Intermountain Pumped Storage Project

FERC Project Number 14993-000

Pre-Application Document

Submitted by:

Premium Energy Holdings, LLC

Date: September 30, 2020

Table of Contents

List of Appendices

List of Tables

List of Figures

Definitions of Terms, Acronyms, and Abbreviations

acre-ft	Acre-foot, the amount of water needed to cover one acre to a depth of one foot
AG	Agriculture
AI	Agriculture Industrial
APE	Area of Potential Effects
BLM	Bureau of Land Management
BOCC	Board of County Commission
CEC	Cation Exchange Capacity
CEII	Critical Energy Infrastructure Information
CFR	Code of Federal Regulations
cfs	Cubic foot per second
cm2/g	Square centimeter per gram
DEQ	Department of Environmental Quality
FERC	Federal Energy Regulatory Commission
ft	Feet
GWh	Gigawatt-hour
HC	Highway Commercial
HI	Heavy Industrial
ILP	Integrate Licensing Process
IPSP	Intermountain Pumped Storage Project
kV	kilovolts
LI	Light Industrial
mg/L	Milligram per liter
mi	Milles
mm	Millimeter
MW	Megawatt
NOI	Notice of Intent
PAD	Pre-Application Document

Ph	Measurement of the degree of acidity or alkalinity of a substance or solution
PURPA	Public Utility Regulatory Policies Act
RF	Range and Forest
RI	Residential
SL	Sensitive Lands
TC	Transmission Corridor
TDS	Total Dissolved Solids
TMDL	Total Maximum Daily Loads
TP	Total Phosphorus
TSS	Total Suspend Sediment
UAC	Utah Administrative Code
UGS	Utah Geological Survey
USDA	United State Department of Agriculture
USFWS	United State Fish and Wildlife Service
USGS	United States Geological Survey

1. Introduction

Premium Energy Holdings, LLC is filing with the Federal Energy Regulatory Commission (FERC or Commission) PAD and NOI to file an Application for license for the proposed Intermountain Pumped Storage Project (FERC Project Number 14993-000) (IPSP or "Project").

The Intermountain Project will be located northeast of Delta City within Millard County, Utah. The project is a proposed 2000-megawatt (MW) pumped storage project that would use a proposed DMAD 2 Reservoir as the lower reservoir, one mile upstream of the existing DMAD Reservoir. The proposed upper reservoir, could be any of the three proposed, located east of the project in the Canyon Mountains Range.

Besides the reservoirs, the IPSP would consist of an underground powerhouse accommodating five pump-turbines, penstock/tunnel connecting the upper and lower reservoirs to the powerhouse, access and cable tunnels, new power transmission lines, access roads, and other related facilities.

On December 18, 2019, the FERC issued the preliminary permit to Premium Energy Holdings, LLC, for a period effective the first day of the month in which this permit is issued (December 1, 2019). The purpose of a preliminary permit is to preserve the right of the permit holder to have the first priority in applying for a license for the Project under the Federal Power Act, allowing Premium Energy Holdings to conduct investigations and secure necessary data to determine the feasibility of the Project and to prepare a license application. Such studies have been ongoing, and results are described in this document.

Premium Energy Holdings, LLC is proposing to move forward with a License Application for the Project using the Integrated Licensing Process (ILP).

The Intermountain Project PAD is comprised of one volume containing Public Information, which do not fall into the Critical Energy Infrastructure Information (CEII). More information about these document classes can be obtained on the FERC website at https://www.ferc.gov/enforcement-legal/ceii

Premium Energy Holdings have filed this volume of the PAD with the Commission and will provide it to any interested entity.

2. Process Plan and Schedule and Communications Plan

2.1. Process Plan and Schedule

Premium Energy Holdings developed the proposed Process Plan and Schedule (Table 1) according to Pre-Application Activity in order to ILP, and in accordance with the Commission's regulations at 18 CFR § 5.6. The Process Plan and Schedule identifies key activities, the responsible parties (FERC, Premium Energy Holdings, and stakeholders), and timelines during the PAD filing period.

The ILP include three main stage, the first and second stage represent the License Application pre-filing process, and the third stage of the post-filing process. The first stage, Premium energy Holdings will consult with resources agencies and stakeholders to identify potential issues and development of study plans to the proposed project. The second stage will incorporate the study plans and reports, the draft License Application, and the filing of the Final License Application with FERC. The final stage, FERC will carry the post-filing process of the License Application.

Table 1. Process Plan and Schedule

Activity	Responsibility	Timeframe and Regulations	Dates
File Notice of Intent (NOI) and Pre-Application Document (PAD)	Premium Energy Holdings	18 CFR § 5.5, 5.6	September 30, 2020
Initial Tribal Consultation Meeting	FERC	Within 30 days of filing NOI & PAD 18 CFR § 5.7	October 30, 2020
Commission notices NOI/PAD and issues Scoping Document 1	FERC	Within 60 days of filling NOI & PAD 18 CFR § 5.8	November 29, 2020
Commission holds Scoping Meetings/Site Visit	FERC	Within 30 days of NOI & PAD notice & issuance of SD1 18 CFR § 5.8	December 29, 2020
Comments on PAD, SD1, and Study Requests	Stakeholders	Within 60 days of NOI & PAD notice & issuance of SD1 18 CFR § 5.9	January 28, 2021
File Proposed Study Plan	Premium Energy Holdings	Within 45 days of deadline for filing comment on PAD 18 CFR § 5.11	March 14, 2021
Issuance of Scoping Document 2, if necessary	FERC	Within 45 days of deadline for filing comment on SD1 18 CFR § 5.10	March 14, 2021
Study Plan Meetings	Premium Energy Holdings	Within 30 days of Proposed Study Plan 18 CFR § 5.11	April 13, 2021

Comments of Proposed Study Plan	Stakeholders	Within 90 days of Proposed Study Plan 18 CFR § 5.12	June 12, 2021
File Revised Study Plan	Premium Energy Holdings	Within 30 days of deadline for comments on Proposed Study Plan 18 CFR § 5.13	July 12, 2021
Comments on Revised Study Plan	Stakeholders	Within 15 days following Revised Study Plan 18 CFR § 5.13	July 27, 2021
Commission issues Study Plan Determination	FERC	Within 30 days of Revised Study Plan 18 CFR § 5.13	August 11, 2021
Mandatory conditioning agencies file notice of study disputes	Agencies and Tribes with mandatory conditioning authority	Within 20 days of Study Plan Determination 18 CFR § 5.14	August 31, 2021
Study Dispute Resolution Process and Determination on Study Dispute	Stakeholders, FERC, Premium Energy Holdings	No later than 70 days after notice of dispute 18 CFR § 5.14	November 9, 2021
Conduct First Studies Season	Premium Energy Holdings	Potential applicant must gather information and conduct studies as provided for in the approved study plan and schedule 18 CFR § 5.15	April 8, 2022
Submit Initial Study Report	Premium Energy Holdings	Pursuant to the Commission approved study plan and schedule provided in § 5.13 or no later than 1 year after Commission approval of the study plan and schedule 18 CFR § 5.15	April 8, 2022
Study Meeting Summary, Comments, and Responses	Stakeholders, Premium Energy Holdings	Within 60 days of Initial Study Report 18 CFR § 5.15	June 7, 2022
Dispute Resolution	Stakeholders, FERC, Premium Energy Holdings	Within 30 days of Study Meeting 18 CFR § 5.15	July 7, 2022
Conduct Second Studies Season	Premium Energy Holdings	18 CFR § 5.15	August 21, 2022

Issue Update Study Report	Premium Energy Holdings	Pursuant to the Commission approved study plan and schedule provided in § 5.13 or no later than 1 year after Commission approval of the study plan and schedule 18 CFR § 5.15	August 21, 2022
Study Meeting Summary, Comments, and Responses	Stakeholders, Premium Energy Holdings	Within 60 days of Issue Update Study Report 18 CFR § 5.15	October 20, 2022
Dispute Resolution	Stakeholders, FERC, Premium Energy Holdings	Within 30 days of Study Meeting 18 CFR § 5.15	November 19, 2022
File Preliminary Licensing Proposal or draft license application	Premium Energy Holdings	No later than 150 days prior to the deadline for filing a new or subsequent license application 18 CFR § 5.16	December 4, 2022
Comments on Preliminary Licensing Proposal	Stakeholders	Within 90 days of filing Preliminary License Proposal or draft license application 18 CFR § 5.16	March 4, 2023
License Application Filed	Premium Energy Holdings	18 CFR § 5.17	May 3, 2023

2.2. Communications Protocols

Effective communication is essential for meeting the defined schedule of the ILP. The primary means of communication will be meetings, documents, email, and telephone. Moreover, Premium Energy Holdings will develop a specific section for the licensing process within the website www.premiumenergyholdings.com/index.php/component/sppagebuilder/43-ipsp.

2.2.1. Licensing Website

This website will be the primary mode of document distribution and access to key documents developed during the licensing process, such as this PAD and NOI, meeting notices, meeting summaries, study plans and study reports, preliminary licensing proposal, and final license application.

Following FERC's regulations protecting Critical Energy Infrastructure Information (CEII) (18 CFR§ 388.113), certain documents may be restricted from publication on the licensing website. This will also apply to documents containing privileged information, such as sensitive species locations, cultural resource sites, etc. Premium Energy Holdings will address requests for access to this information on a case-by-case basis, in accordance with state and federal law as needed during the licensing consultation process.

3. Project Location, Facilities, and Operations

This section provides contact information of each person authorized to act as agent for applicant; maps of land use within Project boundaries, and as applicable, federal and Tribal lands; and the location of proposed facilities. The Project description, including existing and proposed facilities and operational functions are also described below.

3.1. Contact Information

Victor M. Rojas
Managing Director at Premium Energy Holdings, LLC
355 South Lemon Ave, Suite A
Walnut, CA 91789
Telephone: (909) 595-5314
Email: victor.rojas@pehllc.net

Maria Hernandez
Project Manager at Premium Energy Holdings, LLC
355 South Lemon Ave, Suite A
Walnut, CA 91789
Telephone: (909) 595-5314
Email: maria.hernandez@pehllc.net

3.2. Maps

The proposed Intermountain Pumped Storage Project would be located 5 miles north east of Delta, and 7 miles west of Oak City, Utah in the Millard County. Town and City within 15 miles of the project boundary include Delta City, Oak City, Leamington, and Lynndyl. The project would be located in the following township, range, and section designations (Appendix A & B):

Table 2. Township, Range, and Sections

Township	Range	Sections
15S	6W	19, 27-31, 34-36
15S	5W	12-13, 22-24, 26-27, 33-34
15S	4W	4-6, 7-9, 18
16S	6W	4-5, 9-11, 13-14
16S	5W	3-18, 21, 28-27, 34-35
16S	4W	7-18
16S	3W	5-8, 13, 17-20
17S	5W	1-2, 12
17S	4W	7-8, 15-17, 22-25
17S	3W	19

3.3. Existing and Proposed Facilities

3.3.1. Dams

The Intermountain Pumped Storage Project (IPSP) proposes to use a new DMAD 2 Reservoir as a lower pool, located one mile upstream the existing DMAD Reservoir. The dam conceptual dimensions are 45 ft high, 2,142 ft length at crest and 4,709 ft crest elevation above sea level; it will have a spillway to control the water level. Also, the project proposes 3 upper reservoir alternatives in the Canyon Mountains Range. Both the dam and the embankment for the upper reservoir, would be composed of roller-compacted concrete. Conceptual dimensions for the new reservoirs' embankments are detailed in Table 3.

Table 3. Dam's Dimensions for Upper Pool Alternatives

Description	Proposed Reservoir	Dam Crest Elev. [ft]	Dam Height [ft]	Dam Length at Crest [ft]
Upper Reservoir Alternatives	Dry Fork Reservoir	6,205	370	2,637
	Mill Canyon Reservoir	6,605	385	2,223
	Williams Reservoir	7,145	475	1,850

3.3.2. Tunnels/Penstocks System

The proposed Upper Reservoir Alternatives would be connected with the proposed DMAD 2 Reservoir through the proposed tunnel/penstocks system. The tunnel would be concrete-lined, the penstocks steel lined and the surge shafts would either be concrete or steel lined. Conceptual dimensions of the system are detailed in Tables 4 to 6.

Table 4. Dry Fork Reservoir Tunnel Dimensions

Type	Tunnel Diameter [ft]	Tunnel Length [mi]
Headrace Tunnel	38	1.20
Surge Shafts	34	0.02
Vertical Shaft	34	0.16
Horizontal Tunnel	34	7.05
Penstocks (5)	22	0.10
Tailrace Tunnel	40	1.20

Table 5. Mill Canyon Reservoir Tunnel Dimensions

Type	Tunnel Diameter [ft]	Tunnel Length [mi]
Headrace Tunnel	34	1.15
Surge Shafts	30	0.04
Vertical Shaft	30	0.28
Horizontal Tunnel	30	7.60
Penstocks (5)	19	0.15
Tailrace Tunnel	36	1.70

Table 6. Williams Reservoir Tunnel Dimensions

Type	Tunnel Diameter [ft]	Tunnel Length [mi]
Headrace Tunnel	30	1.10
Surge Shafts	27	0.04
Vertical Shaft	27	0.40
Horizontal Tunnel	27	10.05
Penstocks (5)	17	0.10
Tailrace Tunnel	32	2.30

3.3.3. Underground Powerhouse

The powerhouse would be located east of the proposed new DMAD 2 Reservoir. The approximate floor level would be between 200 to 300 ft below ground level. The cavern will be stabilized with high strength sprayed concrete (shotcrete) and the powerhouse will include steel formwork and concrete, as necessary. Tentative dimensions for the powerhouse are 500 ft long, 125 ft wide, and 150 ft high. Moreover, the cavern for the transformers chamber will also be stabilized with high strength sprayed concrete, this chamber will have tentative dimensions of 165 ft long, 60 ft wide, and 50 ft high.

3.3.4. Reservoirs

The upper and lower reservoirs configuration would be determined by evaluating the best suited alternative to maximize the available hydraulic head and minimize the penstock layout to reduce energy losses, while staying within environmental constraints. Therefore, the IPSP proposes construction of a new DMAD 2 Reservoir, which would have a water surface maximum elevation of 4,700ft also, water surface would be 3,186 acres, and a 48,915 acre-ft storage capacity.

The project's upper reservoirs alternatives are located in the Canyon Mountains east of the proposed DMAD 2 Reservoir. The proposed upper reservoir would be created in either the Dry Fork, the Fool Creek (Mill Canyon Reservoir) or the Dry Creek (Williams Reservoir). The new upper reservoir alternatives' physical characteristics are detailed in Table 7.

Table 7. Upper Reservoir Alternatives Characteristics

Proposed Upper Reservoir	Surface Area [acre]	Storage Capacity [acre-ft]	Maximum Surface Elevation [ft]	Head [ft] (Compared to Lower Res.)
Dry Fork Reservoir	277	39,612	6,200	1,500
Mill Canyon Reservoir	210	30,344	6,600	1,900
Williams Reservoir	180	28,063	7,140	2,440

3.3.5. Transmission and Substation

The project proposes interconnection with the existing Intermountain AC Switchyard. The Intermountain Pumped Storage Power Plant would interconnect to the Intermountain AC Switchyard using two new 345 kV transmission lines, which would use the ROW of the existing 46 kV transmission lines. Depending on the Upper Reservoir selected, the corridor could have two alternatives. For the Dry Fork Reservoir or Mill Canyon Reservoir, the interconnection with Intermountain AC Switchyard would have 10,3 mi length; for the Williams Reservoir the length of the corridor would be 10 mi.

In order to deliver the generated power to the regional electrical utility network, the following transmission paths are available:

- Transmission Path 1 (California Path 27) interconnects the Intermountain PS Project to the existing Intermountain AC Switchyard. From there, the power would be transmitted to the Intermountain Converter Station. The power would then be converted from AC to DC and it would be transmitted to Adelanto, CA through the existing 500 kV DC transmission line.

- Transmission Path 2 (Utah Path 28) would interconnect the Intermountain PS Project with the existing Intermountain AC Switchyard and transmit the power to Mona through the existing 345 kV transmission lines to the east.

- Transmission Path 3 (Nevada Path 29) would interconnect the project to the Intermountain Switchyard and then transmit the power to Ely, NV through the existing Gonder IPP 230 kV transmission line.

3.3.6. Capacity and Energy Production

Based on preliminary analysis, the planned total installed capacity of the Intermountain Pumped Storage Power Plant would be 2,000 MW during generation and 2,500 MW to pumping. Therefore, IPSP proposes five pump-turbine generator-motor sets for the pumped storage power plant. Each unit would have a nominal rating at 500 MW.

Assuming a plant capacity factor of 40%, the Intermountain Pumped Storage Power Plant, rated at 2,000 MW, would produce a total of 6,900 GWh of annual energy production and 575 GWh of monthly energy production.

4. Existing Environment and Resource Impacts

This section of the PAD presents a discussion on the existing environment and resources within the Project area that may be affected by the proposed Project. This section includes:

- Description of existing environment.
- Summaries of existing data or studies regarding the resource.
- Description of any existing or proposed Project facilities or operations, and management activities proposed to be undertaken for the purpose of protecting, mitigating impacts to, or enhancing resources potentially affected by the project.

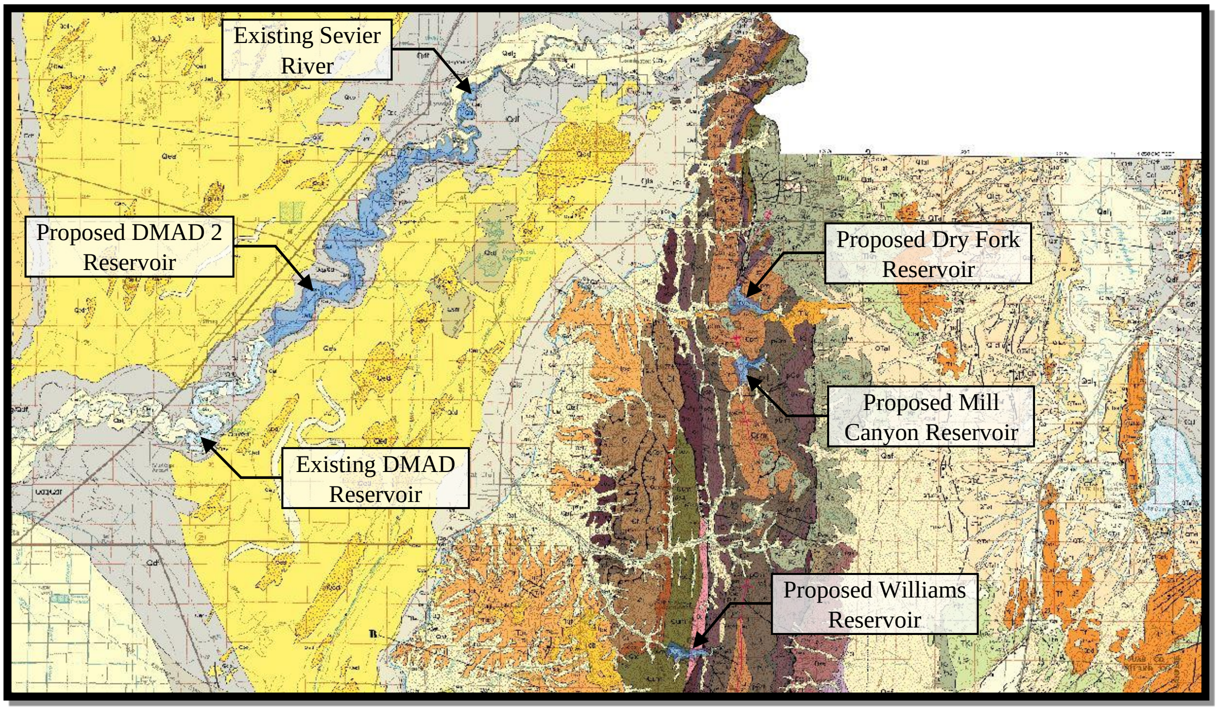
4.1. Geology and Soils

4.1.1. Regional Geology

The IPSP would be located near the Canyon Mountains Range. On its west side, rocks are limestones, quartzites, sandstones, and shales that were deposited below sea level in a gradually deepening ocean basin called a geosyncline. Compressive forces of continental collision thrust huge sheets of this sedimentary sequence up and over other sheets to form high mountain ranges. On the east side, the rocks are conglomerates, sandstones, and shales.

Information referring to geology, faults, lithology, and minerals was obtained from Utah Geological Survey (UGS) Website. Sevier River is surrounded by alluvium deposits that belong to Quaternary Surficial Strata. The proposed reservoirs 1 & 2 (Dry Fork & Mill Canyon) are surrounded by a Quartzite bed and the proposed reservoir 3 (Williams) is surrounded by a dolomite and limestone bed, which belong to Precambrian and Cambrian Strata. There are no glacial deposits in the project area. Utah was largely ice-free about 14,000 years ago, but younger glacial deposits from small ice advances associated with more recent minor climate fluctuations are known in the Uinta Mountains and High Plateaus of southwest Utah.

Figure 1. Geology map surrounding Project Location



(Source: UGS)

The picture below shows the lithologic column in the Utah State, from Precambrian Age to the Quaternary Age.

