PERCENT SLOPES	224.0	0.7%
HuE	HYRUM GRAVELLY LOAM, 10 TO 25 PERCENT SLOPES	379.4	1.2%
KdA	KIDMAN FINE SANDY LOAM, 0 TO 2 PERCENT SLOPES	79.8	0.3%
KdD	KIDMAN FINE SANDY LOAM, 8 TO 15 PERCENT SLOPES	40.5	0.1%
KfB	KIDMAN FINE SANDY LOAM, DEEP WATER TABLE, 2 TO 4 PERCENT SLOPES	8.0	0.0%
KfC	KIDMAN FINE SANDY LOAM, DEEP WATER TABLE, 4 TO 8 PERCENT SLOPES	53.2	0.2%
Ks	KIRKHAM-SHAY COMPLEX	324.4	1.0%

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
La	LAKEWIN GRAVELLY COARSE SANDY LOAM	79.8	0.3%
Lr	LOGAN SILTY CLAY LOAM	626.4	2.0%
McB	MCMURDIE SILT LOAM, 3 TO 6 PERCENT SLOPES	14.7	0.0%
McC	MCMURDIE SILT LOAM, 6 TO 10 PERCENT SLOPES	89.2	0.3%
MeA	MENDON SILT LOAM, 0 TO 3 PERCENT SLOPES	2,780.4	8.9%
MeB	MENDON SILT LOAM, 3 TO 6 PERCENT SLOPES	1,075.1	3.5%
MeC	MENDON SILT LOAM, 6 TO 10 PERCENT SLOPES	298.8	1.0%
MfB	MENDON-COLLINSTON COMPLEX, 1 TO 6 PERCENT SLOPES	391.3	1.3%
MfE2	MENDON-COLLINSTON COMPLEX, 6 TO 30 PERCENT SLOPES,ERODED	593.5	1.9%
MoG2	MUNK-BLACKROCK GRAVELLY LOAMS, 30 TO 70 PERCENT SLOPES, ERODED	213.1	0.7%
NbE	NEBEKER SILT LOAM, 10 TO 25 PERCENT SLOPES	16.6	0.1%
NcA	NIBLEY SILTY CLAY LOAM, 0 TO 3 PERCENT SLOPES	325.1	1.0%
NcB	NIBLEY SILTY CLAY LOAM, 3 TO 6 PERCENT SLOPES	177.9	0.6%
PaA	PARLEYS SILT LOAM, 0 TO 3 PERCENT SLOPES	224.0	0.7%
PaB	PARLEYS SILT LOAM, 3 TO 6 PERCENT SLOPES	339.8	1.1%
PaC	PARLEYS SILT LOAM, 6 TO 10 PERCENT SLOPES	41.4	0.1%
Pu	PROVO LOAM	50.4	0.2%
Pv	PROVO GRAVELLY LOAM	76.4	0.2%
RhA	RICKS GRAVELLY LOAM, 0 TO 3 PERCENT SLOPES	605.6	1.9%
RhB	RICKS GRAVELLY LOAM, 3 TO 6 PERCENT SLOPES	631.7	2.0%
RhC	RICKS GRAVELLY LOAM, 6 TO 10 PERCENT SLOPES	280.1	0.9%
RO	ROCK LAND	2.7	0.0%
Rs	ROSHE SPRINGS SILT LOAM	636.8	2.0%
Rt	ROUGH BROKEN LAND	238.5	0.8%
Sg	SALT LAKE-ROSHE SPRINGS COMPLEX	1,393.2	4.5%

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
SSE	SMARTS SILT LOAM, 10 TO 30 PERCENT SLOPES	128.7	0.4%
STG2	SMARTS-HOSKIN ASSOCIATION, ERODED	1,121.4	3.6%
SUG	SMARTS-LUCKY STAR-POLELINE ASSOCIATION	201.4	0.6%
SvA	STEED GRAVELLY LOAM, 0 TO 3 PERCENT SLOPES	39.0	0.1%
SvB	STEED GRAVELLY LOAM, 3 TO 6 PERCENT SLOPES	37.0	0.1%
SvC	STEED GRAVELLY LOAM, 6 TO 10 PERCENT SLOPES	113.3	0.4%
SwC	STERLING GRAVELLY LOAM, 6 TO 10 PERCENT SLOPES	175.9	0.6%
SwD	STERLING GRAVELLY LOAM, 10 TO 20 PERCENT SLOPES	214.9	0.7%
SwF2	STERLING GRAVELLY LOAM, 20 TO 50 PERCENT SLOPES,ERODED	97.7	0.3%
Sy	STONY ALLUVIAL LAND	422.9	1.4%
TmB	TIMPANOGOS SILT LOAM, 3 TO 6 PERCENT SLOPES	113.8	0.4%
TrA	TRENTON SILTY CLAY LOAM, 0 TO 2 PERCENT SLOPES	1,365.5	4.4%
TtA	TRENTON SILTY CLAY LOAM, MODERATELY DEEP WATER TABLE, 0 TO 2 PERCENT SLOPES	80.4	0.3%
W	WATER	241.5	0.8%
WhE	WHEELON SILT LOAM, 10 TO 30 PERCENT SLOPES	74.0	0.2%
WhF2	WHEELON SILT LOAM, 30 TO 50 PERCENT SLOPES, ERODED	168.4	0.5%
WlE2	WHEELON-COLLINSTON COMPLEX, 10 TO 30 PERCENT SLOPES, ERODED	1,164.4	3.7%
Wn	WINN SILT LOAM	647.3	2.1%
Totals for Area of Interest		**31,148.8**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps.

The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Cache Valley Area, Parts of Cache and Box Elder Counties, Utah

AhA—AIRPORT SILT LOAM, 0 TO 3 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j67s
Elevation: 4,420 to 4,460 feet
Mean annual precipitation: 14 to 17 inches
Mean annual air temperature: 45 to 47 degrees F
Frost-free period: 120 to 140 days
Farmland classification: Farmland of local importance

Map Unit Composition

Airport and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Airport

Setting

Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Lacustrine deposits derived from quartzite and/or lacustrine deposits derived from limestone

Typical profile

A1 - 0 to 4 inches: silt loam
B2t - 4 to 11 inches: silty clay loam
B3ca - 11 to 16 inches: silty clay loam
C1ca - 16 to 25 inches: silty clay loam
C2 - 25 to 60 inches: silt loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 24 to 36 inches
Frequency of flooding: Rare
Frequency of ponding: None
Calcium carbonate, maximum content: 60 percent
Maximum salinity: Slightly saline to strongly saline (4.0 to 32.0 mmhos/cm)
Sodium adsorption ratio, maximum: 60.0
Available water supply, 0 to 60 inches: High (about 10.2 inches)

Interpretive groups

Land capability classification (irrigated): 4w
Land capability classification (nonirrigated): 6w
Hydrologic Soil Group: D
Ecological site: R028AY001UT - Alkali Bottom (Alkali Sacaton)
Hydric soil rating: No

Minor Components

Alkali soils

Percent of map unit: 2 percent
Landform: Depressions
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Ponded soils

Percent of map unit: 2 percent
Landform: Depressions
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Hardpan soils

Percent of map unit: 1 percent

Ak—AIRPORT SILTY CLAY LOAM

Map Unit Setting

National map unit symbol: j67t
Elevation: 4,420 to 4,460 feet
Mean annual precipitation: 14 to 17 inches
Mean annual air temperature: 45 to 47 degrees F
Frost-free period: 120 to 140 days
Farmland classification: Farmland of local importance

Map Unit Composition

Airport and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Airport

Setting

Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Lacustrine deposits derived from limestone and/or lacustrine deposits derived from quartzite

Typical profile

A1 - 0 to 4 inches: silty clay loam
B2t - 4 to 11 inches: silty clay loam
B3ca - 11 to 16 inches: silty clay loam

C1ca - 16 to 25 inches: silty clay loam
C2 - 25 to 60 inches: silt loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 24 to 36 inches
Frequency of flooding: Rare
Frequency of ponding: None
Calcium carbonate, maximum content: 60 percent
Maximum salinity: Slightly saline to strongly saline (4.0 to 32.0 mmhos/cm)
Sodium adsorption ratio, maximum: 60.0
Available water supply, 0 to 60 inches: High (about 10.2 inches)

Interpretive groups

Land capability classification (irrigated): 4w
Land capability classification (nonirrigated): 6w
Hydrologic Soil Group: D
Ecological site: R028AY001UT - Alkali Bottom (Alkali Sacaton)
Hydric soil rating: No

Minor Components

Payson

Percent of map unit: 2 percent

Ponded soils

Percent of map unit: 2 percent
Landform: Depressions
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Alkali soils

Percent of map unit: 1 percent
Landform: Depressions
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

ArA—AVON SILTY CLAY LOAM, 0 TO 3 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j67w
Elevation: 4,600 to 5,100 feet
Mean annual precipitation: 17 to 20 inches

Mean annual air temperature: 45 to 47 degrees F
Frost-free period: 110 to 140 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Avon and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Avon

Setting

Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Lacustrine deposits derived from limestone and sandstone

Typical profile

A1 - 0 to 9 inches: silty clay loam
B1 - 9 to 12 inches: silty clay loam
B21t - 12 to 18 inches: silty clay
B22t - 18 to 27 inches: silty clay
Cca - 27 to 34 inches: silt loam
C - 34 to 60 inches: silt loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 40 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 10.4 inches)

Interpretive groups

Land capability classification (irrigated): 2c
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

ArB—AVON SILTY CLAY LOAM, 3 TO 6 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j67x
Elevation: 4,600 to 5,100 feet

Mean annual precipitation: 17 to 20 inches
Mean annual air temperature: 45 to 47 degrees F
Frost-free period: 110 to 140 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Avon and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Avon

Setting

Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Lacustrine deposits derived from limestone and sandstone

Typical profile

A1 - 0 to 9 inches: silty clay loam
B1 - 9 to 12 inches: silty clay loam
B21t - 12 to 18 inches: silty clay
B22t - 18 to 27 inches: silty clay
Cca - 27 to 34 inches: silt loam
C - 34 to 60 inches: silt loam

Properties and qualities

Slope: 3 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 40 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 10.4 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

Minor Components

Collinston

Percent of map unit: 5 percent

ArC—AVON SILTY CLAY LOAM, 6 TO 10 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j67y
Elevation: 4,600 to 5,100 feet
Mean annual precipitation: 17 to 20 inches
Mean annual air temperature: 45 to 47 degrees F
Frost-free period: 110 to 140 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Avon and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Avon

Setting

Landform: Lake terraces, escarpments
Landform position (three-dimensional): Tread
Down-slope shape: Linear, concave
Across-slope shape: Linear
Parent material: Lacustrine deposits derived from limestone and sandstone

Typical profile

A1 - 0 to 9 inches: silty clay loam
B1 - 9 to 12 inches: silty clay loam
B21t - 12 to 18 inches: silty clay
B22t - 18 to 27 inches: silty clay
Cca - 27 to 34 inches: silt loam
C - 34 to 60 inches: silt loam

Properties and qualities

Slope: 6 to 10 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 40 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 10.4 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North

Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

Minor Components

Wheelon
Percent of map unit: 5 percent

Mendon
Percent of map unit: 5 percent

ArD—AVON SILTY CLAY LOAM, 10 TO 20 PERCENT SLOPES

Map Unit Setting
National map unit symbol: j67z
Elevation: 4,600 to 5,100 feet
Mean annual precipitation: 17 to 20 inches
Mean annual air temperature: 45 to 46 degrees F
Frost-free period: 110 to 140 days
Farmland classification: Farmland of local importance

Map Unit Composition
Avon and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Avon

Setting
Landform: Lake terraces, escarpments
Landform position (three-dimensional): Riser
Down-slope shape: Linear, concave
Across-slope shape: Linear
Parent material: Lacustrine deposits derived from limestone and sandstone

Typical profile
A1 - 0 to 9 inches: silty clay loam
B1 - 9 to 12 inches: silty clay loam
B21t - 12 to 18 inches: silty clay
B22t - 18 to 27 inches: silty clay
Cca - 27 to 34 inches: silt loam
C - 34 to 60 inches: silt loam

Properties and qualities
Slope: 10 to 20 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches

Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 40 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 10.4 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

Minor Components

Wheelon

Percent of map unit: 5 percent

AsC—AVON-COLLINSTON COMPLEX, 6 TO 10 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j680
Elevation: 4,600 to 5,100 feet
Mean annual precipitation: 17 to 20 inches
Mean annual air temperature: 45 to 47 degrees F
Frost-free period: 110 to 140 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Avon and similar soils: 65 percent
Collinston and similar soils: 30 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Avon

Setting

Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Lacustrine deposits derived from limestone and sandstone

Typical profile

A1 - 0 to 9 inches: silty clay loam
B1 - 9 to 12 inches: silty clay loam
B21t - 12 to 18 inches: silty clay
B22t - 18 to 27 inches: silty clay
Cca - 27 to 34 inches: silt loam

C - 34 to 60 inches: silt loam

Properties and qualities

Slope: 6 to 10 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 40 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 10.4 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

Description of Collinston

Setting

Landform: Ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve, crest
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Lacustrine deposits derived from limestone and sandstone and/or lacustrine deposits derived from tuff

Typical profile

A11 - 0 to 8 inches: loam
A12 - 8 to 15 inches: loam
C1ca - 15 to 25 inches: clay loam
C2 - 25 to 35 inches: silt loam
C3 - 35 to 60 inches: silt loam

Properties and qualities

Slope: 6 to 10 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 60 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 10.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

Minor Components

Wheelon, eroded
Percent of map unit: 5 percent

BAF—BARFUSS-LEATHAM ASSOCIATION

Map Unit Setting
National map unit symbol: j682
Elevation: 5,000 to 7,000 feet
Mean annual precipitation: 17 to 25 inches
Mean annual air temperature: 40 to 45 degrees F
Frost-free period: 80 to 110 days
Farmland classification: Not prime farmland

Map Unit Composition
Barfuss and similar soils: 40 percent
Leatham and similar soils: 30 percent
Laplatta and similar soils: 20 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Barfuss

Setting
Landform: Hills, mountain slopes
Landform position (three-dimensional): Mountainflank, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum and colluvium derived from tuff conglomerate, sandstone and limestone

Typical profile
A1 - 0 to 10 inches: silt loam
B21t - 10 to 19 inches: silty clay loam
B22t - 19 to 27 inches: silty clay loam
Cca - 27 to 60 inches: silt loam

Properties and qualities
Slope: 30 to 50 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained

Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 25 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 11.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: C
Ecological site: R047XA434UT - Mountain Loam (shrub)
Hydric soil rating: No

Description of Leatham

Setting

Landform: Mountain slopes, hills
Landform position (three-dimensional): Mountainflank, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum and colluvium derived from tuffs, conglomerate, tuffaceous sandstone, and limestone

Typical profile

A11 - 0 to 4 inches: silt loam
A12 - 4 to 10 inches: silt loam
AC - 10 to 15 inches: silty clay loam
C1ca - 15 to 25 inches: silt loam
C2ca - 25 to 39 inches: silty clay loam
C3ca - 39 to 60 inches: silty clay loam

Properties and qualities

Slope: 30 to 50 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 60 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 10.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: C
Ecological site: R047XA430UT - Mountain Loam (mountain big sagebrush)
Hydric soil rating: No

Description of Laplatta

Setting

Landform: Mountain slopes, hills
Landform position (three-dimensional): Mountainflank, side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum derived from tuff, conglomerate, tuffaceous sandstone and limestone

Typical profile

A1 - 0 to 8 inches: silty clay loam
B21t - 8 to 12 inches: silty clay
B22t - 12 to 26 inches: clay
B23t - 26 to 35 inches: clay
B3ca - 35 to 48 inches: silty clay loam
Cca - 48 to 60 inches: silt loam

Properties and qualities

Slope: 30 to 50 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 40 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 10.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: C
Ecological site: R047XA434UT - Mountain Loam (shrub)
Hydric soil rating: No

Minor Components

Wheelon, eroded

Percent of map unit: 5 percent

Obran

Percent of map unit: 5 percent

BmB—BLACKROCK GRAVELLY LOAM, 3 TO 6 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j689
Elevation: 4,600 to 5,700 feet
Mean annual precipitation: 14 to 17 inches
Mean annual air temperature: 45 to 47 degrees F
Frost-free period: 120 to 140 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Blackrock and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Blackrock

Setting

Landform: Alluvial fans
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Alluvium and colluvium derived from tuff, sandstone and limestone

Typical profile

A11 - 0 to 8 inches: gravelly loam
A12 - 8 to 22 inches: gravelly loam
AC - 22 to 39 inches: very gravelly loam
Cca - 39 to 60 inches: gravelly clay loam

Properties and qualities

Slope: 3 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 20 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 8.2 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North

Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

Cd—CARDON SILTY CLAY

Map Unit Setting

National map unit symbol: j68p
Elevation: 4,420 to 4,470 feet
Mean annual precipitation: 14 to 17 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 120 to 140 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Cardon and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Cardon

Setting

Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Lacustrine deposits derived from limestone and shale

Typical profile

Ap - 0 to 7 inches: silty clay
A12 - 7 to 11 inches: silty clay
AC - 11 to 34 inches: silty clay
C1 - 34 to 62 inches: silty clay

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 30 to 42 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 40 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 10.8 inches)

Interpretive groups

Land capability classification (irrigated): 3w
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: D
Ecological site: R028AY012UT - Semiwet Fresh Meadow

Hydric soil rating: No

Minor Components

Salt lake

Percent of map unit: 5 percent
Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R028AY024UT - Wet Saline Meadow (Saltgrass)
Hydric soil rating: Yes

Ck—COLLETT SILTY CLAY LOAM

Map Unit Setting

National map unit symbol: j68q
Elevation: 4,450 to 4,700 feet
Mean annual precipitation: 14 to 17 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 120 to 140 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Collett and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Collett

Setting

Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Lacustrine deposits derived from limestone, sandstone, and shale

Typical profile

Ap - 0 to 7 inches: silty clay loam
A1 - 7 to 12 inches: silty clay loam
B2 - 12 to 17 inches: silty clay loam
C1ca - 17 to 24 inches: silty clay loam
C2ca - 24 to 34 inches: silty clay loam
C3 - 34 to 60 inches: silty clay loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)

Depth to water table: About 18 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 60 percent
Maximum salinity: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum: 5.0
Available water supply, 0 to 60 inches: High (about 11.4 inches)

Interpretive groups

Land capability classification (irrigated): 3w
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: C
Ecological site: R028AY012UT - Semiwet Fresh Meadow
Hydric soil rating: No

Minor Components

Greenson

Percent of map unit: 3 percent

Poorly drained soils

Percent of map unit: 2 percent
Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

CIA—COLLINSTON LOAMY FINE SAND, 0 TO 3 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j68r
Elevation: 4,600 to 5,300 feet
Mean annual precipitation: 15 to 22 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 100 to 160 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Collinston and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Collinston

Setting

Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear

Parent material: Lacustrine deposits derived from tuff and/or lacustrine deposits derived from limestone and sandstone

Typical profile

A11 - 0 to 8 inches: loamy fine sand
A12 - 8 to 15 inches: loam
C1ca - 15 to 25 inches: clay loam
C2 - 25 to 35 inches: silt loam
C3 - 35 to 60 inches: silt loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 60 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 10.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

Minor Components

Crookston

Percent of map unit: 5 percent

CmC—COLLINSTON LOAM, 1 TO 6 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j68s
Elevation: 4,600 to 5,300 feet
Mean annual precipitation: 15 to 22 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 100 to 160 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Collinston and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Collinston

Setting

Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Lacustrine deposits derived from tuff and/or lacustrine deposits derived from limestone and sandstone

Typical profile

A11 - 0 to 8 inches: loam
A12 - 8 to 15 inches: loam
C1ca - 15 to 25 inches: clay loam
C2 - 25 to 35 inches: silt loam
C3 - 35 to 60 inches: silt loam

Properties and qualities

Slope: 1 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 60 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 10.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

Minor Components

Collinston

Percent of map unit: 5 percent

Mendon

Percent of map unit: 5 percent

CmD—COLLINSTON LOAM, 6 TO 10 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j68t

Elevation: 4,600 to 5,300 feet
Mean annual precipitation: 15 to 22 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 100 to 160 days
Farmland classification: Farmland of local importance

Map Unit Composition

Collinston and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Collinston

Setting

Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Lacustrine deposits derived from tuff and/or lacustrine deposits derived from limestone and sandstone

Typical profile

A11 - 0 to 8 inches: loam
A12 - 8 to 15 inches: loam
C1ca - 15 to 25 inches: clay loam
C2 - 25 to 35 inches: silt loam
C3 - 35 to 60 inches: silt loam

Properties and qualities

Slope: 6 to 10 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 60 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 10.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

Minor Components

Wheelon

Percent of map unit: 10 percent

CmE2—COLLINSTON LOAM, 10 TO 30 PERCENT SLOPES, ERODED

Map Unit Setting

National map unit symbol: j68v
Elevation: 4,600 to 5,300 feet
Mean annual precipitation: 15 to 22 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 100 to 160 days
Farmland classification: Not prime farmland

Map Unit Composition

Collinston and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Collinston

Setting

Landform: Lake terraces
Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Lacustrine deposits derived from limestone and sandstone and/or lacustrine deposits derived from tuff

Typical profile

A11 - 0 to 8 inches: loam
A12 - 8 to 15 inches: loam
C1ca - 15 to 25 inches: clay loam
C2 - 25 to 35 inches: silt loam
C3 - 35 to 60 inches: silt loam

Properties and qualities

Slope: 10 to 30 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 60 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 10.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North

Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

Minor Components

Mendon
Percent of map unit: 5 percent

Wheelon
Percent of map unit: 5 percent

CoA—CROOKSTON LOAM, 0 TO 3 PERCENT SLOPES

Map Unit Setting
National map unit symbol: j68w
Elevation: 4,500 to 5,100 feet
Mean annual precipitation: 15 to 17 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 120 to 150 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition
Crookston and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Crookston

Setting
Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Lacustrine deposits derived from tuff, tuffaceous sandstone and limestone

Typical profile
Ap - 0 to 6 inches: loam
A1 - 6 to 14 inches: loam
B2t - 14 to 27 inches: loam
C1ca - 27 to 48 inches: loam
C2ca - 48 to 60 inches: fine sandy loam

Properties and qualities
Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches

Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 35 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 8.9 inches)

Interpretive groups

Land capability classification (irrigated): 2c
Land capability classification (nonirrigated): 3c
Hydrologic Soil Group: B
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Hydric soil rating: No

Minor Components

Mendon

Percent of map unit: 5 percent

CoB—CROOKSTON LOAM, 3 TO 6 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j68x
Elevation: 4,500 to 5,100 feet
Mean annual precipitation: 15 to 17 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 120 to 150 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Crookston and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Crookston

Setting

Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Lacustrine deposits derived from tuff, tuffaceous sandstone and limestone

Typical profile

Ap - 0 to 6 inches: loam
A1 - 6 to 14 inches: loam
B2t - 14 to 27 inches: loam
C1ca - 27 to 48 inches: loam
C2ca - 48 to 60 inches: fine sandy loam

Properties and qualities

Slope: 3 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 35 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 8.9 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Hydric soil rating: No

Minor Components

Collinston

Percent of map unit: 5 percent

CrB—CROWSHAW GRAVELLY LOAM, 3 TO 6 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j68z
Elevation: 4,500 to 5,000 feet
Mean annual precipitation: 15 to 17 inches
Mean annual air temperature: 45 to 47 degrees F
Frost-free period: 120 to 140 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Crowshaw and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Crowshaw

Setting

Landform: Alluvial fans
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Alluvium derived from sandstone

Typical profile

Ap - 0 to 10 inches: gravelly loam

A1 - 10 to 16 inches: gravelly loam
B2 - 16 to 30 inches: gravelly loam
C - 30 to 60 inches: gravelly loam

Properties and qualities

Slope: 3 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 7.9 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

Minor Components

Hendricks

Percent of map unit: 5 percent

CrC—CROWSHAW GRAVELLY LOAM, 6 TO 10 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j690
Elevation: 4,500 to 5,000 feet
Mean annual precipitation: 15 to 17 inches
Mean annual air temperature: 45 to 47 degrees F
Frost-free period: 120 to 140 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Crowshaw and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Crowshaw

Setting

Landform: Alluvial fans
Down-slope shape: Concave
Across-slope shape: Convex

Parent material: Alluvium derived from sandstone

Typical profile

Ap - 0 to 10 inches: gravelly loam
A1 - 10 to 16 inches: gravelly loam
B2 - 16 to 30 inches: gravelly loam
C - 30 to 60 inches: gravelly loam

Properties and qualities

Slope: 6 to 10 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 7.9 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

Minor Components

Hendricks

Percent of map unit: 5 percent

CrD—CROWSHAW GRAVELLY LOAM, 10 TO 20 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j691
Elevation: 4,500 to 5,000 feet
Mean annual precipitation: 15 to 17 inches
Mean annual air temperature: 45 to 47 degrees F
Frost-free period: 120 to 140 days
Farmland classification: Farmland of local importance

Map Unit Composition

Crowshaw and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Crowshaw

Setting

Landform: Alluvial fans
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Alluvium derived from sandstone

Typical profile

Ap - 0 to 10 inches: gravelly loam
A1 - 10 to 16 inches: gravelly loam
B2 - 16 to 30 inches: gravelly loam
C - 30 to 60 inches: gravelly loam

Properties and qualities

Slope: 10 to 20 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 7.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

