Utah Lake Drainage Basin
Water Delivery System
Bonneville Unit, Central Utah Project

Final
Environmental Impact Statement

Chapter 2
Comparative Analysis of the Proposed Action and Other Alternatives

Chapter 2
Comparative Analysis of the Proposed Action and Other Alternatives

2.1 Introduction

This chapter provides a comparative analysis of the impacts of the Proposed Action and other alternatives after mitigation measures have been implemented. Detailed impact analyses are presented in Chapter 3.

2.2 Comparison of Impacts

Table 2-1 compares key quantified impacts on applicable resources from the Proposed Action and other alternatives. The table shows construction and operation impacts where applicable. Where possible, the table shows percent changes from baseline under the Proposed Action and other alternatives.

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Chapter 3
Affected Environment and Environmental Consequences

Chapter 3
Affected Environment and Environmental Consequences

3.1 Introduction

This chapter describes potential environmental consequences (impacts) from construction and operation of the Utah Lake Drainage Basin Water Delivery System (ULS) as described in Chapter 1. The impact analysis is presented in 24 sections, including an introduction and 23 resource topics (listed in the box) that represent all environmental resources in the area likely to be affected by features of the Proposed Action and other alternatives.

Resources Addressed in this Chapter

- Surface Water Hydrology
- Surface Water Quality
- Groundwater Hydrology
- Groundwater Quality
- Aquatic Resources
- Wetland Resources
- Wildlife Resources and Habitats
- Threatened and Endangered Species
- Sensitive Species
- Agriculture and Soil Resources
- Socioeconomics
- Cultural Resources
- Visual Resources
- Recreation Resources
- Noise
- Public Health and Safety
- Paleontology
- Transportation Networks and Utilities
- Air Quality
- Mineral and Energy Resources
- Land Use Plan Conflicts
- Environmental Justice
- Indian Trust Assets

Each resource section describes the following for the Proposed Action and other alternatives, except for the No Action Alternative:

- Issues raised in scoping meetings
- Scoping issues eliminated from further analysis
- Scoping issues addressed in the impact analysis
- Description of impact area of influence (the area affected by construction and operation of the project – primarily in Utah County).
- Methodology used to conduct the analysis

- Affected environment (defined below)
- Significance criteria (criteria used to determine the significance of the impacts)
- Potential impacts eliminated from further analysis
- Potential impacts of the Proposed Action and other alternatives on the human environment

The last five sections of this chapter describe the following:

- Measures to mitigate and monitor significant impacts for the Proposed Action and other alternatives
- Unavoidable adverse impacts of the Proposed Action and other alternatives
- Net cumulative impacts of the Proposed Action and other alternatives
- Short–term use of the human environment versus maintenance of long-term productivity
- Irreversible and irretrievable commitment of resources

Baseline conditions are the physical conditions of the impacted resources expected to exist in the impact area of influence at the time of the ULS construction. The human environment is defined in this study as all of the environmental resources, including the social and economic conditions in the impact area of influence. Baseline conditions for water-related resources are specific to the river or stream. The Spanish Fork River baseline conditions are with the Municipal and Industrial System (M&I System) exchange in-place, whereby an annual average 86,100 acre-feet of water would flow year-round out of Strawberry Reservoir into the Diamond Fork System, discharge into Diamond Fork Creek near or above its confluence with the Spanish Fork River, and flow down the river to Utah Lake. The 86,100 acre-feet of water is exchanged to Jordanelle Reservoir to provide storage of Provo River water for delivery to northern Utah County and Salt Lake County under the Bonneville Unit M&I System. The Diamond Fork System deliveries will increase from 30,000 acre-feet annually to an average of 86,100 acre-feet annually to Utah Lake in 2005. The Hobble Creek baseline conditions are current conditions. The Provo River baseline conditions are with the M&I System in operation, (as described in Reclamation 1979a) conveying the M&I flows down Provo River below Deer Creek Dam to diversions in Provo Canyon.

The impact analysis assumes the Standard Operating Procedures (SOPs) described in Chapter 1, Section 1.8.8, are implemented during construction and operation to protect environmental resources. The impact presented is less than would have occurred without the SOPs in place. In each resource section, significant impacts are discussed in detail for both the construction and operation phases of the project, while insignificant impacts are briefly summarized.

Where appropriate, "milepost" numbers are used to describe lengths, distances and locations of project features (e.g., pipelines, power facilities, etc.) in the impact area of influence. Maps A-1 and A-2 (in pocket at back of document) show the location of major project features and associated mileposts.

The impact analysis of the Proposed Action and other alternatives (except for the No Action Alternative) includes construction of the Spanish Fork Canyon Pipeline as part of the ULS project. Depending on the need and timing of the construction of this pipeline it may be included as part of the Utah Department of Transportation (UDOT) reconstruction and widening of U.S. Highway 6 in Spanish Fork Canyon (See Chapter 1, Section 1.7). If the Spanish Fork Canyon Pipeline is constructed, any pipeline construction impacts would be included in the impacts of reconstructing the highway. Therefore, none of the impacts from pipeline construction would be associated with the ULS project.

The impact analyses presented in this Final Environmental Impact Statement (FEIS) are supported by six technical reports prepared for specific resources. These technical reports provide detailed technical and scientific information on baseline conditions; analysis methods used to determine impacts; and results of the impact analyses. The following reports are summarized in resource sections of this chapter:

- Surface Water Hydrology Technical Report for the Utah Lake Drainage Basin Water Delivery System (CUWCD 2004a)
- Surface Water Quality Technical Report for the Utah Lake Drainage Basin Water Delivery System (CUWCD 2004b)
- Aquatic Resources Technical Report for the Utah Lake Drainage Basin Water Delivery System (CUWCD 2004c)
- Wildlife Resources and Habitat Technical Report for the Utah Lake Drainage Basin Water Delivery System (CUWCD 2004d)
- Threatened and Endangered Species and Sensitive Species Technical Report for the Utah Lake Drainage Basin Water Delivery System (CUWCD 2004e)
- Cultural Resources Technical Report for the Utah Lake Drainage Basin Water Delivery System (CUWCD 2004f)

These technical reports are not intended as "stand-alone" documents. They rely on information about the Proposed Action and other alternatives that is described in Chapter 1 of this FEIS. These technical reports are available from the Central Utah Water Conservancy District (District) upon request at the following address:

Laurie Barnett
Central Utah Water Conservancy District
355 West University Parkway
Orem, Utah 84058
Telephone: (801) 226-7133
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3.2 Surface Water Hydrology

3.2.1 Introduction

This analysis addresses potential impacts on surface water quantity from construction and operation of the Proposed Action and other alternatives. For additional detail see the Surface Water Hydrology Technical Report for the Utah Lake Drainage Basin Water Delivery System (CUWCD 2004a).

The analysis presented in this section provides the hydrological basis for evaluation of impacts related to surface water quality (Section 3.3) aquatic resources (Section 3.6), wetland resources (Section 3.7), threatened and endangered species (Section 3.9) and sensitive species (Section 3.10). Flow changes that would be caused by the Proposed Action and other alternatives were evaluated for a 50-year period (1950 to 1999) to reflect variations in surface water quantity over time because of natural variations in precipitation and water supply.

3.2.2 Issues Raised in Scoping Meetings

The issues are divided into three categories: changes in streamflows and river stages; changes in lake and reservoir levels; and changes in water operations, supplies and deliveries.

3.2.2.1 Changes in Streamflows and River Stages

- Would there be an increase or decrease of flooding of streams in wet years?
- How would natural streamflow quantities lower than those used in the planning study affect M&I water supplies and associated resources?
- What would be the impacts on flows and fish habitat in Hobble Creek to Utah Lake?
- What would be the impacts of Concept 1 on Daniels Creek? (Concept 1 was later renamed the Strawberry Reservoir-Deer Creek Reservoir Alternative.)
- What would be the impacts from Concept 1 on flow levels in the Provo River below Deer Creek Dam?
- What would be the impacts on streamflows in the Provo River from the Olmsted Diversion to Utah Lake?
- What opportunities would exist under each of the ULS concepts to promote Proper Functioning Condition streamflows?
- What would be the impacts on in-stream conditions of tributaries to Deer Creek or Utah Lake reservoirs?
- What would be the potential impacts of higher flows in the Provo River below Deer Creek Reservoir on channel stability, stream habitats and fishability?
- What would be the impacts on Provo River flows between Deer Creek Reservoir and Olmsted Diversion?
- What would be the opportunity to have supplemental streamflows for the June Sucker Recovery Implementation Program mimic historic flows as closely as possible, while not negatively impacting other project purposes?
- What would be the impacts on channel stability, wildlife habitats, and sediment transport?
- What impacts would occur from Concept 3 on operation of any existing Spanish Fork River diversion structures? (Concept 3 – the Spanish Fork River and Saratoga Springs Pipeline Alternative – was later eliminated as an alternative.)
- What impacts on wetlands and streamflows would occur because of groundwater pumping?
- What would be the impact on stream channel degradation of Currant Creek?

3.2.2.2 Changes in Lake and Reservoir Levels

- What would be the impacts on Utah Lake from a pipeline rupture, as the area is in a zone of high earthquake risk?
- What would be the impacts from each of the ULS water delivery concepts on water levels in Utah Lake and Deer Creek Reservoir?
- What impacts would occur from each ULS water delivery concept on Utah Lake emergent vegetation, water quality and evaporation?
- What would be the opportunity under each concept to stabilize Utah Lake?
- What would be the impacts of continued use of surface water in the Salem area?
- What would be the impact on the Jordanelle-Deer Creek Operating Agreement?

3.2.2.3 Changes in Water Operations, Supplies and Deliveries

- How much water could be conserved for Mapleton and Springville if they could tap into the ULS pipeline in exchange for water in their open canal system?
- How much water could be conserved using sprinkler irrigation versus flood irrigation?
- What would be the impacts of introduction of June sucker on the operation of the Spanish Fork River?
- What is the amount of water potentially available in the Jordan River basin that has not been converted to M&I from agriculture?
- What is the amount of water potentially available in the Utah Lake basin that has not been converted to M&I from agriculture?
- What are the operating constraints on the Provo River related to demands for water and habitat for the June sucker?
- Would the peak flows needed for M&I delivery to Salt Lake County in July and August be met every year?
- How would the intent of the Indian Ford Exchange be fulfilled and what would be the impacts?
- Would all concepts provide the maximum capacity/flow for M&I in combination with Jordanelle and what would be the impacts?
- How much surplus irrigation water exists in Salt Lake and Utah counties?
- What would be the impacts of the ULS on existing water rights in the canals that feed Provo City?
- What would be the impacts of saving ¼ of Mapleton's water?
- What would be the impacts of continued use of surface water in the Salem area?
- What would be the impacts of each of the ULS concepts on Strawberry Valley Project water delivery through the Diamond Fork System?

3.2.3 Scoping Issues Eliminated From Further Analysis

Of the 35 issues that were raised during the public scoping process that apply to surface water hydrology, the following 23 issues were eliminated from further consideration for the reasons described.

What would be the impact on stream channel degradation of Currant Creek?

The ULS project does not propose any changes to or alteration of flows in Currant Creek. While construction of a pipeline to Mona Reservoir is considered in this EIS the ULS project does not propose delivery of any Bonneville

Unit project water through the Santaquin-Mona Reservoir Pipeline. As described in Chapter 1, Section 1.4.2.5, the purpose of the pipeline is to provide an opportunity to develop a June sucker refuge by maintaining a conservation pool in Mona Reservoir if the June Sucker Recovery Implementation Program participants determine that the benefits of the pipeline extension justify the costs. If constructed and operated the water supply conveyed through the pipeline would be used for creation and maintenance of a conservation pool, stored in Mona Reservoir, and would not be released to Currant Creek. Therefore, there are no anticipated impacts to Currant Creek. This EIS addresses only the impacts of constructing the pipeline. The JSRIP will address the water supply and operation of Mona Reservoir in a separate NEPA analysis.

What would be the impacts on Utah Lake from a pipeline rupture, as the area is in a zone of high earthquake risk?

The Spanish Fork-Bluffdale Alternative, the only alternative that would have included a pipeline across Utah Lake, was dropped from further analysis (see Chapter 1, Section 1.11.1).

How much water could be conserved using sprinkler irrigation versus flood irrigation?

Water conservation through irrigation practices is not a subject of this ULS FEIS. The basic need for the ULS is to meet some of the M&I demands in the Wasatch Front area and to implement water conservation measures associated with M&I water use.

How would natural streamflow quantities lower than those used in the planning study affect M&I water supplies and associated resources?

The intent of the 50-year period (1950-1999) used for analysis of the project alternatives is to provide a complete hydrologic cycle to test the validity of project assumptions. The period includes both dry (1961, 1977, 1992) and wet (1952, 1983, 1986) years and represents a range of possible future hydrologic conditions.

What would be the impacts of Concept 1 on Daniels Creek?

Concept 1 was renamed the Strawberry Reservoir-Deer Creek Reservoir Alternative. This alternative was eliminated from detailed analysis. Please see Chapter 1, Section 1.11.8.

What impacts would occur on operation of any existing Spanish Fork River diversion structures?

All of the action alternatives would deliver water to Utah Lake through pipelines that are proposed for construction as part of the ULS project and other tributaries to Utah Lake. Therefore, there would be no impacts on the Spanish Fork River diversion structures under any of the action alternatives.

The No Action Alternative represents baseline conditions where up to 86,100 acre-feet of Bonneville Unit water would flow through the Spanish Fork River to Utah Lake throughout the year. Under the No Action Alternative, the Spanish Fork diversion structures would have to be modified based on commitments in the Diamond Fork System Final Supplement to the Final EIS (FS-FEIS) (CUWCD 1999a).

What would be the impacts of the ULS on existing water rights in the canals that feed Provo City?

The ULS alternatives do not include or alter the water rights and canals that feed Provo City and, therefore, would have no impact on them.

What would be the impacts of each of the ULS concepts on SVP water delivery through the Diamond Fork System?

The ULS alternatives would have no impact on Strawberry Valley Project (SVP) water deliveries through the Diamond Fork System, which would continue to operate according to existing operating agreements and procedures, and applicable NEPA compliance documents.

Would all concepts provide the maximum capacity/flow for M&I in combination with Jordanelle and what would be the impacts?

The ULS alternatives would not provide the maximum supply of M&I water in combination with Jordanelle. The M&I supply from the ULS alternatives would be operated independently of the other M&I supplies. The ULS alternatives have not been planned to increase the overall water supply available from Jordanelle under the Bonneville Unit M&I system or from the other existing M&I water supply systems in the Utah Lake Drainage Basin. Additionally, no new conveyance facilities to bring additional capacity to Salt Lake County are included in the ULS alternatives. The Spanish Fork-Bluffdale Alternative, was an alternative that would have included a new pipeline to Salt Lake County. This alternative was dropped from further analysis (see Chapter 1, Section 1.11.1).

What opportunities would exist under each of the ULS concepts to promote Proper Functioning Condition streamflows?

Promoting Proper Functioning Condition streamflows is outside the scope of the ULS project. However the Bonneville Unit has incorporated minimum flows to protect fisheries in streams that previously were subject to total diversion or natural flows that were limiting the fishery. Under the ULS alternatives, specific volumes of flow are allocated to supplement both the Provo River and Hobble Creek. The impact on aquatic and wetland resources is documented in Sections 3.6 Aquatic Resources and 3.7 Wetland Resources.

What would be the opportunity to have supplemental streamflows for the June Sucker Recovery Implementation Program mimic historic flows as closely as possible, while not negatively impacting other project purposes?

What are the operating constraints on the Provo River related to demands for water and habitat for the June sucker?

The June sucker target flow hydrographs on the Provo River and Hobble Creek were developed in cooperation with the June sucker RIP to mimic the natural flow of the streams during the June sucker spawning season. The actions analyzed in this document include the use of 12,165 acre-feet of water to help meet these target flows in the Provo River. In addition, water would be released through Hobble Creek for the June sucker. The degree of success at meeting the target hydrographs is described in Chapter 3, Section 3.9 Threatened and Endangered Species.

What impacts on wetlands and streamflows would occur because of groundwater pumping?

The ULS alternatives do not include any proposals for groundwater pumping and therefore, do not cause any direct impacts on the groundwater. Additional details regarding analysis of wetlands and groundwater impacts are included in the draft EIS sections covering those resources.

What would be the opportunity under each concept to stabilize Utah Lake?

The only opportunities to stabilize Utah Lake would involve altering the inflow to the Lake or altering the outflow from the Lake. Altering the inflow would involve releasing more water from storage (in Deer Creek, Jordanelle, and Strawberry reservoirs) during dry periods. This would have an extremely adverse effect on M&I water supplies and was not evaluated. Altering the outflow to stabilize the lake would involve reducing releases from the lake during extended dry periods so that the Lake level did not fall as low. This would require purchasing

Utah Lake rights and not calling for them during dry periods. A brief analysis was conducted to estimate the potential benefits of stabilizing the level of Utah Lake by changing the outflows. The estimated benefits were not significant in that the maximum TDS still exceeded the agricultural standard of 1,200 mg/L, and all or most of the Utah Lake water rights would be required. Because of its highly variable inflow, stabilizing Utah Lake is not possible without drastically changing its volume or surface area. Additional study of lake stabilization was determined to be unwarranted.

What would be the impacts of introduction of June sucker on the operation of the Spanish Fork River?

The June sucker is not proposed to be introduced in the Spanish Fork River under the ULS project. While June sucker occur naturally in the lowest reaches of the Spanish Fork River, there are no plans for introduction elsewhere.

What is the amount of water potentially available in the Jordan River basin that has not been converted to M&I from agriculture?

What is the amount of water potentially available in the Utah Lake basin that has not been converted to M&I from agriculture?

How much surplus irrigation water exists in Salt Lake and Utah counties?

The ULS Revised Assessment of M&I Water Needs (CUWCD 2003) estimated the available water supplies in the Utah Lake and Jordan River basins. The potential conversion of certain agricultural water was included in those estimates. The State Water Plan for the Jordan River Basin shows a total average supply from Utah Lake/Jordan River of 308,000 acre-feet per year, of which 140,000 acre-feet per year is used for agriculture (in 1995). Agricultural use would drop to 50,000 acre-feet by 2020, and to 5,000 acre-feet by 2050. Some of this agricultural supply would be converted to M&I use, however, treatment of Utah Lake water to meet potable water quality requirements is very expensive. Jordan Valley Water Conservancy District long range planning calls for treating up to 50,000 acre-feet of converted Utah Lake/Jordan River agricultural water.

Would the peak flows needed for M&I delivery to Salt Lake County in July and August be met every year?

The ULS alternatives were formulated assuming a peak July water demand equal to 17 percent of the annual demands. This is the average peak water use used for planning M&I water supplies in the study area. Annual demands were assumed constant every year. Surface water hydrologic analyses show that these demands are met every year. The actual peak need for M&I water will be higher than this 17 percent assumption on a daily basis and in certain months. The ULS alternatives were not formulated to meet these full peak needs.

How would the intent of the Indian Ford Exchange be fulfilled and what would be the impacts?

The water supply needs associated with the Indian Ford Exchange are met through the acquisition of 7,900 acre-feet of Utah Lake primary water rights by the U.S. Department of the Interior (DOI). This supply was assumed to be held in Utah Lake and was included in the ULS baseline and alternatives. This effectively offsets the supply that could have been realized from the Indian Ford Exchange, which is no longer available to the Bonneville Unit M&I System.

What would be the impacts of saving ¼ of Mapleton's water?

Analysis of the impacts of saving Mapleton water is outside the scope of this EIS.

What would be the impacts of continued use of surface water in the Salem area?

The analysis of the impact of use of surface water in the Salem area is outside the scope of this EIS.

3.2.4 Scoping Issues Addressed in the Impact Analysis

All of the issues identified in Section 3.2.2, except those listed in Section 3.2.3, are addressed in the impact analysis. Issues pertaining to changes in streamflows and river stages and changes in water operations, supplies and deliveries are addressed by evaluating and comparing streamflows throughout the impact area under baseline conditions with streamflows under alternative conditions. Issues pertaining to changes in lake and reservoir levels are addressed by evaluating and comparing the reservoir levels under baseline conditions with those under alternative conditions.

3.2.5 Description of Impact Area of Influence

The surface water hydrology impact area of influence includes each of the streams, lakes and reservoirs that would be affected by the operation of the Proposed Action and other alternatives. This can generally be defined by the pathway of the ULS water supply, beginning where ULS water leaves Strawberry Reservoir and ending at the point of use. Map 3-1 shows the overall impact area of influence for surface water hydrology. The impact area includes streams used to convey ULS water, upstream and downstream from and including Utah Lake.

Strawberry Reservoir is not included in the impact area of influence because operation of the reservoir would not change significantly from previous analyses in the Bonneville Unit Final EIS (Reclamation 1973) and in the Diamond Fork System FS-FEIS (CUWCD 1999a). (See Surface Water Hydrology Technical Report for the Utah Lake Drainage Basin Water Delivery System for more detail (CUWCD 2004a).)

Jordanelle Reservoir and the Provo River above Deer Creek Reservoir are not included in the impact area of influence because surface water hydrology studies documented in the Surface Water Hydrology Technical Report for the Utah Lake Drainage Basin Water Delivery System (CUWCD 2004a) indicate that the operation of the ULS alternatives would not change the operation of the reservoir or the Provo River from Jordanelle Reservoir to the inlet of Deer Creek Reservoir.

The following streams, reservoirs and lakes are in the impact area of influence:

- Provo River between Deer Creek Reservoir and Utah Lake
- Hobble Creek between Mapleton Springville Lateral and Utah Lake
- Spanish Fork River between Diamond Fork Creek and Utah Lake
- Jordan River from Utah Lake Outlet to below the Narrows
- Utah Lake

3.2.6 Methodology

3.2.6.1 Assumptions

The following assumptions were used in the baseline and alternative analysis modeling:

- The selected fifty-year data period (1950-1999) is representative of the possible future natural hydrologic cycle, including wet and dry years, that may occur over the life of the ULS. The use of a 50-year study period is typical for water supply planning projects. The period is representative of hydrologic conditions observed throughout the historic period, includes both extended wet and dry periods, and has better data available on streamflows and diversions than during years prior to 1950.

- In the development of natural flow hydrology for Utah Lake, it was necessary to differentiate between operational calls on Utah Lake and spills of excess water. In general, State Engineer records for water supply deliveries were utilized to define water called from storage. However, in certain years, the State Engineer recorded water supply deliveries in excess of the total volume of water rights (302,500 acre-feet). Operational analysis of water supplies from Utah Lake uses historical deliveries as a basis for estimating future demands for Utah Lake water. In defining water right calls and future Utah Lake demands, historical releases from Utah Lake exceeding the full water right volume of 302,500 acre-feet are assumed to be spills and thus would remain in the Lake in these operations studies, unless the lake was above Compromise Elevation, in which case water would be spilled in accordance with operation of the Utah Lake outlet structure.

- Historical releases associated with the 7,900 acre-feet of Indian Ford water acquired as part of the M&I System water supply would remain in the lake and be exchanged to Jordanelle Reservoir. DOI acquired 7,900 acre-feet of Central Utah Water Conservancy District (District) Utah Lake water rights in 2001. These water rights will be operated to benefit the water supply of the M&I System.

- Under the ULS alternatives, when District secondary water rights are part of the water supply of the alternative, historical demands associated with the secondary rights are reduced proportionally to the volume of rights being held in the lake. If Utah Lake is above compromise elevation or significantly above the baseline level, the full, baseline water right deliveries are assumed. When Utah Lake rights are being exchanged upstream to Jordanelle, they cannot also be used to deliver water downstream. However, if the rights are not needed to convert system storage in Jordanelle, the State Engineer would have the option of delivering this water to a user downstream, instead of exchanging them upstream. Delivering the water to a downstream user during wet years will tend to avoid Utah Lake levels that are higher than historical.

- The M&I System is assumed to be under full operation during the entire hydrologic period. The M&I System delivered 56,000 acre-feet of water in 2003 and is projected to reach full operation level of 107,500 acre-feet by 2009. With the M&I System is under full operation, it will produce baseline streamflow conditions for analysis of potential ULS impacts.

- The Utah Lake Distribution Plan, initiated by the State Engineer in 1992, is modeled for the full hydrologic period. Although the Distribution Plan was not included in historical (baseline) operations, its inclusion in future, simulated operations is necessary to show how the Utah Lake/Jordan River Commissioner will operate the lake under year 2015 conditions.

3.2.6.2 Impact Analysis Methodology

Water requirement studies were used to document demand for ULS water. The following models and spreadsheets were then used to estimate the hydrologic changes of operating the ULS:

- Strawberry Reservoir Spreadsheet Operations Model – to verify the non-impact of ULS operations on Strawberry Reservoir
- Spanish Fork River Spreadsheet Model – to track project and natural flows through the system and determine changes on Spanish Fork River based on SVP water calls estimated with PROSIM2000 and the Provo River Spreadsheet Model
- Hobble Creek Spreadsheet Model – to evaluate the changes of ULS supplemental water delivered to Hobble Creek
- PROSIM2000 Model – a prioritized water balance allocation calculator, to estimate baseline flows, water deliveries and storage on the Provo River, as well as calls on Strawberry to meet those demands
- Provo River Spreadsheet Model – to estimate alternative condition flows, water deliveries and storage on the Provo River
- Utah Lake Spreadsheet Model – to estimate alternative condition Utah Lake storage and outflows

PROSIM2000 was used to estimate baseline flows, water deliveries and reservoir storage on the Provo and Jordan rivers and in Utah Lake, as well as baseline use of Strawberry Reservoir water. Spreadsheet models were used to estimate alternative condition flows and water deliveries on the Provo and Jordan rivers, in Utah Lake, and in Deer Creek and Jordanelle reservoirs. Spreadsheet models were used to estimate baseline and alternative condition flows and water deliveries on the Spanish Fork River System and Hobble Creek based on Strawberry water use needs, estimated with PROSIM2000 and the Provo spreadsheet model.

3.2.6.2.1 Description. Surface water flow changes were estimated by comparing the average monthly flows predicted under the Proposed Action and other alternatives to baseline average monthly flows. Average flows and flow changes from baseline conditions were quantified for the following reaches:

- Provo River from Outlet of Deer Creek Reservoir to North Fork of Provo River
- Provo River from North Fork of Provo River to Olmsted Diversion Dam
- Provo River from Olmsted Diversion Dam to Murdock Diversion Dam
- Provo River from Murdock Diversion Dam to Interstate 15
- Provo River from Interstate 15 to Utah Lake
- Hobble Creek from Mapleton Springville Lateral to Utah Lake
- Spanish Fork River At Castilla Gage (between Diamond Fork Creek and Spanish Fork Diversion Dam)
- Spanish Fork River from Diamond Fork Creek to Spanish Fork Diversion Dam (Castilla gage)
- Spanish Fork River from Spanish Fork Diversion Dam to East Bench Diversion
- Spanish Fork River from East Bench Diversion to Mill Race Canal
- Spanish Fork River from Mill Race Canal to Lakeshore Diversion
- Jordan River from Outlet of Utah Lake to Jordan Narrows

Surface water changes on lakes and reservoirs were estimated by comparing the average monthly storage volume predicted under the Proposed Action and other alternatives to baseline average monthly storage. Average storage volumes and volume changes from baseline conditions were quantified for Deer Creek Reservoir and Utah Lake.

3.2.6.2.2 Verification and Calibration. The analyses and models used to evaluate changes resulting from the ULS alternatives were verified to demonstrate that they provide a reasonable representation of the physical systems being analyzed. The models were calibrated by comparing modeled historical conditions with actual observed historical values. To the extent that there were differences or uncertainties in the modeling parameters, these parameters were adjusted to achieve a better calibration with actual historical conditions.

3.2.7 Affected Environment (Baseline Conditions)

The affected environment is defined by the baseline conditions for the hydrologic features within the impact area of influence. The baseline conditions reflect historical precipitation and natural streamflows at the present level of completed project facilities, existing water contracts and petitions, water demand and existing operating criteria.

Table 3-1 shows the average monthly baseline streamflows for the rivers in the impact area of influence for the 50-year analysis period (1950-1999).

Table 3-1
Average Monthly, Dry Year, and Wet Year Streamflows (cfs) Under Baseline Conditions
Page 1 of 2

Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Annual Flow (ac-ft/yr)
Provo River From Outlet of Deer Creek Reservoir to North Fork of Provo River													
Average	147	110	112	132	138	205	279	743	871	628	568	440	264,774
Wet Years[1]	108	116	106	123	231	1,112	623	1,290	1,598	729	549	469	426,799
Dry Years[2]	125	121	118	140	129	134	206	458	358	456	480	310	183,875
Provo River From North Fork of Provo River to Olmsted Diversion Dam													
Average	161	125	123	143	148	216	300	801	938	674	595	461	283,666
Wet Years[1]	138	128	129	144	259	1,139	671	1,377	1,751	813	603	499	462,997
Dry Years[2]	131	133	128	148	136	141	216	475	368	471	488	327	191,616
Provo River From Olmsted Diversion Dam to Murdock Diversion Dam													
Average	137	70	57	54	68	145	243	740	859	472	386	344	216,482
Wet Years[1]	145	84	88	77	207	1,079	678	1,369	1,712	631	428	415	418,141
Dry Years[2]	94	53	42	39	39	39	90	303	253	154	193	183	89,817
Provo River From Murdock Diversion Dam to Interstate 15													
Average	88	72	59	55	70	147	199	476	527	182	149	134	130,503
Wet Years[1]	95	86	92	80	212	1,083	666	1,189	1,372	280	136	135	327,854
Dry Years[2]	68	55	43	40	40	40	72	105	91	72	115	96	50,687
Provo River From Interstate 15 to Utah Lake													
Average	32	76	56	51	64	142	168	347	374	42	4	6	82,237
Wet Years[1]	79	85	95	81	209	1,082	678	1,124	1,255	131	0	0	291,078
Dry Years[2]	14	49	34	33	34	31	13	0	22	6	52	1	17,293

Table 3-1
Average Monthly, Dry Year, and Wet Year Streamflows (cfs) Under Baseline Conditions
Page 2 of 2

Year Type	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Annual Flow (ac-ft/yr)
Hobble Creek From Mapleton Springville Lateral to Utah Lake													
Average	7	25	23	22	26	38	60	109	38	4	1	1	21,379
Wet Years[1]	13	36	33	32	58	78	202	346	183	28	11	10	62,124
Dry Years[2]	0	14	13	14	16	14	9	0	0	0	0	0	4,831
Jordan River From Outlet of Utah Lake to Jordan Narrows													
Average	251	155	196	248	314	435	566	849	922	919	792	584	377,033
Wet Years[1]	239	320	686	729	1,085	1,502	1,672	2,027	2,040	1,642	1,256	905	851,213
Dry Years[2]	227	16	16	5	6	6	123	476	565	592	440	228	164,233
Jordan River Below Jordan Narrows													
Average	48	83	133	189	239	331	349	252	194	72	40	32	118,146
Wet Years[1]	0	222	591	635	981	1,359	1,426	1,357	1,248	733	436	264	557,026
Dry Years[2]	0	0	0	0	0	0	0	0	0	0	0	0	0
Spanish Fork River From Diamond Fork Creek to Spanish Fork Diversion Dam (Castilla Gage)													
Average	158	191	201	215	248	285	425	740	645	546	457	258	264,195
Wet Years[1]	163	204	276	171	278	326	751	1,351	990	546	454	296	350,881
Dry Years[2]	132	190	174	214	243	259	345	492	544	380	356	188	212,581
Spanish Fork River From Spanish Fork Diversion Dam to East Bench Diversion													
Average	58	109	130	143	163	160	190	339	242	176	134	88	116,656
Wet Years[1]	39	96	181	74	126	90	269	770	414	146	90	65	142,735
Dry Years[2]	73	138	129	167	191	203	275	272	189	120	119	75	117,631
Spanish Fork River From East Bench Diversion to Mill Race Canal													
Average	54	109	130	143	163	159	182	295	187	127	93	70	103,308
Wet Years[1]	37	96	181	74	126	90	269	735	332	80	47	28	126,703
Dry Years[2]	69	138	129	167	191	203	260	244	145	95	94	69	108,673
Spanish Fork River From Mill Race Canal to Lake Shore Diversion													
Average	131	194	205	219	252	289	389	471	257	149	113	86	166,213
Wet Years[1]	141	207	279	174	283	331	755	1,164	499	87	66	74	245,003
Dry Years[2]	120	193	179	219	248	257	274	258	174	113	115	80	134,505
Spanish Fork River at Lake Shore Gage													
Average	125	195	212	226	260	295	387	448	229	125	92	78	161,126
Wet Years[1]	147	210	285	180	292	341	762	1,153	462	67	46	56	241,565
Dry Years[2]	110	192	188	229	257	266	266	246	157	99	97	75	131,404

Notes:
[1]The three wettest years (1952, 1983, 1986) were averaged to calculate the values shown in the table.
[2]The three driest years (1961, 1977, 1992) were averaged to calculate the values shown in the table.

The impact area of influence has been divided into major features for analysis purposes. Table 3-2 shows the major hydrologic features (reservoirs, ponds, rivers, and creeks) that are considered in the impact analysis, and describes potential causes of changes to these features.

Table 3-2
Major Hydrologic Features in the Impact Area of Influence

Hydrologic Features	Discussion
Provo River (Deer Creek Reservoir Outlet to Olmsted Diversion)	Would receive flows from Deer Creek Reservoir
Provo River (Olmsted Diversion to Utah Lake)	Would receive flows from middle Provo River and Spanish Fork-Provo Reservoir Canal Pipeline
Hobble Creek (Mapleton-Springville Lateral to Utah Lake)	Would receive flows from Mapleton-Springville Lateral Pipeline
Upper Spanish Fork River (Diamond Fork Creek to Spanish Fork Diversion)	Flows would be modified by operation of Spanish Fork Canyon Pipeline
Lower Spanish Fork River (Spanish Fork Diversion to Utah Lake)	Flows would be modified by operation of Spanish Fork Canyon Pipeline
Jordan River (Utah Lake outlet to Narrows)	Flows would be modified by operation of ULS as inflows to Utah Lake are changed and water rights exchanged
Deer Creek Reservoir	Would pass through flows from Jordanelle Reservoir
Utah Lake	Would receive surface flows from lower Spanish Fork River, Hobble Creek, and lower Provo River for exchange to storage in Jordanelle Reservoir

3.2.8 Environmental Consequences (Impacts)

This section presents the average monthly streamflows and changes for all the alternatives for each affected stream reach. See Chapter 4 of the Surface Water Hydrology Technical Report for the Utah Lake Drainage Basin Water Delivery System (CUWCD 2004a) for detailed information on proposed flows and baseline flows for each affected stream reach.

3.2.8.1 Significance Criteria

Significance criteria were not developed for surface water hydrology because the changes estimated by this analysis were used by other resource specialists to determine the significance of the impacts that flow changes would have on those resources. These resources include surface water quality, wetlands, aquatics, vegetation, wildlife, threatened and endangered species, and sensitive species.

3.2.8.2 Potential Impacts Eliminated From Further Analysis

3.2.8.2.1 Potential Impacts on Existing Water Rights. Protection of these water rights was incorporated into the formulation and analysis of the Proposed Action and other alternatives. For example, flows in the Provo River are assessed using the PROSIM2000 model and subsequent spreadsheet models, which included protection of existing water rights as a model constraint.

3.2.8.2.2 Potential Impacts on Sixth Water and Diamond Fork Creeks. Potential impacts on Sixth Water and Diamond Fork creeks had been raised under the topic of potential impacts on area streams from the ULS. Sixth Water and Diamond Fork creeks are not within the impact area of influence for the ULS analysis. Flows in these creeks would remain as documented in the Diamond Fork System FS-EIS (CUWCD 1999a).

3.2.8.2.3 Potential Impacts on Higher Flows and Flooding. M&I water supply operations, reservoir releases and deliveries tend to be lower during floods. ULS alternative flows fall below the channel capacities of the stream channels in which they are conveyed. Much of the water delivered by the ULS alternatives would be conveyed in pipelines, thereby somewhat reducing peak flows in natural stream channels. Therefore, operation of the ULS is not likely to increase flood flows or adversely impact bank stability. Operations may result in a minor decrease in flooding. Habitat, fisheries and water quality impacts are considered in subsequent sections.

3.2.8.2.4 Potential Construction Impacts. Potential construction impacts on surface water quantities could occur through the use of surface water supplies for construction activities. The water would be used primarily for dust control, but water would be used for concrete mixing and backfill compaction. Water supplies for construction activities would be obtained from sources approved by the District for which the District would either purchase the water or obtain the necessary water rights. The total construction water required for any alternative would be less than 1,000 acre-feet. Based on the limited amount of construction water required and the need to either purchase or acquire water rights for this water, the potential construction impact of the Proposed Action and other alternatives on surface water supplies would not be measurable.

3.2.8.2.5 Potential Impacts on Utah Lake and Deer Creek Reservoir Tributaries. Utah Lake and Deer Creek **Reservoir** tributaries (other than Provo River, Hobble Creek and Spanish Fork River) are outside the impact area of influence and would not be affected by the ULS alternatives.

3.2.8.2.6 Potential Impacts on Reservoirs and Lakes. The average Deer Creek Reservoir volume under any of the alternatives is 97,900 acre-feet. The pattern of storage tends to be very similar to baseline. The minimum storage is the same as under baseline conditions.

The maximum average Utah Lake volume under any of the alternatives is 719,700 acre-feet, which is 34,900 acre-feet (5 percent) more than under baseline conditions. The pattern of storage tends to be very similar to baseline. The minimum storage is 103,000 acre-feet more than under baseline conditions.

Changes in reservoir storage and water surface elevation resulting from operation of the Proposed Action and other alternatives are negligible (see Surface Water Hydrology Technical Report for the Utah Lake Drainage Basin Water Delivery System (CUWCD 2004a)).

What impacts would occur from each ULS water delivery concept on Utah Lake emergent vegetation, water quality, and evaporation?

The ULS alternatives do not have a significant effect on Utah Lake levels or evaporation. Water quality and vegetation impacts resulting from the ULS alternatives are considered in subsequent sections.

3.2.8.2.7 Potential Impacts on Jordan River Below Jordan Narrows. Under the ULS alternatives, Utah Lake water rights acquired by DOI would be used in a coordinated fashion with deliveries of Bonneville Unit water from Strawberry to exchange water to Jordanelle Reservoir. When it serves the needs of the M&I System project, DOI or the District would notify the State Engineer as to how it intends to use its rights, and the State Engineer (via the Jordan River Commissioner) would operate Utah Lake accordingly. Unless it has a call on the water below Utah Lake, neither DOI nor the District would have any control on how the outflow from the lake is regulated. The River Commissioner operates the lake outlet to meet water user calls and to release water when Utah Lake is above the Compromise Elevation.

Because of this operation by the River Commissioner, the ULS alternatives would not affect stream flows on the Jordan River below Jordan Narrows. If DOI and the District exchange and convert more of their Utah Lake water rights to Jordanelle, bring less water from Strawberry, and deliver less water to a user below Utah Lake (compared with baseline), this would affect flows between Utah Lake and the Narrows, but flows below the Narrows would be unchanged. All releases from Utah Lake are determined by the State Engineer's representative, include no Bonneville Unit M&I water, and the State Engineer's representative's decision process is entirely independent from the ULS project operations.

3.2.8.2.8 Other Impact Issues

What would be the impact on the Jordanelle–Deer Creek Operating Agreement?

The hydrologic analysis tools used in this study take into account critical elements of the Deer Creek Reservoir – Jordanelle Reservoir Operating Agreement. Because the ULS alternatives do not significantly affect the storage of water in Deer Creek or Jordanelle, the ULS alternatives would not affect the operating agreement.

How much water could be conserved for Mapleton and Springville if they could tap into the ULS pipeline in exchange for water in their open canal system?

The proposed Section 207 water conservation project to pipe the Mapleton-Springville Lateral Canal is assumed to conserve 3,000 acre-feet of seepage water per year.

3.2.8.3 Spanish Fork Canyon-Provo Reservoir Canal Alternative (Proposed Action)

3.2.8.3.1 Operations Phase. The following sections describe average monthly streamflows for the Proposed Action and changes from baseline conditions for each affected stream reach. Table 3-3 summarizes average streamflows, differences and percent changes.

Table 3-3
Modeled Average Streamflows on the Provo River, Jordan River, Hobble Creek, and Spanish Fork River
Spanish Fork Canyon-Provo Reservoir Canal Alternative (Proposed Action)

Stream & Reach		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Avg
		Monthly Flow (cfs)												
Provo River from Outlet of Deer Creek Reservoir to North Fork of Provo River	Baseline	147	110	112	132	138	205	279	743	871	628	568	440	365
	Alternative	165	106	105	105	119	186	305	798	904	648	542	448	370
	Difference	18	-4	-7	-27	-19	-19	26	55	33	20	-26	8	5
	Percent Change	12%	-4%	-6%	-20%	-14%	-9%	9%	7%	4%	3%	-5%	2%	1%
Provo River from North Fork of Provo River to Olmsted Diversion Dam	Baseline	161	125	123	143	148	216	300	801	938	674	595	461	392
	Alternative	178	121	117	115	129	197	327	856	972	694	569	469	396
	Difference	17	-4	-6	-28	-19	-19	27	55	34	20	-26	8	4
	Percent Change	11%	-3%	-5%	-20%	-13%	-9%	9%	7%	4%	3%	-4%	2%	1%
Provo River from Olmsted Diversion Dam to Murdock Diversion Dam	Baseline	137	70	57	54	68	145	243	740	859	472	386	344	299
	Alternative	114	75	70	70	82	155	287	765	813	430	299	281	283
	Difference	-23	5	13	16	14	10	44	25	-46	-42	-87	-63	-16
	Percent Change	-17%	7%	23%	30%	21%	7%	18%	3%	-5%	-9%	-23%	-18%	-5%
Provo River from Murdock Diversion Dam to Interstate 15	Baseline	88	72	59	55	70	147	199	476	527	182	149	134	180
	Alternative	129	90	77	74	86	158	251	553	563	231	196	182	216
	Difference	41	18	18	19	16	11	52	77	36	49	47	48	36
	Percent Change	47%	25%	31%	35%	23%	7%	26%	16%	7%	27%	32%	36%	20%
Provo River from Interstate 15 to Utah Lake	Baseline	32	76	56	51	64	142	168	347	374	42	4	6	114
	Alternative	77	94	75	69	81	153	222	445	433	110	61	62	157
	Difference	45	18	19	18	17	11	54	98	59	68	57	56	43
	Percent Change	141%	24%	34%	35%	27%	8%	32%	28%	16%	162%	1425%	933%	38%
Jordan River from Outlet of Utah Lake to Jordan Narrows	Baseline	251	155	196	248	314	435	566	849	922	919	792	584	520
	Alternative	228	152	192	242	305	412	542	804	867	846	702	508	484
	Difference	-23	-3	-4	-6	-9	-23	-24	-45	-55	-73	-90	-76	-36
	Percent Change	-9%	-2%	-2%	-2%	-3%	-5%	-4%	-5%	-6%	-8%	-11%	-13%	-7%
Hobble Creek From Mapleton Springville Lateral to Utah Lake	Baseline	7	25	23	22	26	38	60	109	38	4	1	1	30
	Alternative	20	36	33	32	35	47	100	145	65	16	13	11	46
	Difference	13	11	10	10	9	9	40	36	27	12	12	10	16
	Percent Change	186%	44%	43%	45%	35%	24%	67%	33%	71%	300%	1200%	1000%	53%
Spanish Fork from Diamond Fork to Spanish Fork Diversion (Castilla Gage)	Baseline	158	191	201	215	248	285	425	740	645	546	457	258	365
	Alternative	134	130	124	125	138	171	296	578	452	356	305	180	250
	Difference	-24	-61	-77	-90	-110	-114	-129	-162	-193	-190	-152	-78	-115
	Percent Change	-15%	-32%	-38%	-42%	-44%	-40%	-30%	-22%	-30%	-35%	-33%	-30%	-32%

Table 3-3
Modeled Average Streamflows on the Provo River, Jordan River, Hobble Creek, and Spanish Fork River
Spanish Fork Canyon-Provo Reservoir Canal Alternative (Proposed Action)

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Stream & Reach		Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Avg
		Monthly Flow (cfs)												
Spanish Fork River from Spanish Fork Diversion Dam to East Bench Diversion	Baseline	58	109	130	143	163	160	190	339	242	176	134	88	161
	Alternative	34	48	53	54	53	46	60	189	99	54	43	29	64
	Difference	-24	-61	-77	-89	-110	-114	-130	-150	-143	-122	-91	-59	-97
	Percent Change	-41%	-56%	-59%	-62%	-67%	-71%	-68%	-44%	-59%	-69%	-68%	-67%	-60%
Spanish Fork River from East Bench Diversion to Mill Race Canal	Baseline	54	109	130	143	163	159	182	295	187	127	93	70	143
	Alternative	31	48	53	54	53	46	53	147	51	17	14	15	49
	Difference	-23	-61	-77	-89	-110	-113	-129	-148	-136	-110	-79	-55	-94
	Percent Change	-43%	-56%	-59%	-62%	-67%	-71%	-71%	-50%	-73%	-87%	-85%	-79%	-66%
Spanish Fork River from Mill Race Canal to Lake Shore Gage	Baseline	131	194	205	219	252	289	389	471	257	149	113	86	229
	Alternative	108	133	128	130	143	175	260	324	121	38	35	31	135
	Difference	-23	-61	-77	-89	-109	-114	-129	-147	-136	-111	-78	-55	-94
	Percent Change	-18%	-31%	-38%	-41%	-43%	-39%	-33%	-31%	-53%	-74%	-69%	-64%	-41%

3.2.8.3.1.1 Provo River From Outlet of Deer Creek Reservoir to North Fork of Provo River. The average streamflow is 370 cfs, which is 5 cfs more than under baseline conditions. On an annual basis, flows would increase by 1 percent from baseline conditions. Monthly flows would increase from April through July and then September and October (from 2 to 12 percent). These higher flows are the result of environmental commitments associated with the June sucker and minimum flows below Deer Creek Dam. As a result of these environmental commitments, there is a slight decrease in diversions through the Salt Lake Aqueduct which are re-diverted at Olmsted and moved back into the Salt Lake Aqueduct using the Transfer Pump and Pipeline. Average monthly flows would decrease from November through March and in August (4 to 20 percent) while still maintaining the required minimum flows during these months.