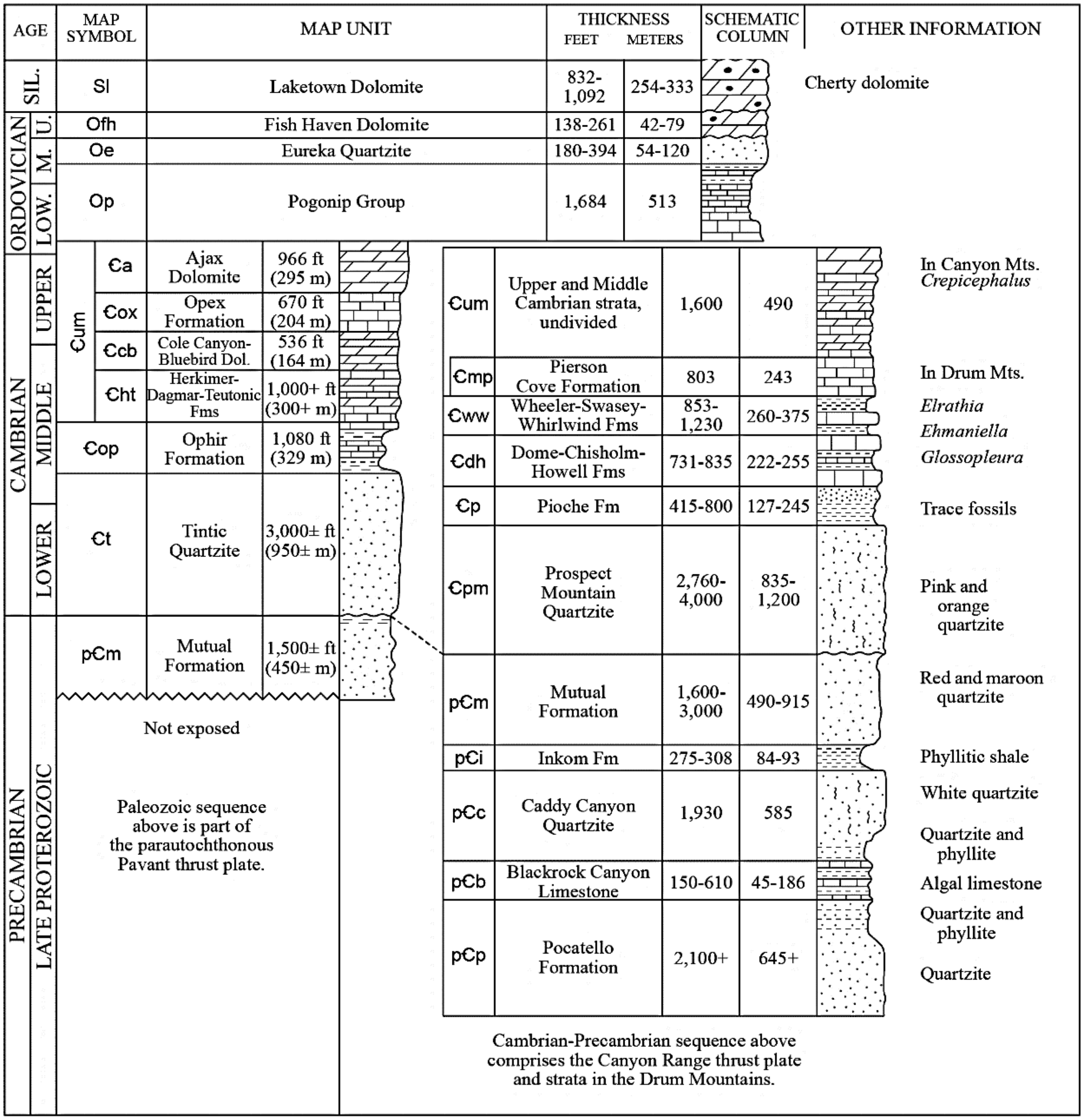
Figure 2. Utah Lithologic Column 1/2

AGE	MAP SYMBOL	MAP UNIT	THICKNESS FEET	THICKNESS METERS	SCHEMATIC COLUMN	OTHER INFORMATION
QUATERNARY	Q-various	Alluvial, lacustrine, eolian, basalt, and other deposits	0-1,000±	0-300±		
	Qvb_1	Basalt of Ice Springs	0-200	0-60		660 to 4,000± years
	Qva,Qvt	Basaltic ash (va) and tuff (vt) of Pahvant Butte	0-600	0-180		15,300 to 16,000 years
	Qvc	Basaltic cinders	0-30±	0-10±		Pre-Lake Bonneville
	Qvb_3	Basalt of Pahvant Butte	0-1,000	0-300		128,000 years
		Basalt of Deseret, Pot Mtn., Sunstone Knoll	0-300	0-100		0.4 Ma local vents
	Qvb_5	Basalt of Crater Bench	0-20±	0-6±		0.95 Ma
	QTaf,QTas	Alluvial fan (af) and Sevier River (as) deposits	0-300+	0-90+		
TERTIARY – QT	QTt	Travertine in Canyon Mountains near Whiskey Spring	0-140	0-43		
	QTlf,QTln	Fine lake sediments (lf); shoreline deposits (ln)	0-870+	0-265+		Pliocene to mid-Pleistocene
MIO.-PLIO.	Toc Tqb Tcb	Oak City Formation including quartzite (qb) and carbonate (cb) breccias	0-2,000±	0-600±		2-11 Ma?
	Tr	Rhyolite of Smelter Knolls	Flowdomes			3.4 Ma
	Tbsk	Basaltic andesite north of Smelter Knolls	0-30+	0-10+		6.1 Ma
	Tht	Tuff of Holden	0-200?	0-60?		10.5-10.8 Ma
	Tfc	Fool Creek Conglomerate	0-530	0-160		Age uncertain
OLIG.	Trk	Red Knolls Tuff	200	60		36.5 Ma Ar/Ar
	Tdc	Volcanic sequence of Dennison Canyon, basal tuff only	500	150		36.7-37.1 Ma Ar/Ar
EOCENE	Tdi	Drum Mountains intrusions	intrusions			Alternating tuffs and volcanic conglomerates
	Tld	Little Drum Formation	1,500-2,325	450-708		37.6 Ma Ar/Ar 38.4 Ma Ar/Ar
	Tdr	Drum Mountains Rhyodacite	2,000±	600±		36.9 and 37.6 Ma Ar/Ar (reset?) Amygdaloidal flows with pyroxene latite below
	Tg	Green River Formation	0-200	0-60		HIATUS AND UNCONFORMITY
PALEOCENE	Tf	Flagstaff Formation	300-2,460	90-750		Freshwater limestone with oncolites
CRETACEOUS	TKn	North Horn Formation	3,000-3,900	915-1,200		Yellowish sandstone grading to conglomerate westward
	Kc	Canyon Range Conglomerate	790-4,500	240-1,370		LATE STAGE THRUST Quartzite clast, carbonate clast, and mixed clast deposits MAJOR UNCONFORMITY
P.	Pc	Cherty dolomite near Holden	100+	30+		HIATUS
DEVONIAN	Dc	Cove Fort Quartzite	250	77		
	Dgu	Upper Guilmette Formation	774	236		
	Dss	Lower Guilmette, Simonson, and Sevy equivalents	2,720	830		Light-gray dolomite

Tse- Sevier River Formation in Sevier County 5.2 to 15(?) Ma

(Source: UGS)

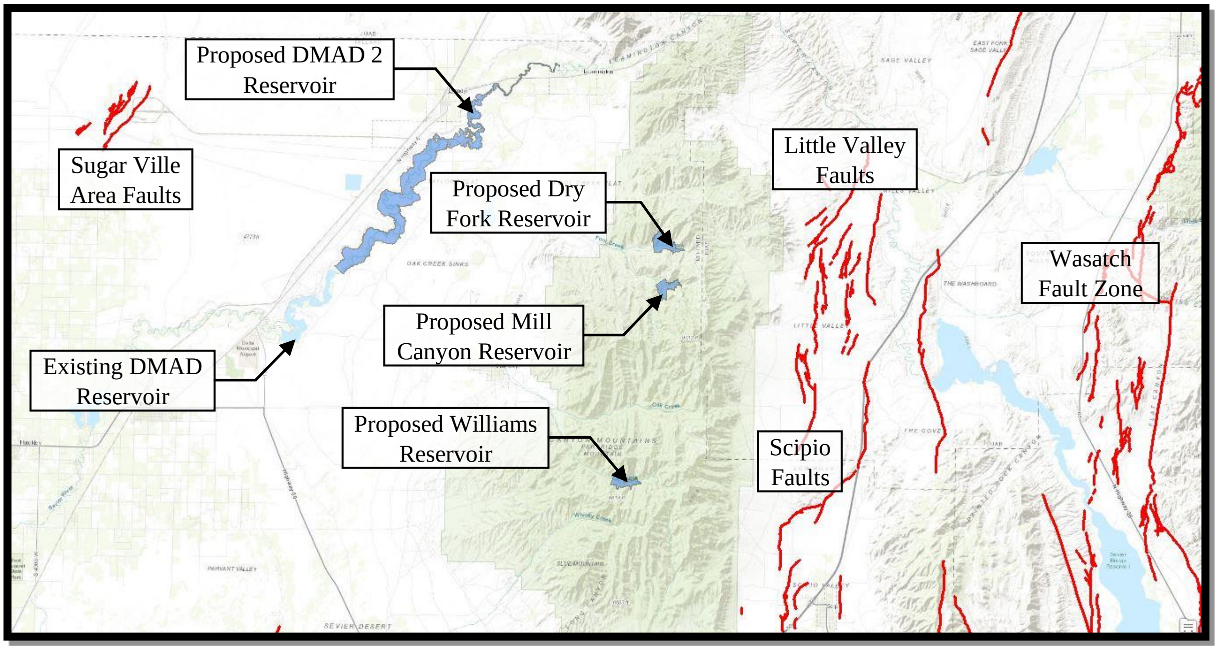
Figure 3. Utah Lithologic Column 2/2



(Source: UGS)

There are 4 main faults near the project location: Sugarville Area Faults, Little Valley Faults, Scipio Faults, and Wasatch Fault Zone. There are earthquakes with a magnitude no greater than 2.9 in the Richter scale, which will not cause potential damage around the zone.

Figure 4. Quaternary Faults near the Project Location



Main ore minerals found in the area are quartzite pebbles, basalt volcanic-tuff pebbles cobbles, boulders, limestone pebbles, sand, gravel, calcium carbonate, limonite, goethite, hematite, cerussite, hemimorphite, malachite, argillite, galena.

Non-ore minerals found in the area are calcite, quartz, dolomite, clay, aragonite.

4.1.2. Soil Characteristics

According to the Utah Department of Environmental Quality (DEQ), there are alluvium deposits near the Sevier River. Those deposits are composed by sand, silt and clay with lenses of gravel; mostly 0 to 20 feet thick. In Canyon Mountain, material found is commonly older alluvial-fan deposits that consist of poorly sorted silt, sand, and pebble, and boulder gravel deposited by debris flows, streams and flash floods.

Table 8. Soil Physical Characteristics

	Sand	Silt	Clay
Grain Size (mm)	0.05 – 2	0.002 – 0.05	< 0.002
Specify Gravity	2.63 – 2.67	2.65 – 2.7	2.67 – 2.9
Surface Area (cm2/g)	230	2,100	23,000
Visibility	Human Eye	Light Microscope	Electron Microscope

Soil remain on a hillslope only while the gravitational forces are unable to overcome the frictional forces keeping the material in place. Some properties required for stability analysis are angle of repose and Poisson's ratio, which are shown in Tables 9 and 10, respectively. Some factors that reduce the frictional resistance relative to the downslope forces, and thus can trigger slope movement, can include earthquake, increased overburden from structures, increased soil moisture, reduction of roots holding the soil bedrock. It will be required to do in situ analysis to determine factors and soil conditions involved for a complete slope analysis.

Table 9. Soil's angle of repose

Material	Condition	Angle of Repose (degrees)
Sand	Dry	34
	Water Filled	15 - 30
	Wet	45
Clay	Dry Lump	25 - 40
	Wet Excavated	15
Silt	-	19

Table 10. Soil Poisson Ratio

Material	Condition	Poisson's Ratio
Sand	Dense	0.2 - 0.4
	Course	0.15
	Fine	0.25
Clay	Saturated	0.4 - 0.5
	Unsaturated	0.1 - 0.3
	Sandy Clay	0.2 - 0.3
Silt	-	0.3 - 0.35

The most common constituent of sand, in inland continental settings and non-tropical coastal settings, is silica (silicon dioxide, or SiO2), usually in the form of quartz, which, because of its chemical inertness and considerable hardness, is the most common mineral resistant to weathering. Some soil chemical properties are Cation Exchange Capacity (CEC) and Soil Reaction (Ph).

CEC is a measurement of the magnitude of the negative charge per unit weight of soil, or the number of cations a particular sample of soil can hold in an exchangeable form. Clay and organic matter particles are predominantly negatively charged (anions) and have the ability to hold cations from being "leached" or washed away. The adsorbed cations are subject to replacement by other cations in a rapid, reversible process called "cation exchange". Cation exchange is an important mechanism in soils for retaining and supplying plant nutrients, and for adsorbing contaminants.

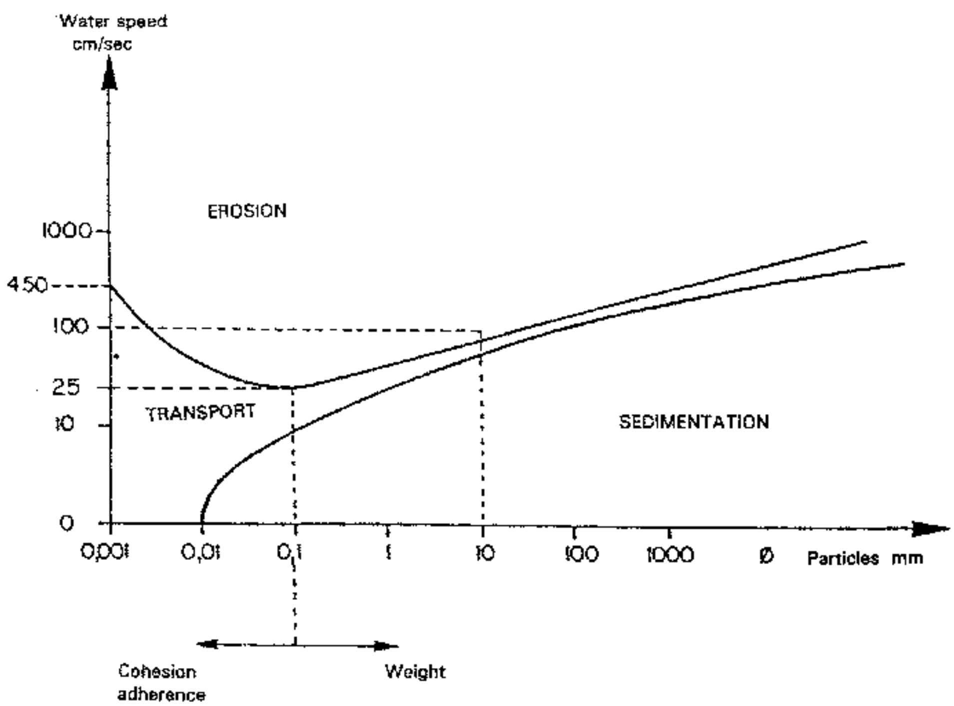
The most important effect of pH in the soil is on ion solubility, which in turn affects microbial and plant growth. It will be required to take soil samples in situ to determine the pH in that area due to factors that affect soil, which include parent material, vegetation, and climate. Some rocks and sediments produce soils that are more acidic than others: quartz-rich sandstone is acidic; limestone is alkaline.

Table 11. Behavior of Soils

	Sand	Silt	Clay
Water Holding	Low	Med - High	High
Aeration	Good	Med	Poor
OM Decomposition	Fast	Med	Slow
Water Erosion	Low	High	Low
Compactability	Low	Med	High
Sealing	Poor	Poor	Good
Nutrient Supplying (CEC)	Poor	Med - High	High
Pollutant Leaching	High	Med	Low

Parameters related to soil/rock erodibility are grain size, cohesion adherence, weight and external source speed like water or wind. The relationship between size particle and flow speed is shown in the Figure 5. This means that soils with low cohesion adherence, like sand, require a lower speed than clay or silt to erode.

Figure 5. Hjulstrom Diagram



(Source: FAO)

4.1.3. Reservoir Shorelines and Streambanks

Composition

The proposed DMAD 2 Reservoir would have an average steepness of 30% in its shorelines and soil weathered over the firm ground. The vegetative cover would be limited to shrubbery with big separation between them. Alluvium deposits in the surroundings of DMAD 2 Reservoir, range thickness of 0 to 20 feet. Additionally, thin beds between 0 and 64 feet thick, has some calcareous silt with minor interbedded very fine sand.

The upper reservoirs would have an average steepness of 60% in its shorelines and soil weathered over the rock of the mountains. The vegetative cover would consist of shrubbery and trees in specific parts, while others remain empty. The upper reservoir has mixed alluvial and colluvial deposits, ranging from 0 to 50 feet thick; also, medium to coarse-grained quartzite and limestone with pebble conglomerate beds lie under the reservoir area.

Instability Factors

According to Utah Department of Environmental Quality, the Sevier River is a highly sinuous, meandering channel. The bank full stream channel is approximately 50 to 60 feet wide and the banks typically range from 4 to 8 feet in height but can be much higher. The bank soil is composed of silty clay loam, is slightly saline, strongly alkaline and calcareous. Given these characteristics the banks have little inherent strength to counter lateral erosion. Virtually, all banks located along the outside of meanders are vertical cut banks, devoid of vegetation, and actively eroding.

The IPSP envisions the underground powerhouse near the proposed new DMAD 2 Reservoir. This would require excavation on the site and the movement of large amounts of earth. Also, it would cause instability conditions during the excavation. Therefore, it would require taking all considerations to avoid any potential damage. The tunnels would be lined with high strength concrete in order to avoid erosion on the walls of the tunnels and to reinforce their stability.

4.1.4. Impacts

Constructability Issues

The main constructability issues may be encountered on the Project with regards to the geology/geotechnical factor:

- Difficult soil/rock conditions
- Variability in rock conditions
- Slope stability

<u>Difficult soil/rock conditions</u>

The proposed Dry Fork Reservoir and Mill Canyon Reservoir (Alternatives 1 and 2) would be located in a quartzite bed, which has a hardness of seven on the Mohs hardness scale (Table 12), this would present a major difficult excavation work than the proposed at Williams Reservoir (Alternative 3), since this reservoir would be surrounded by a bed of dolomite and limestone, which only have a hardness of three.

Table 12. Mohs Hardness Scale

Mineral	Hardness
Talc	1
Gypsum	2
Calcite	3
Fluorite	4
Apatite	5
Orthoclase	6
Quartz	7
Topaz	8
Corundum	9
Diamond	10

<u>Variability in rock conditions</u>

The project proposes a tunnel/penstocks system consisting of a headrace tunnel, surge shaft, vertical shaft, horizontal tunnel, penstocks, and tailrace tunnel. Each of the proposed tunnels/penstocks will be within bedrock material or soils comprised of quartz with alluvial and colluvial deposits, quartz with silt/sand/debris deposits, gravel with runoff rock deposits, deposits silt/clayey silt/sandy silt, and sand dunes. The main soil and bedrock issues that will impact tunnels excavation include:

- mineral and lithological composition
- weathering
- rock strength
- condition and orientation of rock mass discontinuities (fractures, joints, shear zones, etc.)

There could be variations in the composition of the rock along the tunnel alignments that may impact the tunneling effort.

The major difficulty during construction of the tunnels/penstocks and the underground powerhouse would be the variability in the extent of weathering/quality of the rock and the degree of fracturing. The degree of weathering and fracturing will be greater near the ground surface and generally decrease with depth. Due to a lack of subsurface information in the tunnels/penstock alignments and powerhouse area, it is not possible to further evaluate the tunneling conditions at this time, and additional geologic studies should be conducted to assess these conditions.

Slope stability

The potential impacts on the topography at the proposed upper reservoirs would be due to changes in erosional patterns and intensity. The filling of any of the reservoirs would saturate the superficial soil cover, the slopes and the unconsolidated alluvial materials bellow and along the reservoir shoreline. This may induce a surficial slumping in isolated areas where these materials are concentrated, particularly on drainages and along the bottom of the slopes.

The proposed upper reservoirs would act as a sediment trap, thus reducing erosion and the transport of sediment beyond the reservoir.

4.2. Water Resources

4.2.1. Physical Description

The IPSP proposes the new DMAD 2 Reservoir as a lower pool, this drainage the excess water through a spillway to the Sevier River and flows to the existing DMAD Reservoir. Then, this excess keep flowing up to the Gunnison Bend Reservoir, western of Delta City. Finally, the water will then be released 40 mi southwest of Delta City into the Sevier Lake.

The drainage of excess water for the 3 upper reservoir alternatives are as follow:

- Dry Fork Reservoir and Mill Canyon Reservoir. The water would drain through Fool Creek, which is connected to the Central Utah Canal. From Fool Creek, the water would reach Fool Creek Reservoir Number 1 and will flow to Flowell Village, through Central Utah Canal, where water would be used for irrigation purposes.

- Williams Reservoir. The water would be discharged through Dry Creek to Oak Creek and finally reaching Flowell Village, through Central Utah Canal, where water would be used for irrigation purposes.

4.2.2. Flow Data

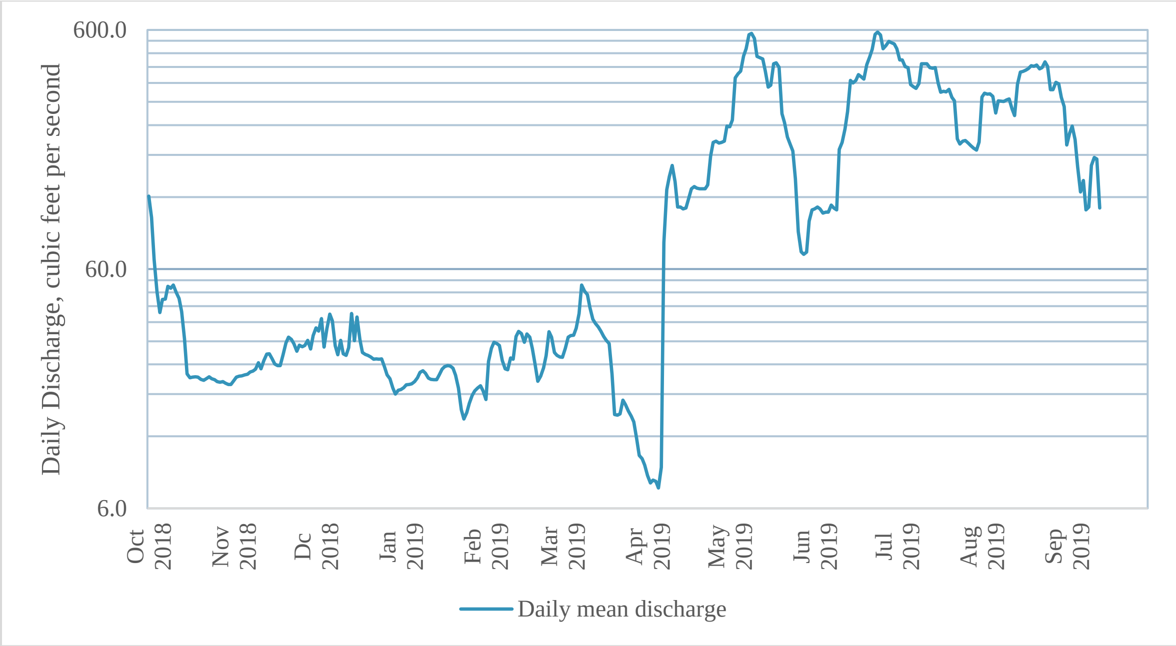
According to the Water Year Summary 2019 of USGS, the Discharge data obtained of Sevier River, with a gauging station near Lynndyl, UT, is presented in the following table:

Table 13. Discharge, Cubic Feet per Second

Day	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
	2018	2018	2018	2019	2019	2019	2019	2019	2019	2019	2019	2019
1	121	20.5	34.1	e18.8	e17.1	25.7	8.22	236	107	500	315	198
2	98.5	21.2	33.1	e19.2	e24.7	28	7.67	252	109	450	326	222
3	65.8	21.4	37.3	e19.7	28	31.2	7.87	378	107	450	323	238
4	48.3	21.5	28.3	e19.8	29.7	31.7	7.77	394	103	421	324	209
5	39.5	21.7	33.9	e19.9	29.3	31.8	7.3	404	104	418	317	161
6	44.9	21.8	38.9	e20.3	e28.8	34	8.91	466	104	355	270	126
7	45	22.3	36.5	e21.1	e24.9	39.2	77.5	501	111	347	303	141
8	50.8	22.5	28.7	e22.2	e23.0	51.5	129	574	108	342	302	106
9	50	22.9	26.3	e22.6	e22.8	48.6	146	581	106	358	301	109
10	51.5	24.4	30.2	e22.0	e25.5	46.9	163	553	190	433	306	163
11	48	23	26.6	e21.0	e25.2	41.4	139	465	203	433	309	176
12	45.2	24.9	26.2	e20.8	e31.4	37	109	460	231	433	281	173
13	39.9	26.5	28.2	e20.7	33	35.6	109	454	273	418	263	108
14	30.6	26.6	39.2	e20.7	32.3	34.4	107	404	369	415	356	63.8
15	21.9	25.3	30.1	e21.7	29.7	33.1	108	346	360	417	400	51.0
16	21.1	24.1	37.8	e22.9	32.2	31.4	118	353	369	360	403	51.6
17	21.2	23.7	30.5	e23.5	31.2	30.2	130	433	390	329	407	52.0
18	21.3	23.7	26.9	e23.7	e27.9	29.3	133	438	382	333	414	50.2
19	21.2	26.3	26.4	e23.6	e23.8	21.8	131	419	374	330	426	48.9
20	20.8	29.5	26.2	e23.1	e20.4	14.8	130	268	429	339	423	44.4
21	20.6	31.2	25.8	e21.6	e21.4	14.7	130	246	462	314	428	45.7
22	20.9	30.5	25.2	e19.1	e23.2	14.9	130	214	497	303	412	44.6
23	21.3	29.2	25.3	e15.5	e26.1	17	135	201	575	210	418	43.2
24	20.9	27.2	25.2	e14.2	e32.9	16.3	178	187	588	200	442	42.4
25	20.7	28.9	e25.3	e15.1	31.2	15.3	203	143	572	206	423	41.3
26	20.3	28.4	e23.4	e16.5	26.9	14.6	206	86	500	207	338	40.8
27	20.2	28.8	e21.7	e17.8	26.2	13.8	202	70.9	517	202	338	37.3
28	20.3	30.2	e20.9	e18.6	25.8	11.7	203	69.3	537	197	362	30.4
29	20	27.8	e19.1	e19.1		9.99	206	70.8	531	192	357	38.8
30	19.8	31.7	e18.0	e19.5		9.69	238	95.3	524	189	314	28.9
31	19.8		e18.7	e18.6		9.11		106		204	287	
Total	1,131	768	874	623	755	825	3,608	9,868	9,832	10,310	10,890	2,885
Mean	36.5	25.6	28.2	20.1	27	26.6	120	318	328	332	351	96.2
Max	121	31.7	39.2	23.7	33	51.5	238	581	588	500	442	238
Min	19.8	20.5	18	14.2	17.1	9.11	7.3	69.3	103	189	263	28.9
Ac-ft	2,244	1,523	1,734	1,236	1,497	1,636	7,157	19,570	19,500	20,440	21,600	5,723

Figure 6 depicts the daily monthly discharge from October 2018 to September 2019. The gauging station is located on Sevier River, near Lynndyl, UT, with the identification number 10224000. According to the figure, the critical streamflow occurs between the months of May and July with an approximate measure of 600 cubic feet per second. This information is provided by the USGS data.