DaC—DAGOR SILT LOAM, 4 TO 8 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j698
Elevation: 4,900 to 5,150 feet
Mean annual precipitation: 17 to 18 inches
Mean annual air temperature: 46 to 47 degrees F
Frost-free period: 120 to 140 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Dagor and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Dagor

Setting

Landform: Alluvial fans
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Alluvium derived from sandstone; residuum weathered from sandstone

Typical profile

Ap - 0 to 5 inches: silt loam
A11 - 5 to 14 inches: silt loam
A12 - 14 to 34 inches: silt loam
AC - 34 to 46 inches: silt loam
C - 46 to 60 inches: silt loam

Properties and qualities

Slope: 4 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 9.7 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

Minor Components

Crowshaw

Percent of map unit: 5 percent

Hendricks

Percent of map unit: 5 percent

DaD—DAGOR SILT LOAM, 10 TO 20 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j699
Elevation: 4,900 to 5,150 feet

Mean annual precipitation: 17 to 18 inches
Mean annual air temperature: 46 to 47 degrees F
Frost-free period: 120 to 140 days
Farmland classification: Farmland of local importance

Map Unit Composition
Dagor and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Dagor

Setting
Landform: Alluvial fans
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Alluvium derived from sandstone

Typical profile
Ap - 0 to 5 inches: silt loam
A11 - 5 to 14 inches: silt loam
A12 - 14 to 34 inches: silt loam
AC - 34 to 46 inches: silt loam
C - 46 to 60 inches: silt loam

Properties and qualities
Slope: 10 to 20 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Rare
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 9.7 inches)

Interpretive groups
Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

DNG—DATWYLER-ELZINGA-MAUGHAN ASSOCIATION

Map Unit Setting
National map unit symbol: j695
Elevation: 5,000 to 7,500 feet
Mean annual precipitation: 20 to 25 inches

Mean annual air temperature: 40 to 45 degrees F
Frost-free period: 90 to 110 days
Farmland classification: Not prime farmland

Map Unit Composition

Datwyler and similar soils: 40 percent
Elzinga and similar soils: 30 percent
Maughan and similar soils: 20 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Datwyler

Setting

Landform: Mountain slopes
Landform position (three-dimensional): Mountainflank
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Colluvium derived from limestone and sandstone and/or residuum weathered from limestone and sandstone

Typical profile

A1 - 0 to 4 inches: very cobbly silty clay loam
B1 - 4 to 11 inches: very cobbly clay
B2t - 11 to 28 inches: extremely cobbly clay
Cca - 28 to 35 inches: extremely cobbly sandy clay loam
R - 35 to 39 inches: unweathered bedrock

Properties and qualities

Slope: 30 to 60 percent
Depth to restrictive feature: 30 to 40 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Low to moderately high (0.01 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 70 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: D
Ecological site: R047XA461UT - Mountain Stony Loam (mountain big sagebrush)
Hydric soil rating: No

Description of Elzinga

Setting

Landform: Mountain slopes
Landform position (three-dimensional): Mountainflank
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Colluvium derived from limestone and sandstone and/or residuum weathered from limestone and sandstone

Typical profile

A1 - 0 to 26 inches: silt loam
A21 - 26 to 48 inches: cobbly silt loam
A2&B2t - 48 to 62 inches: very cobbly very fine sandy loam
R - 62 to 72 inches: unweathered bedrock

Properties and qualities

Slope: 30 to 60 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Low to moderately high (0.01 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 8.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: B
Ecological site: R047XA418UT - Mountain Loam (bigtooth maple)
Hydric soil rating: No

Description of Maughan

Setting

Landform: Mountain slopes
Landform position (three-dimensional): Mountainflank
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Colluvium derived from limestone, sandstone, and shale and/or residuum weathered from limestone, sandstone, and shale

Typical profile

A11 - 0 to 8 inches: silt loam
A12 - 8 to 25 inches: silt loam
A2 - 25 to 32 inches: gravelly silt loam
B21t - 32 to 38 inches: cobbly clay loam
B22t - 38 to 50 inches: cobbly clay
B23t - 50 to 66 inches: cobbly clay

Properties and qualities

Slope: 30 to 60 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 8.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: C
Ecological site: R047XA418UT - Mountain Loam (bigtooth maple)
Hydric soil rating: No

Minor Components

Deep gravelly soils
Percent of map unit: 10 percent

Gp—GRAVEL PIT

Map Unit Composition
Gravel pit: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Gravel Pit

Setting
Landform: Lake terraces
Landform position (three-dimensional): Riser
Down-slope shape: Concave
Across-slope shape: Concave

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydric soil rating: No

GsA—GREENSON LOAM, 0 TO 3 PERCENT SLOPES

Map Unit Setting
National map unit symbol: j69q
Elevation: 4,450 to 4,650 feet
Mean annual precipitation: 14 to 17 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 120 to 140 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition
Greenson and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Greenson

Setting

Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Lacustrine deposits and alluvium derived from limestone, sandstone, and quartzite

Typical profile

Ap - 0 to 7 inches: loam
A1 - 7 to 16 inches: loam
B2 - 16 to 23 inches: loam
C1ca - 23 to 39 inches: loam
C2ca - 39 to 51 inches: loam
C3 - 51 to 72 inches: loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: About 30 to 60 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 40 percent
Maximum salinity: Slightly saline to moderately saline (4.0 to 8.0 mmhos/cm)
Sodium adsorption ratio, maximum: 20.0
Available water supply, 0 to 60 inches: High (about 10.9 inches)

Interpretive groups

Land capability classification (irrigated): 3w
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: C
Ecological site: R028AY012UT - Semiwet Fresh Meadow
Hydric soil rating: No

Minor Components

Logan

Percent of map unit: 5 percent
Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R028AY020UT - Wet Fresh Meadow
Hydric soil rating: Yes

Collett

Percent of map unit: 5 percent

GsB—GREENSON LOAM, 3 TO 6 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j69r
Elevation: 4,450 to 4,650 feet
Mean annual precipitation: 14 to 17 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 120 to 140 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Greenson and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Greenson

Setting

Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Lacustrine deposits and alluvium derived from limestone, sandstone, and quartzite

Typical profile

Ap - 0 to 7 inches: loam
A1 - 7 to 16 inches: loam
B2 - 16 to 23 inches: loam
C1ca - 23 to 39 inches: loam
C2ca - 39 to 51 inches: loam
C3 - 51 to 72 inches: loam

Properties and qualities

Slope: 3 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: About 30 to 60 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 40 percent
Maximum salinity: Slightly saline to moderately saline (4.0 to 8.0 mmhos/cm)
Sodium adsorption ratio, maximum: 20.0
Available water supply, 0 to 60 inches: High (about 10.9 inches)

Interpretive groups

Land capability classification (irrigated): 3w
Land capability classification (nonirrigated): 4w

Hydrologic Soil Group: C
Ecological site: R028AY012UT - Semiwet Fresh Meadow
Hydric soil rating: No

Minor Components

Collett
Percent of map unit: 5 percent

Greenson, 6-10% slopes
Percent of map unit: 3 percent

Poorly drained soils, hydric, not correlated
Percent of map unit: 2 percent
Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

GsC—GREENSON LOAM, 6 TO 10 PERCENT SLOPES

Map Unit Setting
National map unit symbol: j69s
Elevation: 4,450 to 4,650 feet
Mean annual precipitation: 14 to 17 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 120 to 140 days
Farmland classification: Farmland of statewide importance

Map Unit Composition
Greenson and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Greenson

Setting
Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Lacustrine deposits and alluvium derived from limestone, sandstone, and quartzite

Typical profile
Ap - 0 to 7 inches: loam
A1 - 7 to 16 inches: loam
B2 - 16 to 23 inches: loam
C1ca - 23 to 39 inches: loam
C2ca - 39 to 51 inches: loam

C3 - 51 to 72 inches: loam

Properties and qualities

Slope: 6 to 10 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: About 30 to 60 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 40 percent
Maximum salinity: Slightly saline to moderately saline (4.0 to 8.0 mmhos/cm)
Sodium adsorption ratio, maximum: 20.0
Available water supply, 0 to 60 inches: High (about 10.9 inches)

Interpretive groups

Land capability classification (irrigated): 3w
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: C
Ecological site: R028AY012UT - Semiwet Fresh Meadow
Hydric soil rating: No

Minor Components

Nibley

Percent of map unit: 5 percent

GuA—GREENSON LOAM, DEEP OVER CLAY, 0 TO 1 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j69t
Elevation: 4,450 to 4,650 feet
Mean annual precipitation: 14 to 17 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 120 to 140 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Greenson and similar soils: 98 percent
Minor components: 2 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Greenson

Setting

Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear

Parent material: Lacustrine deposits and alluvium derived from limestone, sandstone, and quartzite

Typical profile

Ap - 0 to 7 inches: loam
A1 - 7 to 16 inches: loam
B2 - 16 to 23 inches: loam
C1ca - 23 to 39 inches: loam
C2ca - 39 to 51 inches: loam
C3 - 51 to 72 inches: loam

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: About 24 to 42 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 40 percent
Maximum salinity: Slightly saline to moderately saline (4.0 to 8.0 mmhos/cm)
Sodium adsorption ratio, maximum: 20.0
Available water supply, 0 to 60 inches: High (about 10.9 inches)

Interpretive groups

Land capability classification (irrigated): 3w
Hydrologic Soil Group: C
Ecological site: R028AY024UT - Wet Saline Meadow (Saltgrass)
Hydric soil rating: No

Minor Components

Poorly drained soils, hydric, not correlated

Percent of map unit: 2 percent
Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

HdA—HENDRICKS SILT LOAM, 1 TO 3 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j6b3
Elevation: 4,800 to 5,400 feet
Mean annual precipitation: 17 to 20 inches
Mean annual air temperature: 44 to 48 degrees F
Frost-free period: 120 to 140 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Hendricks and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hendricks

Setting

Landform: Alluvial fans
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Alluvium derived from sandstone and/or alluvium derived from quartzite

Typical profile

Ap - 0 to 5 inches: silt loam
B1 - 5 to 15 inches: silt loam
B21t - 15 to 27 inches: silty clay loam
B22t - 27 to 47 inches: silty clay loam
B23t - 47 to 66 inches: silty clay loam

Properties and qualities

Slope: 1 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 10.2 inches)

Interpretive groups

Land capability classification (irrigated): 2c
Land capability classification (nonirrigated): 2c
Hydrologic Soil Group: C
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

Minor Components

Ricks

Percent of map unit: 5 percent

HdB—HENDRICKS SILT LOAM, 3 TO 6 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j6b4
Elevation: 4,800 to 5,400 feet
Mean annual precipitation: 17 to 20 inches
Mean annual air temperature: 44 to 48 degrees F
Frost-free period: 120 to 140 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Hendricks and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hendricks

Setting

Landform: Alluvial fans
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Alluvium derived from sandstone and/or alluvium derived from quartzite

Typical profile

Ap - 0 to 5 inches: silt loam
B1 - 5 to 15 inches: silt loam
B21t - 15 to 27 inches: silty clay loam
B22t - 27 to 47 inches: silty clay loam
B23t - 47 to 66 inches: silty clay loam

Properties and qualities

Slope: 3 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 10.2 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)

Hydric soil rating: No

Minor Components

Ricks

Percent of map unit: 5 percent

HdC—HENDRICKS SILT LOAM, 6 TO 10 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j6b5
Elevation: 4,800 to 5,400 feet
Mean annual precipitation: 17 to 20 inches
Mean annual air temperature: 44 to 48 degrees F
Frost-free period: 120 to 140 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Hendricks and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hendricks

Setting

Landform: Alluvial fans
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Alluvium derived from quartzite and/or alluvium derived from sandstone

Typical profile

Ap - 0 to 5 inches: silt loam
B1 - 5 to 15 inches: silt loam
B21t - 15 to 27 inches: silty clay loam
B22t - 27 to 47 inches: silty clay loam
B23t - 47 to 66 inches: silty clay loam

Properties and qualities

Slope: 6 to 10 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 10.2 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

Minor Components

Crowshaw

Percent of map unit: 5 percent

HdD—HENDRICKS SILT LOAM, 10 TO 20 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j6b6
Elevation: 4,800 to 5,400 feet
Mean annual precipitation: 17 to 20 inches
Mean annual air temperature: 44 to 48 degrees F
Frost-free period: 120 to 140 days
Farmland classification: Farmland of local importance

Map Unit Composition

Hendricks and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hendricks

Setting

Landform: Alluvial fans
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Alluvium derived from quartzite and/or alluvium derived from sandstone

Typical profile

Ap - 0 to 5 inches: silt loam
B1 - 5 to 15 inches: silt loam
B21t - 15 to 27 inches: silty clay loam
B22t - 27 to 47 inches: silty clay loam
B23t - 47 to 66 inches: silty clay loam

Properties and qualities

Slope: 10 to 20 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained

Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 10.2 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Ecological site: R047XA430UT - Mountain Loam (mountain big sagebrush)
Hydric soil rating: No

Minor Components

Sterling

Percent of map unit: 5 percent

HeC—HIIBNER GRAVELLY CLAY LOAM, 3 TO 10 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j6b7
Elevation: 4,500 to 6,000 feet
Mean annual precipitation: 17 to 20 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 100 to 140 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Hiibner and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hiibner

Setting

Landform: Alluvial fans
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Colluvium and alluvium derived from sandstone and quartzite

Typical profile

A11 - 0 to 3 inches: gravelly clay loam
A12 - 3 to 6 inches: gravelly clay loam
B21t - 6 to 12 inches: very cobbly clay
B22t - 12 to 27 inches: very cobbly clay
B23t - 27 to 60 inches: very cobbly clay

Properties and qualities

Slope: 3 to 10 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 4.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: R047XA454UT - Mountain Stony Clay (slender wheatgrass)
Hydric soil rating: No

Minor Components

Nebeker

Percent of map unit: 5 percent

HeD—HIIBNER GRAVELLY CLAY LOAM, 10 TO 30 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j6b8
Elevation: 4,500 to 6,000 feet
Mean annual precipitation: 17 to 20 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 100 to 140 days
Farmland classification: Not prime farmland

Map Unit Composition

Hiibner and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hiibner

Setting

Landform: Alluvial fans
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Colluvium and alluvium derived from sandstone and quartzite

Typical profile

A11 - 0 to 3 inches: gravelly clay loam
A12 - 3 to 6 inches: gravelly clay loam

B21t - 6 to 12 inches: very cobbly clay
B22t - 12 to 27 inches: very cobbly clay
B23t - 27 to 60 inches: very cobbly clay

Properties and qualities

Slope: 10 to 20 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 4.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Ecological site: R047XA454UT - Mountain Stony Clay (slender wheatgrass)
Hydric soil rating: No

Minor Components

Nebeker

Percent of map unit: 5 percent

HfE—HIIBNER EXTREMELY STONY CLAY LOAM, 1 TO 30 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j6bb
Elevation: 4,500 to 6,000 feet
Mean annual precipitation: 17 to 20 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 100 to 140 days
Farmland classification: Not prime farmland

Map Unit Composition

Hiibner and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hiibner

Setting

Landform: Alluvial fans
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Alluvium and colluvium from sandstone and quartzite

Typical profile

A11 - 0 to 3 inches: cobbly clay loam
A12 - 3 to 6 inches: cobbly clay loam
B21t - 6 to 12 inches: very cobbly clay
B22t - 12 to 27 inches: very cobbly clay
B23t - 27 to 60 inches: very cobbly clay

Properties and qualities

Slope: 1 to 30 percent
Surface area covered with cobbles, stones or boulders: 0.1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 4.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Ecological site: R047XA454UT - Mountain Stony Clay (slender wheatgrass)
Hydric soil rating: No

Minor Components

Nebeker

Percent of map unit: 5 percent

HLG2—HOSKIN-DATWYLER ASSOCIATION, ERODED

Map Unit Setting

National map unit symbol: j69y
Elevation: 5,000 to 8,000 feet
Mean annual precipitation: 20 to 25 inches
Mean annual air temperature: 40 to 45 degrees F
Frost-free period: 70 to 110 days
Farmland classification: Not prime farmland

Map Unit Composition

Hoskin and similar soils: 50 percent
Datwyler and similar soils: 30 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hoskin

Setting

Landform: Mountain slopes
Landform position (three-dimensional): Mountainflank
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum and colluvium derived from conglomerate and sandstone

Typical profile

A1 - 0 to 7 inches: cobbly loam
B2t - 7 to 16 inches: very cobbly loam
C - 16 to 28 inches: extremely cobbly loam
R - 28 to 32 inches: unweathered bedrock

Properties and qualities

Slope: 30 to 70 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): Low to moderately high (0.01 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Very low (about 1.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: C
Ecological site: R047XA461UT - Mountain Stony Loam (mountain big sagebrush)
Hydric soil rating: No

Description of Datwyler

Setting

Landform: Mountains
Landform position (three-dimensional): Mountainflank
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Colluvium derived from limestone and sandstone and/or residuum weathered from limestone and sandstone

Typical profile

A1 - 0 to 4 inches: very cobbly silty clay loam
B1 - 4 to 11 inches: very cobbly clay
B2t - 11 to 28 inches: extremely cobbly clay
Cca - 28 to 35 inches: extremely cobbly sandy clay loam
R - 35 to 39 inches: unweathered bedrock

Properties and qualities

Slope: 30 to 60 percent
Depth to restrictive feature: 30 to 40 inches to lithic bedrock
Drainage class: Well drained

Capacity of the most limiting layer to transmit water (Ksat): Low to moderately high (0.01 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 70 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.3 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: D
Ecological site: R047XA461UT - Mountain Stony Loam (mountain big sagebrush)
Hydric soil rating: No

Minor Components

Smarts
Percent of map unit: 7 percent

Rock land
Percent of map unit: 7 percent

Elzinga
Percent of map unit: 6 percent

HuC—HYRUM GRAVELLY LOAM, 4 TO 8 PERCENT SLOPES

Map Unit Setting
National map unit symbol: j6bf
Elevation: 4,600 to 5,000 feet
Mean annual precipitation: 15 to 17 inches
Mean annual air temperature: 45 to 47 degrees F
Frost-free period: 130 to 150 days
Farmland classification: Farmland of statewide importance

Map Unit Composition
Hyrum and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hyrum

Setting
Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear

Parent material: Alluvium and lacustrine deposits derived from sandstone, quartzite, and lesser amounts of limestone

Typical profile

A1 - 0 to 8 inches: gravelly loam
B1 - 8 to 17 inches: gravelly loam
B21t - 17 to 31 inches: very cobbly clay loam
B22t - 31 to 42 inches: very cobbly clay loam
C - 42 to 60 inches: very cobbly loam

Properties and qualities

Slope: 4 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 5.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: R028AY334UT - Upland Stony Loam (Wyoming Big Sagebrush)
Other vegetative classification: Upland Stony Loam (Mountain Big Sagebrush) (028AY334UT)
Hydric soil rating: No

Minor Components

Hendricks

Percent of map unit: 5 percent

HuE—HYRUM GRAVELLY LOAM, 10 TO 25 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j6bg
Elevation: 4,600 to 5,000 feet
Mean annual precipitation: 15 to 17 inches
Mean annual air temperature: 45 to 47 degrees F
Frost-free period: 130 to 150 days
Farmland classification: Farmland of local importance

Map Unit Composition

Hyrum and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hyrum

Setting

Landform: Lake terraces
Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium and lacustrine deposits derived from sandstone, quartzite, and lesser amounts of limestone

Typical profile

A1 - 0 to 8 inches: gravelly loam
B1 - 8 to 17 inches: gravelly loam
B21t - 17 to 31 inches: very cobbly clay loam
B22t - 31 to 42 inches: very cobbly clay loam
C - 42 to 60 inches: very cobbly loam

Properties and qualities

Slope: 10 to 25 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 5.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Ecological site: R028AY334UT - Upland Stony Loam (Wyoming Big Sagebrush)
Other vegetative classification: Upland Stony Loam (Mountain Big Sagebrush) (028AY334UT)
Hydric soil rating: No

Minor Components

Crowshaw

Percent of map unit: 5 percent

KdA—KIDMAN FINE SANDY LOAM, 0 TO 2 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j6bl
Elevation: 4,450 to 4,550 feet
Mean annual precipitation: 15 to 17 inches
Mean annual air temperature: 45 to 48 degrees F

Frost-free period: 130 to 150 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Kidman, well drained, and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kidman, Well Drained

Setting

Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Lacustrine deposits derived from limestone and sandstone

Typical profile

Ap - 0 to 8 inches: fine sandy loam
B1 - 8 to 12 inches: fine sandy loam
B2 - 12 to 20 inches: fine sandy loam
C1 - 20 to 27 inches: fine sandy loam
C2ca - 27 to 43 inches: fine sandy loam
IIC3 - 43 to 60 inches: fine sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 7.2 inches)

Interpretive groups

Land capability classification (irrigated): 2c
Land capability classification (nonirrigated): 4c
Hydrologic Soil Group: A
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

Minor Components

Preston

Percent of map unit: 3 percent

Kidman, moderately well drained

Percent of map unit: 2 percent

KdD—KIDMAN FINE SANDY LOAM, 8 TO 15 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j6bm
Elevation: 4,450 to 4,550 feet
Mean annual precipitation: 15 to 17 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 130 to 150 days
Farmland classification: Farmland of local importance

Map Unit Composition

Kidman and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kidman

Setting

Landform: Lake terraces
Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Lacustrine deposits derived from limestone and sandstone

Typical profile

Ap - 0 to 8 inches: fine sandy loam
B1 - 8 to 12 inches: fine sandy loam
B2 - 12 to 20 inches: fine sandy loam
C1 - 20 to 27 inches: fine sandy loam
C2ca - 27 to 43 inches: fine sandy loam
IIC3 - 43 to 60 inches: fine sand

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 7.2 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North

Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

KfB—KIDMAN FINE SANDY LOAM, DEEP WATER TABLE, 2 TO 4 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j6bp
Elevation: 4,450 to 4,550 feet
Mean annual precipitation: 15 to 17 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 130 to 150 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Kidman and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kidman

Setting

Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Lacustrine deposits derived from limestone and sandstone

Typical profile

Ap - 0 to 8 inches: fine sandy loam
B1 - 8 to 12 inches: fine sandy loam
B2 - 12 to 20 inches: fine sandy loam
C1 - 20 to 27 inches: fine sandy loam
C2ca - 27 to 43 inches: fine sandy loam
IIC3 - 43 to 60 inches: fine sand

Properties and qualities

Slope: 2 to 4 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: About 42 to 60 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 7.2 inches)

Interpretive groups

Land capability classification (irrigated): 2e

Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: A
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

Minor Components

Layton
Percent of map unit: 3 percent

Kidman
Percent of map unit: 2 percent

KfC—KIDMAN FINE SANDY LOAM, DEEP WATER TABLE, 4 TO 8 PERCENT SLOPES

Map Unit Setting
National map unit symbol: j6bq
Elevation: 4,450 to 4,550 feet
Mean annual precipitation: 15 to 17 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 130 to 150 days
Farmland classification: Farmland of statewide importance

Map Unit Composition
Kidman and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kidman

Setting
Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Lacustrine deposits derived from limestone and sandstone

Typical profile
Ap - 0 to 8 inches: fine sandy loam
B1 - 8 to 12 inches: fine sandy loam
B2 - 12 to 20 inches: fine sandy loam
C1 - 20 to 27 inches: fine sandy loam
C2ca - 27 to 43 inches: fine sandy loam
IIC3 - 43 to 60 inches: fine sand

Properties and qualities
Slope: 4 to 8 percent
Depth to restrictive feature: More than 80 inches

Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: About 42 to 60 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 7.2 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: A
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

Minor Components

Layton

Percent of map unit: 5 percent

Ks—KIRKHAM-SHAY COMPLEX

Map Unit Setting

National map unit symbol: j6br
Elevation: 4,420 to 4,500 feet
Mean annual precipitation: 14 to 17 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 120 to 140 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Kirkham and similar soils: 55 percent
Shay and similar soils: 40 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kirkham

Setting

Landform: Flood plains
Landform position (three-dimensional): Talf, dip
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Alluvium derived from quartzite and/or alluvium derived from limestone and sandstone

Typical profile

Ap - 0 to 9 inches: silt loam
C1 - 9 to 15 inches: silty clay loam
C2 - 15 to 23 inches: silty clay loam
C3 - 23 to 60 inches: silt loam

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 30 to 54 inches
Frequency of flooding: Rare
Frequency of ponding: None
Calcium carbonate, maximum content: 40 percent
Gypsum, maximum content: 2 percent
Maximum salinity: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum: 15.0
Available water supply, 0 to 60 inches: High (about 9.7 inches)

Interpretive groups

Land capability classification (irrigated): 2w
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: C
Ecological site: R028AY012UT - Semiwet Fresh Meadow
Hydric soil rating: No

Description of Shay

Setting

Landform: Flood plains
Landform position (three-dimensional): Talf, dip
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Alluvium derived from limestone and sandstone and/or alluvium derived from quartzite

Typical profile

Ap - 0 to 14 inches: silty clay loam
IIC1 - 14 to 30 inches: silty clay
IIIC2 - 30 to 44 inches: loam
IVC3 - 44 to 58 inches: sandy loam
VC4 - 58 to 60 inches: stratified extremely gravelly coarse sand to coarse sand

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 30 to 48 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Calcium carbonate, maximum content: 40 percent
Maximum salinity: Very slightly saline to slightly saline (2.0 to 4.0 mmhos/cm)

Sodium adsorption ratio, maximum: 10.0
Available water supply, 0 to 60 inches: Moderate (about 8.5 inches)

Interpretive groups
Land capability classification (irrigated): 3w
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: D
Ecological site: R028AY012UT - Semiwet Fresh Meadow
Hydric soil rating: No