3.2.8.3.1.2 Provo River From North Fork of Provo River to Olmsted Diversion Dam. The average streamflow is 396 cfs, which is 4 cfs more than under baseline conditions. On an annual basis, flows would remain essentially the same, increasing by one percent from baseline conditions. Monthly flows would increase from April through July and September and October (from 2 to 11 percent), with the additional releases resulting from the above described flow changes. Flows would decrease from November through March and in August (3 to 20 percent), with the resulting flows slightly above the required minimum flows during these months.

3.2.8.3.1.3 Provo River From Olmsted Diversion Dam to Murdock Diversion Dam. On an annual basis, flows would remain essentially the same, being reduced by 5 percent from baseline conditions. Monthly flows would increase from January through May (from 3 to 30 percent), with the additional flows resulting from the additional releases resulting from the June sucker attraction operations. Flows would decrease from June through October (5 to 23 percent). Flows would not change in November and December.

3.2.8.3.1.4 Provo River From Murdock Diversion Dam to Interstate 15. The average streamflow is 216 cfs, which is 36 cfs (20 percent) more than under baseline conditions. Monthly flows would increase in all months of the year (from 7 to 47 percent), with the additional flows resulting from ULS releases and flow changes associated with providing June sucker attraction flows. These changes would be caused by the delivery of 16,000 acre-feet per year of ULS water to supplement the lower Provo River.

3.2.8.3.1.5 Provo River From Interstate 15 to Utah Lake. The average streamflow is 157 cfs, which is 43 cfs (38 percent) more than under baseline conditions. Monthly flows would increase in all months of the year (from 8 to 1,425 percent), with the additional releases resulting from ULS releases of water towards the 75-cfs target streamflow and providing June sucker attraction flows and Utah Reclamation Mitigation and Conservation Commission (Mitigation Commission) releases. The very large percentage increases in August and September, 1,425 and 933 percent respectively, are a result of the fact that in the baseline, Provo River downstream from Interstate 15 is nearly dry during those two months, so increasing the flow for the 75-cfs target flow in the reach results in very large percentage increases.

3.2.8.3.1.6 Hobble Creek From Mapleton-Springville Lateral to Utah Lake. The average streamflow is 46 cfs, which is 16 cfs (53 percent) more than under baseline conditions. Monthly flows would increase in all months of the year (from 24 to 1200 percent), with the additional releases resulting from providing June sucker attraction flows and summer-time supplemental flows. The very large percentage increases in July through October (186 to 1,200 percent) are a result of the fact that in the baseline Hobble Creek downstream from the Mapleton-Springville Lateral is nearly dry during those months, so even modest increases of 12 to 13 cfs result in very large percentage increases.

3.2.8.3.1.7 Spanish Fork River From Diamond Fork Creek to Spanish Fork Diversion Dam (Castilla Gage). The average streamflow is 250 cfs, which is 115 cfs (32 percent) less than under baseline conditions. There are significant changes in individual monthly and average monthly flows. Flows would decrease in all months of the year (15 to 44 percent). The reductions in flow occur because most project flows would be conveyed in the Spanish Fork Canyon Pipeline and therefore would no longer flow in the Spanish Fork River.

3.2.8.3.1.8 Spanish Fork River From Spanish Fork Diversion Dam to East Bench Diversion. The average streamflow is 64 cfs, which is 97 cfs (60 percent) less than under baseline conditions. There are changes in individual monthly and average monthly flows. Flows would decrease in all months of the year (from 41 to 71 percent). The reductions in flow occur because project flows that in baseline are conveyed to Utah Lake in the Spanish Fork River would be contained in project pipelines (Spanish Fork Canyon Pipeline, Spanish Fork–Provo Reservoir Canal Pipeline, Spanish Fork–Santaquin Pipeline, and Mapleton–Springville Lateral Pipeline).

3.2.8.3.1.9 Spanish Fork River From East Bench Diversion to Mill Race Canal. The average streamflow is 49 cfs, which is 94 cfs (66 percent) less than under baseline conditions. There are changes in individual monthly and average monthly flows, particularly in the summer. Flows would decrease in all months of the year (from 50 to 87 percent). The reductions in flow occur because project flows that in baseline are conveyed to Utah Lake in Spanish Fork River would be contained in project pipelines (Spanish Fork Canyon Pipeline, Spanish Fork–Provo Reservoir Canal Pipeline, Spanish Fork–Santaquin Pipeline, and Mapleton Springville Lateral Pipeline).

3.2.8.3.1.10 Spanish Fork River From Mill Race Canal to Lakeshore Gage. The average streamflow is 135 cfs, which is 94 cfs (41 percent) less than under baseline conditions. There are changes in individual monthly and average monthly flows, mostly in the summer. Flows would decrease all months of the year (from 18 to 74 percent). The reductions in flow occur because project flows that in baseline are conveyed to Utah Lake in Spanish Fork River would be contained in project pipelines (Spanish Fork Canyon Pipeline, Spanish Fork–Provo Reservoir Canal Pipeline, Spanish Fork–Santaquin Pipeline, and Mapleton Springville Lateral Pipeline).

3.2.8.3.1.11 Jordan River From Outlet of Utah Lake to Jordan Narrows. The average streamflow is 484 cfs, which is 36 cfs (7 percent) less than under baseline conditions. There are changes in individual monthly and average monthly flows in all months of the year. Monthly flows would change (by 2 to 13 percent), because part of the District's secondary water rights would be exchanged to Jordanelle Reservoir.

3.2.8.3.2 Summary of Alternative Impacts. Stream flow and river stage impacts associated with the Proposed Action are confined to general increases on the lower Provo River below Olmsted and Hobble Creek and decreases on the Spanish Fork River.

3.2.8.4 Bonneville Unit Water Alternative

3.2.8.4.1 Operations Phase. The following sections describe average monthly streamflows for the Bonneville Unit Water Alternative, and changes from baseline conditions for each affected stream reach. Table 3-4 summarizes average streamflows, differences, and percent changes.

Table 3-4
Modeled Average Streamflows on the Provo River, Jordan River, Hobble Creek, and Spanish Fork River
Bonneville Unit Water Alternative

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		Monthly Flow (cfs)												
Stream & Reach		**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Avg**
Provo River from Outlet of Deer Creek Reservoir to North Fork of Provo River	Baseline	147	110	112	132	138	205	279	743	871	628	568	440	365
	Alternative	165	106	105	105	119	186	305	798	904	648	542	448	370
	Difference	18	-4	-7	-27	-19	-19	26	55	33	20	-26	8	5
	Percent Change	12%	-4%	-6%	-20%	-14%	-9%	9%	7%	4%	3%	-5%	2%	1%
Provo River from North Fork of Provo River to Olmsted Diversion Dam	Baseline	161	125	123	143	148	216	300	801	938	674	595	461	392
	Alternative	178	121	117	115	129	197	327	856	972	694	569	469	396
	Difference	17	-4	-6	-28	-19	-19	27	55	34	20	-26	8	4
	Percent Change	11%	-3%	-5%	-20%	-13%	-9%	9%	7%	4%	3%	-4%	2%	1%
Provo River from Olmsted Diversion Dam to Murdock Diversion Dam	Baseline	137	70	57	54	68	145	243	740	859	472	386	344	299
	Alternative	113	70	57	55	72	148	287	765	813	430	299	281	283
	Difference	-24	0	0	1	4	3	44	25	-46	-42	-87	-63	-16
	Percent Change	-18%	0%	0%	2%	6%	2%	18%	3%	-5%	-9%	-23%	-18%	-5%
Provo River from Murdock Diversion Dam to Interstate 15	Baseline	88	72	59	55	70	147	199	476	527	182	149	134	180
	Alternative	93	72	59	56	73	150	242	512	544	213	166	145	194
	Difference	5	0	0	1	3	3	43	36	17	31	17	11	14
	Percent Change	6%	0%	0%	2%	4%	2%	22%	8%	3%	17%	11%	8%	8%
Provo River from Interstate 15 to Utah Lake	Baseline	32	76	56	51	64	142	168	347	374	42	4	6	114
	Alternative	41	76	56	52	68	145	213	404	414	93	30	26	135
	Difference	9	0	0	1	4	3	45	57	40	51	26	20	21
	Percent Change	28%	0%	0%	2%	6%	2%	27%	16%	11%	121%	650%	333%	18%

Table 3-4
Modeled Streamflows on the Provo River, Jordan River, Hobble Creek, and Spanish Fork River
Bonneville Unit Water Alternative

Stream & Reach		**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Avg**
		Monthly Flow (cfs)												
Jordan River from Outlet of Utah Lake to Jordan Narrows	Baseline	251	155	196	248	314	435	566	849	922	919	792	584	520
	Alternative	251	154	196	248	314	433	573	842	919	913	796	584	520
	Difference	0	-1	0	0	0	-2	7	-7	-3	-6	4	0	0
	Percent Change	0	-1%	0	0	0	0	1%	-1%	0	-1%	1%	0	0
Hobble Creek From Mapleton Springville Lateral to Utah Lake	Baseline	7	25	23	22	26	38	60	109	38	4	1	1	30
	Alternative	38	55	53	52	56	68	102	147	72	35	33	32	62
	Difference	31	30	30	30	30	30	42	38	34	31	32	31	32
	Percent Change	443%	120%	130%	136%	115%	79%	70%	35%	89%	775%	3200%	3100%	107%
Spanish Fork from Diamond Fork to Spanish Fork Diversion (Castilla Gage)	Baseline	158	191	201	215	248	285	425	740	645	546	457	258	365
	Alternative	192	256	246	247	272	293	417	578	452	356	305	180	316
	Difference	34	65	45	32	24	8	-8	-162	-193	-190	-152	-78	-49
	Percent Change	22%	34%	22%	15%	10%	3%	-2%	-22%	-30%	-35%	-33%	-30%	-13%
Spanish Fork River from Spanish Fork Diversion Dam to East Bench Diversion	Baseline	58	109	130	143	163	160	190	339	242	176	134	88	16
	Alternative	93	174	175	175	187	168	181	189	99	54	43	29	130
	Difference	35	65	45	32	24	8	-9	-150	-143	-122	-91	-59	-31
	Percent Change	60%	60%	35%	22%	15%	5%	-5%	-44%	-59%	-69%	-68%	-67%	-19%
Spanish Fork River from East Bench Diversion to Mill Race Canal	Baseline	54	109	130	143	163	159	182	295	187	127	93	70	143
	Alternative	90	174	175	175	187	168	174	147	51	17	14	15	115
	Difference	36	65	45	32	24	9	-8	-148	-136	-110	-79	-55	-28
	Percent Change	67%	60%	35%	22%	15%	6%	-4%	-50%	-73%	-87%	-85%	-79%	-20%
Spanish Fork River from Mill Race Canal to Lake Shore Gage	Baseline	131	194	205	219	252	289	389	471	257	149	113	86	229
	Alternative	167	259	250	252	276	297	381	324	121	38	35	31	202
	Difference	36	65	45	33	24	8	-8	-147	-136	-111	-78	-55	-27
	Percent Change	27%	34%	22%	15%	10%	3%	-2%	-31%	-53%	-74%	-69%	-64%	-12%

3.2.8.4.1.1 Provo River From Outlet of Deer Creek Reservoir to North Fork of Provo River. On an annual basis, flows would remain essentially the same, increasing by 1 percent from baseline conditions. Monthly flows would increase from April through July and September and October (from 3 to 12 percent), with the additional releases resulting from the related actions associated with increasing June sucker attraction flows. Flows would decrease from November through March and in August (4 to 20 percent), with the resulting flows slightly above the required minimum flows during these months.

3.2.8.4.1.2 Provo River From North Fork of Provo River to Olmsted Diversion Dam. On an annual basis, flows would remain essentially the same, increasing by 1 percent from baseline conditions. Monthly flows would increase from April through July and September and October (from 2 to 11 percent), with the additional releases resulting from the need to maintain minimum streamflows. Flows would decrease from November through March and in August (3 to 20 percent), with the resulting flows slightly above the required minimum flows during these months.

3.2.8.4.1.3 Provo River From Olmsted Diversion Dam to Murdock Diversion Dam. The average streamflow is 283 cfs, which is 16 cfs (5 percent) less than under baseline conditions. Monthly flows would increase from November through May (from 0 to 18 percent), with the additional releases resulting from the June sucker attraction operations. Flows would decrease from June through October (5 to 23 percent).

3.2.8.4.1.4 Provo River From Murdock Diversion Dam to Interstate 15. The average streamflow is 194 cfs, which is 14 cfs (8 percent) less than under baseline conditions. There are changes in individual monthly and average monthly flows. Monthly flows would increase in all months of the year (from 0 to 22 percent), with the additional releases resulting from meeting the 75-cfs target streamflow and providing June sucker attraction flows.

3.2.8.4.1.5 Provo River From Interstate 15 to Utah Lake. The average streamflow is 135 cfs, which is 21 cfs (18 percent) greater than under baseline conditions. There are changes in individual monthly and average monthly flows. Monthly flows would increase in all months of the year (from 0 to 650 percent), with the additional releases resulting from increasing flow toward the 75-cfs target streamflow and providing June sucker attraction flows. The very large percentage increases in August and September, 650 and 333 percent respectively, are a result of the fact that in the baseline Provo River downstream from Interstate 15 is nearly dry during those two months, so increasing for the 75-cfs target flow in the reach results in very large percentage increases.

3.2.8.4.1.6 Hobble Creek From Mapleton-Springville Lateral to Utah Lake. The average streamflow is 62 cfs, which is 32 cfs (107 percent) more than under baseline conditions. There are changes in individual monthly and average monthly flows. Monthly flows would increase in all months of the year (from 35 to 3,200 percent), with the additional releases resulting from providing June sucker attraction flows and other supplemental water. The very large percentage increases in July through October (443 to 3,200 percent) are a result of the fact that in the baseline Hobble Creek downstream from Mapleton Springville Later is nearly dry during those months, so even a increases of around 30 cfs result in very large percentage increases.

3.2.8.4.1.7 Spanish Fork River From Diamond Fork Creek to Spanish Fork Diversion Dam (Castilla Gage). The average streamflow is 316 cfs, which is 49 cfs (13 percent) less than under baseline conditions. There are changes in individual monthly and average monthly flows. Flows from April to September would decrease (2 to 35 percent). The reductions in flow occur because project flows would be conveyed in the Spanish Fork Canyon Pipeline and therefore would not flow in the Spanish Fork River. Flows from October to March would increase (3 to 34 percent).

3.2.8.4.1.8 Spanish Fork River From Spanish Fork Diversion Dam to East Bench Diversion. The average streamflow is 130 cfs, which is 31 cfs (19 percent) less than under baseline conditions. There are changes in individual monthly and average monthly flows. Flows from April to September would decrease (4 to 69 percent). The reductions in flow occur because certain project flows that are conveyed to Utah Lake in Spanish Fork River would be contained in the Mapleton Springville Lateral Pipeline. Flows from October to March would increase (5 to 60 percent).

3.2.8.4.1.9 Spanish Fork River From East Bench Diversion to Mill Race Canal. On an annual basis, flows would decrease 20 percent from baseline conditions. Flows would decrease in April through September (from 4 to 87 percent). The reductions in flow occur because certain project flows that are conveyed to Utah Lake in Spanish Fork River would be contained in the Mapleton Springville Lateral Pipeline. Flows would increase in October through March (6 to 67 percent).

3.2.8.4.1.10 Spanish Fork River From Mill Race Canal to Lakeshore Gage. On an annual basis, flows would decrease 12 percent from baseline conditions. Flows would decrease in April through September (from 2 to 74 percent). The reductions in flow occur because certain project flows that are conveyed to Utah Lake in Spanish Fork River would be contained in the Mapleton Springville Lateral Pipeline. Flows would increase in October through March (3 to 34 percent).

3.2.8.4.1.11 Jordan River From Outlet of Utah Lake to Jordan Narrows. The average streamflow is 520 cfs, which would be no change from baseline conditions. There are changes in individual monthly and average monthly flows. Monthly flows would decrease in May through September (2 to 7 percent) and increase in April (7 percent) because of holding District secondary water rights in Utah Lake for exchange to Jordanelle Reservoir.

3.2.8.4.2 Summary of Alternative Impacts. Significant stream flow and river stage impacts associated with this alternative are confined to general increases on the lower Provo River below Olmsted and Hobble Creek and decreases on the Spanish Fork River.

3.2.8.5 No Action Alternative

3.2.8.5.1 Operations Phase. The changes in flows on the following reaches are exactly the same as under the Bonneville Unit Water Alternative (see Table 3-4).

- Provo River from outlet of Deer Creek Reservoir to North Fork of Provo River (Section 3.2.8.4.1.1)
- Provo River from North Fork of Provo River to Olmsted Diversion Dam (Section 3.2.8.4.1.2)
- Provo River from Olmsted Diversion Dam to Murdock Diversion Dam (Section 3.2.8.4.1.3)
- Provo River from Murdock Diversion Dam to Interstate 15 (Section 3.2.8.4.1.4)
- Provo River from Interstate 15 to Utah Lake (Section 3.2.8.4.5)

There are no changes in flows on the following reaches compared to baseline (see Table 3-1).

- Hobble Creek from Mapleton Springville Lateral to Utah Lake
- Spanish Fork River from Diamond Fork Creek to Spanish Fork Diversion Dam (Castilla Gage)
- Spanish Fork River from Spanish Fork Diversion Dam to East Bench Diversion
- Spanish Fork River from East Bench Diversion to Mill Race Canal
- Spanish Fork River from Mill Race Canal to Lakeshore Diversion

3.2.8.5.1.1 Jordan River From Outlet of Utah Lake to Jordan Narrows. On an annual basis, flows would be very slightly (1 percent) higher than baseline conditions. Estimated flow changes are the result of routing the June sucker attraction flows and Mitigation Commission water through Utah Lake. Because these changes are so small and because of the large storage volume of the lake, actual outflow changes would be unmeasurable. Utah Lake is operated by the State Engineer and the operating decision process is entirely independent from ULS.

3.2.8.5.2 Summary of Alternative Impacts. Streamflow and river stage changes associated with the No Action Alternative are confined to general increases on the lower Provo River from Olmsted Diversion to Utah Lake.

3.3 Surface Water Quality

3.3.1 Introduction

This analysis addresses potential impacts on surface water quality from operation of the Proposed Action and other alternatives.

3.3.2 Issues Raised In Scoping Meetings

The following issues and concerns were identified during the public and agency scoping process:

- What impacts would occur on the upper Strawberry River as a result of constructing a pipeline from the proposed pump station to Daniels Pass?
- What would be the impacts of constructing the pipeline along Highway 6 and within the communities in Utah County?
- What would be the impacts of possible catastrophic failure of the pipeline through Utah Lake?
- What impacts would occur on water quality under each of the ULS concepts?
- What water quality impacts would occur from passing Strawberry Reservoir water through Deer Creek Reservoir?
- What impacts would occur of each ULS water delivery concept on Utah Lake emergent vegetation, water quality, and evaporation?
- What would be the impacts of the ULS water delivery concepts on pollution of surface water and groundwater; habitat destruction, fragmentation and alteration (aquatic and terrestrial); and groundwater depletion?
- What would be the short-term impacts of construction of a pipeline from Strawberry Reservoir to Daniels Pass, with particular concern for water quality, sediment yield, noxious weed invasion, and ORV use of disturbed sites?
- What would be the impacts of constructing a pipeline along Daniels Creek on riparian habitat, water quality and transportation networks?
- What impacts would occur on water quality and energy usage from delivering water from the Spanish Fork River?
- What would be the impacts on channel stability, wildlife habitats, and sediment transport?
- What would be impacts on water quality in Utah Lake and the Jordan River, including the effects of disturbing sediments that may contain heavy metals or nutrients, from laying the pipeline across Utah Lake?
- What would be the impacts of the ULS on Jordan River and Great Salt Lake wetland habitats and water quality?
- What would be the impacts on Utah Lake from a pipeline rupture, since the area is in a zone of high earthquake risk?
- What would be the impacts of the ULS water delivery concepts on pollution of surface water and groundwater and groundwater depletion?
- What would the impacts be on water quality from Concept 1?
- What would be the impacts of each ULS water delivery concept on Utah Lake emergent vegetation, water quality, and evaporation?
- What would be the impacts of the ULS water delivery concepts on pollution of surface water and groundwater?
- What would be the impacts on channel stability, wildlife habitats, and sediment transport?
- What impacts would occur on the Utah Lake ecosystem in terms of water quality?
- What would be the impacts of imported water on water quality in Utah Lake?

- What would be the impact on Utah Lake water quality from the No Action Alternative?

3.3.3 Scoping Issues Eliminated From Further Analysis

The following issues were eliminated from further analysis because three alternatives that would have delivered Strawberry Reservoir water to Deer Creek Reservoir, have been eliminated from further analysis. The Strawberry Reservoir-Daniels Summit Alternative, which included a 12.5-mile long steel pipeline from Strawberry Reservoir to Daniels Summit and discharge of water into Daniels Creek for conveyance to Deer Creek Reservoir, was eliminated from further analysis (see Chapter 1, Section 1.11.6). The Upper Strawberry River Basin Pipeline Alternative, which included 8-miles of steel pipeline across wetlands in the upper Strawberry River basin, was eliminated from further analysis (see Chapter 1, Section 1.11.7). The Strawberry Reservoir-Deer Creek Reservoir Alternative, which included construction of a pipeline from Strawberry Reservoir across Daniels Pass and down Daniels Canyon to the Provo River above Deer Creek Reservoir, was eliminated from further analysis (see Chapter 1, Section 1.11.8).

What impacts would occur on the upper Strawberry River as a result of constructing a pipeline from the proposed pump station to Daniels Pass?

What water quality impacts would occur from passing Strawberry Reservoir water through Deer Creek Reservoir?

What would be the short-term impacts of construction of a pipeline from Strawberry Reservoir to Daniels Pass, with particular concern for water quality, sediment yield, noxious weed invasion, and ORV use of disturbed sites?

What would be the impacts of constructing a pipeline along Daniels Creek on riparian habitat, water quality and transportation networks?

What would the impacts be on water quality from Concept 1? [Concept 1 was the Strawberry Reservoir-Deer Creek Reservoir Pipeline during early scoping]

The following issues were eliminated from further analysis because the Spanish Fork-Bluffdale Alternative, which included construction of a pipeline from Lincoln Point across Utah Lake to its western shore, was eliminated from further analysis (see Chapter 1, Section 1.11.1).

What would be the impacts of possible catastrophic failure of the pipeline through Utah Lake?

What would be impacts on water quality in Utah Lake and the Jordan River, including the effects of disturbing sediments that may contain heavy metals or nutrients, from laying the pipeline across Utah Lake?

What would be the impacts on Utah Lake from a pipeline rupture, since the area is in a zone of high earthquake risk?

3.3.4 Issues Addressed in the Impact Analysis

All the issues identified in Section 3.3.2, with the exception of those listed in Section 3.3.3, are addressed in this section.

3.3.5 Description of Impact Area of Influence

The surface water quality impact area of influence includes each of the streams, lakes, and reservoirs that would be affected by the construction or operation of the project alternatives. Map 3-2 shows the overall ULS impact area of influence. The following water bodies are included in the impact area of influence.

3.3.5.1 Spanish Fork Canyon–Provo Reservoir Canal (Proposed Action) and Bonneville Unit Water Alternatives

- Jordan River (From Utah Lake outlet to the Narrows)
- Utah Lake
- Provo River between Murdock Diversion and Utah Lake
- Hobble Creek between Mapleton-Springville Lateral and Utah Lake
- Spanish Fork River between Diamond Fork Creek and Utah Lake

3.3.5.2 No Action Alternative

- Utah Lake
- Spanish Fork River between Diamond Fork Creek and Utah Lake

3.3.6 Methodology

A detailed description of the methodology used in the impact analysis is located in the Surface Water Quality Technical Report for the Utah Lake Drainage Basin Water Delivery System (CUWCD 2004b).

3.3.6.1 Assumptions

The following key assumptions were made for the surface water quality impact analysis:

- Data obtained from USGS, EPA, NOAA and the Utah Division of Water Quality were adequately reviewed for quality by the respective organizations.

- Water quality data from the past 10 years adequately represents current conditions. The Utah Division of Water Quality recommended that the water quality analysis be performed during the period 1990 through 1999.

- The U.S. Fish and Wildlife Service recommended that the water quality analysis not use selenium data prior to 1996 because of analytical techniques resulting in too many non-detect values. A new analytical technique was used starting in early 1996. Therefore, the selenium data from January 1996 through July 2003 is assumed to be representative of the historic water quality conditions.

- Non-detect data values were assumed to equal half the detection limit for a subject water quality characteristic. For a water quality characteristic of concern, a range of typical concentrations is derived by substituting zero for non-detect values to define the lower end of the range, and substitution of the full detection limit to define the upper end of the range. The median value of each substitution set (0 and the detection limit) of data are considered as the lower and upper values, respectively, of typical concentrations of the characteristic (Michael and Moore 1997). The median is a measure of central tendency that describes a property of the population of data, using a sample statistic, which is a good estimate of the central tendency of the population. The median is the middle measurement in a set of data, and the sample median is the best estimate of the population mean. In symmetrical distributions, the sample median also is an unbiased and consistent estimate of μ, the population mean. Extremely high or low measurements do not affect the median as much as the mean, and when analyzing populations, the median may be preferred to express central tendency.

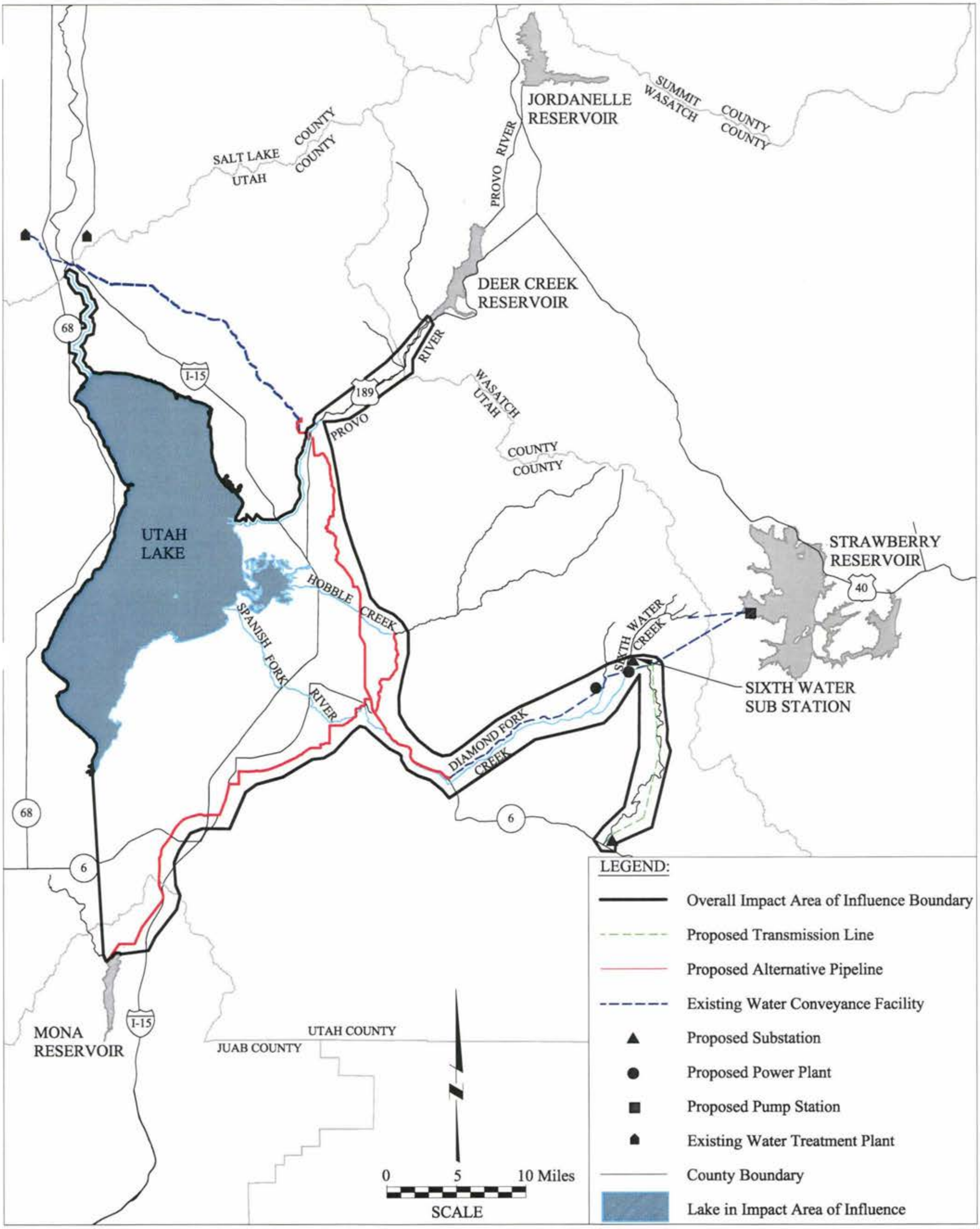
3.3.6.2 Impact Analysis Methodology

Flow data for all analyses were obtained from the Surface Water Hydrology Technical Report for the Utah Lake Drainage Basin Water Delivery System (CUWCD 2004a). The majority of the water quality data were obtained from the EPA STORET database. Additional water quality data were obtained from the Utah Division of Water Quality and other sources. The impact analysis considered the standard operating procedures (SOPs) and project design features that the District will implement as part of the project.

3.3.6.2.1 LKSIM2000 TDS Model. Total dissolved solids (TDS) modeling was performed using the LKSIM2000 model. This model is essentially a mass balance model that calculates water and salt balances for Utah Lake. Early versions of the model were developed in the 1970s by Drs. LaVere Merritt and Dean Fuhriman, and since about 1985 Dr. Wood Miller, professors of civil and environmental engineering at Brigham Young University. The current version, LKSIM2000, is used routinely by the Central Utah Water Conservancy District and their consultants to evaluate lake salt concentrations associated with various water management scenarios for Utah Lake. The model computes the water balances and "conservative" salt concentrations for monthly time steps for any selected time period within the 50-year historical database period, 1950-1999 water years. Extensive data files, containing measured and/or correlated/calibrated hydrologic and water quality data for over 50 "tributary" inflows and outflows are used in the modeling. The model is useful in simulating the TDS response to various water management scenarios evaluated.

Only 30 acceptable TDS values on nine dates were available for Utah Lake during the period 1990 through 1999. Because these data were not sufficient to compute representative monthly concentrations, these concentrations were compared directly to LKSIM2000 results for the month and year corresponding to when the sample was collected.

3.3.6.2.2 Mass Balance Model. A mass balance model was used to estimate water quality under baseline conditions and each ULS alternative in the Provo River, Hobble Creek, Spanish Fork River and Utah Lake. Data from the EPA STORET database were used to develop the mass balance model. For locations evaluated in the Diamond Fork System FS-FEIS (CUWCD 1999a), the Interim Proposed Action results from that impact analysis were used as baseline concentrations for the ULS water quality analysis. These locations included the Spanish Fork River, Strawberry Reservoir, and Diamond Fork Creek. Two different baseline conditions have to be used to estimate water quality impacts in the Spanish Fork River and Utah Lake because the Diamond Fork System began operating in 2004, conveying Strawberry Reservoir water already committed under the 1999 Diamond Fork System FS-FEIS and mixing it with the natural flow in Spanish Fork River. The simulated baseline condition is defined as water quality conditions resulting from operating the Diamond Fork System to convey 86,100 acre-feet of Bonneville Unit water from Strawberry Reservoir to Utah Lake in exchange for Provo River water that would normally flow from Jordanelle Reservoir. The historic baseline condition is defined as water quality conditions occurring from 1990 through 1999. There is one baseline condition in the Provo River and Hobble Creek because there is only one source of flow in these streams.



Map 3-2

Overall Impact Area of Influence

Data from 1997 to 2002 were used to develop model-input concentrations for Hobble Creek because it was not evaluated in the Diamond Fork System FS-FEIS. However, data were not sufficient to provide accurate representative monthly concentrations. Therefore, a single annual average concentration was used to define baseline conditions and in evaluating alternative impacts in Hobble Creek. Analogous to the other modeling approaches, these concentrations were combined with the corresponding flows from CUWCD 2004a to produce projected concentrations on a monthly basis.

The estimated water quality conditions for each alternative were calculated by combining the natural stream water quality with the Strawberry Reservoir water quality, according to the ratio of the two sources of water. Results from these calculations were extracted and summarized, and compared to the historic baseline and simulated baseline to estimate the impacts.

The Provo River and Hobble Creek characteristic concentrations under each alternative are compared only to historic baseline conditions. The Spanish Fork River and Utah Lake characteristic concentrations are compared to both historic baseline conditions and simulated baseline conditions.

3.3.6.3 Verification and Calibration

3.3.6.3.1 LKSIM2000 TDS Model. The model was calibrated for the 50 year, 1950-1999, historical conditions, leading to good estimates of the unmeasured fresh and mineralized groundwater inflows. Both the range of short-term variations and the long-term average salts resulting from each scenario simulation are rather accurate, perhaps plus or minus 10 percent in the total values. However, the relative values found between various scenarios are considered to be even more accurate, with only 5 percent error in the differences between the various scenarios.

3.3.7 Affected Environment (Baseline Conditions)

3.3.7.1 Lake and Reservoir Water Quality

3.3.7.1.1 Utah Lake. Utah Lake is a large, shallow, semi-saline, eutrophic lake. When it is full, the lake has a surface area of about 150 square miles and an average depth of 9.2 feet. The lake is highly silted and experiences high turbidity, particularly during periods of high wind and wave action that stirs the lake bed sediments. It serves primarily as an irrigation water supply source for lands in northern Utah and Salt Lake counties. The water quality is generally adequate for most irrigation uses, but is not suitable for direct use in potable water systems. The lake provides a warm-water commercial and public recreational fishery, important waterfowl habitat, and contains an endangered fish and seasonal use by birds of special concern and listed as threatened.

Total phosphorus (TP) and total dissolved solids (TDS) are the water quality characteristics of primary concern in Utah Lake with respect to the ULS project.

3.3.7.1.1.1 Total Phosphorus. Elevated levels of phosphorus may tend to accelerate the eutrophication process. The 428 measurements of total phosphorus in Utah Lake collected between 1990 and 1999 have an average concentration of 0.11 mg/L, with a maximum concentration of 1.88 mg/L. Thirty-three of the measurements had concentrations below 0.05 mg/L, and 85 were above 0.10 mg/L. More than half of the samples collected had concentrations below 0.08 mg/L. Water quality data for Utah Lake inflows are included in Appendix A of the Surface Water Quality Technical Report for the Utah Lake Drainage Basin Water Delivery System (CUWCD 2004b).

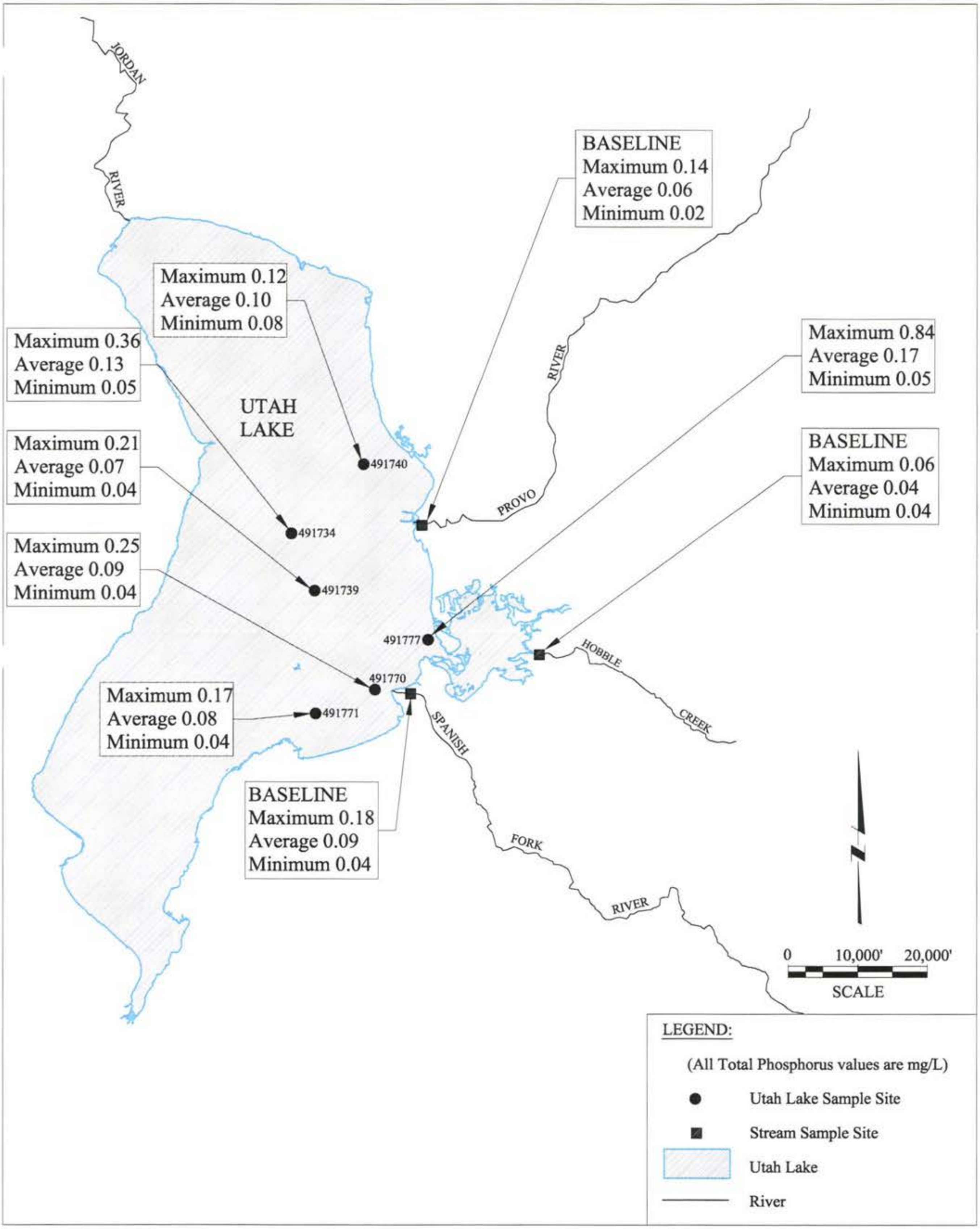
Three tributary streams would convey Strawberry Reservoir water into Utah Lake under the ULS: Provo River, Hobble Creek, and Spanish Fork River. The following sections present the analysis of localized TP concentrations and TP loading in Utah Lake.

A. Localized TP Concentrations. Total phosphorus in Utah Lake is highly influenced by physical and biological processes, and it is not possible to model or predict the actual operational effects of the ULS alternatives on TP concentrations in Utah Lake. The Utah Lake STORET sample stations closest to mouths of the Provo River, Hobble Creek and Spanish Fork River are shown on Map 3-3. Maximum, average, and minimum TP concentrations are shown on Map 3-3 for each Utah Lake STORET station and for baseline conditions in the Provo River, Hobble Creek, and Spanish Fork River. Table 3-5 presents historic (1990 through 1999) TP concentration data for the Utah Lake STORET stations closest to the mouths of these streams during the months ULS water would inflow to the lake. The three Utah Lake STORET stations closest to the mouth of the Provo River show higher average and minimum TP concentrations than the Provo River baseline average and minimum TP concentrations. Utah Lake STORET station 491740 shows a maximum TP concentration lower than the Provo River baseline maximum TP concentration; the other two Utah Lake STORET stations near the mouth of the Provo River show higher maximum TP concentrations than the Provo River baseline maximum TP concentration. The Utah Lake STORET station closest to the mouth of Hobble Creek is located just outside Provo Bay and shows higher maximum, average and minimum TP concentrations than the Hobble Creek baseline maximum, average and minimum TP concentrations. The Utah Lake STORET stations closest to the mouth of the Spanish Fork River show average and minimum TP concentrations the same as or slightly higher than the Spanish Fork River baseline average and minimum TP concentrations. Utah Lake STORET station 491770 shows a maximum TP concentration higher than the Spanish Fork River baseline maximum TP concentration; the other Utah Lake STORET station (491771) shows a slightly lower maximum TP concentration than the Spanish Fork River baseline maximum TP concentration.

Table 3-5
Utah Lake Surface Total Phosphorus Concentrations at Selected STORET Stations, 1990 to 1999

Station Number	Potential Impact River/Stream	ULS Project Water Delivery Months	Number of Sample Values	Maximum TP Conc. (mg/L)	Average TP Conc. (mg/L)	Minimum TP Conc. (mg/L)
491734	Provo River	All	15	0.36	0.13	0.05
491739	Provo River	All	18	0.21	0.07	0.04
491740	Provo River	All	11	0.12	0.10	0.08
491777	Hobble Creek	April to June	7	0.25	0.12	0.07
491777	Hobble Creek	All	19	0.84	0.17	0.05
491770	Spanish Fork River	Oct. to May	7	0.25	0.10	0.05
491770	Spanish Fork River	Oct. to Apr.	5	0.25	0.11	0.05
491770	Spanish Fork River	All	12	0.25	0.09	0.04
491771	Spanish Fork River	Oct. to May	7	0.17	0.09	0.06
491771	Spanish Fork River	Oct. to Apr.	5	0.17	0.11	0.06
491771	Spanish Fork River	All	12	0.17	0.08	0.04

B. Estimated TP Load. Under historic hydrological conditions during the period 1990 to 1999, the average volume of water entering Utah Lake associated with the Provo and Spanish Fork rivers and Hobble Creek totaled about 236,643 acre-feet. The average volume of surface and subsurface water entering the lake totaled about 558,248 acre-feet. When combined with available monitoring data for the three streams, the 236,634 acre-feet is estimated to have carried approximately 23.7 tons per year of phosphorus into Utah Lake. Wastewater treatment



Map 3-3

Utah Lake Historic Surface Total Phosphorus Concentrations plant inflows totaled about 52,591 acre-feet, and the EPA estimated the total phosphorus inflow concentrations from these plants at 3.00 mg/L (EPA 1999), for an average annual load of 225.6 tons. The other inflows to the lake were estimated to have carried a phosphorus load of 42.3 tons. Total phosphorus concentration of these other inflows was estimated at 0.11 mg/L based on other total phosphorus loads estimated by the EPA (EPA 1999). Based on these estimates, the total average historic phosphorus load to the Lake is 291.6 tons per year (Table 3-6).

Table 3-6
Estimated Historic Baseline Utah Lake Total Phosphorus Load

Inflow Source	Average Annual Inflow (acre-feet)	Concentration (mg/L)	Combined Load (Tons per Year)
Provo River	124,721	0.06	10.7
Spanish Fork River	91,581	0.09	11.8
Hobble Creek	20,332	0.04	1.2
WWTP Discharges	52,591	3.00	225.6
Other Inflows	269,023	0.11	42.3
Total	**558,248**		**291.6**

Under simulated hydrological conditions, the average volume of water entering Utah Lake associated with the Provo and Spanish Fork Rivers and Hobble Creek total 264,971 acre-feet (Table 3-7). The differences between the historic and simulated baseline are with the contributions from the Provo and Spanish Fork Rivers; Hobble Creek remains the same under historic and simulated baseline conditions. The average total volume of surface and subsurface water entering the lake totals 588,735 acre-feet. When combined with available monitoring data for the three streams, this volume of water is estimated to carry approximately 26.9 tons per year of TP into Utah Lake. Wastewater treatment plant inflows totaled about 52,591 acre-feet, contributing a TP load of 225.6 tons per year to Utah Lake. The other inflows to the lake are estimated to carry a phosphorus load of 42.3 tons, the same as for historic conditions. Based on these estimates, the total average simulated phosphorus load to the lake is approximately 294.8 tons per year (Table 3-7).