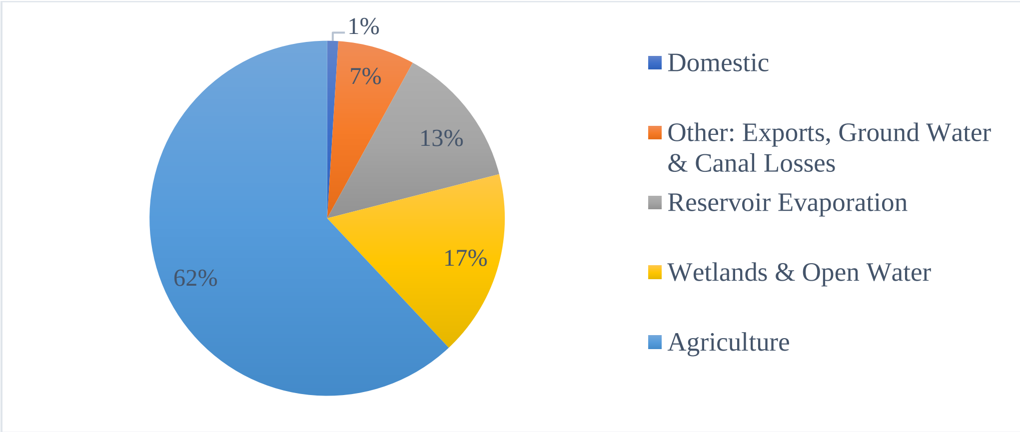
Figure 6. Daily Discharge Flow by Month



4.2.3. Existing and Proposed Water Use

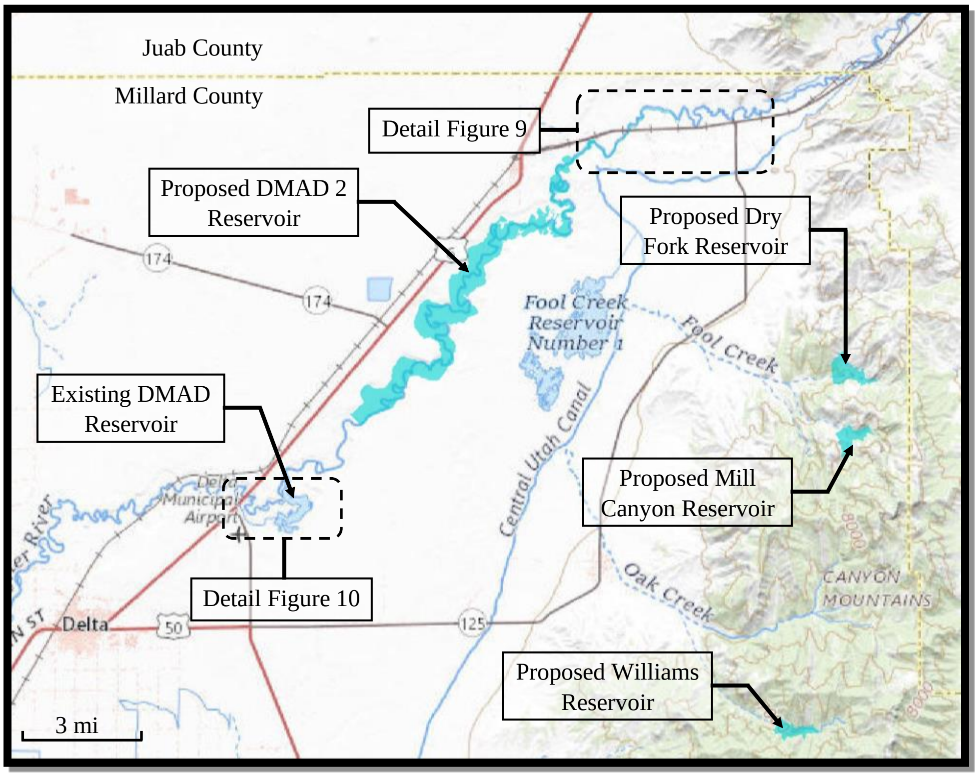
Figure 7 depicts the annual water usage of Sevier River Basin, which uses approximately 62% of water for agriculture and the remaining 38% represents domestic, reservoir evaporation, wetlands & open water, and other purposes (exports, ground water & canal losses). Therefore, according to the Sevier River Water Users Association, the majority of water from Sevier River is used in agriculture.

Figure 7. Annual Water Usage



The Sevier River has several streams and canals that are used for irrigation of crop fields, as well as for domestic and industrial use. Figure 8 depicts Central Utah Canal, beginning near Leamington town in the limit between Juab County and Millar County, upstream of the proposed DMAD 2 Reservoir. This Canal would serve the project to collect water from several creeks (Oak Creek, Fool Creek, etc.) and take it up to Flowell Village.

Figure 8. Central Utah Canal



Figures 9 and 10 depict the existing Leamington Canal and A Canal, respectively. The Leamington Canal provides Leamington Town with enough water for irrigation of crops and for domestic use. On the other hand the Canal A carries the water of the existing DMAD reservoir up to Delta City and then it is distributed to the surrounding areas of Delta City through Terry Dith Canal, Melville West Canal, and C Canal.

Figure 9. Leamington Canal

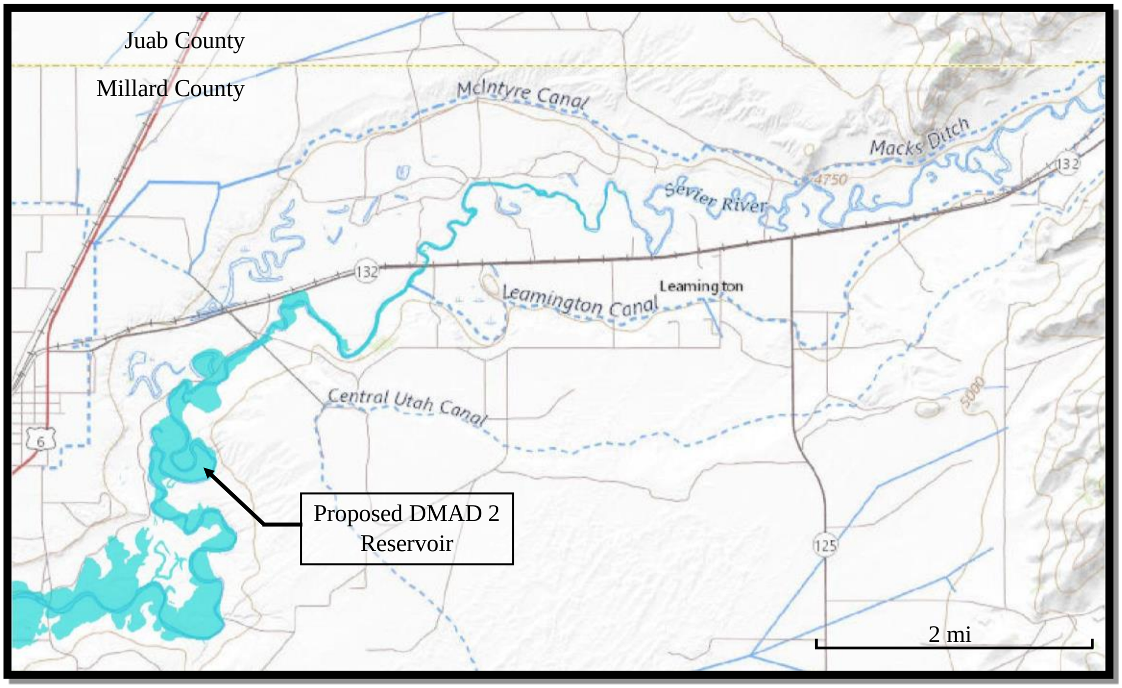
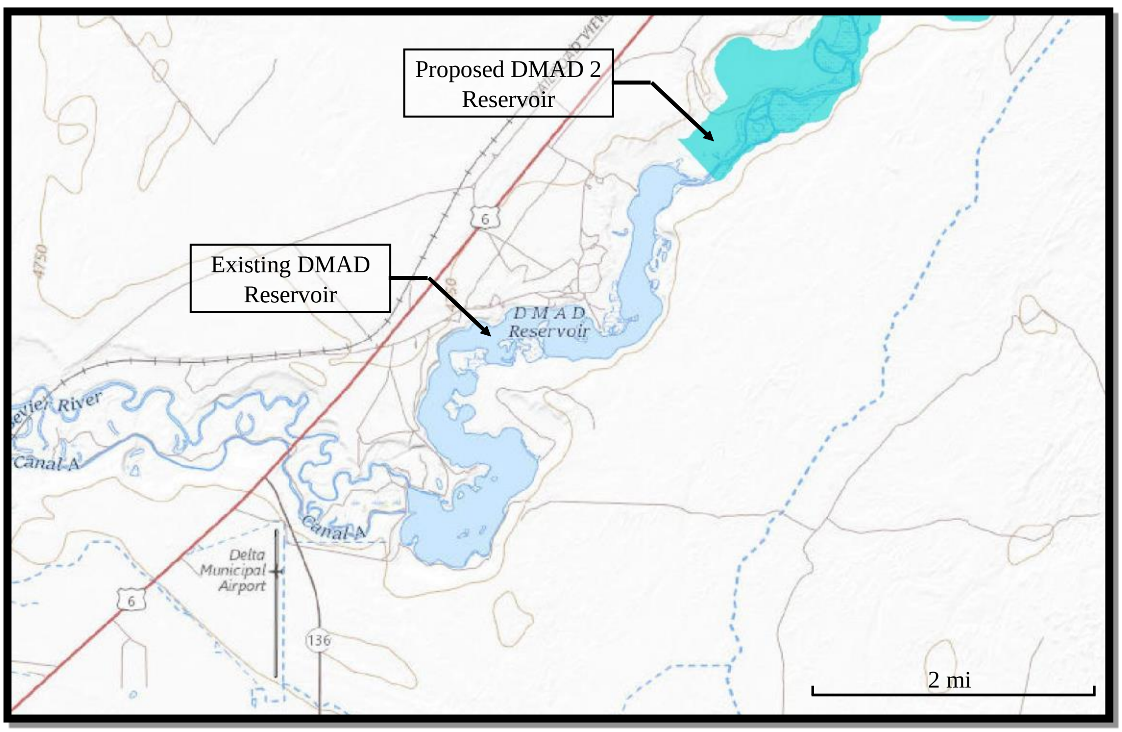


Figure 10. A Canal

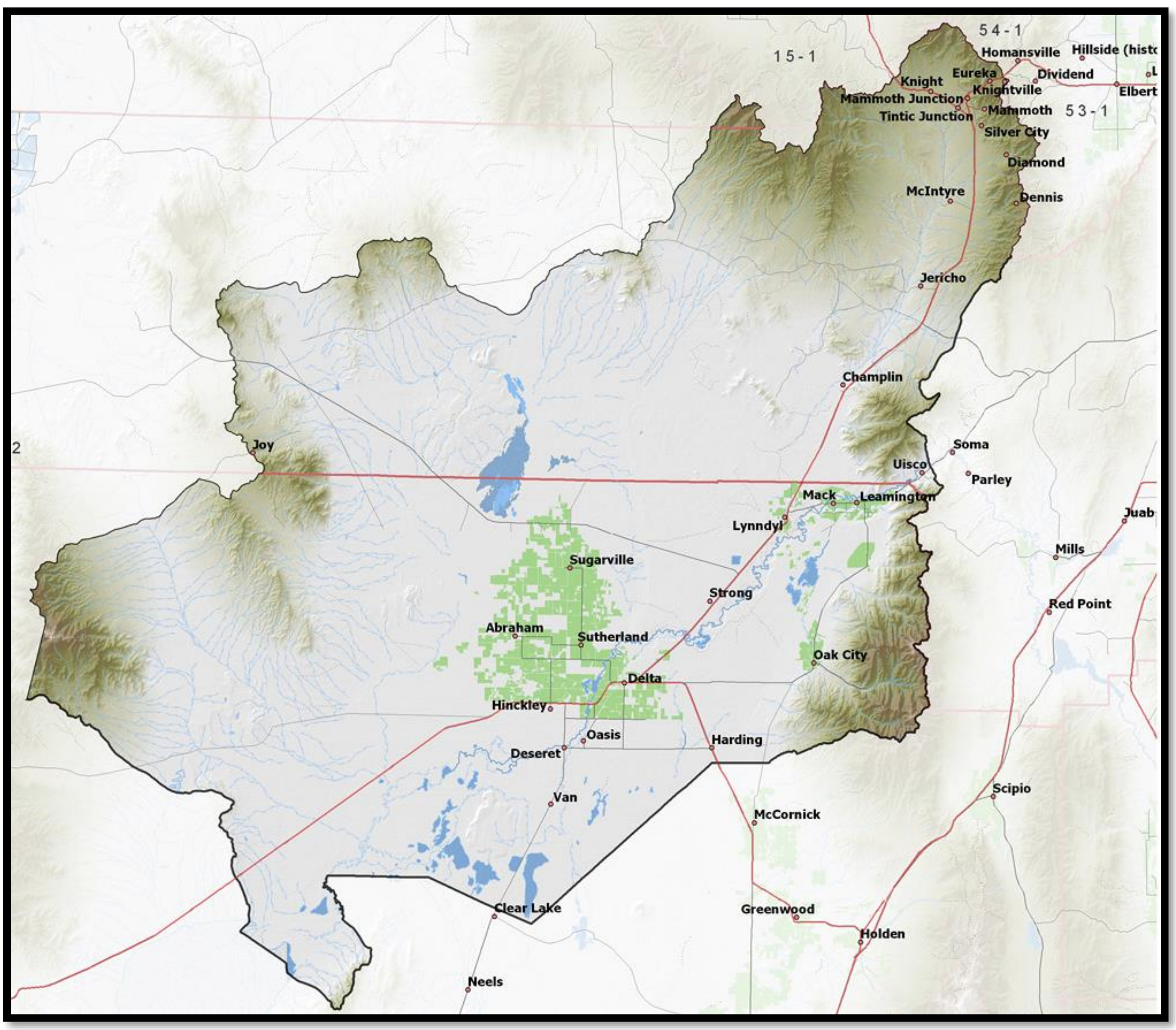


According to the Utah Division of Water Rights, the Intermountain Pumped Storage Project would be located in Area 68 – Sevier Desert (Figure 11). This area is located in three counties (Tooele County, Juab County and Millar County). Some of the water systems in this area are the Sevier River (Millard County), Sevier Lake, several creeks and canals. Storage facilities like DMAD, Gunnison Bend, Fool Creek No. 1 & 2 Reservoirs are also located in the vicinity.

Regarding water rights, the following companies have ownership over water systems within the area:

- Leamington Irrigation Company: Leamington Canal
- Melville Irrigation Company: A Canal
- Central Utah Water Company: Central Utah Canal

Figure 11. Area 68 – Sevier Desert



(Source: Utha Division of Water Rights)

4.2.4. Water Quality

According to the Department of Environmental Quality (DEQ) of Utah, the water quality standards are contained in the Utah Administrative Code, Rule R317-2, Standards of Quality for Waters of the State (UAC R317-2).

The IPSP would be located upstream of the existing DMAD Reservoir. Therefore, according to UAC R317-2-6 (Use Designations) and R317-2-13 (Classification of Waters of the State), both, the existing DMAD Reservoir (upstream up to Leamington Town) and the proposed DMAD 2 Reservoir (downstream up to Delta City), are classified with Usage Category 2B (infrequent primary recreation), 3B (warm water aquatic life) and 4 (agricultural).

Additional information provided by Environmental Scientists staff of the Division of Water Quality, describes the two segments of the project as “Sevier River between Gunnison Bend Reservoir and DMAD Reservoir” and “Sevier River and tributaries below the U.S. National Forest boundary from Gunnison Bend Reservoir to Annabella Diversion except as listed below”, based on UAC R317-2-13.

The UAC R317-2-14 (Numeric Criteria) defines the water quality standard parameters that must comply and be verified by all irrigation agencies or companies using any water body in the Utah State when performing a water quality study.

According to the “TMDL Water Quality Study of the Middle and Lower Sevier River Watersheds” submitted to Utah DEQ, Division of Water Quality in the segment of the Sevier River between the DMAD Reservoir and the Yuba Dam, the 29% of the samples taken from the quality stations between 1996 and 2002 violated the 0.05 mg/L standard of Total Phosphorus (TP) stipulated in UAC R317-2-14 Numeric Criteria. The values of TP are usually above the average during the early summer and below late summer and winter. Figure 12 shows the TP variation of the several years and the TP standard limit. Also, Figure 13 depicts the Monthly TP from September 7, 1976 to July 30, 2002.

Figure 12. Historical TP data at station 494210 (South of Lynndyl)

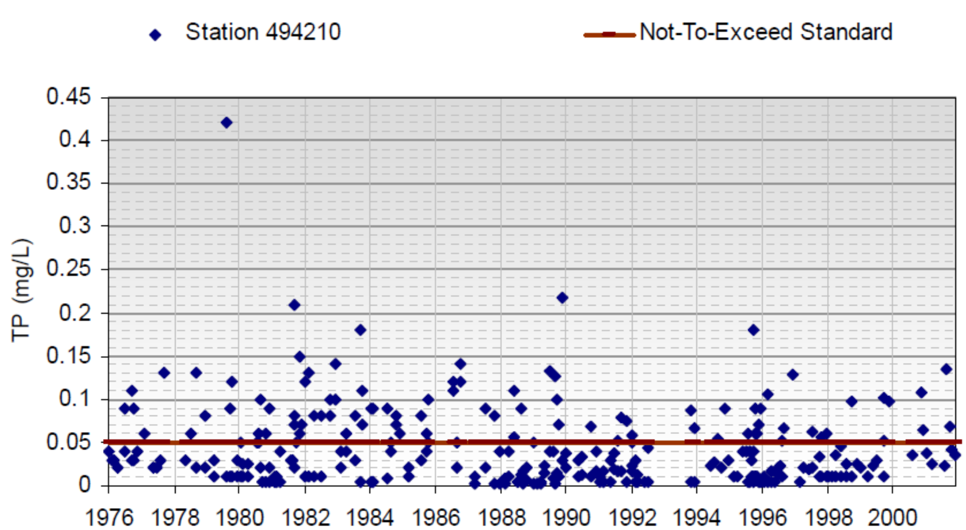
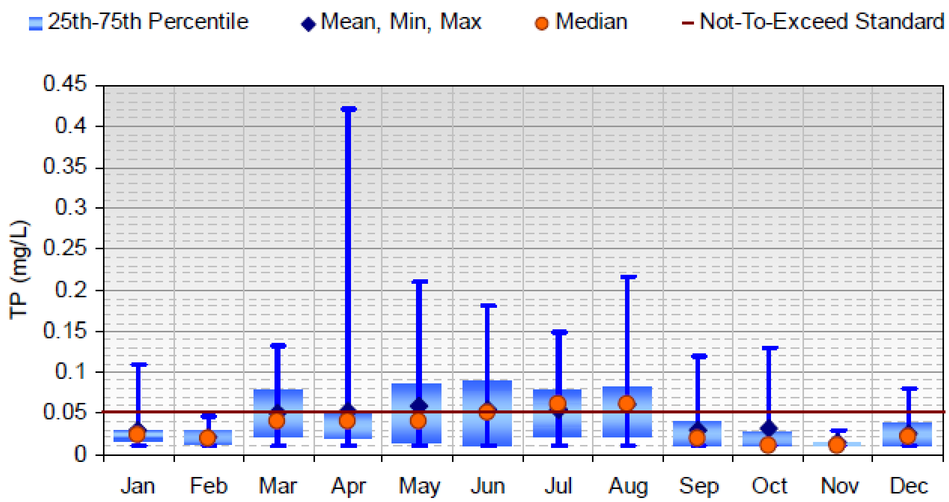


Figure 13. Monthly TP data for station 494210 (south of Lynndyl)



The Total Suspend Sediment (TSS) concentration data from station 494210 (south of Lynndyl) between 1996 and 2002 exceeded the interim water quality target of 90 mg/L. Figure 14 depicts the monthly TSS for the mentioned period, which shows the highest values in the spring. Also, the maximum TSS registered was around 830 mg/L between 1979 and 1980, according to Figure 15.

Figure 14. Monthly TSS data for station 494210 (south of Lynndyl)

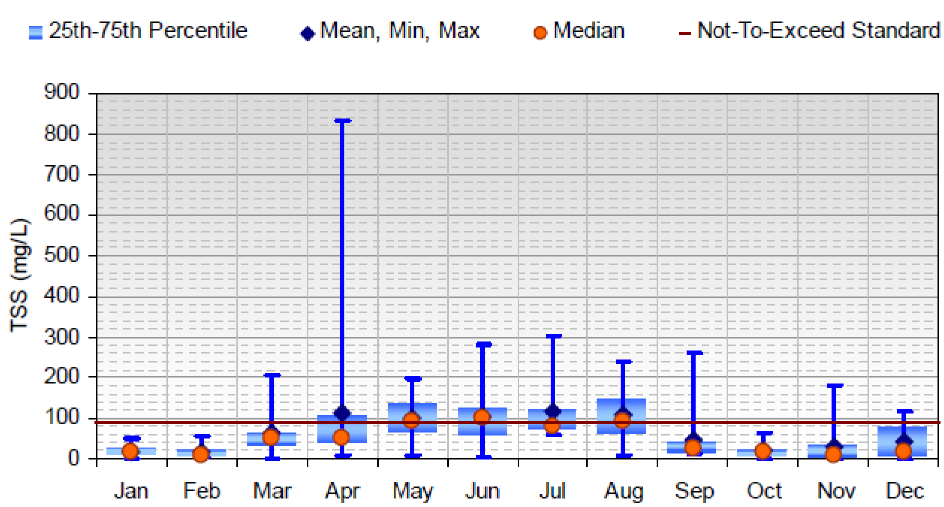
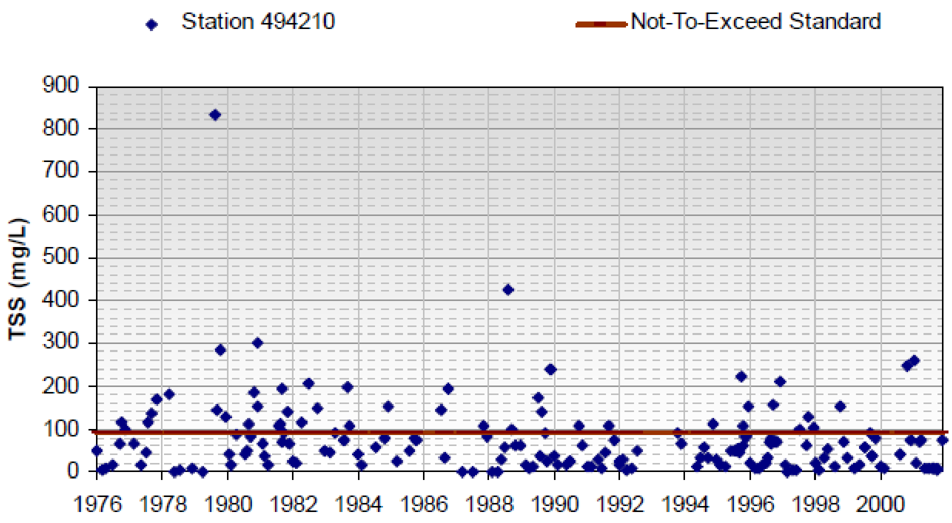


Figure 15. Historical TSS data at station 494210 (south of Lynndyl)



Finally, the Total Dissolved Solids (TDS) in this segment of Sevier River, was a maximum value of 3,300 mg/L between 1982 and 1983 according to Figure 16. The TDS concentration usually is greater in January and February, as shown in Figure 17.