Minor Components

Winn
Percent of map unit: 3 percent

Gravelly alluvial soils
Percent of map unit: 2 percent
Landform: Flood plains
Landform position (three-dimensional): Talf, dip
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: Yes

La—LAKEWIN GRAVELLY COARSE SANDY LOAM

Map Unit Setting
National map unit symbol: j6c3
Elevation: 4,740 to 4,800 feet
Mean annual precipitation: 15 to 17 inches
Mean annual air temperature: 46 to 47 degrees F
Frost-free period: 120 to 140 days
Farmland classification: Not prime farmland

Map Unit Composition
Lakewin and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Lakewin

Setting
Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy and gravelly alluvium and lacustrine deposits derived from limestone, sandstone and quartzite

Typical profile
Ap - 0 to 7 inches: gravelly coarse sandy loam

A1 - 7 to 18 inches: gravelly coarse sandy loam
C1 - 18 to 27 inches: gravelly loamy sand
C2ca - 27 to 34 inches: very gravelly loamy sand
C3ca - 34 to 60 inches: very gravelly sand

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): High to very high (6.00 to 20.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 25 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.1 inches)

Interpretive groups

Land capability classification (irrigated): 4s
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: A
Ecological site: R047XA332UT - Upland Stony Loam (black sagebrush)
Hydric soil rating: No

Minor Components

Kidman

Percent of map unit: 5 percent

Lr—LOGAN SILTY CLAY LOAM

Map Unit Setting

National map unit symbol: j6c7
Elevation: 4,420 to 4,500 feet
Mean annual precipitation: 14 to 17 inches
Mean annual air temperature: 45 to 47 degrees F
Frost-free period: 120 to 140 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Logan and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Logan

Setting

Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear

Across-slope shape: Linear
Parent material: Alluvium and lacustrine deposits derived from limestone, sandstone and quartzite

Typical profile

A1 - 0 to 13 inches: silty clay loam
C1cag - 13 to 26 inches: silty clay loam
C2g - 26 to 45 inches: silty clay
C3g - 45 to 60 inches: silty clay

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 10 to 30 inches
Frequency of flooding: Rare
Frequency of ponding: None
Calcium carbonate, maximum content: 45 percent
Maximum salinity: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum: 2.0
Available water supply, 0 to 60 inches: High (about 10.3 inches)

Interpretive groups

Land capability classification (irrigated): 3w
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: C/D
Ecological site: R028AY020UT - Wet Fresh Meadow
Hydric soil rating: Yes

Minor Components

Greenson

Percent of map unit: 4 percent

Salt lake

Percent of map unit: 4 percent
Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R028AY024UT - Wet Saline Meadow (Saltgrass)
Hydric soil rating: Yes

Alkali soils

Percent of map unit: 2 percent
Landform: Depressions
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

McB—MCMURDIE SILT LOAM, 3 TO 6 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j6cf
Elevation: 4,800 to 5,150 feet
Mean annual precipitation: 17 to 20 inches
Mean annual air temperature: 45 to 47 degrees F
Frost-free period: 130 to 150 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Mcmurdie and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Mcmurdie

Setting

Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Lacustrine deposits derived from quartzite and/or lacustrine deposits derived from limestone and sandstone

Typical profile

Ap - 0 to 7 inches: silt loam
B1 - 7 to 14 inches: silty clay loam
B2t - 14 to 33 inches: silty clay
B3ca - 33 to 43 inches: silty clay loam
C1ca - 43 to 50 inches: loam
IIC2 - 50 to 60 inches: sandy loam

Properties and qualities

Slope: 3 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 30 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 9.3 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C

Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

Minor Components

Hillfield
Percent of map unit: 5 percent

McC—MCMURDIE SILT LOAM, 6 TO 10 PERCENT SLOPES

Map Unit Setting
National map unit symbol: j6cg
Elevation: 4,800 to 5,150 feet
Mean annual precipitation: 17 to 20 inches
Mean annual air temperature: 45 to 47 degrees F
Frost-free period: 130 to 150 days
Farmland classification: Farmland of statewide importance

Map Unit Composition
Mcmurdie and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Mcmurdie

Setting
Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Lacustrine deposits derived from limestone and sandstone and/or lacustrine deposits derived from quartzite

Typical profile
Ap - 0 to 7 inches: silt loam
B1 - 7 to 14 inches: silty clay loam
B2t - 14 to 33 inches: silty clay
B3ca - 33 to 43 inches: silty clay loam
C1ca - 43 to 50 inches: loam
IIC2 - 50 to 60 inches: sandy loam

Properties and qualities
Slope: 6 to 10 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None

Frequency of ponding: None
Calcium carbonate, maximum content: 30 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 9.3 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

Minor Components

Hillfield

Percent of map unit: 5 percent

MeA—MENDON SILT LOAM, 0 TO 3 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j6cj
Elevation: 4,450 to 5,100 feet
Mean annual precipitation: 14 to 20 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 120 to 150 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Mendon and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Mendon

Setting

Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium and colluvium derived from tuff, conglomerate, tuffaceous sandstone and limestone

Typical profile

Ap - 0 to 7 inches: silt loam
B2t - 7 to 24 inches: clay loam
B3ca - 24 to 28 inches: clay loam
C1ca - 28 to 34 inches: loam
C2 - 34 to 40 inches: loam
C3 - 40 to 60 inches: loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 45 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 10.8 inches)

Interpretive groups

Land capability classification (irrigated): 2c
Land capability classification (nonirrigated): 2c
Hydrologic Soil Group: C
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

Minor Components

Roshe springs

Percent of map unit: 5 percent
Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R028AY020UT - Wet Fresh Meadow
Hydric soil rating: Yes

MeB—MENDON SILT LOAM, 3 TO 6 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j6ck
Elevation: 4,500 to 5,100 feet
Mean annual precipitation: 17 to 20 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 120 to 150 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Mendon and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Mendon

Setting

Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium and colluvium derived from tuff, conglomerate, tuffaceous sandstone and limestone

Typical profile

Ap - 0 to 7 inches: silt loam
B2t - 7 to 24 inches: clay loam
B3ca - 24 to 28 inches: clay loam
C1ca - 28 to 34 inches: loam
C2 - 34 to 40 inches: loam
C3 - 40 to 60 inches: loam

Properties and qualities

Slope: 3 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 45 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 10.8 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

Minor Components

Collinston

Percent of map unit: 5 percent

Wheelon

Percent of map unit: 5 percent

MeC—MENDON SILT LOAM, 6 TO 10 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j6cl
Elevation: 4,500 to 5,100 feet
Mean annual precipitation: 17 to 20 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 120 to 150 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Mendon and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Mendon

Setting

Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium and colluvium derived from tuff, conglomerate, tuffaceous sandstone and limestone

Typical profile

Ap - 0 to 7 inches: silt loam
B2t - 7 to 24 inches: clay loam
B3ca - 24 to 28 inches: clay loam
C1ca - 28 to 34 inches: loam
C2 - 34 to 40 inches: loam
C3 - 40 to 60 inches: loam

Properties and qualities

Slope: 6 to 10 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 45 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 10.8 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C

Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

Minor Components

Wheelon
Percent of map unit: 5 percent

MfB—MENDON-COLLINSTON COMPLEX, 1 TO 6 PERCENT SLOPES

Map Unit Setting
National map unit symbol: j6cm
Elevation: 4,500 to 5,300 feet
Mean annual precipitation: 15 to 22 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 100 to 160 days
Farmland classification: Farmland of statewide importance

Map Unit Composition
Mendon and similar soils: 50 percent
Collinston and similar soils: 40 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Mendon

Setting
Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium and colluvium derived from tuff, conglomerate, tuffaceous sandstone and limestone

Typical profile
Ap - 0 to 7 inches: silt loam
B2t - 7 to 24 inches: clay loam
B3ca - 24 to 28 inches: clay loam
C1ca - 28 to 34 inches: loam
C2 - 34 to 40 inches: loam
C3 - 40 to 60 inches: loam

Properties and qualities
Slope: 3 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches

Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 45 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 10.8 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

Description of Collinston

Setting

Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Lacustrine deposits derived from tuff and/or lacustrine deposits derived from limestone and sandstone

Typical profile

A11 - 0 to 8 inches: loam
A12 - 8 to 15 inches: loam
C1ca - 15 to 25 inches: clay loam
C2 - 25 to 35 inches: silt loam
C3 - 35 to 60 inches: silt loam

Properties and qualities

Slope: 1 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 60 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 10.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

Minor Components

Wheelon

Percent of map unit: 10 percent

MfE2—MENDON-COLLINSTON COMPLEX, 6 TO 30 PERCENT SLOPES,ERODED

Map Unit Setting

National map unit symbol: j6cn
Elevation: 4,500 to 5,300 feet
Mean annual precipitation: 14 to 22 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 100 to 160 days
Farmland classification: Not prime farmland

Map Unit Composition

Mendon and similar soils: 45 percent
Collinston and similar soils: 35 percent
Wheelon and similar soils: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Mendon

Setting

Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium and colluvium derived from tuff, conglomerate, tuffaceous sandstone and limestone

Typical profile

Ap - 0 to 7 inches: silt loam
B2t - 7 to 24 inches: clay loam
B3ca - 24 to 28 inches: clay loam
C1ca - 28 to 34 inches: loam
C2 - 34 to 40 inches: loam
C3 - 40 to 60 inches: loam

Properties and qualities

Slope: 6 to 10 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None

Frequency of ponding: None
Calcium carbonate, maximum content: 45 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 10.8 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

Description of Collinston

Setting

Landform: Lake terraces
Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Lacustrine deposits derived from tuff and/or lacustrine deposits derived from limestone and sandstone

Typical profile

A11 - 0 to 8 inches: loam
A12 - 8 to 15 inches: loam
C1ca - 15 to 25 inches: clay loam
C2 - 25 to 35 inches: silt loam
C3 - 35 to 60 inches: silt loam

Properties and qualities

Slope: 10 to 30 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 60 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 10.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

Description of Wheelon

Setting

Landform: Lake terraces

Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Lacustrine deposits derived from tuff and/or lacustrine deposits derived from limestone and sandstone

Typical profile

Ap - 0 to 6 inches: silt loam
AC - 6 to 12 inches: silt loam
C1ca - 12 to 23 inches: silt loam
C2ca - 23 to 43 inches: silt loam
C3 - 43 to 66 inches: silt loam

Properties and qualities

Slope: 30 to 50 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 35 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 10.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: B
Ecological site: R028AY325UT - Upland Shallow Loam (Black Sagebrush)
Hydric soil rating: No

MoG2—MUNK-BLACKROCK GRAVELLY LOAMS, 30 TO 70 PERCENT SLOPES, ERODED

Map Unit Setting

National map unit symbol: j6cs
Elevation: 4,500 to 5,700 feet
Mean annual precipitation: 14 to 17 inches
Mean annual air temperature: 45 to 46 degrees F
Frost-free period: 120 to 140 days
Farmland classification: Not prime farmland

Map Unit Composition

Munk and similar soils: 60 percent
Blackrock and similar soils: 40 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Munk

Setting

Landform: Mountain slopes
Landform position (three-dimensional): Mountainflank
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum and colluvium derived from tuff, tuffaceous sandstone and limestone

Typical profile

A1 - 0 to 8 inches: very gravelly loam
AC - 8 to 23 inches: very gravelly loam
Cca - 23 to 36 inches: very gravelly sandy loam
R - 36 to 40 inches: unweathered bedrock

Properties and qualities

Slope: 30 to 70 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Low to moderately high (0.01 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 30 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Very low (about 2.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: C
Ecological site: R047XA332UT - Upland Stony Loam (black sagebrush)
Hydric soil rating: No

Description of Blackrock

Setting

Landform: Alluvial fans
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Alluvium and colluvium derived from tuff, sandstone and limestone

Typical profile

A11 - 0 to 8 inches: gravelly loam
A12 - 8 to 22 inches: gravelly loam
AC - 22 to 39 inches: very gravelly loam
Cca - 39 to 60 inches: gravelly clay loam

Properties and qualities

Slope: 30 to 60 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)

Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 20 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 8.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: C
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

NbE—NEBEKER SILT LOAM, 10 TO 25 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j6cw
Elevation: 5,100 to 5,700 feet
Mean annual precipitation: 17 to 20 inches
Mean annual air temperature: 45 to 46 degrees F
Frost-free period: 110 to 140 days
Farmland classification: Farmland of local importance

Map Unit Composition

Nebeker and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Nebeker

Setting

Landform: Lake terraces
Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from quartzite and/or alluvium derived from sandstone and shale

Typical profile

Ap - 0 to 8 inches: silt loam
B1 - 8 to 14 inches: silt loam
B21t - 14 to 26 inches: silty clay loam
B22t - 26 to 48 inches: clay
B23t - 48 to 55 inches: clay
IIC - 55 to 70 inches: clay loam

Properties and qualities

Slope: 10 to 25 percent

Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 10.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Ecological site: R047XA430UT - Mountain Loam (mountain big sagebrush)
Hydric soil rating: No

Minor Components

Sterling

Percent of map unit: 5 percent

Hendricks

Percent of map unit: 5 percent

NcA—NIBLEY SILTY CLAY LOAM, 0 TO 3 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j6cx
Elevation: 4,450 to 4,700 feet
Mean annual precipitation: 14 to 17 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 120 to 150 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Nibley and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Nibley

Setting

Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Lacustrine deposits derived from quartzite and/or lacustrine deposits derived from limestone and sandstone

Typical profile

Ap - 0 to 7 inches: silty clay loam
A1 - 7 to 13 inches: silty clay loam
B21t - 13 to 20 inches: silty clay
B22tca - 20 to 32 inches: silty clay
B3ca - 32 to 43 inches: silty clay
C - 43 to 60 inches: silty clay

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 30 to 48 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 50 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 10.9 inches)

Interpretive groups

Land capability classification (irrigated): 3w
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: D
Ecological site: R028AY012UT - Semiwet Fresh Meadow
Hydric soil rating: No

Minor Components

Collett

Percent of map unit: 5 percent

Greenson

Percent of map unit: 3 percent

Poorly drained soils, hydric, not correlated

Percent of map unit: 2 percent
Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

NcB—NIBLEY SILTY CLAY LOAM, 3 TO 6 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j6cy
Elevation: 4,450 to 4,700 feet
Mean annual precipitation: 14 to 17 inches
Mean annual air temperature: 45 to 46 degrees F

Frost-free period: 120 to 150 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Nibley and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Nibley

Setting

Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Lacustrine deposits derived from limestone and sandstone and/or lacustrine deposits derived from quartzite

Typical profile

Ap - 0 to 7 inches: silty clay loam
A1 - 7 to 13 inches: silty clay loam
B21t - 13 to 20 inches: silty clay
B22tca - 20 to 32 inches: silty clay
B3ca - 32 to 43 inches: silty clay
C - 43 to 60 inches: silty clay

Properties and qualities

Slope: 3 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 30 to 48 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 50 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 10.9 inches)

Interpretive groups

Land capability classification (irrigated): 3w
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: D
Ecological site: R028AY012UT - Semiwet Fresh Meadow
Hydric soil rating: No

Minor Components

Greenson

Percent of map unit: 5 percent

Poorly drained soils, hydric, not correlated

Percent of map unit: 5 percent
Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear

Hydric soil rating: Yes

PaA—PARLEYS SILT LOAM, 0 TO 3 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j6d3
Elevation: 4,500 to 5,100 feet
Mean annual precipitation: 15 to 17 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 120 to 160 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Parleys and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Parleys

Setting

Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Lacustrine deposits derived from quartzite and/or lacustrine deposits derived from limestone and sandstone

Typical profile

Ap - 0 to 8 inches: silt loam
B1 - 8 to 12 inches: loam
B21t - 12 to 19 inches: clay loam
B22t - 19 to 31 inches: clay loam
B3ca - 31 to 36 inches: silt loam
C1ca - 36 to 52 inches: silt loam
C2ca - 52 to 68 inches: silt loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 30 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 9.8 inches)

Interpretive groups

Land capability classification (irrigated): 2c

Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

Minor Components

Timpanogos
Percent of map unit: 5 percent

Parleys
Percent of map unit: 5 percent

PaB—PARLEYS SILT LOAM, 3 TO 6 PERCENT SLOPES

Map Unit Setting
National map unit symbol: j6d4
Elevation: 4,500 to 5,100 feet
Mean annual precipitation: 15 to 17 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 120 to 160 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition
Parleys and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Parleys

Setting
Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Lacustrine deposits derived from limestone and sandstone and/or lacustrine deposits derived from quartzite

Typical profile
Ap - 0 to 8 inches: silt loam
B1 - 8 to 12 inches: loam
B21t - 12 to 19 inches: clay loam
B22t - 19 to 31 inches: clay loam
B3ca - 31 to 36 inches: silt loam
C1ca - 36 to 52 inches: silt loam
C2ca - 52 to 68 inches: silt loam

Properties and qualities
Slope: 3 to 6 percent

Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 30 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 9.8 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

Minor Components

Hillfield, eroded

Percent of map unit: 5 percent

PaC—PARLEYS SILT LOAM, 6 TO 10 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j6d5
Elevation: 4,500 to 5,100 feet
Mean annual precipitation: 15 to 17 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 120 to 160 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Parleys and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Parleys

Setting

Landform: Lake plains
Landform position (three-dimensional): Talf, rise
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Lacustrine deposits derived from quartzite and/or lacustrine deposits derived from limestone and sandstone

Typical profile

Ap - 0 to 8 inches: silt loam
B1 - 8 to 12 inches: loam
B21t - 12 to 19 inches: clay loam
B22t - 19 to 31 inches: clay loam
B3ca - 31 to 36 inches: silt loam
C1ca - 36 to 52 inches: silt loam
C2ca - 52 to 68 inches: silt loam

Properties and qualities

Slope: 6 to 10 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 30 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 9.8 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

Minor Components

Hillfield, eroded

Percent of map unit: 5 percent

Pu—PROVO LOAM

Map Unit Setting

National map unit symbol: j6dc
Elevation: 4,470 to 4,650 feet
Mean annual precipitation: 14 to 17 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 120 to 140 days
Farmland classification: Farmland of local importance

Map Unit Composition

Provo and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Provo

Setting

Landform: Flood plains
Landform position (three-dimensional): Talf, dip
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Alluvium derived from limestone and sandstone and/or alluvium derived from quartzite

Typical profile

A11 - 0 to 7 inches: loam
A12 - 7 to 13 inches: gravelly loam
C1ca - 13 to 19 inches: extremely gravelly loam
C2ca - 19 to 27 inches: extremely gravelly loam
C3ca - 27 to 60 inches: extremely gravelly sandy loam

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 26 to 60 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Calcium carbonate, maximum content: 40 percent
Available water supply, 0 to 60 inches: Low (about 5.0 inches)

Interpretive groups

Land capability classification (irrigated): 3w
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: B
Ecological site: R028AY020UT - Wet Fresh Meadow
Hydric soil rating: No

Minor Components

Ponded soils

Percent of map unit: 5 percent
Landform: Depressions
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Winn

Percent of map unit: 5 percent

Pv—PROVO GRAVELLY LOAM

Map Unit Setting

National map unit symbol: j6dd
Elevation: 4,450 to 4,650 feet
Mean annual precipitation: 14 to 17 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 120 to 140 days
Farmland classification: Farmland of local importance

Map Unit Composition

Provo and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Provo

Setting

Landform: Flood plains
Landform position (three-dimensional): Talf, dip
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Alluvium derived from limestone and sandstone and/or alluvium derived from quartzite

Typical profile

A11 - 0 to 7 inches: gravelly loam
A12 - 7 to 13 inches: gravelly loam
C1ca - 13 to 19 inches: extremely gravelly loam
C2ca - 19 to 27 inches: extremely gravelly loam
C3ca - 27 to 60 inches: extremely gravelly sandy loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 26 to 60 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Calcium carbonate, maximum content: 40 percent
Available water supply, 0 to 60 inches: Low (about 4.7 inches)

Interpretive groups

Land capability classification (irrigated): 3w
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: B
Ecological site: R028AY020UT - Wet Fresh Meadow
Hydric soil rating: No

Minor Components

Roshe springs

Percent of map unit: 5 percent
Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R028AY020UT - Wet Fresh Meadow
Hydric soil rating: Yes

Ponded soils

Percent of map unit: 5 percent
Landform: Depressions
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

RhA—RICKS GRAVELLY LOAM, 0 TO 3 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j6dn
Elevation: 4,500 to 5,700 feet
Mean annual precipitation: 15 to 17 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 130 to 160 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Ricks and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ricks

Setting

Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium and deltaic sediments derived from limestone, sandstone and quartzite

Typical profile

Ap - 0 to 4 inches: gravelly loam
A1 - 4 to 9 inches: gravelly loam
B2 - 9 to 14 inches: gravelly loam
B3ca - 14 to 18 inches: gravelly sandy loam
IIC1ca - 18 to 24 inches: very gravelly sand

IIC2ca - 24 to 60 inches: very gravelly sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 25 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.4 inches)

Interpretive groups

Land capability classification (irrigated): 4s
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: B
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

Minor Components

Timpanogos

Percent of map unit: 5 percent

RhB—RICKS GRAVELLY LOAM, 3 TO 6 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j6dp
Elevation: 4,500 to 5,700 feet
Mean annual precipitation: 15 to 17 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 130 to 160 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Ricks and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ricks

Setting

Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear

Parent material: Alluvium and deltaic sediments derived from limestone, sandstone and quartzite

Typical profile

Ap - 0 to 4 inches: gravelly loam
A1 - 4 to 9 inches: gravelly loam
B2 - 9 to 14 inches: gravelly loam
B3ca - 14 to 18 inches: gravelly sandy loam
IIC1ca - 18 to 24 inches: very gravelly sand
IIC2ca - 24 to 60 inches: very gravelly sand

Properties and qualities

Slope: 3 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 25 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.4 inches)

Interpretive groups

Land capability classification (irrigated): 4s
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: B
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

Minor Components

Timpanogos

Percent of map unit: 5 percent

Sterling

Percent of map unit: 5 percent

RhC—RICKS GRAVELLY LOAM, 6 TO 10 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j6dq
Elevation: 4,500 to 5,700 feet
Mean annual precipitation: 15 to 17 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 130 to 160 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Ricks and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ricks

Setting

Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium and deltaic sediments derived from limestone, sandstone and quartzite

Typical profile

Ap - 0 to 4 inches: gravelly loam
A1 - 4 to 9 inches: gravelly loam
B2 - 9 to 14 inches: gravelly loam
B3ca - 14 to 18 inches: gravelly sandy loam
IIC1ca - 18 to 24 inches: very gravelly sand
IIC2ca - 24 to 60 inches: very gravelly sand

Properties and qualities

Slope: 6 to 10 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 25 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.4 inches)

Interpretive groups

Land capability classification (irrigated): 4s
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: B
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

RO—ROCK LAND

Map Unit Composition

Rock outcrop: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Rock Outcrop

Setting

Landform: Mountain slopes
Landform position (three-dimensional): Mountainflank
Down-slope shape: Convex
Across-slope shape: Convex

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydric soil rating: No

Rs—ROSHE SPRINGS SILT LOAM

Map Unit Setting

National map unit symbol: j6ds
Elevation: 4,450 to 4,600 feet
Mean annual precipitation: 14 to 17 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 120 to 140 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Roshe springs and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Roshe Springs

Setting

Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

A1 - 0 to 8 inches: silt loam
C1ca - 8 to 14 inches: silt loam
C2ca - 14 to 23 inches: silt loam
C3ca - 23 to 35 inches: silt loam
C4 - 35 to 60 inches: silt loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 10 to 36 inches
Frequency of flooding: None
Frequency of ponding: None

Calcium carbonate, maximum content: 55 percent
Maximum salinity: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum: 5.0
Available water supply, 0 to 60 inches: High (about 10.8 inches)

Interpretive groups

Land capability classification (irrigated): 3w
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: B/D
Ecological site: R028AY020UT - Wet Fresh Meadow
Hydric soil rating: Yes

Minor Components

Logan

Percent of map unit: 5 percent
Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R028AY020UT - Wet Fresh Meadow
Hydric soil rating: Yes

Ponded soils

Percent of map unit: 5 percent
Landform: Depressions
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Rt—ROUGH BROKEN LAND

Map Unit Composition

Rough broken land: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Rough Broken Land

Setting

Landform: Drainageways
Down-slope shape: Linear
Across-slope shape: Concave

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydric soil rating: No

Sg—SALT LAKE-ROSHE SPRINGS COMPLEX

Map Unit Setting

National map unit symbol: j6fb
Elevation: 4,420 to 4,600 feet
Mean annual precipitation: 14 to 17 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 120 to 140 days
Farmland classification: Farmland of local importance

Map Unit Composition

Salt lake and similar soils: 55 percent
Roshe springs and similar soils: 40 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Salt Lake

Setting

Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Lacustrine deposits derived from limestone and/or lacustrine deposits derived from quartzite

Typical profile

A1 - 0 to 7 inches: silty clay
ACcag - 7 to 15 inches: silty clay
C1cag - 15 to 36 inches: silty clay
C2 - 36 to 66 inches: silty clay

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 0 to 30 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Calcium carbonate, maximum content: 50 percent
Maximum salinity: Very slightly saline to slightly saline (2.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum: 5.0
Available water supply, 0 to 60 inches: High (about 10.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: D
Ecological site: R028AY024UT - Wet Saline Meadow (Saltgrass)
Hydric soil rating: Yes