Table 3-7
Estimated Simulated Baseline Utah Lake Total Phosphorus Load

Inflow Source	Average Annual Inflow acre-feet	Concentration mg/L	Combined Load Tons per Year
Provo River	79,580	0.06	6.8
Spanish Fork River	165,059	0.08	18.9
Hobble Creek	20,332	0.04	1.2
Project Return Flows	560	0.05	0.0
WWTP Discharges	52,591	3.00	225.6
Other Inflows	269,023	0.11	42.3
Total	**587,145**		**294.8**

3.3.7.1.1.2 Total Dissolved Solids

A. TDS Concentrations. Utah Lake evaporates nearly as much water as it releases to the Jordan River each year, primarily because of its large surface area relative to its volume. This large volume of evaporation results in high total dissolved solids levels in the lake, because the salt in the lake inflows is concentrated. Twelve samples were collected from Utah Lake on 9 days during the 1990 to 1999 period. The TDS concentration exceeded the agricultural use criterion of 1,200 mg/L on one day at 17 stations during the 9 days that samples were collected and analyzed (Table 3-8).

Table 3-8
Utah Lake Historic Baseline Total Dissolved Solids Concentration Data

Sample Date	Monitoring Station ID Number	Monitoring Station Description	Measured Utah Lake TDS (mg/L)
08/14/90	491730	300 feet offshore from Geneva Steel	1240
08/14/90	491750	3 miles WNW of Lincoln Beach	1246
08/14/90	491751	4 miles E of Saratoga Springs	1284
08/14/90	491777	Provo Bay outside entrance to Provo Bay	1214
08/14/90	491770	2.5 miles NE of Lincoln Point	1284
08/14/90	491771	1 mile NE of Lincoln Point	1278
08/14/90	491762	Goshen Bay midway off main point on east shore	1330
08/14/90	491739	4 miles W of Provo Airport 4 miles N of Lincoln Point	1262
08/14/90	491733	5 miles NNW of Lincoln Beach, 1 mile offshore	1288
08/14/90	491734	E of Provo Boat Harbor, 6 miles N of Lincoln Beach	1292
08/14/90	491742	1 mile SE of Pelican Point	1262
08/14/90	491741	1 mile NE of Pelican Point	1244
08/14/90	491752	2 miles E of Saratoga Springs	1262
08/14/90	491737	4 miles N of Pelican Point 5 miles West of Geneva	1238
08/14/90	491738	0.5 mile S of American Fork Boat Harbor	1254
08/14/90	491732	0.5 mile W of Geneva Discharge site	1248
08/14/90	491740	1.5 mile NW of Provo Boat Harbor	1224
07/02/93	491731	0.5 mile W of Geneva Discharge site	816
07/15/94	491731	0.5 mile W of Geneva Discharge site	1022
07/26/95	491731	0.5 mile W of Geneva Discharge site	872
09/27/95	491731	0.5 mile W of Geneva Discharge site	924
07/15/97	491731	0.5 mile W of Geneva Discharge site	760
07/15/97	491732	0.5 mile W of Geneva Discharge site	758
09/11/97	491732	0.5 mile W of Geneva Discharge site	800
09/11/97	491731	0.5 mile W of Geneva Discharge site	806
07/06/99	491731	0.5 mile W of Geneva Discharge site	700
07/06/99	491762	Goshen Bay midway off main point on east shore	716
07/06/99	491777	Provo Bay outside entrance to Provo Bay	682
08/19/99	491731	0.5 mile W of Geneva Discharge site	720
08/19/99	491732	0.5 mile W of Geneva Discharge site	714

Historic TDS concentrations in Utah Lake have varied inversely relative to lake volume with a correlation index (r^2) of 0.811 relating increasing TDS concentration with decreasing Utah Lake volume (see Surface Water Quality Technical Report for the Utah Lake Drainage Basin Water Delivery System (CUWCD 2004b), Section 3.2.1.2.1, Figure 3-1).

B. Estimated TDS Load. The TDS load to Utah Lake was estimated in a manner similar to that performed for total phosphorus. Inflow sources and flows were the same as previously described (Section 3.2.1.1.2). TDS concentrations for streams and rivers were averaged from STORET data for years 1990 through 1999. WWTP discharge TDS concentration was derived from typical values for untreated wastewater (Table 3-5 in Metcalf and Eddy 1979), assuming that the conventional wastewater treatment processes used at treatment plants around Utah Lake do not remove TDS. Other inflow TDS concentration was derived from the Utah Lake Water Quality Salinity Model (LKSIM 2000), which simulates TDS concentrations in Utah Lake (Merritt and Miller 2004). The estimated historic baseline TDS load to Utah Lake is shown in Table 3-9.

Table 3-9
Estimated Historic Baseline Utah Lake Total Dissolved Solids Load

Inflow Source	Average Annual Inflow (acre-feet)	Concentration (mg/L)	Combined Load (Tons per Year)
Provo River	124,721	276	49,225
Spanish Fork River	91,581	481	62,992
Hobble Creek	20,332	293	8,519
Project Return Flows	0	457	0
WWTP Discharges	52,591	600	45,123
Other Inflows	269,023	450	173,116
Total	**558,248**		**338,975**

The estimated historic baseline TDS load to Utah Lake is dominated by other inflows consisting of irrigation return flows by surface and groundwater, M&I secondary water return flows, salt springs within the lake, other tributary streams, and other point sources. Discharges from wastewater treatment plants (WWTP) contribute an estimated 13.3 percent of the TDS load to Utah Lake via point-source discharges. The Spanish Fork River contributes a higher TDS load to Utah Lake than the Provo River or Hobble Creek because of watershed characteristics and irrigation return flows back into the Spanish Fork River.

Estimated simulated baseline TDS loading to Utah Lake is shown in Table 3-10.

Table 3-10
Estimated Simulated Baseline Utah Lake Total Dissolved Solids Load

Inflow Source	Average Annual Inflow (acre-feet)	Concentration (mg/L)	Combined Load (Tons per Year)
Provo River	79,580	276	31,409
Spanish Fork River	165,059	387	91,345
Hobble Creek	20,332	293	8,519
Project Return Flows	560	457	366
WWTP Discharges	52,591	600	45,123
Other Inflows	269,023	450	173,116
Total	**587,145**		**349,878**

The estimated simulated baseline TDS load to Utah Lake is dominated by other inflows consisting of irrigation return flows by surface and groundwater, M&I secondary water return flows, salt springs within the lake, other tributary streams, and other point sources. Discharges from wastewater treatment plants (WWTP) contribute an estimated 12.9 percent of the TDS load to Utah Lake via point-source discharges. The Spanish Fork River contributes a higher TDS load to Utah Lake than the Provo River or Hobble Creek because of watershed characteristics, irrigation return flows back into the Spanish Fork River, and higher average annual inflow with full conveyance of Bonneville Unit flows to Utah Lake for exchange to Jordanelle Reservoir.

3.3.7.2 Stream and River Water Quality

3.3.7.2.1 Lower Provo River From Murdock Diversion to Utah Lake. Historic data beginning in 1990 collected at STORET station number 499559 (lower Provo River at Utah State Route 114 crossing) were used to determine the baseline conditions. These data are included in Appendix A of the Surface Water Quality Technical Report for the Utah Lake Drainage Basin Water Delivery System (CUWCD 2004b). Baseline conditions for dissolved oxygen, water temperature, TDS, pH, nitrate plus nitrite, ammonia, and selenium are all within state water quality standards or pollution indicator levels on a monthly basis and in the normal range for streams in northern Utah. Table 3-11 provides a summary of annual average and maximum monthly values for baseline water quality conditions in the lower Provo River. Baseline total phosphorus concentrations in this reach of the lower Provo River exceed the Utah pollution indicator for streams and rivers in May and September, likely because of spring and fall turnover conditions occurring in Deer Creek Reservoir that cause dissolved phosphorus to be mixed throughout the reservoir.

Table 3-11
Summary of Annual Average and Maximum Monthly Baseline Water Quality Conditions in the Lower Provo River

Water Quality Characteristic		TDS	pH	Dissolved Oxygen	Temperature	Nitrate as N	Ammonia as N	Phosphorus as P	Selenium
	Units	(mg/L)	(units)	(mg/L)	(°C)	(mg/L)	(mg/L)	(mg/L)	(µg/L)
Annual Average Water Quality									
Flow-Weighted Average	Value	276	8.3	10.1	10.4	0.37	0.04	0.06	1.1
Maximum Monthly Water Quality									
	Value	290	8.4	9.1[a]	18.2	0.82	0.12	0.14	2.0

[a] Minimum monthly water quality value.

3.3.7.2.2 Hobble Creek From Mapleton-Springville Lateral to Utah Lake. Historic data beginning in 1990 collected at STORET station number 499610 (Hobble Creek at I-15 bridge crossing) were used to determine the baseline conditions. These data are included in Appendix A of the Surface Water Quality Technical Report for the Utah Lake Drainage Basin Water Delivery System (CUWCD 2004b). Baseline conditions for dissolved oxygen, TDS, pH, nitrate plus nitrite, ammonia, and selenium are all within state water quality standards or pollution indicator levels on a monthly basis and in the normal range for streams in northern Utah. Table 3-12 provides a summary of annual average and maximum monthly values for baseline water quality conditions in Hobble Creek. Baseline water temperatures exceed the Utah water quality standard for coldwater game fishery in July, when most or all of the stream flow is diverted for irrigation. Baseline total phosphorus concentrations in this reach of Hobble Creek exceed the Utah pollution indicator for streams and rivers in May, likely because of runoff carrying phosphorus-bearing sediment.

Table 3-12
Summary of Annual Average and Maximum Monthly Baseline Water Quality Conditions in Hobble Creek

Water Quality Characteristic		TDS	pH	Dissolved Oxygen	Temperature	Nitrate as N	Ammonia as N	Phosphorus as P	Selenium
	Units	(mg/L)	(units)	(mg/L)	(°C)	(mg/L)	(mg/L)	(mg/L)	(µg/L)
Annual Average Water Quality									
Flow-Weighted Average	Value	293	8.2	8.8	10.6	0.7	0.05	0.04	1.6
Maximum Monthly Water Quality									
	Value	403	8.3	7.7[a]	23.2	1.8	0.12	0.06	2.5

[a] Minimum monthly water quality value.

3.3.7.2.3 Spanish Fork River From Diamond Fork Creek to Utah Lake. Historic data beginning in 1990 collected at STORET station numbers 499558 (Spanish Fork River at Lakeshore), 499560 (Spanish Fork River at Moark Diversion), and 499579 (Spanish Fork River above confluence with Diamond Fork Creek) were used to determine the historic baseline conditions. These data are included in Appendix A of the Surface Water Quality Technical Report for the Utah Lake Drainage Basin Water Delivery System (CUWCD 2004b). Baseline conditions for dissolved oxygen, water temperature, TDS, pH, nitrate plus nitrite, ammonia, and selenium are all within state water quality standards or pollution indicator levels on a monthly basis and in the normal range for streams in northern Utah. Table 3-13 provides a summary of annual average and maximum monthly values for historic baseline water quality conditions in the Spanish Fork River. Historic baseline total phosphorus concentrations in the upper Spanish Fork River exceed the Utah pollution indicator for streams and rivers from May through October, likely because of runoff carrying phosphorus-bearing sediment and water released from Strawberry Reservoir into Diamond Fork Creek. Historic baseline total phosphorus concentrations in the lower Spanish Fork River exceed the Utah pollution indicator for streams and rivers from January through October, likely because of runoff carrying phosphorus-bearing sediment, water released from Strawberry Reservoir into Diamond Fork Creek, and irrigation return flows carrying dissolved fertilizer and animal wastes.

Table 3-13
Summary of Annual Average and Maximum Monthly Historic Baseline Water Quality Conditions in the Spanish Fork River

Water Quality Characteristic		TDS	pH	Dissolved Oxygen	Temperature	Nitrate as N	Ammonia as N	Phosphorus as P	Selenium
	Units	(mg/L)	(units)	(mg/L)	(°C)	(mg/L)	(mg/L)	(mg/L)	(µg/L)
Annual Average Water Quality[a]									
Upper Spanish Fork River	Value	324	8.1	11.7	10.6	0.17	0.03	0.14	1.0
Lower Spanish Fork River	Value	481	8.1	10.3	10.1	0.82	0.11	0.09	1.0
Maximum Monthly Water Quality[a]									
Upper Spanish Fork River	Value	527	8.4	9.1[b]	14.7	0.64	0.05	0.30	2.1
Lower Spanish Fork River	Value	572	8.3	8.1[b]	18.0	2.37	0.17	0.18	1.4

[a]Values are flow-weighted
[b]Minimum monthly water quality value.

Simulated baseline conditions are based on the flows that would occur if the 1999 Diamond Fork FS-FEIS Interim Proposed Action were to be the final action of the Bonneville Unit water delivery for exchange from Utah Lake to Jordanelle Reservoir. Simulated baseline conditions for water temperature, TDS, pH, nitrate plus nitrite, ammonia, dissolved oxygen and selenium are all within state water quality standards or pollution indicator levels on a monthly basis and in the normal range for streams in northern Utah. Table 3-14 provides a summary of average annual and maximum monthly values for simulated baseline water quality conditions in the Spanish Fork River. Simulated baseline conditions for total phosphorus concentrations in the upper Spanish Fork River exceed the Utah pollution indicator for streams and rivers from May through October, likely because of runoff carrying phosphorus-bearing sediment and water released from Strawberry Reservoir into Diamond Fork Creek. Simulated baseline total phosphorus concentrations in the lower Spanish Fork River exceed the Utah pollution indicator for streams and rivers during all months except December, likely because of runoff carrying phosphorus-bearing sediment, water released from Strawberry Reservoir into Diamond Fork Creek, and irrigation return flows carrying dissolved fertilizer and animal wastes.

Table 3-14
Summary of Annual Average and Maximum Monthly Simulated Baseline Water Quality Conditions in the Spanish Fork River

Water Quality Characteristic		TDS	pH	Dissolved Oxygen	Temperature	Nitrate as N	Ammonia as N	Phosphorus as P	Selenium
	Units	(mg/L)	(units)	(mg/L)	(°C)	(mg/L)	(mg/L)	(mg/L)	(µg/L)
Annual Average Water Quality[a]									
Upper Spanish Fork River	Value	285	8.1	11.8	9.9	0.19	0.03	0.12	1.0
Lower Spanish Fork River	Value	387	8.1	10.8	9.5	0.64	0.09	0.08	1.1
Maximum Monthly Water Quality[a]									
Upper Spanish Fork River	Value	386	8.3	9.8[b]	14.4	0.48	0.06	0.24	2.0
Lower Spanish Fork River	Value	474	8.2	9.0[b]	16.2	1.61	0.15	0.13	1.5

[a]Values are flow-weighted
[b]Minimum monthly water quality value.

3.3.7.2.4 Jordan River. Historic data beginning in 1990 collected at STORET station number 499479 (Jordan River at Utah Lake Outlet) were used to determine the baseline conditions. These data are included in Appendix A of the Surface Water Quality Technical Report for the Utah Lake Drainage Basin Water Delivery System (CUWCD 2004b). Baseline water quality conditions for the Jordan River from the Utah Lake outlet to the Jordan Narrows are presented in Table 3-15. Average baseline conditions for pH, dissolved oxygen, water temperature, nitrate plus nitrite and selenium are all within state water quality standards. The average and maximum baseline TP concentrations exceed the Utah pollution indicator 0.05 mg/L for streams and rivers. The high TP concentrations occur from phosphorus stored in Utah Lake bed sediments, decomposing aquatic plant matter in the lake, nutrient inflows to the lake from tributaries, wastewater treatment plant discharges, and other discharges into the lake. The average and maximum baseline TDS concentrations exceed the Utah water quality standard of 1,200 mg/L for agricultural water supplies. The high TDS concentrations in the Jordan River result from high evaporation rates causing TDS to concentrate in Utah Lake, salt springs that inflow to the lake, return flows carrying TDS into the lake, and the State Engineer's operation of Utah Lake levels and volume. Maximum baseline conditions for pH, nitrate plus nitrite, and selenium are all within state water quality standards. Maximum temperature exceeds the warmwater game fishery and non-game fishery water quality standard of 27 degrees C. Minimum baseline dissolved oxygen, while very low, does not exceed the 1-day average water quality standard of 3.0 mg/L for both the warm-water game fishery and non-game fishery applicable to the Jordan River.

Table 3-15
Summary of Average and Maximum Baseline Water Quality Conditions in Jordan River From Utah Lake Outlet to Jordan Narrows

Water Quality Characteristic		TDS	pH	Dissolved Oxygen	Temperature	Nitrate as N	Phosphorus as P	Selenium
	Units	(mg/L)	(units)	(mg/L)	(°C)	(mg/L)	(mg/L)	(µg/L)
Average Water Quality Conditions								
	Value	1,241	7.9	8.8	12.6	0.2	0.1	1.2
Maximum Water Quality Conditions								
	Value	1,910	8.7	4.4[a]	28.0	0.7	0.6	1.8

[a]Minimum monthly water quality value.

3.3.8 Environmental Consequences (Impacts)

3.3.8.1 Significance Criteria

Significance of water quality impacts is determined by whether or not water quality standards or pollutant indicators that are currently met would be exceeded; whether standards that are exceeded would be improved; or whether exceeded standards would be further degraded. The significance of water quality impacts with respect to related resources is described in the sections that deal with these related resources.

The State of Utah has established water quality standards that are based upon the beneficial uses. This information can be found in detail in Utah Administrative Code R317-2 Standards of Quality for Waters of the State. Table 3-16 lists water quality standards and Table 3-17 summarizes Utah water use classifications of the major hydrologic features in the impact area of influence. In addition, the Jordanelle Reservoir Water Quality Technical Advisory Committee (JTAC) has established water quality standards in the Provo River Watershed because of problems relating to eutrophication.

According to State standards, the pH for waters of all classifications must remain in the range from 6.5 to 9.0. For cold water species of fish (Class 3A) the maximum water temperature is 20 degrees Celsius. Maximum water temperature and minimum dissolved oxygen levels have been set for aquatic life. Minimum dissolved oxygen levels have been determined based upon the presence of early life stages of fish. When fish in early life stages are present, 8.0 mg/L is the minimum limit; otherwise it is 4.0 mg/L. The Utah Division of Water Quality, rather than perform an investigation at each location for early stages of life, has established the practice of using 6.5 mg/L as an indicator of a low dissolved oxygen level.

The State's pollution indicators for phosphorus are for recreational and aquatic wildlife uses (Classes 2 & 3). The 1984 Deer Creek Reservoir and Proposed Jordanelle Reservoir Water Quality Management Plan recommended that the phosphorus concentration target be reduced to 0.04 mg/L for streams in the Provo River Watershed because of problems relating to eutrophication (Sowby and Berg Consultants, 1984). The total phosphorus pollution indicator is 0.05 mg/L in streams and rivers, and is 0.025 mg/L in lakes and reservoirs.

3.3.8.2 Potential Impacts Eliminated From Further Analysis

Potential water quality impacts associated with construction were eliminated from further analysis. With application of the Standard Operating Procedures described in the EIS (see Chapter 1, Section 1.8.8), impacts on water quality from construction activities associated with the Proposed Action and other alternatives are not expected to occur. Therefore, the following impacts raised in the scoping meetings have been eliminated from further analysis.

- What would be the impacts of constructing the pipeline along Highway 6 and within the communities in Utah County?

Annual average inflow to Utah Lake for the 1950-1999 period is approximately 700,000 acre-feet, including precipitation gains of more than 100,000 acre-feet. Inflows under the Proposed Action and other alternatives to Utah Lake are estimated to range from 40,000 to 85,000 acre-feet, or 6 to 12 percent of the total inflow. Based on flow alone, impacts on water quality are expected to be minimal both in Utah Lake, and on the Jordan River (i.e., the outflow from Utah Lake). Therefore, impacts on water quality characteristics in Utah Lake were eliminated from further analysis, except for TDS and phosphorus. These parameters were retained for detailed analysis because they are considered impaired in Utah Lake. Impacts on water quality characteristics in the Jordan River

Table 3-16
State of Utah Water Quality Standards and Pollution Indicators by Key Parameters and Water Use Classification

Page 1 of 2

Key Water Quality Parameters	Units	Water Use Classification: 1C Domestic	2A Recreation (Primary Contact)	2B Recreation (Secondary Contact)	3A Coldwater Game Fishery	3B Warmwater Game Fishery	3C Non-Game Fishery	3D Waterfowl	4 Agriculture
Minimum pH	units	6.5	6.5	6.5	6.5	6.5	6.5	6.5	6.5
Maximum pH	units	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
Minimum Dissolved Oxygen[a]	mg/L	No standard	No standard	No standard	6.5 (30-day avg) 9.5/5.0 (7-day avg) 8.0/4.0 (1-day avg)	5.5 (30-day avg) 6.0/4.0 (7-day avg) 5.0/3.0 (1-day avg)	5.0 (30-day avg) No standard 3.0 (1-day avg)	5.0 (30-day avg) No standard 3.0 (1-day avg)	No standard
Maximum Temperature	°C	No standard	No standard	No standard	20	27	27	No standard	No standard
Temperature Change	°C	No standard	No standard	No standard	2	4	4	No standard	No standard
Biochemical Oxygen Demand (BOD)	mg/L	No standard	5	5	5	5	5	5	5
Nitrate as N[b]	mg/L	10	No indicator	No indicator	4	4	4	No indicator	No indicator
Total Ammonia as N	mg/L	No standard	No standard	No standard	(30-day avg)[c] (1-hr avg)[d]	(30-day avg)[c] (1-hr avg)[d]	No standard (1-hr avg)[d]	No standard (1-hr avg)[d]	No standard
Total Phosphorus as P[e]	mg/L	No indicator	0.05 in streams 0.025 in lakes and reservoirs	0.05 in streams 0.025 in lakes and reservoirs	No indicator	0.05 in streams 0.025 in lakes and reservoirs	0.05 in streams 0.025 in lakes and reservoirs	No indicator	No indicator
Maximum Total Coliforms	count	5,000	1,000	5,000	No standard	No standard	No standard	No standard	No standard
Total Dissolved Solids[f] (TDS)	mg/L	No standard	No standard	No standard	No standard	No standard	No standard	No standard	1,200

Table 3-16
State of Utah Water Quality Standards and Pollution Indicators by Key Parameters and Water Use Classification

Key Water Quality Parameters	Units	Water Use Classification							
		1C Domestic	2A Recreation (Primary Contact)	2B Recreation (Secondary Contact)	3A Coldwater Game Fishery	3B Warmwater Game Fishery	3C Non-Game Fishery	3D Waterfowl	4 Agriculture
Maximum Fecal Coliforms	count	2,000	200	200	No standard	No standard	No standard	No standard	No standard
Turbidity Increase	NTU	No standard	10	10	10	10	15	15	No standard
Selenium	See water use classifi-cations	0.05 mg/L (maximum dissolved)	No standard	0.05 mg/L (maximum dissolved)	4.6 µg/L (4-day avg) 18.4 µg/L (1-hour avg)	4.6 µg/L (4-day avg) 18.4 µg/L (1-hour avg)	4.6 µg/L (4-day avg) 18.4 µg/L (1-hour avg)	4.6 µg/L (4-day avg) 18.4 µg/L (1-hour avg)	No standard

Source: Source: *R317-2. Standards of Quality for Waters of the State As in effect March 1, 2004. Available at:* http://www.rules.utah.gov/publicat/code/r317/r317-002.htm.

NOTES:

[a]These limits are not applicable to lower water levels in deep impoundments. The 30-day standard is used in this FS-FEIS as it corresponds with the monthly time step used for analysis.

[b]Nitrate as N is a pollution indicator, not a State water quality standard.

[c]The 30-Day average (chronic) concentration of un-ionized ammonia in mg/l as N does not exceed, more than once every three years on the average:

Fish Early Life Stages Present:

$(0.0577/(1+10^{7.688-pH}) + 2.487/(1+10^{7.688-pH})) * MIN(2.845, 1.45*10^{0.028*(25-Temperature)})$

Fish Early Life Stages Absent

$(0.0577/(1+10^{7.688-pH}) + 2.487/(1+10^{7.688-pH})) * 1.45*10^{0.028*(25-MAX(Temperature-7)})$

[d]The 1-Hour average (acute) concentration of un-ionized ammonia in mg/l as N does not exceed, more than once every three years on the average:

Class 3A:

$0.275/(1+10^{7.204-pH}) + 39/(1+10^{pH-7.204})$

Class 3B, 3C, 3D:

$0.411/(1+10^{7.204-pH}) + 58.4/(1+10^{pH-7.204})$

[e]Total phosphorus as P is a pollution indicator, not a State water quality standard.

[f]TDS standards shall be at background where it can be shown that natural or un-alterable conditions prevent its attainment. Limits may be adjusted if such adjustment does not impair the designated beneficial use of the receiving water.

Table 3-17
State of Utah Water Use Classification of Hydrologic Features in the Impact Area of Influence

Affected Water Features	Water Use Classification[a]							
	1C Domestic	**2A[b] Recreation (Primary Contact)**	**2B[c] Recreation (Secondary Contact)**	**3A Coldwater Game Fishery**	**3B Warmwater Game Fishery**	**3C Non-Game Fishery**	**3D Waterfowl**	**4 Agriculture**
Lake and Reservoir Water Quality								
Utah Lake			X		X		X	X
Stream and River Water Quality								
Spanish Fork and tributaries from Utah Lake to Moark Junction			X		X		X	X
Spanish Fork and tributaries from Moark Junction to headwaters			X	X				X
Provo River (Murdock Diversion to Utah Lake)			X	X				X
Hobble Creek			X	X				X
Jordan River (Utah Lake to Narrows)	X		X			X		X

[a]Source: *R317-2. Standards of Quality for Waters of the State As in effect March 1, 2004. Available at:* http://www.rules.utah.gov/publicat/code/r317/r317-002.htm.

[b]eg. swimming

[c]e.g. boating, wading, etc.

[d]All waters not specifically classified are presumptively classified as 2B, 3B, or 3D.

from the Utah Lake outlet to the Narrows were eliminated from further analysis because the ULS project would have minimal or no changes in Jordan River flows.

Changes in flow to and from the Provo River would be very minor under the Bonneville Unit Water Alternative and No Action Alternative. Therefore, the Provo River was eliminated from detailed analysis for these two alternatives.

The Jordan River below the Narrows and the Great Salt Lake are located outside of the ULS impact area of influence. The ULS would have no measurable hydrologic impacts on the Jordan River, therefore, there would be no impacts on water quality in the Jordan River and Great Salt Lake. The following impacts have been eliminated from further analysis.

- What would be the impacts of the ULS on Jordan River and Great Salt Lake wetland habitats and water quality?

3.3.8.3 Spanish Fork Canyon–Provo Reservoir Canal Alternative (Proposed Action)

3.3.8.3.1 Lake and Reservoir Water Quality

3.3.8.3.1.1 Utah Lake

A. Total Phosphorus. The following sections summarize the impact analysis detailed in the Surface Water Quality Technical Report for the Utah Lake Drainage Basin Water Delivery System (CUWCD 2004b), Section 4.3.1.1.1, Total Phosphorus. TP impacts in Utah Lake were analyzed in terms of localized TP concentrations and estimated TP concentrations in inflow sources and for estimated TP load in Utah Lake.

Utah Lake EPA STORET sample station surface TP concentration data during seasonal project water delivery were compared to stream TP input concentrations under the Proposed Action. The ULS Proposed Action would provide in-stream flows to the lower Provo River throughout the year. Strawberry Reservoir water conveyed through the Spanish Fork-Provo Reservoir Canal Pipeline would be mixed with Provo River water near the mouth of Provo Canyon and flow down to Utah Lake. The Proposed Action annual flow-weighted average TP inflow concentration of 0.06 mg/L would be 0.01 to 0.07 mg/L lower than the historic annual average TP concentrations at the three Utah Lake STORET stations closest to the mouth of the Provo River. Historic annual average TP concentrations in surface samples at these stations during Proposed Action water delivery range from 0.07 mg/L to 0.13 mg/L. The maximum flow-weighted TP concentration of 0.13 mg/L in the Provo River under the Proposed Action would be below to just over the maximum recorded Utah Lake TP concentration range of 0.12 mg/L to 0.36 mg/L. The Proposed Action inflows from the lower Provo River would dilute and reduce Utah Lake TP concentrations near the mouth of the Provo River. The Proposed Action would not have a significant impact on TP concentrations in Utah Lake near the mouth of the Provo River.

The ULS Proposed Action would provide June sucker spawning and rearing flows in Hobble Creek from April through May. Strawberry Reservoir water conveyed through the Mapleton-Springville Lateral Pipeline would be mixed with Hobble Creek water upstream of Springville City and flow down to Utah Lake. The Proposed Action flow-weighted average TP concentration of 0.05 mg/L would be 0.07 mg/L lower than the historic average TP concentration at the Utah Lake STORET station closest to the mouth of Hobble Creek during April and May. The historic average TP concentration in surface samples at this station during Proposed Action water delivery months of April and May is 0.12 mg/L. The maximum flow-weighted TP concentration of 0.12 mg/L in Hobble Creek under the Proposed Action would be below the maximum recorded Utah Lake TP concentration of 0.25 mg/L.

The Proposed Action inflows from Hobble Creek would dilute and reduce Utah Lake TP concentrations near the mouth of Hobble Creek. The Proposed Action would not have a significant impact on TP concentrations in Utah Lake near the mouth of Hobble Creek.

The ULS Proposed Action would deliver Bonneville Unit flows through the Spanish Fork River to Utah Lake from October through May. In-stream flows provided to Sixth Water Creek and Diamond Fork Creek from Strawberry Reservoir water would flow down the Spanish Fork River to Utah Lake. The Proposed Action flow-weighted average TP concentration of 0.09 mg/L would be 0.01 mg/L lower or the same as historic average TP concentrations at the two Utah Lake STORET stations closest to the mouth of the Spanish Fork River. Historic average TP concentrations in surface samples at these stations during Proposed Action water delivery months from October through May range from 0.09 mg/L to 0.10 mg/L. The maximum flow-weighted TP concentration of 0.19 mg/L in the Spanish Fork River under the Proposed Action would be below to just over the maximum recorded Utah Lake TP concentration range of 0.17 mg/L to 0.25 mg/L. The Proposed Action inflows from the Spanish Fork River would slightly dilute and reduce or not change Utah Lake TP concentrations near the mouth of the Spanish Fork River. The Proposed Action would not have a significant impact on TP concentrations in Utah Lake near the mouth of the Spanish Fork River.

The estimated TP load to Utah Lake under the Proposed Action would not change from the estimated historic TP load to Utah Lake (Table 3-18). The TP load would decrease in the Provo River because of water exchanged from Utah Lake to Jordanelle Reservoir, would decrease from Other Inflow because of reduced return flows in northern Utah County, and would increase in the Spanish Fork River, Hobble Creek, and in ULS return flows. Under the Proposed Action, the estimated net TP load of 291.6 tons per year from all inflow sources to Utah Lake would be the same as the estimated net historic TP load to Utah Lake. The Proposed Action would not have a significant impact on TP load to Utah Lake.

Table 3-18
Estimated Utah Lake Total Phosphorus Load Under the Proposed Action and Change From Historic Baseline Total Phosphorus Load

Inflow Source	Average Annual Inflow (acre-feet)	TP Concentration (mg/L)	Combined TP Load (tons per year)	Change from Historic Baseline Load (tons per year)	Change from Historic Baseline Load (percent)
Provo River	112,170	0.06	9.6	-1.1	-10
Spanish Fork River	96,902	0.09	12.5	+0.7	+5.9
Hobble Creek	39,274	0.05	2.8	+1.6	+133
ULS Return Flows	9,660	0.05	0.7	+0.7	NA
WWTP Discharges	52,591	3.00	225.6	0	0
Other Inflows	256,707	0.11	40.4	-1.9	-4.5
Total	**567,304**		**291.6**	**0**	**0**

The estimated TP load to Utah Lake under the Proposed Action would decrease by 3.2 tons per year (net –1.1 percent) from the estimated simulated baseline TP load to Utah Lake (Table 3-19). The TP load would increase in the Provo River and Hobble Creek because of increased Strawberry Reservoir water being mixed with Provo River and Hobble Creek water, would decrease from Other Inflows because of reduced return flows in northern Utah County, would decrease in the Spanish Fork River because of decreased load from reduced Strawberry Reservoir flows, and would increase in ULS return flows. Under the Proposed Action, the estimated net TP load of 291.6 tons per year from all inflow sources to Utah Lake would be lower than the estimated net simulated baseline TP load of 294.8 tons per year to Utah Lake. The Proposed Action would not have a significant impact on TP load to Utah Lake.

Table 3-19
Estimated Utah Lake Total Phosphorus Load Under the Proposed Action and Change From Simulated Baseline Total Phosphorus Load

Inflow Source	Average Annual Inflow (acre-feet)	TP Concentration (mg/L)	Combined TP Load (tons per year)	Change from Simulated Baseline Load (tons per year)	Change from Simulated Baseline Load (percent)
Provo River	112,170	0.06	9.6	+2.8	+41
Spanish Fork River	96,902	0.09	12.5	-6.4	-34
Hobble Creek	39,274	0.05	2.8	+1.6	+133
ULS Return Flows	9,660	0.05	0.7	+0.7	NA
WWTP Discharges	52,591	3.00	225.6	0	0
Other Inflows	256,707	0.11	40.4	-1.9	-4.5
Total	**567,304**		**291.6**	**-3.2**	**-1.1**

B. Total Dissolved Solids. Total dissolved solids impacts in Utah Lake were analyzed in terms of TDS concentrations and estimated TDS load from inflow sources. The influence of evaporation, tributary and WWTP effluent inflows, other inflows including salt springs and irrigation return flows, upstream water demands, and State Engineer operations of Utah Lake volume and levels on TDS concentrations in Utah Lake cannot be separated and the TDS concentrations discussed in this section represent cumulative concentrations rather than concentrations caused solely by the ULS operations. The changes in TDS concentrations under the ULS are therefore cumulative impacts resulting under ULS operations and are addressed in the cumulative impacts section of this technical report. The following sections present the Proposed Action impact analysis for TDS cumulative concentrations and TDS load in Utah Lake.

The ULS and the M&I System (Jordanelle Reservoir) exchange flows originate in Strawberry Reservoir, which has an average TDS concentration of 159 mg/L. When the Strawberry Reservoir water is mixed with and conveyed through the Spanish Fork River under the Proposed Action, the resulting inflow to Utah Lake would have an estimated average TDS concentration of 488 mg/L. When the Strawberry Reservoir water is mixed with and conveyed through Hobble Creek under the Proposed Action, the resulting inflow to Utah Lake would have an estimated average TDS concentration of 230 mg/L. When the Strawberry Reservoir water is mixed with and conveyed through the lower Provo River under the Proposed Action, the resulting inflow to Utah Lake would have an estimated average TDS concentration of 257 mg/L. ULS project return flows to Utah Lake under the Proposed Action would have an estimated TDS concentration of 457 mg/L. Wastewater treatment plant inflows to Utah Lake have an estimated TDS concentration of 600 mg/L (based on Table 3-5, Metcalf and Eddy 1979). Other inflows (irrigation return flows, other tributary inflows, springs, etc.) are estimated to have a TDS concentration of 450 mg/L (derived from LKSIM2000 model inflow and outflow concentrations). Therefore, the impact of the ULS inflows would be a dilution of TDS concentrations in the primary tributary inflows, and would dilute and reduce in-lake TDS concentrations.

Under the Proposed Action, TDS cumulative concentrations in Utah Lake would remain essentially unchanged compared with historic baseline conditions (Table 3-20). The TDS cumulative concentration would not exceed the agricultural use criterion of 1,200 mg/L because the Proposed Action inflows would contribute lower TDS concentration water than occurs in Utah Lake.

Table 3-20
Utah Lake Total Dissolved Solids Cumulative Concentrations Under the Proposed Action Compared to Historic and Simulated Baseline Conditions

Sample Date	Monitoring Station ID Number	Utah Lake Measured Historic TDS (mg/L)	Utah Lake Simulated Baseline TDS (mg/L)	Projected Cumulative ULS Proposed Action TDS (mg/L)	Cumulative Change from Historic Baseline TDS (percent)	Cumulative Change from Simulated Baseline TDS (percent)
8/14/90	491738	1,254	949	1,124	-10.3	+18
8/14/90	491750	1,246	949	1,124	-9.8	+18
8/14/90	491751	1,284	949	1,124	-12.5	+18
8/14/90	491777	1,214	949	1,124	-7.4	+18
8/14/90	491770	1,284	949	1,124	-12.5	+18
8/14/90	491771	1,278	949	1,124	-12.1	+18
8/14/90	491762	1,330	949	1,124	-15.5	+18
8/14/90	491739	1,262	949	1,124	-10.9	+18
8/14/90	491733	1,288	949	1,124	-12.7	+18
8/14/90	491734	1,292	949	1,124	-13.0	+18
8/14/90	491742	1,262	949	1,124	-10.9	+18
8/14/90	491741	1,244	949	1,124	-9.6	+18
8/14/90	491752	1,262	949	1,124	-10.9	+18
8/14/90	491737	1,238	949	1,124	-9.2	+18
8/14/90	491730	1,240	949	1,124	-9.4	+18
8/14/90	491732	1,248	949	1,124	-9.9	+18
8/14/90	491740	1,224	949	1,124	-8.2	+18
7/2/93	491731	816	877	962	+17.9	+9.7
7/15/94	491731	1,022	1,000	1,077	+5.4	+7.7
7/26/95	491731	872	855	888	+1.8	+3.9
9/27/95	491731	924	931	973	+5.3	+4.5
7/15/97	491731	760	677	714	-6.1	+5.5
7/15/97	491732	758	677	714	-5.8	+5.5
9/11/97	491731	806	765	799	-0.9	+4.4
9/11/97	491732	800	765	799	-0.1	+4.4
7/6/99	491731	700	643	659	-5.9	+2.5
7/6/99	491762	716	643	659	-8.0	+2.5
7/6/99	491777	682	643	659	-3.4	+2.5
8/19/99	491731	720	718	729	+1.3	+1.5
8/19/99	491732	714	718	729	+2.1	+1.5

The 18 percent increase in projected TDS cumulative concentration from historic baseline during July 1993 coincides with several anomalous events. Utah Lake volume dropped to approximately 208,000 acre-feet in

August 1992, and then 40,000 acre-feet of Bonneville Unit water from Strawberry Reservoir was conveyed down Spanish Fork River to supplement Utah Lake volume in winter 1993. Jordanelle Reservoir began storing Provo River water in April 1993, significantly reducing the Provo River inflow to Utah Lake. The 1993 winter snowpack and precipitation resulted in an extreme spring runoff to Utah Lake, and the lake volume doubled from 309,000 acre-feet in December 1992 to 691,000 acre-feet in June 1993. The effect of these anomalous events was to decrease the Utah Lake TDS concentration in July 1993 at the one station sampled, because of dilution with low TDS water and increased lake volume. However, the LKSIM2000 model projected a higher TDS cumulative concentration with the ULS project and did not reflect as much TDS dilution in the lake. The contribution to TDS dilution from Bonneville Unit inflows to Utah Lake beginning with 1995 is demonstrated by the in-lake TDS concentrations that occurred from 1995 through 1999, which ranged from 700 to 924 mg/L, at least 276 mg/L below the 1200 mg/L water quality standard for agricultural irrigation water.

The estimated TDS load to Utah Lake under the Proposed Action would decrease from the estimated historic TDS load to Utah Lake (Table 3-21). The TDS load would decrease in the Provo River because of water exchanged from Utah Lake to Jordanelle Reservoir, would decrease from Other Inflow because of reduced return flows in northern Utah County, and would increase in the Spanish Fork River, Hobble Creek, and in ULS return flows. Under the Proposed Action, the estimated net TDS load of 338,391 tons per year from all inflow sources to Utah Lake would be 584 tons lower (-0.2 percent) than the estimated net historic TDS load of 338,975 tons per year to Utah Lake. The Proposed Action would not have a significant impact on TDS load to Utah Lake.

Table 3-21
Estimated Utah Lake TDS Load Under the Proposed Action and Change From Historic Baseline

Inflow Source	Average Annual Inflow (acre-feet)	TDS Concentration (mg/L)	Combined TDS Load (tons per year)	Change from Historic Baseline Load (tons per year)	Change from Historic Baseline Load (percent)
Provo River	112,170	257	41,224	-8,001	-16.3
Spanish Fork River	96,902	488	67,622	+4,630	+7.4
Hobble Creek	39,274	230	12,917	+4,398	+51.6
ULS Return Flows	9,660	457	6,315	+6,315	NA
WWTP Discharges	52,591	600	45,123	0	0
Other Inflows	256,707	450	165,191	-7,925	-4.6
Total	**567,304**		**338,392**	**-584**	**-0.2**

The estimated TDS load to Utah Lake under the Proposed Action would decrease by 11,487 tons per year (net – 3.3 percent) from the estimated simulated baseline TDS load to Utah Lake (Table 3-22). The TDS load would increase in the Provo River and Hobble Creek because of increased Strawberry Reservoir water being mixed with Provo River and Hobble Creek water, would decrease from Other Inflows because of reduced return flows in northern Utah County, would decrease in the Spanish Fork River because of decreased load from reduced Strawberry Reservoir flows, and would increase in ULS return flows. Under the Proposed Action, the estimated net TDS load of 338,391 tons per year from all inflow sources to Utah Lake would be lower than the estimated net simulated baseline TDS load of 349,878 tons per year to Utah Lake. The Proposed Action would not have a significant impact on TP load to Utah Lake.

Table 3-22 Estimated Utah Lake TDS Load Under the Proposed Action and Change From Simulated Baseline Conditions					
Inflow Source	**Average Annual Inflow (acre-feet)**	**TDS Concentration (mg/L)**	**Combined TDS Load (tons per year)**	**Change from Simulated Baseline Load (tons per year)**	**Change from Simulated Baseline Load (percent)**
Provo River	112,170	257	41,224	+9,815	+31.2
Spanish Fork River	96,902	488	67,622	-23,723	-25.9
Hobble Creek	39,274	230	12,917	+4,398	+51.6
ULS Return Flows	9,660	457	6,315	+5,949	+1,625
WWTP Discharges	52,591	600	45,123	0	0
Other Inflows	256,707	450	165,191	-7,925	-4.6
Total	**567,304**		**338,392**	**-11,486**	**-3.3**

3.3.8.3.2 Stream and River Water Quality

The following sections present the water quality impact analysis for the lower Provo River, Hobble Creek, and Spanish Fork River under the Proposed Action. Detailed descriptions and tables showing the changes by water quality characteristic are presented in the Surface Water Quality Technical Report for the Utah Lake Drainage Basin Water Delivery System (CUWCD 2004b).

3.3.8.3.2.1 Lower Provo River From Murdock Diversion to Utah Lake. Water quality conditions in the lower Provo River would be generally improved under the Proposed Action because of the additional water added to the river downstream of the Murdock Diversion. Table 3-23 summarizes the water quality impacts on an annual basis. Monthly maximum comparisons are based on the average flow scenario. Provo River dissolved oxygen concentrations would increase or remain unchanged from baseline conditions. The increased dissolved oxygen concentrations would occur from the ULS water discharged to the lower Provo River, which at times could be most of the river flow between Murdock Diversion Dam and Utah Lake. There would be a significant beneficial impact on dissolved oxygen concentrations in the lower Provo River under the Proposed Action. Other water quality characteristics including TDS, nitrate plus nitrite, ammonia, and selenium concentrations would decrease or remain unchanged under the Proposed Action. Water temperatures would decrease during summer months and increase during winter months, providing improved fish habitat conditions throughout the year. Lower Provo River pH values would decrease or remain unchanged with the additional water provided under the Proposed Action. Provo River total phosphorus concentrations would remain unchanged from baseline conditions on an annual average basis. Monthly total phosphorus concentrations would increase to above the pollution indicator level in July, August and October, and would decrease from higher concentrations above the same pollution indicator level in May and September. The increases and decreases in total phosphorus in the lower Provo River under the Proposed Action would be caused by total phosphorus concentrations in Strawberry Reservoir at the Syar Tunnel inlet. Total phosphorus concentrations of water entering the Syar Tunnel inlet tend to increase during the summer months because of reservoir stratification, leading to higher concentrations near the reservoir bottom and the inlet. Data from the Syar Tunnel inlet indicate that most of the total phosphorus is dissolved total phosphorus, which is highly reactive and utilized by aquatic plants. Therefore, as the Bonneville Unit water would be discharged to the lower Provo River, the dissolved total phosphorus would be utilized by aquatic macrophytes (plants) growing in the river, which provide substrate and habitat for aquatic macroinvertebrates. This natural food source for fish would support a projected increase in fish biomass in the lower Provo River discussed in Section 3.6, Aquatic Resources. Additionally, the ULS Bonneville Unit water discharged to the lower Provo River would dilute the concentrated stormwater runoff that flows into the Provo River in this reach and would provide flows to improve aquatic resource habitat and water quality conditions for aquatic resources. The potential increases in total phosphorus during July, August and October are not considered a significant impact on water quality for aquatic resources in the lower Provo River. Other water quality characteristics including TDS, nitrate plus nitrite, ammonia, and selenium concentrations would decrease or remain unchanged under the Proposed Action.