Figure 16. Historical TDS data at station 494210 (south of Lynndyl)

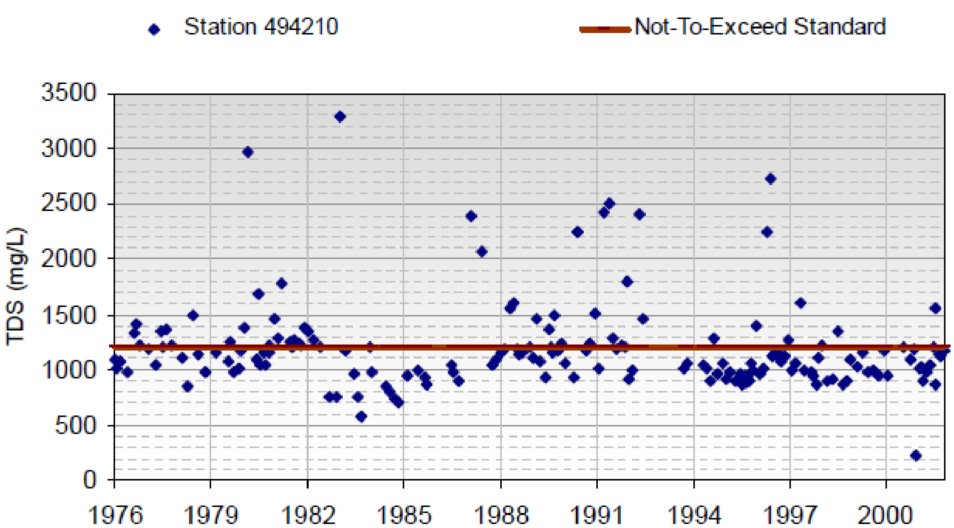
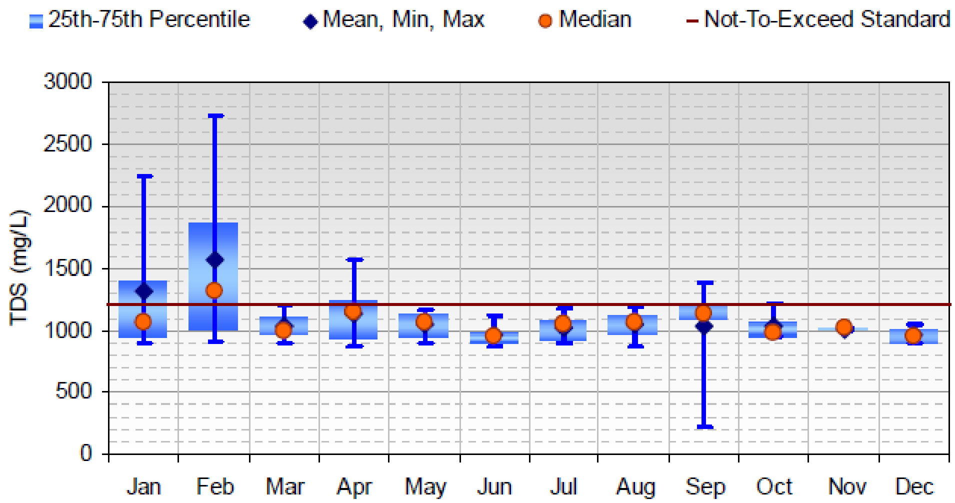


Figure 17. Monthly TDS data for station 494210 (south of Lynndyl)



In order to obtain updated values of TP, TSS, TDS and other physical/chemical parameters, further studies will be developed.

4.2.5. Existing or Proposed Lake or Reservoir Association

The IPSP would be located upstream of the existing DMAD Reservoir with an approximate surface area of 1,200 acres and a volume of 11,000 acre-ft. The maximum depth and mean depth for this reservoir are 24 ft and 9 ft, respectively. Also, this reservoir has a shoreline length of 6.3 miles, information provided in the report “DMAD Reservoir: Lake Report”, obtained from the Utah Government Digital Library. Also, according to the Stations Report of Sevier River Water User Association, the flushing rate is between 88.60 cfs and 159.40 cfs. The details for the proposed new lower reservoir and the upper reservoir alternatives are shown in table 14

Table 14. Upper Reservoir Alternatives Characteristics

Reservoir	Name	Surface Area [acre]	Storage Capacity [acre-ft]	Maximum Depth [ft]	Mean Depth [ft]	Shoreline Length [miles]
Lower	DMAD 2 Reservoir	3,186	48,915	21	8	16.3
Upper	Dry Fork Reservoir	277	39,612	162	81	1.25
	Mill Canyon Reservoir	210	30,344	193	97	1.6
	Williams Reservoir	180	28,063	201	98	1.4

According to the National Wetland Inventory of the U.S. Fish & Wildlife Service, the gradient downstream of the existing DMAD Reservoir is low. Therefore, this segment is appropriate for species that reach their maximum abundance in still water, and true planktonic organisms.

4.2.6. Impacts

<u>Effect on Water Quality During Construction</u>

The temporal deviation of the existing Sevier River, upstream of the proposed DMAD 2 Reservoir, would produce erosion on the byway, increasing the sediment displacement into the existing DMAD Reservoir. However, the extra sediment would decrease over time as the river flow regulates.

<u>Effect on Water Quality During Operation</u>

Pumped storage operation would provide a reduction in the vertical stratification of the proposed reservoirs. Also, increased oxygen levels and delayed time of algae productivity would be expected due to water mixing. Moreover, the initial startup operations of the project may cause erosion of sediments near the inlet/outlet structures, producing an increase in turbidity levels. However, turbidity levels are expected to decline over time, as sediments are transported elsewhere.

4.3. Fish and Aquatic Resources

4.3.1. General Description

DMAD Reservoir is located northeast of Delta and is named for the communities that receive irrigation water from it. Most of the shoreline is accessible BLM land, though this reservoir receives less recreation activities due to more extreme water fluctuation. A small boat ramp is located at the southwest end of the reservoir, near the dam.

DMAD Reservoir receives only light fishing, despite harboring a variety of warm and cool water fish species. These include:

Likely to catch: Channel Catfish, Common Carp, Largemouth bass, Walleye, White Bass, White Crappie, Yellow Perch

Possible to catch: Black Bullhead Catfish, Green Sunfish, Northern Pike, Smallmouth Bass

It is important to mention that at certain times of the year the rivers that feed this reservoir dry up and the level of the reservoir lowers significantly, causing many species to not be found during that time period. Even the Utah Fish and Wildlife Department puts more fish during these periods to preserve life in the area.

Warm Water Essential Habit

- Spawning Area

Warm Water fish are cavity spawners. Hollow logs, a hole in a bank, a washout under a log or large boulder, a cavity in a riprap bank, even some of man's discards provide spawning spots. Spawning cavities share two characteristics: Shelter from currents and protection for their developing embryos from marauding predators.

- Nursery Area

The young occupy channel and channel-border areas. In large rivers, they can be found on sandbars and over large sand shelves. In smaller rivers, they are known to concentrate in riffles.

Although occasionally found around brush piles, the abundant cover does not appear to be as essential for these fish as it is for the young of other sport fish. Forsaking cover, the solution to high survival of young warm water fish is rapid growth. And that means access to good food resources.

- Feeding Habits

Normally, this type of fish feed on almost anything under this criterion, basically any lake area can be considered as a feeding area.

4.3.2. Impacts

The proposed DMAD 2 Reservoir would own the same fish species that the existing DMAD Reservoir. However, due to the water flow between the upper and lower (DMAD 2 Reservoir) reservoir, fishes could be affected by entrainment at the diversion structures and intakes. The risk of entrainment would be influenced by the depth of the intake, intake design, flow velocity, and other factors. Therefore, the inlet/outlet structure would be equipped with trash racks to avoid that debris and large fish enter the powerhouse. Also, entrainment of large fish from the proposed DMAD 2 Reservoir would be expected to be minimal due to the low intake velocity.

4.4. Wildlife and Botanical Resources

4.4.1. General Description

The upland habitat near the project is the Canyon Mountain Range, east of the existing DMAD Reservoir, which is part of the Fishlake National Forest (Figure 18). The animal species that use this habitat are detailed in Table 15.

Figure 18. National Forest near the IPSP

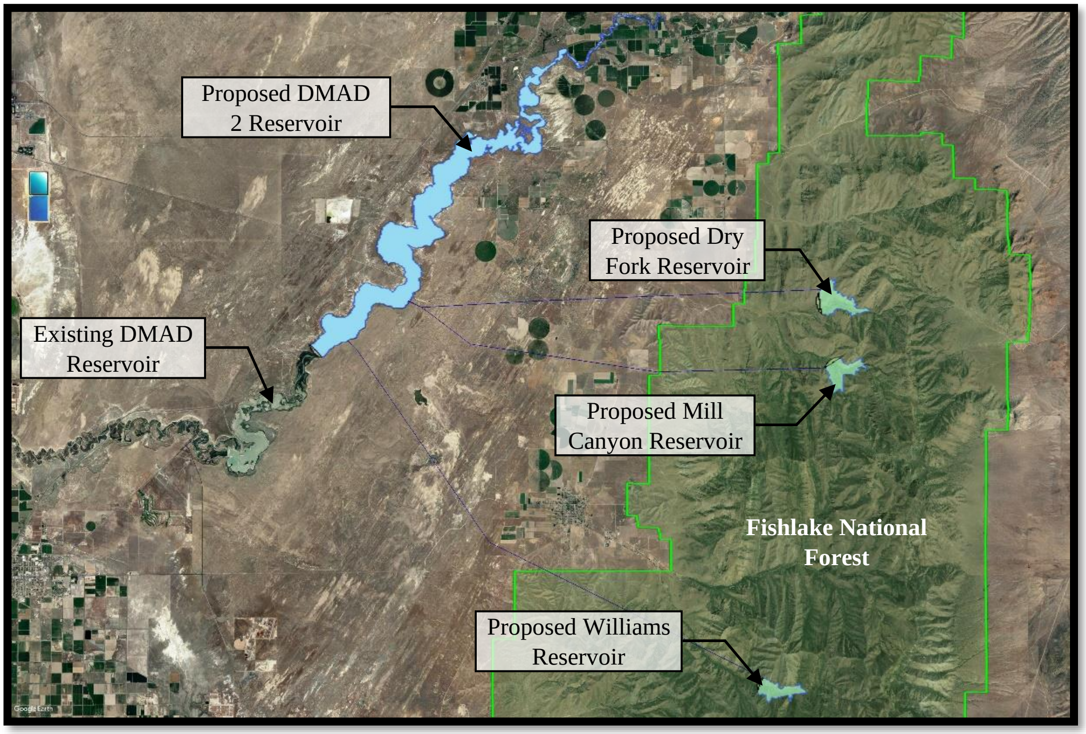


Table 15. Animals near the Project

No.	Animal	No.	Animal	No.	Animal
1	Elk	**9**	American Marten	**17**	White Bass
2	Rubber Boa	**10**	Gray Jay	**18**	White Crappie
3	Rocky Mountain Bighorn Sheep	**11**	Montane Shrew	**19**	Yellow Perch
4	Sonoran Mountain Kingsnake	**12**	Sharp-Shinned Hawk	**20**	Black Bullhead Catfish
5	Mountain Goat	**13**	Channel Catfish	**21**	Green Sunfish
6	Mountain Chickadee	**14**	Common Carp	**22**	Northern Pike
7	Cassin's Finch	**15**	Largemouth Bass	**23**	Smallmouth Bass
8	Dark-Eyed Junco	**16**	Walleye		

Also, the Fishlake National Forest is part of the U.S. Forest Service, and according to this organization, the major tree species in this forest are Engelmann spruce, ponderosa pine, blue spruce, pinyon pine, juniper, Douglas-fir, subalpine fir, white fir, and aspen.

4.4.2. Impacts

The proposed upper reservoirs alternatives sites and the tunnels/penstock system alignment would encroach upon and pass-through specific sites on the Canyon Mountain Range. The potential effects would include habitat loss that supports several animal species as well as endemic plants. Measures to avoid, minimize and compensate for impacts will be identified in studies to be completed as a part of the preparation of the License Application, including evaluation of all potential impacts to biological resources, and development of a comprehensive Resource Management Plan. Impact studies, mitigation strategies, and the Resource Management Plan will be completed in coordination with U.S. Forest Service (Fishlake National Forest).

4.5. Floodplains, Wetlands, Riparian, and Littoral Habitat Impacts

4.5.1. Wildlife Species

According to National Wetlands Inventory and Utah Wildlife Resources, downstream and upstream, the existing DMAD Reservoir has a variety of plant and animal species, due to the fact of being a water and food source. Some of them are listed in the tables below.

Table 16. Plant Species List

Scientific Name	Common Name
Allenrolfea Occidentalis	Pickleweed
Sporobulus Airoides	Alkali Sacaton
Carex Spp	Sedges
Distichlis Spicata	Inland Saltgrass
Eleocharis Spp	Spikerush
Asclepias Speciosa	Showy Milkweed
Hordeum Jubatum	Foxtail Barley
Juncus Spp	Rush
Phragmites Australis	Common Reed
Phleum Pratense	Timothy
Puccinellia Airoides	Nuttall Alkali Grass
Polygonum Spp	Smartweed
Rumex Spp	Dock
Sueda Spp	Seepweed
Spartina Gracilis	Alkali Cord Grass
Triglochin Maritimum	Arrow Grass
Scirpus Americanus	Common Threesquare
Scirpus Spp	Bulrush
Typha Spp	Cattail
Ruppia Maritima	Widgeon Grass
Ceratophyllum Spp	Coontail
Populus Spp	Cottonwood
Salix Spp	Willow
Acer Negundo	Boxelder
Tamarix Spp	Saltcedar
Atriplex Nuttalli	Nuttall Saltbush

Table 17. Animal Species List

Scientific Name	Common Name
Callipepla Californica	California Quail
Alectoris Chukar	Chukar
Corvus	Crow
Ovis Canadensis	California Bighorn Sheep
Cervus Canadensis	Elk
Odocoileus Hemionus	Mule Deer
Phasianus Colchicus	Ring-Necked Pheasant

Also, upstream DMAD Reservoir there are some walk-in access properties where hunting and fishing activities are allowed. Some of them are Peterson Crawford, Peterson Fishing hole, Peterson Crawford 2, and K Nielson.

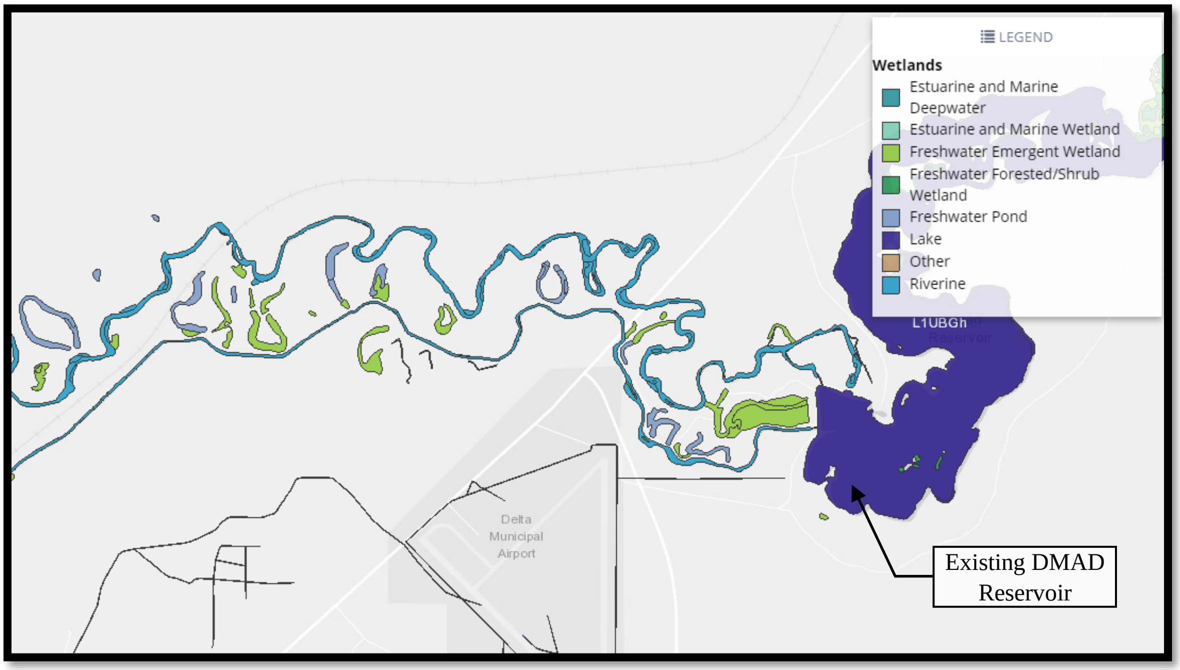
Table 18. Animal Hunting and Fishing Species List

Peterson Crawford's Species List	K Nielson's Species List
Channel Catfish	Bluegill
Common Carp	Channel Catfish
Cottontail Rabbit	Common Carp
Coyote	Crappie
Crappie	Green Sunfish
Green Sunfish	Largemouth Bass
Largemouth Bass	Northern Pike
Mourning Dove	Smallmouth Bass
Mule Deer	Walleye
Northern Pike	White Bass
Ring-necked Pheasant	Yellow Perch
Smallmouth Bass	
Walleye	
Waterfowl	
White Bass	
Yellow Perch	

4.5.2. Habitat Types

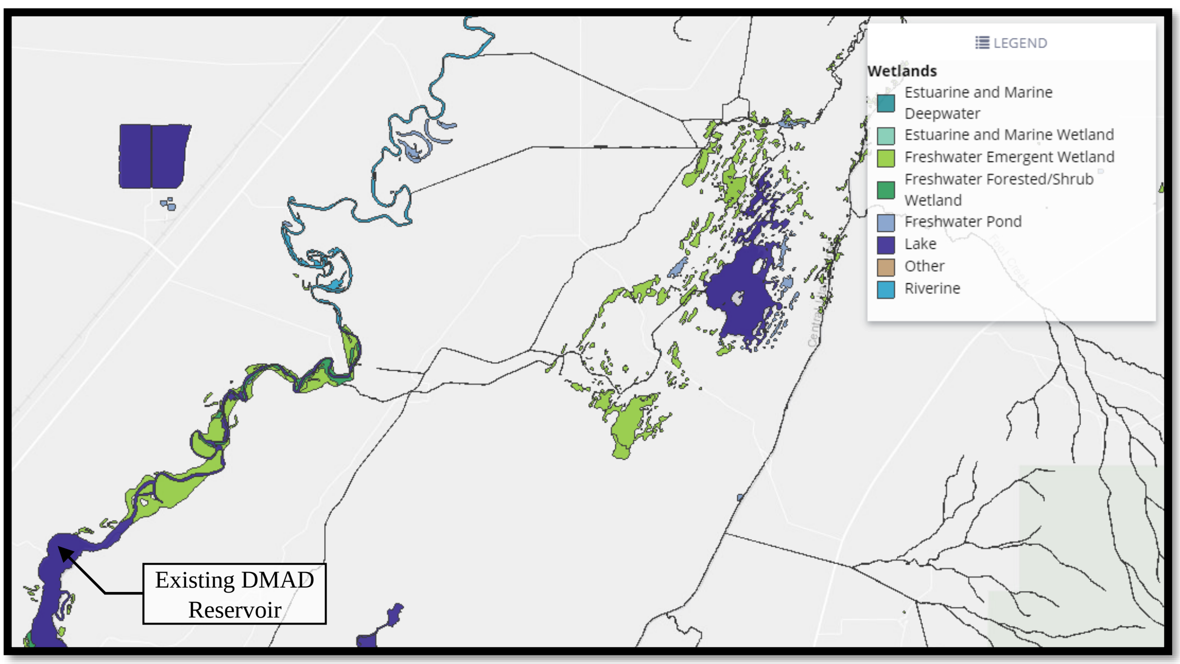
According to U.S. Fish & Wildlife Service, there are different habitats upstream and downstream DMAD Reservoir as shown in Figure 19 and 20. Each area has its own wetland classification nomenclature that best describes a particular wetland habitat as shown in Table 19. Nomenclature is formed by the following aspects: system, subsystem, class, water regime, and special modifier.

Figure 19. Wetland Map Downstream DMAD Reservoir



(Source: National Wetlands Inventory)

Figure 20. Wetland Map Upstream DMAD Reservoir



(Source: National Wetlands Inventory)

Table 19. Habitats Nomenclature

Nomenclature	Description
L1UBGh	Lacustrine (L) – Limnetic (1) – Unconsolidated Bottom (UB) – Intermittently Exposed (G) – Diked/Impounded (h)
L2USAh	Lacustrine (L) – Littoral (2) – Unconsolidated Shore (US) – Temporary Flooded (A) – Diked/Impounded (h)
PEM1A	Palustrine (P) – Emergent (EM) – Persistent (1) – Temporary Flooded (A)
PEM1C	Palustrine (P) – Emergent (EM) – Persistent (1) – Seasonally Flooded (C)
R2UBFx	Riverine (R) – Lower Perennial (2) – Unconsolidated Bottom (UB) – Semipermanently Flooded (F) – Excavated (x)
R2UBG	Riverine (R) – Lower Perennial (2) – Unconsolidated Bottom (UB) – Intermittently Exposed (G)
PABF	Palustrine (P) – Aquatic Bed (AB) – Semipermanently Flooded (F)
PFOCh	Palustrine (P) – Forested (FO) – Seasonally Flooded (C) – Diked/Impounded (h)
PSSAh	Palustrine (P) – Scrub-Shrub (SS) – Temporary Flooded (A) – Diked/Impounded (h)

(1) The Lacustrine System

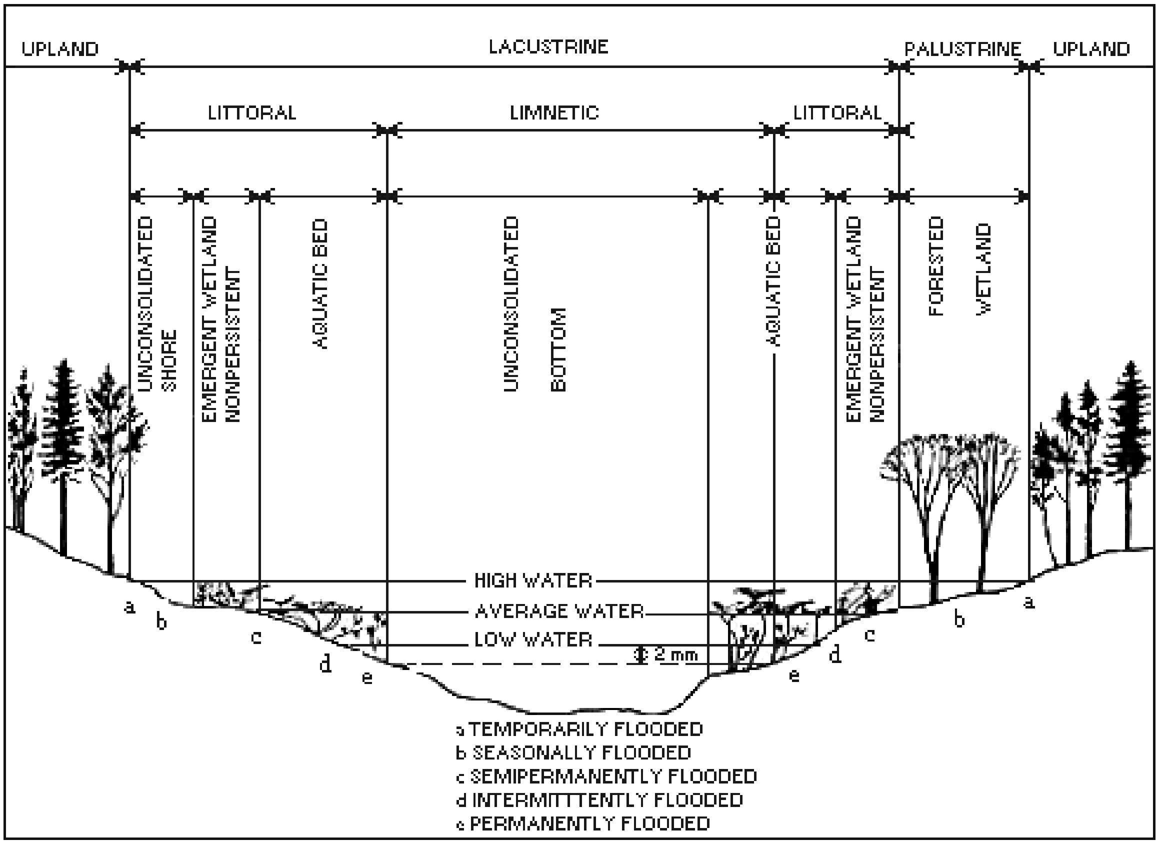
It includes wetlands and deep-water habitats with all of the following characteristics: (1) situated in a topographic depression or a dammed river channel; (2) lacking trees, shrubs, persistent emergent, emergent mosses, or lichens with greater than 30% areal coverage; and (3) total area exceeds 8 ha (20 acres). Similarly, wetland and deep-water habitats totaling less than 8 ha are also included in the Lacustrine System if an active wave-formed or bedrock shoreline feature makes up all or part of the boundary, or if the water depth in the deepest part of the basin exceeds 2 m (6.6 feet) at low water. Lacustrine waters may be tidal or nontidal, but ocean derived salinity is always less than 0.5 ‰.

a. Subsystem
   i. Limnetic: All deep-water habitats within the Lacustrine System; many small Lacustrine Systems have no Limnetic Subsystem
   ii. Littoral: All wetland habitats in the Lacustrine System. Extends from the shoreward boundary of the system to a depth of 2 m (6.6 feet) below low water or to the maximum extent of nonpersistent emergent, if these grow at depths greater than 2 m.

b. Classes

Rock Bottom, Unconsolidated Bottom, Aquatic Bed, Rocky Shore, Unconsolidated Shore, and Emergent Wetland (nonpersistent).