Description of Roshe Springs

Setting

Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

A1 - 0 to 8 inches: silt loam
C1ca - 8 to 14 inches: silt loam
C2ca - 14 to 23 inches: silt loam
C3ca - 23 to 35 inches: silt loam
C4 - 35 to 60 inches: silt loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 10 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 55 percent
Maximum salinity: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum: 5.0
Available water supply, 0 to 60 inches: High (about 10.8 inches)

Interpretive groups

Land capability classification (irrigated): 3w
Land capability classification (nonirrigated): 5w
Hydrologic Soil Group: B/D
Ecological site: R028AY020UT - Wet Fresh Meadow
Hydric soil rating: Yes

Minor Components

Airport

Percent of map unit: 5 percent
Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R028AY001UT - Alkali Bottom (Alkali Sacaton)
Hydric soil rating: Yes

SSE—SMARTS SILT LOAM, 10 TO 30 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j6f4
Elevation: 5,200 to 9,000 feet
Mean annual precipitation: 20 to 30 inches
Mean annual air temperature: 37 to 45 degrees F
Frost-free period: 80 to 110 days
Farmland classification: Not prime farmland

Map Unit Composition

Smarts and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Smarts

Setting

Landform: Alluvial fans
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Alluvium and colluvium derived from sandstone, quartzite and limestone

Typical profile

A11 - 0 to 15 inches: silt loam
A12 - 15 to 22 inches: gravelly silt loam
B21t - 22 to 49 inches: extremely cobbly loam
C - 49 to 60 inches: extremely cobbly loam

Properties and qualities

Slope: 10 to 30 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 6.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: R047XA418UT - Mountain Loam (bigtooth maple)
Hydric soil rating: No

STG2—SMARTS-HOSKIN ASSOCIATION, ERODED

Map Unit Setting

National map unit symbol: j6f5
Elevation: 5,200 to 9,000 feet
Mean annual precipitation: 20 to 30 inches
Mean annual air temperature: 37 to 45 degrees F
Frost-free period: 70 to 110 days
Farmland classification: Not prime farmland

Map Unit Composition

Smarts and similar soils: 50 percent
Hoskin and similar soils: 40 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Smarts

Setting

Landform: Alluvial fans
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Alluvium and colluvium derived from sandstone, quartzite and limestone

Typical profile

A11 - 0 to 15 inches: gravelly loam
A12 - 15 to 22 inches: gravelly silt loam
B21t - 22 to 49 inches: extremely cobbly loam
C - 49 to 60 inches: extremely cobbly loam

Properties and qualities

Slope: 30 to 70 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 6.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: B
Ecological site: R047XA418UT - Mountain Loam (bigtooth maple)
Hydric soil rating: No

Description of Hoskin

Setting

Landform: Mountain slopes
Landform position (three-dimensional): Mountainflank
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum and colluvium derived from conglomerate and sandstone

Typical profile

A1 - 0 to 7 inches: cobbly loam
B2t - 7 to 16 inches: very cobbly loam
C - 16 to 28 inches: extremely cobbly loam
R - 28 to 32 inches: unweathered bedrock

Properties and qualities

Slope: 30 to 70 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): Low to moderately high (0.01 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Very low (about 1.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: C
Ecological site: R047XA461UT - Mountain Stony Loam (mountain big sagebrush)
Hydric soil rating: No

Minor Components

Rock outcrop

Percent of map unit: 10 percent

SUG—SMARTS-LUCKY STAR-POLELINE ASSOCIATION

Map Unit Setting

National map unit symbol: j6f6
Elevation: 5,200 to 9,000 feet
Mean annual precipitation: 20 to 35 inches
Mean annual air temperature: 36 to 46 degrees F
Frost-free period: 70 to 110 days
Farmland classification: Not prime farmland

Map Unit Composition

Smarts and similar soils: 40 percent
Lucky star and similar soils: 25 percent
Poleline and similar soils: 20 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Smarts

Setting

Landform: Alluvial fans
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Alluvium and colluvium derived from sandstone, quartzite and limestone

Typical profile

A11 - 0 to 15 inches: gravelly silt loam
A12 - 15 to 22 inches: gravelly silt loam
B21t - 22 to 49 inches: extremely cobbly loam
C - 49 to 60 inches: extremely cobbly loam

Properties and qualities

Slope: 30 to 70 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 6.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: B
Ecological site: R047XA418UT - Mountain Loam (bigtooth maple)
Hydric soil rating: No

Description of Lucky Star

Setting

Landform: Mountains
Landform position (three-dimensional): Mountainflank
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Colluvium derived from sandstone and/or residuum weathered from sandstone

Typical profile

A1 - 0 to 13 inches: gravelly silt loam
A2 - 13 to 35 inches: very cobbly fine sandy loam
A2&B2t - 35 to 55 inches: very cobbly fine sandy loam
B2t&A2 - 55 to 70 inches: very cobbly sandy clay loam

C - 70 to 72 inches: very cobbly loam

Properties and qualities

Slope: 30 to 60 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 5.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: B
Ecological site: F047XA508UT - High Mountain Loam (quaking aspen)
Hydric soil rating: No

Description of Poleline

Setting

Landform: Mountain slopes
Landform position (three-dimensional): Mountainflank
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Colluvium derived from sandstone

Typical profile

A11 - 0 to 8 inches: gravelly loam
A12 - 8 to 20 inches: gravelly loam
A13 - 20 to 32 inches: very gravelly very fine sandy loam
B2 - 32 to 60 inches: very gravelly loam

Properties and qualities

Slope: 30 to 70 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 6.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: B
Ecological site: R047XA458UT - Mountain Stony Loam (quaking aspen thicket)
Hydric soil rating: No

Minor Components

Dateman

Percent of map unit: 7 percent

Rock outcrop
Percent of map unit: 5 percent

Agassiz
Percent of map unit: 3 percent

SvA—STEED GRAVELLY LOAM, 0 TO 3 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j6ff
Elevation: 4,550 to 5,700 feet
Mean annual precipitation: 15 to 17 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 120 to 160 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Steed and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Steed

Setting

Landform: Alluvial fans
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Alluvium derived from limestone and sandstone and/or alluvium derived from quartzite

Typical profile

Ap - 0 to 5 inches: gravelly loam
A11 - 5 to 11 inches: gravelly loam
A12 - 11 to 17 inches: extremely gravelly sandy loam
C - 17 to 60 inches: extremely gravelly loamy sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 48 inches
Frequency of flooding: Rare
Frequency of ponding: None
Calcium carbonate, maximum content: 40 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.2 inches)

Interpretive groups

Land capability classification (irrigated): 4s
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: B
Ecological site: R028AY334UT - Upland Stony Loam (Wyoming Big Sagebrush)
Other vegetative classification: Upland Stony Loam (Mountain Big Sagebrush) (028AY334UT)
Hydric soil rating: No

Minor Components

Poorly drained soils, hydric, not correlated

Percent of map unit: 5 percent
Landform: Flood plains
Landform position (three-dimensional): Talf, dip
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: Yes

Stony alluvial land

Percent of map unit: 5 percent
Landform: Flood plains
Landform position (three-dimensional): Talf, dip
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: No

SvB—STEED GRAVELLY LOAM, 3 TO 6 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j6fg
Elevation: 4,550 to 5,700 feet
Mean annual precipitation: 15 to 17 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 120 to 160 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Steed and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Steed

Setting

Landform: Alluvial fans
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Alluvium derived from quartzite and/or alluvium derived from limestone and sandstone

Typical profile

Ap - 0 to 5 inches: gravelly loam
A11 - 5 to 11 inches: gravelly loam
A12 - 11 to 17 inches: extremely gravelly sandy loam
C - 17 to 60 inches: extremely gravelly loamy sand

Properties and qualities

Slope: 3 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 48 inches
Frequency of flooding: Rare
Frequency of ponding: None
Calcium carbonate, maximum content: 40 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.2 inches)

Interpretive groups

Land capability classification (irrigated): 4s
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: B
Ecological site: R028AY334UT - Upland Stony Loam (Wyoming Big Sagebrush)
Other vegetative classification: Upland Stony Loam (Mountain Big Sagebrush) (028AY334UT)
Hydric soil rating: No

SvC—STEED GRAVELLY LOAM, 6 TO 10 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j6fh
Elevation: 4,550 to 5,700 feet
Mean annual precipitation: 15 to 17 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 120 to 160 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Steed and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Steed

Setting

Landform: Alluvial fans
Down-slope shape: Concave
Across-slope shape: Convex
Parent material: Alluvium derived from quartzite and/or alluvium derived from limestone and sandstone

Typical profile

Ap - 0 to 5 inches: gravelly loam
A11 - 5 to 11 inches: gravelly loam
A12 - 11 to 17 inches: extremely gravelly sandy loam
C - 17 to 60 inches: extremely gravelly loamy sand

Properties and qualities

Slope: 6 to 10 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 48 inches
Frequency of flooding: Rare
Frequency of ponding: None
Calcium carbonate, maximum content: 40 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.2 inches)

Interpretive groups

Land capability classification (irrigated): 4s
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: B
Ecological site: R028AY334UT - Upland Stony Loam (Wyoming Big Sagebrush)
Other vegetative classification: Upland Stony Loam (Mountain Big Sagebrush) (028AY334UT)
Hydric soil rating: No

SwC—STERLING GRAVELLY LOAM, 6 TO 10 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j6fj
Elevation: 4,600 to 5,500 feet
Mean annual precipitation: 15 to 17 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 130 to 160 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Sterling and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sterling

Setting

Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear

Parent material: Alluvium and lacustrine deposits derived from limestone, quartzite and sandstone

Typical profile

A11 - 0 to 9 inches: gravelly loam
A12 - 9 to 16 inches: very gravelly loam
C1ca - 16 to 27 inches: extremely gravelly sandy loam
C2 - 27 to 60 inches: extremely gravelly loamy sand

Properties and qualities

Slope: 6 to 10 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 60 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.1 inches)

Interpretive groups

Land capability classification (irrigated): 4s
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: B
Ecological site: R028AY334UT - Upland Stony Loam (Wyoming Big Sagebrush)
Other vegetative classification: Upland Stony Loam (Mountain Big Sagebrush) (028AY334UT)
Hydric soil rating: No

Minor Components

Sterling

Percent of map unit: 5 percent

Timpanogos

Percent of map unit: 5 percent

SwD—STERLING GRAVELLY LOAM, 10 TO 20 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j6fk
Elevation: 4,600 to 5,500 feet
Mean annual precipitation: 15 to 17 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 130 to 160 days
Farmland classification: Farmland of local importance

Map Unit Composition

Sterling and similar soils: 95 percent

Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sterling

Setting
Landform: Lake terraces
Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium and lacustrine deposits derived from limestone, quartzite and sandstone

Typical profile
A11 - 0 to 9 inches: gravelly loam
A12 - 9 to 16 inches: very gravelly loam
C1ca - 16 to 27 inches: extremely gravelly sandy loam
C2 - 27 to 60 inches: extremely gravelly loamy sand

Properties and qualities
Slope: 10 to 20 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 60 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.1 inches)

Interpretive groups
Land capability classification (irrigated): 4s
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: B
Ecological site: R028AY334UT - Upland Stony Loam (Wyoming Big Sagebrush)
Other vegetative classification: Upland Stony Loam (Mountain Big Sagebrush) (028AY334UT)
Hydric soil rating: No

Minor Components

Timpanogos, eroded
Percent of map unit: 5 percent

SwF2—STERLING GRAVELLY LOAM, 20 TO 50 PERCENT SLOPES,ERODED

Map Unit Setting
National map unit symbol: j6fl

Elevation: 4,600 to 5,500 feet
Mean annual precipitation: 15 to 17 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 130 to 160 days
Farmland classification: Not prime farmland

Map Unit Composition

Sterling and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sterling

Setting

Landform: Lake terraces
Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium and lacustrine deposits derived from limestone, quartzite and sandstone

Typical profile

A11 - 0 to 9 inches: gravelly loam
A12 - 9 to 16 inches: very gravelly loam
C1ca - 16 to 27 inches: extremely gravelly sandy loam
C2 - 27 to 60 inches: extremely gravelly loamy sand

Properties and qualities

Slope: 20 to 50 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 60 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 3.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: B
Ecological site: R028AY334UT - Upland Stony Loam (Wyoming Big Sagebrush)
Other vegetative classification: Upland Stony Loam (Mountain Big Sagebrush) (028AY334UT)
Hydric soil rating: No

Minor Components

Hillfield, eroded

Percent of map unit: 5 percent

Sy—STONY ALLUVIAL LAND

Map Unit Composition

Stony alluvial land: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Stony Alluvial Land

Setting

Landform: Flood plains
Landform position (three-dimensional): Talf, dip
Down-slope shape: Linear
Across-slope shape: Concave

Properties and qualities

Frequency of flooding: Rare

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8w
Hydric soil rating: No

TmB—TIMPANOGOS SILT LOAM, 3 TO 6 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j6fp
Elevation: 4,450 to 5,100 feet
Mean annual precipitation: 15 to 17 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 140 to 160 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Timpanogos and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Timpanogos

Setting

Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Lacustrine deposits derived from quartzite and/or lacustrine deposits derived from limestone and sandstone

Typical profile

Ap1 - 0 to 4 inches: silt loam
Ap2 - 4 to 9 inches: loam
B21t - 9 to 13 inches: loam
B22tca - 13 to 18 inches: loam
C1ca - 18 to 29 inches: loam
C2ca - 29 to 42 inches: loam
C3 - 42 to 60 inches: very fine sandy loam

Properties and qualities

Slope: 3 to 6 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 45 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 15.0
Available water supply, 0 to 60 inches: High (about 10.1 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

Minor Components

Ricks

Percent of map unit: 5 percent

Parleys

Percent of map unit: 5 percent

TrA—TRENTON SILTY CLAY LOAM, 0 TO 2 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j6ft
Elevation: 4,400 to 4,700 feet
Mean annual precipitation: 14 to 17 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 120 to 150 days
Farmland classification: Farmland of local importance

Map Unit Composition

Trenton and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Trenton

Setting

Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Lacustrine deposits derived from quartzite and/or lacustrine deposits derived from limestone and sandstone

Typical profile

Ap - 0 to 8 inches: silty clay loam
B21t - 8 to 15 inches: silty clay
B21t - 15 to 26 inches: silty clay
B21t - 26 to 34 inches: silty clay
B21t - 34 to 60 inches: silty clay
B21t - 60 to 72 inches: silty clay

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 42 to 60 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 40 percent
Maximum salinity: Very slightly saline to strongly saline (2.0 to 16.0 mmhos/cm)
Sodium adsorption ratio, maximum: 30.0
Available water supply, 0 to 60 inches: High (about 10.7 inches)

Interpretive groups

Land capability classification (irrigated): 4w
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: D
Ecological site: R028AY001UT - Alkali Bottom (Alkali Sacaton)
Hydric soil rating: No

Minor Components

Slickspots

Percent of map unit: 5 percent
Landform: Depressions
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Cache

Percent of map unit: 5 percent

Landform: Lake plains
Landform position (three-dimensional): Talf, dip
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R028AY024UT - Wet Saline Meadow (Saltgrass)
Hydric soil rating: Yes

TtA—TRENTON SILTY CLAY LOAM, MODERATELY DEEP WATER TABLE, 0 TO 2 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j6fy
Elevation: 4,400 to 4,700 feet
Mean annual precipitation: 14 to 17 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 120 to 150 days
Farmland classification: Not prime farmland

Map Unit Composition

Trenton and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Trenton

Setting

Landform: Lake terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Lacustrine deposits derived from quartzite and/or lacustrine deposits derived from limestone and sandstone

Typical profile

Ap - 0 to 8 inches: silty clay loam
B21t - 8 to 15 inches: silty clay
B21t - 15 to 26 inches: silty clay
B21t - 26 to 34 inches: silty clay
B21t - 34 to 60 inches: silty clay
B21t - 60 to 72 inches: silty clay

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 18 to 42 inches
Frequency of flooding: None
Frequency of ponding: None

Calcium carbonate, maximum content: 40 percent
Maximum salinity: Very slightly saline to strongly saline (2.0 to 16.0 mmhos/cm)
Sodium adsorption ratio, maximum: 30.0
Available water supply, 0 to 60 inches: High (about 10.7 inches)

Interpretive groups

Land capability classification (irrigated): 4w
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: D
Ecological site: R028AY001UT - Alkali Bottom (Alkali Sacaton)
Hydric soil rating: No

Minor Components

Cache

Percent of map unit: 5 percent
Landform: Lake plains
Landform position (three-dimensional): Dip, talf
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R028AY024UT - Wet Saline Meadow (Saltgrass)
Hydric soil rating: Yes

Lewiston

Percent of map unit: 3 percent

Poorly drained soils

Percent of map unit: 2 percent
Landform: Lake plains
Landform position (three-dimensional): Dip, talf
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

W—WATER

Map Unit Composition

Water: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

WhE—WHEELON SILT LOAM, 10 TO 30 PERCENT SLOPES

Map Unit Setting

National map unit symbol: j6g0
Elevation: 4,500 to 5,300 feet
Mean annual precipitation: 14 to 17 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 110 to 140 days
Farmland classification: Not prime farmland

Map Unit Composition

Wheelon and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Wheelon

Setting

Landform: Terraces
Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Lacustrine deposits derived from tuff and/or limestone & sandstone; lacustrine deposits derived from tuff and/or lacustrine deposits derived from limestone and sandstone

Typical profile

Ap - 0 to 6 inches: silt loam
AC - 6 to 12 inches: silt loam
C1ca - 12 to 23 inches: silt loam
C2ca - 23 to 43 inches: silt loam
C3 - 43 to 66 inches: silt loam

Properties and qualities

Slope: 10 to 30 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 35 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 10.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: R028AY325UT - Upland Shallow Loam (Black Sagebrush)
Hydric soil rating: No

Minor Components

Collinston

Percent of map unit: 5 percent

WhF2—WHEELON SILT LOAM, 30 TO 50 PERCENT SLOPES, ERODED

Map Unit Setting

National map unit symbol: j6g1
Elevation: 4,500 to 5,300 feet
Mean annual precipitation: 14 to 17 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 110 to 140 days
Farmland classification: Not prime farmland

Map Unit Composition

Wheelon and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Wheelon

Setting

Landform: Terraces
Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Lacustrine deposits derived from tuff and/or lacustrine deposits derived from limestone and sandstone

Typical profile

Ap - 0 to 6 inches: silt loam
AC - 6 to 12 inches: silt loam
C1ca - 12 to 23 inches: silt loam
C2ca - 23 to 43 inches: silt loam
C3 - 43 to 66 inches: silt loam

Properties and qualities

Slope: 30 to 50 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 35 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 10.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: B
Ecological site: R028AY325UT - Upland Shallow Loam (Black Sagebrush)

Hydric soil rating: No

Minor Components

Collinston

Percent of map unit: 5 percent

WIE2—WHEELON-COLLINSTON COMPLEX, 10 TO 30 PERCENT SLOPES, ERODED

Map Unit Setting

National map unit symbol: j6g2
Elevation: 4,500 to 5,300 feet
Mean annual precipitation: 14 to 22 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 100 to 160 days
Farmland classification: Not prime farmland

Map Unit Composition

Wheelon and similar soils: 55 percent
Collinston and similar soils: 40 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Wheelon

Setting

Landform: Terraces
Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Lacustrine deposits derived from tuff and/or lacustrine deposits derived from limestone and sandstone

Typical profile

Ap - 0 to 6 inches: silt loam
AC - 6 to 12 inches: silt loam
C1ca - 12 to 23 inches: silt loam
C2ca - 23 to 43 inches: silt loam
C3 - 43 to 66 inches: silt loam

Properties and qualities

Slope: 10 to 30 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 35 percent

Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 10.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: R028AY325UT - Upland Shallow Loam (Black Sagebrush)
Hydric soil rating: No

Description of Collinston

Setting

Landform: Lake terraces
Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Lacustrine deposits derived from tuff and/or lacustrine deposits derived from limestone and sandstone

Typical profile

A11 - 0 to 8 inches: loam
A12 - 8 to 15 inches: loam
C1ca - 15 to 25 inches: clay loam
C2 - 25 to 35 inches: silt loam
C3 - 35 to 60 inches: silt loam

Properties and qualities

Slope: 10 to 30 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 60 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 10.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C
Ecological site: R028AY310UT - Upland Loam (Bonneville Big Sagebrush) North
Other vegetative classification: Upland Loam (Mountain Big Sagebrush) (028AY310UT)
Hydric soil rating: No

Minor Components

Mendon

Percent of map unit: 5 percent

Wn—WINN SILT LOAM

Map Unit Setting

National map unit symbol: j6g3
Elevation: 4,450 to 4,900 feet
Mean annual precipitation: 14 to 17 inches
Mean annual air temperature: 45 to 48 degrees F
Frost-free period: 120 to 150 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Winn and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Winn

Setting

Landform: Flood plains
Landform position (three-dimensional): Talf, dip
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Alluvium derived from limestone and sandstone and/or alluvium derived from quartzite

Typical profile

A11 - 0 to 6 inches: silt loam
A12 - 6 to 13 inches: loam
AC - 13 to 18 inches: loam
C1 - 18 to 40 inches: loam
C2 - 40 to 60 inches: silt loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 30 to 42 inches
Frequency of flooding: Rare
Frequency of ponding: None
Calcium carbonate, maximum content: 30 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 10.8 inches)

Interpretive groups

Land capability classification (irrigated): 3w
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: C

Ecological site: R028AY012UT - Semiwet Fresh Meadow
Hydric soil rating: No

Minor Components

Kirkham
Percent of map unit: 5 percent

Provo
Percent of map unit: 5 percent
Landform: Flood plains
Landform position (three-dimensional): Talf, dip
Down-slope shape: Linear
Across-slope shape: Concave
Ecological site: R028AY020UT - Wet Fresh Meadow
Hydric soil rating: No

Poorly drained soils, hydric, not correlated
Percent of map unit: 5 percent
Landform: Lake plains
Landform position (three-dimensional): Dip, talf
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

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NRCS Web Soil Survey Data Spreadsheet PDF

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
AhA	AIRPORT SILT LOAM, 0 TO 3 PERCENT SLOPES	CL-ML	145.1	0.50%
Ak	AIRPORT SILTY CLAY LOAM	CL	53.9	0.20%
ArA	AVON SILTY CLAY LOAM, 0 TO 3 PERCENT SLOPES	CL	174.3	0.60%
ArB	AVON SILTY CLAY LOAM, 3 TO 6 PERCENT SLOPES	CL	558	1.80%
ArC	AVON SILTY CLAY LOAM, 6 TO 10 PERCENT SLOPES	CL	18.2	0.10%

ArD	AVON SILTY CLAY LOAM, 10 TO 20 PERCENT SLOPES	CL	81.9	0.30%
AsC	AVON-COLLINSTON COMPLEX, 6 TO 10 PERCENT SLOPES	CL	88.9	0.30%
BAF	BARFUSS-LEATHAM ASSOCIATION	CL	372.4	1.20%
BmB	BLACKROCK GRAVELLY LOAM, 3 TO 6 PERCENT SLOPES	GC	50.3	0.20%
Cd	CARDON SILTY CLAY	CH	39.5	0.10%
Ck	COLLETT SILTY CLAY LOAM	CL	965.8	3.10%

ClA	COLLINSTON LOAMY FINE SAND, 0 TO 3 PERCENT SLOPES	SM	52.2	0.20%
CmC	COLLINSTON LOAM, 1 TO 6 PERCENT SLOPES	CL	174.3	0.60%
CmD	COLLINSTON LOAM, 6 TO 10 PERCENT SLOPES	CL	259	0.80%
CmE2	COLLINSTON LOAM, 10 TO 30 PERCENT SLOPES, ERODED	CL	181.4	0.60%

CoA	CROOKSTON LOAM, 0 TO 3 PERCENT SLOPES	CL-ML	914.9	2.90%
CoB	CROOKSTON LOAM, 3 TO 6 PERCENT SLOPES	CL-ML	174	0.60%
CrB	CROWSHAW GRAVELLY LOAM, 3 TO 6 PERCENT SLOPE	GC-GM	277.7	0.90%
CrC	CROWSHAW GRAVELLY LOAM, 6 TO 10 PERCENT SLOPE	GC-GM	####	3.30%

CrD	CROWSHAW GRAVELLY LOAM, 10 TO 20 PERCENT SLOPES	GC-GM	516	1.70%
DaC	DAGOR SILT LOAM, 4 TO 8 PERCENT SLOPES	CL-ML	58.8	0.20%
DaD	DAGOR SILT LOAM, 10 TO 20 PERCENT SLOPES	CL-ML	165.4	0.50%
DNG	DATWYLER-ELZINGA-MAUGHAN ASSOCIATION	CL-ML	0.4	0.00%
Gp	GRAVEL PIT		39.1	0.10%
GsA	GREENSON LOAM, 0 TO 3 PERCENT SLOPES	CL-ML	####	####

GsB	GREENSON LOAM, 3 TO 6 PERCENT SLOPES	CL-ML	268.9	0.90%
GsC	GREENSON LOAM, 6 TO 10 PERCENT SLOPES	CL-ML	134.4	0.40%
GuA	GREENSON LOAM, DEEP OVER CLAY, 0 TO 1 PERCENT SLOPES	CL-ML	165.1	0.50%
HdA	HENDRICKS SILT LOAM, 1 TO 3 PERCENT SLOPES	CL-ML	72.2	0.20%
HdB	HENDRICKS SILT LOAM, 3 TO 6 PERCENT SLOPES	CL-ML	188.9	0.60%