Table 3-23
Lower Provo River Annual Average Water Quality Under the Proposed Action and Change From Baseline Conditions

Water Quality Characteristic		TDS (mg/L)	pH (units)	DO (mg/L)	Temperature (°C)	Nitrate[3] (mg/L)	Ammonia (mg/L)	Phosphorus (mg/L)	Selenium (µg/L)
Average Flow Water Quality									
Flow-Weighted Average	Change[1]	-19	-0.1	0.2	-0.1	-0.03	0	0	-0.1
	Value	257	8.2	10.3	10.3	0.34	0.04	0.06	1.0
Dry Year Water Quality (1992)									
Flow-Weighted Average	Change[1]	-48	-0.1	0.6	-0.6	-0.07	0	0.01	-0.3
	Value	228	8.2	10.7	9.9	0.30	0.04	0.05	0.9
Wet Year Water Quality (1998)									
Flow-Weighted Average	Change[1]	-12	0	0.2	-0.2	-0.01	0	0	-0.1
	Value	261	8.3	10.2	11.3	0.32	0.03	0.07	1.0
Maximum Monthly Levels									
Flow-Weighted Average	Change[2]	-4	0.0	0.8	-2.6	0.00	-0.02	-0.01	0
	Value	286	8.4	9.9[a]	15.6	0.82	0.10	0.13	2.0

Notes:
[1] Change from Baseline Annual Average
[2] Change from Baseline Maximum Monthly
[3] Nitrate + Nitrite as Nitrogen
[a] Minimum monthly water quality value.

3.3.8.3.2.2 Hobble Creek From Mapleton-Springville Lateral to Utah Lake. Water quality conditions in Hobble Creek would be generally improved under the Proposed Action because of the additional water added to the creek downstream of the Mapleton Lateral. Table 3-24 summarizes the water quality impacts on an annual basis. Monthly maximum comparisons are based on the average flow scenario. Hobble Creek dissolved oxygen concentrations would increase in every month from baseline conditions. The increased dissolved oxygen concentrations would occur from the Bonneville Unit water discharged to Hobble Creek, which at times could be most of the river flow between the Mapleton Lateral and Utah Lake. There would be a significant beneficial impact on dissolved oxygen concentrations in Hobble Creek under the Proposed Action. Other water quality characteristics including TDS, nitrate plus nitrite, and selenium concentrations would decrease or remain unchanged from baseline conditions under the Proposed Action. Water temperatures would decrease during summer months and increase during winter months, providing improved fish habitat conditions throughout the year. This would be a significant beneficial impact on water quality conditions in July by decreasing the water temperature below the state water quality standards. Hobble Creek pH values would decrease or remain unchanged with the additional water provided under the Proposed Action. Total phosphorus concentrations would increase 0.01 mg/L from baseline conditions on an annual average basis. Monthly total phosphorus concentrations would increase to above the pollution indicator level in July, August, September and October, and would remain at or below the pollution indicator level in all other months. The increases in total phosphorus in Hobble Creek under the Proposed Action would be caused by total phosphorus concentrations in Strawberry Reservoir at the Syar Tunnel inlet. Total phosphorus concentrations of water entering the Syar Tunnel inlet tend to increase during the summer months because of reservoir stratification, leading to higher concentrations near the reservoir bottom and the inlet. Data from the Syar Tunnel inlet indicate that most of the total phosphorus is dissolved total phosphorus, which is highly reactive and utilized by aquatic plants. Therefore, as the Bonneville Unit water would be discharged to Hobble Creek, the dissolved total phosphorus would be utilized by aquatic macrophytes (plants) growing in the river, which provide substrate and habitat for aquatic macroinvertebrates. This natural food source for fish would support a projected increase in fish biomass in Hobble Creek discussed in Section 3.6, Aquatic Resources. Additionally, the Bonneville Unit water discharged to Hobble Creek would dilute concentrated stormwater runoff that flows into the creek in this reach and would provide flows to improve aquatic resource habitat and water quality conditions for aquatic resources. The potential increases in total phosphorus during July, August, September and October are not considered a significant impact on water quality for aquatic resources in Hobble Creek.

Table 3-24
Hobble Creek Annual Average Water Quality Under the Proposed Action and Change From Baseline Conditions

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Water Quality Characteristic		**TDS (mg/L)**	**pH (units)**	**DO (mg/L)**	**Temperature (°C)**	**Nitrate[3] (mg/L)**	**Ammonia (mg/L)**	**Phosphorus (mg/L)**	**Selenium (µg/L)**
Average Flow Water Quality									
Flow-Weighted Average	Change[1]	-63	-0.1	1.5	~~-1.4~~ **-1.3**	-0.23	-0.01	0.01	-0.5
	Value	230	8.1	10.3	9.3	0.47	0.04	0.05	1.1
Dry Year Water Quality (1992)									
Flow-Weighted Average	Change[1]	-110	-0.1	2.0	0.2	-0.56	-0.02	0.02	-0.1
	Value	195	8.0	11.5	7.5	0.36	0.03	0.05	0.8

Table 3-24
Hobble Creek Annual Average Water Quality Under the Proposed Action and Change From Baseline Conditions

Water Quality Characteristic		TDS (mg/L)	pH (units)	DO (mg/L)	Temperature (°C)	Nitrate[3] (mg/L)	Ammonia (mg/L)	Phosphorus (mg/L)	Selenium (µg/L)
Wet Year Water Quality (1998)									
Flow-Weighted Average	Change[1]	-56	-0.1	1.2	-1.0	-0.18	-0.01	0.01	-0.5
	Value	238	8.1	10.1	9.8	0.51	0.04	0.05	1.1
Maximum Monthly Levels									
Flow-Weighted Average	Change[2]	-145	-0.1	1.4	-10.1	-0.97	0.04	0.06	-0.8
	Value	258	8.2	9.1[a]	13.0	0.83	0.08	0.12	1.7

Notes:
[1] Change from Baseline Annual Average
[2] Change from Baseline Maximum Monthly
[3] Nitrate + Nitrite as Nitrogen
[a]Minimum monthly water quality value.

3.3.8.3.2.3 Spanish Fork River From Diamond Fork Creek to Utah Lake. Water quality conditions in the Spanish Fork River would remain unchanged or change slightly under the Proposed Action. Table 3-25 summarizes the water quality impacts on an annual basis compared to historic baseline conditions. Monthly maximum comparisons are based on the average flow scenario. Spanish Fork River dissolved oxygen concentrations would increase or decrease slightly from historic baseline conditions, however, monthly values would remain above the water quality standards for upper and lower Spanish Fork River sites. Water temperatures would increase slightly or remain unchanged in every month and would be within water quality standards for designated beneficial uses in the upper and lower Spanish Fork River. Total phosphorus would increase slightly above historic baseline conditions in upper Spanish Fork River during May through October from levels already above the pollution indicator level for streams. Total phosphorus would increase slightly above historic baseline conditions in lower Spanish Fork River during February through October. The increases in total phosphorus in the Spanish Fork River under the Proposed Action would be influenced by total phosphorus concentrations in Strawberry Reservoir at the Syar Tunnel inlet. Data from the Syar Tunnel inlet indicate that most of the total phosphorus is dissolved total phosphorus, which is highly reactive and utilized by aquatic plants. Therefore, as the Bonneville Unit water would be discharged to the Spanish Fork River, the dissolved total phosphorus would be utilized by aquatic macrophytes (plants) growing in the river, which provide substrate and habitat for aquatic macroinvertebrates. TDS would increase slightly in most months in the upper and lower Spanish Fork River, remaining below the water quality standard. Other water quality characteristics including pH, nitrate plus nitrite, ammonia, and selenium concentrations would increase or decrease slightly under the Proposed Action, with all values remaining within water quality standards or pollution indicators as applicable.

Table 3-25
Spanish Fork River Annual Average Water Quality From Diamond Fork Creek to Utah Lake Under the Proposed Action Compared to Historic Baseline Conditions

Water Quality Characteristic		TDS (mg/L)	pH (units)	DO (mg/L)	Temperature (°C)	Nitrate[3] (mg/L)	Ammonia (mg/L)	Phosphorus (mg/L)	Selenium (µg/L)
Average Flow Water Quality									
Upper Spanish Fork River	Change[1]	21	0	0	0.1	0	0	0.1	0
	Value	345	8.1	11.7	10.7	0.17	0.03	0.15	1.0
Lower Spanish Fork River	Change[1]	7	0	-0.3	-0.3	0.05	0	0	0
	Value	488	8.1	10.0	9.8	0.87	0.11	0.09	1.0
Dry Year Water Quality (1992)									
Upper Spanish Fork River	Change[1]	-23	0	0.2	-1.0	0.02	0	-0.05	+0.1
	Value	302	8.1	11.9	9.6	0.18	0.03	0.09	1.1
Lower Spanish Fork River	Change[1]	-58	0	0.7	-3.3	-2.2	-0.03	-0.01	+0.1
	Value	423	8.1	11.0	6.9	0.61	0.07	0.08	1.1
Wet Year Water Quality (1998)									
Upper Spanish Fork River	Change[1]	50	0	0	0.4	0.06	0.04	0.03	-0.1
	Value	374	8.1	11.7	11.0	0.23	0.03	0.17	0.9
Lower Spanish Fork River	Change[1]	62	0	-0.3	0.9	0.06	0.02	0.01	0
	Value	543	8.1	10.0	11.0	0.88	0.13	0.10	1.0
Maximum Monthly Levels									
Upper Spanish Fork River	Change[2]	4	0	0.6	1.0	-0.05	-0.01	0.01	0
	Value	531	8.4	9.7[a]	15.8	0.59	0.05	0.31	2.1
Lower Spanish Fork River	Change[2]	58	0	-0.1	2.2	0.12	0.05	0.01	0
	Value	630	8.3	8.0[a]	20.2	2.49	0.21	0.19	1.4

All values are flow-weighted.
[1] Change from Historic Baseline Annual Average
[2] Change from Historic Baseline Maximum Monthly
[3] Nitrate + Nitrite as Nitrogen
[a] Minimum monthly water quality value.

Table 3-26 summarizes the water quality impacts on an annual basis compared to simulated baseline conditions. Monthly maximum comparisons are based on the average flow scenario. Spanish Fork River dissolved oxygen concentrations would increase or decrease slightly from simulated baseline conditions, however, monthly values would remain above the water quality standards for upper and lower Spanish Fork River sites. Water temperatures would increase slightly or remain unchanged in every month and would be within water quality standards for designated beneficial uses in the upper and lower Spanish Fork River. Total phosphorus would increase slightly above simulated baseline conditions in upper Spanish Fork River during May through October from levels already above the pollution indicator level for streams. Total phosphorus would increase slightly above simulated baseline conditions in lower Spanish Fork River during February through July and in September and October. The increases in total phosphorus in the Spanish Fork River under the Proposed Action would be influenced by total phosphorus concentrations in Strawberry Reservoir at the Syar Tunnel inlet. Data from the Syar Tunnel inlet indicate that most of the total phosphorus is dissolved total phosphorus, which is highly reactive and utilized by aquatic plants. Therefore, as the Bonneville Unit water would be discharged to the Spanish Fork River, the dissolved total phosphorus would be utilized by aquatic macrophytes (plants) growing in the river, which provide substrate and habitat for aquatic macroinvertebrates. The slight increases in total phosphorus are not considered significant water quality impacts in the Spanish Fork River. TDS would increase slightly in every month in the upper and lower Spanish Fork River, with TDS concentrations remaining below the water quality standard. Other water quality characteristics including pH, nitrate plus nitrite, ammonia, and selenium concentrations would increase or decrease slightly, with all values remaining within water quality standards or pollution indicators as applicable.

Table 3-26
Spanish Fork River Annual Average Water Quality From Diamond Fork Creek to Utah Lake Under the Proposed Action Compared to Simulated Baseline

Water Quality Characteristic		TDS (mg/L)	pH (units)	DO (mg/L)	Temperature (°C)	Nitrate[3] (mg/L)	Ammonia (mg/L)	Phosphorus (mg/L)	Selenium (µg/L)
Average Flow Water Quality									
Upper Spanish Fork River	Change[1]	60	0	-0.1	0.8	-0.02	0	0.03	0
	Value	345	8.1	11.7	10.7	0.17	0.03	0.15	1.0
Lower Spanish Fork River	Change[1]	101	0	-0.8	0.3	0.23	0.02	0.01	-0.1
	Value	488	8.1	10.0	9.8	0.87	0.11	0.09	1.0
Dry Year Water Quality (1992)									
Upper Spanish Fork River	Change[1]	16	0	0.1	-0.3	0	0	-0.03	-0.1
	Value	302	8.1	11.9	9.6	0.18	0.03	0.09	1.1
Lower Spanish Fork River	Change[1]	36	0	0.2	-2.7	-0.03	-0.01	0	-0.2
	Value	423	8.1	11.0	6.9	0.61	0.07	0.08	1.1
Wet Year Water Quality (1998)									
Upper Spanish Fork River	Change[1]	88	0.1	-0.1	1.1	0.04	0	0.05	-0.1
	Value	374	8.1	11.7	11.0	0.23	0.03	0.17	0.9
Lower Spanish Fork River	Change[1]	156	0	-0.8	1.5	0.24	0.04	0.02	-0.1
	Value	543	8.1	10.0	11.0	0.88	0.13	0.10	1.0
Maximum Monthly Levels									
Upper Spanish Fork River	Change[2]	145	0.1	-0.1	1.3	0.11	-0.01	0.07	+0.1
	Value	531	8.4	9.7[a]	15.8	0.59	0.05	0.31	2.1
Lower Spanish Fork River	Change[2]	156	0.1	-1.0	4.0	0.88	-0.06	0.06	-0.1
	Value	630	8.3	8.0[a]	20.2	2.49	0.21	0.19	1.4

All values are flow-weighted
[1] Change from Simulated Baseline Annual Average
[2] Change from Simulated Baseline Maximum Monthly
[3] Nitrate + Nitrite as Nitrogen
[a] Minimum monthly water quality value.

3.3.8.3.3 Summary of Proposed Action Impacts. The Proposed Action would decrease localized TP concentrations in Utah Lake near the mouths of the Provo River, Hobble Creek and Spanish Fork River. The Proposed Action would result in no change in TP load into Utah Lake compared to historic baseline conditions. The Proposed Action would result in a 3.2 tons per year (-1.1 percent) decrease in TP load into Utah Lake compared to simulated baseline conditions. This net decrease in total TP would improve water quality in Utah Lake and would not be a significant water quality impact. TDS cumulative concentrations would remain essentially unchanged from historic TDS concentrations, with minor increases or decreases projected, all below the TDS water quality standard. The Proposed Action would increase TDS concentrations in Utah Lake compared to simulated baseline conditions, with the concentrations remaining under or near the agricultural use standard of 1,200 mg/L. Average annual TDS load to Utah Lake would decrease by 584 tons (-0.2 percent) from historic baseline and by 11,486 tons (-3,3 percent) from simulated baseline under the Proposed Action.

Water quality conditions in the lower Provo River would generally improve because of the Bonneville Unit water provided for in-stream flows. Dissolved oxygen concentrations would increase in the lower Provo River during most months, resulting in a significant beneficial impact on water quality. Water temperatures would decrease during summer months and increase in winter months, providing benefits to aquatic resources throughout the year. Total phosphorus concentrations in the lower Provo River would remain unchanged on an average annual basis, however, monthly total phosphorus concentrations would increase to above the pollution indicator level during some summer and fall months. TDS, pH, nitrate plus nitrite, ammonia, and selenium concentrations would decrease or remain unchanged.

Water quality conditions in Hobble Creek would generally improve because of the Bonneville Unit water provided for in-stream flows downstream of the Mapleton Lateral. Dissolved oxygen concentrations would increase in Hobble Creek during every month, resulting in a significant beneficial impact on water quality. Water temperatures would decrease during summer months and increase in winter months, providing benefits to aquatic resources throughout the year. Total phosphorus concentrations in Hobble Creek would increase by 0.01 mg/L on an average annual basis, and monthly total phosphorus concentrations would increase to above the pollution indicator level during some summer and fall months. TDS, pH, nitrate plus nitrite, ammonia, and selenium concentrations would decrease or remain unchanged.

Water quality conditions in the Spanish Fork River would remain unchanged or change slightly under the Proposed Action. Dissolved oxygen concentrations would increase or decrease slightly from simulated baseline conditions, with all values remaining above the minimum water quality standards. Water temperatures would increase or decrease slightly from simulated baseline conditions, with all values remaining below water quality standards. Total phosphorus concentrations would increase slightly above simulated baseline conditions during most months from levels above the pollution indicator level for streams. TDS, pH, nitrate plus nitrite, ammonia, and selenium monthly concentrations would increase or decrease slightly, with all monthly values remaining within water quality standards.

3.3.8.4 Bonneville Unit Water Alternative

3.3.8.4.1 Lake and Reservoir Water Quality

3.3.8.4.1.1 Utah Lake

A. Total Phosphorus. The following sections summarize the impact analysis detailed in the Surface Water Quality Technical Report for the Utah Lake Drainage Basin Water Delivery System (CUWCD 2004b), Section 4.4.1.1.1, Total Phosphorus. Total phosphorus impacts in Utah Lake were analyzed in terms of localized TP concentrations and estimated TP concentrations in inflow sources and for estimated TP load in Utah Lake.

The ULS Bonneville Unit Water Alternative would provide Bonneville Unit flows in Hobble Creek year-round in similar monthly volumes. Strawberry Reservoir water conveyed through the Mapleton-Springville Lateral Pipeline would be mixed with Hobble Creek water upstream of Springville City and flow down to Utah Lake. The Bonneville Unit Water Alternative flow-weighted average TP concentration of 0.05 mg/L would be 0.12 mg/L lower than the historic annual average TP concentration at the Utah Lake STORET station closest to the mouth of Hobble Creek. The historic annual average TP concentration in surface samples at this station is 0.17 mg/L. The maximum flow-weighted TP concentration of 0.12 mg/L in Hobble Creek under the Bonneville Unit Water Alternative would be below the maximum recorded Utah Lake TP concentration of 0.84 mg/L. The Bonneville Unit Water Alternative inflows from Hobble Bonneville Unit Water Alternative would not have a significant impact on TP concentrations in Utah Lake near the mouth of Hobble Creek.

The ULS Bonneville Unit Water Alternative would deliver Bonneville Unit flows through the Spanish Fork River to Utah Lake from October through April. In-stream flows provided to Sixth Water Creek and Diamond Fork Creek from Strawberry Reservoir water would flow down the Spanish Fork River to Utah Lake. The Bonneville Unit Water Alternative flow-weighted average TP concentration of 0.08 mg/L would be 0.03 mg/L lower than historic average TP concentrations at the two Utah Lake STORET stations closest to the mouth of the Spanish Fork River. Historic average TP concentrations in surface samples at these stations during Bonneville Unit Water Alternative water delivery months from October through April is 0.11 mg/L. The maximum flow-weighted TP concentration of 0.14 mg/L in the Spanish Fork River under the Bonneville Unit Water Alternative would be below the maximum recorded Utah Lake TP concentration range of 0.17 mg/L to 0.25 mg/L. The Bonneville Unit Water Alternative inflows from the Spanish Fork River would dilute and reduce Utah Lake TP concentrations near the mouth of the Spanish Fork River. The Bonneville Unit Water Alternative would not have a significant impact on TP concentrations in Utah Lake near the mouth of the Spanish Fork River.

The estimated TP load to Utah Lake under the Bonneville Unit Water Alternative would increase by 4.2 tons per year (+1.4 percent) compared to historic TP load (Table 3-27). TP loads would decrease in the Provo River because of water exchanged from Utah Lake to Jordanelle Reservoir, and would increase in the Spanish Fork River, Hobble Creek and in ULS return flows. TP load from Other Inflows would decrease because of reduced return flows from northern Utah County. Under the Bonneville Unit Water Alternative, the estimated net TP load of 295.8 tons per year from all inflow sources to Utah Lake would be slightly higher than the estimated historic TP load. The Bonneville Unit Water Alternative would have a significant impact on TP load to Utah Lake.

Table 3-27
Estimated Utah Lake Total Phosphorus Load Under the Bonneville Unit Water Alternative and Change From Historic Baseline Conditions

Inflow Source	Average Annual Inflow (acre-feet)	TP Concentration (mg/L)	Combined TP Load (tons per year)	Change from Historic Baseline Load (tons per year)	Change from Historic Baseline Load (percent)
Provo River	94,063	0.06	8.1	-2.6	-24
Spanish Fork River	158,138	0.08	18.1	+6.3	+53
Hobble Creek	46,024	0.05	3.3	+2.1	+175
ULS Return Flows	4,660	0.05	0.3	+0.3	NA
WWTP Discharges	52,591	3.00	225.6	0	0
Other Inflows	256,707	0.11	40.4	-1.9	-4.5
Total	**612,183**		**295.8**	**+4.2**	**+1.4**

The estimated TP load to Utah Lake under The Bonneville Unit Water Alternative would increase by 1.0 ton per year (+0.3 percent) compared to simulated TP load (Table 3-28). The estimated TP load would increase in the Provo River because of increased flows down the Provo River to provide June sucker spawning and rearing habitat, in Hobble Creek because of increased Strawberry Reservoir flows, and in the ULS return flows. TP load in Other Inflows would decrease because of reduced return flows from northern Utah County. Under the Bonneville Unit Water Alternative, the estimated net TP load of 295.8 tons from all inflow sources would be slightly higher than the simulated TP load of 294.8 tons to Utah Lake.

Table 3-28
Estimated Utah Lake Total Phosphorus Load Under the Bonneville Unit Water Alternative and Change From Simulated Baseline Conditions

Inflow Source	Average Annual Inflow (acre-feet)	TP Concentration (mg/L)	Combined TP Load (tons per year)	Change from Simulated Baseline Load (tons per year)	Change from Simulated Baseline Load (percent)
Provo River	94,063	0.06	8.1	+1.3	+19
Spanish Fork River	158,138	0.08	18.1	-1.0	-5.2
Hobble Creek	46,024	0.05	3.3	+2.1	+175
ULS Return Flows	4,660	0.05	0.3	+0.3	NA
WWTP Discharges	52,591	3.00	225.6	0	0
Other Inflows	256,707	0.11	40.4	-1.9	-4.5
Total	**612,183**		**295.8**	**+1.0**	**+0.3**

B. Total Dissolved Solids. The methodology used to analyze TDS impacts in Utah Lake under the Proposed Action (see Section 3.3.8.1.1 B) were used to analyze TDS impacts in Utah Lake under the Bonneville Unit Water Alternative. The following sections present the Bonneville Unit Water Alternative impact analysis for TDS cumulative concentrations and TDS load in Utah Lake.

Under the Bonneville Unit Water Alternative, Utah Lake TDS cumulative concentrations would decrease slightly from historical baseline measurements except for one measurement (STORET station 491731 on 7/2/93), and all concentrations would be below the agricultural use water quality standard of 1,200 mg/L (Table 3-29).

Compared to the simulated baseline TDS concentrations, the Bonneville Unit Water Alternative would increase TDS cumulative concentrations compared to all STORET stations measured on 8/14/90, but would not exceed the agricultural use water quality standard (Table 3-29). Compared to all other Utah Lake simulated baseline values, the Bonneville Unit Water Alternative would decrease TDS concentrations slightly. The LKSIM2000 model provides a conservatively higher estimate of TDS cumulative concentrations under the Bonneville Unit Water Alternative, which is one reason the values shown are higher than the ULS simulated baseline.

Table 3-29
Utah Lake Total Dissolved Solids Cumulative Concentrations Under the Bonneville Unit Water Alternative Compared to Historical and Simulated Baseline Conditions

Sample Date	Monitoring Station ID Number	Utah Lake Measured Historic TDS (mg/L)	Utah Lake Simulated Baseline TDS (mg/L)	Projected Cumulative ULS Bonneville Unit Water Alternative TDS (mg/L)	Cumulative Change from Historic Baseline TDS (percent)	Cumulative Change from Simulated Baseline TDS (percent)
8/14/90	491730	1,240	1,002	1,059	-15	+5.7
8/14/90	491732	1,248	1,002	1,059	-15	+5.7
8/14/90	491733	1,288	1,002	1,059	-18	+5.7
8/14/90	491734	1,292	1,002	1,059	-18	+5.7
8/14/90	491737	1,238	1,002	1,059	-14	+5.7
8/14/90	491738	1254	1,002	1,059	-16	+5.7
8/14/90	491739	1,262	1,002	1,059	-16	+5.7
8/14/90	491740	1,224	1,002	1,059	-13	+5.7
8/14/90	491741	1,244	1,002	1,059	-15	+5.7
8/14/90	491742	1,262	1,002	1,059	-16	+5.7
8/14/90	491750	1,246	1,002	1,059	-15	+5.7
8/14/90	491751	1,284	1,002	1,059	-18	+5.7
8/14/90	491752	1,262	1,002	1,059	-16	+5.7
8/14/90	491762	1,330	1,002	1,059	-20	+5.7
8/14/90	491770	1,284	1,002	1,059	-18	+5.7
8/14/90	491771	1,278	1,002	1,059	-17	+5.7
8/14/90	491777	1,214	1,002	1,059	-13	+5.7
7/2/93	491731	816	921	865	+6.0	-6.1
7/15/94	491731	1,022	1,069	996	-2.5	-6.8
7/26/95	491731	872	855	786	-9.9	-8.1
9/27/95	491731	924	931	867	-6.2	-6.9
7/15/97	491731	760	728	689	-9.3	-5.4
7/15/97	491732	758	728	689	-9.1	-5.4
9/11/97	491731	806	785	742	-7.9	-5.5
9/11/97	491732	800	785	742	-7.3	-7.3
7/6/99	491731	700	681	634	-9.4	-6.9
7/6/99	491762	716	681	634	-11.5	-6.9
7/6/99	491777	682	681	634	-7.0	-6.9
8/19/99	491731	720	718	678	-5.8	-5.6
8/19/99	491732	714	718	678	-5.0	-5.6

The estimated TDS load to Utah Lake under the Bonneville Unit Water Alternative would increase from the estimated historic TDS load to Utah Lake (Table 3-30). The TDS load would decrease in the Provo River because of water exchanged from Utah Lake to Jordanelle Reservoir, would decrease from Other Inflow because of reduced return flows in northern Utah County, and would increase in the Spanish Fork River, Hobble Creek, and in ULS return flows. Under the Bonneville Unit Water Alternative, the estimated net TDS load of 349,021 tons per year from all inflow sources to Utah Lake would be 10,046 tons higher (+3.0 percent) than the estimated net historic TDS load of 338,975 tons per year to Utah Lake. The Bonneville Unit Water Alternative would have a significant impact on TDS load into Utah Lake compared to historic baseline conditions.

Table 3-30
Estimated Utah Lake TDS Load Under the Bonneville Unit Water Alternative and Change From Historic Baseline Conditions

Inflow Source	Average Annual Inflow (acre-feet)	Concentration (mg/L)	Combined Load (tons per year)	Change from Historic Baseline Load (tons per year)	Change from Historic Baseline Load (percent)
Provo River	94,063	276	37,125	-12,100	-25
Spanish Fork River	158,138	372	84,123	21,131	34
Hobble Creek	46,024	219	14,413	5,894	69
ULS Return Flows	4,660	457	3,046	3,036	NA
WWTP Discharges	52,591	600	45,123	0	0
Other Inflows	256,707	450	165,191	-7,925	-5
Total	**612,183**		**349,021**	**10,046**	**+3**

The estimated TDS load to Utah Lake under the Bonneville Unit Water Alternative would decrease by 1,989 tons per year (net –0.6 percent) from the estimated simulated baseline TDS load to Utah Lake (Table 3-31). The estimated TDS load would increase in the Provo River because of increased flow for June sucker spawning and rearing, increase in Hobble Creek because of increased Strawberry Reservoir water being mixed with Hobble Creek water, and increase in ULS return flows. The estimated TDS load would decrease from Other Inflows because of reduced return flows in northern Utah County and would decrease in the Spanish Fork River because of decreased load from reduced Strawberry Reservoir flows. Under the Bonneville Unit Water Alternative, the estimated net TDS load of 347,734 tons per year from all inflow sources to Utah Lake would be lower than the estimated net simulated baseline TDS load of 349,878 tons per year to Utah Lake. The Bonneville Unit Water Alternative would not have a significant impact on TP load to Utah Lake compared to simulated baseline conditions.

Table 3-31
Estimated Utah Lake TDS Load Under the Bonneville Unit Water Alternative and Change From Simulated Baseline Conditions

Inflow Source	Average Annual Inflow (acre-feet)	Concentration (mg/L)	Combined Load (tons per year)	Change from Simulated Baseline Load (tons per year)	Change from Simulated Baseline Load (percent)
Provo River	94,063	276	37,125	+5,716	+18.2
Spanish Fork River	158,138	372	84,123	-7,222	_7.9
Hobble Creek	46,024	219	14,413	+5,894	+69.2
ULS Return Flows	4,660	264	1,759	+1,548	NA
WWTP Discharges	52,591	600	45,123	0	0
Other Inflows	256,707	450	165,191	-7,925	-4.6
Total	**612,183**		**347,734**	**-1,989**	**-0.6**

3.3.8.4.2 Stream and River Water Quality

The following sections present the water quality impact analysis for Hobble Creek and the Spanish Fork River under the Bonneville Unit Water Alternative. There would be no new sources of water in the lower Provo River under this alternative, therefore, there would be no measurable changes in water quality. Detailed descriptions and tables showing the changes by water quality characteristic are presented in the Surface Water Quality Technical Report for the Utah Lake Drainage Basin Water Delivery System (CUWCD 2004b).

3.3.8.4.2.1 Hobble Creek From Mapleton-Springville Lateral to Utah Lake. Water quality conditions in Hobble Creek would be generally improved under the Bonneville Unit Water Alternative because of the additional water added to the creek downstream of the Mapleton Lateral. Table 3-32 summarizes the water quality impacts on an annual basis. Monthly maximum comparisons are based on the average flow scenario. Hobble Creek dissolved oxygen concentrations would increase in every month from baseline conditions. The increased dissolved oxygen concentrations would occur from the Bonneville Unit water discharged to Hobble Creek, which at times could be most of the river flow between the Mapleton Lateral and Utah Lake. There would be a significant beneficial impact on dissolved oxygen concentrations in Hobble Creek under the Bonneville Unit Water Alternative. Other water quality characteristics including TDS, nitrate plus nitrite, and selenium concentrations would decrease or remain unchanged from baseline conditions under the Bonneville Unit Water Alternative. Water temperatures would decrease during summer months and increase during winter months, providing improved fish habitat conditions throughout the year. This would be a significant beneficial impact on water quality conditions in July by decreasing the water temperature below the state water quality standards. Hobble Creek pH values would decrease or remain unchanged with the additional water provided under the Bonneville Unit Water Alternative. Total phosphorus concentrations would increase 0.01 mg/L from baseline conditions on an annual average basis. Monthly total phosphorus concentrations would increase to above the pollution indicator level in July, August, September and October, and would remain at or below the pollution indicator level in all other months. The increases in total phosphorus in Hobble Creek under the Bonneville Unit Water Alternative would be caused by total phosphorus concentrations in Strawberry Reservoir at the Syar Tunnel inlet mixed with the Hobble Creek water. Total phosphorus concentrations of water entering the Syar Tunnel inlet tend to increase during the summer months because of reservoir stratification, leading to higher concentrations near the reservoir bottom and the inlet. Data from the Syar Tunnel inlet indicate that most of the total phosphorus is dissolved total phosphorus, which is highly reactive and utilized by aquatic plants. Therefore, as the Bonneville Unit water would be discharged to Hobble Creek, the dissolved total phosphorus would be utilized by aquatic macrophytes (plants) growing in the river, which provide substrate and habitat for aquatic macroinvertebrates. This natural food source for fish would support a projected increase in fish biomass in Hobble Creek discussed in Section 3.6, Aquatic Resources. Additionally, the Bonneville Unit water discharged to Hobble Creek would dilute concentrated stormwater runoff that flows into the creek in this reach and would provide flows to improve aquatic resource habitat and water quality conditions for aquatic resources. The potential increases in total phosphorus during July, August, September and October are not considered a significant impact on water quality for aquatic resources in Hobble Creek.

Table 3-32
Hobble Creek Annual Average Water Quality Under the Bonneville Unit Water Alternative and Change From Baseline Conditions

Water Quality Characteristic		TDS (mg/L)	pH (units)	DO (mg/L)	Temperature (°C)	Nitrate[3] (mg/L)	Ammonia (mg/L)	Phosphorus (mg/L)	Selenium (µg/L)
Average Flow Water Quality									
Flow-Weighted Average	Change[1]	-74	-0.1	1.7	-1.3	-0.26	-0.01	0.01	-0.61
	Value	219	8.1	10.5	9.3	0.44	0.04	0.05	0.99
Dry Year Water Quality (1992)									
Flow-Weighted Average	Change[1]	-117	-0.1	2.7	0.6	-0.58	-0.01	0.02	-1.02
	Value	187	8.0	11.5	7.9	0.35	0.04	0.05	0.73
Wet Year Water Quality (1998)									
Flow-Weighted Average	Change[1]	-46	0.0	1.0	-0.7	-0.15	-0.01	0.01	-0.38
	Value	248	8.1	9.8	10.1	0.54	0.04	0.05	1.21
Maximum Monthly Levels									
Flow-Weighted Average	Change[2]	-145	-0.1	1.4	-10.3	-1.03	-0.04	0.06	-0.94
	Value	258	8.2	9.1[a]	12.9	0.77	0.08	0.12	1.56

Notes:
[1] Change from Baseline Annual Average
[2] Change from Baseline Maximum Monthly
[3] Nitrate + Nitrite as Nitrogen
[a] Minimum monthly water quality value.

3.3.8.4.2.2 Spanish Fork River From Diamond Fork Creek to Utah Lake. Water quality conditions in the Spanish Fork River would remain unchanged or change slightly under the Bonneville Unit Water Alternative. Table 3-33 summarizes the water quality impacts on an annual basis compared to historic baseline conditions. Monthly maximum comparisons are based on the average flow scenario. Spanish Fork River dissolved oxygen concentrations would increase or decrease slightly from historic baseline conditions, however, monthly values would remain above the water quality standards for upper and lower Spanish Fork River sites. Water temperatures would increase or decrease slightly in every month and would be within water quality standards for designated beneficial uses in the upper and lower Spanish Fork River. Total phosphorus would increase above historic baseline conditions in upper Spanish Fork River during May through October from levels already above the pollution indicator level for streams. Total phosphorus would increase slightly above historic baseline conditions in lower Spanish Fork River during January through October. The increases in total phosphorus in the Spanish Fork River under the Bonneville Unit Water Alternative would be influenced by total phosphorus concentrations in Strawberry Reservoir at the Syar Tunnel inlet mixed with Spanish Fork River water. Data from the Syar Tunnel inlet indicate that most of the total phosphorus is dissolved total phosphorus, which is highly reactive and utilized by aquatic plants. Therefore, as the Bonneville Unit water would be discharged to the Spanish Fork River, the dissolved total phosphorus would be utilized by aquatic macrophytes (plants) growing in the river, which provide substrate and habitat for aquatic macroinvertebrates. TDS would increase slightly in most months in the upper and lower Spanish Fork River, remaining below the water quality standard. Other water quality characteristics including pH, nitrate plus nitrite, ammonia, and selenium concentrations would increase or decrease slightly under the Bonneville Unit Water Alternative, with all values remaining within water quality standards.

Table 3-33
Spanish Fork River Annual Average Water Quality From Diamond Fork Creek to Utah Lake Under the Bonneville Unit Water Alternative Compared to Historic Baseline Conditions

Water Quality Characteristic		TDS (mg/L)	pH (units)	DO (mg/L)	Temperature (°C)	Nitrate[3] (mg/L)	Ammonia (mg/L)	Phosphorus (mg/L)	Selenium (µg/L)
Average Flow Water Quality									
Upper Spanish Fork River	Change[1]	-15	0	0.2	-0.8	0.03	0	-0.01	+0.1
	Value	309	8.1	11.9	9.8	0.20	0.03	0.13	1.1
Lower Spanish Fork River	Change[1]	-109	0	0.7	-1.6	-0.13	-0.03	-0.01	+0.2
	Value	372	8.1	11.0	8.5	0.69	0.08	0.08	1.2
Dry Year Water Quality (1992)									
Upper Spanish Fork River	Change[1]	-68	0	0.3	-1.9	0.06	0	-0.06	+0.2
	Value	256	8.1	12.0	8.7	0.23	0.03	0.08	1.2
Lower Spanish Fork River	Change[1]	-188	0	1.7	-2.9	-0.38	-0.05	-0.02	+0.3
	Value	293	8.1	12.0	7.2	0.44	0.05	0.07	1.3
Wet Year Water Quality (1998)									
Upper Spanish Fork River	Change[1]	-4	0	0.1	-0.7	0.03	0	0	0
	Value	320	8.1	11.9	9.9	0.20	0.03	0.14	1.0
Lower Spanish Fork River	Change[1]	-71	0	0.7	-0.5	-0.14	-0.02	-0.01	+0.2
	Value	410	8.1	11.0	9.6	0.68	0.09	0.08	1.2
Maximum Monthly Levels									
Upper Spanish Fork River	Change[2]	-180	-0.1	0.7	1.4	-0.20	0.01	0.02	-0.2
	Value	347	8.3	9.8[a]	16.1	0.44	0.06	0.32	1.9
Lower Spanish Fork River	Change[2]	160	-0.1	-0.3	3.1	-0.60	0.10	-0.04	+0.2
	Value	732	8.2	7.8[a]	21.1	1.77	0.27	0.14	1.6

All values are flow-weighted.
[1] Change from Historic Baseline Annual Average
[2] Change from Historic Baseline Maximum Monthly
[3] Nitrate + Nitrite as Nitrogen
[a] Minimum monthly water quality value.

Table 3-34 summarizes the water quality impacts on an annual basis compared to simulated baseline conditions. Monthly maximum comparisons are based on the average flow scenario. Spanish Fork River dissolved oxygen concentrations would increase or decrease slightly from simulated baseline conditions, however, monthly values would remain above the water quality standards for upper and lower Spanish Fork River sites. Water temperatures would increase slightly or remain unchanged in every month and would be within water quality standards for designated beneficial uses in the upper and lower Spanish Fork River. Total phosphorus would increase slightly above simulated baseline conditions in upper Spanish Fork River during May through October from levels already above the pollution indicator level for streams. Total phosphorus would increase slightly above simulated baseline conditions in lower Spanish Fork River during January through July and in September and October. The increases in total phosphorus in the Spanish Fork River under the Bonneville Unit Water Alternative would be influenced by total phosphorus concentrations in Strawberry Reservoir at the Syar Tunnel inlet mixed with Spanish Fork River water. Data from the Syar Tunnel inlet indicate that most of the total phosphorus is dissolved total phosphorus, which is highly reactive and utilized by aquatic plants. Therefore, as the Bonneville Unit water would be discharged to the Spanish Fork River, the dissolved total phosphorus would be utilized by aquatic macrophytes (plants) growing in the river, which provide substrate and habitat for aquatic macroinvertebrates. The slight increases in total phosphorus are not considered significant water quality impacts in the Spanish Fork River. TDS would increase slightly in some months in the upper and lower Spanish Fork River, with TDS concentrations remaining below the water quality standard. Other water quality characteristics including pH, nitrate plus nitrite, ammonia, and selenium concentrations would increase or decrease slightly, with all values remaining within water quality standards or pollution indicators as applicable.

Table 3-34
Spanish Fork River Annual Average Water Quality From Diamond Fork Creek to Utah Lake Under the Bonneville Unit Water Alternative Compared to Simulated Baseline Conditions

Water Quality Characteristic		TDS (mg/L)	pH (units)	DO (mg/L)	Temperature (°C)	Nitrate[3] (mg/L)	Ammonia (mg/L)	Phosphorus (mg/L)	Selenium (µg/L)
Average Flow Water Quality									
Upper Spanish Fork River	Change[1]	24	0	0.1	-0.1	0.01	0	0.01	+0.1
	Value	309	8.1	11.9	9.8	0.20	0.03	0.13	1.1
Lower Spanish Fork River	Change[1]	-15	0	0.2	-1.0	0.05	-0.01	0	+0.1
	Value	372	8.1	11.0	8.5	0.69	0.08	0.08	1.2
Dry Year Water Quality (1992)									
Upper Spanish Fork River	Change[1]	-29	0	1.2	-1.2	0.04	0	-0.04	0
	Value	256	8.1	12.0	8.7	0.23	0.03	0.08	1.2
Lower Spanish Fork River	Change[1]	-94	0	2.2	-2.3	-0.20	-0.04	-0.01	0
	Value	293	8.1	12.0	7.2	0.44	0.05	0.07	1.3
Wet Year Water Quality (1998)									
Upper Spanish Fork River	Change[1]	35	0	0.1	0	0.01	0	0.02	0
	Value	320	8.1	11.9	9.9	0.20	0.03	0.14	1.0
Lower Spanish Fork River	Change[1]	23	0	0.2	0.1	0.04	-0.01	0	+0.1
	Value	410	8.1	11.0	9.6	0.68	0.10	0.08	1.2
Maximum Monthly Levels									
Upper Spanish Fork River	Change[2]	-39	0	0	1.7	-0.04	0.26	0.08	-0.1
	Value	347	8.3	9.8[a]	16.1	0.44	0.32	0.32	1.9
Lower Spanish Fork River	Change[2]	258	0	-1.2	4.9	0.16	-0.01	0.01	+0.1
	Value	732	8.2	7.8[a]	21.1	1.77	0.14	0.14	1.6

All values are flow-weighted.
[1] Change from Historic Baseline Annual Average
[2] Change from Historic Baseline Maximum Monthly
[3] Nitrate + Nitrite as Nitrogen
[a] Minimum monthly water quality value.

3.3.8.4.3 Summary of Bonneville Unit Water Alternative Impacts. In-lake TP concentrations would decrease or remain unchanged near the mouths of Hobble Creek and the Spanish Fork River. The Bonneville Unit Water Alternative would result in a 4.2 tons per year increase (+1.4 percent) in TP load into Utah Lake compared to historic baseline conditions. The estimated TP load would increase by 1 ton per year (+0.3 percent) in Utah Lake compared to simulated baseline conditions. These net increases in total phosphorus load in Utah Lake would be significant water quality impacts. The Bonneville Unit Water Alternative would decrease projected TDS cumulative concentrations in Utah Lake compared to historic conditions. TDS cumulative concentrations would decrease in Utah Lake compared to simulated baseline conditions, with the concentrations remaining under the agricultural use standard of 1,200 mg/L. Total average annual TDS load into Utah Lake under the Bonneville Unit Water Alternative would increase by 10,046 tons per year (+3 percent) over historic baseline conditions, resulting in significant impacts on Utah Lake water quality. Total average annual TDS load into Utah Lake would decrease by 1,989 tons per year (-0.6 percent) from simulated baseline conditions.

Water quality conditions in Hobble Creek would generally improve because of the Bonneville Unit water provided for in-stream flows downstream of the Mapleton Lateral. Dissolved oxygen concentrations would increase in Hobble Creek during every month, resulting in a significant beneficial impact on water quality. Water temperatures would decrease during summer months and increase in winter months, providing benefits to aquatic resources throughout the year. Total phosphorus concentrations in Hobble Creek would increase by 0.01 mg/L on an average annual basis, and monthly total phosphorus concentrations would increase to above the pollution indicator level during some summer and fall months. TDS, pH, nitrate plus nitrite, ammonia, and selenium concentrations would decrease or remain unchanged.

Water quality conditions in the Spanish Fork River would remain unchanged or change slightly under the Bonneville Unit Water Alternative. Dissolved oxygen concentrations would increase or decrease slightly from simulated baseline conditions, with all values remaining above the minimum water quality standards. Water temperatures would increase or decrease slightly from simulated baseline conditions, with all values remaining below water quality standards. Total phosphorus concentrations would generally increase slightly above simulated baseline conditions during most months from levels above the pollution indicator level for streams. TDS, pH, nitrate plus nitrite, ammonia, and selenium monthly concentrations would increase or decrease slightly, with all monthly values remaining within water quality standards. Impacts on Spanish Fork River water quality would not exceed the significance criteria.

3.3.8.5 No Action Alternative

Water quality under the No Action Alternative would be the same as the simulated baseline condition. Since there would be no difference between the No Action Alternative and the simulated baseline, this alternative is only compared to the historic baseline conditions.