Figure 21. Features in Lacustrine System



(Source: National Wetlands Inventory)

(2) The Riverine System

It includes all wetlands and deep-water habitats contained within a channel, with two exceptions: (1) wetlands dominated by trees, shrubs, persistent emergent, emergent mosses, or lichens, and (2) habitats with water containing ocean-derived salts in excess of 0.5 ‰.

a. Subsystems

The Riverine System is divided into four Subsystems: The Tidal, the Lower Perennial, the Upper Perennial, and the Intermittent. Each is defined in terms of water permanence, gradient, water velocity, substrate, and the extent of floodplain development. The Subsystems have characteristic flora and fauna. All four Subsystems are not necessarily present in all rivers, and the order of occurrence may be other than that given below.

i. Tidal: The gradient is low and water velocity fluctuates under tidal influence. The streambed is mainly mud with occasional patches of sand. Oxygen deficits may sometimes occur. the fauna is composed mostly of species that reach their maximum abundance in still water, and true planktonic organisms are common. The floodplain is typically well developed.
ii. Lower Perennial: The gradient is low and water velocity is slow. There is no tidal

influence, and some water flows throughout the year. The substrate consists mainly of sand and mud. Oxygen deficits may sometimes occur, the fauna is similar to that of the Tidal Subsystem. The gradient is lower than that of the Upper Perennial Subsystem and the floodplain is well developed.

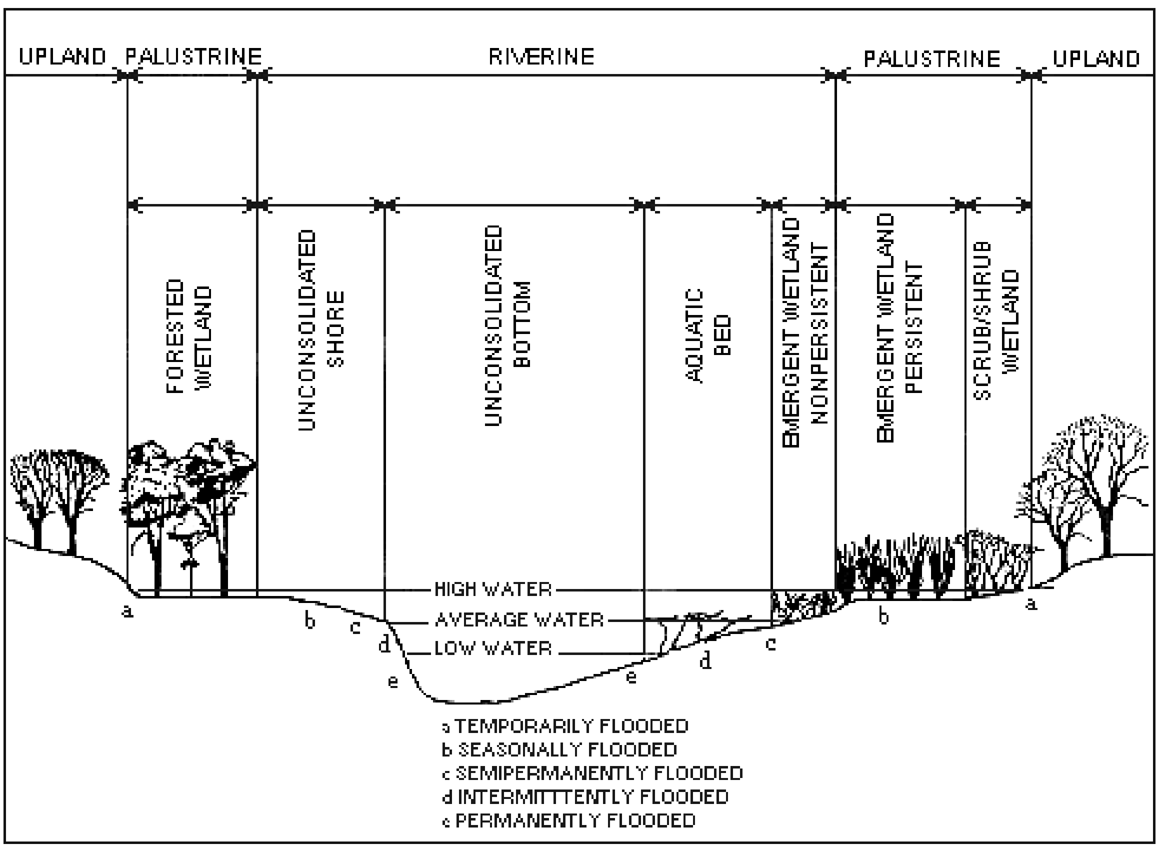
iii. Upper Perennial: The gradient is high and velocity of the water fast. There is no tidal influence and some water flows throughout the year. The substrate consists of rock, cobbles, or gravel with occasional patches of sand. The natural dissolved oxygen concentration is normally near saturation. The fauna is characteristic of running water, and there are few or no planktonic forms. The gradient is high compared with that of the Lower Perennial Subsystem, and there is little floodplain development.

iv. Intermittent: In this Subsystem, the channel contains flowing water for only part of the year. When the water is not flowing, it may remain in isolated pools or surface water may be absent.

b. Classes

Rock Bottom, Unconsolidated Bottom, Aquatic Bed, Streambed, Rocky Shore, Unconsolidated Shore, and Emergent Wetland (nonpersistent).

Figure 22. Features in Riverine System



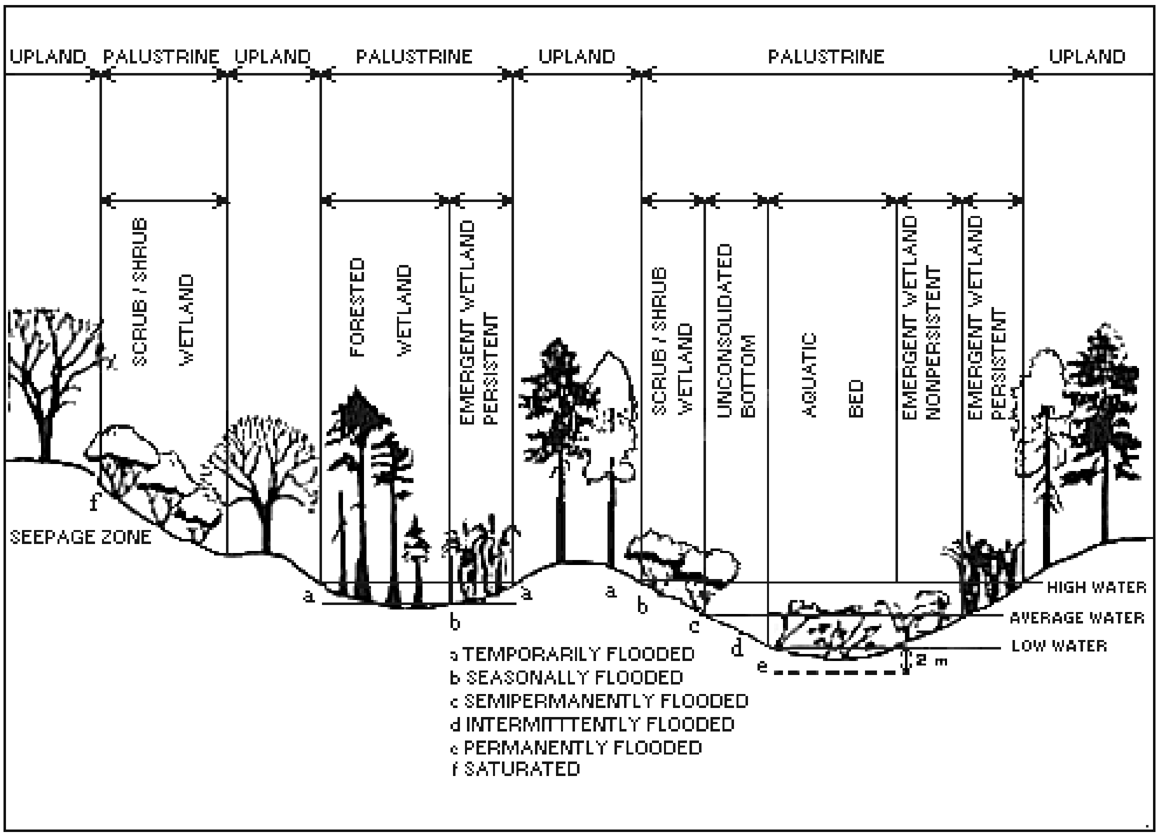
(Source: National Wetlands Inventory)

(3) Palustrine System

It includes all nontidal wetlands dominated by trees, shrubs, persistent emergent, emergent mosses or lichens, and all such wetlands that occur in tidal areas where salinity, due to ocean-derived salts, is below 0.5 ‰. It also includes wetlands lacking such vegetation, but with all of the following four characteristics: (1) area less than 8 ha (20 acres); (2) active wave-formed or bedrock shoreline features lacking; (3) water depth in the deepest part of basin less than 2 m at low water; and (4) salinity due to ocean-derived salts less than 0.5 ‰.

a. Classes. Rock Bottom, Unconsolidated Bottom, Aquatic Bed, Unconsolidated Shore, Moss-Lichen Wetland, Emergent Wetland, Scrub-Shrub Wetland, and Forested Wetland.

Figure 23. Features in Palustrine System



(Source: National Wetlands Inventory)

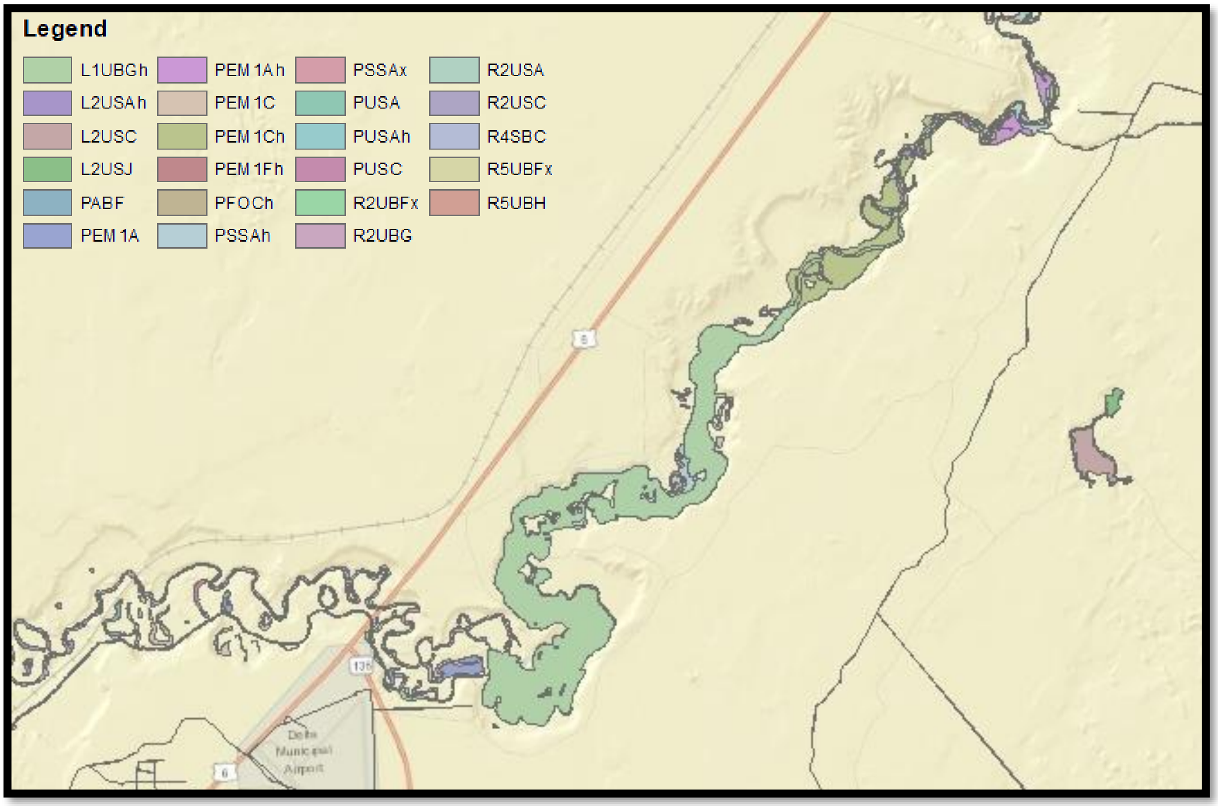
As described in this section, those are the most abundant habitats. However, there are more habitats within the project's area, as shown in Table 20 with their respective nomenclature.

Table 20. Habitats Acreage

Wetland Nomenclature	Estimated Area (acre)
L1UBGh	890
L2USAh	13
L2USC	47
L2USJ	19
PABF	26
PEM1A	39
PEM1Ah	33
PEM1C	51
PEM1Ch	185
PEM1Fh	2
PFOCh	1
PSSAh	60
PSSAx	1
PUSA	4
PUSAh	1
PUSC	11
R2UBFx	55
R2UBG	547
R2USA	27
R2USC	6
R4SBC	16
R5UBFx	52

The habitats shown in the previous table 20 are depicted in Figure 24. These habitats are located upstream and downstream in the existing DMAD Reservoir.

Figure 24. Analyzed Habitats Map



(Source: National Wetlands Inventory)

4.5.3. Impacts

The proposed DMAD 2 Reservoir would be located over a freshwater emergent wetland and freshwater forested/shrub wetland. These wetlands usually present trees, shrubs, emergent mosses, or lichens. Therefore, filling this reservoir would decrease the existing vegetation cover, however, a new vegetation cover would expect to grow up around the shoreline of the proposed DMAD 2 Reservoir.

Moreover, the proposed tunnels/penstock system in order to the proposed Dry Fork Reservoir (alternative 1) would pass-through a freshwater emergent wetland, but this wetland usually is a dry and non-vegetation cover.

4.6. Rare, Threatened, and Endangered Species

4.6.1. Species Description

Description of listed rare, threatened and endangered, candidate, or special status species in the project vicinity.

(1) Bald Eagle

Bald eagles are large, predatory raptors recognizable for their brown body and wings, white head, and tail, and hooked yellow beak. Their feet, which are also yellow, are equipped with sharp black talons.

(2) Lewis's Woodpecker

One of the largest species of American woodpeckers, Lewis's woodpecker can measure up to 10–11 inches (25–28 cm) in length. It is mainly reddish-breasted, blackish-green in color with a black rump. It has a gray collar and upper breast, with a pinkish belly, and a red face.

(3) Short-eared Owl

The short-eared owl (Asio flammeus) is a species of typical owl (family Strigidae). Owls belonging to genus Asio are known as the eared owls, as they have tufts of feathers resembling mammalian ears. These "ear" tufts may or may not be visible. Asio flammeus will display its tufts when in a defensive pose, although its very short tufts are usually not visible.

(4) Burrowing Owl

The burrowing owl (Athene cunicularia) is a small, long-legged owl found throughout open landscapes of North and South America. Burrowing owls can be found in grasslands, rangelands, agricultural areas, deserts, or any other open dry area with low vegetation.

(5) Ferruginous Hawk

This is the largest of the North American Buteos and is often mistaken for an eagle due to its size, proportions, and behavior. Among all the nearly thirty species of Buteo in the world, only the upland buzzard (B. hemilasius) of Asia averages larger in length and wingspan.

(6) Kit Fox

The kit fox (Vulpes macrotis) is a fox species of North America. Its range is primarily in the Southwestern United States and northern and central Mexico. Some mammalogists classify it as conspecific with the swift fox, V. velox, but molecular systematics imply that the two species are distinct. It has also been called an American Fennec fox due to its large ears

(7) Northern Goshawk

The northern goshawk (Accipiter gentilis) is a medium-large raptor in the family Accipitridae, which also includes other extant diurnal raptors, such as eagles, buzzards and harriers. As a species in the genus Accipiter, the goshawk is often considered a "true hawk".[3] The scientific name is Latin; Accipiter is "hawk", from accipere, "to grasp", and gentilis is "noble" or "gentle" because in the Middle Ages only the nobility were permitted to fly goshawks for falconry.

(8) American White Pelican

The American white pelican rivals the trumpeter swan, with a similar overall length, as the longest bird native to North America. Both very large and plump, it has an overall length of about 50–70 in (130–180 cm), courtesy of the huge beak which measures 11.3–15.2 in (290–390 mm) in males and 10.3–14.2 in (260–360 mm) in females.

(9) Least Chub

The least chub is a small minnow, with a maximum size of less than 2.5 inches. It is a colorful species with a gold stripe along blue sides with white to yellow fins. The chub eats primarily algae and small invertebrates and is considered a slow-growing species that rarely lives beyond 3 years of age.

(10) Southern Leatherside Chub

The southern leatherside chub (Lepidomeda aliciae) is a species of freshwater ray-finned fish from the family Cyprinidae, same as carps and minnows. It is endemic to Utah in the United States.

(11) Western Toad

The western toad (Anaxyrus boreas, formerly Bufo boreas) is a large toad species, between 2.2 and 5.1 in (5.6 and 13 cm) long, native to western North America.

4.6.2. Habitat Requirements

(1) Bald Eagle

Bald Eagles typically nest in forested areas adjacent to large bodies of water, staying away from heavily developed areas when possible. Bald Eagles are tolerant of human activity when feeding, and may congregate around fish processing plants, dumps, and below dams where fish concentrate. For perching, Bald Eagles prefer tall, mature coniferous or deciduous trees that afford a wide view of the surroundings. In winter, Bald Eagles can also be seen in dry, open uplands if there is access to open water for fishing.

(2) Lewis's Woodpecker

Lewis's Woodpeckers frequently breed in open ponderosa pine forests and burned forests with a high density of standing dead trees (snags). They also breed in woodlands near streams, oak woodlands, orchards, and pinyon-juniper woodlands. During the nonbreeding season, they move around in nomadic fashion stopping off in cottonwoods near streams, orchards, and oak woodlands with plentiful resources.

(3) Short-eared Owl

Short-eared Owls live in large, open areas with low vegetation, including prairie and coastal grasslands, heathlands, meadows, shrub steppe, savanna, tundra, marshes, dunes, and agricultural areas. Winter habitat is similar but is more likely to include large open areas within woodlots, stubble fields, fresh and saltwater marshes, weedy fields, dumps, gravel pits, rock quarries, and shrub thickets. When food is plentiful, winter areas often become breeding areas.

(4) Burrowing Owl

Burrowing Owls live in open, treeless areas with low, sparse vegetation, usually on gently sloping terrain. The owls can be found in grasslands, deserts, and steppe environments; on golf courses, pastures, agricultural fields, airport medians, and road embankments; in cemeteries and urban vacant lots. They are often associated with high densities of burrowing mammals such as prairie dogs, ground squirrels, and tortoises. Breeding pairs stay near a dedicated nesting burrow, while wintering owls may move around and may roost in tufts of vegetation rather than in burrows.

(5) Ferruginous Hawk

Ferruginous Hawks are open-country birds that breed in grasslands, sagebrush country, saltbush-greasewood shrublands, and edges of pinyon-juniper forests at low to moderate elevations. Their breeding habitat includes features such as cliffs, outcrops, and tree groves for nesting. West of the Rockies, Ferruginous Hawks spend the winter in grasslands or deserts with abundant rabbits, pocket gophers, or prairie dogs. East of the Rockies they live mostly in grasslands, especially those with abundant prairie dogs.

(6) Kit Fox

Kit foxes are mostly nocturnal but sometimes venture out of their den during the day. They usually go out to hunt shortly after sunset. Different Kit fox families can occupy the same hunting grounds but do not generally go hunting at the same time. These foxes prefer to live in underground burrows in pairs or small family groups.

(7) Northern Goshawk

Throughout their range, whether at sea level or in alpine settings, Northern Goshawks nest in mature and old-growth forests with more than 60% closed canopy. In the East, goshawks seek out nest sites in mixed-hardwood forests where beeches, birch, hemlock and maples dominate. In South Dakota and the Southwest, they nest in ponderosa pine forests. Farther west, breeding sites include Douglas-fir and pine forests, aspen groves, and stands of paper birch (in Alaska). Goshawks often build nests near breaks in the canopy, such as a forest trail, jeep road, or opening created by a downed tree, and prefer sites with a creek, pond, or lake nearby. Goshawks hunt in the forest, along riparian corridors, and in more open habitat, such as the sagebrush steppes of Nevada, where their broad, powerful wings can quickly generate speed to ambush prey.

(8) American White Pelican

American White Pelicans breed mainly on isolated islands in freshwater lakes or, in the northern Great Plains, on ephemeral islands in shallow wetlands. They forage in shallow water on inland marshes, along lake or river edges, and in wetlands, commonly 30 miles or more from their nesting islands. When late summer temperatures bring sunning fish near the surface, these pelicans can forage on deeper lakes. During migrations, they stop in similar habitats to forage and rest. Catfish aquaculture farms in the Mississippi Delta have become increasingly popular spring migration stops for more easterly migrating flocks. In the winter, they favor coastal bays, inlets, estuaries, and sloughs where they can forage in shallow water and rest on exposed spots like sandbars. They rarely winter inland, though the Salton Sea in Southern California is a regular exception. Other inland sites may include large rivers where moving water prevents surface ice, including stretches below dams.