HdC	HENDRICKS SILT LOAM, 6 TO 10 PERCENT SLOPE	CL-ML	298	1.00%
HdD	HENDRICKS SILT LOAM, 10 TO 20 PERCENT SLOPE	CL-ML	158.5	0.50%
HeC	HIIBNER GRAVELLY CLAY LOAM, 3 TO 10 PERCENT SLOPE	GC	76.2	0.20%
HeD	HIIBNER GRAVELLY CLAY LOAM, 10 TO 30 PERCENT SLOPE	GC	39.5	0.10%

HfE	HIIBNER EXTREMELY STONY CLAY LOAM, 1 TO 30 PERCENT SLOPES	CL	571	1.80%
HLG2	HOSKIN-DATWYLER ASSOCIATION, ERODED	CL-ML	16.5	0.10%
HuC	HYRUM GRAVELLY LOAM, 4 TO 8 PERCENT SLOPES	GC-GM	224	0.70%
HuE	HYRUM GRAVELLY LOAM, 10 TO 25 PERCENT SLOPES	GC-GM	360.3	1.20%

KdA	KIDMAN FINE SANDY LOAM, 0 TO 2 PERCENT SLOPES	SC-SM	79.8	0.30%
KdD	KIDMAN FINE SANDY LOAM, 8 TO 15 PERCENT SLOPES	SC-SM	40.5	0.10%
KfB	KIDMAN FINE SANDY LOAM, DEEP WATER TABLE, 2 TO 4 PERCENT SLOPES	SC-SM	8	0.00%

KfC	KIDMAN FINE SANDY LOAM, DEEP WATER TABLE, 4 TO 8 PERCENT SLOPES	SC-SM	53.2	0.20%
Ks	KIRKHAM-SHAY COMPLEX	CL-ML	324.4	1.00%
La	LAKEWIN GRAVELLY COARSE SANDY LOAM	SM	79.8	0.30%
Lr	LOGAN SILTY CLAY LOAM	CL	626.4	2.00%
McB	MCMURDIE SILT LOAM, 3 TO 6 PERCENT SLOPES	CL	14.7	0.00%

McC	MCMURDIE SILT LOAM, 6 TO 10 PERCENT SLOPES	CL	89.2	0.30%
MeA	MENDON SILT LOAM, 0 TO 3 PERCENT SLOPES	CL	####	8.90%
MeB	MENDON SILT LOAM, 3 TO 6 PERCENT SLOPES	CL	####	3.50%
MeC	MENDON SILT LOAM, 6 TO 10 PERCENT SLOPES	CL	298.8	1.00%

MfB	MENDON-COLLINSTON COMPLEX, 1 TO 6 PERCENT SLOPES	CL	391.3	1.30%
MfE2	MENDON-COLLINSTON COMPLEX, 6 TO 30 PERCENT SLOPES,ERODED	CL	593.5	1.90%
MoG2	MUNK-BLACK ROCK GRAVELLY LOAMS, 30 TO 70 PERCENT SLOPES, ERODE	GC-GM	213.1	0.70%

NbE	NEBEKER SILT LOAM, 10 TO 25 PERCENT SLOPES	CL-ML	16.6	0.10%
NcA	NIBLEY SILTY CLAY LOAM, 0 TO 3 PERCENT SLOPES	CL	325.1	1.00%
NcB	NIBLEY SILTY CLAY LOAM, 3 TO 6 PERCENT SLOPES	CL	177.9	0.60%
PaA	PARLEYS SILT LOAM, 0 TO 3 PERCENT SLOPES	CL	224	0.70%

PaB	PARLEYS SILT LOAM, 3 TO 6 PERCENT SLOPES	CL	339.8	1.10%
PaC	PARLEYS SILT LOAM, 6 TO 10 PERCENT SLOPES	CL	41.4	0.10%
Pu	PROVO LOAM	CL-ML	50.4	0.20%
Pv	PROVO GRAVELLY LOAM	GC-GM	76.4	0.20%
RhA	RICKS GRAVELLY LOAM, 0 TO 3 PERCENT SLOPES	GC-GM	582	1.90%
RhB	RICKS GRAVELLY LOAM, 3 TO 6 PERCENT SLOPES	GC-GM	631.7	2.00%

RhC	RICKS GRAVELLY LOAM, 6 TO 10 PERCENT SLOPES	GC-GM	280.1	0.90%
RO	ROCK LAND		2.7	0.00%
Rs	ROSHE SPRINGS SILT LOAM	CL-ML	636.8	2.00%
Rt	ROUGH BROKEN LAND		238.5	0.80%
Sg	SALT LAKE-ROSHE SPRINGS COMPLEX	CH	####	4.50%
SSE	SMARTS SILT LOAM, 10 TO 30 PERCENT SLOPES	CL-ML	128.7	0.40%

STG2	SMARTS-HOSKIN ASSOCIATION, ERODED	SC-SM	####	3.60%
SUG	SMARTS-LUCKY STAR-POLELINE ASSOCIATION	CL-ML	201.4	0.60%
SvA	STEED GRAVELLY LOAM, 0 TO 3 PERCENT SLOPES	SC	39	0.10%
SvB	STEED GRAVELLY LOAM, 3 TO 6 PERCENT SLOPES	SC	36.9	0.10%
SvC	STEED GRAVELLY LOAM, 6 TO 10 PERCENT SLOPES	SC	113.3	0.40%

SwC	STERLING GRAVELLY LOAM, 6 TO 10 PERCENT SLOPE	GM	175.9	0.60%
SwD	STERLING GRAVELLY LOAM, 10 TO 20 PERCENT SLOPE	GM	213.5	0.70%
SwF2	STERLING GRAVELLY LOAM, 20 TO 50 PERCENT SLOPES,ERO	GM	97.7	0.30%
Sy	STONY ALLUVIAL LAND		422.9	1.40%

TmB	TIMPANOGOS SILT LOAM, 3 TO 6 PERCENT SLOPES	CL	113.8	0.40%
TrA	TRENTON SILTY CLAY LOAM, 0 TO 2 PERCENT SLOPES	ML	####	4.40%
TtA	TRENTON SILTY CLAY LOAM, MODERATELY DEEP WATER TABLE, 0 TO 2 PERCENT SLOPES	ML	80.4	0.30%
W	WATER		241.5	0.80%

WhE	WHEELON SILT LOAM, 10 TO 30 PERCENT SLOPE	CL-ML	74	0.20%
WhF2	WHEELON SILT LOAM, 30 TO 50 PERCENT SLOPES, ERODE	CL-ML	168.4	0.50%
WlE2	WHEELON-COLLINSTON COMPLEX, 10 TO 30 PERCENT SLOPES, ERODED	CL-ML	####	3.70%
Wn	WINN SILT LOAM	CL-ML	647.3	2.10%
Totals for Area of Interest			####	####

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
AhA	AIRPORT SILT LOAM, 0 TO 3 PERCENT SLOPES	Poorly drained	145.1	0.50%
Ak	AIRPORT SILTY CLAY LOAM	Poorly drained	53.9	0.20%
ArA	AVON SILTY CLAY LOAM, 0 TO 3 PERCENT SLOPES	Well drained	174.3	0.60%
ArB	AVON SILTY CLAY LOAM, 3 TO 6 PERCENT SLOPES	Well drained	558	1.80%
ArC	AVON SILTY CLAY LOAM, 6 TO 10 PERCENT SLOPES	Well drained	18.2	0.10%

ArD	AVON SILTY CLAY LOAM, 10 TO 20 PERCENT SLOPES	Well drained	81.9	0.30%
AsC	AVON-COLLINSTON COMPLEX, 6 TO 10 PERCENT SLOPES	Well drained	88.9	0.30%
BAF	BARFUSS-LEATHAM ASSOCIATION	Well drained	372.4	1.20%
BmB	BLACK ROCK GRAVELLY LOAM, 3 TO 6 PERCENT SLOPES	Well drained	50.3	0.20%
Cd	CARDON SILTY CLAY	Somewhat poorly drained	39.5	0.10%

Ck	COLLETT SILTY CLAY LOAM	Somewhat poorly drained	965.8	3.10%
ClA	COLLINSTON LOAMY FINE SAND, 0 TO 3 PERCENT SLOPES	Well drained	52.2	0.20%
CmC	COLLINSTON LOAM, 1 TO 6 PERCENT SLOPES	Well drained	174.3	0.60%
CmD	COLLINSTON LOAM, 6 TO 10 PERCENT SLOPES	Well drained	259	0.80%
CmE2	COLLINSTON LOAM, 10 TO 30 PERCENT SLOPES, ERODED	Well drained	181.4	0.60%

CoA	CROOKSTON LOAM, 0 TO 3 PERCENT SLOPES	Well drained	914.9	2.90%
CoB	CROOKSTON LOAM, 3 TO 6 PERCENT SLOPES	Well drained	174	0.60%
CrB	CROWSHAW GRAVELLY LOAM, 3 TO 6 PERCENT SLOPE	Well drained	277.7	0.90%
CrC	CROWSHAW GRAVELLY LOAM, 6 TO 10 PERCENT SLOPE	Well drained	####	3.30%

CrD	CROWSHAW GRAVELLY LOAM, 10 TO 20 PERCENT SLOPES	Well drained	516	1.70%
DaC	DAGOR SILT LOAM, 4 TO 8 PERCENT SLOPES	Well drained	58.8	0.20%
DaD	DAGOR SILT LOAM, 10 TO 20 PERCENT SLOPES	Well drained	165.4	0.50%
DNG	DATWYLER-ELZINGA-MAUGHAN ASSOCIATION	Well drained	0.4	0.00%
Gp	GRAVEL PIT		39.1	0.10%
GsA	GREENSON LOAM, 0 TO 3 PERCENT SLOPES	Somewhat poorly drained	####	####

GsB	GREENSON LOAM, 3 TO 6 PERCENT SLOPES	Somewhat poorly drained	268.9	0.90%
GsC	GREENSON LOAM, 6 TO 10 PERCENT SLOPES	Somewhat poorly drained	134.4	0.40%
GuA	GREENSON LOAM, DEEP OVER CLAY, 0 TO 1 PERCENT SLOPES	Somewhat poorly drained	165.1	0.50%
HdA	HENDRICKS SILT LOAM, 1 TO 3 PERCENT SLOPES	Well drained	72.2	0.20%
HdB	HENDRICKS SILT LOAM, 3 TO 6 PERCENT SLOPES	Well drained	188.9	0.60%

HdC	HENDRICKS SILT LOAM, 6 TO 10 PERCENT SLOPE	Well drained	298	1.00%
HdD	HENDRICKS SILT LOAM, 10 TO 20 PERCENT SLOPE	Well drained	158.5	0.50%
HeC	HIIBNER GRAVELLY CLAY LOAM, 3 TO 10 PERCENT SLOPE	Well drained	76.2	0.20%
HeD	HIIBNER GRAVELLY CLAY LOAM, 10 TO 30 PERCENT SLOPE	Well drained	39.5	0.10%

HfE	HIIBNER EXTREMELY STONY CLAY LOAM, 1 TO 30 PERCENT SLOPES	Well drained	571	1.80%
HLG2	HOSKIN-DATWYLER ASSOCIATION, ERODED	Somewhat excessively drained	16.5	0.10%
HuC	HYRUM GRAVELLY LOAM, 4 TO 8 PERCENT SLOPES	Well drained	224	0.70%
HuE	HYRUM GRAVELLY LOAM, 10 TO 25 PERCENT SLOPES	Well drained	360.3	1.20%

KdA	KIDMAN FINE SANDY LOAM, 0 TO 2 PERCENT SLOPES	Well drained	79.8	0.30%
KdD	KIDMAN FINE SANDY LOAM, 8 TO 15 PERCENT SLOPES	Well drained	40.5	0.10%
KfB	KIDMAN FINE SANDY LOAM, DEEP WATER TABLE, 2 TO 4 PERCENT SLOPES	Moderately well drained	8	0.00%

KfC	KIDMAN FINE SANDY LOAM, DEEP WATER TABLE, 4 TO 8 PERCENT SLOPES	Moderately well drained	53.2	0.20%
Ks	KIRKHAM-SHAY COMPLEX	Somewhat poorly drained	324.4	1.00%
La	LAKEWIN GRAVELLY COARSE SANDY LOAM	Somewhat excessively drained	79.8	0.30%
Lr	LOGAN SILTY CLAY LOAM	Poorly drained	626.4	2.00%
McB	MCMURDIE SILT LOAM, 3 TO 6 PERCENT SLOPES	Well drained	14.7	0.00%

McC	MCMURDIE SILT LOAM, 6 TO 10 PERCENT SLOPES	Well drained	89.2	0.30%
MeA	MENDON SILT LOAM, 0 TO 3 PERCENT SLOPES	Well drained	####	8.90%
MeB	MENDON SILT LOAM, 3 TO 6 PERCENT SLOPES	Well drained	####	3.50%
MeC	MENDON SILT LOAM, 6 TO 10 PERCENT SLOPES	Well drained	298.8	1.00%

MfB	MENDON-COLLINSTON COMPLEX, 1 TO 6 PERCENT SLOPES	Well drained	391.3	1.30%
MfE2	MENDON-COLLINSTON COMPLEX, 6 TO 30 PERCENT SLOPES,ERODED	Well drained	593.5	1.90%
MoG2	MUNK-BLACK ROCK GRAVELLY LOAMS, 30 TO 70 PERCENT SLOPES, ERODE	Well drained	213.1	0.70%

NbE	NEBEKER SILT LOAM, 10 TO 25 PERCENT SLOPES	Well drained	16.6	0.10%
NcA	NIBLEY SILTY CLAY LOAM, 0 TO 3 PERCENT SLOPES	Somewhat poorly drained	325.1	1.00%
NcB	NIBLEY SILTY CLAY LOAM, 3 TO 6 PERCENT SLOPES	Somewhat poorly drained	177.9	0.60%
PaA	PARLEYS SILT LOAM, 0 TO 3 PERCENT SLOPES	Well drained	224	0.70%

PaB	PARLEYS SILT LOAM, 3 TO 6 PERCENT SLOPES	Well drained	339.8	1.10%
PaC	PARLEYS SILT LOAM, 6 TO 10 PERCENT SLOPES	Well drained	41.4	0.10%
Pu	PROVO LOAM	Poorly drained	50.4	0.20%
Pv	PROVO GRAVELLY LOAM	Poorly drained	76.4	0.20%
RhA	RICKS GRAVELLY LOAM, 0 TO 3 PERCENT SLOPES	Somewhat excessively drained	582	1.90%
RhB	RICKS GRAVELLY LOAM, 3 TO 6 PERCENT SLOPES	Somewhat excessively drained	631.7	2.00%

RhC	RICKS GRAVELLY LOAM, 6 TO 10 PERCENT SLOPES	Somewhat excessively drained	280.1	0.90%
RO	ROCK LAND		2.7	0.00%
Rs	ROSHE SPRINGS SILT LOAM	Poorly drained	636.8	2.00%
Rt	ROUGH BROKEN LAND		238.5	0.80%
Sg	SALT LAKE-ROSHE SPRINGS COMPLEX	Very poorly drained	####	4.50%
SSE	SMARTS SILT LOAM, 10 TO 30 PERCENT SLOPES	Well drained	128.7	0.40%

STG2	SMART S-HOSKIN ASSOCIATION, ERODE	Well drained	####	3.60%
SUG	SMART S-LUCKY STAR-POLELINE ASSOCIATION	Well drained	201.4	0.60%
SvA	STEED GRAVELLY LOAM, 0 TO 3 PERCENT SLOPE	Somewhat excessively drained	39	0.10%
SvB	STEED GRAVELLY LOAM, 3 TO 6 PERCENT SLOPE	Somewhat excessively drained	36.9	0.10%
SvC	STEED GRAVELLY LOAM, 6 TO 10 PERCENT SLOPE	Somewhat excessively drained	113.3	0.40%

SwC	STERLING GRAVELLY LOAM, 6 TO 10 PERCENT SLOPE	Somewhat excessively drained	175.9	0.60%
SwD	STERLING GRAVELLY LOAM, 10 TO 20 PERCENT SLOPE	Somewhat excessively drained	213.5	0.70%
SwF2	STERLING GRAVELLY LOAM, 20 TO 50 PERCENT SLOPES,ERO	Somewhat excessively drained	97.7	0.30%
Sy	STONY ALLUVIAL LAND		422.9	1.40%

TmB	TIMPANOGOS SILT LOAM, 3 TO 6 PERCENT SLOPES	Well drained	113.8	0.40%
TrA	TRENTON SILTY CLAY LOAM, 0 TO 2 PERCENT SLOPES	Somewhat poorly drained	####	4.40%
TtA	TRENTON SILTY CLAY LOAM, MODERATELY DEEP WATER TABLE, 0 TO 2 PERCENT SLOPES	Somewhat poorly drained	80.4	0.30%
W	WATER		241.5	0.80%

WhE	WHEELON SILT LOAM, 10 TO 30 PERCENT SLOPE	Well drained	74	0.20%
WhF2	WHEELON SILT LOAM, 30 TO 50 PERCENT SLOPES, ERODE	Well drained	168.4	0.50%
WlE2	WHEELON-COLLINSTON COMPLEX, 10 TO 30 PERCENT SLOPES, ERODED	Well drained	####	3.70%
Wn	WINN SILT LOAM	Somewhat poorly drained	647.3	2.10%
Totals for Area of Interest			####	####

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
AhA	AIRPORT SILT LOAM, 0 TO 3 PERCENT SLOPES	A-4	145.1	0.50%
Ak	AIRPORT SILTY CLAY LOAM	A-6	53.9	0.20%
ArA	AVON SILTY CLAY LOAM, 0 TO 3 PERCENT SLOPES	A-6	174.3	0.60%
ArB	AVON SILTY CLAY LOAM, 3 TO 6 PERCENT SLOPES	A-6	558	1.80%
ArC	AVON SILTY CLAY LOAM, 6 TO 10 PERCENT SLOPES	A-6	18.2	0.10%

ArD	AVON SILTY CLAY LOAM, 10 TO 20 PERCENT SLOPE	A-6	81.9	0.30%
AsC	AVON-COLLINSTON COMPLEX, 6 TO 10 PERCENT SLOPES	A-6	88.9	0.30%
BAF	BARFUSS-LEATHAM ASSOCIATION	A-6	372.4	1.20%
BmB	BLACK ROCK GRAVELLY LOAM, 3 TO 6 PERCENT SLOPE	A-4	50.3	0.20%
Cd	CARDON SILTY CLAY	A-7	39.5	0.10%
Ck	COLLETT SILTY CLAY LOAM	A-6	965.8	3.10%

ClA	COLLINSTON LOAMY FINE SAND, 0 TO 3 PERCENT SLOPES	A-2	52.2	0.20%
CmC	COLLINSTON LOAM, 1 TO 6 PERCENT SLOPES	A-6	174.3	0.60%
CmD	COLLINSTON LOAM, 6 TO 10 PERCENT SLOPES	A-6	259	0.80%
CmE2	COLLINSTON LOAM, 10 TO 30 PERCENT SLOPES, ERODED	A-6	181.4	0.60%

CoA	CROOKSTON LOAM, 0 TO 3 PERCENT SLOPES	A-4	914.9	2.90%
CoB	CROOKSTON LOAM, 3 TO 6 PERCENT SLOPES	A-4	174	0.60%
CrB	CROWSHAW GRAVELLY LOAM, 3 TO 6 PERCENT SLOPE	A-4	277.7	0.90%
CrC	CROWSHAW GRAVELLY LOAM, 6 TO 10 PERCENT SLOPE	A-4	####	3.30%

CrD	CROWSHAW GRAVELLY LOAM, 10 TO 20 PERCENT SLOPES	A-4	516	1.70%
DaC	DAGOR SILT LOAM, 4 TO 8 PERCENT SLOPES	A-4	58.8	0.20%
DaD	DAGOR SILT LOAM, 10 TO 20 PERCENT SLOPES	A-4	165.4	0.50%
DNG	DATWYLER-ELZINGA-MAUGHAN ASSOCIATION	A-4	0.4	0.00%
Gp	GRAVEL PIT		39.1	0.10%
GsA	GREENSON LOAM, 0 TO 3 PERCENT SLOPES	A-4	####	####

GsB	GREENSON LOAM, 3 TO 6 PERCENT SLOPES	A-4	268.9	0.90%
GsC	GREENSON LOAM, 6 TO 10 PERCENT SLOPES	A-4	134.4	0.40%
GuA	GREENSON LOAM, DEEP OVER CLAY, 0 TO 1 PERCENT SLOPES	A-4	165.1	0.50%
HdA	HENDRICKS SILT LOAM, 1 TO 3 PERCENT SLOPES	A-4	72.2	0.20%
HdB	HENDRICKS SILT LOAM, 3 TO 6 PERCENT SLOPES	A-4	188.9	0.60%

HdC	HENDRICKS SILT LOAM, 6 TO 10 PERCENT SLOPE	A-4	298	1.00%
HdD	HENDRICKS SILT LOAM, 10 TO 20 PERCENT SLOPE	A-4	158.5	0.50%
HeC	HIIBNER GRAVELLY CLAY LOAM, 3 TO 10 PERCENT SLOPE	A-6	76.2	0.20%
HeD	HIIBNER GRAVELLY CLAY LOAM, 10 TO 30 PERCENT SLOPE	A-6	39.5	0.10%

HfE	HIIBNER EXTREMELY STONY CLAY LOAM, 1 TO 30 PERCENT SLOPES	A-6	571	1.80%
HLG2	HOSKIN-DATWYLER ASSOCIATION, ERODED	A-4	16.5	0.10%
HuC	HYRUM GRAVELLY LOAM, 4 TO 8 PERCENT SLOPES	A-4	224	0.70%
HuE	HYRUM GRAVELLY LOAM, 10 TO 25 PERCENT SLOPES	A-4	360.3	1.20%

KdA	KIDMAN FINE SANDY LOAM, 0 TO 2 PERCENT SLOPES	A-4	79.8	0.30%
KdD	KIDMAN FINE SANDY LOAM, 8 TO 15 PERCENT SLOPES	A-4	40.5	0.10%
KfB	KIDMAN FINE SANDY LOAM, DEEP WATER TABLE, 2 TO 4 PERCENT SLOPES	A-4	8	0.00%

KfC	KIDMAN FINE SANDY LOAM, DEEP WATER TABLE, 4 TO 8 PERCENT SLOPES	A-4	53.2	0.20%
Ks	KIRKHAM-SHAY COMPLEX	A-4	324.4	1.00%
La	LAKEWIN GRAVELLY COARSE SANDY LOAM	A-1	79.8	0.30%
Lr	LOGAN SILTY CLAY LOAM	A-6	626.4	2.00%
McB	MCMURDIE SILT LOAM, 3 TO 6 PERCENT SLOPES	A-6	14.7	0.00%

McC	MCMURDIE SILT LOAM, 6 TO 10 PERCENT SLOPES	A-6	89.2	0.30%
MeA	MENDON SILT LOAM, 0 TO 3 PERCENT SLOPES	A-4	####	8.90%
MeB	MENDON SILT LOAM, 3 TO 6 PERCENT SLOPES	A-4	####	3.50%
MeC	MENDON SILT LOAM, 6 TO 10 PERCENT SLOPES	A-4	298.8	1.00%

MfB	MENDON-COLLINSTON COMPLEX, 1 TO 6 PERCENT SLOPES	A-4	391.3	1.30%
MfE2	MENDON-COLLINSTON COMPLEX, 6 TO 30 PERCENT SLOPES,ERODED	A-4	593.5	1.90%
MoG2	MUNK-BLACK ROCK GRAVELLY LOAMS, 30 TO 70 PERCENT SLOPES, ERODE	A-2	213.1	0.70%

NbE	NEBEKER SILT LOAM, 10 TO 25 PERCENT SLOPES	A-6	16.6	0.10%
NcA	NIBLEY SILTY CLAY LOAM, 0 TO 3 PERCENT SLOPES	A-6	325.1	1.00%
NcB	NIBLEY SILTY CLAY LOAM, 3 TO 6 PERCENT SLOPES	A-6	177.9	0.60%
PaA	PARLEYS SILT LOAM, 0 TO 3 PERCENT SLOPES	A-4	224	0.70%

PaB	PARLEYS SILT LOAM, 3 TO 6 PERCENT SLOPES	A-4	339.8	1.10%
PaC	PARLEYS SILT LOAM, 6 TO 10 PERCENT SLOPES	A-4	41.4	0.10%
Pu	PROVO LOAM	A-4	50.4	0.20%
Pv	PROVO GRAVELLY LOAM	A-4	76.4	0.20%
RhA	RICKS GRAVELLY LOAM, 0 TO 3 PERCENT SLOPES	A-4	582	1.90%
RhB	RICKS GRAVELLY LOAM, 3 TO 6 PERCENT SLOPES	A-4	631.7	2.00%

RhC	RICKS GRAVELLY LOAM, 6 TO 10 PERCENT SLOPES	A-4	280.1	0.90%
RO	ROCK LAND		2.7	0.00%
Rs	ROSHE SPRINGS SILT LOAM	A-4	636.8	2.00%
Rt	ROUGH BROKEN LAND		238.5	0.80%
Sg	SALT LAKE-ROSHE SPRINGS COMPLEX	A-7	####	4.50%
SSE	SMARTS SILT LOAM, 10 TO 30 PERCENT SLOPES	A-4	128.7	0.40%