3.3.8.5.1 Lake and Reservoir Water Quality

3.3.8.5.1.1 Utah Lake

A. Total Phosphorus. The following sections summarize the impact analysis detailed in the Surface Water Quality Technical Report for the Utah Lake Drainage Basin Water Delivery System (CUWCD 2004b), Section 4.5.1.1.1, Total Phosphorus. TP impacts in Utah Lake were analyzed in terms of localized TP concentrations and estimated TP concentrations in inflow sources and for estimated TP load in Utah Lake. The following sections present the No Action Alternative impact analysis for TP localized concentrations and TP load in Utah Lake.

The No Action Alternative would deliver Bonneville Unit flows through the Spanish Fork River to Utah Lake year-round. In-stream flows provided to Sixth Water Creek and Diamond Fork Creek from Strawberry Reservoir water would flow down the Spanish Fork River to Utah Lake. The No Action Alternative flow-weighted average

TP concentration of 0.09 mg/L would be 0.01 mg/L higher than or equal to historic average TP concentrations at the two Utah Lake STORET stations closest to the mouth of the Spanish Fork River. Historic average TP concentrations in surface samples at these stations during No Action Alternative water delivery months range from 0.08 mg/L to 0.09 mg/L. The No Action Alternative maximum flow-weighted TP inflow concentration of 0.13 mg/L would be lower than historic maximum recorded TP concentration range of 0.25 mg/L to 0.17 mg/L. The No Action Alternative would slightly increase or not change Utah Lake TP concentrations near the mouth of the Spanish Fork River. The No Action Alternative would not have a significant impact on TP concentrations in Utah Lake near the mouth of the Spanish Fork River.

The estimated TP load to Utah Lake under the No Action Alternative would increase by 2.5 tons per year (net +0.9 percent) compared to historic baseline conditions (Table 3-35). Total phosphorus loads would decrease in the Provo River because of water exchanged from Utah Lake to Jordanelle Reservoir, decrease from Other Inflows because of reduced return flows in northern Utah County and would substantially increase in the Spanish Fork River because of increased Strawberry Reservoir flows.

Table 3-35
Estimated Utah Lake Total Phosphorus Load Under the No Action Alternative and Change From Historic Baseline Conditions

Inflow Source	Average Annual Inflow (acre-feet)	TP Concentration (mg/L)	Combined TP Load (tons per year)	Change from Historic Baseline Load (tons per year)	Change from Historic Baseline Load (percent)
Provo River	94,063	0.06	8.1	-2.6	-24
Spanish Fork River	166,649	0.08	19.1	+7.3	+65
Hobble Creek	20,332	0.04	1.2	0	0
ULS Return Flows	210	0.05	0	0	0
WWTP Discharges	52,591	3.00	225.6	0	0
Other Inflows	256,707	0.11	40.4	-1.9	-4.5
Total	**588,962**		**294.1**	**+2.5**	**+0.9**

B. Total Dissolved Solids. The methodology used to analyze TDS impacts in Utah Lake under the Proposed Action was used to analyze TDS impacts in Utah Lake under the No Action Alternative. The following sections present the No Action Alternative impact analysis for TDS cumulative concentrations and TDS load in Utah Lake.

The ULS and the M&I System (Jordanelle Reservoir) exchange flows originate in Strawberry Reservoir, which has an average TDS concentration of 159 mg/L. When the Strawberry Reservoir water is mixed with and conveyed through the Spanish Fork River under the No Action Alternative, the resulting inflow to Utah Lake would have an estimated average TDS concentration of 387 mg/L. Other inflows (irrigation return flows, other tributary inflows, springs, etc.) are estimated to have a TDS concentration of 450 mg/L (derived from LKSIM2000 model inflow and outflow concentrations). Therefore, the impact of the ULS inflows would be a dilution of TDS concentrations in the primary tributary inflows, and would dilute and reduce in-lake TDS concentrations.

Under the No Action Alternative, Utah Lake estimated TDS cumulative concentrations would generally decrease slightly from historic baseline conditions, and all estimated TDS cumulative concentrations would below the agricultural use criterion of 1,200 mg/L (Table 3-36).

Table 3-36
Utah Lake Total Dissolved Solids Cumulative Concentrations
Under the No Action Alternative Compared to Historic Baseline Conditions

Sample Date	Monitoring Station ID Number	Utah Lake Measured Historic TDS (mg/L)	Projected Cumulative ULS No Action Alternative TDS (mg/L)	Cumulative Change from Historic Baseline TDS (percent)
8/14/90	491730	1,240	993	-20
8/14/90	491732	1,248	993	-20
8/14/90	491733	1,288	993	-23
8/14/90	491734	1,292	993	-23
8/14/90	491737	1,238	993	-20
8/14/90	491738	1254	993	-21
8/14/90	491739	1,262	993	-21
8/14/90	491740	1,224	993	-19
8/14/90	491741	1,244	993	-20
8/14/90	491742	1,262	993	-21
8/14/90	491750	1,246	993	-20
8/14/90	491751	1,284	993	-23
8/14/90	491752	1,262	993	-21
8/14/90	491762	1,330	993	-25
8/14/90	491770	1,284	993	-23
8/14/90	491771	1,278	993	-22
8/14/90	491777	1,214	993	-18
7/2/93	491731	816	927	+14
7/15/94	491731	1,022	1,063	+4.0
7/26/95	491731	872	850	-2.5
9/27/95	491731	924	923	-0.1
7/15/97	491731	760	719	-5.4
7/15/97	491732	758	719	-5.1
9/11/97	491731	806	776	-3.7
9/11/97	491732	800	776	-3.0
7/6/99	491731	700	666	-4.9
7/6/99	491762	716	666	-7.0
7/6/99	491777	682	666	-2.3
8/19/99	491731	720	702	-2.5
8/19/99	491732	714	702	-1.7

The estimated TDS load to Utah Lake under the No Action Alternative would increase from the estimated historic TDS load to Utah Lake (Table 3-37). The TDS load would decrease in the Provo River because of water exchanged from Utah Lake to Jordanelle Reservoir, would decrease in Other Inflows because of reduced return flows in northern Utah County and would increase in the Spanish Fork River because of increased Strawberry Reservoir flow and increase in ULS return flows. Under the No Action Alternative, the estimated net TDS load of 347,440 tons per year from all inflow sources to Utah Lake would be 8,465 tons higher (+2.5 percent) than the estimated net historic TDS load of 338,975 tons per year to Utah Lake. The No Action Alternative would have a significant impact on TDS load into Utah Lake.

Table 3-37
Estimated Utah Lake TDS Load Under the No Action Alternative and Change From Historic Baseline Conditions

Inflow Source	Average Annual Inflow (acre-feet)	Concentration (mg/L)	Combined Load (tons per year)	Change from Historic Baseline Load (tons per year)	Change from Historic Baseline Load (percent)
Provo River	94,063	276	37,125	-12,100	-24.6
Spanish Fork River	165,059	387	91,345	+28,353	+45.0
Hobble Creek	20,332	293	8,519	0	0
ULS Return Flows	210	264	137	+137	NA
WWTP Discharges	52,591	600	45,123	0	0
Other Inflows	256,707	450	165,191	-7,925	-4.6
Total	**588,962**		**347,440**	**+8,465**	**+2.5**

3.3.8.5.2 Stream and River Water Quality

The following section presents the water quality impact analysis for the Spanish Fork River under the No Action Alternative. Water quality conditions in the Spanish Fork River under the No Action Alternative would be the same as simulated baseline conditions, which were described in the Diamond Fork FS-FEIS (CUWCD 1999a) and are updated in this DEIS. There would be no new sources of water in the lower Provo River and Hobble Creek under this alternative, therefore, there would be no measurable changes in water quality in these streams. Detailed descriptions and tables showing the changes by water quality characteristic are presented in the Surface Water Quality Technical Report for the Utah Lake Drainage Basin Water Delivery System (CUWCD 2004b).

3.3.8.5.2.1 Spanish Fork River From Diamond Fork Creek to Utah Lake. Water quality conditions in the Spanish Fork River would remain unchanged or change slightly under the No Action Alternative. Table 3-38 summarizes the water quality impacts on an annual basis compared to historic baseline conditions. Monthly maximum comparisons are based on the average flow scenario. Spanish Fork River dissolved oxygen concentrations would increase or decrease slightly from historic baseline conditions, however, monthly values would remain above the water quality standards for upper and lower Spanish Fork River sites. Water temperatures would increase or decrease slightly in every month and would be within water quality standards for designated beneficial uses in the upper and lower Spanish Fork River. Total phosphorus would decrease from historic baseline conditions in upper Spanish Fork River during May through September from levels already above the pollution indicator level for streams. Total phosphorus would increase or decrease slightly from historic baseline conditions in lower Spanish Fork River during most months. The changes in total phosphorus in the Spanish Fork River under the No Action Alternative would be influenced by total phosphorus concentrations in Strawberry Reservoir at the Syar Tunnel inlet mixed with Spanish Fork River water. Data from the Syar Tunnel inlet indicate that most of the total phosphorus is dissolved total phosphorus, which is highly reactive and utilized by aquatic plants. Therefore, as the Bonneville Unit water would be discharged to the Spanish Fork River, the dissolved total phosphorus would be utilized by aquatic macrophytes (plants) growing in the river, which provide substrate and habitat for aquatic macroinvertebrates. TDS would decrease in all months in the upper and lower Spanish Fork River, remaining below the water quality standard. Other water quality characteristics including pH, nitrate plus nitrite, and ammonia concentrations would increase or decrease slightly under the No Action Alternative, with all values remaining within water quality standards. Selenium concentration is the Spanish Fork River would remain unchanged or increase slightly under the No Action Alternative.

Table 3-38
Spanish Fork River Annual Average Water Quality From Diamond Fork Creek to Utah Lake Under the No Action Alternative Compared to Historic Baseline Conditions

Water Quality Characteristic		TDS (mg/L)	pH (units)	DO (mg/L)	Temperature (°C)	Nitrate[3] (mg/L)	Ammonia (mg/L)	Phosphorus (mg/L)	Selenium (µg/L)
Average Flow Water Quality									
Upper Spanish Fork River	Change[1]	-39	0	0.1	-0.7	0.02	0	-0.02	0
	Value	285	8.1	11.8	9.9	0.19	0.03	0.12	1.0
Lower Spanish Fork River	Change[1]	-94	0	0.5	-0.6	-0.18	-0.02	-0.01	+0.1
	Value	387	8.1	10.8	9.5	0.64	0.09	0.08	1.1
Dry Year Water Quality (1992)									
Upper Spanish Fork River	Change[1]	-93	0	0.4	-2.4	0.04	0	-0.07	+0.2
	Value	231	8.1	12.1	8.2	0.21	0.03	0.07	1.2
Lower Spanish Fork River	Change[1]	-207	0	1.7	-3.1	-0.43	-0.06	-0.03	+0.3
	Value	274	8.1	12.0	7.0	0.39	0.05	0.06	1.3
Wet Year Water Quality (1998)									
Upper Spanish Fork River	Change[1]	1	0	0.1	-0.3	0.02	0	-0.13	0
	Value	325	8.1	11.8	10.3	0.19	0.03	0.01	1.0
Lower Spanish Fork River	Change[1]	-39	0	-0.3	0.1	-0.09	-0.01	0	+0.1
	Value	442	8.1	10.0	10.2	0.73	0.10	0.09	1.1
Maximum Monthly Levels									
Upper Spanish Fork River	Change[2]	-141	-0.1	0.7	-0.3	-0.16	0.01	-0.06	-0.1
	Value	386	8.3	9.8[a]	14.4	0.48	0.06	0.24	2.0
Lower Spanish Fork River	Change[2]	81	-0.1	0.9	-1.8	0.84	-0.02	-0.05	+0.1
	Value	562	8.2	9.0[a]	16.2	1.66	0.15	0.13	1.5

All values are flow-weighted.
[1] Change from Historic Baseline Annual Average
[2] Change from Historic Baseline Maximum Monthly
[3] Nitrate + Nitrite as Nitrogen
[a] Minimum monthly water quality value.

3.3.8.5.3 Summary of No Action Alternative Impacts. The No Action Alternative would slightly increase or not change TP concentrations in Utah Lake near the mouth of the Spanish Fork River. The No Action Alternative would result in a 2.5 tons per year increase (+0.9 percent) in total phosphorus load into Utah Lake compared to historic baseline conditions. This net increase in total phosphorus load in Utah Lake would be a significant water quality impact. The No Action Alternative would slightly decrease TDS cumulative concentrations in Utah Lake compared to historic baseline conditions, with the projected TDS concentrations remaining under the agricultural use standard of 1,200 mg/L. The total estimated TDS load into Utah Lake under the No Action Alternative would increase by 8,465 tons per year (+2.5 percent) over historic baseline conditions. This would be a significant impact.

Water quality conditions in the Spanish Fork River would remain unchanged or change slightly under the No Action Alternative. Dissolved oxygen concentrations would increase or decrease slightly from simulated baseline conditions, with all values remaining above the minimum water quality standards. Water temperatures would increase or decrease slightly from simulated baseline conditions, with all values remaining below water quality standards. Total phosphorus concentrations would decrease slightly from baseline conditions during most months from levels above the pollution indicator level for streams. TDS concentrations would decrease in all months, remaining below the water quality standard. Other water quality characteristics including pH, nitrate plus nitrite, and ammonia would increase or decrease slightly, with all monthly values remaining within water quality standards. Selenium concentrations would decrease or remain unchanged from baseline conditions. Impacts on Spanish Fork River water quality would not exceed the significance criteria under the No Action Alternative.

3.4 Groundwater Hydrology

3.4.1 Introduction

This analysis addresses potential impacts on groundwater levels from construction and operation of the Proposed Action and other alternatives.

3.4.2 Issues Raised in Scoping Meetings

- What is the potential for reuse of ULS water and what impacts would this have on groundwater and secondary growth?
- What would be the impacts of a depleted water table on water supplies if well drilling were implemented in south Utah County?
- What would be the impacts from converting Strawberry Valley Project (SVP) water to municipal and industrial (M&I) uses?
- What impacts would occur from not converting SVP irrigation water to M&I use until after 2030?
- What would be the impacts on municipal and private individual well production in the Salem area from using 37,172 acre-feet of groundwater for M&I use?
- What would be the impacts of the ULS water delivery concepts on groundwater depletion?

3.4.3 Scoping Issues Eliminated From Further Analysis

What would be impacts of a depleted water table on water supplies if well drilling were implemented in south Utah County?

This is beyond the scope of this EIS. The ULS project does not include any proposed groundwater pumping.

What would be the impacts from converting SVP water to M&I uses?

SVP water cannot be converted to M&I use under the water user's existing contracts with the Federal government.

What impacts would occur from not converting SVP irrigation water to M&I use until after 2030?

SVP water cannot be converted to M&I use under the water user's existing contracts with the Federal government.

What would be the impacts on municipal and private individual well production in the Salem area from using 37,172 acre-feet of groundwater for M&I use?

The ULS project does not involve development of any groundwater for M&I use, and this issue is beyond the scope of this EIS.

3.4.4 Scoping Issues Addressed in the Impact Analysis

All issues identified in Section 3.4.2, except those listed in Section 3.4.3, are addressed in the impact analysis.

3.4.5 Description of Impact Area of Influence

The primary groundwater hydrology impact area of influence is in southern Utah Valley since there would be no changes in groundwater pumping or recharge in other areas. Map 3-4 shows the impact area of influence.

3.4.6 Methodology

3.4.6.1 Impact Analysis Methodology

This methodology was used to estimate the impact of the No Action Alternative on groundwater levels.

The general approach used to assess impacts on groundwater levels was to compare the water levels predicted by the model (described below) to the calculated baseline for each respective hydrologic year. The U.S. Geological Survey, in cooperation with the Utah Division of Water Rights, prepared a groundwater flow model using the MODFLOW simulation model for southern Utah Valley. This model is documented in the report Hydrology and Simulation of Ground-Water Flow in Southern Utah and Goshen Valleys, Utah (Brooks and Stolp 1995). MODFLOW is a well-documented, frequently used, and versatile program that is widely accepted by the scientific and regulatory communities. The existing model, with some modifications, was used to evaluate potential changes to groundwater conditions in southern Utah Valley. The impact analysis considered the standard operating procedures (SOPs) and project design features that the District would implement as part of the project.

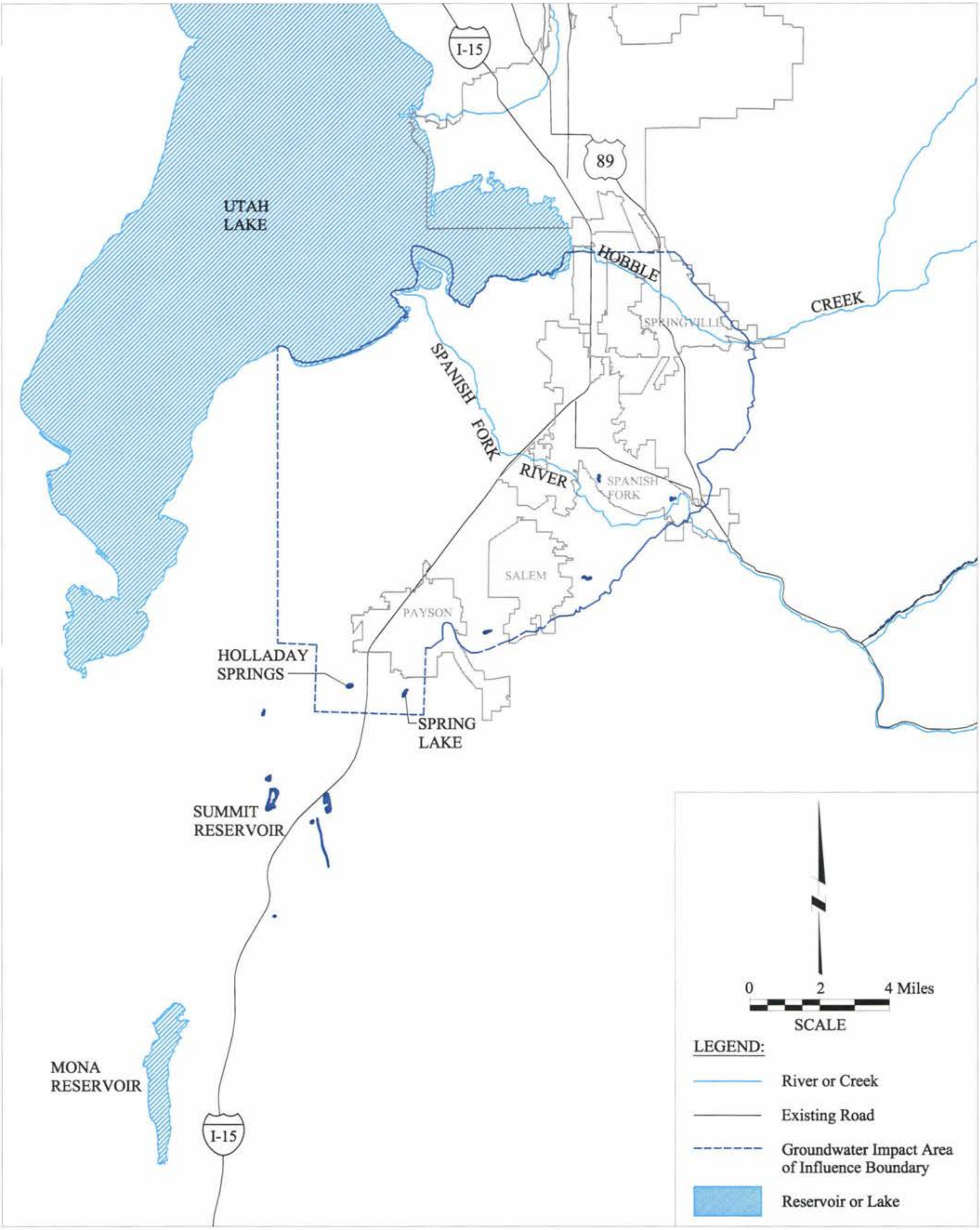
The MODFLOW model for southern Utah Valley covers an area of approximately 17 miles by 33 miles, extending from the Utah-Juab County boundary on the south; immediately north of Hobble Creek on the north; the East Tintic Mountains on the west; and the Wasatch Range on the east. Pumping data were modified in the model to simulate groundwater levels under the No Action Alternative. These modifications are summarized below.

The model was used to estimate groundwater levels for each year of the simulation period for the No Action Alternative and historical conditions for baseline conditions. A contour map of the water table surface for the No Action Alternative in 2030 was compared to those of the original model for the same hydrologic conditions (results were compared to 1977 historical conditions for dry conditions). This map was then used to generate different plots that indicate the change in water levels between the historical conditions (baseline) and the No Action Alternative. Simulation year 29, corresponding to drought conditions of 1977, was considered the worst case condition; thus results from this hydrologic condition are presented. M&I pumping was increased for both culinary (indoor) use and secondary (outdoor) use to meet future demands under the No Action Alternative, as estimated for continued population growth for 2030 and reported in the Revised Assessment of M&I Water Needs (CUWCD 2003).

Additional pumping for each city in 2030 was based on M&I water demand estimates from the Revised Assessment of M&I Water Needs Supplement (CUWCD 2003).

3.4.6.2 Assumptions

The documentation of the groundwater model and the numerous assumptions used to develop the southern Utah Valley MODFLOW model are described in detail in the report prepared by Brooks and Stolp (1995). General assumptions are described in the documentation for MODFLOW prepared by McDonald and Harbaugh (1988).



Map 3-4

Groundwater Impact Area of Influence

The only assumptions described in this section concern changes that were made to the model to predict future conditions. They include the following:

Hydrologic Period of Record

- Future precipitation and temperature would be similar to the meteorological conditions that occurred during the historic period modeled (1949-1990). It is assumed that hydrologic conditions in the future would be similar to the historical hydrologic period, given the duration of this period (50 years). This period includes extreme periods in terms of both drought and flooding.

Modifications to Pumping

- The demand for culinary indoor M&I water would be 70 gallons per capita per day (gpcd) multiplied by the estimated population. Eighty gpcd is a commonly accepted number for indoor water use throughout the U.S. For purposes of the ULS impact analysis, it was assumed that water conservation methods would be in place by 2050, and the consumption would be 70 gpcd.

- The demand for secondary M&I water would be equivalent to the per capita water secondary demand multiplied by the estimated population. Values for population estimates and water demand are from the Revised Assessment of M&I Water Needs (CUWCD 2003).

- Demand for culinary M&I water would be supplied by springs until the demand exceeded spring supplies. Any remaining demand for culinary M&I water would be met by pumping from the aquifer. This assumption was made because spring water is likely the preferred source of drinking water over well water given the additional expenses associated with pumping well water.

- Demand for secondary M&I water would be supplied by surplus spring supplies, if any supplies remain after supplying water for culinary use. Any remaining demand for secondary M&I water would be met by local stream and river supplies and pumping from the aquifer. Again, spring water is likely the preferred source of water over well water given the additional expenses associated with pumping well water. Spring water is provided for culinary use and only is used for secondary M&I if culinary demand has been met.

- Any additional pumping for M&I water would require installation of new wells. It was assumed that there are no unused wells, thus any additional pumping would require new wells. It is unlikely that there are unused production wells.

- New wells would be deep (screened between 450-1000 feet below ground surface) so they were added to layer 5 of the model within the city declaration boundaries. New production wells were assumed to be deep (screened between 450 to 1000 feet below ground surface) so that they would draw water from aquifers that generally are untapped. Most of the existing wells in southern Utah County are less than 500 feet deep.

- Pumping for agricultural irrigation in 2030 would remain unchanged from the original calibrated model, because no additional land has been added for agriculture and the demand for agricultural irrigation water generally is not met, so it is unlikely that pumping would be reduced even as land is taken out of production as it is converted from agriculture to residential or industrial uses.

The groundwater hydrology impact analysis included one operational period: during delivery of ULS water for secondary M&I use (2016 through full delivery by 2030). 2030 is considered the appropriate year for full M&I

water demand because it would have the largest population and greatest demand for groundwater in the 2016 to 2030 study period.

Areal recharge was not modified in the model for conversion of agricultural land to residential or commercial uses because of its negligible impact on water levels and the overall flow budget. Areal recharge attributed to irrigation and precipitation falling directly on the area modeled in southern Utah Valley accounts for 12 percent of the total recharge to the aquifer. Leakage from streams and canals and subsurface inflow (mountain front recharge) accounts for 88 percent of the total. Furthermore, the shallow aquifer receives upward vertical leakage from the underlying aquifer. Although areal recharge on irrigated agricultural land that has been converted to residential and industrial uses could be reduced (by approximately 50 percent), the magnitude of this change is negligible. To evaluate the influence that changing areal recharge would have on water levels, recharge was reduced to zero throughout most areas of Spanish Fork City that are zoned for industrial and residential development. This was an extreme scenario, assuming the entire area zoned residential and industrial was developed and the recharge was reduced to zero. Spanish Fork City was selected because it is farthest from the mountain front and thus farthest from the boundary conditions associated with mountain front recharge and canal leakage, where changes in areal recharge would be expected to have the largest impact. The model was run and compared against the original model run for the period 1949 through 1990. Water level differences were minimal (less than 0.5 feet). Despite this extreme condition, water levels in the shallow aquifer changed minimally in and down-gradient of the Spanish Fork City area.

For non-irrigated agricultural land converted to residential use, areal recharge may increase, but enforceable conservation plans would be required. These plans would require that water use approximately matches consumptive use by the vegetation. Although this is difficult in practice, the increase in recharge is expected to be negligible. Furthermore, because these areas tend to be located around the valley margins, they tend to be adjacent to the model domain boundary where large amounts of water enter the area from mountain front recharge and leakage from canals.

Increased effluent from wastewater treatment plants at the south end of the valley (e.g., Payson) would increase flow along Benjamin Slough and subsequent recharge to the shallow aquifer. This would occur under all alternatives including the No Action Alternative. However, with no quantitative information concerning recharge, this was not modeled.

Recharge was not reduced along Mapleton Lateral Canal for alternatives in which the canal would be piped because Mapleton Lateral is on the Mapleton Bench and is underlain by a perched aquifer that was not included in the model. Recharge was not increased along canals that are expected to carry more flow under various alternatives because leakage is not expected to increase.

3.4.7 Affected Environment (Baseline Conditions)

3.4.7.1 Overview

Southern Utah Valley is underlain by unconsolidated, interbedded deposits of sand, gravel, silt and clay. Sand and gravel form the aquifers and are separated by silt and clay that act as confining layers. For practical purposes, the total thickness of the aquifer (including intervening aquitards) is assumed to be approximately 1,000 feet because few wells extend to lower depths. Recharge to the groundwater system is from streams, canals, irrigation, precipitation and subsurface inflow from the adjacent bedrock aquifer beneath the Wasatch Range, estimated to be approximately 120,000 acre-feet per year in southern Utah Valley. Deep percolation of irrigation water is not believed to be a major source of recharge based on observed water level fluctuations in wells. Discharge from the groundwater system is to springs, field and land drains, evapotranspiration, wells, streams, canals and Utah Lake.

Only changes to the water table surface are discussed because the primary uses of groundwater model results are used for analyzing impacts on other resources. In all future projections, water levels are the same or lower than conditions in the original model (i.e., historical conditions). This indicates that increases in water levels during wet years in the future would not increase water levels above those of 1983, thus simulation results for the wet year for each alternative and operational scenario are not presented. Simulation results are presented for dry year conditions only.

3.4.7.2 Baseline Water Levels

Map 3-5 shows historical groundwater levels under dry conditions (1977). These levels were used as the baseline for the analysis of the alternatives.

3.4.8 Environmental Consequences (Impacts)

No analysis was performed for the construction period since no impacts on groundwater quantity are expected during construction of any proposed ULS features. Pipelines that could intercept shallow groundwater would not affect groundwater hydrology because cutoff walls would be constructed as part of the standard operating procedures described in Chapter 1, Section 1.8.8. Operation impacts are discussed for the delivery of ULS water for secondary M&I use (2016 through 2030).

3.4.8.1 Significance Criteria

No significance criteria were identified for groundwater hydrology because data developed in this section are used by other resource disciplines to determine significant impacts from changes in groundwater conditions.

3.4.8.2 Potential Impacts Eliminated From Further Analysis

What is the potential for reuse of ULS water and what impacts would this have on groundwater and secondary growth?

Plans for reuse or recycling of ULS water are described in Chapter 1, Sections 1.4.9.3, 1.5.9.2, and 1.6.3.2. Return flows from ULS water in southern Utah County would accrue to Utah Lake, be recaptured and become part of the ULS water supply by exchange to Jordanelle Reservoir for delivery to M&I users in Salt Lake County. ULS return flows would therefore not be available for reuse in southern Utah County. There would be no impact on secondary growth.

What is the impact of construction on groundwater hydrology?

Construction of any of the features associated with the Proposed Action and other action alternatives would not change or affect groundwater levels. Pipelines that could intercept shallow groundwater would not affect groundwater hydrology because cutoff walls would be constructed as part of the standard operating procedures described in Chapter 1, Section 1.8.8.

3.4.8.3 Spanish Fork Canyon-Provo Reservoir Canal Alternative (Proposed Action)

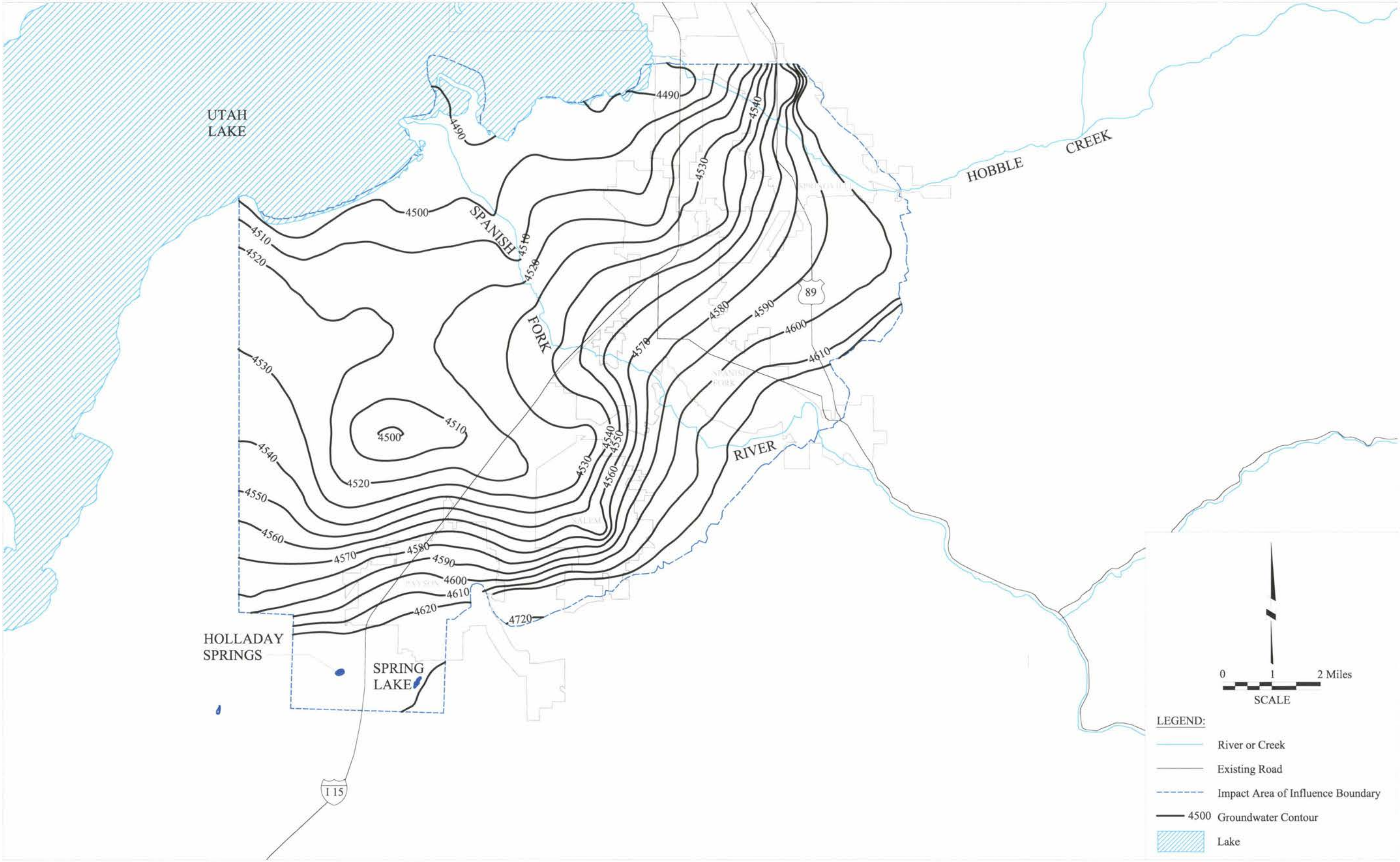
3.4.8.3.1 M&I Secondary Water Use Delivery. Under the Proposed Action a total of 27,000 acre-feet (30,000 acre-feet minus 3,000 acre-feet returned to DOI under 207 projects) of secondary M&I water would be delivered to southern Utah County. It is estimated that approximately 9,660 acre-feet would return to Utah Lake as groundwater. The change in groundwater levels from baseline conditions as a result of this 9,660 acre-feet over such a large area could cause a slight increase in groundwater levels. Impacts of the Proposed Action on groundwater hydrology would not exceed the significance criteria.

3.4.8.4 Bonneville Unit Water Alternative

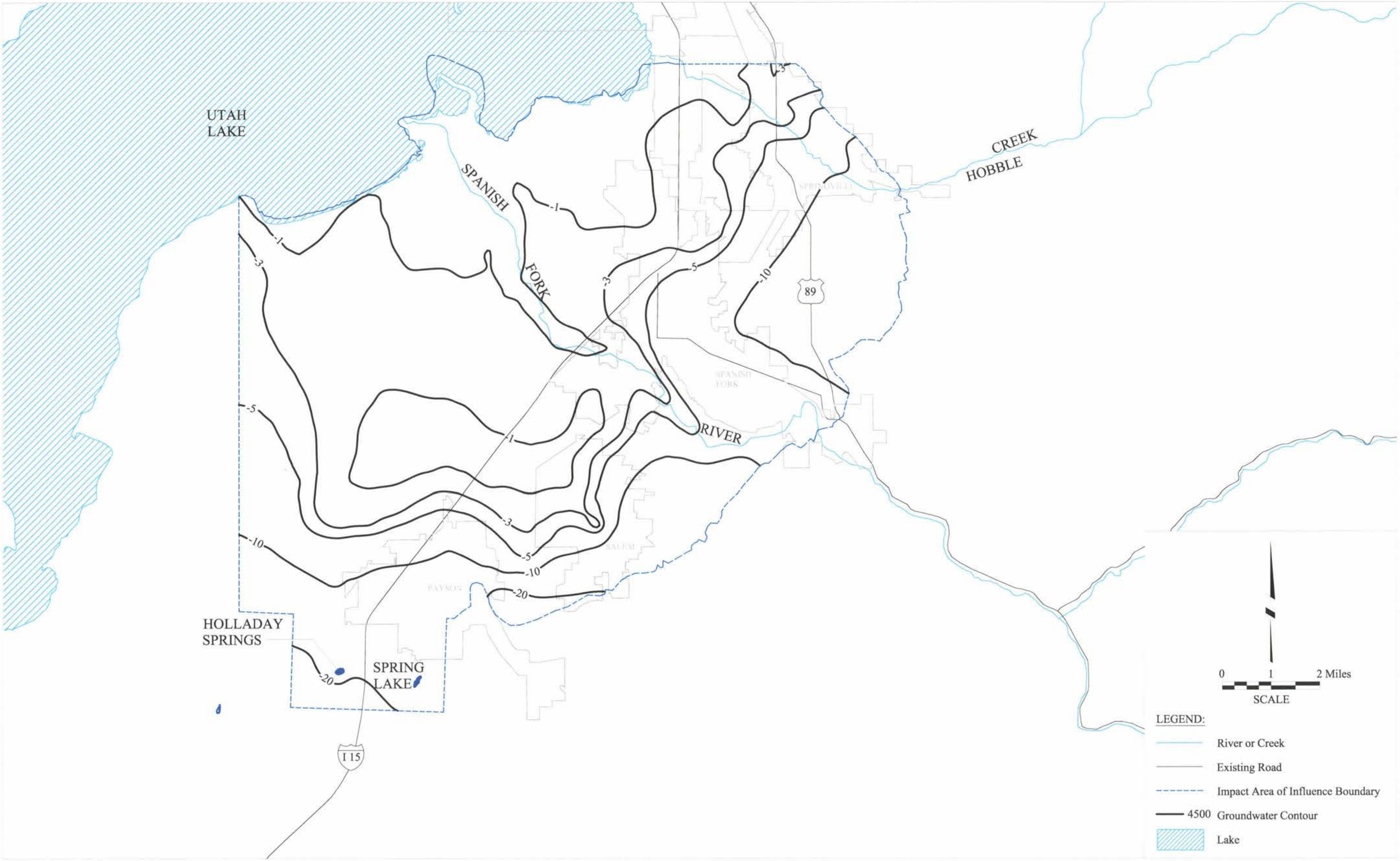
3.4.8.4.1 M&I Secondary Water Use Delivery. Under the Bonneville Unit Water Alternative a total of 12,800 acre-feet (15,800 acre-feet minus 3,000 acre-feet returned to DOI under 207 projects) of secondary M&I water would be delivered to southern Utah County. It is estimated that approximately 4,660 acre-feet would return to Utah Lake as groundwater. The change in groundwater levels from baseline conditions as a result of this 4,660 acre-feet over such a large area could cause a slight increase in groundwater levels. Impacts of the Bonneville Unit Water Alternative on groundwater hydrology would not exceed the significance criteria.

3.4.8.5 No Action Alternative

Under this alternative, no additional Bonneville Unit M&I water would be delivered. It is reasonable to estimate that without additional Bonneville Unit M&I, water the cities in southern Utah County would rely heavily upon additional groundwater pumping. The increased pumping by the cities would cause a drawdown in groundwater levels. Model studies indicate that groundwater levels could decrease by up to 26 feet in part of the impact area of influence (Woodland Hills). Map 3-6 shows the changes in water levels under the No Action Alternative under dry conditions for the 2030 operational period compared to baseline conditions (historical water levels in 1977).



Map 3-5
Historical Groundwater Levels
Under Dry Conditions (1977)



Map 3-6

Modeled Differences in Groundwater Elevation Between Baseline and the No Action Alternative for 2030 Under Dry Conditions (1977)

3.5 Groundwater Quality

3.5.1 Introduction

This analysis addresses potential impacts on groundwater quality from construction and operation of the Proposed Action and other alternatives.

3.5.2 Issues Raised in Scoping Meetings

The following groundwater quality issues were raised during the public and agency scoping process:

- What would be the impacts from known groundwater contamination on M&I groundwater supplies in the Mapleton area?
- What would be the impacts of the ULS water delivery concepts on pollution of surface water and groundwater?

3.5.3 Scoping Issues Eliminated From Further Analysis

What would be the impacts from known groundwater contamination on M&I groundwater supplies in the Mapleton area?

This is beyond the scope of this EIS. The ULS project does not include any proposed groundwater pumping and no known or projected groundwater contamination would occur as a result of the ULS project.

3.5.4 Scoping Issues Addressed in the Impact Analysis

Except for the issue eliminated in Section 3.5.3, the issues identified in Section 3.5.2 are addressed in this section.

3.5.5 Description of Impact Area of Influence

3.5.5.1 Construction Phase

Map 3-2 shows the overall ULS project impact area of influence. Within that area, the specific groundwater quality impact area of influence includes the area around construction corridors that could be impacted by degradation of shallow groundwater in excavations resulting from turbidity, fuel spills, concentration of stormwater runoff, or land application of water pumped from trenches or pits. It includes all pipeline alignments.

3.5.5.2 Operations Phase

The groundwater quality impact area of influence during system operation would include areas where application of secondary M&I water could increase the rate of recharge to groundwater (see Map 3-3).

3.5.6 Methodology

The groundwater quality impact analysis included two parts: a) the temporary impacts of construction activities on groundwater quality in the impact area of influence, and b) the impacts on groundwater quality in the impact area of influence from applying M&I water for secondary use. The delivery of the secondary M&I water would start as facilities are completed and reach full delivery by 2030. The year 2030 was chosen for the impact analysis of the M&I water. This year would represent the full-demand condition.

3.5.6.1 Assumptions

3.5.6.1.1 Baseline Conditions. The following assumptions were made for baseline conditions.

- Existing conditions are represented by the data collection period from January 1, 1950 to December 31, 1999. A 50-year data period just prior to the current time should include most naturally occurring variations that might affect water quality over the next 50 years. Furthermore, little data are available prior to that time, and the period selected includes the vast majority of data that are available for the study area and therefore should be most representative of existing conditions.

- Water quality is represented by the average concentration of representative water quality parameters. Use of average water quality concentrations for long periods of sampling is a standard practice and tends to cancel unusual or extreme data from sampling events that may either have resulted from sampling or analytical error or from non-representative conditions.

The EPA STORET electronic database (EPA 2003a) was used to determine baseline groundwater quality conditions. The database includes water quality data from wells and springs throughout the impact area of influence. These data are not uniform in distribution, age, or completeness of parameters.

- Nitrate and other constituents used by the Ensign-Bickford Company (EBCo) near the mouth of Spanish Fork Canyon are distributed as described in a July 2001 report (Charter Oak Environmental Services 2001). These constituents are called "constituents of energetic materials" (CEMs) and consist of materials used in making explosive items to produce explosives, and have been found in shallow groundwater originating from the EBCo site. The information from the Charter Oaks 2001 report appears to be the most recent and complete information available for this location.

- EBCo will continue to operate its groundwater pumping containment and treatment system through 2030 and beyond, unless these constituents diminish sufficiently to warrant discontinuation of the system. The system appears to contain the movement of nitrate and CEMs in the aquifer. The Charter Oaks 2001 report indicates that the movement of nitrate and CEMs is not expanding beyond the existing plume, presumably because of the EBCo containment and treatment system. It is reasonable to assume the EBCo will be required to operate the system as long as there is a reasonable risk to water quality from nitrates and CEMs from the plume.

3.5.6.1.2 Recharge Conditions. Recharge from application of secondary M&I project water would occur only in the shallow aquifer in the applied areas. The groundwater system consists of several layers of waterbearing materials that are generally separated by low-permeability alluvial beds. These low-permeability beds are not laterally continuous throughout the valley but are generally thought to be continuous between the first and second aquifer within the areas where application of secondary M&I project water would occur. Thus, any recharge from the surface within the application areas would reach only the shallow aquifer and, for all practical purposes, would not affect any of the underlying aquifers.

3.5.6.2 Impact Analysis Methodology

The impact analysis considered the standard operating procedures (SOPs) and project design features that the District would implement as part of the project.

3.5.6.2.1 Construction Phase. Construction impacts were assessed using the following methods:

- Identify segments of pipeline construction where shallow groundwater is likely to be encountered in trenches and excavations
- Determine the proximity to wells, springs and surface-water bodies
- Determine the geologic conditions anticipated in trenches and excavations (i.e., course-grained, medium-grained, fine-grained, solid bedrock, or fractured bedrock)
- Determine the anticipated direction of groundwater flow from the disturbed area
- Estimate the probability of turbid groundwater reaching a well, spring or surface water body using published permeabilities for similar geologic conditions
- Evaluate whether longer-term changes in recharge associated with conversion of the Mapleton Lateral from an open canal to a pipeline would have an adverse impact on contaminant plume distribution in the underlying aquifer.

3.5.6.2.2 Operations Phase. Operational impacts were assessed using the following methods:

- Evaluate distribution of aquifers (deep versus shallow)
- Identify wells and springs within the impact area of influence
- Compile water quality data for primary ions, nitrate and phosphorous within the impact area of influence using the EPA STORET database
- Determine whether wells and springs used in the database are associated with the deep or shallow aquifers
- Evaluate and compare water quality types in the shallow aquifer, deep aquifer and Strawberry Reservoir using a trilinear diagram (Piper 1944). A trilinear diagram is a graphic tool for plotting concentrations of the primary ions in water, allowing classification of water quality types, for example "calcium-bicarbonate type, sodium-potassium-sulfate type, etc. Water quality types from different aquifers or surface water sources typically plot at different points on a trilinear diagram.
- Calculate "reasonable worst-case" concentrations of database water quality using the third quartile method. The quartile statistical method divides the number of data points into quarters. In this instance, the average concentrations of each parameter for all the sampled wells were arrayed from greatest to least and the number of wells was divided into fourths. The concentration at mid-point between the highest in the third quarter and the lowest in the fourth quarter (i.e. the quarter of samples with highest average

concentrations) was selected as the third quartile concentration and represents a concentration higher than three quarters of average concentrations for a given parameter.

- Calculate concentrations to simulate a wide range of potential mixing ratios to include the extreme potential ratios of surface water to groundwater, using the water quality model PHREEQC Version 2, a U.S. Geological Survey computer program that can be used to simulate chemical reactions and concentrations of different water types when mixed (USGS 1999).
- Evaluate model results to determine whether adverse water quality impacts (precipitation of minerals in the aquifer or exceedances of water quality standards) may occur within the range of mixing ratios considered in the model
- Use model results to qualitatively project whether adverse impacts on surface water may occur from groundwater discharge to surface water bodies

3.5.7 Affected Environment (Baseline Conditions)

Resources in the impact area of influence include groundwater from wells and springs that are used for drinking water or irrigation. Other resources include surface water bodies (rivers, streams, wetlands and lakes) that receive substantial discharge from groundwater.