(9) Least Chub

Least Chubs usually are located in freshwater ponds, swamps, springs, and tributaries around the Great Salt Lake, Utah Lake and Sevier Lake.

(10) Southern Leatherside Chub

Southern Leatherside Chubs are found in slow-flowing pools and backwaters, usually over substrates consisting of mud or sand, of creeks and small to medium-sized rivers.

(11) Western Toad

The western toad is found in the Rocky Mountains in aspen groves and riparian forests. In Colorado, the largest populations are typically found in areas characterized by willows, bog birch, and shrubby cinquefoil. In the Pacific Northwest, the western toad occurs in mountain meadows and less commonly in Douglas-fir forests.

4.6.3. References to known biological opinion

(1) Bald Eagle

The U.S. Fish and Wildlife Service presented a biological opinion about Bald Eagle to the Federal Highway Administration on August 24, 2006. (R., 2006)

Also, the Washington Department of Fish and Wildlife presented a periodic status review for the Bald Eagle in Washington in October. 2016. (Kalasz & Buchanan, 2016)

(2) Bifid Duct Pyrg

The U.S. Fish and Wildlife Service presented “Species Status Assessment Report for 14 Springs nails in Nevada and Utah” on June 22, 2017. (U.S. Fish and Wildlife Service, 2017)

(3) Burrowing Owl

The U.S. Fish and Wildlife Service presented a Biological Technical Publication titled “Status Assessment and Conservation Plan for the Western Burrowing Owl in the United States” in 2003. (Klute, et al., 2003)

(4) Ferruginous Hawk

A technical conservation assessment about Ferruginous Hawk was presented to USDA Forest Service on September 2, 2005. (Collins & Reynolds, 2005)

(5) Kit Fox

The U.S. Fish and Wildlife Service presented a biological opinion about Kit Fox to the Bureau of Reclamation on June 10, 2016. (Field Supervisor, Ventura Fish and Wildlife Office. U.S. Fish and Wildlife Service, 2016)

The U.S. Fish and Wildlife Service presented “San Joaquin Kit Fox five-year review of status” in 2010. (U.S. Fish and Wildlife Service, 2010)

(6) Northern Goshawk

The U.S. Fish and Wildlife Service prepared a status report about Northern Goshawk in 1998. (U.S. Fish and Wildlife Service, 1998)

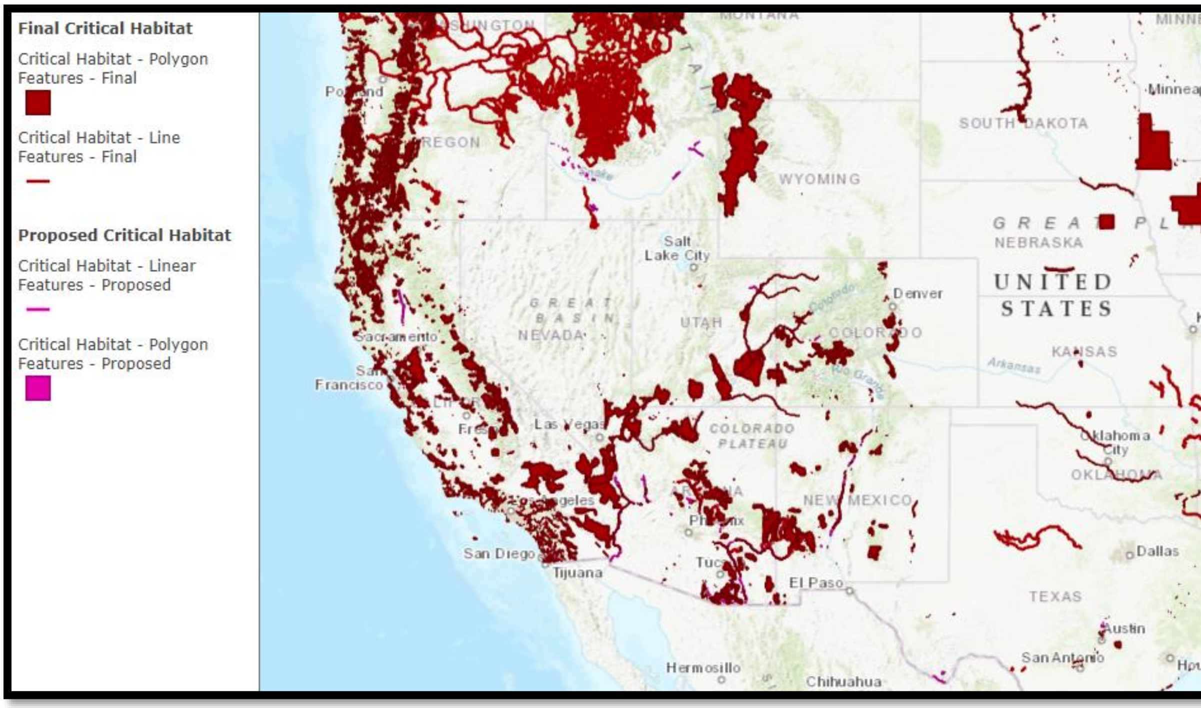
(7) American White Pelican

Washington Department of Fish and Wildlife presented a periodic status review for the American White Pelican in Washington in October. 2016. (Stinson, 2016)

4.6.4. Federally designated Critical Habitat

Extent and location of federally-designated critical habitat or other habitat for listed species in the project area. Figure 25 depicts the critical habitats in the United States where any of the previous listed species are located, according to U.S. Fish and Wildlife Service (USFWS).

Figure 25. Critical Habitat for Threatened & Endangered Species



(Source: USFWS)

4.6.5. Temporal and spatial distribution of the listed species

The temporal and spatial distributions of the listed species in the vicinity of the project are shown in "Appendix D. Rare, Threatened, and Endangered Species", in which, lists and tables identify endangered animals.

4.6.6. Impacts

The proposed upper reservoirs alternatives sites would be in the Canyon Mountain Range (Fishlake National Forest), managed by the U.S. Forest Service. These reservoirs may have the potential to affect species how the bald eagle or the northern goshawk. However, the project would perform studies that detail potential conflicts with in Fishlake National Forest, and mitigation strategies would be examined that could offset project effects, which would implement in preparation of the License Application.

4.7. Recreation and Land Use

4.7.1. Existing Recreational Facilities

Within our area of study 4 cities are found. Delta to the south, Lynndyl and Leamington to the north and Oak City to the East (Appendix E).

Delta is the largest city in Millard County. All kinds of recreational and necessary activities can be found, like education, culture, and other attractions and activities (Appendix F).

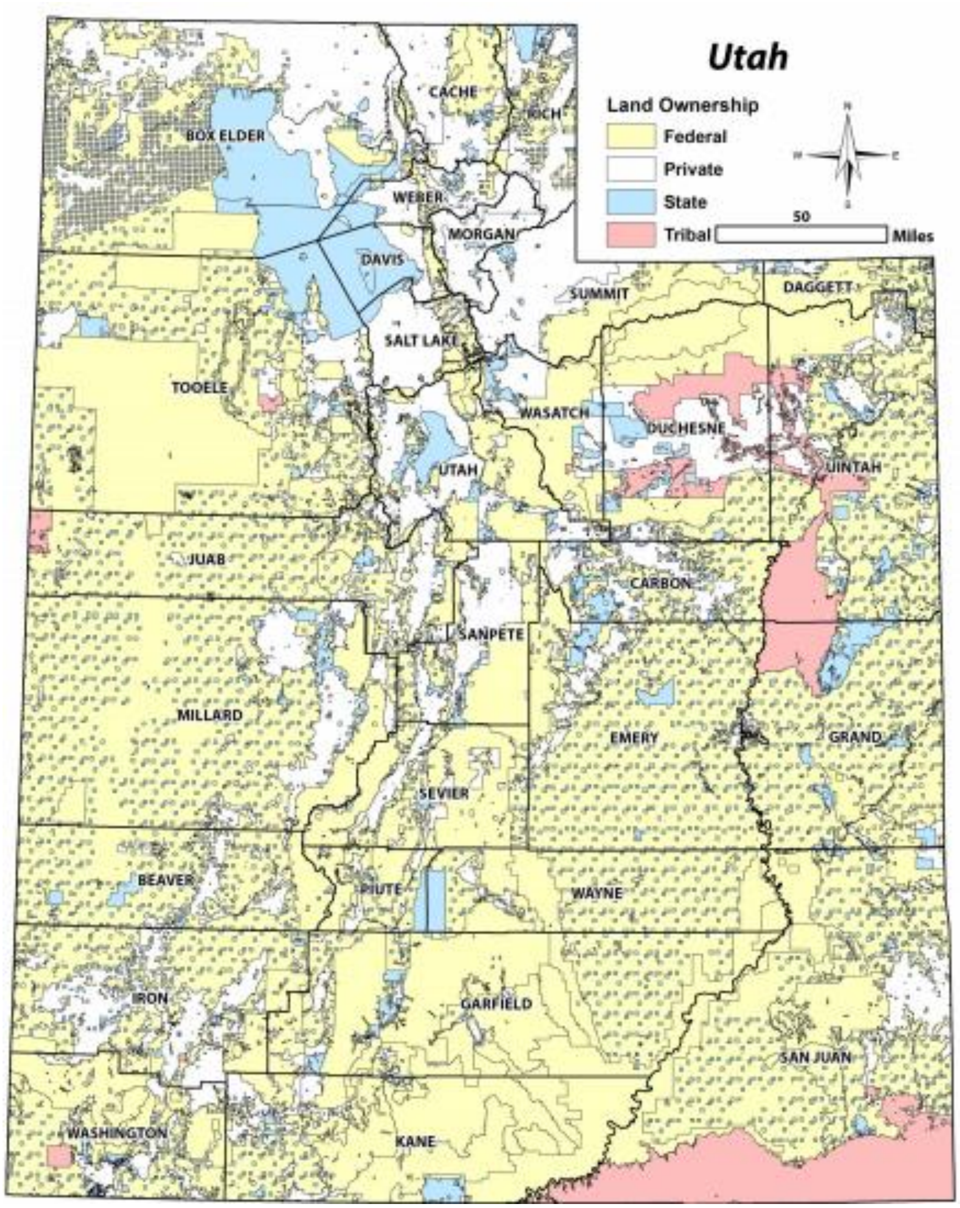
Lynndyl, Leamington and Oak City are towns with a small population, where most of the buildings are houses. There are also parks (in Lynndyl and Oak City) and a church (in Leamington). (Appendix G, H, I).

4.7.2. Recreational Use

Utah is located in the Rocky Mountain region of the United States. As the 13th largest state in the nation, Utah spans several topographies and ecoregions. Desert regions such as the San Rafael Swell, the Red Rocks, and Desert Slot Canyons offer different landscapes that serve as backdrops for many recreational activities. Additionally, Utah enjoys a four-season climate, offering diverse activities unique to each season of the year.

The diversity of terrain and climate combine for a broad range of recreational opportunities. Utah is home to world-class skiing, as well as mountain biking. The Canyon Mountain Range to the east of the proposed project offers amazing mountain camping experiences and motorized recreation opportunities. Also, hiking and biking trails extend through many roads within of the Range. Lakes and reservoirs, like the existing DMAD Reservoir, offer boating, fishing, and camping opportunities.

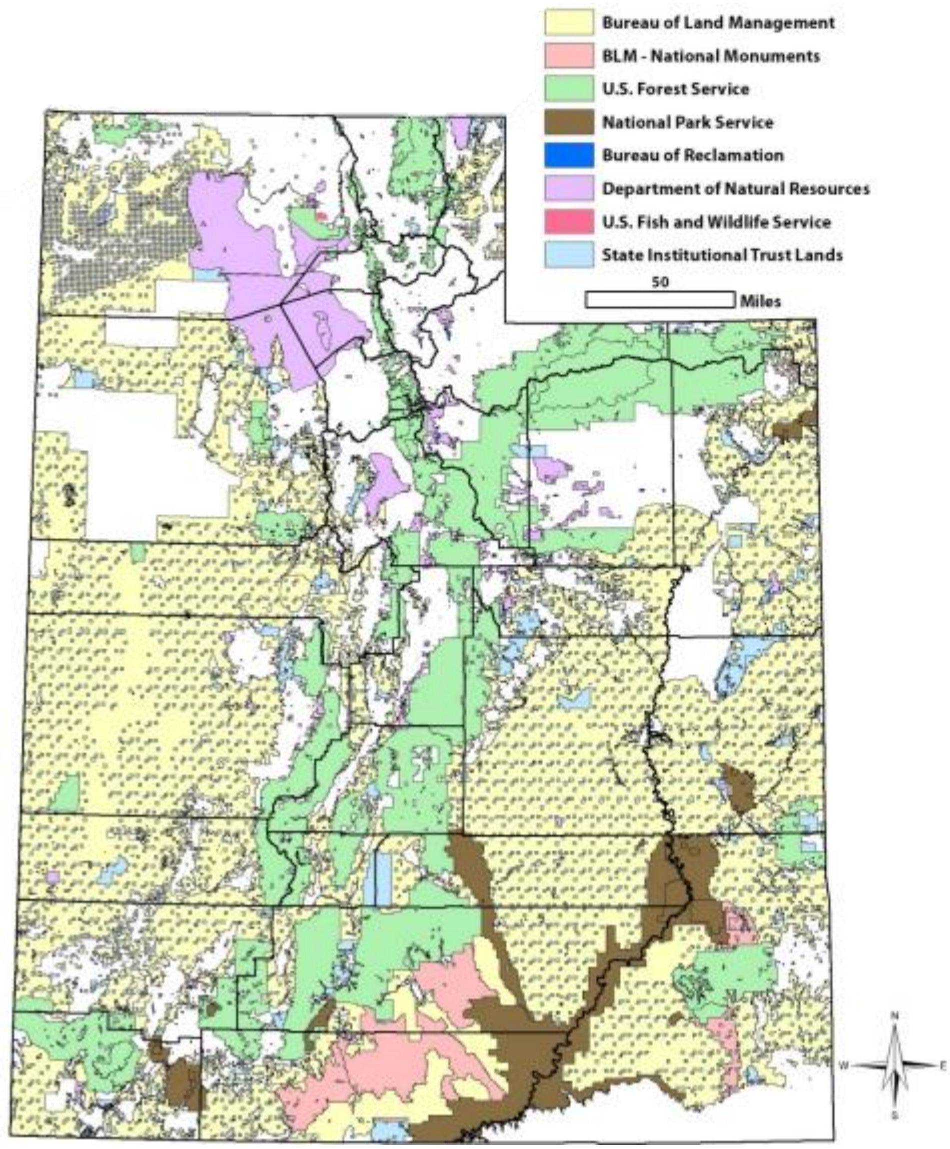
Figure 26. Map of Utah's Land Ownership with Counties



(Source: Utah Department of Natural Resources and the Utah Division of Parks and Recreation)

The Utah recreation industry is as diverse and dynamic as its natural resources. The state boasts a wide spectrum of natural and human-made attractions, recreational opportunities, and cultural heritage sites. Nearly 75 percent of the state consists of land administered for public use by federal, state, and local governments and resource management agencies, Figure 27

Figure 27. Utah's Public Recreation Land



(Source: Utah Department of Natural Resources and the Utah Division of Parks and Recreation)

4.7.3. Current and Future Recreation Needs

According to Utah Department of Natural Resources and the Utah Division of Parks and Recreation many recreational facilities in Utah are over 30 years old and in need of renovation and improvement. However, as the communities grow and develop, new parks and facilities are needed to address the recreation deficits. Surveys have been conducted to identify general recreational needs, thus prioritizing funding.

Figure 28. General Recreation Priorities

(Source: Utah Department of Natural Resources and the Utah Division of Parks and Recreation)

Figure 28 depicts, the 3 more relevant priorities for Recreation Professionals and State Park Managers when deciding future recreational needs.

4.7.4. Project Proximity to Protected Rivers

Designated or under study for inclusion in the National Wild and Scenic River system

The river near the project is not designated or under study for inclusion in the National System of Wild and Scenic Rivers. (National Wild and Scenic Rivers System, 1968)

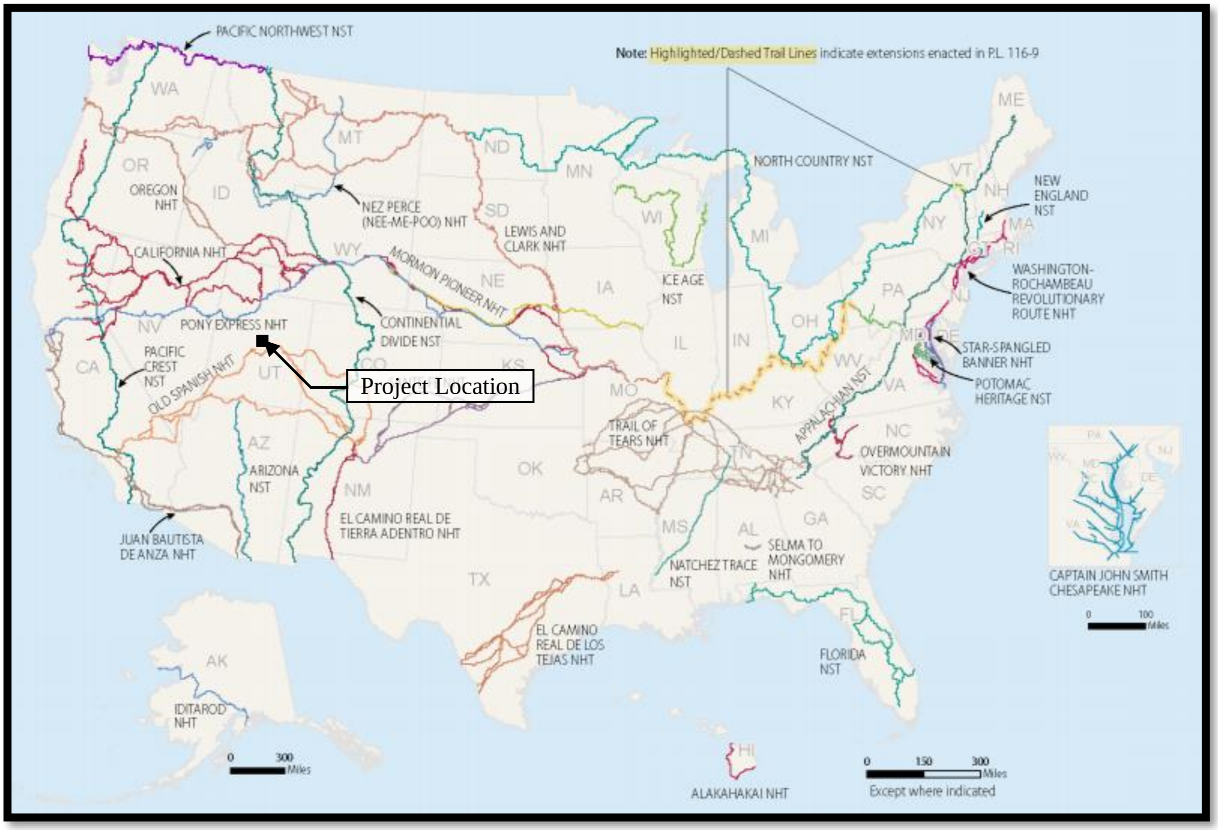
A state-protected river segment

The Sevier River segment within the project perimeter will be managed by BLM and the State of Utah School and Institutional Trust Lands Administration. However, no segment of the river would be state-protected.

4.7.5. Project Land Use for inclusion in the National Trails System or as a Wilderness Area

There are not many trail areas in Utah, and those that do exist do not go through the project areas, as shown in Figure 29:

Figure 29. Map of National Scenic and National Historic Trails



(Source: National Park Service)

These are the following National Scenic and Historic Routes that exist:

Table 21. National Scenic and National Historic Trails

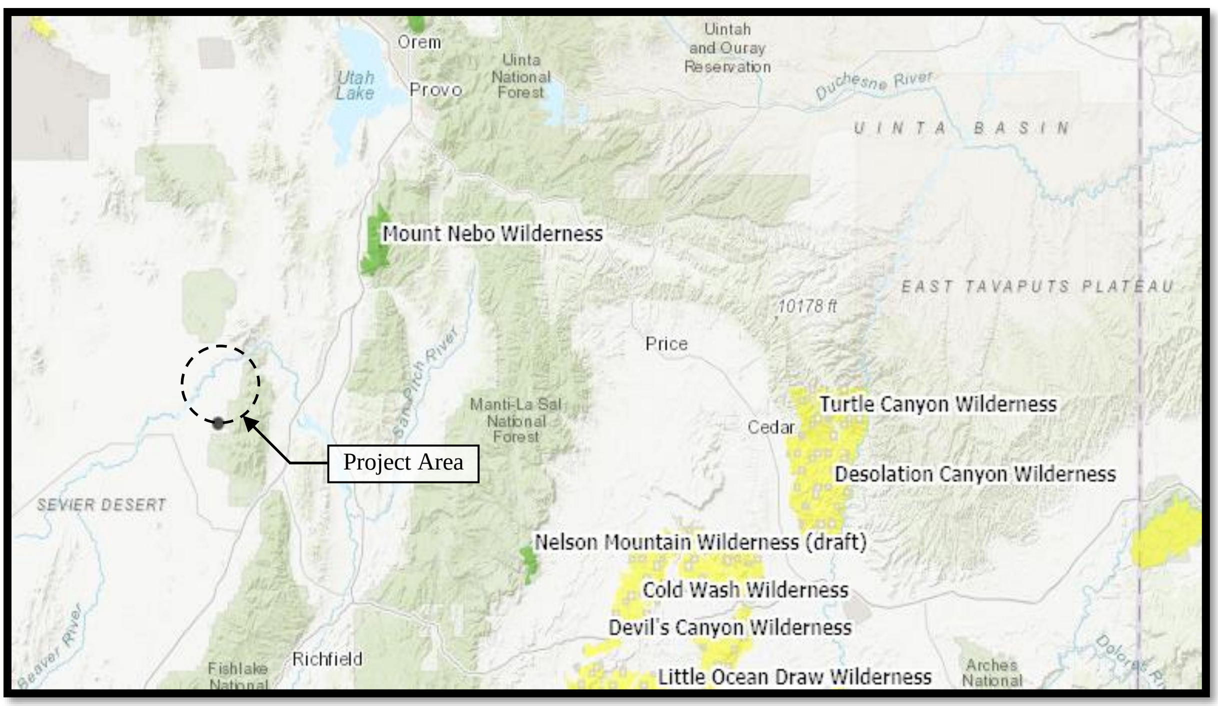
Year Created	Trail Name and Category	Established by Public Law
1968	Appalachian NST	90-543
1968	Pacific Crest NST	90-543
1978	Continental Divide NST	95-625
1978	Oregon NHT	95-625
1978	Mormon Pioneer NHT	95-625
1978	Iditarod NHT	95-625
1978	Lewis and Clark NHT	95-625
1980	North Country NST	96-199
1980	Overmountain Victory NHT	96-344
1980	Ice Age NST	96-370
1983	Florida NST	98-11
1983	Potomac Heritage NST	98-11
1983	Natchez Trace NST	98-11
1986	Nez Perce (Nee-Me-Poo) NHT	99-445
1987	Santa Fe NHT	100-35

1987	Trail of Tears NHT	100-192
1990	Juan Bautista de Anza NHT	101-365
1992	California NHT	102-328
1992	Pony Express NHT	102-328
1996	Selma to Montgomery NHT	104-333
2000	El Camino Real de Tierra Adentro NHT	106-307
2000	Ala Kahakai NHT	106-509
2002	Old Spanish NHT	107-325
2004	El Camino Real de los Tejas NHT	108-342
2006	Captain John Smith Chesapeake NHT	109-418
2008	Star-Spangled Banner NHT	110-229
2009	Arizona NST	111-11
2009	New England NST	111-11
2009	Washington-Rochambeau Revolutionary Route NHT	111-11
2009	Pacific Northwest NST	111-11

(Source: National Park Service)

Also, there are no protected wilderness areas near the project, as shown in Figure 30:

Figure 30. Wilderness Areas near the Project



(Source: Wilderness Connect)

4.7.6. Regionally or nationally recreation areas

The recreation areas near the proposed project are located in the four cities around the boundaries of the project. The details are present in Appendix F to I.