STG2	SMARTS-HOSKIN ASSOCIATION, ERODED	A-4	####	3.60%
SUG	SMARTS-LUCKY STAR-POLELINE ASSOCIATION	A-4	201.4	0.60%
SvA	STEED GRAVELLY LOAM, 0 TO 3 PERCENT SLOPES	A-4	39	0.10%
SvB	STEED GRAVELLY LOAM, 3 TO 6 PERCENT SLOPES	A-4	36.9	0.10%
SvC	STEED GRAVELLY LOAM, 6 TO 10 PERCENT SLOPES	A-4	113.3	0.40%

SwC	STERLING GRAVELLY LOAM, 6 TO 10 PERCENT SLOPE	A-4	175.9	0.60%
SwD	STERLING GRAVELLY LOAM, 10 TO 20 PERCENT SLOPE	A-4	213.5	0.70%
SwF2	STERLING GRAVELLY LOAM, 20 TO 50 PERCENT SLOPES,ERO	A-4	97.7	0.30%
Sy	STONY ALLUVIAL LAND		422.9	1.40%

TmB	TIMPANOGOS SILT LOAM, 3 TO 6 PERCENT SLOPES	A-4	113.8	0.40%
TrA	TRENTON SILTY CLAY LOAM, 0 TO 2 PERCENT SLOPES	A-4	####	4.40%
TtA	TRENTON SILTY CLAY LOAM, MODERATELY DEEP WATER TABLE, 0 TO 2 PERCENT SLOPES	A-4	80.4	0.30%
W	WATER		241.5	0.80%

WhE	WHEELON SILT LOAM, 10 TO 30 PERCENT SLOPE	A-4	74	0.20%
WhF2	WHEELON SILT LOAM, 30 TO 50 PERCENT SLOPES, ERODE	A-4	168.4	0.50%
WlE2	WHEELON-COLLINSTON COMPLEX, 10 TO 30 PERCENT SLOPES, ERODED	A-4	####	3.70%
Wn	WINN SILT LOAM	A-4	647.3	2.10%
Totals for Area of Interest			####	####

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
AhA	AIRPORT SILT LOAM, 0 TO 3 PERCENT SLOPES	7	145.1	0.50%
Ak	AIRPORT SILTY CLAY LOAM	7	53.9	0.20%
ArA	AVON SILTY CLAY LOAM, 0 TO 3 PERCENT SLOPES	12	174.3	0.60%
ArB	AVON SILTY CLAY LOAM, 3 TO 6 PERCENT SLOPES	12	558	1.80%
ArC	AVON SILTY CLAY LOAM, 6 TO 10 PERCENT SLOPES	12	18.2	0.10%

ArD	AVON SILTY CLAY LOAM, 10 TO 20 PERCENT SLOPE	12	81.9	0.30%
AsC	AVON-COLLINSTON COMPLEX, 6 TO 10 PERCENT SLOPES	12	88.9	0.30%
BAF	BARFUSS-LEATHAM ASSOCIATION	5	372.4	1.20%
BmB	BLACK ROCK GRAVELLY LOAM, 3 TO 6 PERCENT SLOPE	0	50.3	0.20%
Cd	CARDON SILTY CLAY	36	39.5	0.10%
Ck	COLLETT SILTY CLAY LOAM	19	965.8	3.10%

ClA	COLLINSTON LOAMY FINE SAND, 0 TO 3 PERCENT SLOPES	6	52.2	0.20%
CmC	COLLINSTON LOAM, 1 TO 6 PERCENT SLOPES	7	174.3	0.60%
CmD	COLLINSTON LOAM, 6 TO 10 PERCENT SLOPES	7	259	0.80%
CmE2	COLLINSTON LOAM, 10 TO 30 PERCENT SLOPES, ERODED	7	181.4	0.60%

CoA	CROOKSTON LOAM, 0 TO 3 PERCENT SLOPES	1	914.9	2.90%
CoB	CROOKSTON LOAM, 3 TO 6 PERCENT SLOPES	1	174	0.60%
CrB	CROWSHAW GRAVELLY LOAM, 3 TO 6 PERCENT SLOPE	0	277.7	0.90%
CrC	CROWSHAW GRAVELLY LOAM, 6 TO 10 PERCENT SLOPE	0	####	3.30%

CrD	CROWSHAW GRAVELLY LOAM, 10 TO 20 PERCENT SLOPES	0	516	1.70%
DaC	DAGOR SILT LOAM, 4 TO 8 PERCENT SLOPES	3	58.8	0.20%
DaD	DAGOR SILT LOAM, 10 TO 20 PERCENT SLOPES	3	165.4	0.50%
DNG	DATWYLER-ELZINGA-MAUGHAN ASSOCIATION	1	0.4	0.00%
Gp	GRAVEL PIT		39.1	0.10%
GsA	GREENSON LOAM, 0 TO 3 PERCENT SLOPES	4	####	####

GsB	GREENSON LOAM, 3 TO 6 PERCENT SLOPES	4	268.9	0.90%
GsC	GREENSON LOAM, 6 TO 10 PERCENT SLOPES	4	134.4	0.40%
GuA	GREENSON LOAM, DEEP OVER CLAY, 0 TO 1 PERCENT SLOPES	4	165.1	0.50%
HdA	HENDRICKS SILT LOAM, 1 TO 3 PERCENT SLOPES	9	72.2	0.20%
HdB	HENDRICKS SILT LOAM, 3 TO 6 PERCENT SLOPES	9	188.9	0.60%

HdC	HENDRICKS SILT LOAM, 6 TO 10 PERCENT SLOPE	9	298	1.00%
HdD	HENDRICKS SILT LOAM, 10 TO 20 PERCENT SLOPE	9	158.5	0.50%
HeC	HIIBNER GRAVELLY CLAY LOAM, 3 TO 10 PERCENT SLOPE	10	76.2	0.20%
HeD	HIIBNER GRAVELLY CLAY LOAM, 10 TO 30 PERCENT SLOPE	10	39.5	0.10%

HfE	HIIBNER EXTREMELY STONY CLAY LOAM, 1 TO 30 PERCENT SLOPES	10	571	1.80%
HLG2	HOSKIN-DATWYLER ASSOCIATION, ERODED	0	16.5	0.10%
HuC	HYRUM GRAVELLY LOAM, 4 TO 8 PERCENT SLOPES	2	224	0.70%
HuE	HYRUM GRAVELLY LOAM, 10 TO 25 PERCENT SLOPES	2	360.3	1.20%

KdA	KIDMAN FINE SANDY LOAM, 0 TO 2 PERCENT SLOPES	0	79.8	0.30%
KdD	KIDMAN FINE SANDY LOAM, 8 TO 15 PERCENT SLOPES	0	40.5	0.10%
KfB	KIDMAN FINE SANDY LOAM, DEEP WATER TABLE, 2 TO 4 PERCENT SLOPES	0	8	0.00%

KfC	KIDMAN FINE SANDY LOAM, DEEP WATER TABLE, 4 TO 8 PERCENT SLOPES	0	53.2	0.20%
Ks	KIRKHAM-SHAY COMPLEX	14	324.4	1.00%
La	LAKEWIN GRAVELLY COARSE SANDY LOAM	0	79.8	0.30%
Lr	LOGAN SILTY CLAY LOAM	21	626.4	2.00%
McB	MCMURDIE SILT LOAM, 3 TO 6 PERCENT SLOPES	20	14.7	0.00%

McC	MCMURDIE SILT LOAM, 6 TO 10 PERCENT SLOPES	20	89.2	0.30%
MeA	MENDON SILT LOAM, 0 TO 3 PERCENT SLOPES	6	####	8.90%
MeB	MENDON SILT LOAM, 3 TO 6 PERCENT SLOPES	6	####	3.50%
MeC	MENDON SILT LOAM, 6 TO 10 PERCENT SLOPES	6	298.8	1.00%

MfB	MENDON-COLLINSTON COMPLEX, 1 TO 6 PERCENT SLOPES	6	391.3	1.30%
MfE2	MENDON-COLLINSTON COMPLEX, 6 TO 30 PERCENT SLOPES,ERODED	6	593.5	1.90%
MoG2	MUNK-BLACK ROCK GRAVELLY LOAMS, 30 TO 70 PERCENT SLOPES, ERODE	0	213.1	0.70%

NbE	NEBEKER SILT LOAM, 10 TO 25 PERCENT SLOPES	17	16.6	0.10%
NcA	NIBLEY SILTY CLAY LOAM, 0 TO 3 PERCENT SLOPES	24	325.1	1.00%
NcB	NIBLEY SILTY CLAY LOAM, 3 TO 6 PERCENT SLOPES	24	177.9	0.60%
PaA	PARLEYS SILT LOAM, 0 TO 3 PERCENT SLOPES	6	224	0.70%

PaB	PARLEYS SILT LOAM, 3 TO 6 PERCENT SLOPES	6	339.8	1.10%
PaC	PARLEYS SILT LOAM, 6 TO 10 PERCENT SLOPES	6	41.4	0.10%
Pu	PROVO LOAM	0	50.4	0.20%
Pv	PROVO GRAVELLY LOAM	0	76.4	0.20%
RhA	RICKS GRAVELLY LOAM, 0 TO 3 PERCENT SLOPES	0	582	1.90%
RhB	RICKS GRAVELLY LOAM, 3 TO 6 PERCENT SLOPES	0	631.7	2.00%

RhC	RICKS GRAVELLY LOAM, 6 TO 10 PERCENT SLOPES	0	280.1	0.90%
RO	ROCK LAND		2.7	0.00%
Rs	ROSHE SPRINGS SILT LOAM	0	636.8	2.00%
Rt	ROUGH BROKEN LAND		238.5	0.80%
Sg	SALT LAKE-ROSHE SPRINGS COMPLEX	35	####	4.50%
SSE	SMARTS SILT LOAM, 10 TO 30 PERCENT SLOPES	1	128.7	0.40%

STG2	SMARTS-HOSKIN ASSOCIATION, ERODED	0	####	3.60%
SUG	SMARTS-LUCKY STAR-POLELINE ASSOCIATION	0	201.4	0.60%
SvA	STEED GRAVELLY LOAM, 0 TO 3 PERCENT SLOPES	0	39	0.10%
SvB	STEED GRAVELLY LOAM, 3 TO 6 PERCENT SLOPES	0	36.9	0.10%
SvC	STEED GRAVELLY LOAM, 6 TO 10 PERCENT SLOPES	0	113.3	0.40%

SwC	STERLING GRAVELLY LOAM, 6 TO 10 PERCENT SLOPE	0	175.9	0.60%
SwD	STERLING GRAVELLY LOAM, 10 TO 20 PERCENT SLOPE	0	213.5	0.70%
SwF2	STERLING GRAVELLY LOAM, 20 TO 50 PERCENT SLOPES,ERO	0	97.7	0.30%
Sy	STONY ALLUVIAL LAND		422.9	1.40%

TmB	TIMPANOGOS SILT LOAM, 3 TO 6 PERCENT SLOPES	2	113.8	0.40%
TrA	TRENTON SILTY CLAY LOAM, 0 TO 2 PERCENT SLOPES	20	####	4.40%
TtA	TRENTON SILTY CLAY LOAM, MODERATELY DEEP WATER TABLE, 0 TO 2 PERCENT SLOPES	20	80.4	0.30%
W	WATER		241.5	0.80%

WhE	WHEELON SILT LOAM, 10 TO 30 PERCENT SLOPE	5	74	0.20%
WhF2	WHEELON SILT LOAM, 30 TO 50 PERCENT SLOPES, ERODE	5	168.4	0.50%
WlE2	WHEELON-COLLINSTON COMPLEX, 10 TO 30 PERCENT SLOPES, ERODED	5	####	3.70%
Wn	WINN SILT LOAM	2	647.3	2.10%
Totals for Area of Interest			####	####

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
AhA	AIRPORT SILT LOAM, 0 TO 3 PERCENT SLOPES	0.43	145.1	0.50%
Ak	AIRPORT SILTY CLAY LOAM	0.37	53.9	0.20%
ArA	AVON SILTY CLAY LOAM, 0 TO 3 PERCENT SLOPES	0.28	174.3	0.60%
ArB	AVON SILTY CLAY LOAM, 3 TO 6 PERCENT SLOPES	0.28	558	1.80%
ArC	AVON SILTY CLAY LOAM, 6 TO 10 PERCENT SLOPES	0.28	18.2	0.10%

ArD	AVON SILTY CLAY LOAM, 10 TO 20 PERCENT SLOPE	0.28	81.9	0.30%
AsC	AVON-COLLINSTON COMPLEX, 6 TO 10 PERCENT SLOPES	0.28	88.9	0.30%
BAF	BARFUSS-LEATHAM ASSOCIATION	0.32	372.4	1.20%
BmB	BLACKROCK GRAVELLY LOAM, 3 TO 6 PERCENT SLOPE	0.1	50.3	0.20%
Cd	CARDON SILTY CLAY	0.17	39.5	0.10%
Ck	COLLETT SILTY CLAY LOAM	0.32	965.8	3.10%

ClA	COLLINSTON LOAMY FINE SAND, 0 TO 3 PERCENT SLOPES	0.17	52.2	0.20%
CmC	COLLINSTON LOAM, 1 TO 6 PERCENT SLOPES	0.37	174.3	0.60%
CmD	COLLINSTON LOAM, 6 TO 10 PERCENT SLOPES	0.37	259	0.80%
CmE2	COLLINSTON LOAM, 10 TO 30 PERCENT SLOPES, ERODED	0.37	181.4	0.60%

CoA	CROOKSTON LOAM, 0 TO 3 PERCENT SLOPES	0.28	914.9	2.90%
CoB	CROOKSTON LOAM, 3 TO 6 PERCENT SLOPES	0.28	174	0.60%
CrB	CROWSHAW GRAVELLY LOAM, 3 TO 6 PERCENT SLOPE	0.15	277.7	0.90%
CrC	CROWSHAW GRAVELLY LOAM, 6 TO 10 PERCENT SLOPE	0.15	####	3.30%

CrD	CROWSHAW GRAVELLY LOAM, 10 TO 20 PERCENT SLOPES	0.15	516	1.70%
DaC	DAGOR SILT LOAM, 4 TO 8 PERCENT SLOPES	0.32	58.8	0.20%
DaD	DAGOR SILT LOAM, 10 TO 20 PERCENT SLOPES	0.32	165.4	0.50%
DNG	DATWYLER-ELZINGA-MAUGHAN ASSOCIATION	0.1	0.4	0.00%
Gp	GRAVEL PIT		39.1	0.10%
GsA	GREENSON LOAM, 0 TO 3 PERCENT SLOPES	0.32	####	####

GsB	GREENSON LOAM, 3 TO 6 PERCENT SLOPES	0.32	268.9	0.90%
GsC	GREENSON LOAM, 6 TO 10 PERCENT SLOPES	0.32	134.4	0.40%
GuA	GREENSON LOAM, DEEP OVER CLAY, 0 TO 1 PERCENT SLOPES	0.32	165.1	0.50%
HdA	HENDRICKS SILT LOAM, 1 TO 3 PERCENT SLOPES	0.43	72.2	0.20%
HdB	HENDRICKS SILT LOAM, 3 TO 6 PERCENT SLOPES	0.43	188.9	0.60%

HdC	HENDRICKS SILT LOAM, 6 TO 10 PERCENT SLOPE	0.43	298	1.00%
HdD	HENDRICKS SILT LOAM, 10 TO 20 PERCENT SLOPE	0.43	158.5	0.50%
HeC	HIIBNER GRAVELLY CLAY LOAM, 3 TO 10 PERCENT SLOPE	0.1	76.2	0.20%
HeD	HIIBNER GRAVELLY CLAY LOAM, 10 TO 30 PERCENT SLOPE	0.1	39.5	0.10%

HfE	HIIBNER EXTREMELY STONY CLAY LOAM, 1 TO 30 PERCENT SLOPES	0.1	571	1.80%
HLG2	HOSKIN-DATWYLER ASSOCIATION, ERODED	0.1	16.5	0.10%
HuC	HYRUM GRAVELLY LOAM, 4 TO 8 PERCENT SLOPES	0.15	224	0.70%
HuE	HYRUM GRAVELLY LOAM, 10 TO 25 PERCENT SLOPES	0.15	360.3	1.20%

KdA	KIDMAN FINE SANDY LOAM, 0 TO 2 PERCENT SLOPES	0.2	79.8	0.30%
KdD	KIDMAN FINE SANDY LOAM, 8 TO 15 PERCENT SLOPES	0.2	40.5	0.10%
KfB	KIDMAN FINE SANDY LOAM, DEEP WATER TABLE, 2 TO 4 PERCENT SLOPES	0.2	8	0.00%

KfC	KIDMAN FINE SANDY LOAM, DEEP WATER TABLE, 4 TO 8 PERCENT SLOPES	0.2	53.2	0.20%
Ks	KIRKHAM-SHAY COMPLEX	0.37	324.4	1.00%
La	LAKEWIN GRAVELLY COARSE SANDY LOAM	0.05	79.8	0.30%
Lr	LOGAN SILTY CLAY LOAM	0.32	626.4	2.00%
McB	MCMURDIE SILT LOAM, 3 TO 6 PERCENT SLOPES	0.32	14.7	0.00%

McC	MCMURDIE SILT LOAM, 6 TO 10 PERCENT SLOPES	0.32	89.2	0.30%
MeA	MENDON SILT LOAM, 0 TO 3 PERCENT SLOPES	0.37	####	8.90%
MeB	MENDON SILT LOAM, 3 TO 6 PERCENT SLOPES	0.37	####	3.50%
MeC	MENDON SILT LOAM, 6 TO 10 PERCENT SLOPES	0.37	298.8	1.00%

MfB	MENDON-COLLINSTON COMPLEX, 1 TO 6 PERCENT SLOPES	0.37	391.3	1.30%
MfE2	MENDON-COLLINSTON COMPLEX, 6 TO 30 PERCENT SLOPES,ERODED	0.37	593.5	1.90%
MoG2	MUNK-BLACK ROCK GRAVELLY LOAMS, 30 TO 70 PERCENT SLOPES, ERODE	0.1	213.1	0.70%

NbE	NEBEKER SILT LOAM, 10 TO 25 PERCENT SLOPES	0.32	16.6	0.10%
NcA	NIBLEY SILTY CLAY LOAM, 0 TO 3 PERCENT SLOPES	0.32	325.1	1.00%
NcB	NIBLEY SILTY CLAY LOAM, 3 TO 6 PERCENT SLOPES	0.32	177.9	0.60%
PaA	PARLEYS SILT LOAM, 0 TO 3 PERCENT SLOPES	0.49	224	0.70%

PaB	PARLEYS SILT LOAM, 3 TO 6 PERCENT SLOPES	0.49	339.8	1.10%
PaC	PARLEYS SILT LOAM, 6 TO 10 PERCENT SLOPES	0.49	41.4	0.10%
Pu	PROVO LOAM	0.28	50.4	0.20%
Pv	PROVO GRAVELLY LOAM	0.17	76.4	0.20%
RhA	RICKS GRAVELLY LOAM, 0 TO 3 PERCENT SLOPES	0.15	582	1.90%
RhB	RICKS GRAVELLY LOAM, 3 TO 6 PERCENT SLOPES	0.15	631.7	2.00%

RhC	RICKS GRAVELLY LOAM, 6 TO 10 PERCENT SLOPES	0.15	280.1	0.90%
RO	ROCK LAND		2.7	0.00%
Rs	ROSHE SPRINGS SILT LOAM	0.37	636.8	2.00%
Rt	ROUGH BROKEN LAND		238.5	0.80%
Sg	SALT LAKE-ROSHE SPRINGS COMPLEX	0.2	####	4.50%
SSE	SMARTS SILT LOAM, 10 TO 30 PERCENT SLOPES	0.32	128.7	0.40%

STG2	SMARTS-HOSKIN ASSOCIATION, ERODED	0.17	####	3.60%
SUG	SMARTS-LUCKY STAR-POLELINE ASSOCIATION	0.15	201.4	0.60%
SvA	STEED GRAVELLY LOAM, 0 TO 3 PERCENT SLOPES	0.2	39	0.10%
SvB	STEED GRAVELLY LOAM, 3 TO 6 PERCENT SLOPES	0.2	36.9	0.10%
SvC	STEED GRAVELLY LOAM, 6 TO 10 PERCENT SLOPES	0.2	113.3	0.40%

SwC	STERLING GRAVELLY LOAM, 6 TO 10 PERCENT SLOPE	0.15	175.9	0.60%
SwD	STERLING GRAVELLY LOAM, 10 TO 20 PERCENT SLOPE	0.15	213.5	0.70%
SwF2	STERLING GRAVELLY LOAM, 20 TO 50 PERCENT SLOPES,ERO	0.15	97.7	0.30%
Sy	STONY ALLUVIAL LAND		422.9	1.40%

TmB	TIMPANOGOS SILT LOAM, 3 TO 6 PERCENT SLOPES	0.43	113.8	0.40%
TrA	TRENTON SILTY CLAY LOAM, 0 TO 2 PERCENT SLOPES	0.37	####	4.40%
TtA	TRENTON SILTY CLAY LOAM, MODERATELY DEEP WATER TABLE, 0 TO 2 PERCENT SLOPES	0.37	80.4	0.30%
W	WATER		241.5	0.80%

WhE	WHEELON SILT LOAM, 10 TO 30 PERCENT SLOPE	0.37	74	0.20%
WhF2	WHEELON SILT LOAM, 30 TO 50 PERCENT SLOPES, ERODE	0.37	168.4	0.50%
WlE2	WHEELON-COLLINSTON COMPLEX, 10 TO 30 PERCENT SLOPES, ERODED	0.37	####	3.70%
Wn	WINN SILT LOAM	0.32	647.3	2.10%
Totals for Area of Interest			####	####

FID	CROP
0	Grass/Pasture
1	Alfalfa
2	Alfalfa
3	Other Hay/Non-Alfalfa
4	Alfalfa
5	Alfalfa
6	Alfalfa
7	Alfalfa
8	Non-Agricultural Cropland
9	Other Hay/Non-Alfalfa
10	Developed land
11	Alfalfa
12	Other Hay/Non-Alfalfa
13	Winter Wheat
14	Alfalfa
15	Alfalfa
16	Other Hay/Non-Alfalfa
17	Alfalfa
18	Other Hay/Non-Alfalfa
19	Alfalfa
20	Other Hay/Non-Alfalfa
21	Non-Agricultural Cropland
22	Alfalfa
23	Alfalfa
24	Non-Agricultural Cropland
25	Non-Agricultural Cropland
26	Alfalfa
27	Alfalfa
28	Other Hay/Non-Alfalfa
29	Alfalfa
30	Non-Agricultural Cropland
31	Other Hay/Non-Alfalfa
32	Alfalfa
33	Alfalfa
34	Non-Agricultural Cropland
35	Safflower
36	Alfalfa
37	Non-Agricultural Cropland
38	Alfalfa
39	Winter Wheat
40	Alfalfa
41	Alfalfa
42	Developed land
43	Alfalfa
44	Non-Agricultural Cropland
45	Alfalfa

46 Alfalfa
47 Safflower
48 Alfalfa
49 Other Hay/Non-Alfalfa
50 Alfalfa
51 Alfalfa
52 Developed land
53 Non-Agricultural Cropland
54 Winter Wheat
55 Alfalfa
56 Developed land
57 Alfalfa
58 Alfalfa
59 Winter Wheat
60 Alfalfa
61 Alfalfa
62 Winter Wheat
63 Non-Agricultural Cropland
64 Alfalfa
65 Alfalfa
66 Winter Wheat
67 Non-Agricultural Cropland
68 Alfalfa
69 Alfalfa
70 Alfalfa
71 Alfalfa
72 Alfalfa
73 Alfalfa
74 Alfalfa
75 Developed land
76 Developed land
77 Alfalfa
78 Winter Wheat
79 Alfalfa
80 Alfalfa
81 Other Hay/Non-Alfalfa
82 Other Hay/Non-Alfalfa
83 Other Hay/Non-Alfalfa
84 Alfalfa
85 Alfalfa
86 Developed land
87 Other Hay/Non-Alfalfa
88 Alfalfa
89 Alfalfa
90 Alfalfa
91 Alfalfa
92 Other Hay/Non-Alfalfa

93 Non-Agricultural Cropland
94 Grass/Pasture
95 Alfalfa
96 Alfalfa
97 Alfalfa
98 Other Hay/Non-Alfalfa
99 Developed land
100 Non-Agricultural Cropland
101 Other Hay/Non-Alfalfa
102 Alfalfa
103 Alfalfa
104 Other Hay/Non-Alfalfa
105 Alfalfa
106 Winter Wheat
107 Alfalfa
108 Alfalfa
109 Alfalfa
110 Alfalfa
111 Alfalfa
112 Non-Agricultural Cropland
113 Alfalfa
114 Other Hay/Non-Alfalfa
115 Winter Wheat
116 Alfalfa
117 Other Hay/Non-Alfalfa
118 Alfalfa
119 Alfalfa
120 Non-Agricultural Cropland
121 Non-Agricultural Cropland
122 Alfalfa
123 Non-Agricultural Cropland
124 Alfalfa
125 Alfalfa
126 Non-Agricultural Cropland
127 Winter Wheat
128 Alfalfa
129 Alfalfa
130 Alfalfa
131 Alfalfa
132 Developed land
133 Alfalfa
134 Alfalfa
135 Winter Wheat
136 Alfalfa
137 Alfalfa
138 Alfalfa
139 Alfalfa