Groundwater quality for the baseline period (1950 through 1999) is generally good, meeting state and federal groundwater quality and drinking water quality regulatory requirements for naturally occurring parameters (EPA 2003a). An exception is near the mouth of Spanish Fork Canyon, where nitrate and CEMs occur in a plume in shallow groundwater (Charter-Oak Environmental Services 2001). Water quality for Strawberry Reservoir in the same time period generally meets state and federal groundwater quality standards, except for infrequent exceedances of total phosphorus.

3.5.8 Environmental Consequences (Impacts)

3.5.8.1 Significance Criteria

Impacts on groundwater quality are considered significant if construction, maintenance and operation of the Preferred Alternative and other alternatives would result in one or more of the following conditions:

- Quality of potable groundwater is degraded in the impact area of influence to a condition where it no longer meets state drinking water quality standards (UAC 2003a)
- Quality of groundwater is degraded in the impact area of influence to a condition where it no longer meets state groundwater quality standards (UAC 2003b)
- Quality of baseline system groundwater that discharges to surface water (rivers, streams, lakes and wetlands) in the impact area of influence is degraded to a condition where the receiving surface water quality changes from compliant to noncompliant status with state surface water quality standards, and this condition is caused by discharge from degraded groundwater into the surface water (UAC 2004)
- Known contaminant plume distributions change to the extent that existing containment and remediation systems are less effective at capturing, containing and treating contaminated groundwater

3.5.8.2 Potential Impacts Eliminated From Further Analysis

Groundwater quality would not be impacted by flow rate changes of surface rivers and streams because the change in recharge rate would be insignificant. The rate of groundwater recharge from these project waters would be affected only by the relatively small changes in channel depth, which is minor compared to the regional recharge conditions.

3.5.8.3 Spanish Fork Canyon-Provo Reservoir Canal Alternative (Proposed Action)

3.5.8.3.1 Construction Phase. An evaluation of the available groundwater data indicates that groundwater is not expected to be encountered during construction of the following features, therefore no significant impacts on groundwater quality are expected.

- Sixth Water Power Facility and Transmission Line
- Upper Diamond Fork Power Facility
- Mapleton-Springville Lateral Pipeline

The evaluation of available groundwater data indicates that impacts on groundwater quality would not exceed significance criteria. This includes springs, wells or surface water bodies from disturbance of groundwater, exposure to surface storm water runoff, or incidental spills in trenches during construction. If groundwater is encountered during construction of any features of the Proposed Action, it is expected to flow into the pipeline trench. Any groundwater collected in pipeline trenches would be discharged into local storm drains or small holding impoundments in accordance with procedures described in the SOPs (see Chapter 1, Section 1.8.8).

3.5.8.3.1.1 Spanish Fork Canyon Pipeline. Groundwater may be encountered in some reaches of the pipeline trench, but it is expected to flow into the trench rather than out, and it is not close to drinking water wells in the shallow aquifer. Impacts on groundwater quality along the Spanish Fork Canyon Pipeline would not exceed the significance criteria.

3.5.8.3.1.2 Spanish Fork-Santaquin Pipeline. Groundwater may be encountered along some reaches of the pipeline trench in the lowest elevation of the trench southwest of the mouth of Spanish Fork Canyon. However, it is expected that groundwater will flow into the trench rather than out of it, and it is not close to surface water or drinking water wells in the shallow aquifer. Groundwater is unlikely to be encountered elsewhere in this segment of pipeline trench. Impacts on groundwater quality along the Spanish Fork-Santaquin Pipeline would not exceed the significance criteria.

3.5.8.3.1.3 Santaquin-Mona Reservoir Pipeline. Although groundwater may be encountered in the pipeline trench near Mona Reservoir, it is expected to flow into the trench rather than out. Impacts on groundwater quality along the Santaquin-Mona Reservoir Pipeline would not exceed the significance criteria.

3.5.8.3.1.4 Spanish Fork-Provo Reservoir Canal Pipeline. Groundwater may be encountered in short segments, notably near the Provo River. Impacts on groundwater quality along the Spanish Fork-Provo Reservoir Canal Pipeline would not exceed the significance criteria.

3.5.8.3.2 Operations Phase

3.5.8.3.2.1 Mapleton-Springville Lateral Pipeline. Elimination of seepage from the existing Mapleton-Springville Lateral by replacing it with a pipeline would reduce the seepage recharge in the vicinity of the contaminant plume north of the mouth of Spanish Fork Canyon by a small amount. The small reduction in recharge would not significantly reduce the plume's hydraulic head (forces causing vertical and lateral pressure outward from the plume). Impacts on groundwater quality along the Mapleton-Springville Lateral Pipeline would not exceed the significance criteria.

3.5.8.3.2.2 M&I Secondary Water. Groundwater quality modeling does not indicate that mixing of Bonneville water applied as M&I secondary water would result in any of the conditions identified in the significance criteria. Impacts on groundwater quality from ULS operation involving M&I secondary water would not exceed the significance criteria.

3.5.8.3.3 Summary of Alternative Impacts. Impacts on groundwater quality from construction and operation of any Proposed Action features would not exceed the significance criteria.

3.5.8.4 Bonneville Unit Water Alternative

An evaluation of the available groundwater data indicates that groundwater is not expected to be encountered during construction of the following features, therefore no significant impacts on groundwater quality are expected.

- Sixth Water Power Facility and Transmission Line
- Upper Diamond Fork Power Facility
- Mapleton-Springville Lateral Pipeline

The impact of the following features is the same as described under the Spanish Fork Canyon-Provo Reservoir Canal Pipeline:

- Spanish Fork Canyon Pipeline (Section 3.5.8.3.1.1)
- Spanish Fork-Santaquin Pipeline (Section 3.5.8.3.1.2)

The operations impacts of this alternative are the same as for the Spanish Fork Canyon-Provo Reservoir Canal Alternative (see Section 3.5.8.3.2).

3.5.8.4.1 Summary of Alternative Impacts. Impacts on groundwater quality from construction and operation of any Bonneville Unit Water Alternative features would not exceed the significance criteria.

3.5.8.5 No Action Alternative

No ULS features would be constructed, and no ULS water would be delivered under the No Action Alternative. However, the projected continued population growth, and associated expansion of industry, could impact groundwater quality in the future to some degree. Data are not available to estimate what potential changes may occur.

3.6 Aquatic Resources

3.6.1 Introduction

This analysis addresses potential impacts on aquatic resources and habitats from construction and operation of the Proposed Action and other alternatives. This analysis is based on flow projections as described in detail in the Surface Water Hydrology Technical Report for the Utah Lake Drainage Basin Water Delivery System (CUWCD 2004a).

3.6.2 Issues Raised in Scoping Meetings

The following aquatic resources issues were raised during the public and agency scoping process:

- What would be the impacts of high flows in the Provo River on aquatic resources and recreational fishing?
- Would the timing of demand for M&I water be compatible with instream flows for stream habitats, particularly protection of spawning habitats, etc.?
- What would be the impacts on Utah Lake from a pipeline rupture, since the area is in a zone of high earthquake risk?
- What would be the short-term impacts of pipeline construction on riparian areas, wildlife habitats and critical spawning periods for aquatic species?
- What would be the impacts on the Daniels Creek fishery from the Strawberry Reservoir - Deer Creek Reservoir Alternative.
- What would be the impacts on aquatic habitats if all available ULS capacity were needed for M&I peak demands during the summer season?
- What would be the opportunities for and impacts of the Strawberry Reservoir - Deer Creek Reservoir Alternative on the roadside put-and-take fishery conditions in Daniels Canyon?
- What would be the impacts of pipeline construction on streams and wetlands in Daniels Canyon?
- What would be the potential impacts on channel stability, stream habitats and fishability from higher flows in the Provo River below Deer Creek Reservoir?
- What would be the impacts on flows and fish habitat in Hobble Creek to Utah Lake?
- What would be the impacts of possible catastrophic failure of the pipeline through Utah Lake?
- What would be the impacts on each of the ULS concepts from aquatic nuisance species such as the zebra mussel?
- What would be the impacts of the ULS water delivery concepts on:

- Pollution of surface water and groundwater?
- Habitat destruction, fragmentation and alteration (aquatic and terrestrial)?
- Groundwater depletion?
- Loss of species diversity (aquatic and terrestrial)?

- What would be the impacts on the endangered June sucker and Bonneville cutthroat trout from any of the ULS concepts?

- What would be the impact on Utah Lake biota from constructing a pipeline across Utah Lake?

3.6.3 Scoping Issues Eliminated From Further Analysis

What would be the impact on Utah Lake biota from constructing a pipeline across Utah Lake?

What would be the impacts of possible catastrophic failure of the pipeline through Utah Lake?

What would be the impacts on Utah Lake from a pipeline rupture, since the area is in a zone of high earthquake risk?

The only alternative that would have included a pipeline across Utah Lake has been eliminated from further analysis (see EIS Chapter 1, Section 1.11.1).

What would be the impacts on wetlands, aquatic life and T&E species from overuse of groundwater?

The ULS project does not involve any features that require the pumping of groundwater. The pumping of groundwater is controlled by the State Engineer and would continue with or without the construction of the ULS project.

What would be the impacts on the endangered June sucker and Bonneville cutthroat trout from any of the ULS concepts?

The impacts on June sucker (an endangered species) and Bonneville cutthroat trout (a sensitive species) are covered in the Threatened and Endangered Species and Sensitive Species Technical Report for the Utah Lake Drainage Basin Water Delivery System (CUWCD 2004e) and in EIS Sections 3.9 and 3.10.

What would be the impacts on the Daniels Creek fishery from the Strawberry Reservoir - Deer Creek Reservoir Alternative?

What would be the opportunities for and impacts of the Strawberry Reservoir - Deer Creek Reservoir Alternative on the roadside put-and-take fishery conditions in Daniels Canyon?

What would be the impacts of pipeline construction on streams and wetlands in Daniels Canyon?

The Strawberry Reservoir–Deer Creek Reservoir Alternative and other alternatives involving Daniels Canyon were eliminated from detailed analysis. Please see Chapter 1, Sections 1.11.6, 1.11.7, and 1.11.8.

3.6.4 Scoping Issues Addressed in the Impact Analysis

All issues identified in Section 3.6.2 are addressed except for those listed in Section 3.6.3.

3.6.5 Description of Impact Area of Influence

Map 3-2 shows the ULS project overall impact area of influence. Within that area the specific impact area of influence for aquatic resources includes the following:

- Rivers, and streams and creeks in the Utah Lake drainage basin that support aquatic species and have potential to be directly impacted by water withdrawal or flow alterations
- Rivers and streams affected by construction of pipelines, access roads, pump stations, pressure management structures, power lines, generation stations, instream water delivery and water diversions

3.6.6 Methodology

For a detailed description of the methodology used, please refer to the Aquatic Resources Technical Report for the Utah Lake Drainage Basin Water Delivery System (CUWCD 2004c).

3.6.6.1 Assumptions

- Wetted perimeter and macroinvertebrate habitat are directly related; thus, increases in wetted perimeter were assumed to result in increased habitat for macroinvertebrates. In general, increased flows result in greater amounts of inundated area, or, wetted perimeter of a stream. When new aquatic habitat is inundated for a sufficient duration and habitat quality is sufficient, studies have shown that macroinvertebrates will colonize these new habitats. Hershey and Lambati (1998) noted that in broad, alluviated channels, increased amounts of substrate from inundation led to increased invertebrate production. Macroinvertebrate densities also have been shown to increase with water depth (Busven and Triley 1978) below dams. Finally, several studies have noted that the preferred habitat for benthic organisms is within the wetted perimeter of streams (Erman 1996). These studies support the assumption that increased wetted perimeter in ULS streams would result in increased available habitat for macroinvertebrates.
- Data from river cross-sections that were collected in the Spanish Fork River immediately downstream of the Diamond Fork River confluence are representative of the Spanish Fork River sections downstream of the Spanish Fork Diversion Dam. The Spanish Fork River below the Spanish Fork Diversion Dam has been modified to accommodate human uses. Much of the river channel is confined or channelized in this lower reach of the river and the channel is fairly uniform. For these reasons we are confident that the existing cross sections are representative of the lower river.
- In the Provo River below Deer Creek Reservoir, the baseline condition was assumed to be the habitat conditions published in the M&I FEIS (Reclamation 1979a). While trout biomass in the Provo River was estimated in 1979, more recent habitat surveys from 2000 to 2001 (UDNR 2003c) provided slightly different biomass estimates using the Habitat Quality Index (HQI) Model II (Binns 1982). It was assumed that the more recent estimates provided more accurate description of the trout populations, thus these data were used to estimate baseline condition of trout standing crop in the Provo River. The fish biomass estimates from the M&I EIS were projections of how biomass should respond to modeled flow changes. The 2000 and 2001 biomass data were actual measurements of fish biomass and therefore were determined to be the best available data to provide an accurate picture of the game fish community for baseline conditions of this EIS.

- The Spanish Fork River baseline conditions were updated with modeled flows from 1950 to 1999 from the habitat conditions published in the Diamond Fork System Final Supplement to the Final FEIS (CUWCD 1999a). The flow changes from the Diamond Fork System Final Supplement to the Final FEIS were minor and were implemented because detailed analysis showed minor inaccuracies in the previous modeled flow data. Thus, the revised flows were determined to be the best available data to represent the baseline condition for this EIS.

3.6.6.2 Impact Analysis Methodology

The impact analysis considered the standard operating procedures (SOPs) and project design features that the District would implement as part of the project.

3.6.6.2.1 Baseline Conditions. The description of baseline habitat conditions in this region was complex. Baseline conditions of habitat were determined through a combination of hydrology modeling, direct field observations and sampling, review of literature, and agency file data on resources in the area, and discussions with knowledgeable state and federal agency personnel. Baseline flow conditions for all rivers and streams were taken from the Surface Water Hydrology Technical Report for the Utah Lake Drainage Basin Water Delivery System (CUWCD 2004a). In the Provo River below Deer Creek Reservoir, the baseline condition was assumed to be the habitat conditions published in the M&I FEIS (Reclamation 1979a). However, since Binns HQI Model II habitat ratings were not available in the M&I FEIS, Binns HQI Model II habitat surveys from 2000 to 2001 were used for determining baseline condition. The baseline condition for the Jordan River was based on hydrologic modeling. The Spanish Fork River baseline conditions were updated with modeled flows from 1950 to 1999 and habitat conditions published in the Diamond Fork System FS-FEIS (CUWCD 1999a).

3.6.6.2.2 Fish. A comprehensive list of native and game fish species with the potential to be found within the project surface waters was compiled after consultation with the U.S. Fish and Wildlife Service (FWS), Utah Division of Wildlife Resources, Natural Heritage Program (NHP), and the Uinta National Forest (UNF). Fish species that occupied similar habitat niches were grouped for habitat modeling on the Provo River. Population abundance data were obtained from existing documents and/or Utah Division of Wildlife Resources fisheries survey data.

Data on spawn timing and water temperatures associated with spawning activity for game and non-game fishes were compiled from scientific literature. This information was used in conjunction with projected changes in flow quantity and timing to determine potential impacts on fish.

The following modeling methodologies used in the analysis are summarized from the Aquatic Resources Technical Report for the Utah Lake Drainage Basin Water Delivery System (CUWCD 2004c).

3.6.6.2.2.1 Provo River IFIM and PHABSIM Models. The Instream Flow Incremental Methodology (IFIM) was used in this study to assess the effects of flow manipulation in the Provo River on fish habitat (BIO-WEST 2003b; Radant and Shirley 1987). IFIM is composed of a suite of analytical procedures that describe habitat features resulting from a specific flow scenario (Bovee et al. 1998). One of these procedures is the microhabitat model component of the IFIM known as the Physical Habitat Simulation (PHABSIM). In a recent study by BIO-WEST (2003a, 2003b), the PHABSIM component of the IFIM was used to predict the amount of fish habitat for fish species under a range of possible flows in the Provo River. The major premise of the PHABSIM procedure is that the suitability of a species' habitat can be described by measuring selected physical variables in a stream. To address this assumption, an extensive search of published and unpublished physical habitat relationships for the species of interest in this study was conducted (e.g. Radant and Shirley 1987). Additional research was conducted for some fishes in the Provo River to measure or validate their requirements for depth, velocity and substrate (BIO-WEST 2003b; Belk and Elsworth 2000). Once these values were determined, the biological data were linked with the physical and hydraulic properties of the river. The physical habitat features of the river were determined by overlaying substrate maps with detailed digital terrain models developed for each site. The river's hydraulic properties were then simulated using a two-dimensional (quasi-three-dimensional) hydraulic model (a version of STAGR, modified by Craig Addley, Utah State University (BIO-WEST 2003a, 2003b) of each study site. The hydraulic model calculates depth and velocity at hundreds of nodes within the study site mesh, at different discharge values. Linking the biological data to the hydraulic values was used to estimate the relationship between habitat availability and flow within study reaches. The following methods are summarized from BIO-WEST 2003a and 2003b.

Because data on specific habitat requirements for some non-game fishes were limited, a second, more general modeling approach was used to evaluate impacts of flow on niche habitats. Fish species in similar habitats were grouped and impacts were modeled for each of the following seven niche habitats: backwater/edge, slow flow/shallow, moderate flow/ shallow, fast flow/shallow, moderate flow/mid-depth, fast flow/mid-depth, moderate flow/deep (BIO-WEST 2003b). This approach provides a more broad measure of habitat usage than the model of habitat suitability by species. A given habitat niche may be the only one used by a species or a certain life stage of the species; or conversely, a niche could be used by multiple species or life stages. Habitat availability, calculated in WUA, was determined for each niche for each alternative.

3.6.6.2.2.2 Binns Habitat Quality Index Model II. Potential impacts on aquatic resources were estimated with the Binns HQI (Habitat Quality Index) Model II, a method to evaluate the quality of the habitat of trout-supporting, cold-water river systems. Analysis output for the HQI is expressed in terms of standing crop of trout, where trout are used as an indicator species for the coldwater aquatic ecosystem. The Binns HQI Model II was used to calculate the net increase, or decrease, in trout standing crop based on streamflow and other habitat variables. The net increase or decrease in Habitat Quality Index as a result of providing supplemental instream flows was compared to baseline conditions to determine whether changes were beneficial or adverse to game fish.

In the Provo River below Deer Creek Reservoir, a projected trout standing crop was established from the M&I FEIS (Reclamation 1979a). Although estimates of fish biomass were presented in the M&I FEIS, habitat ratings were not provided. More recent data on fish resources in the Provo River have been collected by the Utah Division of Wildlife Resources at nine sites in the Provo River below Deer Creek Reservoir, including individual Binns habitat ratings and estimates of fish standing crop. Data from the 2000 and 2001 Binns HQI habitat surveys were used as the starting point for biomass determinations. To estimate trout standing crop these data were then adjusted for the surface water hydrology that was projected for baseline and alternative conditions as described in Section 3.2 of Chapter 3 and for surface water quality conditions as described in Section 3.3. A final calculation, multiplying an estimate of standing crop (pounds per acre) by the total available area (acres) was used to generate total biomass (pounds). Results from four of the Division of Wildlife Resources sampling sites were combined to portray the conditions for the Murdock Diversion to Interstate 15 segment. These four sites were: Murdock Diversion Dam to Spanish Fork-Provo Reservoir Canal Pipeline Discharge; Spanish Fork-Provo Reservoir Canal Pipeline Discharge to Riverside Country Club; Riverside Country Club to Tanner Race Diversion Dam; and Tanner Race Diversion Dam to Fort Field Diversion. The net increase or decrease in predicted trout biomass under each alternative was compared to baseline conditions to determine whether changes were beneficial or adverse to game fish. This protocol was used to estimate trout standing crop and biomass for the Spanish Fork River and Hobble Creek.

3.6.6.2.2.3 Hobble Creek Geomorphic Survey and HEC-RAS Modeling. Potential effects on aquatic habitat from changes in flow in Hobble Creek were evaluated using these two modeling techniques. The geomorphic survey was used to estimate baseline geomorphic conditions and potential impacts of altered flow on substrate movement. The survey approach was adapted from the Rosgen method. Features of interest included channel stability, bank erosion, channel incision and sediment deposition zones. Initially, historical and existing channel and riparian conditions of the affected reach were characterized based on reviews of topographic maps, aerial photography, flow data, channel and aquatic habitat surveys, and land management information. This resulted in a characterization of valley type, landform and channel type, which was verified through field surveys. Data were analyzed to qualitatively evaluate potential impacts on channel form, including sediment erosion and deposition, and potential impacts on fish habitat.

The hydrologic model (HEC-RAS) was used to assess impacts related to changes in wetted channel width, maximum channel depth, wetted perimeter, and mean channel velocity in Hobble Creek because of estimated flow regimes. The model was used to simulate steady flow conditions and backwater impacts that can occur in Hobble Creek from Utah Lake. A diversion structure approximately 800 feet downstream of the I-15 crossing prevented an analysis of backwater impacts upstream of this point. Data inputs into the model included 60 habitat cross-sections and baseline and alternative flows. Data outputs from the model were analyzed to determine potential impacts on Hobble Creek aquatic habitat for each alternative.

3.6.6.2.2.4 Spanish Fork River Habitat Modeling. Impacts on habitat were assessed by evaluating the potential change in Spanish Fork River water levels under the Proposed Action and other alternatives. Hydrologic relationships between flow and water level were determined based on information obtained at two river cross-sections with different channel morphology taken immediately downstream of the Diamond Fork Creek confluence with the Spanish Fork River. Flow and water-level relationships were used with baseline and projected flow information to estimate habitat impacts in the Spanish Fork River. Flow and water-level relationships derived from habitat cross-sections were not available for the reaches below the Spanish Fork diversion dam. Therefore, these two habitat cross-sections were assumed to be representative of channel morphology in the entire section of the Spanish Fork River downstream of this reach.

3.6.6.2.3 Macroinvertebrates. Where information was available, macroinvertebrates in the affected environment were described in two ways: by providing a discussion of the community in terms of the number and groups of taxa, and by estimating the density of macroinvertebrates indirectly through habitat ratings. Descriptions of taxa were obtained from various sources, including previously published reports (BIO-WEST 2003b; Reclamation 2001; CUWCD 1996b), unpublished data (Gray 2003), and the EPA STORET database (USEPA 2003a). Habitat ratings were obtained from previously performed Binns HQI Model II analyses (UDNR 2003c; CUWCD 1999a; CUWCD 1998a). The Binns HQI method evaluates a number of factors that can be used to estimate the quantity of trout in a stream (Binns 1982). One of these factors, submerged aquatic vegetation, can be used as an indicator of the density of macroinvertebrates. Surveyors qualitatively rank the density of submerged aquatic vegetation on a discrete scale from 0 to 4 that corresponds to a density range of macroinvertebrates per square foot.

To evaluate impacts, channel morphology data and flow data were obtained for the Provo River, Hobble Creek, Spanish Fork River, and Jordan River from USGS gage data. Cross-sectional information gathered at these gages was assumed to be representative of the entire reach for each analysis. Data were used to calculate changes in the wetted perimeter, and, based on this information, directional impacts (benefit or negative impact) on macroinvertebrates were determined for these water bodies for each alternative. Wetted width and stream depth were assumed to have a direct relationship with discharge during calculation of wetted perimeter. Increases in wetted perimeter were assumed to result in increased habitat for macroinvertebrates. Descriptions of macroinvertebrate diversity and density from the affected environment were used to support the assessment of directional impacts on macroinvertebrate communities and aid in the evaluation of macroinvertebrates based on significance criteria.

3.6.6.2.4 Verification and Calibration. For the Provo River: As part of the IFIM study, BIO-WEST performed a sensitivity analysis to compare the habitat suitability by species and life stage to the habitat niche approach. This was performed by modeling several species using both methods, and comparing the relationships between the two model results. Results indicated that relationships were similar for all species evaluated, while the total amount of habitat availability calculated under the two approaches differed. This was expected because the habitat niche approach is a more general measure than the species-specific habitat suitability method.

For Hobble Creek: As discussed in Section 3.6.6.2.1, conclusions from the initial geomorphic characterization of Hobble Creek were verified through field surveys. The HEC-RAS model was qualitatively calibrated. The survey data used for the model, including water levels and flow measurements, were used to confirm approximate accuracy of the geometric data.

3.6.7 Affected Environment (Baseline Conditions)

3.6.7.1 Overview

River reaches and lakes and reservoirs that would not be impacted are not included in the baseline condition description.

The description of the affected environment focuses on game fish, as listed in Table 3-39, because they indicate the overall health of an aquatic system and have recreational and economic value.

Table 3-39
Game Fish Species Potentially Affected by the ULS Project Alternatives

Common Name	Scientific Name
Brown trout	*Salmo trutta*
Cutthroat trout	*Oncorhynchus clarki*
Rainbow trout	*Oncorhynchus mykiss*
Channel catfish	*Ictalurus punctatus*
Black bullhead	*Ameiurus melas*
Walleye	*Sander vitreus*
White bass	*Morone chrysops*
Mountain whitefish	*Prosopium williamsoni*

3.6.7.2 Habitats

3.6.7.2.1 Provo River From Deer Creek Reservoir Outlet to Olmsted Diversion. This 9.6-mile reach lies entirely within Provo Canyon. It was channelized and leveed to accommodate highway, railroad, and trail construction. Measured stream widths range from 41 to 89 feet.

This reach is controlled by flow releases from Deer Creek Dam, inputs from tributary streams, and major irrigation diversions. Spring peak flows have been reduced from historical levels, and summer flow releases are artificially high because the river is used as a water delivery conduit to supply downstream users and irrigators (BIO-WEST 2003b).

Water quality was assessed as meeting its beneficial uses (UDEQ 2003a). Low dissolved oxygen measurements have been documented in a small area immediately below Deer Creek Dam and appear to be related to releases of deep, anoxic reservoir water from Deer Creek Reservoir (BIO-WEST 2003b). Operation of the Deer Creek Reservoir has the potential to affect water quality in the lower Provo River, since tributary inputs to the reservoir can be high in phosphorus. Water quality in the lower Provo River has not been considered limiting to fish and other aquatic species. The river and its tributaries have not been listed as impaired by the State of Utah. Historic water quality data indicated that criteria exceedances for water temperature, dissolved oxygen, and TDS were minimal in the Provo River from Deer Creek Reservoir to Utah Lake.

3.6.7.2.2 Provo River From Olmsted Diversion Dam to Murdock Diversion Dam. The Provo River from Olmsted Diversion Dam to Murdock Diversion Dam is a large, low to moderate gradient stream. Habitat, fisheries, and water quality in this reach are similar to that described in Section 3.6.7.2.1, however the channel includes both moderate and high gradient reaches (BIO-WEST 2003b). Geologic controls such as landslide deposits and steep canyon walls provides for steeper, boulder-bedded, cascading habitat conditions for a portion of this reach near Bridal Veil Falls. Stream width is fairly uniform throughout this reach. The substrate consists mostly of fine sands and silts deposited over cobble, rubble and boulder-sized rock in the channel (Reclamation 2001). Some sections have overhanging vegetation and subsequent input of organic matter to the river (Reclamation 2001). The reach was highly channelized and modified to accommodate residential, commercial, and industrial land uses (BIO-WEST 2003b). Flows are controlled by releases from Deer Creek Dam, inputs from tributary streams, and water withdrawals from Olmsted Diversion. Average monthly flows range from 54 to 859 cfs. Diversions trap sediment and prevent natural hydrologic and geomorphic processes (BIO-WEST 2003b). Currently, there are no legally-binding summer in-stream flow requirements in this reach of the Provo River. A wintertime minimum flow requirement of 25 cfs exists for the Provo River between Olmsted Diversion and Utah Lake.

3.6.7.2.3 Provo River From Murdock Diversion Dam to Interstate 15. The portion of the river between Murdock Diversion and Interstate 15 has been channelized and levied to allow for residential and commercial development across the historic floodplain and terraces (BIO-WEST 2003b). Because of these channel modifications, the floodplain width is minimal, streambanks are overly steep and tall, and natural geomorphic processes such as point bar deposition and channel avulsion are limited. Sediment supply is limited to bed erosion and nonpoint source inputs since upstream sources have been cut off by the Murdock Diversion, Olmsted Diversion, and Deer Creek Dam. The banks for the most part are lined with rock rip-rap to protect against erosion. Channel substrate is coarse consisting primarily of cobble (bowling ball) sized particles.

In addition to being controlled by Deer Creek Dam releases and withdrawals at Salt Lake Aqueduct and Olmsted Diversion upstream, streamflows in this reach are affected by 7 additional diversion structures: Murdock Diversion, Timpanogos Diversion, Provo Bench Diversion, Upper Union Diversion, Lake Bottom Diversion, Upper City Dam, and Lower City Dam (also known as Tanner Race) (BIO-WEST 2003a). Murdock Diversion (also known as Provo Reservoir Canal Diversion) is the most significant of these diversions, typically removing 200 to 300 cfs from Provo River during the irrigation season. In combination, the other six diversions remove an additional 150 to 200 cfs. Because of these diversions, flows in this reach are significantly less than in Provo Canyon between April and October. Currently, there are no legally-binding summer in-stream flow requirements for the lower Provo River. A wintertime minimum flow requirement of 25 cfs exists for the Provo River between Utah Lake and Olmsted Diversion.

The State of Utah does not operate any water quality monitoring stations between Murdock Diversion and Interstate 15; therefore, little is known about water quality in this reach (Table 3-10). Fish kills have been associated with polluted runoff during low-water periods (FWS 1999). Monthly flows range from 55 to 527 cfs. Portions of the river between diversion structures are dewatered in some years (BIO-WEST 2001).

Although channelized and levied, the game and non-game fisheries conditions in this reach are similar to those described in Section 3.6.7.2.2.

3.6.7.2.4 Provo River From Interstate 15 to Utah Lake. This deep-profile, slow-velocity, low-gradient reach is fairly uniform throughout. The substrate consists mostly of fine sands and silts deposited over cobble, rubble and boulder-sized rock in the channel. This reach has been highly channelized and modified to accommodate residential, commercial and industrial land uses.

Flows in this reach are controlled by releases from Deer Creek Dam, inputs from tributary streams, and major irrigation diversions. Water diversions have reduced flow to zero in some months from May to September. Modeled average monthly flows during summer were as low as 4 cfs.

Water quality concerns in this reach are similar to the reach from Murdock Diversion Dam to Interstate 15 (see Section 3.6.7.2.3), although little is known about water quality in this reach.

3.6.7.2.5 Hobble Creek From Mapleton-Springville Lateral to Utah Lake. Hobble Creek originates in the canyons of the Wasatch Front in northern Utah and discharges to Utah Lake near the City of Springville. As the creek descends into Springville, the majority of the stream is surrounded by private land. Irrigation diversions and dams are common in Hobble Creek below the small debris basin in the mouth of Hobble Canyon. Downstream of the debris basin, bank vegetation is very dense and grown over the stream in residential areas. As the creek flows west toward Utah Lake, agricultural land and industrial areas are more predominant and there is less streamside vegetation. Riparian vegetation consists of cottonwood, willow, dogwood, rose and box elder.

The reach of Hobble Creek downstream of the Mapleton Lateral is dominated by cobble and gravel; the middle reach is gravel- and cobble-dominated; and the lower reach is sand-dominated with small gravel sub-dominant. Median sizes of surface substrate decreased from about 51 mm upstream, to 23 mm at the middle reach cross section, to less than 1mm at the lower cross-section. Field geomorphology indicated that more than 90 percent of banks surveyed in upper and lower Hobble Creek are stable. Sediment modeling indicated that bedload transport in Hobble Creek was initiated when flows exceeded 95 cfs.

Historic data showed that water temperature occasionally exceeded significance criteria for water temperature. Data indicated that total dissolved solids and dissolved oxygen did not exceed significance criteria in Hobble Creek. Water temperature exceedances generally occurred at a station at the lower end of Hobble Creek near Utah Lake.

3.6.7.2.6 Spanish Fork River–Diamond Fork Creek to Spanish Fork Diversion Dam. The upper part of this reach is low-gradient and heavily disturbed by man-made features that encroach on the stream channel and floodplain. Much of the reach was altered by railroad and road grades that parallel the river. A variety of channel types are present, including meandering stream through floodplain and highly channelized sections with riprap banks. Approximately 20 percent is channelized, and the amount of riparian vegetation is highly variable. A few short segments of the reach contain up to 70 percent mature riparian vegetation throughout the floodplain, while other segments have a low percentage of riparian habitat (less than 10 percent). The substrate is primarily dominated by gravel, followed by sand and silt. The reach is dominated by riffle-run habitat types and contains very few pools. Overall, the existing habitat condition is poor (CUWCD 1998a).

Water quality in the upper part of the Spanish Fork River is adequate to meet the standards for its beneficial uses (UDEQ 2003a). High turbidity was observed from Diamond Fork irrigation releases and tributaries to the Spanish Fork River during storm events. However, no exceedances of state water quality standards were projected under baseline conditions.

3.6.7.2.7 Spanish Fork River–Spanish Fork Diversion Dam to East Bench Diversion and East Bench Diversion to Mill Race Canal. Habitat and water quality in this reach of the Spanish Fork River is similar to that described in Section 3.6.7.2.6.

3.6.7.2.8 Spanish Fork River–Mill Race Canal to Lakeshore Diversion. This reach has low-gradient, deep, slow-moving water that flows primarily through agricultural land. Much of the reach was altered by railroad and road grades that parallel the Spanish Fork River. Portions of the stream have a thin strip of riparian vegetation. The substrate is dominated by sand and silt, although some areas contain suitable spawning gravel.

During the irrigation season, typically April 15 to October 15, streamflow above this reach is diverted at intervals for agricultural purposes. Summer flows in this reach are comprised largely from seepage, irrigation return flows and septic tank drainfield inflow to the river.

Water quality is adequate to meet the standards for its beneficial uses (UDEQ 2003a). Water quality fluctuates significantly from season to season and deteriorates considerably during the summer. This reach experiences high water temperatures, high total dissolved solid levels and nutrient levels, with periodic increases in biological oxygen demand and coliform levels (CUWCD 1998). Agricultural and urban runoff contributes to the pollutant load. Despite numerous water quality conditions that have the potential to limit fish production, no exceedances of state water quality standards are projected under baseline conditions.

3.6.7.2.9 Utah Lake. The aquatic habitat of Utah Lake and its water quality is closely related to its water level and its water level fluctuations throughout the year. In 2002, Utah Lake was assigned the status of "partially supporting" with respect to water quality criteria (UDEQ 2003a). The reservoir has been assigned this designation since 1994. Utah Lake is currently on the State of Utah's Clean Water Act Section 303(d) list of impaired waters for total phosphorus and total dissolved solids. Blue green algae abundance, trophic state index levels, and total phosphorus levels exceeded standards during some periods (UDEQ 2003a). Although water quality modeling indicated that total dissolved solids may exceed the water quality criterion established for agricultural uses, water quality in the lake is adequate to support aquatic resources. The State of Utah has not established TDS standards for aquatic resources. See Water Quality discussions in Section 3.3.

3.6.7.3 Game Fish Biomass and Communities

3.6.7.3.1 Provo River From Deer Creek Reservoir Outlet to North Fork of Provo River. Game fish species that have been documented in this reach include brown, rainbow and cutthroat trout, smallmouth bass, and mountain whitefish.

Fisheries assessments using the Binns HQI Model II have been used to estimate the trout standing crop in this reach under baseline conditions. The baseline projection of trout standing crop in this reach with the adjusted Binns HQI Model II was 675 pounds per acre. Total biomass was estimated at 15,728 pounds.

3.6.7.3.2 Provo River From North Fork of Provo River to Olmsted Diversion Dam. Game fish community composition is similar to communities described in Section 3.6.7.3.1.

Fisheries assessments using the Binns HQI Model II have been used to estimate the trout standing crop in this reach under baseline conditions. The baseline projection of trout standing crop in this reach with the adjusted Binns HQI Model II was 506 pounds per acre. Total biomass was estimated at 16,091 pounds.

3.6.7.3.3 Provo River From Olmsted Diversion Dam to Murdock Diversion Dam. Game fish community composition is similar to communities described in Section 3.6.7.3.1. The baseline projection of trout standing crop in this reach with the adjusted Binns HQI Model II was 545 pounds per acre. Total biomass was estimated at 8,339 pounds.

3.6.7.3.4 Provo River Murdock Diversion Dam to Interstate 15. Game fish community composition is similar to communities described in Section 3.6.7.3.1. The baseline projection of trout standing crop in this reach with the adjusted Binns HQI Model II was 173 pounds per acre. Total biomass was estimated at 5,919 pounds.

3.6.7.3.5 Provo River From Interstate 15 to Utah Lake. Game fish community composition is similar to communities described in Section 3.6.7.3.1. The baseline projection of trout standing crop in this reach with the adjusted Binns HQI Model II was 86 pounds per acre. Total biomass was estimated at 714 pounds.

3.6.7.3.6 Hobble Creek. The baseline projection of trout standing crop in this reach with the adjusted Binns HQI Model II was 10 pounds per acre above Kolob Park in Springville, Utah. Total biomass was estimated at 56 pounds. In the lower section of Hobble Creek below Kolob Park, the baseline projection of trout standing crop in this reach with the adjusted Binns HQI Model II was 15 pounds per acre from Kolob Park to Utah Lake. Total biomass in this lower reach of Hobble Creek was estimated at 132 pounds.

3.6.7.3.7 Spanish Fork River–Diamond Fork Creek to Spanish Fork Diversion Dam. This 4.2-mile reach supports a fishery dominated by brown trout. Other game fish documented in the reach include rainbow and rainbow-cutthroat trout hybrids. Based on projected flows from the Interim Proposed Action in the 1999 Diamond Fork System FS-FEIS (CUWCD 1999a) and modeled average monthly flows, the baseline projection of trout standing crop in this reach with the adjusted Binns HQI Model II was 151 pounds per acre. Total biomass was estimated at 4,002 pounds.

3.6.7.3.8 Spanish Fork River–Spanish Fork Diversion Dam to East Bench Diversion. This reach supports marginal brown trout and cutthroat fisheries (Sakaguchi 1994; Shirley 1994). Based on projected flows from the Interim Proposed Action in the 1999 Diamond Fork System FS-FEIS (CUWCD 1999a) and modeled average monthly flows, the baseline projection of trout standing crop in this reach with the adjusted Binns HQI Model II was 348 pounds per acre. Total biomass was estimated at 2,888 pounds.

3.6.7.3.9 Spanish Fork River–East Bench Diversion to Mill Race Canal. Fisheries in this reach are affected by low flows throughout most of the year. It supports a marginal brown trout and cutthroat trout fisheries. Other game species documented in the reach include walleye and largemouth bass. Based on projected flows from the Interim Proposed Action in the 1999 Diamond Fork System FS-FEIS (CUWCD 1999a) and modeled average monthly flows, the baseline projection of trout standing crop in this reach with the adjusted Binns HQI Model II was 348 pounds per acre. Total biomass was estimated at 3,793 pounds.

3.6.7.3.10 Spanish Fork River–Mill Race Canal to Lakeshore Diversion. Fisheries in this reach are similar to those described in Section 3.6.7.3.9. Based on projected flows from the Interim Proposed Action in the 1999 Diamond Fork System FS-FEIS (CUWCD 1999a) and modeled average monthly flows, the baseline projection of trout standing crop in this reach with the adjusted Binns HQI Model II was 126 pounds per acre. Total biomass was estimated at 7,623 pounds.

3.6.7.3.11 Utah Lake. Utah Lake supports a fish community dominated by non-native warmwater species. Game fish documented in Utah Lake include white bass, walleye, largemouth bass, brown trout, and rainbow trout. Carp are the most prevalent species, followed by white bass, walleye, black bullhead, and channel catfish. Additional non-game species are present in lower numbers. Recent data were not available to characterize the diversity and abundance of game fish species in Utah Lake.

3.6.7.4 Macroinvertebrates

Table 3-40 lists macroinvertebrates known to occur in varying numbers and diversity throughout the impact area of influence. The Provo River supports areas of high and low populations, but generally low diversity. Hobble Creek is estimated to have fair to good macroinvertebrate population levels. The Spanish Fork River does not provide suitable habitat for large macroinvertebrate populations. Information was not available to evaluate macroinvertebrate populations and communities in Utah Lake.

Table 3-40
Known Macroinvertebrates in Impact Area of Influence

Family	Related Taxon	Common Name
Baetidae, Cinygmula	Ephemeroptera	Mayflies
Chironomid	Diptera	Midges
Simuliidae	Diptera	black flies
Optioservus, Elmidae	Coleoptera	Beetles
Hydropsyche, Hydroptilidae	Trichoptera	Caddisflies
–	Plecoptera (Order)	Stoneflies
Orthocladiinae	Diptera (Order)	True flies
–	Isopoda (Order)	isopods, aquatic sow bugs
–	Amphipoda (Order)	Amphipods, scuds
Tubificidae	Oligochaeta (Subclass)	Earthworms
Planariidae	Turbellaria (Class)	flat worms
Hydracarina	Acari (Subclass)	water mites
–	Copepoda (Order)	Copepods
–	Ostracoda (Order)	seed shrimp

3.6.8 Environmental Consequences (Impacts)

3.6.8.1 Significance Criteria

Impacts on aquatic resources and habitats are considered significant if construction and operation of the Proposed Action and other alternatives would result in one or more of the following conditions:

3.6.8.1.1 Fish

- A long-term (more than one year) change in sport fish numbers and/or biomass in an affected stream section caused by a change in habitat conditions (quantity and quality of instream flows).

- A long-term change in native fish species numbers or habitat caused by a change in habitat conditions (quantity and quality of instream flows).

- The Utah Water Quality Standards for protection of aquatic life are likely to be exceeded because surface water classified as 3A (protected for coldwater fish) have temperatures exceeding 68°F (81°F for surface water classified 3B [warmwater fisheries]) (UDEQ 2003b). If existing temperatures are estimated to periodically exceed this standard, the assessment of impact significance is based on the frequency and duration.

- The Utah Water Quality Standards for protection of aquatic life are exceeded because surface water classified as 3A have dissolved oxygen concentrations of less than a 30-day average of 6.5 ppm, a seven-day average less than 5.0 ppm or greater than 9.5 ppm, or a one-day average less than 4.0 ppm or greater than 8.0 ppm. For surface water classified as 3B, the dissolved oxygen standards are a 30-day average of 5.5 ppm, a seven -day average of 4.0 to 6.0 ppm, and a one-day average of 3.0 to 5.0 ppm.

- Operations were to cause surface water that support trout to exceed 2,000 ppm total dissolved solids or surface water supporting fish other than trout to exceed 5,000 ppm total dissolved solids (a professional judgment standard based on McKee and Wolf (1963). The State of Utah has not adopted water salinity standards for protection of fisheries.

3.6.8.1.2 Macroinvertebrates. Three categories of "potential for impact" were developed for macroinvertebrate habitat. Habitat was categorized according to the following criteria and best professional judgment:

Low Potential

- Low to moderate potential for impact is based on fluctuations in stream discharge that correspondingly results in altered habitat availability. Low to moderate impacts are considered if habitat availability of affected rivers changed by less than 5 percent compared to baseline values.

- Low to moderate potential for impact is based on low magnitude, short-term changes of water quality parameters beyond their natural range in project surface water. Low to moderate potential is considered if water quality parameters change less than 10 percent compared to natural range of values in project surface water.

Moderate Potential

- Moderate to high potential for impact is based on fluctuations in stream discharge that correspondingly results in altered habitat availability. Moderate to high impacts are considered if habitat availability of affected rivers changes between 5 and 40 percent compared to baseline values.

- Moderate to high potential for impact is based on moderate-magnitude, short- or long-term changes of water quality parameters 10 and 30 percent beyond their natural range in project surface water.

High Potential

- High potential for impact is based on fluctuations in stream discharge that correspondingly result in altered habitat availability. Moderate to high impacts are considered significant if habitat availability of affected rivers change more than 40 percent compared to baseline values.

- High potential for impact is based on high-magnitude, short- or long-term changes of water quality parameters greater than 30 percent beyond their natural range in project surface water.

3.6.8.2 Potential Impacts Eliminated From Further Analysis

3.6.8.2.1 Nuisance Species. The inter-basin delivery of water and flow alterations that affect aquatic environments posed the risk of transporting or facilitating the expansion of non-indigenous or exotic nuisance species (e.g., crayfish, carp, water flea). However, transbasin deliveries of water from the Colorado River basin to the Utah Lake basin have been occurring at least since the early 1900s. Under the Proposed Action or other alternatives, including No Action, there would be no increased risk of nuisance species.