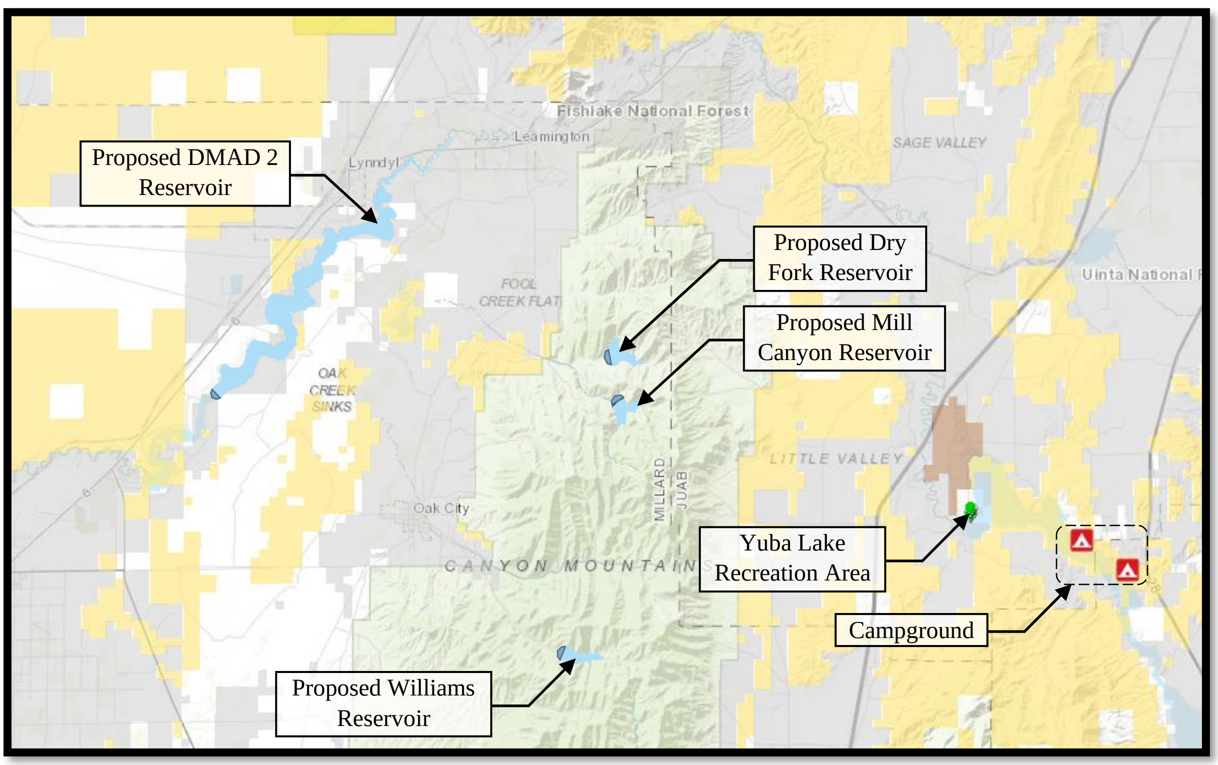
4.7.7. Non-recreational land use and management within the project boundary

Appendix A presents the land use (non-recreational land use) within the project boundary, the main use of the land is agricultural. Also, Figure 39 shows the land use in Millard County.

4.7.8. Land Use and Management Within and Adjacent to Project Boundary

The recreation areas adjacent to the project are limited to Campground Zones and recreation places as Yuba Lake, east of Canyon Mountain Range, these areas are detailed in Figure 31. (U.S. Department of the Interior Bureau of Land Managment). The non-recreational lands use is detail in Figure 39, depicting agriculture as the main land use.

Figure 31. Recreational land use adjacent to the project boundary



(Source: BLM)

4.7.9. Impacts

The proposed DMAD 2 Reservoir construction may affect recreation activities like fishing or boating in the existing DMAD Reservoir, due to the temporary deviation of the Sevier River. However, these activities would be expected to return to normality after the filling of the reservoirs.

4.8. Aesthetic Resources

4.8.1. General Description

Land around the existing DMAD Reservoir belong to tropical weather, for this reason there is no vegetation in the arid zones. As depicted in Figure 32, the vegetation grows along the Sevier River as it is the nearest water source in the area.

Figure 32. Plan View of DMAD Reservoir Downstream

(Source: Google Earth)

Figure 33. DMAD Spillway Outlet Vegetation

(Photo by Calvin Jones)

The Fishlake National Forest in central Utah features majestic stands of aspen encircling open mountain meadows that are lush with a diverse community of forbs and grasses. The mountains of the Fishlake are a source of water for many of the neighboring communities and agricultural valleys in the region. According to National Forest Foundation, in the coming years increased interest in mineral, oil and gas reserves may extend to portions of the Fishlake National Forest.

In the Canyon Mountains, dams will be made of concrete and may cause some dissonance with the nature environment. It is expected that the new dams and reservoirs would increase recreational activities around the area, like camping or hunting, due to creation of new water body.

Figure 34. North-west Fish lake Forest View

(Source: United States Department of Agriculture)

4.8.2. Impacts

The lower reservoir, pumphouse and transmission lines will be visible from U.S. Route 6 Highway (US-6) and Brush Wellman Road.

The construction stage of the tunnels and upper reservoir will have a negative visual impact for Oak City inhabitants.

Primary effects relevant to aesthetics and visual alteration of the proposed Project area will occur as a result of equipment installation and civil work during construction. A comprehensive evaluation of existing visual character of the upper and lower reservoirs, proposed transmission line, and overall project area is required.

4.9. Cultural Resources

4.9.1. General Description

To identify the feasibility of the IPSP project and the of the surrounded area, cultural resources near the DMAD reservoir where located. Exploring the surroundings, it is found the Millard County. It reaches the Fool Creek Peak which belongs to the Oak City, UT.

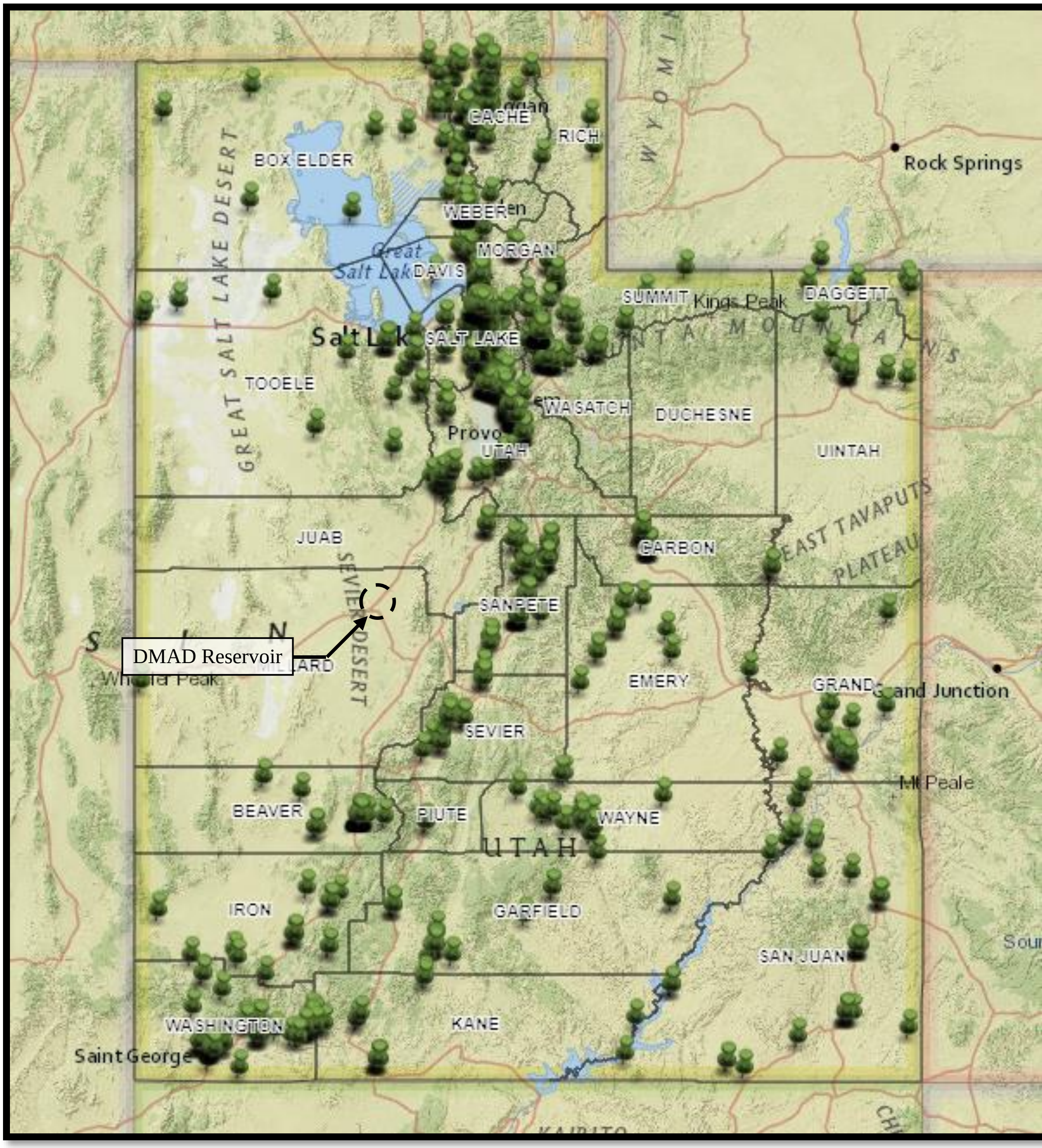
Figure 35. Project Location

(Source: J. Willard Marriot Library Blog, The University of Utah. Exploring Utah's National Historic Landmarks and Register of Historic Places)

Based on the University of Utah information, various historic landmarks and locations are found throughout the State of Utah that fall under the National Historic Preservation Act, passed in 1966 to aid in preserving places, sites, features, and structures. The following list describes the landmarks included:

- Airport
- Amusement
- Building
- Camp
- Cemetery
- City/Town Hall
- Comfort Station
- Cultural
- Deport / Warehouse
- District
- Education
- Entertainment
- Factory
- Farm/Ranch
- Feature
- Fire Station / Tower
- Government
- Highway
- Historic Site
- Inscription
- Liquor / Winery
- Manufacturing
- Railroad
- Recreation
- Religion
- Ruins
- Shop
- Station
- Street / Road
- Structure
- Town Trading Post
- Train / Stagecoach

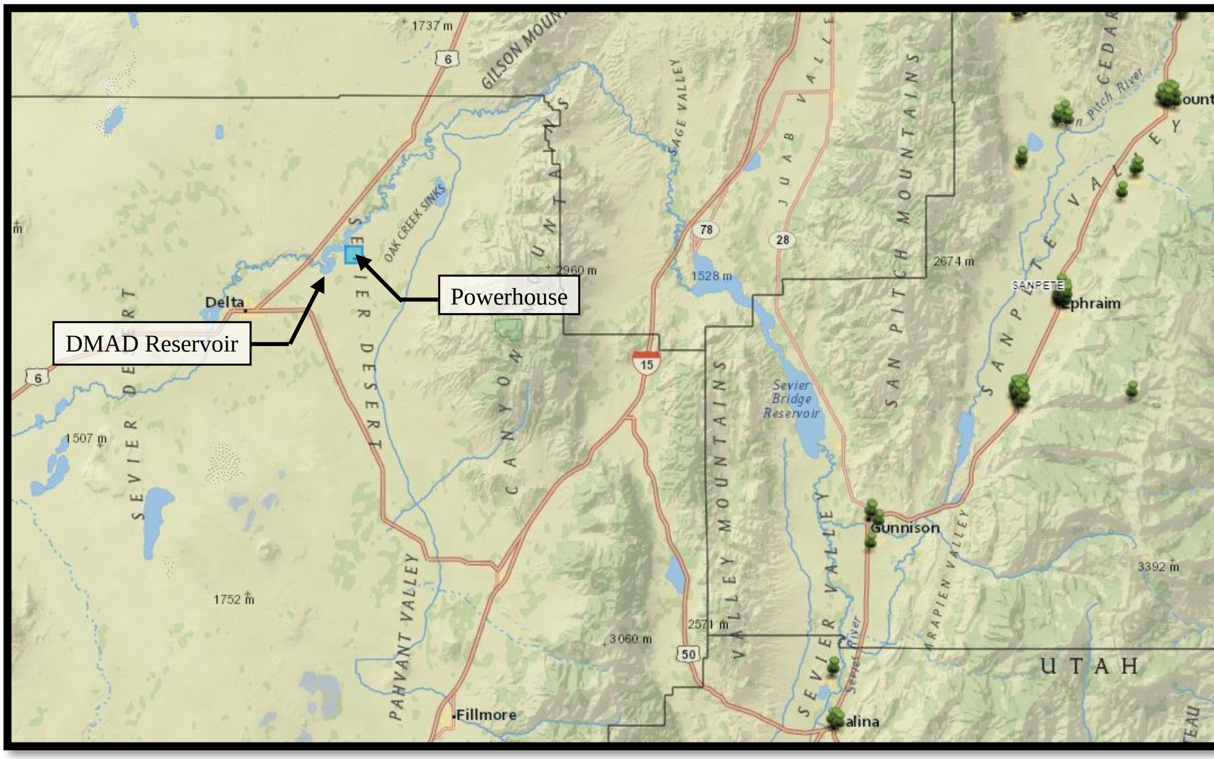
Figure 36. Cultural Resources in Utah



(Source: J. Willard Marriot Library Blog, The University of Utah. Exploring Utah's National Historic Landmarks and Register of Historic Places)

In Millard County, near the DMAD Reservoir, most locations lie on the right side of the Canyon Mountain Range.

Figure 37. Cultural Resources Near Project Location



(Source: J. Willard Marriot Library Blog, The University of Utah. Exploring Utah's National Historic Landmarks and Register of Historic Places)

The nearest landmark is located 40 miles east from the proposed DMAD Reservoir, for this reason, the construction process would have no impact on the surrounding historic places in Millard County.

4.9.2. Impacts

Based upon results of the record search and existing environmental mapping, there would not be any considerable affection to significant historic and archaeological resources within project area.

4.10. Socio-economics Resources

4.10.1. Socio-economic Impact Area

The primary socio-economic impact area for the proposed Projects includes several cities and towns in Millard County, Utah, as shown in Table 22.

Table 22. Affected Areas

City/Town	County	State
Delta	Millard	Utah
Leamington	Millard	Utah
Lynndyl	Millard	Utah
Oak City	Millard	Utah

Based on data from the U.S. Census Bureau (United States Census Bureau, 2018), Millard County is the 3rd-largest county in Utah by area, covering 6,603.2 square miles, Millard County is bounded by Juab County, Sanpete County, Sevier County, Beaver County, Lincoln County, and White Pine County.

Table 23. Millard County Statistics

Metric	Value
Population	12,733
Annual Household Income	$60,445
Poverty Rate	11.4%
Employment Rate	60.2%

4.10.2. General Land Use Patterns

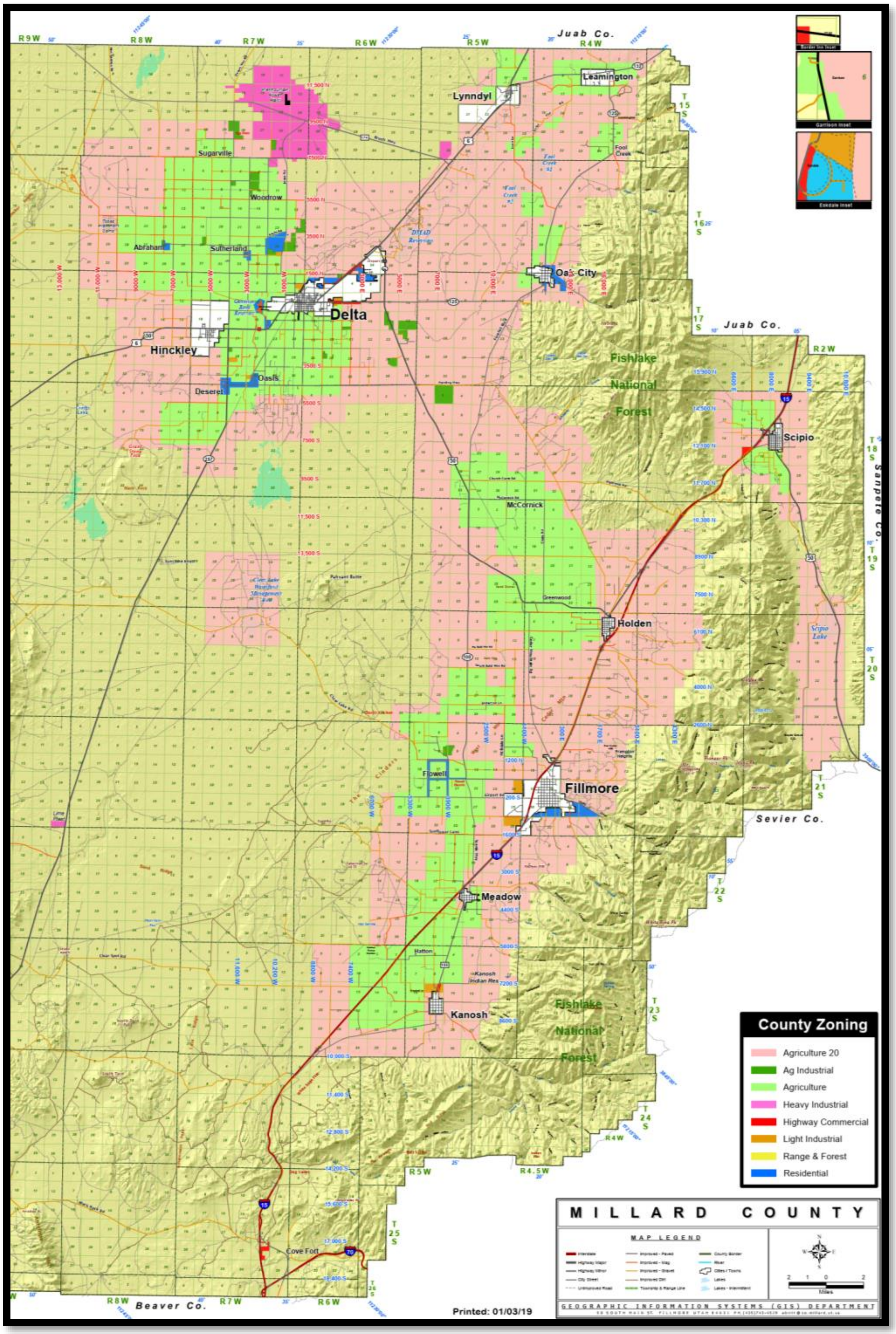
According to the Ordinance regarding Establishment of Zoning Districts (Millard County, 2014), Millard County is divided into Zoning Districts that rule the use or activities occurring on all unincorporated lands located within the County, as shown on the Millard County Zoning Districts Map (Millard County, 2019).

The following Zoning Districts are provided:

- Range and Forest (RF) District
- Agriculture – 20 (AG-20) District.
- Agriculture (AG) District.
- Agricultural Industrial District (AI) District.
- Residential (RI) District.
- Highway Commercial (HC) District.
- Light Industrial (LI) District.
- Heavy Industrial (HI) District.
- Transmission Corridor (TC) District.

- Sensitive Lands Overlay District (SL) (not mapped).

Figure 38. Millard County Zoning



(Source: Millard County)

The Millard County identifies the uses allowed within each Zoning District and provides a definition for each use. The Table of Uses (Millard County, 2014) identifies uses allowed as follows:

- "P-1" and "P-2" Permitted Use
- "C-1" and "C-2" Conditional Use
- "X" Use Prohibited in the Zoning District (Zone).

Any use not identified in the Table of Uses is determined to be a Prohibited Use in Millard County.

The Land Use Authority for all P-1 uses is the County Planner/Zoning Administrator. The Land Use Authority for all P-2, C-1, and C-2 uses is the Board of County Commission (BOCC).

4.10.3. Population Patterns

Table 24 shows the annual resident population (estimated) in the cities and towns around the project area (United States Census Bureau, 2019).

Table 24. Annual Estimates of the Resident Population for Affected Areas: April 1, 2010 to July 1, 2019

Geographic Area	April 1, 2010		Population Estimate (as of July 1)									
	Census	Estimates Base	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Delta city, Utah	3,436	3,437	3,445	3,456	3,430	3,453	3,451	3,471	3,489	3,536	3,558	3,602
Leamington town, Utah	226	226	226	226	224	225	224	227	227	231	234	239
Lynndyl town, Utah	106	106	108	106	105	108	107	109	111	111	112	117
Oak City town, Utah	578	604	607	610	604	613	614	629	632	638	643	649
Note: The estimates are based on the 2010 Census and reflect changes to the April 1, 2010 population due to the Count Question Resolution program and geographic program revisions. All geographic boundaries for the 2019 population estimates are as of January 1, 2019. An "(X)" in the 2010 Census field indicates a locality that was formed or incorporated after the 2010 Census. Additional information on these localities can be found in the Geographic Boundary Change Notes (see https://www.census.gov/programs-surveys/geography/technical-documentation/boundary-change-notes.html). For population estimates methodology statements, see http://www.census.gov/programs-surveys/popest/technical-documentation/methodology.html.												
Suggested Citation:												
Annual Estimates of the Resident Population for Incorporated Places in Utah: April 1, 2010 to July 1, 2019 (SUB-IP-EST2019-ANNRES-49)												
Source: U.S. Census Bureau, Population Division												
Release Date: May 2020												

4.10.4. Impacts

The implementation of this Project is expected to contribute to the local economy, construction related jobs, purchase of services and materials, and household earnings.

Another positive impact may be during construction stage, as work crews may lodge in local communities' accommodations.

A comprehensive evaluation of both positive and negative effects on socio-economic resources in the Project area shall be further developed.

4.11. Tribal Resources

4.11.1. General Description

According to Appendix J, Tribal Resources Layout Plan, there are no nearby tribes around the project area. Therefore, there would not be any affected resources of the tribes.

Considering Appendix J, several tribes are located in the Utah area. However, there are no close by tribes that could be affected. The closest tribe is "Paiute of Utah UT", located approximately 40 miles to the south of the project.

4.12. River Basin Description

4.12.1. General Description

According to the Sevier River Water Users Association, the Sevier River Basin is one of Utah State's major drainages. The terrain consists of high plateaus, narrow valleys, and broad deserts; this is a closed river basin with 6.8 million acres.

The main streams of the Sevier River are the 65-mile-long San Pitch River, the 45-mile-long East Fork Sevier River, and the 40-mile-long Otter Creek, which flows to the East Fork Sevier River.