140 Winter Wheat
141 Developed land
142 Alfalfa
143 Non-Agricultural Cropland
144 Alfalfa
145 Alfalfa
146 Safflower
147 Other Hay/Non-Alfalfa
148 Alfalfa
149 Non-Agricultural Cropland
150 Winter Wheat
151 Non-Agricultural Cropland
152 Alfalfa
153 Alfalfa
154 Alfalfa
155 Winter Wheat
156 Alfalfa
157 Developed land
158 Alfalfa
159 Alfalfa
160 Developed land
161 Safflower
162 Non-Agricultural Cropland
163 Other Hay/Non-Alfalfa
164 Other Hay/Non-Alfalfa
165 Alfalfa
166 Alfalfa
167 Developed land
168 Alfalfa
169 Developed land
170 Alfalfa
171 Alfalfa
172 Alfalfa
173 Alfalfa
174 Alfalfa
175 Alfalfa
176 Alfalfa
177 Alfalfa
178 Safflower
179 Winter Wheat
180 Alfalfa
181 Alfalfa
182 Other Hay/Non-Alfalfa
183 Alfalfa
184 Alfalfa
185 Alfalfa
186 Alfalfa

187 Alfalfa
188 Winter Wheat
189 Alfalfa
190 Alfalfa
191 Alfalfa
192 Alfalfa
193 Winter Wheat
194 Alfalfa
195 Alfalfa
196 Other Hay/Non-Alfalfa
197 Non-Agricultural Cropland
198 Other Hay/Non-Alfalfa
199 Alfalfa
200 Alfalfa
201 Alfalfa
202 Winter Wheat
203 Alfalfa
204 Alfalfa
205 Winter Wheat
206 Alfalfa
207 Other Hay/Non-Alfalfa
208 Alfalfa
209 Grass/Pasture
210 Alfalfa
211 Alfalfa
212 Winter Wheat
213 Safflower
214 Alfalfa
215 Other Hay/Non-Alfalfa
216 Alfalfa
217 Non-Agricultural Cropland
218 Other Hay/Non-Alfalfa
219 Winter Wheat
220 Alfalfa
221 Alfalfa
222 Alfalfa
223 Alfalfa
224 Alfalfa
225 Alfalfa
226 Alfalfa
227 Other Hay/Non-Alfalfa
228 Other Hay/Non-Alfalfa
229 Alfalfa
230 Alfalfa
231 Other Hay/Non-Alfalfa
232 Winter Wheat
233 Alfalfa

234 Alfalfa
235 Alfalfa
236 Alfalfa
237 Alfalfa
238 Alfalfa
239 Alfalfa
240 Alfalfa
241 Alfalfa
242 Other Hay/Non-Alfalfa
243 Alfalfa
244 Alfalfa
245 Other Hay/Non-Alfalfa
246 Alfalfa
247 Non-Agricultural Cropland
248 Alfalfa
249 Alfalfa
250 Alfalfa
251 Alfalfa
252 Alfalfa
253 Other Hay/Non-Alfalfa
254 Alfalfa
255 Winter Wheat
256 Alfalfa
257 Alfalfa
258 Alfalfa
259 Winter Wheat
260 Winter Wheat
261 Alfalfa
262 Alfalfa
263 Alfalfa
264 Other Hay/Non-Alfalfa
265 Alfalfa
266 Alfalfa
267 Other Hay/Non-Alfalfa
268 Alfalfa
269 Alfalfa
270 Non-Agricultural Cropland
271 Developed land
272 Alfalfa
273 Alfalfa
274 Alfalfa
275 Alfalfa
276 Grass/Pasture
277 Non-Agricultural Cropland
278 Alfalfa
279 Alfalfa
280 Developed land

281 Winter Wheat
282 Developed land
283 Alfalfa
284 Alfalfa
285 Other Hay/Non-Alfalfa
286 Alfalfa
287 Alfalfa
288 Non-Agricultural Cropland
289 Alfalfa
290 Alfalfa
291 Other Hay/Non-Alfalfa
292 Alfalfa
293 Alfalfa
294 Other Hay/Non-Alfalfa
295 Other Hay/Non-Alfalfa
296 Winter Wheat
297 Alfalfa
298 Non-Agricultural Cropland
299 Winter Wheat
300 Non-Agricultural Cropland
301 Alfalfa
302 Non-Agricultural Cropland
303 Alfalfa
304 Non-Agricultural Cropland
305 Alfalfa
306 Other Hay/Non-Alfalfa
307 Alfalfa
308 Alfalfa
309 Alfalfa
310 Alfalfa
311 Winter Wheat
312 Developed land
313 Winter Wheat
314 Non-Agricultural Cropland
315 Developed land
316 Fallow/Idle Cropland
317 Winter Wheat
318 Alfalfa
319 Other Hay/Non-Alfalfa
320 Winter Wheat
321 Grass/Pasture
322 Alfalfa
323 Alfalfa
324 Alfalfa
325 Alfalfa
326 Alfalfa
327 Alfalfa

328 Alfalfa
329 Non-Agricultural Cropland
330 Alfalfa
331 Safflower
332 Safflower
333 Alfalfa
334 Winter Wheat
335 Safflower
336 Alfalfa
337 Alfalfa
338 Alfalfa
339 Other Hay/Non-Alfalfa
340 Alfalfa
341 Alfalfa
342 Winter Wheat
343 Other Hay/Non-Alfalfa
344 Other Hay/Non-Alfalfa
345 Non-Agricultural Cropland
346 Other Hay/Non-Alfalfa
347 Winter Wheat
348 Other Hay/Non-Alfalfa
349 Alfalfa
350 Alfalfa
351 Alfalfa
352 Other Hay/Non-Alfalfa
353 Alfalfa
354 Developed land
355 Developed land
356 Alfalfa
357 Alfalfa
358 Alfalfa
359 Alfalfa
360 Alfalfa
361 Winter Wheat
362 Non-Agricultural Cropland
363 Other Hay/Non-Alfalfa
364 Alfalfa
365 Alfalfa
366 Alfalfa
367 Alfalfa
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369 Alfalfa
370 Other Hay/Non-Alfalfa
371 Other Hay/Non-Alfalfa
372 Other Hay/Non-Alfalfa
373 Other Hay/Non-Alfalfa
374 Other Hay/Non-Alfalfa

375 Alfalfa
376 Other Hay/Non-Alfalfa
377 Non-Agricultural Cropland
378 Alfalfa
379 Non-Agricultural Cropland
380 Alfalfa
381 Alfalfa
382 Alfalfa
383 Alfalfa
384 Other Hay/Non-Alfalfa
385 Non-Agricultural Cropland
386 Alfalfa
387 Alfalfa
388 Alfalfa
389 Non-Agricultural Cropland
390 Developed land
391 Alfalfa
392 Non-Agricultural Cropland
393 Other Hay/Non-Alfalfa
394 Alfalfa
395 Alfalfa
396 Developed land
397 Other Hay/Non-Alfalfa
398 Other Hay/Non-Alfalfa
399 Alfalfa
400 Winter Wheat
401 Alfalfa
402 Non-Agricultural Cropland
403 Winter Wheat
404 Alfalfa
405 Alfalfa
406 Non-Agricultural Cropland
407 Developed land
408 Alfalfa
409 Non-Agricultural Cropland
410 Alfalfa
411 Other Hay/Non-Alfalfa
412 Alfalfa
413 Non-Agricultural Cropland
414 Other Hay/Non-Alfalfa
415 Other Hay/Non-Alfalfa
416 Other Hay/Non-Alfalfa
417 Alfalfa
418 Other Hay/Non-Alfalfa
419 Winter Wheat
420 Non-Agricultural Cropland
421 Alfalfa

422 Alfalfa
423 Alfalfa
424 Winter Wheat
425 Alfalfa
426 Alfalfa
427 Alfalfa
428 Alfalfa
429 Developed land
430 Winter Wheat
431 Non-Agricultural Cropland
432 Other Hay/Non-Alfalfa
433 Alfalfa
434 Alfalfa
435 Non-Agricultural Cropland
436 Other Hay/Non-Alfalfa
437 Alfalfa
438 Alfalfa
439 Non-Agricultural Cropland
440 Alfalfa
441 Other Hay/Non-Alfalfa
442 Other Hay/Non-Alfalfa
443 Alfalfa
444 Alfalfa
445 Alfalfa
446 Alfalfa
447 Non-Agricultural Cropland
448 Alfalfa
449 Other Hay/Non-Alfalfa
450 Other Hay/Non-Alfalfa
451 Alfalfa
452 Other Hay/Non-Alfalfa
453 Other Hay/Non-Alfalfa
454 Alfalfa
455 Other Hay/Non-Alfalfa
456 Non-Agricultural Cropland
457 Alfalfa
458 Developed land
459 Winter Wheat
460 Alfalfa
461 Alfalfa
462 Other Hay/Non-Alfalfa
463 Non-Agricultural Cropland
464 Non-Agricultural Cropland
465 Other Hay/Non-Alfalfa
466 Alfalfa
467 Non-Agricultural Cropland
468 Non-Agricultural Cropland

469 Non-Agricultural Cropland
470 Non-Agricultural Cropland
471 Non-Agricultural Cropland
472 Fallow/Idle Cropland
473 Fallow/Idle Cropland
474 Non-Agricultural Cropland
475 Non-Agricultural Cropland
476 Non-Agricultural Cropland
477 Grass/Pasture
478 Grass/Pasture
479 Grass/Pasture
480 Other Hay/Non-Alfalfa
481 Other Hay/Non-Alfalfa
482 Other Hay/Non-Alfalfa
483 Other Hay/Non-Alfalfa
484 Other Hay/Non-Alfalfa
485 Other Hay/Non-Alfalfa
486 Other Hay/Non-Alfalfa
487 Other Hay/Non-Alfalfa
488 Other Hay/Non-Alfalfa
489 Non-Agricultural Cropland
490 Non-Agricultural Cropland
491 Alfalfa
492 Other Hay/Non-Alfalfa
493 Other Hay/Non-Alfalfa
494 Other Hay/Non-Alfalfa
495 Developed land
496 Developed land
497 Developed land
498 Developed land
499 Non-Agricultural Cropland
500 Non-Agricultural Cropland
501 Non-Agricultural Cropland
502 Other Hay/Non-Alfalfa
503 Other Hay/Non-Alfalfa
504 Non-Agricultural Cropland
505 Alfalfa
506 Alfalfa
507 Non-Agricultural Cropland
508 Non-Agricultural Cropland
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510 Non-Agricultural Cropland
511 Other Hay/Non-Alfalfa
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547 Non-Agricultural Cropland
548 Non-Agricultural Cropland
549 Fallow/Idle Cropland
550 Fallow/Idle Cropland
551 Developed land
552 Developed land
553 Non-Agricultural Cropland
554 Non-Agricultural Cropland
555 Non-Agricultural Cropland
556 Non-Agricultural Cropland
557 Other Hay/Non-Alfalfa
558 Other Hay/Non-Alfalfa
559 Other Hay/Non-Alfalfa
560 Other Hay/Non-Alfalfa
561 Non-Agricultural Cropland
562 Other Hay/Non-Alfalfa

563 Other Hay/Non-Alfalfa
564 Other Hay/Non-Alfalfa
565 Alfalfa
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568 Alfalfa
569 Alfalfa
570 Non-Agricultural Cropland
571 Non-Agricultural Cropland
572 Other Hay/Non-Alfalfa
573 Alfalfa
574 Non-Agricultural Cropland
575 Alfalfa
576 Non-Agricultural Cropland
577 Non-Agricultural Cropland
578 Other Hay/Non-Alfalfa
579 Grass/Pasture
580 Other Hay/Non-Alfalfa
581 Other Hay/Non-Alfalfa
582 Other Hay/Non-Alfalfa
583 Other Hay/Non-Alfalfa
584 Non-Agricultural Cropland
585 Other Hay/Non-Alfalfa
586 Non-Agricultural Cropland

Map unit symbol	Map unit name	Rating (centimeters per centimeter)	Acres in AOI	Percent of AOI
AhA	AIRPORT SILT LOAM, 0 TO 3 PERCENT SLOPES	0.17	145.1	0.50%
Ak	AIRPORT SILTY CLAY LOAM	0.17	53.9	0.20%
ArA	AVON SILTY CLAY LOAM, 0 TO 3 PERCENT SLOPES	0.19	174.3	0.60%
ArB	AVON SILTY CLAY LOAM, 3 TO 6 PERCENT SLOPES	0.19	558	1.80%
ArC	AVON SILTY CLAY LOAM, 6 TO 10 PERCENT SLOPES	0.19	18.2	0.10%

ArD	AVON SILTY CLAY LOAM, 10 TO 20 PERCENT SLOPE	0.19	81.9	0.30%
AsC	AVON-COLLINSTON COMPLEX, 6 TO 10 PERCENT SLOPES	0.19	88.9	0.30%
BAF	BARFUSS-LEATHAM ASSOCIATION	0.19	372.4	1.20%
BmB	BLACKROCK GRAVELLY LOAM, 3 TO 6 PERCENT SLOPE	0.14	50.3	0.20%
Cd	CARDON SILTY CLAY	0.18	39.5	0.10%
Ck	COLLETT SILTY CLAY LOAM	0.19	965.8	3.10%

ClA	COLLINSTON LOAMY FINE SAND, 0 TO 3 PERCENT SLOPES	0.09	52.2	0.20%
CmC	COLLINSTON LOAM, 1 TO 6 PERCENT SLOPES	0.17	174.3	0.60%
CmD	COLLINSTON LOAM, 6 TO 10 PERCENT SLOPES	0.17	259	0.80%
CmE2	COLLINSTON LOAM, 10 TO 30 PERCENT SLOPES, ERODED	0.17	181.4	0.60%

CoA	CROOKSTON LOAM, 0 TO 3 PERCENT SLOPES	0.15	914.9	2.90%
CoB	CROOKSTON LOAM, 3 TO 6 PERCENT SLOPES	0.15	174	0.60%
CrB	CROWSHAW GRAVELLY LOAM, 3 TO 6 PERCENT SLOPE	0.14	277.7	0.90%
CrC	CROWSHAW GRAVELLY LOAM, 6 TO 10 PERCENT SLOPE	0.14	####	3.30%

CrD	CROWSHAW GRAVELLY LOAM, 10 TO 20 PERCENT SLOPES	0.14	516	1.70%
DaC	DAGOR SILT LOAM, 4 TO 8 PERCENT SLOPES	0.17	58.8	0.20%
DaD	DAGOR SILT LOAM, 10 TO 20 PERCENT SLOPES	0.17	165.4	0.50%
DNG	DATWYLER-ELZINGA-MAUGHAN ASSOCIATION	0.12	0.4	0.00%
Gp	GRAVEL PIT		39.1	0.10%
GsA	GREENSON LOAM, 0 TO 3 PERCENT SLOPES	0.19	####	####

GsB	GREENSON LOAM, 3 TO 6 PERCENT SLOPES	0.19	268.9	0.90%
GsC	GREENSON LOAM, 6 TO 10 PERCENT SLOPES	0.19	134.4	0.40%
GuA	GREENSON LOAM, DEEP OVER CLAY, 0 TO 1 PERCENT SLOPES	0.19	165.1	0.50%
HdA	HENDRICKS SILT LOAM, 1 TO 3 PERCENT SLOPES	0.17	72.2	0.20%
HdB	HENDRICKS SILT LOAM, 3 TO 6 PERCENT SLOPES	0.17	188.9	0.60%

HdC	HENDRICKS SILT LOAM, 6 TO 10 PERCENT SLOPE	0.17	298	1.00%
HdD	HENDRICKS SILT LOAM, 10 TO 20 PERCENT SLOPE	0.17	158.5	0.50%
HeC	HIIBNER GRAVELLY CLAY LOAM, 3 TO 10 PERCENT SLOPE	0.15	76.2	0.20%
HeD	HIIBNER GRAVELLY CLAY LOAM, 10 TO 30 PERCENT SLOPE	0.15	39.5	0.10%

HfE	HIIBNER EXTREMELY STONY CLAY LOAM, 1 TO 30 PERCENT SLOPES	0.15	571	1.80%
HLG2	HOSKIN-DATWYLER ASSOCIATION, ERODED	0.09	16.5	0.10%
HuC	HYRUM GRAVELLY LOAM, 4 TO 8 PERCENT SLOPES	0.12	224	0.70%
HuE	HYRUM GRAVELLY LOAM, 10 TO 25 PERCENT SLOPES	0.12	360.3	1.20%

KdA	KIDMAN FINE SANDY LOAM, 0 TO 2 PERCENT SLOPES	0.13	79.8	0.30%
KdD	KIDMAN FINE SANDY LOAM, 8 TO 15 PERCENT SLOPES	0.13	40.5	0.10%
KfB	KIDMAN FINE SANDY LOAM, DEEP WATER TABLE, 2 TO 4 PERCENT SLOPES	0.13	8	0.00%

KfC	KIDMAN FINE SANDY LOAM, DEEP WATER TABLE, 4 TO 8 PERCENT SLOPES	0.13	53.2	0.20%
Ks	KIRKHAM-SHAY COMPLEX	0.17	324.4	1.00%
La	LAKEWIN GRAVELLY COARSE SANDY LOAM	0.06	79.8	0.30%
Lr	LOGAN SILTY CLAY LOAM	0.18	626.4	2.00%
McB	MCMURDIE SILT LOAM, 3 TO 6 PERCENT SLOPES	0.17	14.7	0.00%

McC	MCMURDIE SILT LOAM, 6 TO 10 PERCENT SLOPES	0.17	89.2	0.30%
MeA	MENDON SILT LOAM, 0 TO 3 PERCENT SLOPES	0.19	####	8.90%
MeB	MENDON SILT LOAM, 3 TO 6 PERCENT SLOPES	0.19	####	3.50%
MeC	MENDON SILT LOAM, 6 TO 10 PERCENT SLOPES	0.19	298.8	1.00%

MfB	MENDON-COLLINSTON COMPLEX, 1 TO 6 PERCENT SLOPES	0.19	391.3	1.30%
MfE2	MENDON-COLLINSTON COMPLEX, 6 TO 30 PERCENT SLOPES,ERODED	0.19	593.5	1.90%
MoG2	MUNK-BLACK ROCK GRAVELLY LOAMS, 30 TO 70 PERCENT SLOPES, ERODE	0.08	213.1	0.70%

NbE	NEBEKER SILT LOAM, 10 TO 25 PERCENT SLOPES	0.17	16.6	0.10%
NcA	NIBLEY SILTY CLAY LOAM, 0 TO 3 PERCENT SLOPES	0.19	325.1	1.00%
NcB	NIBLEY SILTY CLAY LOAM, 3 TO 6 PERCENT SLOPES	0.19	177.9	0.60%
PaA	PARLEYS SILT LOAM, 0 TO 3 PERCENT SLOPES	0.16	224	0.70%

PaB	PARLEYS SILT LOAM, 3 TO 6 PERCENT SLOPES	0.16	339.8	1.10%
PaC	PARLEYS SILT LOAM, 6 TO 10 PERCENT SLOPES	0.16	41.4	0.10%
Pu	PROVO LOAM	0.15	50.4	0.20%
Pv	PROVO GRAVELLY LOAM	0.11	76.4	0.20%
RhA	RICKS GRAVELLY LOAM, 0 TO 3 PERCENT SLOPES	0.12	582	1.90%
RhB	RICKS GRAVELLY LOAM, 3 TO 6 PERCENT SLOPES	0.12	631.7	2.00%

RhC	RICKS GRAVELLY LOAM, 6 TO 10 PERCENT SLOPE	0.12	280.1	0.90%
RO	ROCK LAND		2.7	0.00%
Rs	ROSHE SPRINGS SILT LOAM	0.18	636.8	2.00%
Rt	ROUGH BROKEN LAND		238.5	0.80%
Sg	SALT LAKE-ROSHE SPRINGS COMPLEX	0.17	####	4.50%
SSE	SMARTS SILT LOAM, 10 TO 30 PERCENT SLOPE	0.16	128.7	0.40%

STG2	SMARTS-HOSKIN ASSOCIATION, ERODED	0.12	####	3.60%
SUG	SMARTS-LUCKY STAR-POLELINE ASSOCIATION	0.13	201.4	0.60%
SvA	STEED GRAVELLY LOAM, 0 TO 3 PERCENT SLOPES	0.14	39	0.10%
SvB	STEED GRAVELLY LOAM, 3 TO 6 PERCENT SLOPES	0.14	36.9	0.10%
SvC	STEED GRAVELLY LOAM, 6 TO 10 PERCENT SLOPES	0.14	113.3	0.40%

SwC	STERLING GRAVELLY LOAM, 6 TO 10 PERCENT SLOPE	0.12	175.9	0.60%
SwD	STERLING GRAVELLY LOAM, 10 TO 20 PERCENT SLOPE	0.12	213.5	0.70%
SwF2	STERLING GRAVELLY LOAM, 20 TO 50 PERCENT SLOPES,ERO	0.12	97.7	0.30%
Sy	STONY ALLUVIAL LAND		422.9	1.40%

TmB	TIMPANOGOS SILT LOAM, 3 TO 6 PERCENT SLOPES	0.2	113.8	0.40%
TrA	TRENTON SILTY CLAY LOAM, 0 TO 2 PERCENT SLOPES	0.17	####	4.40%
TtA	TRENTON SILTY CLAY LOAM, MODERATELY DEEP WATER TABLE, 0 TO 2 PERCENT SLOPES	0.17	80.4	0.30%
W	WATER		241.5	0.80%

WhE	WHEELON SILT LOAM, 10 TO 30 PERCENT SLOPE	0.17	74	0.20%
WhF2	WHEELON SILT LOAM, 30 TO 50 PERCENT SLOPES, ERODE	0.17	168.4	0.50%
WlE2	WHEELON-COLLINSTON COMPLEX, 10 TO 30 PERCENT SLOPES, ERODED	0.17	####	3.70%
Wn	WINN SILT LOAM	0.19	647.3	2.10%
Totals for Area of Interest			####	####

Map unit symbol	Map unit name	Rating (percent)	Acres in AOI	Percent of AOI
AhA	AIRPORT SILT LOAM, 0 TO 3 PERCENT SLOPES	28.6	145.1	0.50%
Ak	AIRPORT SILTY CLAY LOAM	29.2	53.9	0.20%
ArA	AVON SILTY CLAY LOAM, 0 TO 3 PERCENT SLOPES	36.1	174.3	0.60%
ArB	AVON SILTY CLAY LOAM, 3 TO 6 PERCENT SLOPES	36.1	558	1.80%
ArC	AVON SILTY CLAY LOAM, 6 TO 10 PERCENT SLOPES	36.1	18.2	0.10%

ArD	AVON SILTY CLAY LOAM, 10 TO 20 PERCENT SLOPE	36.1	81.9	0.30%
AsC	AVON-COLLINSTON COMPLEX, 6 TO 10 PERCENT SLOPES	36.1	88.9	0.30%
BAF	BARFUSS-LEATHAM ASSOCIATION	25.7	372.4	1.20%
BmB	BLACKROCK GRAVELLY LOAM, 3 TO 6 PERCENT SLOPE	26.7	50.3	0.20%
Cd	CARDON SILTY CLAY	55	39.5	0.10%
Ck	COLLETT SILTY CLAY LOAM	39	965.8	3.10%

ClA	COLLINSTON LOAMY FINE SAND, 0 TO 3 PERCENT SLOPES	26.6	52.2	0.20%
CmC	COLLINSTON LOAM, 1 TO 6 PERCENT SLOPES	28.2	174.3	0.60%
CmD	COLLINSTON LOAM, 6 TO 10 PERCENT SLOPES	28.2	259	0.80%
CmE2	COLLINSTON LOAM, 10 TO 30 PERCENT SLOPES, ERODED	28.2	181.4	0.60%

CoA	CROOKSTON LOAM, 0 TO 3 PERCENT SLOPES	24	914.9	2.90%
CoB	CROOKSTON LOAM, 3 TO 6 PERCENT SLOPES	24	174	0.60%
CrB	CROWSHAW GRAVELLY LOAM, 3 TO 6 PERCENT SLOPE	25	277.7	0.90%
CrC	CROWSHAW GRAVELLY LOAM, 6 TO 10 PERCENT SLOPE	25	####	3.30%

CrD	CROWSHAW GRAVELLY LOAM, 10 TO 20 PERCENT SLOPES	25	516	1.70%
DaC	DAGOR SILT LOAM, 4 TO 8 PERCENT SLOPES	25	58.8	0.20%
DaD	DAGOR SILT LOAM, 10 TO 20 PERCENT SLOPES	25	165.4	0.50%
DNG	DATWYLER-ELZINGA-MAUGHAN ASSOCIATION	45.3	0.4	0.00%
Gp	GRAVEL PIT		39.1	0.10%
GsA	GREENSON LOAM, 0 TO 3 PERCENT SLOPES	25	####	####

GsB	GREENSON LOAM, 3 TO 6 PERCENT SLOPES	25	268.9	0.90%
GsC	GREENSON LOAM, 6 TO 10 PERCENT SLOPES	25	134.4	0.40%
GuA	GREENSON LOAM, DEEP OVER CLAY, 0 TO 1 PERCENT SLOPES	25	165.1	0.50%
HdA	HENDRICKS SILT LOAM, 1 TO 3 PERCENT SLOPES	36.6	72.2	0.20%
HdB	HENDRICKS SILT LOAM, 3 TO 6 PERCENT SLOPES	36.6	188.9	0.60%

HdC	HENDRICKS SILT LOAM, 6 TO 10 PERCENT SLOPE	36.6	298	1.00%
HdD	HENDRICKS SILT LOAM, 10 TO 20 PERCENT SLOPE	36.6	158.5	0.50%
HeC	HIIBNER GRAVELLY CLAY LOAM, 3 TO 10 PERCENT SLOPE	43.8	76.2	0.20%
HeD	HIIBNER GRAVELLY CLAY LOAM, 10 TO 30 PERCENT SLOPE	43.8	39.5	0.10%