3.6.8.2.2 Construction Impacts. Based on the implementation of the standard operating procedures (see Chapter 1, Section 1.8.8) and the proposed design and construction techniques, there would be minimal to no impact on aquatic resources from any of the project construction activities. Therefore, the following sections discuss only potential impacts that may occur from the operation of the Proposed Action and other alternatives.

3.6.8.2.3 Lake and Reservoir Impacts. There would be no impacts on aquatic resources from changes in the following reservoir and lakes:

- Strawberry Reservoir
- Deer Creek Reservoir

The changes in reservoir storage volume and stage are shown in Chapter 3, Section 3.2, Surface Water Hydrology. The incremental changes would be small relative to baseline reservoir operations and would be within normal historic fluctuations that these reservoirs experience on a yearly basis. As a result, there would be minimal change in aquatic habitat, and therefore, no impact on aquatic species populations and communities.

3.6.8.2.4 Jordan River From Utah Lake Outlet to the Jordan Narrows Impacts. The Jordan River would experience a maximum decrease in average monthly flow of about 90 cfs in August under the Proposed Action. Flow changes under the Bonneville Unit Water Alternative and No Action Alternative would be minimal, and impacts on hydraulic conditions in the Jordan River would not exceed the significance criteria. This reach of the river is wide and slow-moving. An analysis of wetted perimeter changes under the proposed flow regime under all alternatives showed that wetted perimeter would vary less than 2 percent from baseline conditions. Small changes in water surface elevations likely would have minimal to negligible impacts on habitat, and therefore game and non-game fish or macroinvertebrate populations and communities. Changes in water quality that could have a significant impact on aquatic resources in this reach would not be expected to occur under any alternative.

3.6.8.3 Spanish Fork Canyon–Provo Reservoir Canal Alternative (Proposed Action)

3.6.8.3.1 Habitat

3.6.8.3.1.1 Provo River From Deer Creek Reservoir Outlet to North Fork of Provo River. Habitat modeling results indicated that proposed flow under the Proposed Action would reduce habitat availability slightly (1 to 16 percent) for all game species. The spawning life stage of rainbow trout would experience the largest projected habitat decrease (15 percent), followed by decreases in spawning cutthroat trout (3 percent). Estimated habitat availability for all life stages of brown trout was projected to decrease between 1 and 2 percent under the Proposed Action. Although habitat availability was projected to be lower for all trout species, these decreases would be minor. Slight, long-term decreases in habitat availability would not exceed the significance criteria.

Under the Proposed Action, flow changes likely would not affect critical spawning periods of game species. The largest proportional decreases in monthly flow occur during January through March in an average water year (9 to 20 percent). Flow decreases during this period are outside critical spawning periods for rainbow trout and cutthroat trout in the Provo River. Moderate increases in flow in September (2 percent) and October (12 percent) would occur before the primary spawning period of mountain whitefish and brown trout. Modeling of game fish life stages supports the idea that flow changes would not affect game fish spawning, as habitat availability for this life stage would be expected to change between 1 to 15 percent from baseline conditions for brown trout, rainbow trout, and cutthroat trout.

Habitat niche modeling projected decreases in habitat availability between Deer Creek and the North Fork of the Provo River. Most of the habitat decreases would be less than 10 percent, and impacts on non-game fish would not exceed the significance criteria. Estimated habitat decreases would be 1 to 3 percent in slow-flow niches, 4 to

5 percent in moderate-flow niches, and 10 to 16 percent in fast-flow niches. Moderate decreases in fast/shallow and mid-depth habitats could impact habitat availability for adult mountain sucker, longnose dace, and Utah sucker. Small decreases in the amount of low-velocity, backwater habitats could adversely impact juvenile and young-of-year life stages of non-game species such as mountain sucker, speckled dace, longnose dace, and redside shiner. Although estimated habitat in all niches would experience minimal decreases under the Proposed Action, these changes are relatively minor and likely would not result in a long-term change in non-game abundance or fish community structure. However, small losses in slow- and moderate-flow niches combined with a moderate decrease (10 percent) in the fast/mid-depth habitat niche could result in a significant loss of available habitat for mountain sucker in this reach. Overall, projected long-term decreases in habitat availability for non-game species would be relatively small and these impacts on non-game fish habitat would not exceed the significance criteria.

Based on model projections, water temperature, dissolved oxygen, and total dissolved solids, water quality impacts on aquatic resources under the Proposed Action would not exceed the significance criteria. Water release impacts on water quality in this reach would not exceed the significance criteria.

3.6.8.3.1.2 Provo River From North Fork of Provo River to Olmsted Diversion Dam. Operational impacts on habitat availability in modeled niches and species' life stages would be similar to the Provo River reach between the outlet of Deer Creek Reservoir and the North Fork of the Provo River. Modeling results indicated that Proposed Action flows would lower habitat availability for all adult game species and life stages. The spawning life stage of rainbow trout would experience the largest projected habitat decrease (15 percent), followed by spawning cutthroat trout (2 percent). Estimated habitat for all other game species and life stages were projected to decrease between 1 to 2 percent under the Proposed Action. Estimated habitat decreases of 2 to 4 percent in moderate flow habitats could impact habitat availability for adult trout, while a projected decrease of 3 percent in the slow/shallow habitat niche could affect the spawning life stage of trout. Although habitat availability would be lower for all trout species and life stages, most of these decreases would be small (less than 2 percent change from baseline conditions). Overall the long-term, small decreases in habitat availability in this reach would not exceed the significance criteria for brown trout or other game fish habitat.

Under the Proposed Action, flow changes likely would not affect critical spawning periods of game species. The moderate percent change estimated for rainbow trout spawning habitat could have localized negative impact for spawning rainbow trout located in this reach. However, this reach of the Provo is managed primarily for brown trout (BIO-WEST 2003a). Rainbow trout are stocked annually into lakes, reservoir, and stream sections within the Provo River to support sport fishing activities. Thus, even a moderate decrease in rainbow trout spawning habitat in this reach likely would not exceed the significance criteria.

Additionally, the largest proportional decreases in monthly flow occur during January through March in an average water year (9 to 20 percent). Flow decreases during this period are outside critical spawning periods for rainbow trout and cutthroat trout in the Provo River. Moderate increases in flow in September (2 percent) and October (11 percent) would occur before the primary spawning period of mountain whitefish and brown trout. Modeling of game fish life stages supports the conclusion that flow changes would not exceed the significance criteria for game fish spawning, as habitat availability for this life stage would be expected to change between 1 to 18 percent from baseline conditions for brown trout, rainbow trout, and cutthroat trout.

Habitat availability in all modeled niches was projected to decrease in this reach. Most of the decreases would be less than 10 percent. Impacts on non-game fish habitat would not exceed the significance criteria. Estimated habitat decreases were approximately 1 to 3 percent in slow-flow niches, 2 to 4 percent in moderate-flow niches, and 10 to 16 percent in fast-flow niches. The moderate decreases estimated for fast/shallow and mid-depth habitats could impact habitat availability for adult mountain sucker, mottled sculpin, longnose dace, and Utah sucker. Decreases in the amount of low-velocity, backwater habitats would be minor and not likely to impact juvenile and young-of-year life stages of non-game species such as mountain sucker, speckled dace, longnose dace, and redside shiner. Estimated habitat in all niches showed minimal decreases under the Proposed Action and likely would not result in a long-term change in non-game abundance or fish community structure. Small losses in slow- and moderate-flow niches combined with a moderate decrease (16 percent) in the fast/shallow habitat niche could result in a significant loss of available habitat for mountain sucker and mottled sculpin in this reach. Overall, projected long-term decreases in habitat availability for non-game species would be relatively small and impacts on fish habitat would not exceed the significance criteria.

Impacts on macroinvertebrate habitat in this reach would be similar to those occurring upstream in the reach between Deer Creek Reservoir and North Fork of the Provo River. This alternative would result in small increases and decreases in wetted perimeter at various times of the year. Projected decreases were generally greater than increases, though neither were large in magnitude. The greatest decrease (2.8 percent) was estimated to occur in January. The Proposed Action would have a low potential to impact macroinvertebrate habitat in this reach.

Based on model projections, water temperature, dissolved oxygen, and total dissolved solids, water quality impacts on aquatic resources under the Proposed Action would not exceed the significance criteria. Water release impacts on water quality in this reach would not exceed the significance criteria.

3.6.8.3.1.3 Provo River From Olmsted Diversion Dam to Murdock Diversion Dam. Habitat availability for game species in this reach was not estimated to change substantially (less than 11 percent) from baseline conditions. Modeling results indicated that proposed flows would provide low to moderate gains in habitat availability for all game species except brown trout fry (5 percent decrease), spawning cutthroat trout (3 percent decrease), and spawning rainbow trout (5 percent decrease). Habitat availability in modeled habitat niches used by game species was estimated to change somewhat more substantially. The greatest projected change in a habitat niche used by game fish would be a 12 percent decrease in the backwater/edge niche. This niche is used by mountain whitefish fry but is only a partial use niche. Overall, projected habitat changes for game fish would be long-term, but they would be expected to be small enough that they would not exceed the significance criteria.

Under the Proposed Action, flow changes likely would not affect game species that spawn in autumn months, and could provide a slight benefit to spring spawners. In an average water year, the largest decreases in monthly flow would occur during June through October and the largest increases would occur from December through April. Moderate decreases in flow during October would occur before the primary spawning period for mountain whitefish and brown trout. Small to moderate increases in flow in April and May would occur during the spawning period of rainbow trout. Modeling of game fish life stages supports the conclusion that flow changes would not exceed the significance criteria for game fish spawning, as habitat availability for this life stage would be expected to change less than 11 percent from baseline conditions. Under the Proposed Action, the highest risk to game fishes would occur during the summer in an average flow year. Reductions in flow of 18 to 23 percent during late summer could affect the quantity and quality of instream habitat in this reach of the Provo River.

Habitat availability for non-game species would increase in all modeled habitat niches except the backwater/edge habitat type (12 percent decrease). The greatest change in a niche used by non-game fish would be an estimated 79 percent increase in the fast/shallow niche. Although the percent increase would be high for the fast/shallow niche, the total available habitat under baseline conditions would be low at 351 square feet per 1,000 linear feet, and the increase would likely result in fewer than 300 square feet per 1,000 linear feet being added to this niche. This niche provides partial habitat availability for mountain sucker and mottled sculpin. Given the small change in total available habitat and the partial use of this habitat by game fishes, this increase would not be expected to have substantial impact on non-game fish. Fast/mid-depth habitats, used primarily by mountain sucker, are estimated to increase (by 17 percent). Habitat increases in other niches of less than 11 percent (shallow niches and moderate/mid-depth niches) would benefit juvenile and adult native species including mottled sculpin, Utah sucker, longnose dace, and speckled dace. The increase of habitat in these niches would benefit some of the species affected by loss of backwater/edge habitat, but at different life stages. The backwater/edge habitat type was projected to decrease by 12 percent. This habitat niche is used by mountain whitefish fry, young-of-year Utah sucker, specked dace, and longnose dace, and multiple life stages of redside shiner. Although a minor decrease in the backwater/edge habitat niche was projected under the Proposed Action, habitat increases in other modeled niches would offset these habitat losses and would provide a significant long-term benefit to many species of non-game fish in this reach of the Provo River.

The delivery of additional ULS water to this reach would not result in water quality impacts on aquatic resources in this reach that would exceed the significance criteria. Water quality impacts would be similar to those described for the Provo River from Deer Creek Reservoir to North Fork of the Provo River (Section 3.6.8.3.1.1).

3.6.8.3.1.4 Provo River From Murdock Diversion Dam to Interstate 15. In the upper portion of the reach (Site 2a), habitat modeling results indicated that proposed flows would cause habitat decreases estimated at 8 percent for brown trout juveniles, 32 percent for brown trout fry, and 20 percent for all trout juveniles. Habitat would be increased for brown trout adults (3 percent) and brown trout spawning (378 percent). More moderate increases would occur for brown trout adults (47 percent) and juveniles (36 percent) in the middle part of this reach (Site 2b). In the lower end of the reach (Site 2c), habitat modeling results indicated that proposed flows would provide additional brown trout adult (167 percent) and brown trout juvenile (154 percent) habitat. The modeled category for all trout juveniles was projected to experience a net increase under the Proposed Action. Modeled habitat availability for spawning cutthroat, rainbow, and brown trout was minimal throughout this reach of the Provo River. Overall, however, habitat increases for modeled game fish species and life stages would represent at significant benefit for game fish in this reach.

Habitat availability in niches used by game fish vary throughout the reach, with slow flow niches (backwater/edge and slow/shallow) exhibiting decreases as large as 43 percent and moderate flow niches experiencing very large increases in habitat. The greatest increase in a niche used by game fish was projected to occur in the moderate/shallow and moderate/mid-depth niches (17 to 452 percent). These niches are used by juvenile, fry, spawning, and adult life stages of all trout. Smaller decreases in slow/shallow habitat availability would affect juvenile, fry, and spawning stages for all trout, but this is only one of several habitat niches used by these trout. A decrease in the amount of backwater/edge habitat under this alternative that could adversely impact mountain whitefish fry would be compensated for by greater increases in the moderate/mid-depth niche. Net habitat increases for game fish would compensate for small losses and would be a significant benefit to game fish in this reach.

For non-game fish, the greatest increase in habitat availability would be in the fast/shallow (91 to 5,207 percent) and fast/mid-depth (215 to 49,498 percent) habitat niches. These niches provide suitable habitat for mountain sucker and mottled sculpin, and thus these species would benefit by increased habitat associated with this alternative. Large proportional increases were estimated for these two habitat niches because only small amounts of habitat (as low as 1 ft^2 and up to 602 ft^2 per 1,000 feet of river) are available in this reach under baseline conditions. Moderate flow habitat niches were estimated to increase under the Proposed Action. Habitat increases in the moderate/shallow and moderate/mid-depth habitat niche would benefit adult mountain sucker, mottled sculpin, speckled and longnose dace, and Utah sucker. Juvenile sculpin and Utah sucker would benefit by projected habitat increases in moderate flow niches. The moderate/shallow habitat niche was projected to increase by as much as 452 percent in this reach. A similar trend was estimated for the moderate/mid-depth habitat niche that was estimated to increase 428 percent in the lower portion of the reach and 17 to 97 percent in the upper and middle portions respectively. Smaller decreases in habitat availability were estimated to occur in backwater/edge and slow/shallow (19 and 1 percent [Site 2c lower], 29 and 43 percent [Site 2b middle], and 10 and 32 percent [Site 2a upper]). A moderate decrease in the availability of backwater/edge habitats under this alternative could adversely impact young-of-year suckers and dace, and all life stages of redside shiner; at these life stages, these species utilize this habitat exclusively. Decreased slow/shallow habitat availability potentially could affect juvenile longnose dace and young-of-year mottled sculpin, which use this habitat niche exclusively. Overall, decreased slow water habitat availability could have a significant, long-term adverse impact on habitats for non-game fishes. Increases in moderate and fast water habitats would help to offset the losses and would provide benefits to mountain sucker, mottled sculpin and dace, however, redside shiner would be subject to significant losses in available habitat.

Water quality impacts for dissolved oxygen, total dissolved solids, and water temperature would be expected under the Proposed Action. Water delivered from Strawberry Reservoir through new ULS pipelines would increase the concentration of dissolved oxygen in the reach downstream of the Murdock Diversion. Total dissolved solids concentrations would decrease under this alternative. The average total dissolved solids concentration in the lower Provo would decrease up to 12 percent, remaining well below state standards for aquatic life. Water temperatures would decrease during summer months and increase during the winter months as a result of the Proposed Action. Estimated monthly temperature changes would be small (less than 2 degrees) and would not change water temperatures beyond state standards for aquatic life. Overall, the impacts on water quality and aquatic resources would not exceed the significance criteria.

3.6.8.3.1.5 Provo River From Interstate 15 to Utah Lake. Modeling results indicate that proposed flows would provide higher habitat availability for all game species and life stages modeled compared to the baseline condition. Projected habitat increases for game fish in this reach range from 51 to 302 percent. The estimated net increase in habitat for game species throughout the entire reach would be a significant benefit to game fish within this reach.

Projected changes in availability of habitat niches used by game species varied. Habitat availability for all niches used by game species would increase substantially compared to baseline conditions under the Proposed Action. The greatest increase in a niche used by game fish (1,294 percent) would occur in the moderate/shallow niche, which is used by trout in juvenile, fry, and spawning life stages. The increases in habitat for game fish would be a significant benefit to game fish within this reach.

All habitat niches were estimated to increase (49 to 7,868 percent). The greatest proportional increase in habitat availability would be associated with the fast/shallow habitat niche (7,868 percent), which is used by adult mountain sucker and adult and juvenile mottled sculpin. The large proportional increase would occur in this niche because only 2 ft^2 per 1,000 linear feet of river was estimated under baseline conditions, compared with 137 ft^2 per 1,000 linear feet of river under the Proposed Action. A similar magnitude habitat increase would occur in the moderate/deep habitat niche, which accounts for the large proportional increase (1,071 percent) projected by the PHABSIM model. These moderate to large increases in habitat availability would provide benefits in habitat availability to mountain sucker, mottled sculpin, redside shiner, and longnose and speckled dace and would be a significant benefit to non-game fishes within this reach.

Based on model projections, water temperature, dissolved oxygen, and total dissolved solids, water quality impacts on aquatic resources under the Proposed Action would not exceed the significance criteria. Water release impacts on water quality in this reach would not exceed the significance criteria.

3.6.8.3.1.6 Hobble Creek. Hydraulic modeling of Hobble Creek estimated habitat impacts on wetted width, maximum channel depth and water velocities in the main river channel. Hydraulic modeling of steady-state conditions in Hobble Creek indicated that wetted widths would increase between 4 and 70 percent under the Proposed Action. Maximum channel depth would increase between 8 and 124 percent, and mean main channel velocity would increase by 10 to 367 percent. This alternative has the potential to impact substrates in Hobble Creek that are important for trout spawning, however, a net loss of suitable habitat is not anticipated with flows below bankfull width. Increased habitat availability from increased flows during all months would provide a significant long-term benefit on non-game species in Hobble Creek.

Based on hydraulic modeling and estimated average monthly flows, habitat for macroinvertebrates in Hobble Creek would increase because flow would increase in all months. Water depth and wetted perimeter in Hobble

Creek would increase. These changes could cause a moderate-to-high increase in macroinvertebrate habitat compared to baseline conditions. There is high potential to improve macroinvertebrate habitat in this reach.

Based on model projections, water temperature would decrease under the Proposed Action. The likelihood of water temperatures exceeding significance criteria is expected to decrease. Thus, increased flows in Hobble Creek during low flow periods could result in significant benefits on aquatic resources as a result of lower water temperatures. Based on water quality modeling, dissolved oxygen concentrations would increase and total dissolved solids concentrations would decrease. Impacts on total dissolved solids and dissolved oxygen in this reach would not exceed the significance criteria. Bonneville Unit water release impacts on water quality in this reach would not exceed the significance criteria.

3.6.8.3.1.7 Spanish Fork River From Diamond Fork Creek to Lakeshore Diversion. Overall aquatic habitat would decrease during all months under this alternative. The greatest flow decreases, greater than 100 cfs, would occur from February through July and would result in water surface elevations that are decreased by approximately 6 inches and would decrease the area of in-channel aquatic habitat available for game species. Under baseline conditions, late spring and early summer flows provide water to much of the river including side channels. However, water surface elevation reductions in areas with trapezoidal channel morphology has the potential to confine water to the deepest part of the main channel during May through July. This would result in a decrease in overall habitat availability as well as a decrease in availability of off-channel habitats that are used by brown trout and other game species during these months. Reduced spring and fall flows and associated decreases in habitat have the potential to significantly impact rainbow trout spawning in March and April and brown trout spawning in October and November. Projected flow decreases in the Spanish Fork River likely would result in small, long-term, and significant impacts on game and non-game fish habitats under the Proposed Action.

Based on channel cross-section data, this alternative would result in small changes to wetted perimeter during all months. Wetted perimeter would decrease 2 to 21 percent during the year. Long-term but small decreases in wetted perimeter would be expected to have a moderate potential to impact macroinvertebrate habitat. Impacts on water quality in this reach would not exceed the significance criteria. Only small changes in water temperature, dissolved oxygen, and total dissolved solids would occur because water quality conditions for aquatic resources would be similar to baseline conditions.

3.6.8.3.1.8 Utah Lake. Delivery of ULS water to Utah Lake under the Proposed Action would have minimal impacts on water quality and aquatic resources in Utah Lake. These impacts would not exceed the significance criteria in terms of water quality conditions supporting aquatic resource habitat.

3.6.8.3.2 Game Fish Biomass and Communities

3.6.8.3.2.1 Provo River From Deer Creek Reservoir Outlet to North Fork of Provo River. Standing crop estimates from the Binns HQI Model II indicate that game fish biomass and total biomass would remain the same as baseline.

3.6.8.3.2.2 Provo River From North Fork of Provo River to Olmsted Diversion Dam. Standing crop estimates from the Binns HQI Model II indicate that game fish biomass and total biomass would remain the same as baseline.

3.6.8.3.2.3 Provo River From Olmsted Diversion Dam to Murdock Diversion Dam. Standing crop estimates from the Binns HQI Model II indicate that game fish biomass would increase by 118 pounds per acre in this reach. Total biomass was estimated to increase by 1,805 pounds. This increase reflects a reduction in annual stream flow variation. This prediction from the Binns HQI Model II suggests a significant increase in game fish numbers and/or biomass would be expected in this reach.

3.6.8.3.2.4 Provo River From Murdock Diversion Dam to Interstate 15. Standing crop estimates from the Binns HQI Model II indicate that game fish biomass would increase by 497 pounds per acre in this reach. Total biomass was estimated to increase by 13,545 pounds. This increase reflects improved critical low flows in late summer, reduction in annual stream flow variation, increased fish cover, improved substrate, and higher water velocities compared to baseline conditions. This prediction from the Binns HQI Model II suggests a significant increase in game fish numbers and biomass would be expected in this reach.

3.6.8.3.2.5 Provo River From Interstate 15 to Utah Lake. Standing crop estimates from the Binns HQI Model II indicate that game fish biomass would increase by 329 pounds per acre in this reach. Total biomass was estimated to increase by 2,731 pounds. This increase reflects improved critical low flows in late summer and reductions in annual stream flow variation. This prediction from the Binns HQI Model II suggests a significant increase in game fish numbers and biomass would be expected in this reach.

3.6.8.3.2.6 Hobble Creek. Higher springtime flows would increase total available aquatic habitat and could benefit game fish. The net effect of redistributing spawning gravels in the reach below the Mapleton Lateral is not expected to impact spawning populations of trout. Standing crop estimates from the Binns HQI Model II indicate that game fish biomass would increase by 344 pounds per acre in upper Hobble Creek from the Mapleton-Springville Lateral discharge to Kolob Park in Springville. Total biomass was estimated to increase by 1,926 pounds in upper Hobble Creek. In the lower reach of Hobble Creek from Kolob Park to Utah Lake, standing crop estimates from the Binns HQI Model II indicate that game fish biomass would increase by 388 pounds per acre. Total biomass was estimated to increase by 3,414 pounds in lower Hobble Creek. These increases reflect improved critical low flows in late summer, reductions in annual stream flow variation, lower water temperatures, decreased nitrate concentrations, and improved substrate conditions. These predictions from the Binns HQI Model II suggest a significant increase in game fish numbers and biomass would be expected in Hobble Creek.

3.6.8.3.2.7 Spanish Fork River. Flow-related habitat changes in the Spanish Fork River would reduce habitat during much of the year and have potential to reduce habitat complexity in the system. Estimated game fish standing crop and biomass changes are shown in Table 3-41.

Table 3-41
Estimated Changes in Standing Crop and Biomass From Baseline Under the Proposed Action

Reach Description	Standing Crop (lbs/acre)	Biomass (lbs)
Spanish Fork River from Diamond Fork Creek to Spanish Fork Diversion Dam	+8	+212
Spanish Fork River from Spanish Fork Diversion Dam to East Bench Diversion	+17	+142
Spanish Fork River from East Bench Diversion to Mill Race Diversion	-43	-468
Spanish Fork River from Mill Race Diversion to Utah Lake	-63	-3,811
Total	**-81**	**-3,925**

The decreased biomass downstream reflects decreased cover, decreased water velocity, and increased summer water temperature in the lower reaches. Overall, a net long-term decrease in fish numbers and/or biomass would be expected for game species in the four reaches of the Spanish Fork River. Under the baseline condition, the Spanish Fork River supports only a small population of trout.

3.6.8.3.2.8 Utah Lake. Delivery of ULS water under the Proposed Action would not be expected to significantly affect game fish populations and/or biomass in Utah Lake because decreases in water availability to Utah Lake would be minimal.

3.6.8.3.3 Macroinvertebrate Populations and Communities

3.6.8.3.3.1 Provo River From Deer Creek Reservoir Outlet to Olmsted Diversion. Impacts on macroinvertebrates in this reach are not expected to be substantial under this alternative because increases and decreases in habitat are not projected to exceed 3 percent. The Proposed Action has a low potential to impact macroinvertebrate populations in this reach.

3.6.8.3.3.2 Provo River From Olmsted Diversion Dam to Murdock Diversion Dam. Although projected increases in macroinvertebrate habitat are greater in this reach than in upstream reaches, they would not exceed the significance criteria. The Proposed Action has a low potential to impact macroinvertebrate populations in this reach.

3.6.8.3.3.3 Provo River From Murdock Diversion Dam to Interstate 15. Projected increases in macroinvertebrate habitat (up to 7.3 percent) in this reach may be large enough to benefit macroinvertebrate populations and communities to a small degree. Macroinvertebrate diversity and population size in this reach is relatively low. The Proposed Action has a low to moderate potential to impact macroinvertebrate populations in this reach.

3.6.8.3.3.4 Provo River From Interstate 15 to Utah Lake. Increases in aquatic habitat (up to 64 percent) would have a high potential to increase macroinvertebrate populations. This reach supports a low diversity of pollution-tolerant macroinvertebrates. Based on Binns HQI Model II for submerged aquatic vegetation, the macroinvertebrate population is estimated to be very high. Project operations under the Proposed Action are not likely to improve diversity but may increase macroinvertebrate abundance to higher levels. The increased flows in this reach would increase macroinvertebrate habitat and abundance compared to baseline conditions.

3.6.8.3.3.5 Hobble Creek. A moderate to high potential to benefit macroinvertebrate populations during all months would occur because increased habitat (up to 71 percent) would be available. A high potential for positive impacts would occur during summer (July through September) when additional flow is provided to Hobble Creek for the benefit of potential June sucker habitat.

3.6.8.3.3.6 Spanish Fork River. This alternative is likely to cause low-to-moderate impacts on macroinvertebrates in the Spanish Fork River with relatively small changes in macroinvertebrate habitat (up to about 21 percent). This area currently supports a fair population of macroinvertebrates, and this alternative is not likely to substantially alter macroinvertebrate populations or diversity.

3.6.8.3.3.7 Utah Lake. Delivery of ULS water under the Proposed Action would have a low potential for impact to macroinvertebrate populations and communities because decreases in water availability to Utah Lake would be minimal.

3.6.8.3.4 Summary of Proposed Action Impacts

3.6.8.3.4.1 Habitat. Estimated change in habitat is variable for the areas of impact and by habitat type. In the Provo River, slow and backwater habitats generally would decrease while moderate and fast water habitats would increase. One notable exception is the lowest reach of the Provo River where all habitats would experience large increases. Projected increases in habitat likely would provide a significant benefit for aquatic species in Hobble Creek. Although a net loss would not be expected, high spring flows in Hobble Creek pose a risk to trout spawning habitat. Large projected flow decreases in the Spanish Fork River would be expected to decrease habitat complexity for fishes and macroinvertebrates.

3.6.8.3.4.2 Game Fish Biomass. Game fish biomass and total biomass are projected to increase substantially because of reductions in annual streamflow variation in the Provo River downstream of the Olmsted Diversion Dam. Trout standing crop and total biomass are projected to decrease compared to baseline conditions in two of four reaches in the Spanish Fork River. Impacts on game fish in the Spanish Fork River would be compounded by a loss in available habitat and would likely have a significant impact on trout populations. In Hobble Creek, game fish populations were estimated to experience significant long-term increases. Total biomass was estimated to increase in Hobble Creek. Overall the game fish biomass would experience an increase of 19,496 pounds under the Proposed Action.

3.6.8.3.4.3 Macroinvertebrates. Macroinvertebrate populations may experience high potential increases in the Provo River downstream of the I-15 bridge. Habitat changes in Hobble Creek associated with enhanced flows would have a moderate to high potential to benefit macroinvertebrates. In the Spanish Fork River, macroinvertebrate populations may experience a low to moderate negative impact because flow would be decreased in all months.

3.6.8.4 Bonneville Unit Water Alternative

3.6.8.4.1 Habitat. The habitat changes for the following reaches would be the same as under the Proposed Action:

- Provo River from Deer Creek Reservoir to North Fork of Provo River -- Section 3.6.8.3.1.1
- Provo River from North Fork of Provo River to Olmsted Diversion Dam -- Section 3.6.8.3.1.2
- Provo River from Olmsted Diversion Dam to Murdock Diversion Dam -- Section 3.6.8.3.1.3
- Utah Lake--Section 3.6.8.3.1.8

3.6.8.4.1.1 Provo River From Murdock Diversion Dam to Interstate 15. Habitat modeling results indicate that proposed flow under the Bonneville Unit Water Alternative would increase habitat availability for most game fish and life stages. In the lower portion of the reach (Site 2c), PHABSIM results indicated that proposed flows would substantially increase habitat availability for brown trout juveniles and adults (by 105 to 106 percent). More moderate increases would be evident for the middle part of this reach (Site 2b: 19 to 23 percent increases). Habitat availability was estimated to decrease slightly (3 percent) for brown trout juveniles in the upper part of the reach (Site 2a). Habitat availability for brown trout fry would decrease by 5 to 20 percent in the middle and upper portions of this reach. However, habitat availability increases in the lower end (27 percent) should offset these losses. Spawning habitat for brown trout was identified only in the upper part of this reach and would be expected to increase slightly from 4.1 to 4.7 ft^2 per 1,000 ft of river (14 percent). No cutthroat or rainbow trout spawning habitat has been identified in this reach (BIO-WEST 2003a). Estimated habitat changes should generally result in significant improvements in game fish habitat.

Habitat niche modeling estimated increases in moderate- and fast-water habitats with decreases expected for slow- and backwater habitats. The backwater/edge niche was projected to decrease by 4 to 13 percent. This decrease could adversely impact juvenile and young-of-year mountain sucker, young-of-year dace and various life stages of redside shiner that utilize this habitat exclusively. Slow shallow habitat would increase at the lower end but decrease in the upper sections of the reach resulting in a small net decrease in slow shallow habitat between Murdock Diversion and Interstate 15. Decreased slow/shallow habitat availability potentially would affect adult and juvenile specked and longnose dace, various life stages of mottled sculpin, and mountain sucker adults. Juvenile dace would experience a net negative effect, as they use slow/shallow habitats exclusively. Impacts on other species that utilize this habitat niche would be offset by greater increases in habitat availability in other niches.

This alternative would result in small increases in wetted perimeter during all months (Table 4-26). The greatest increase (3.7 percent) was estimated to occur in April. These changes are small and would be expected to have low potential for significant impact on macroinvertebrate habitat.

Based on model projections, water temperature, dissolved oxygen, and total dissolved solids, water quality impacts on aquatic resources under the Bonneville Unit Water Alternative would not exceed the significance criteria. Water release impacts on water quality in this reach would not exceed the significance criteria.

3.6.8.4.1.2 Provo River From Interstate 15 to Utah Lake. Model results indicated that trout habitats used by all life stages and species would experience moderate to substantial increases (37 to 354 percent) in habitat availability. Game habitat increases should have significant benefits on game fishes in this reach.

Habitat availability in niches used by game increased substantially for most niches modeled. Shallow and mid-depth habitats with all flow conditions would become more available to aquatic species. The moderate deep habitat would increase. The greatest increases (362 to 1097 percent) were projected for shallow water habitats that are used a variety of non-game species including sucker, whitefish, sculpin, and dace. Modeling the effects of increased flows in this reach projected an increase of 44 percent in backwater/edge habitat that is used by young of the year fishes. Overall, the increase in habitat availability would be expected to have significant benefits for non-game fishes in this reach.

Wetted perimeter would increase in all months. Increases would be substantial in some months, particularly August (44 percent) and September (30.4 percent). These increases should have a significant benefit for the macroinvertebrate habitat in this reach.

3.6.8.4.1.3 Hobble Creek. Hydraulic modeling of Hobble Creek was used to estimate habitat impacts on wetted width, maximum channel depth and water velocities in the main river channel. Hydraulic modeling of steady-state conditions in Hobble Creek indicated that wetted widths would increase between 7 and 111 percent under the Bonneville Unit Alternative. Maximum channel depth would increase between 12 and 218 percent, and mean main channel velocity would increase by 25 to 757 percent. This alternative would have the potential to impact substrates in Hobble Creek that are important for trout spawning, however, a net loss of suitable habitat is not anticipated with flow under bankfull width. Increased habitat available during all months would provide a significant benefit for game fish habitat compared to baseline conditions.

Based on hydraulic modeling and estimated average monthly flows, habitat for macroinvertebrates in Hobble Creek would increase because flow would increase in all months. Water depth and wetted perimeter in Hobble Creek would increase. These changes could cause a moderate-to-high increase in macroinvertebrate habitat compared to baseline conditions.

Based on model projections, water temperature would decrease under the Bonneville Unit Water Alternative. The likelihood of water temperatures exceeding significance criteria is expected to decrease. Thus, increased flows in Hobble Creek during low flow periods could result in significant benefits for aquatic resources as a result of improved water temperatures. Impacts of the Bonneville Unit Water Alternative on total dissolved solids and dissolved oxygen concentrations would not exceed significance criteria in this reach. Bonneville Unit water release impacts on water quality in this reach would not exceed the significance criteria.

3.6.8.4.1.4 Spanish Fork River From Diamond Fork Creek to Lakeshore Diversion. As compared to baseline conditions, the average monthly flows proposed under the Bonneville Unit Water Alternative would exhibit moderate to large decreases from April to September and moderate to large increases from October through March. These flow changes would result in a general reduction in aquatic habitat during the spring and summer and increases in these habitats through fall and winter. Flow and subsequent habitat changes would be more moderate from the mouth Diamond Fork River to the Spanish Fork Diversion Dam. Below the dam, the changes would become more substantial, in particular during summer months.

Based on channel cross-section data, this alternative would result in small changes in wetted perimeter during all months. Wetted perimeter would decrease approximately 1 to 20 percent and increase up to 6 percent during the year.

Higher flows and increased habitat in autumn months would benefit any brown trout spawning during the fall. In contrast, reduced flows and habitat in late spring are anticipated to impact any cutthroat or rainbow trout spawning during that time of year. This, combined with substantially reduced summertime flows (by up to 87 percent) in the lower reaches of the river, would likely have significant impacts on both game and non-game fishes habitats in the river.

Bonneville Unit water release impacts on water quality in this reach of the Spanish Fork River would not exceed the significance criteria. Only small changes in water temperature, dissolved oxygen, and total dissolved solids are expected under the Bonneville Unit Water Alternative.

3.6.8.4.2 Game Fish Biomass and Communities. The changes for the following reaches would be the same as under the Proposed Action:

- Provo River from Deer Creek Reservoir to North Fork of Provo River -- Section 3.6.8.3.2.1
- Provo River from North Fork of Provo River to Olmsted Diversion Dam -- Section 3.6.8.3.2.2
- Provo River from Olmsted Diversion Dam to Murdock Diversion Dam -- Section 3.6.8.3.2.3
- Spanish Fork River from Mill Race Diversion to Utah Lake – Section 3.6.8.3.2.7
- Utah Lake (Section 3.6.8.3.2.8)

3.6.8.4.2.1 Provo River From Murdock Diversion Dam to Interstate 15. Standing crop estimates from the Binns HQI Model II indicate that game fish biomass would increase by 186 pounds per acre in this reach. Total biomass was estimated to increase by 6,371 pounds. This increase reflects improved critical low flows in late summer and reductions in annual stream flow variation. This prediction from the Binns HQI Model II suggests a significant increase in trout biomass would be expected in this reach.

3.6.8.4.2.2 Provo River From Interstate 15 to Utah Lake. Standing crop estimates from the Binns Model II indicated that game fish biomass would increase by 184 pounds per acre in this reach. Total biomass was estimated to increase by 1,527 pounds. This increase reflects improved critical low flows in late summer and reductions in annual stream flow variation. This prediction from the Binns HQI Model II suggests a significant increase in trout biomass would be expected in this reach.

3.6.8.4.2.3 Hobble Creek From Mapleton-Springville Lateral to Kolob Park. Standing crop estimates from the Binns Model II indicated that game fish biomass would increase by 437 pounds per acre. Total biomass was estimated to increase by 2,447 pounds. Based on changes in habitat availability and standing crop estimates estimated from the Binns HQI Model II, a significant long-term increase in trout biomass would be expected in this reach.

3.6.8.4.2.4 Hobble Creek From Kolob Park to Utah Lake. The Binns HQI Model II projected trout standing crop to increase by 493 pounds per acre. Total biomass was estimated to increase by 4,338 pounds. Based on changes in habitat availability and standing crop estimates estimated from the Binns HQI Model II, a significant long-term increase in trout biomass would be expected in this reach.

3.6.8.4.2.5 Spanish Fork River From Diamond Fork to Spanish Fork Diversion Dam. The Binns HQI Model II estimated that there would be no change from baseline conditions for trout standing crop or total biomass.

3.6.8.4.2.6 Spanish Fork River From Spanish Fork Diversion Dam to East Bench Dam. The Binns HQI Model II projected trout standing crop to decrease by 57 pounds per acre. Total biomass is projected to decrease by 473 pounds. The Binns HQI Model II output suggests a long-term decrease in game fish numbers biomass would be expected in this reach.

3.6.8.4.2.7 Spanish Fork River From East Bench Dam to Mill Race Diversion. The Binns HQI Model II projected trout standing crop to decrease by 182 pounds per acre. Total biomass is projected to decrease by 1,984 pounds. The Binns HQI Model II results suggest a long-term decrease in game fish (trout) biomass would be expected in this reach.

3.6.8.4.3 Macroinvertebrate Populations and Communities. The changes for the following reaches would be the same as under the Proposed Action:

- Provo River from Deer Creek Reservoir to North Fork of Provo River -- Section 3.6.8.3.3.1
- Provo River from North Fork of Provo River to Olmsted Diversion Dam -- Section 3.6.8.3.3.2
- Provo River from Olmsted Diversion Dam to Murdock Diversion Dam -- Section 3.6.8.3.3.3

3.6.8.4.3.1 Provo River From Murdock Diversion Dam to Interstate 15. The increases in habitat, approximately 4 percent, may be large enough to provide a benefit to macroinvertebrate populations and communities to a small degree in this reach. Macroinvertebrate diversity and population size in this reach is relatively low. Project operations under this alternative are not likely to improve diversity but may slightly increase population size. Flow induced habitat changes have low potential to benefit macroinvertebrate populations and communities in this reach.

3.6.8.4.3.2 Provo River From Interstate 15 to Utah Lake. This alternative would have a moderate to high potential to benefit macroinvertebrate communities. This reach supports a low diversity of pollution-tolerant macroinvertebrates. Based on measurements performed for the Binns HQI Model II analysis for submerged aquatic vegetation, the population size of macroinvertebrates is estimated to be very high. Project operations under the Bonneville Unit Water Alternative are not likely to improve diversity but should increase population size to even greater levels.

3.6.8.4.3.3 Hobble Creek. A moderate-to-high benefit would be realized for macroinvertebrate populations during all months because increased habitat would be available. A high potential for positive impact would occur during summer (July through September) when additional flow would be provided to Hobble Creek for the benefit of potential June Sucker habitat.

3.6.8.4.3.4 Spanish Fork River From Spanish Fork Diversion Dam to Lakeshore Diversion. This alternative is likely to cause moderate impact on macroinvertebrates in the Spanish Fork River because of relative decreases in macroinvertebrate habitat (up to about 21 percent).

3.6.8.4.4 Summary of Bonneville Unit Water Alternative Impacts

3.6.8.4.4.1 Habitat. Large increases in habitat availability would be expected for the lower Provo River. The greatest increases would be expected to occur downstream of the Murdock Diversion Dam reach and should improve game and non-game fish habitats. In the Spanish Fork River, habitat is projected to increase and decrease seasonally. The greatest potential loss would occur during summer months and could have significant impact on non-game spawning habitat. Hobble Creek habitat is projected to increase significantly under the Bonneville Unit Alternative.

3.6.8.4.4.2 Game Fish Biomass. Game fish biomass may be expected to increase as a result of reductions in annual streamflow variation in the Provo River downstream of the Olmsted Diversion Dam to the Murdock Diversion Dam reach. Game fish populations in the Spanish Fork River were projected to decrease because of decreases in late summer flows. In Hobble Creek, game fish populations and total biomass were estimated to experience significant long-term increases. Overall the Bonneville Unit Water Alternative would result in a net increase of 10,220 pounds of fish biomass.

3.6.8.4.4.3 Macroinvertebrates Macroinvertebrate populations are expected to experience habitat changes that range from low to moderate potential and moderate to high benefit for populations in the Provo River downstream of the Murdock Diversion Dam. Flow decreases in the Spanish Fork River are not expected to result in impacts on macroinvertebrates that would exceed the significance criteria. There is a moderate to high potential for benefits to macroinvertebrates in Hobble Creek.

3.6.8.5 No Action Alternative

There would be no change in habitat, standing crop per acre or total biomass, and macroinvertebrate populations and communities from baseline in the following reaches:

- Spanish Fork River from Diamond Fork to Utah Lake
- Hobble Creek from Mapleton-Springville Lateral discharge to Utah Lake
- Provo River from Deer Creek Reservoir to Olmsted Diversion

The change in habitat, standing crop per acre, total biomass, and macroinvertebrate populations and communities would be the same as under the Bonneville Unit Water Alternative for the following reaches:

- Provo River from Olmsted Diversion to Murdock Diversion
- Provo River from Murdock Diversion to Interstate 15
- Provo River from Interstate 15 to Utah Lake

The No Action Alternative would result in an increase of 9,703 pounds of fish biomass. This increase in game fish biomass would result from flow changes that would occur in the lower Provo River because of summer river flows provided for June sucker spawning and rearing habitat.

3.7 Wetland Resources

3.7.1 Introduction

This analysis addresses potential wetland impacts from construction and operation of the Proposed Action and other alternatives. Impact topics include the following:

- Aerial extent
- Changes in plant communities, soils or hydrology
- Changes in functions

3.7.2 Issues Raised in Scoping Meetings

The following wetland issues were raised during the public and agency scoping meetings.

- What impacts would occur on the upper Strawberry River as a result of constructing a pipeline from the proposed pump station to Daniels Pass?
- What would the impacts be of Concept 1 (Concept 1 was later named the Strawberry Reservoir-Deer Creek Reservoir Alternative) on Strawberry Valley?
- What would be the impacts of Concept 1 on Daniels Creek and wetlands along Daniels Creek?
- What would be the impacts of constructing a pipeline along Daniels Creek on riparian habitat, water quality and transportation networks?
- What would be the short-term impacts of pipeline construction on riparian areas, wildlife habitats and critical spawning periods for aquatic species?
- What would be the impacts of pipeline construction on streams and wetlands in Daniels Canyon?
- What would be the impacts of continued use of surface water in the Salem area?
- What would be the impacts on wetlands, aquatic life, and T&E species from overuse of groundwater?
- What impacts would occur on wetlands and stream flows because of groundwater pumping?
- What would be the impacts of developing new wells on existing wetlands in areas that do not receive ULS water and are required to drill wells to meet future water needs?
- What would be the impacts of each ULS water delivery concept on Utah Lake emergent vegetation, water quality, and evaporation?
- What would be the impacts of the ULS on riparian vegetation around Utah Lake?
- What would be the impacts of the ULS on wetlands and shoreline habitats around Utah Lake?
- What would be the impacts of the ULS on Jordan River and Great Salt Lake wetlands habitats and water quality?
- What would be the impacts of increased irrigation return flows on wetlands?
- What would be the impact on wetlands associated with the Provo River?

3.7.3 Scoping Issues Eliminated From Further Analysis

What would be the impacts of developing new wells on existing wetlands in areas that do not receive ULS water and are required to drill wells to meet future water needs?

What impacts would occur on wetlands and stream flows because of groundwater pumping?

New wells that are drilled in the future and continued groundwater pumping to meet the demands of the anticipated continued population expansion and associated impacts would not be a result of implementing the ULS project.

What would be the impacts on wetlands, aquatic life, and T&E species from overuse of groundwater?

The ULS project does not involve the use of any groundwater and therefore would not result in any impacts associated with overuse of groundwater.

What impacts would occur on the upper Strawberry River as a result of constructing a pipeline from the proposed pump station to Daniels Pass?

What would the impacts be of Concept 1 (Concept 1 was later named the Strawberry Reservoir-Deer Creek Reservoir Alternative) on Strawberry Valley?