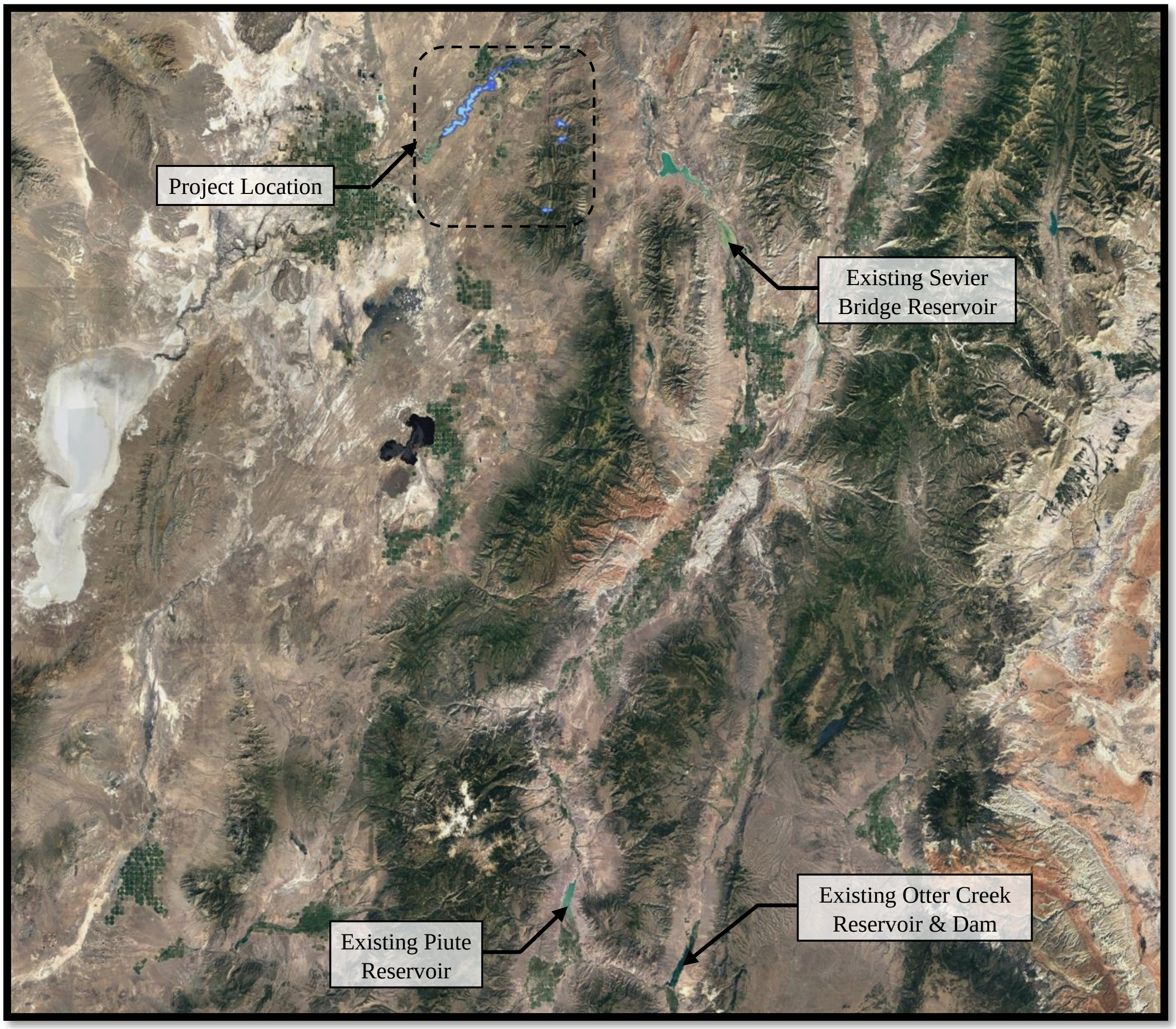
The project area is inside the Agriculture-20 (AG-20) zoning district. The Sevier River Water Users Association describes the primary use of land and water in the Sevier River basin as agriculture. According to Appendix A. Land Use Map, land use around the project is also agricultural, and the water use is detailed in Figure 7.

4.12.2. Dams and Diversion Structures

In order to construct Vermillion Diversion Dam (east of Richfield), the Sevier River Basin Administration produced two major divisions, the upper and lower.

Due to the construction cost of the dams, settlers often depended solely on low diversion weirs to dam a creek or river. However, Gunnison Bend had good geological features in order to construct a reservoir.

Figure 39. Existing dams and diversion structures in Sevier Basin



(1) Sevier Bridge Reservoir

Sevier Bridge Reservoir or Yuba Reservoir began its construction in 1902 with a dam of 60 ft high. However, the runoff on the Sevier River almost destroyed the unfinished structure in 1907. The dam was completed 2 years later, but it was unsuitable due to inflicting flow issues under the dam. Therefore, four irrigation corporations (Deseret Irrigation, Melville Irrigation, Delta Land and Water, and Sevier watercourse Land and Water corporations) within the Lower Sevier Basin improved the existing dam, which was finished June 17, 1916. Currently, the Yuba dam has a 90 ft high, 236,145 acre-ft water capacity, and a surface area of 10,905 acres.

(2) Piute Reservoir

Piute Reservoir was constructed by Robert D. Young in 1908. This reservoir gave to service the Sevier and Gunnison valleys after that the Native water users resolved their monetary problems. Also, the Piute Reservoir receives named for the Native Americans who dominate this area. Now, this reservoir has a surface area of 2,508 acres with 71,826 acre-ft.

(3) Otter Creek Reservoir & Dam

The Otter Creek Dam and Reservoir was constructed during the 1890s. Robert Dixon Young supervised the construction of the reservoir in 1987 when the ground was broken.

The project was a lot of difficulties due to the hard-working conditions, lack of proper working equipment, and the almost non-existent local support. However, when crops in Sevier Valley were saved with water impounded by the almost completed structure, the project aroused the interest of the stakeholders. Most of the work was done in 1901, but the other works continued for many years among them, the drainage, spillway, and feeder canal. Now, the Otter Creek Reservoir & Dam have a surface area of 2,520 acres with 52,495 acre-ft.

4.12.3. Tributary Rivers and Streams

Mountain ranges in the Basin trend southwest to northeast. Most are high plateaus, but there are some basin-and-range types in the northwest. Elevations range from 4,500 to 12,200 feet above sea level. Except where the river flows into the Sevier Desert, valleys are long and narrow.

Major streams in the basin include the main stem of the Sevier River and its tributaries: The San Pitch River, the East Fork Sevier River, and Otter Creek (Appendix K. Sevier Basin River). Agricultural return flows are an important component of the Sevier River. Fifty percent or more of the total tributary and river diversions reappear as return flow downstream.

Headwaters of the Sevier River are in the Markagunt and Paunsaugunt Plateaus of south-central Utah. The river generally flows northward to just below the Sevier Bridge (Yuba) Reservoir, where it turns to the northwest and then southwest through Leamington Canyon. From the main stem near the town of Hatch, the river flows 225 miles before it reaches Sevier Lake. The river is regulated by reservoirs and irrigation systems.

The Sevier River and its tributaries constitute the major sources of water for agriculture in western Garfield, Piute, Sevier, Sanpete, Millard, and southeastern Juab Counties.

5. Preliminary Issues and Studies

Based on the resource descriptions and impacts discussion presented in Section 4.0, the preliminary environmental issues associated with the Intermountain Pump Storage Project are presented below. Further assessment may require conducting studies and information gathering activities, in addition to review of relevant qualifying federal and State or Tribal plans, and relevant resource management plans.

5.1. Geology and Soils

5.1.1. Issues

Each of the proposed tunnels for each upper reservoir alternative will be within a bedrock comprised of quartzite rock materials. Key soil and bedrock issues that will impact tunnel excavation and supporting methods include mineral and lithological composition, weathering, and rock strength, as well as degree, condition and orientation of rock mass discontinuities (fractures, joints, shear zones, etc.). Due to lack of site-specific subsurface information along any of the tunnel alignments, it is not possible to further evaluate the tunneling conditions at this time, and additional geologic studies will be required to address these conditions.

Areas with steep sloping ground affect constructability by deterring access and limiting the ease of movement around the Project site. This often requires the use of specialized equipment and construction methods.

Potential impacts to the existing topography at the upper reservoirs site are effects due to changes in erosional patterns and intensity, and mass movement on slopes facilitated by water saturation. Filling of the upper reservoir would saturate the loose surficial soil cover on slopes and the unconsolidated alluvial materials below reservoir level and along the reservoir shoreline. Erosion would be affected because reservoirs generally act as a sediment trap, arresting transport of the sediment beyond the confines of the reservoir.

5.1.2. Studies

A geotechnical investigation will be prepared to further define specific issues related to the reservoirs and dams, tunnels, inlet/outlet structures, access roads, and power transmission lines. Mitigation measures, including best management practices, will be employed to address soil erosion during construction and post-construction activities.

5.2. Water Resources

5.2.1. Issues

Initial startup operations of the Project may result in displacement of sediments in the vicinity of the inlet/outlet structure, producing an increase in turbidity levels. These high turbidity episodes are expected to decline over time as sediments are transported elsewhere. Startup operations will be performed to avoid periods when the reservoir is stratified and the hypolimnion is anoxic to avoid a rapid transfer of hydrogen sulfide and other substances from the hypolimnion that could otherwise result in adverse effects on fish and recreation.

5.2.2. Studies

Water quality modeling studies will be conducted, including a shoreline erosion analysis, to assure that daily reservoir fluctuations will not impact water quality. If possible, it will be required to test the water quality between the existing DMAD Reservoir and Yuba Dam to obtain updated data.

5.3. Fish and Aquatic Resources

5.3.1. Issues

There are no existing fish populations at the upper reservoir site, as that site contains only minor ephemeral channels and does not have habitat for aquatic resources currently. Therefore, this discussion of the existing fish community is focused on the lower reservoir. Fish can be affected by entrainment at the diversion structures and intakes. The risk of entrainment is influenced by the depth of the intake, intake design, flow approach velocities, and other factors. Smaller fish unable to avoid entrainment are expected to suffer mortality when they pass through the pumping system.

5.3.2. Studies

Fish Entrainment Risk Assessment: Proposed Project inlet/outlet structures may pose a risk of entrainment for small and weaker swimming fish present near the intakes that might pass through the trash racks and into the inlet/outlet structures. During construction, a bypass channel will be required, that connects upstream new DMAD 2 Reservoir to the existing DMAD Reservoir to avoid fish mortality.

5.4. Wildlife and Botanical Resources

5.4.1. Issues

Key biological constraints generally include sensitive natural communities (coastal sage scrub, chaparral, riparian, lakeshore fringe wetland), special-status species, jurisdictional wetlands, designated critical habitat and preserved areas, and existing Regional Preserves.

5.4.2. Studies

The following surveys and studies will be required later for environmental review:

- Presence/absence protocol-level surveys for rare plants and potentially other special-status species.
- General biological survey, including vegetation mapping, special-status species habitat assessment, and jurisdictional delineation of wetlands and other waters of the U.S. and State to determine extent of U.S. Army Corps of Engineers, Regional Water Quality Control Board, and Department jurisdictional wetlands and other waters.
- Biological Assessment pursuant to Endangered Species Act for federally listed species, and assessment pursuant to the California Endangered Species Act of potential impacts to State listed species.
- Demonstration of consistency with City and County Multi-Species Conservation Plan and Subarea Plans, including siting and design criteria.
- Equivalency analysis for impacts to Multi-Habitat Planning Areas Cornerstone Lands and Pre-Approved Mitigation Areas.
- Potential amendments to applicable Resource Management Plans.

5.5. Floodplains, Wetland, Riparian and Littoral Resources

5.5.1. Issues

Potential wetlands, riparian and littoral habitat effects could occur in development of the Inlet/Outlet works on the lower reservoir. It will require measures for shoreline protection and restoration, and for erosion and sediment control in all construction zones.

5.5.2. Studies

Study aspects will include:

- Conduct a detailed wetland, aquatic and riparian habitat analysis of all areas identified in the jurisdictional delineation, especially in the area of the tunnels, roads, and powerline corridor.
- Identify construction and operations details that may affect aquatic and riparian

biological resources, including, but not limited to scheduling, work force, length of construction, and other Project details.

5.6. Rare, Threatened and Endangered Resources

5.6.1. Issues

The proposed Intermountain Pump Storage Project would affect the biological habitats and resources at the proposed reservoirs sites and related features, thus a deep survey will be required with the corresponding department to evaluate it(e.g. Division of Wildlife Resources).

5.6.2. Studies

The proposed Intermountain Pump Storage Project will need to assess the biological resources at the proposed reservoirs site and related features, including transmission lines, tunnels, and roads.

- Protocol-level surveys for those species for which survey protocols exist.
- Focused surveys in potential on-site habitat for other special-status species.
- Focused surveys in areas adjacent to the Project for special-status species that might be affected by Project-associated activities.

5.7. Recreation and Land Use

5.7.1. Issues

Recreational facilities are not proposed to be altered by the proposed Project in the lower Reservoir. The upper reservoirs are not proposed for recreational use. Therefore, no studies of new recreational uses or facilities are proposed. A study will be undertaken to evaluate potential impacts of project development on existing recreational uses at the upper reservoir which will be located within Fishlake Forest.

5.7.2. Studies

The following studies will be needed:

- Short-term potential restrictions on recreational use and access at the proposed Reservoirs during periods of Project construction and potential for conflicts with existing land use and management plans
- Detailed studies and consultation will include identification of existing land use and resource management plans as they may affect land acquisition, easements and mitigation requirements to enable development of the upper reservoir area, associated Project facilities and access, and the transmission lines consistent with regional land use and resource management plans.

5.8. Aesthetic Resources

5.8.1. Issues

Outdoor activities such as marina, boat launch and associated picnic and parking areas, are a predominant visual feature of the reservoir area. The mentioned activities would be regulated with the authorities to avoid congestion in the area

5.8.2. Studies

Study elements to be undertaken in support of environmental review include:

- Conduct assessment of existing visual character of the reservoirs area and overall project area.
- Assessment of potential impacts on visual resources associated with project construction and staging areas, including terrain alteration and grading, construction equipment operation, and lighting.
- Assessment of potential impacts on visual resources of the proposed project reservoirs, and other project facilities, including the proposed transmission line.

5.9. Cultural Resources

5.9.1. Issues

Based upon results of the record search and existing environmental mapping, no substantial cultural resource constraints have been identified regarding potential affects to large or highly significant cultural resources due to distance between the project area and the cultural resources found.

5.9.2. Studies

Study elements to be undertaken in support of environmental review include:

- Conduct intensive cultural resource survey of the proposed Project's Area of Potential Effects (APE), including the upper reservoir area, transmission line corridor, and new access road.

5.10. Socio-Economic Resources

5.10.1. Issues

It is expected that the power generated at the Intermountain Pump Storage Project will meet local electrical load resulting in many economic benefits to the local area. In addition, the regional economy would benefit from the incomes associated to a major construction project, and this would indirectly benefit regional assessed values through the increase of County-wide sales. There are no socio-economic issues warranting further study.

5.10.2. Studies

There are no known socio-economic resource issues that would affect the construction and operation of the Project, therefore, studies probably may not be required.

5.11. Tribal Resources

5.11.1. Issues

There are no nearby tribes around the boundaries of the project. Therefore, there would not be any affected resources of the tribes. The potential for impact to Tribal Resources will be further defined during the licensing process and Tribal consultation.

5.11.2. Studies

There are no known tribal resource issues that would affect the construction and operation of the Project. Qualified cultural resource consultants will work to identify locations requiring additional surveys. Results of surveys will be documented and reviewed with agency and tribal representatives. If applicable, a Historic Properties Management Plan will be prepared for the Project that will identify appropriate measures of protection for identified cultural resource sites, including management and protection of Native American values.

5.12. River Basin

5.12.1. Issues

The new lower reservoir will receive natural runoff from the Lower Sevier Watershed but in dry season, when Sevier River runs dry, lower reservoir will need local transfers from one reservoir to other in order to operate.

5.12.2. Studies

The proposed Project will utilize stored water in the existing DMAD Reservoir and will not utilize or involve any waters diverted from a stream, or have any potential to affect water resources and related biological and cultural resources within the river basin. Therefore, no studies are proposed for this issue area.

5.13. Relevant Waterway and Resource Management Plan

- State Water Plan: Sevier River Basin
- Utah State Water Plan
- Millard County Resource Management Plan
- State of Utah Resource Management Plan
- Millard County General Plan

6. Summary of Contacts

This section provides an appendix summarizing the contacts with Federal, state, and interstate resources agencies, Indian tribes, non-governmental organizations, or other members of the public in connection with the preparation of this Intermountain Pump Storage Project Pre-Application Document.

6.1. Interested Parties Mailing List

Millard County Commission
Dean Draper, Commissioner
71 S 200 W
Delta, UT 84624

Millard County Water Conservancy District
Clayton Jeffery, Chairman
2525 South 500 West
Delta, UT 84624

Utah Division of Water Rights
Teresa Wilhelmsen, State Engineer
1594 West North Temple Suite 220
P.O. Box 146300,
Salt Lake City, UT 84114

Intermountain Power Agency
Ted L. Olson, Chair
10653 S. River Front Parkway, Suite 120
South Jordan, UT 84095

Los Angeles Department Water and Power
Boar of Water and Power Commissioners
Cynthia McClain, President
111 N Hope Street
Los Angeles, CA 90012

Utah Division of Forestry, Fire & State Lands
Brian Cottam, State Forest/Director
1594 W North Temple, Ste 3520
Salt Lake City, UT 84114-5703

Utah Division of Forestry, Fire & State Lands
Central Area
Jason Torgerson, Area Manager
2031 South Industrial Park Road
Richfield, UT 84701

Utah Chapter, Sierra Club
Carly Ferro, Chapter Director
423 West 800 South, Ste A103
Salt Lake City UT 84101-2238

Delta City Administration
John W. Niles, Mayor
76 North 200 West
Delta, UT 84624-99440

Town of Oak City
Kenneth Christensen, Mayor
30 West Center
PO Box 217
Oak City, UT 84649

Leamington Town Hall
Clark Nielson, Mayor
61 W Main, PO Box 38101
Leamington, UT 84638

Lynndyl Town
Andrew Dutson, Mayor
98 E Center Street
PO Box 40207
Lynndyl, UT 844640

Utah Department of Environmental Quality
Utah Division of Water Quality
Jake Vander Laan, Environmental Scientist
Standards and Technical Services
P.O. Box 144870
Salt Lake City, Utah 84114-4870

Utah Department of Environmental Quality
Utah Division of Water Quality
Mike Allred, Environmental Scientist
Watershed Protection
P.O. Box 144870
Salt Lake City, Utah 84114-4870

Utah Department of Environmental Quality
Utah Division of Water Quality
Harry Campbell, Wastewater Review
Engineer
P.O. Box 144870
Salt Lake City, Utah 84114-4870

Utah Department of Environmental Quality
Chris Bittner, Standards Coordinator
195 N 1950 W
Salt Lake City, Utah 84116

Utah Division of Wildlife Resources
Southern Region Office – Impact Analysis
Gary Bezzant, Habitat Manager
319 N Carbonville Rd, Suite A
Price, UT 8450

U.S. Fish & Wildlife Service
National Wetlands Inventory
Jane Harner, Wetlands Database
Administrator
505 Science Dr
Madison, WI 53711

Fool Creek Irrigation Company
Stewart Vughn, President
PO Box 184
Oak City, UT 84649

6.2. Public Utility Regulatory Policies Act

As a part of its proposal to develop the Intermountain Pumped Storage Project, Premium Energy Holdings, LLC are not seeking benefits under Section 210 of the Public Utility Regulatory Policies Act of 1978 (PURPA).

7. References

Collins, C. P., & Reynolds, T. D. (2005). *A technical conservation.* Rocky Mountain Region: USDA Forest Service. Retrieved from https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5182004.pdf

Congressional Research Service. (2020, February 20). *Federation of American Scientists.* Retrieved from The National Trails System: A Brief Overview: https://fas.org/sgp/crs/misc/R43868.pdf

Field Supervisor, Ventura Fish and Wildlife Office. U.S. Fish and Wildlife Service. (2016). *Biological Opinion for the San Felipe Pipeline Road/Levee and Culvert Repair Project, San Benito County, California (15-007) (8-8-15-F- 14).* Fresno, California: Bureau of Reclamation. Retrieved from https://www.usbr.gov/mp/nepa/includes/documentShow.php?Doc_ID=26460

Kalasz, K. S., & Buchanan, J. B. (2016, October). *Washington Departement of Fish and Wildlife.* Retrieved from Periodic Status Review for the Bald Eagle: http://wdfw.wa.gov/publications/01825/wdfw01825.pdf

Klute, D. S., Ayers, L. W., Green, M. T., Howe, W. H., Jones, S. L., Shaffer, J. A., . . . Zimmerman, T. S. (2003). *Status Assessment and Conservation Plan for the Western Burrowing Owl in the United States.* Washington, DC: U.S. Department of Interior, Fish and Wildlife Service. Retrieved from https://www.fws.gov/mountain-prairie/migbirds/species/birds/wbo/Western%20Burrowing%20Owlrev73003a.pdf

Millard County. (2014). *Millard County.* Retrieved from Title 10, Chapter 16 Establishment of Zoning Districts: https://www.millardcounty.org/wp-content/uploads/public-notices/2014/PC_-_CODIFICATION_CORRECTIONS_PC_Public_Hearing_02052014__Z-2014-002.pdf

Millard County. (2019). *Millard County.* Retrieved from Millard County District Zoning Map: https://www.millardcounty.org/your-government/about-the-county/maps/

National Park Service. (2019, January). *National Park Service.* Retrieved from National Trails System: https://www.nps.gov/policy/Reference_Manual_45.pdf

National Wild and Scenic Rivers System. (1968). *Wild and Scenic Rivers Act.* National Wild and Scenic Rivers System. Retrieved from https://www.internationalrivers.org/wp-content/uploads/sites/86/2020/06/wild_and_scenic_rivers_act.pdf

R., A. K. (2006, August 24). *U.S. Fish & Wildlife Service.* Retrieved from https://www.fws.gov/MIDWEST/ENDANGERED/section7/batbo/06_IN_I69revisedBO.doc

Stinson, D. W. (2016, October). *Washington Department of Fish and Wildlife.* Retrieved from Periodic status review for the American White Pelican: https://wdfw.wa.gov/sites/default/files/publications/01829/wdfw01829.pdf

U.S. Department of the Interior Bureau of Land Managment. (n.d.). *Bureau of Land Managment*. Retrieved from BLM Recreation Web Map: https://www.blm.gov/visit

U.S. Fish & Wildlife Service. (2020, May 11). *U.S. Fish & Wildlife Service*. Retrieved from National Wetlands Inventory: https://www.fws.gov/wetlands/index.html

U.S. Fish and Wildlife Service. (1998, June). *U.S. Fish and Wildlife Service*. Retrieved from Status Review of the northern goshawk in the forested west, Office of Technical Support - Forest Resources: https://www.fws.gov/pacific/news/pdf/gh_sr.pdf

U.S. Fish and Wildlife Service. (2010). *Center for Biological Diversity*. Retrieved from San Joaquin Kit Fox: https://www.biologicaldiversity.org/species/mammals/San_Joaquin_kit_fox/pdfs/San_Joaquin_kit_fox_5-year_review.pdf

U.S. Fish and Wildlife Service. (2017). *Species Status Assessment Report for 14 Springsnails in Nevada and Utah (June 22, 2017 version).* Pacific Southwest Region, Sacramento, California: U.S. Fish and Wildlife Service.

U.S. Forest Service. (n.d.). *United States Department of Agriculture*. Retrieved from Fishlake National Forest: https://www.fs.usda.gov/fishlake

United States Census Bureau. (2018). *Census Bureau*. Retrieved from Millard County, Utah: https://data.census.gov/cedsci/profile?g=0500000US49027

United States Census Bureau. (2019). *Census Bureau.* Retrieved from City and Town Population Totals: 2010-2019: https://www.census.gov/data/tables/time-series/demo/popest/2010s-total-cities-and-towns.html

Utah Department of Natural Resources and the Utah Division of Parks and Recreation. (2019). *Utah* . Retrieved from Utah's Outdoor Recreation Plan - 2019: https://site.utah.gov/stateparks/wp-content/uploads/sites/13/2019/01/UtahsOutdoorRecreationPlanSCORP2019.pdf

Utah Government. (2020). *Utah Division of Wildlife Resources*. Retrieved from Wildlife Utah Government: https://wildlife.utah.gov/

Utah Government. (n.d.). *Sevier Bridge Reservoir (Yuba Lake).* Retrieved from Digital Library: https://digitallibrary.utah.gov/awweb/awarchive?type=file&item=22002

Utah Government. (n.d.). *Utah's Wildlife Habitats.* Retrieved from Digital Library: https://digitallibrary.utah.gov/awweb/awarchive?type=file&item=29617

W.A. Franke College of Forestry and Conservation's Wilderness Institute at The University of Montana. (1996). *Wilderness Connect*. Retrieved from Interactive Map: https://www.arcgis.com/apps/webappviewer/index.html?id=a415bca07f0a4bee9f0e894b0db5c3b6