HfE	HIIBNER EXTREMELY STONY CLAY LOAM, 1 TO 30 PERCENT SLOPES	44	571	1.80%
HLG2	HOSKIN-DATWYLER ASSOCIATION, ERODED	18.2	16.5	0.10%
HuC	HYRUM GRAVELLY LOAM, 4 TO 8 PERCENT SLOPES	29.2	224	0.70%
HuE	HYRUM GRAVELLY LOAM, 10 TO 25 PERCENT SLOPES	29.2	360.3	1.20%

KdA	KIDMAN FINE SANDY LOAM, 0 TO 2 PERCENT SLOPES	22.2	79.8	0.30%
KdD	KIDMAN FINE SANDY LOAM, 8 TO 15 PERCENT SLOPES	22.2	40.5	0.10%
KfB	KIDMAN FINE SANDY LOAM, DEEP WATER TABLE, 2 TO 4 PERCENT SLOPES	22.2	8	0.00%

KfC	KIDMAN FINE SANDY LOAM, DEEP WATER TABLE, 4 TO 8 PERCENT SLOPES	22.2	53.2	0.20%
Ks	KIRKHAM-SHAY COMPLEX	26.7	324.4	1.00%
La	LAKEWIN GRAVELLY COARSE SANDY LOAM	12.9	79.8	0.30%
Lr	LOGAN SILTY CLAY LOAM	45.4	626.4	2.00%
McB	MCMURDIE SILT LOAM, 3 TO 6 PERCENT SLOPES	45.6	14.7	0.00%

McC	MCMURDIE SILT LOAM, 6 TO 10 PERCENT SLOPES	45.6	89.2	0.30%
MeA	MENDON SILT LOAM, 0 TO 3 PERCENT SLOPES	29.1	####	8.90%
MeB	MENDON SILT LOAM, 3 TO 6 PERCENT SLOPES	29.1	####	3.50%
MeC	MENDON SILT LOAM, 6 TO 10 PERCENT SLOPES	29.1	298.8	1.00%

MfB	MENDON-COLLINSTON COMPLEX, 1 TO 6 PERCENT SLOPES	29.1	391.3	1.30%
MfE2	MENDON-COLLINSTON COMPLEX, 6 TO 30 PERCENT SLOPES,ERODED	29.1	593.5	1.90%
MoG2	MUNK-BLACK ROCK GRAVELLY LOAMS, 30 TO 70 PERCENT SLOPES, ERODE	23	213.1	0.70%

NbE	NEBEKER SILT LOAM, 10 TO 25 PERCENT SLOPES	42.5	16.6	0.10%
NcA	NIBLEY SILTY CLAY LOAM, 0 TO 3 PERCENT SLOPES	47.2	325.1	1.00%
NcB	NIBLEY SILTY CLAY LOAM, 3 TO 6 PERCENT SLOPES	47.2	177.9	0.60%
PaA	PARLEYS SILT LOAM, 0 TO 3 PERCENT SLOPES	29.2	224	0.70%

PaB	PARLEYS SILT LOAM, 3 TO 6 PERCENT SLOPES	29.2	339.8	1.10%
PaC	PARLEYS SILT LOAM, 6 TO 10 PERCENT SLOPES	29.2	41.4	0.10%
Pu	PROVO LOAM	25	50.4	0.20%
Pv	PROVO GRAVELLY LOAM	25	76.4	0.20%
RhA	RICKS GRAVELLY LOAM, 0 TO 3 PERCENT SLOPES	25	582	1.90%
RhB	RICKS GRAVELLY LOAM, 3 TO 6 PERCENT SLOPES	25	631.7	2.00%

RhC	RICKS GRAVELLY LOAM, 6 TO 10 PERCENT SLOPES	25	280.1	0.90%
RO	ROCK LAND		2.7	0.00%
Rs	ROSHE SPRINGS SILT LOAM	15	636.8	2.00%
Rt	ROUGH BROKEN LAND		238.5	0.80%
Sg	SALT LAKE-ROSHE SPRINGS COMPLEX	55	####	4.50%
SSE	SMARTS SILT LOAM, 10 TO 30 PERCENT SLOPES	31.6	128.7	0.40%

STG2	SMARTS-HOSKIN ASSOCIATION, ERODED	31.6	####	3.60%
SUG	SMARTS-LUCKY STAR-POLELINE ASSOCIATION	31.6	201.4	0.60%
SvA	STEED GRAVELLY LOAM, 0 TO 3 PERCENT SLOPES	13.4	39	0.10%
SvB	STEED GRAVELLY LOAM, 3 TO 6 PERCENT SLOPES	13.4	36.9	0.10%
SvC	STEED GRAVELLY LOAM, 6 TO 10 PERCENT SLOPES	13.4	113.3	0.40%

SwC	STERLING GRAVELLY LOAM, 6 TO 10 PERCENT SLOPE	18.8	175.9	0.60%
SwD	STERLING GRAVELLY LOAM, 10 TO 20 PERCENT SLOPE	18.8	213.5	0.70%
SwF2	STERLING GRAVELLY LOAM, 20 TO 50 PERCENT SLOPES,ERO	18.8	97.7	0.30%
Sy	STONY ALLUVIAL LAND		422.9	1.40%

TmB	TIMPANOGOS SILT LOAM, 3 TO 6 PERCENT SLOPES	23.5	113.8	0.40%
TrA	TRENTON SILTY CLAY LOAM, 0 TO 2 PERCENT SLOPES	48.6	####	4.40%
TtA	TRENTON SILTY CLAY LOAM, MODERATELY DEEP WATER TABLE, 0 TO 2 PERCENT SLOPES	48.6	80.4	0.30%
W	WATER		241.5	0.80%

WhE	WHEELON SILT LOAM, 10 TO 30 PERCENT SLOPE	27.1	74	0.20%
WhF2	WHEELON SILT LOAM, 30 TO 50 PERCENT SLOPES, ERODE	27.1	168.4	0.50%
WlE2	WHEELON-COLLINSTON COMPLEX, 10 TO 30 PERCENT SLOPES, ERODED	27.1	####	3.70%
Wn	WINN SILT LOAM	25	647.3	2.10%
Totals for Area of Interest			####	####

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
AhA	AIRPORT SILT LOAM, 0 TO 3 PERCENT SLOPES	D	145.1	0.50%
Ak	AIRPORT SILTY CLAY LOAM	D	53.9	0.20%
ArA	AVON SILTY CLAY LOAM, 0 TO 3 PERCENT SLOPES	C	174.3	0.60%
ArB	AVON SILTY CLAY LOAM, 3 TO 6 PERCENT SLOPES	C	558	1.80%
ArC	AVON SILTY CLAY LOAM, 6 TO 10 PERCENT SLOPES	C	18.2	0.10%

ArD	AVON SILTY CLAY LOAM, 10 TO 20 PERCENT SLOPE	C	81.9	0.30%
AsC	AVON-COLLINSTON COMPLEX, 6 TO 10 PERCENT SLOPES	C	88.9	0.30%
BAF	BARFUSS-LEATHAM ASSOCIATION	C	372.4	1.20%
BmB	BLACKROCK GRAVELLY LOAM, 3 TO 6 PERCENT SLOPE	C	50.3	0.20%
Cd	CARDON SILTY CLAY	D	39.5	0.10%
Ck	COLLETT SILTY CLAY LOAM	C	965.8	3.10%

ClA	COLLINSTON LOAMY FINE SAND, 0 TO 3 PERCENT SLOPES	C	52.2	0.20%
CmC	COLLINSTON LOAM, 1 TO 6 PERCENT SLOPES	C	174.3	0.60%
CmD	COLLINSTON LOAM, 6 TO 10 PERCENT SLOPES	C	259	0.80%
CmE2	COLLINSTON LOAM, 10 TO 30 PERCENT SLOPES, ERODED	C	181.4	0.60%

CoA	CROOKSTON LOAM, 0 TO 3 PERCENT SLOPES	B	914.9	2.90%
CoB	CROOKSTON LOAM, 3 TO 6 PERCENT SLOPES	B	174	0.60%
CrB	CROWSHAW GRAVELLY LOAM, 3 TO 6 PERCENT SLOPE	B	277.7	0.90%
CrC	CROWSHAW GRAVELLY LOAM, 6 TO 10 PERCENT SLOPE	B	####	3.30%

CrD	CROWSHAW GRAVELLY LOAM, 10 TO 20 PERCENT SLOPES	B	516	1.70%
DaC	DAGOR SILT LOAM, 4 TO 8 PERCENT SLOPES	B	58.8	0.20%
DaD	DAGOR SILT LOAM, 10 TO 20 PERCENT SLOPES	B	165.4	0.50%
DNG	DATWYLER-ELZINGA-MAUGHAN ASSOCIATION	D	0.4	0.00%
Gp	GRAVEL PIT		39.1	0.10%
GsA	GREENSON LOAM, 0 TO 3 PERCENT SLOPES	C	####	####

GsB	GREENSON LOAM, 3 TO 6 PERCENT SLOPES	C	268.9	0.90%
GsC	GREENSON LOAM, 6 TO 10 PERCENT SLOPES	C	134.4	0.40%
GuA	GREENSON LOAM, DEEP OVER CLAY, 0 TO 1 PERCENT SLOPES	C	165.1	0.50%
HdA	HENDRICKS SILT LOAM, 1 TO 3 PERCENT SLOPES	C	72.2	0.20%
HdB	HENDRICKS SILT LOAM, 3 TO 6 PERCENT SLOPES	C	188.9	0.60%

HdC	HENDRICKS SILT LOAM, 6 TO 10 PERCENT SLOPE	C	298	1.00%
HdD	HENDRICKS SILT LOAM, 10 TO 20 PERCENT SLOPE	C	158.5	0.50%
HeC	HIIBNER GRAVELLY CLAY LOAM, 3 TO 10 PERCENT SLOPE	C	76.2	0.20%
HeD	HIIBNER GRAVELLY CLAY LOAM, 10 TO 30 PERCENT SLOPE	C	39.5	0.10%

HfE	HIIBNER EXTREMELY STONY CLAY LOAM, 1 TO 30 PERCENT SLOPES	C	571	1.80%
HLG2	HOSKIN-DATWYLER ASSOCIATION, ERODED	C	16.5	0.10%
HuC	HYRUM GRAVELLY LOAM, 4 TO 8 PERCENT SLOPES	C	224	0.70%
HuE	HYRUM GRAVELLY LOAM, 10 TO 25 PERCENT SLOPES	C	360.3	1.20%

KdA	KIDMAN FINE SANDY LOAM, 0 TO 2 PERCENT SLOPES	A	79.8	0.30%
KdD	KIDMAN FINE SANDY LOAM, 8 TO 15 PERCENT SLOPES	A	40.5	0.10%
KfB	KIDMAN FINE SANDY LOAM, DEEP WATER TABLE, 2 TO 4 PERCENT SLOPES	A	8	0.00%

KfC	KIDMAN FINE SANDY LOAM, DEEP WATER TABLE, 4 TO 8 PERCENT SLOPES	A	53.2	0.20%
Ks	KIRKHAM-SHAY COMPLEX	C	324.4	1.00%
La	LAKEWIN GRAVELLY COARSE SANDY LOAM	A	79.8	0.30%
Lr	LOGAN SILTY CLAY LOAM	C/D	626.4	2.00%
McB	MCMURDIE SILT LOAM, 3 TO 6 PERCENT SLOPES	C	14.7	0.00%

McC	MCMURDIE SILT LOAM, 6 TO 10 PERCENT SLOPES	C	89.2	0.30%
MeA	MENDON SILT LOAM, 0 TO 3 PERCENT SLOPES	C	####	8.90%
MeB	MENDON SILT LOAM, 3 TO 6 PERCENT SLOPES	C	####	3.50%
MeC	MENDON SILT LOAM, 6 TO 10 PERCENT SLOPES	C	298.8	1.00%

MfB	MENDON-COLLINSTON COMPLEX, 1 TO 6 PERCENT SLOPES	C	391.3	1.30%
MfE2	MENDON-COLLINSTON COMPLEX, 6 TO 30 PERCENT SLOPES,ERODED	C	593.5	1.90%
MoG2	MUNK-BLACK ROCK GRAVELLY LOAMS, 30 TO 70 PERCENT SLOPES, ERODE	C	213.1	0.70%

NbE	NEBEKER SILT LOAM, 10 TO 25 PERCENT SLOPES	C	16.6	0.10%
NcA	NIBLEY SILTY CLAY LOAM, 0 TO 3 PERCENT SLOPES	D	325.1	1.00%
NcB	NIBLEY SILTY CLAY LOAM, 3 TO 6 PERCENT SLOPES	D	177.9	0.60%
PaA	PARLEYS SILT LOAM, 0 TO 3 PERCENT SLOPES	C	224	0.70%

PaB	PARLEYS SILT LOAM, 3 TO 6 PERCENT SLOPES	C	339.8	1.10%
PaC	PARLEYS SILT LOAM, 6 TO 10 PERCENT SLOPES	C	41.4	0.10%
Pu	PROVO LOAM	B	50.4	0.20%
Pv	PROVO GRAVELLY LOAM	B	76.4	0.20%
RhA	RICKS GRAVELLY LOAM, 0 TO 3 PERCENT SLOPES	B	582	1.90%
RhB	RICKS GRAVELLY LOAM, 3 TO 6 PERCENT SLOPES	B	631.7	2.00%

RhC	RICKS GRAVELLY LOAM, 6 TO 10 PERCENT SLOPES	B	280.1	0.90%
RO	ROCK LAND		2.7	0.00%
Rs	ROSHE SPRINGS SILT LOAM	B/D	636.8	2.00%
Rt	ROUGH BROKEN LAND		238.5	0.80%
Sg	SALT LAKE-ROSHE SPRINGS COMPLEX	D	####	4.50%
SSE	SMARTS SILT LOAM, 10 TO 30 PERCENT SLOPES	B	128.7	0.40%

STG2	SMARTS-HOSKIN ASSOCIATION, ERODED	B	####	3.60%
SUG	SMARTS-LUCKY STAR-POLELINE ASSOCIATION	B	201.4	0.60%
SvA	STEED GRAVELLY LOAM, 0 TO 3 PERCENT SLOPES	B	39	0.10%
SvB	STEED GRAVELLY LOAM, 3 TO 6 PERCENT SLOPES	B	36.9	0.10%
SvC	STEED GRAVELLY LOAM, 6 TO 10 PERCENT SLOPES	B	113.3	0.40%

SwC	STERLING GRAVELLY LOAM, 6 TO 10 PERCENT SLOPE	B	175.9	0.60%
SwD	STERLING GRAVELLY LOAM, 10 TO 20 PERCENT SLOPE	B	213.5	0.70%
SwF2	STERLING GRAVELLY LOAM, 20 TO 50 PERCENT SLOPES,ERO	B	97.7	0.30%
Sy	STONY ALLUVIAL LAND		422.9	1.40%

TmB	TIMPANOGOS SILT LOAM, 3 TO 6 PERCENT SLOPES	C	113.8	0.40%
TrA	TRENTON SILTY CLAY LOAM, 0 TO 2 PERCENT SLOPES	D	####	4.40%
TtA	TRENTON SILTY CLAY LOAM, MODERATELY DEEP WATER TABLE, 0 TO 2 PERCENT SLOPES	D	80.4	0.30%
W	WATER		241.5	0.80%

WhE	WHEELON SILT LOAM, 10 TO 30 PERCENT SLOPE	B	74	0.20%
WhF2	WHEELON SILT LOAM, 30 TO 50 PERCENT SLOPES, ERODE	B	168.4	0.50%
WlE2	WHEELON-COLLINSTON COMPLEX, 10 TO 30 PERCENT SLOPES, ERODED	B	####	3.70%
Wn	WINN SILT LOAM	C	647.3	2.10%
Totals for Area of Interest			####	####

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
AhA	AIRPORT SILT LOAM, 0 TO 3 PERCENT SLOPES	Rare	145.1	0.50%
Ak	AIRPORT SILTY CLAY LOAM	Rare	53.9	0.20%
ArA	AVON SILTY CLAY LOAM, 0 TO 3 PERCENT SLOPES	None	174.3	0.60%
ArB	AVON SILTY CLAY LOAM, 3 TO 6 PERCENT SLOPES	None	558	1.80%
ArC	AVON SILTY CLAY LOAM, 6 TO 10 PERCENT SLOPES	None	18.2	0.10%

ArD	AVON SILTY CLAY LOAM, 10 TO 20 PERCENT SLOPES	None	81.9	0.30%
AsC	AVON-COLLINSTON COMPLEX, 6 TO 10 PERCENT SLOPES	None	88.9	0.30%
BAF	BARFUSS-LEATHAM ASSOCIATION	None	372.4	1.20%
BmB	BLACK ROCK GRAVELLY LOAM, 3 TO 6 PERCENT SLOPES	None	50.3	0.20%
Cd	CARDON SILTY CLAY	None	39.5	0.10%

Ck	COLLETT SILTY CLAY LOAM	None	965.8	3.10%
ClA	COLLINSTON LOAMY FINE SAND, 0 TO 3 PERCENT SLOPES	None	52.2	0.20%
CmC	COLLINSTON LOAM, 1 TO 6 PERCENT SLOPES	None	174.3	0.60%
CmD	COLLINSTON LOAM, 6 TO 10 PERCENT SLOPES	None	259	0.80%

CmE2	COLLINSTON LOAM, 10 TO 30 PERCENT SLOPES, ERODED	None	181.4	0.60%
CoA	CROOKSTON LOAM, 0 TO 3 PERCENT SLOPES	None	914.9	2.90%
CoB	CROOKSTON LOAM, 3 TO 6 PERCENT SLOPES	None	174	0.60%
CrB	CROWSHAW GRAVELLY LOAM, 3 TO 6 PERCENT SLOPES	None	277.7	0.90%

CrC	CROWSHAW GRAVELLY LOAM, 6 TO 10 PERCENT SLOPE	None	####	3.30%
CrD	CROWSHAW GRAVELLY LOAM, 10 TO 20 PERCENT SLOPE	None	516	1.70%
DaC	DAGOR SILT LOAM, 4 TO 8 PERCENT SLOPES	None	58.8	0.20%
DaD	DAGOR SILT LOAM, 10 TO 20 PERCENT SLOPES	Rare	165.4	0.50%

DNG	DATWYLER-ELZINGA-MAUGHAN ASSOCIATION	None	0.4	0.00%
Gp	GRAVEL PIT	None	39.1	0.10%
GsA	GREENSON LOAM, 0 TO 3 PERCENT SLOPES	None	####	####
GsB	GREENSON LOAM, 3 TO 6 PERCENT SLOPES	None	268.9	0.90%
GsC	GREENSON LOAM, 6 TO 10 PERCENT SLOPES	None	134.4	0.40%

GuA	GREENSON LOAM, DEEP OVER CLAY, 0 TO 1 PERCENT SLOPE	None	165.1	0.50%
HdA	HENDRICKS SILT LOAM, 1 TO 3 PERCENT SLOPE	None	72.2	0.20%
HdB	HENDRICKS SILT LOAM, 3 TO 6 PERCENT SLOPE	None	188.9	0.60%
HdC	HENDRICKS SILT LOAM, 6 TO 10 PERCENT SLOPE	None	298	1.00%

HdD	HENDRICKS SILT LOAM, 10 TO 20 PERCENT SLOPE	None	158.5	0.50%
HeC	HIIBNER GRAVELLY CLAY LOAM, 3 TO 10 PERCENT SLOPE	None	76.2	0.20%
HeD	HIIBNER GRAVELLY CLAY LOAM, 10 TO 30 PERCENT SLOPE	None	39.5	0.10%

HfE	HIIBNER EXTREMELY STONY CLAY LOAM, 1 TO 30 PERCENT SLOPES	None	571	1.80%
HLG2	HOSKIN-DATWYLER ASSOCIATION, ERODED	None	16.5	0.10%
HuC	HYRUM GRAVELLY LOAM, 4 TO 8 PERCENT SLOPES	None	224	0.70%
HuE	HYRUM GRAVELLY LOAM, 10 TO 25 PERCENT SLOPES	None	360.3	1.20%

KdA	KIDMAN FINE SANDY LOAM, 0 TO 2 PERCENT SLOPES	None	79.8	0.30%
KdD	KIDMAN FINE SANDY LOAM, 8 TO 15 PERCENT SLOPES	None	40.5	0.10%
KfB	KIDMAN FINE SANDY LOAM, DEEP WATER TABLE, 2 TO 4 PERCENT SLOPES	None	8	0.00%

KfC	KIDMAN FINE SANDY LOAM, DEEP WATER TABLE, 4 TO 8 PERCENT SLOPES	None	53.2	0.20%
Ks	KIRKHAM-SHAY COMPLEX	Rare	324.4	1.00%
La	LAKEWIN GRAVELLY COARSE SANDY LOAM	None	79.8	0.30%
Lr	LOGAN SILTY CLAY LOAM	Rare	626.4	2.00%
McB	MCMURDIE SILT LOAM, 3 TO 6 PERCENT SLOPES	None	14.7	0.00%

McC	MCMURDIE SILT LOAM, 6 TO 10 PERCENT SLOPES	None	89.2	0.30%
MeA	MENDON SILT LOAM, 0 TO 3 PERCENT SLOPES	None	####	8.90%
MeB	MENDON SILT LOAM, 3 TO 6 PERCENT SLOPES	None	####	3.50%
MeC	MENDON SILT LOAM, 6 TO 10 PERCENT SLOPES	None	298.8	1.00%

MfB	MENDON-COLLINSTON COMPLEX, 1 TO 6 PERCENT SLOPES	None	391.3	1.30%
MfE2	MENDON-COLLINSTON COMPLEX, 6 TO 30 PERCENT SLOPES,ERODED	None	593.5	1.90%
MoG2	MUNK-BLACKROCK GRAVELLY LOAMS, 30 TO 70 PERCENT SLOPES, ERODE	None	213.1	0.70%

NbE	NEBEKER SILT LOAM, 10 TO 25 PERCENT SLOPES	None	16.6	0.10%
NcA	NIBLEY SILTY CLAY LOAM, 0 TO 3 PERCENT SLOPES	None	325.1	1.00%
NcB	NIBLEY SILTY CLAY LOAM, 3 TO 6 PERCENT SLOPES	None	177.9	0.60%
PaA	PARLEYS SILT LOAM, 0 TO 3 PERCENT SLOPES	None	224	0.70%

PaB	PARLEYS SILT LOAM, 3 TO 6 PERCENT SLOPES	None	339.8	1.10%
PaC	PARLEYS SILT LOAM, 6 TO 10 PERCENT SLOPES	None	41.4	0.10%
Pu	PROVO LOAM	Occasional	50.4	0.20%
Pv	PROVO GRAVELLY LOAM	Occasional	76.4	0.20%
RhA	RICKS GRAVELLY LOAM, 0 TO 3 PERCENT SLOPES	None	582	1.90%
RhB	RICKS GRAVELLY LOAM, 3 TO 6 PERCENT SLOPES	None	631.7	2.00%

RhC	RICKS GRAVELLY LOAM, 6 TO 10 PERCENT SLOPES	None	280.1	0.90%
RO	ROCK LAND	None	2.7	0.00%
Rs	ROSHE SPRINGS SILT LOAM	None	636.8	2.00%
Rt	ROUGH BROKEN LAND	None	238.5	0.80%
Sg	SALT LAKE-ROSHE SPRINGS COMPLEX	Frequent	####	4.50%
SSE	SMARTS SILT LOAM, 10 TO 30 PERCENT SLOPES	None	128.7	0.40%

STG2	SMARTS-HOSKIN ASSOCIATION, ERODED	None	####	3.60%
SUG	SMARTS-LUCKY STAR-POLELINE ASSOCIATION	None	201.4	0.60%
SvA	STEED GRAVELLY LOAM, 0 TO 3 PERCENT SLOPES	Rare	39	0.10%
SvB	STEED GRAVELLY LOAM, 3 TO 6 PERCENT SLOPES	Rare	36.9	0.10%
SvC	STEED GRAVELLY LOAM, 6 TO 10 PERCENT SLOPES	Rare	113.3	0.40%

SwC	STERLING GRAVELLY LOAM, 6 TO 10 PERCENT SLOPE	None	175.9	0.60%
SwD	STERLING GRAVELLY LOAM, 10 TO 20 PERCENT SLOPE	None	213.5	0.70%
SwF2	STERLING GRAVELLY LOAM, 20 TO 50 PERCENT SLOPES,ERO	None	97.7	0.30%
Sy	STONY ALLUVIAL LAND	Rare	422.9	1.40%

TmB	TIMPANOGOS SILT LOAM, 3 TO 6 PERCENT SLOPES	None	113.8	0.40%
TrA	TRENTON SILTY CLAY LOAM, 0 TO 2 PERCENT SLOPES	None	####	4.40%
TtA	TRENTON SILTY CLAY LOAM, MODERATELY DEEP WATER TABLE, 0 TO 2 PERCENT SLOPES	None	80.4	0.30%
W	WATER	None	241.5	0.80%

WhE	WHEELON SILT LOAM, 10 TO 30 PERCENT SLOPES	None	74	0.20%
WhF2	WHEELON SILT LOAM, 30 TO 50 PERCENT SLOPES, ERODE	None	168.4	0.50%
WlE2	WHEELON-COLLINSTON COMPLEX, 10 TO 30 PERCENT SLOPES, ERODED	None	####	3.70%
Wn	WINN SILT LOAM	Rare	647.3	2.10%
Totals for Area of Interest			####	####