What would be the impacts of Concept 1 on Daniels Creek and wetlands along Daniels Creek?

What would be the impacts of constructing a pipeline along Daniels Creek on riparian habitat, water quality and transportation networks?

What would be the impacts of pipeline construction on streams and wetlands in Daniels Canyon?

The Strawberry Reservoir–Deer Creek Reservoir Alternative and other alternatives involving Daniels Canyon were eliminated from detailed analysis. Please see Chapter 1, Sections 1.11.6, 1.11.7, and 1.11.8.

3.7.4 Scoping Issues Addressed in the Impact Analysis

All issues except those listed in Section 3.7.3 are addressed.

3.7.5 Description of Impact Area of Influence

Map 3-2 shows the overall impact area of influence. Within that area the wetland impact area of influence includes the following:

- Any area directly affected by project features (construction impact area of influence)
- Any stream or river and associated corridor that would be subject to water deliveries or alterations in flow (operations impact area of influence)
- Any wetlands that could be affected by changes in groundwater levels resulting from ULS water delivery (operations impact area of influence) (Map 3-7)

3.7.6 Methodology

3.7.6.1 Assumptions

- A groundwater drawdown of 1 foot or greater during the growing season could affect existing wetland vegetation in the area of drawdown by removing the supporting hydrology to the vegetative root zone. The Federal wetland hydric soil and hydrology criteria are as follows:

  "For soil saturation to impact vegetation, it must occur within a major portion of the root zone (usually within 12 inches of the surface) of the prevalent vegetation. The major portion of the root zone is that portion of the soil profile in which more than one half of the plant roots occur". (USACOE 1987)

  Therefore if the water table is drawn down one foot or more the supporting hydrology criterion would not be satisfied and wetland vegetation could be affected. As stated in the federal wetland criteria, the hydrology threshold is 12 inches. Therefore, if the water supply is changed resulting from conservation of flows, decrease in stream flow, changes in pumping or water application scenarios that result in groundwater drawdown from this root zone, wetland vegetation would be impacted.

- Wetlands mapped in the Spanish Fork-Nephi Irrigation District Draft EIS (CUWCD 1998a) approximate currently existing wetlands in southern Utah County, therefore no new wetland mapping was prepared for this area. The mapped wetlands were field reviewed by wetland specialists to determine if there had been any substantial changes since the time of the mapping. The wetlands that were reviewed closely approximated the wetland mapping in the Spanish Fork-Nephi Irrigation District Draft EIS.

3.7.6.2 Impact Analysis Methodology

The wetland resources impact analysis involved identifying, defining and documenting existing wetlands by type, extent, and function, then determining the impact of the Proposed Action and other alternatives on each wetland type, extent and function. All wetlands were addressed regardless if they are jurisdictional or non-jurisdictional. Direct and indirect impacts were evaluated, quantified to the extent possible. The impact analysis considered the standard operating procedures (SOPs) and project design features that the District will implement as part of the project.

Impacts under the alternatives could range from no discernable impact to a complete conversion of some wetlands to upland environments. Indirect and direct impacts on wetlands are dependent upon responses to change agents resulting from the alternatives. The following change agents were considered.

- Direct fill resulting from construction of project features (temporary and permanent disturbance)
- Altered groundwater conditions (flow, elevation/level) resulting from conservation of flows, increase or decrease in instream flows, changes in pumping and water application scenarios, and potential changes in lake or reservoir levels
- Altered surface water flow patterns resulting from operation of canals and rivers within the system

3.7.6.2.1 Direct Fill Impacts. The acreage of direct fill impacts under the alternatives was determined by measuring wetlands directly impacted by construction of project features. The affected areas were measured in a GIS. SOPs and construction methods such as jacking and boring under streams and certain wetlands were taken into account. These construction techniques would be expected to reduce or eliminate direct construction impacts on wetlands.

3.7.6.2.2 Impacts of Changes in Groundwater and Surface Water Levels. To analyze the potential impacts of the ULS alternatives, a CAD layer of the estimated 2003 wetlands (CUWCD 1998a) was overlaid with AutoCAD layers of modeled 2030 groundwater contours that would be associated with the No Action Alternative. These contours were based on the projected groundwater pumping that would occur to support the population growth expected by 2030.

3.7.6.2.3 Impacts on Wetland Functions. Impacts on wetland functions were assessed by comparing pre-project values for all applicable wetland functions to estimates of changes under the alternatives. Baseline wetland functions were assessed using the Wetland Evaluation Technique (WET) methodology and best professional judgement. Estimates of amounts of change for all applicable wetland functions were developed for each impacted wetland type based on existing data, projections of hydrology and plant community changes, and best professional judgement. Revised functional values were developed using projected values for applicable wetland functions. The new functional values were compared to the old functional values. Under WET methodology, wet meadow and saline meadow functions are essentially the same. Areas identified as saline meadow were combined with wet meadow for analysis and mapped using the same symbolization.

3.7.7 Affected Environment (Baseline Conditions)

The 2003 baseline wetland inventory for southern Utah County was based on the Spanish Fork Canyon-Nephi Irrigation Project (SFN) Draft EIS map of wetlands in southern Utah County (CUWCD 1998a). Baseline wetlands for the Spanish Fork-Santaquin, Santaquin-Mona Reservoir, Mapleton-Springville Lateral, and Spanish Fork Canyon pipelines were derived from National Wetlands Inventory (NWI) GIS layers. Fieldwork for wetland reconnaissance was conducted in May 2002 and May and June 2003 to identify and delineate existing wetlands, characterize wetland hydrology and hydrogeological settings, and determine wetland functions in the construction and operation impact areas of influence.

3.7.7.1 Wetland Community Types

Table 3-42 shows the types of wetland communities that occur within the construction impact area of influence.

Table 3-42
Wetland Community Types in the ULS Construction Impact Area of Influence

Wetland Community Type	ULS Construction Feature
Palustrine Wet Meadow	Spanish Fork Canyon Pipeline
Palustrine Riparian Forest	Spanish Fork-Santaquin Pipeline Mapleton-Springville Lateral Pipeline
Palustrine Shrub	Spanish Fork-Santaquin Pipeline Mapleton-Springville Lateral Pipeline
Aquatic Bed/Open Water	Spanish Fork Canyon Pipeline

The types of wetland communities that occur within the operations impact area of influence are:

- Palustrine Wet Meadow
- Palustrine Emergent Marsh
- Palustrine Riparian Forest
- Palustrine Scrub-shrub
- Aquatic Bed/Open Water

The descriptions of the community types that follow are based on National Wetland Inventory (NWI) mapping, the SFN DEIS (CUWCD 1998a) and 2003 field observations.

3.7.7.1.1 Palustrine Wet Meadow. Palustrine wet meadow is the most abundant wetland community type within the impact area of influence. Most of the wet meadow communities occupy low lands along the shoreline around Utah Lake, Holladay Springs, and Benjamin Slough. This community type is highly variable in these areas and is dominated by rush and wiregrass (*Juncus bufonius and J. articus*), blackcreeper sedge (*Carex praegracilis*), water sedge (*C. aquatilis*), redtop (*Agrostis stolonifera*), tall fescue (*Festuca arundinacea*), and common spikerush (*Elocharis palustris*). Many of the native plant species within the wet meadow communities have been disturbed or modified by local farmers to create pastures and croplands. Plants that dominate these fields are crop species or planted grasses such as smooth brome (*Bromus imermis*) and intermediate wheatgrass (*Elymus hispidus*) (CUWCD 1998a).

Saline meadow is a major wet meadow component within the impact area of influence, located primarily in the low-lying areas near Utah Lake in southern Utah County. Saline meadow may occur intermixed within distinct areas of larger wet meadow having slightly higher and lower moisture regimes. Saltgrass (*Distichlis spicata*) is the dominant species in this community type. Some of this community type has been converted to pastures and cropland, but are typically less productive than wet meadow areas, primarily because of the high salt content in the soils. Saline meadows are located in a wide range of soil salinity's occurring in very fresh conditions (135 parts per million [ppm] to highly saline conditions (16,100 ppm) (Brotherson and Evenson 1982).

3.7.7.1.2 Palustrine Emergent Marsh. Palustrine emergent marsh includes several plant communities, all of which occur in areas that are seasonally inundated or submerged. Small areas of emergent marsh are common along the shoreline around Utah Lake, Holladay Springs and Benjamin Slough. Dominate plant species include hardstem bulrush (*Scirpus acutus*), Olyney's threesquare (*S. americanus*), pale bulrush (*S. paludosus*), common threesquare (*S. pungens*), cattail (*Typha latifolia*) and horsetail (*Equisetum arvense*). Associated plant species in this community type typically include sedges, rushes, and grasses.

3.7.7.1.3 Riparian Forest (Palustrine, Forested, Broad-leaved, Deciduous). The riparian forest community type occurs primarily along Provo River, portions of the lower Spanish Fork River, and near Interstate 15 (I-15) in southern Utah County. The riparian forest community classification is divided into two sub-classes: low tree-dominated communities and cottonwood-dominated communities. One of the two low tree-dominated communities is composed of box elder (*Acer negundo*) in the overstory with thinleaf alder (*Alnus incana*), red-osier dogwood (*Cornus sericea*) and mixed willow (*Salix sp.*) species making up the shrub stratum.

Much of the existing riparian forest community is not in pristine condition, particularly along the Provo River. The riparian community has been adversely impacted by decades of heavy cattle grazing, road construction and in some areas by excess recreation use along the streambanks. These activities have hindered the regeneration and establishment of cottonwood trees and adversely impacted understory herbaceous vegetation. Along the Provo River, historic diking has contributed to this situation.

Riparian forest occurs on the south shores of Utah Lake between Benjamin Slough and the mouth of the Spanish Fork River where tamarisk tree/shrubs dominated. These areas, which were subject to prolonged flooding in 1983, are dominated by extensive stands of tamarisk. Tamarisk (*Tamarix* spp.) is an exotic shrub species that can out-complete native tree and shrub species under suitable conditions. Tamarisk is a particular concern since it tends to form dense stands, uses extensive water and is of limited value to native wildlife. Although some native willow and cottonwood remain in these areas, tamarisk has invaded and dominates large tracts of former mixed deciduous woodland habitat along the moister, immediate shoreline of Utah Lake. Tamarisk can occupy dry to moist sites, typically with slightly higher salinity levels than other natural plant communities (CUWCD 1998b).

3.7.7.1.4 Riparian Shrub (Riparian Scrub-Shrub). The riparian shrub community is found along various reaches of streams and rivers within the impact area of influence and is often associated with natural springs, rivers, canals, ditches, and areas receiving irrigation return flows. These riparian shrub edges are found near the confluence with Utah Lake, Beer Creek (Benjamin Slough), the lower Spanish Fork River (below the Strawberry Diversion Dam and above Utah Lake), shoreline areas of Utah Lake, the Jordan River, and the Provo River. In many instances, the vegetation along these riparian corridors is comprised of a mix of introduced and native plant species and has been influenced by human activities including farming, grazing, water diversions, irrigation techniques, diking and road construction. Numerous plant species dominate these areas, but often they are woody species such as willows (*Salix* spp.), red-osier dogwood, chokecherry (*Prunus virginiana*), Wood's rose (*Rosa woodsii*), Russian olive, and tamarisk.

3.7.7.1.5 Aquatic Bed/Open Water The aquatic bed/open water community type is comprised of open water habitat (lakes, small ponds and reservoirs). Little information is available on the submergent plant species in these water bodies within the impact area of influence, but the community is dominated by one plant species, broad-leaf pondweed (*Potamogeton latifolius*). Other common pondweeds include sago pondweed (*P. pectinatus*) and widgeon grass (*Ruppia maritima*). Both of these aquatic species are widespread and tolerant of fresh to slightly brackish water conditions and are likely associated with low water-velocity spring pools, outlet sloughs, and small ponds in the impact area of influence (CUWCD 1998a).

3.7.7.2 Areal Extent

3.7.7.2.1 Construction Impact Area of Influence. Wetland areas within the Spanish Fork-Santaquin Pipeline corridor consist of narrow strips (8-12 feet wide) of mixed riparian forest/scrub-shrub vegetation located between pipeline mileposts 0.5 to 0.6, 2.2 to 2.4, 2.8 to 3.0, and 4.6 to 4.8 (Map A-1). Wetlands within the Mapleton-Springville Lateral Pipeline corridor are similar riparian strips adjacent to the existing canal and are located between pipeline mileposts 1.8 to 2.3 and 3.8 to 4.6 and 4.8 to 5.1 (Map A-1). Wetlands in the Spanish Fork Canyon Pipeline corridor are a narrow strip of wet meadow at pipeline milepost 1.5 and the Cold Spring Pond from pipeline milepost 2.8 to 3.0 (Map A-1).

Table 3-43 summarizes the areas of wetland community types found in the construction impact area of influence.

Table 3-43
Approximate Area of Wetland Community Types
in the ULS Construction Impact Area of Influence (acres)

Wetland Community Type	Area
Palustrine Wet Meadow	0.4
Riparian Forest	0.5
Riparian Scrub-shrub	1.1
Aquatic Bed/Open Water	3.7
Total	**5.7**

3.7.7.2.2 Operations Impact Area of Influence. Map 3-7 shows the wetlands that occur within the operations impact area of influence in southern Utah County.

3.7.7.3 Wetland Functions

Wetland functions and values are described in the Wetland Evaluation Technique (WET) developed for the U.S. Army Corps of Engineers (Adamus et al. 1987), which was used to evaluate the functions and values of wetlands that would be impacted by the Proposed Action and other alternatives. Wetland functions are the physical, chemical and biological characteristics of a wetland. Wetland values are characteristics that are beneficial to society. The following wetland functions and values were evaluated.

A preliminary functional assessment was performed on baseline conditions for the four general wetland plant community types: riparian forest, scrub-shrub, wet meadow and emergent marsh. Table 3-44 shows the functions and values assessment derived from a combination of professional judgement and basic ranking criteria adapted from WET. Table 3-45 presents the functional assessment for baseline conditions and the rationale supporting the rankings.

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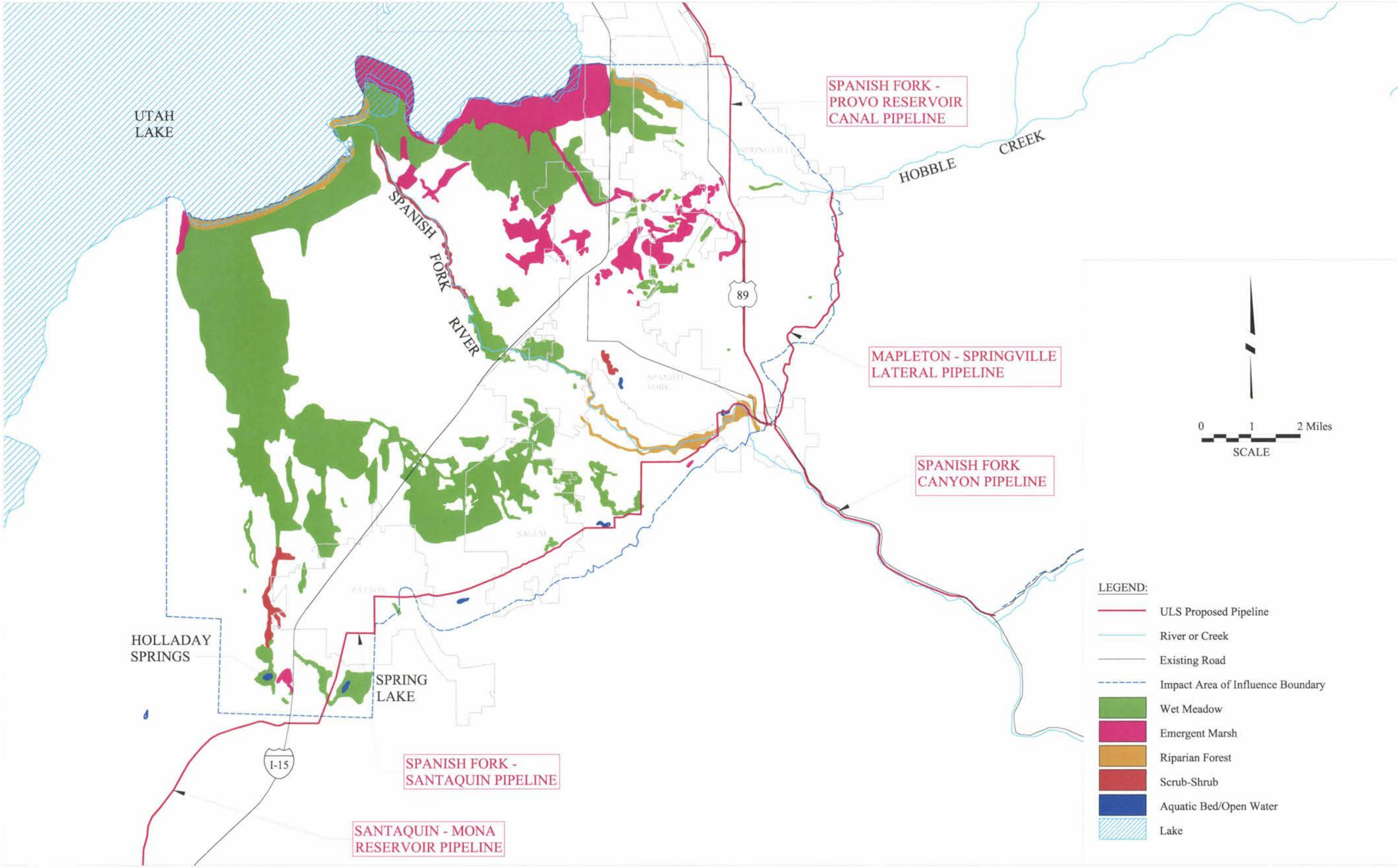


Map 3-7
Locations of Wetlands in
Operations Impact Area of Influence

Table 3-44
Summary of Ranking Criteria for Assessing Wetland Functions and Values*

Function	Basis for High Ranking	Basis for Low Ranking
Groundwater Recharge	Water table slopes away; not permanently flooded; nonfringe wetland	Impervious underlying strata; nonfringe wetlands that have outlets only
Groundwater Discharge	Permanently flooded or saturated wetland in precipitation deficit region; lacking inlet, but having outlets; characterized by springs	Rated high for groundwater recharge; not permanently flooded and lacking high ranking criteria
Flood Flow Alteration	**Regulated outflow (dam)**; outflows less than inflow; neither outlet or inlet; expanded surface area at least 25 percent larger than 5 acres; or **larger than 200 acres** in precipitation deficit region; **presence of dense woody vegetation**	Permanent hydroperiod; fringe wetlands with unconstricted outlet; flow is present and channels are not sinuous and do not contain **significant woody vegetation**.
Sediment Stabilization	Erosive forces present; water table influenced by upstream impoundment; wetland is less than 20 percent of watershed; **good water and vegetation interspersion**	No flowing water or other erosive forces; open water less than 100 feet in width; **no vegetation** or rubble substrate.
Sediment/Toxicant Retention	No or constricted outlet; no or limited flow velocity; brackish water salinity; depositional environment; relatively long duration and extent of seasonal flooding; free of artificial channelization and soil tillage; high suspended solids and low velocities	**Tilled soils**; permanent, unconstricted outlet; not in a depositional area; rocky substrates; **minimal vegetation interspersion**.
Nutrient Removal/ Transformation	No or constricted outlet; low flow velocity; presence of significant vegetation; fine mineral soils; somewhat alkaline; permanently flooded or saturated hydroperiod; **dense emergent vegetation**	Low sediment trapping capabilities; peat sediments; anoxic water conditions
Production Export	Permanent outlet; **significant areas of erect vegetation**; potential erosive forces; potential for expansive flooding; high levels of dissolved solids; high plant productivity	No permanent or intermittent outlet; moss-lichen class extensive; sandy substrate; high water velocity; **low water/vegetation interspersion**; artificially manipulated water levels
Wildlife Diversity/Abundance	**Good vegetation diversity and interspersion**; open water present at least part of year; limited disturbance to hydric soils or hydroperiod; good connectivity to nearby wetlands; salinity less than 300 ppm, provides habitat for wetland birds	Wetlands with toxic inputs and having no outlet or less than 5 acres in size; moss-lichen wetland with no open water; small isolated **wetlands with no woody cover**
Aquatic Diversity/Abundance	Inlet and outlet present; large wetland with large watershed; permanent water present; adequate dissolved oxygen; variety of depth conditions; **moderate to good vegetation to open water interspersion**	Farmed or tilled; toxic inputs and lacks outlet and is less than 40 acres; no surface water, bedrock or rubble substrates without substantial algal growth

Table 3-44
Summary of Ranking Criteria for Assessing Wetland Functions and Values*

Page 2 of 2

Function	Basis for High Ranking	Basis for Low Ranking
Recreation/Aesthetics	Wetland provides a point of major access to a recreational waterway, regularly used for recreation or consumptive activities. Provides exceptional scenic quality and is near a primary travel route.	Limited opportunity for recreation purposes. Not assessable to the public
Uniqueness/Heritage	**Provides habitat for T&E species**; owned or controlled for conservation purposes e.g., park, refuge, scenic river, recreation area; wetland possesses ecological or geological features considered by scientists to be rare among wetland types in the region; wetland is the only wetland in this locality; public or private expenditures have been made to create, restore, protect, or ecologically manage the wetland; the wetland includes a statewide listing of historical or archaeological sites; it is essential to ongoing, long-term environmental research or monitoring program.	Does not provide habitat for T&E species, not unique among wetlands in the region.

*Bolded characteristics are those with the greatest potential to change as a result of the ULS.
Note: Criteria adopted from Wetland Evaluation Technique (WET) Volume II: Methodology (Adamus et al. 1987).

Table 3-45
Summary of Estimated Baseline Wetland Functions and Values

Page 1 of 3

Wetland Function	Riparian Forest	Scrub-shrub	Wet Meadow/ Saline Meadow	Emergent Marsh	Ranking Rationale
Groundwater Recharge	Moderate to High	Moderate to High	Moderate to High	Low	The moderate to high ranking results from wetlands not being permanently flooded. Low ranking results from emergent marsh being permanently flooded and relatively impervious soils.
Groundwater Discharge	Low	Low	Low	High	The low ranking results from not being permanently flooded or saturated, and not being primarily supported by springs. The high ranking results from the wetland being permanently saturated or flooded and supported by some spring inflow.

Table 3-45
Summary of Estimated Baseline Wetland Functions and Values

Wetland Function	Riparian Forest	Scrub-shrub	Wet Meadow/ Saline Meadow	Emergent Marsh	Ranking Rationale
Flood flow alteration	Low	Low	Low	Low	For the riparian forest and scrub-shrub communities, the low ranking results from the small size of the individual wetlands being evaluated. In the cases of wet meadow and emergent marsh communities, the low ranking results from lack of significant woody vegetation.
Sediment Stabilization	Low	Low	Low	Low	The low ranking applies since there the wetlands evaluated all have open water less than 100 feet in width and wetlands constitute less than 20 percent of the watersheds in which they are situated.
Sediment/ Toxicant Retention	Moderate to High	Moderate to High	Moderate to High	Moderate to High	The moderate to high rating is probable since the wetlands evaluated have a limited flow velocity, are situated in a depositional area, and they are not tilled. There is a potential source of sediments/toxicants from road cuts and highway runoff adjacent to many of the wetlands.
Nutrient Removal/ Transformation	Low to Moderate	Low to Moderate	Moderate to High	High	The low to moderate rankings apply because there is not an abundance of dense emergent vegetation. The high ranking applies because the emergent marsh does provide dense emergent vegetation and is saturated for longer periods and has low flow velocities.
Production Export	Low	Low	Low	Low	The low ranking applies because the wetland communities do not have the potential for expansive flooding, very limited erosive forces and plant production is moderate.
Wildlife Diversity/ Abundance	Low	Low	Moderate	Moderate	The low ranking for riparian forest and scrub-shrub because areas are less than 40 acres in size, there is no permanent water present and vegetation open water interspersion is limited. The moderate ranking applies to wet meadow and emergent marsh because the wetland areas are larger in size especially in South Utah County; there's more open water and vegetation interspersion present, and the watershed areas are larger.

Table 3-45
Summary of Estimated Baseline Wetland Functions and Values

Wetland Function	Riparian Forest	Scrub-shrub	Wet Meadow/ Saline Meadow	Emergent Marsh	Ranking Rationale
Aquatic Diversity/ Abundance	Low	Low	Low	Low	The low ranking applies because areas are small in size supported by a small watershed, there is limited permanent water present and vegetation open water interspersion is limited.
Recreation/ Aesthetics	Low/ High	Low/ High	Low/ High	Low/ High	The low ranking for recreation results from the limited size of the wetland areas, and limited public access to private properties in South Utah County; there are no developed recreation facilities associated with the wetlands. The high ranking for aesthetics results from these areas adding diversity to the characteristic landscape and most of the wetlands evaluated are visible from primary or secondary travel routes.
Uniqueness/ Heritage	Moderate	Moderate	Moderate	Moderate	The moderate ranking applies because there are numerous similar wetland/riparian systems in the region, however these area are assessable to many persons therefore the moderate ranking rather than low.

Note: Aquatic Bed/Open Water community type is not shown on the table because this type would not be impacted by the Proposed Action and other alternatives.

Except for direct construction impacts most of the physical and biological characteristics used in the ranking criteria would not be altered by the ULS project. The major potential changes to wetland functions and values would occur as a result of changes in wetland hydrology and wetland community types or structure.

3.7.8 Environmental Consequences (Impacts)

3.7.8.1 Significance Criteria

Potential impacts on wetland resources would be considered significant if any one of the following conditions occurred:

- A net loss of wetlands resulting from construction or operational activities
- Change in the quality or quantity of wetland hydrologic support that would result in an overall loss or gain of wetland acreage

- Loss of wetland functions and values because of changes in water supply affecting wetland plant communities, wetland soils and hydrology

- Temporary loss of wetland functions and values caused by construction disturbance

3.7.8.2 Potential Impacts Eliminated From Further Analysis

There would be no impacts from construction, maintenance and operation of the following project components because they would all be constructed, maintained and operated in upland areas.

- Sixth Water Power Facility and Transmission Line
- Upper Diamond Fork Power Facility

There would be no measurable impacts from flow changes in the Jordan River from Utah Lake to Jordan Narrows. There would be minor changes in Jordan River flows from the outlet of Utah Lake to Jordan Narrows (annual average flows under average conditions of -8 to +4 percent), but the changes in flows would not affect wetlands as the flows would remain in the river channel and field observations indicate that there would be no appreciable change in water level contact with vegetation next to the river or adjacent areas.

There would be changes in operational flows in the Spanish Fork River and Hobble Creek, but no wetlands or riparian vegetation would be affected by the flow changes because water surface elevations in these streams would not change sufficiently to alter bank saturation or water tables that might otherwise effect adjacent wetlands.

There would be no measurable impacts from flow changes in the Provo River. Flow changes in the Provo River under operation of all alternatives are estimated to have no effects on riparian/wetland vegetation in all reaches above the Olmsted Diversion Dam (BIO-WEST 2003b). Potential streambed vegetation change in reaches below the Olmsted Diversion Dam would be limited to change in seasonal incursion of grass species at low flow rates (BIO-WEST 2003b; Stamp 2003). This vegetation would not be persistent and would not represent a change in wetland areal extent or change in plant communities, soils or functions.

Changes in water levels in Utah Lake would have no measurable impact on wetlands.

The changes in reservoir storage volume and stage are shown in Chapter 3, Section 3.2, Surface Water Hydrology. The incremental changes would be small relative to baseline reservoir operations and would be within the normal historic fluctuations that these reservoirs experience on an annual basis.

3.7.8.3 Spanish Fork Canyon-Provo Reservoir Canal Alternative (Proposed Action)

3.7.8.3.1 Construction Phase

3.7.8.3.1.1 Spanish Fork Canyon Pipeline. Implementation of the SOPs (see Chapter 1, Section 1.8.8) would protect wetlands from impacts associated with construction of the Spanish Fork Canyon Pipeline.

3.7.8.3.1.2 Spanish Fork-Santaquin Pipeline

A. Areal Extent. Approximately 0.18 acres of wetland would be directly and temporarily impacted by construction, with less than 0.02 acre permanently lost from construction of drain and discharge structures.

B. Changes in Plant Communities, Soils or Hydrology. Approximately 0.18 acre of scrub-shrub plant communities would be temporarily impacted by construction, with a permanent loss of less than 0.02 acre of scrub-shrub wetlands. Soils would be temporarily disturbed by pipeline trenching, but would be restored after completion of construction, and the corridor would be revegetated with wetland species. It would take longer to re-establish the riparian forest and scrub-shrub communities than wet meadow because the tree and shrub components would take time to reach a mature size.

C. Changes in Functions. The temporary loss of 0.18 acre and permanent loss of less than 0.02 acre of scrub-shrub would not impair the overall function of the wetland.

3.7.8.3.1.3 Mapleton-Springville Lateral Pipeline

A. Areal Extent. Construction of the Mapleton-Springville Lateral Pipeline would remove 1 acre of wetlands (Mileposts 1.8-2.3, 3.8-4.6 and 4.8-5.1, Map A-1) during construction. This acreage would not be restored after construction, since the water source (seepage from the ditch) would be eliminated.

B. Changes in Plant Communities, Soils or Hydrology. Table 3-46 lists the wetland communities, the number of wetlands of each community type and impacted wetland acreage that would be permanently removed by construction of the Mapleton-Springville Lateral Pipeline. Soils would be temporarily disturbed by pipeline trenching, but would be restored after completion of construction, and the corridor would be revegetated with upland species.

Table 3-46
Wetlands Directly Impacted by Construction of the Mapleton-Springville Lateral Pipeline

Wetland Community Type	Number of Wetlands	Impacted Area (acre)
Palustrine riparian forest	2	0.3
Palustrine scrub-shrub	13	0.7
Total Impacted Area		**1.0**

There would be a permanent loss of 0.3 acre of riparian forest and 0.7 acre of scrub-shrub wetland because the Mapleton Lateral seepage that supports these communities would no longer occur after pipeline construction.

C. Changes in Functions. There would be a permanent loss of wetland functions on 1.0 acre of riparian forest and scrub-shrub communities.

3.7.8.3.1.4 Spanish Fork-Provo Reservoir Canal Pipeline

A. Areal Extent. Approximately 0.09 acre of wetland would be directly and temporarily impacted by construction, with less than 0.01 acre lost from construction of drain and discharge structures.

B. Changes in Plant Communities, Soils or Hydrology. Less than 0.01 acre of riparian forest vegetation would be permanently lost to the discharge structure; less than 0.09 acre of riparian forest would have temporary impacts that would be restored after construction. Soils would be temporarily disturbed during construction, but would be restored upon completion.

C. Changes in Functions. The temporary loss of less than 0.09 acre and permanent loss of less than 0.01 acre of riparian forest and scrub-shrub community would not impair the overall function of the wetland.

3.7.8.3.2 Operations Phase. Operational impacts are based on the slight change in groundwater levels in southern Utah County. The impact was estimated for the year 2030 when full delivery of ULS M&I secondary water supply would occur.

3.7.8.3.2.1 M&I Water

A. Areal Extent. The delivery of project M&I water could have some small beneficial impacts on the wetlands within the impact area of influence (see Map 3-7). Some increased level of groundwater recharge resulting from the application of the secondary use M&I water would cause the potential beneficial impact. The quantity and location of the wetlands beneficially impacted is not measurable based on the information available for use in the EIS analysis (see Section 3.4.8.3 Groundwater Hydrology).

B. Plant Communities, Soils or Hydrology

There is a slight potential for change in plant communities, soils and hydrology in areas affected by groundwater changes, however the specific location and amount of change can not be determined based on the available information (see Section 3.4.8.3 Groundwater Hydrology).

C. Changes in Functions. Some changes in functions could occur, but are not measurable based on the information available for use in the analysis (see Section 3.4.8.3 Groundwater Hydrology).

3.7.8.3.3 Summary of Proposed Action Impacts

3.7.8.3.3.1 Areal Extent. A total of 0.27 acres comprised of 12 small, scattered non-jurisdictional wetlands would be temporarily lost, but then restored upon completion of construction; 1.03 acres comprised of 16 small, scattered, non-jurisdictional wetlands would be permanently lost from construction of the Mapleton-Springville Lateral Pipeline and drain or discharge structures associated with other pipelines. The permanent loss of wetland associated with construction of pipelines would be a significant impact.

3.7.8.3.3.2 Changes in Plant Communities, Soils or Hydrology. Construction of the Mapleton-Springville Lateral Pipeline would cause permanent conversion of 0.3 acre of riparian forest and 0.7 acre of scrub-shrub wetland to upland vegetation. Construction of drain or discharge structures would result in the loss of 0.04 acres of riparian forest, scrub-shrub and emergent marsh wetlands. Soils would be restored after pipeline construction disturbance, but hydrology would be permanently affected within the pipeline corridor. The changes associated with the construction of pipelines would be a significant impact.

3.7.8.3.3.3 Changes in Functions. Wetland functions would be permanently lost on 1.03 acres of riparian forest, scrub-shrub and emergent marsh wetlands that would be converted to upland vegetation from construction of the Mapleton-Springville Lateral Pipeline and drain or discharge structures on other pipelines. Wetland functions would be temporarily lost on 0.27 acre until restoration was completed. The temporary and permanent loss of wetland functions associated with construction of pipelines would be a significant impact.

3.7.8.4 Bonneville Unit Water Alternative

3.7.8.4.1 Construction Phase. The construction impacts of the following features of this alternative would be the same as described for the Spanish Fork Canyon-Provo Reservoir Canal Alternative and are not repeated in this section:

- Spanish Fork Canyon Pipeline – Section 3.7.8.3.1.1
- Spanish Fork-Santaquin Pipeline – Section 3.7.8.3.1.2
- Mapleton-Springville Lateral Pipeline – Section 3.7.8.3.1.3

3.7.8.4.2 Operations Phase. The operation impacts of this alternative would be the same as described for the Spanish Fork Canyon–Provo Reservoir Canal Alternative (Section 3.7.8.3.2.1).

3.7.8.4.3 Summary of Bonneville Unit Water Alternative Impacts

3.7.8.4.3.1 Areal Extent. One acre of wetland habitat would be lost from construction of the Mapleton-Springville Lateral Pipeline and 0.02 acre from construction of drain or discharge structures. The Spanish Fork-Santaquin Pipeline would cause a temporary loss of 0.18 acre during construction and until restoration was completed. The permanent loss of wetland associated with construction of pipelines would be a significant impact.

3.7.8.4.3.2 Changes in Plant Communities, Soils or Hydrology. Construction of the Mapleton-Springville Lateral Pipeline would permanently convert 0.3 acres of riparian forest and 0.7 acres of scrub-shrub wetland to upland vegetation, while 0.02 acre of riparian wetlands would be converted from construction of drain or discharge structures. Soils would be restored after pipeline construction disturbance, but hydrology would be permanently affected. The changes associated with construction of pipelines would be a significant impact.

3.7.8.4.3.3 Changes in Functions. Wetland functions would be permanently lost in 1 acre of riparian forest and scrub-shrub wetland converted to upland vegetation from construction of the Mapleton-Springville Lateral Pipeline and 0.04 acres of riparian wetlands from construction of drain or discharge structures. Wetland functions would be temporarily lost on 0.18 acre until restoration was completed. The temporary and permanent loss of wetland functions associated with construction would be a significant impact.

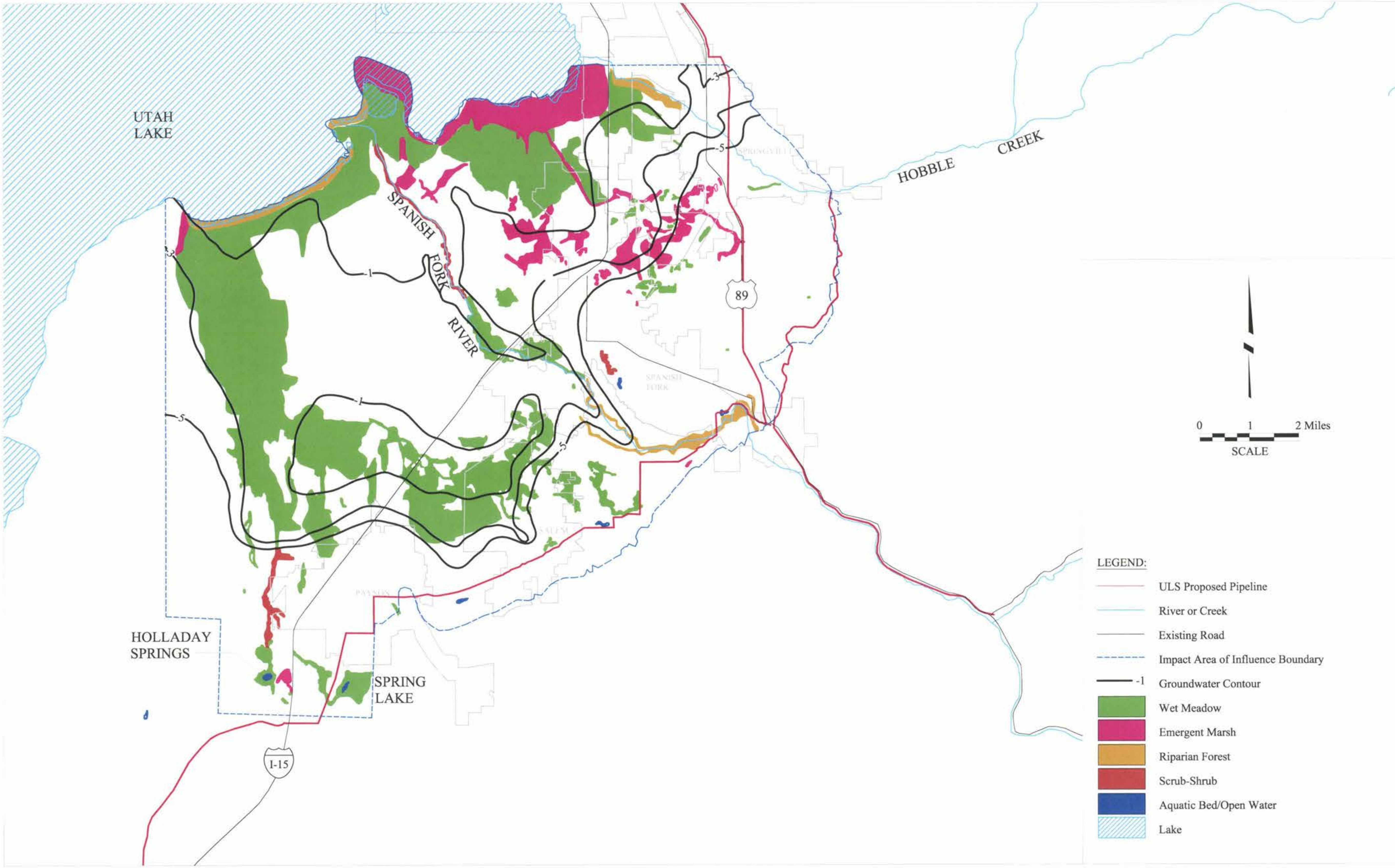
3.7.8.5 No Action Alternative

3.7.8.5.1 Construction Phase. There would be no construction impacts because no features would be constructed under this alternative.

3.7.8.5.2 Operations Phase. No ULS water would be delivered to southern Utah County under the No Action Alternative.

Operational impacts are based on the change in groundwater levels in southern Utah County that were determined through modeling. The impact was estimated for the year 2030.

3.7.8.5.2.1 Areal Extent. Map 3-8 shows the wetlands in southern Utah County and the one-foot, three-foot and five-foot groundwater contour changes relative to baseline under the No Action Alternative. Wetlands that could be potentially impacted are those that occur in the area where the wetland water supply may decline due to the groundwater drawdown of one foot or more relative to baseline as determined under a worse case scenario. The



Map 3-8
Wetlands Potentially Affected Under the
No Action Alternative

wetland acreage and specific locations of potential wetland impacts relative to baseline is not measurable based on the information available for use in the analysis (see Section 3.4.8.5 Groundwater Hydrology). However, it is expected that a considerable amount of wetland area could be potentially impacted under the No Action Alternative. Potential increased pumping resulting from continued population growth would cause the drawdown of groundwater levels relative to baseline and the potential effect on wetlands.

3.7.8.5.2.2 Change in Plant Communities, Soils or Hydrology. There is potential for change in plant communities, soils and hydrology in areas affected by groundwater drawdown, however the specific location and amount of change can not be determined based on the available information (see Section 3.4.8.5 Groundwater Hydrology).

3.7.8.5.2.3 Changes in Functions. Wetland functions would be potentially reduced or lost in wetland areas in southern Utah County that are affected by groundwater drawdown.

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3.8 Wildlife Resources and Habitats

3.8.1 Introduction

This analysis addresses potential impacts on wildlife species and their habitats from the construction and operation of the Proposed Action and other alternatives.

3.8.2 Issues Raised in Scoping Meetings

The following wildlife and habitat issues were raised during the public and agency scoping process.

- What impacts would occur on wildlife under Concept 1? (Concept 1 was later named the Strawberry Reservoir-Deer Creek Reservoir Alternative.)
- What impacts would occur on Wasatch Mountain State Park from a power line?
- What would be the short-term impacts of pipeline construction on riparian areas, wildlife habitats and critical spawning periods for aquatic species?
- What would be the impacts on deer, elk and bighorn sheep under Concept 2 if the pipeline followed the Bonneville Shoreline Trail? (Concept 2 was later named the Spanish Fork Canyon-Provo Reservoir Canal Alternative (Proposed Action)).
- What would be the impacts on channel stability, wildlife habitats and sediment transport?
- What would be the impacts on open space and wildlife habitat from providing irrigation rather than M&I water through the ULS?
- What would be the impacts of the ULS Project on wetlands and shoreline habitats around Utah Lake?
- What would be the impacts of each of the ULS concepts on any species covered by conservation agreements or strategies?
- What would be the impacts of the ULS water delivery concepts on:
  - Habitat destruction, fragmentation and alteration (aquatic and terrestrial)
  - Loss of species diversity (aquatic and terrestrial)
- What would be the impacts of the ULS water delivery alternatives on vegetation?
- What would be the short-term impacts of construction of a pipeline from Strawberry Reservoir to Daniels Pass, with particular concern for water quality, sediment yield, noxious weed invasion, and ORV use of disturbed sites?
- What would be the impacts of each ULS water delivery concept on Utah Lake emergent vegetation, water quality and evaporation?

3.8.3 Scoping Issues Eliminated From Further Analysis

The following issues were eliminated from further analysis:

What impacts would occur on Wasatch Mountain State Park from a power line?

None of the proposed alternatives would involve constructing a power line across the Wasatch Mountain State Park.

What would be the impacts on deer, elk and bighorn sheep under Concept 2 if the pipeline followed the Bonneville Shoreline Trail?

At the time of the public scoping process Concept 2 was a pipeline through Springville and Provo, which now corresponds to the Spanish Fork-Provo Reservoir Canal Alternative. No features in this alternative are proposed for construction along the Bonneville Shoreline Trail.

What would be the impacts of each of the ULS concepts on any species covered by conservation agreements or strategies?

Species covered by conservation agreements or strategies are included in Chapter 3, Section 3.10, Sensitive Species.

What would be the impacts on open space and wildlife habitat from providing irrigation rather than M&I water through the ULS?

No irrigation water would be provided under the ULS project. Only M&I water (including M&I secondary water) is proposed to be delivered by ULS alternatives. As a related action (i.e. not part of ULS), temporary supplemental irrigation water would be applied to land that is already under irrigation. No new land would be irrigated and no changes in irrigation practices would result from supplying this temporary supplemental irrigation water.

What would be the impacts of the ULS Project on wetlands and shoreline habitats around Utah Lake?

There would be no impacts on wetlands or shoreline habitats since operation of Utah Lake would not vary from normal operations and historic levels under any ULS alternatives (see Section 3.2 and 3.7).

What would be the impacts of each ULS water delivery concept on Utah Lake emergent vegetation, water quality and evaporation?

There would be no impacts on emergent vegetation since operation of Utah Lake would not vary from normal operations and historic levels under any ULS alternatives.

What impacts would occur on wildlife under Concept 1? (Concept 1 was later named the Strawberry Reservoir-Deer Creek Reservoir Alternative.)

What would be the short-term impacts of construction of a pipeline from Strawberry Reservoir to Daniels Pass, with particular concern for water quality, sediment yield, noxious weed invasion, and ORV use of disturbed sites?

The Strawberry Reservoir–Deer Creek Reservoir Alternative and other alternatives involving a pipeline to Daniels Canyon were eliminated from detailed analysis. Please see Chapter 1, Sections 1.11.6, 1.11.7, and 1.11.8.

3.8.4 Scoping Issues Addressed in the Impact Analysis

All issues in Section 3.8.2 are addressed in the impact analysis except those listed in Section 3.8.3.

3.8.5 Description of Impact Area of Influence

Map 3-2 shows the overall impact area of influence for the ULS project. The specific wildlife resources and habitat impact area of influence with the overall area includes the following:

- Corridors (approximately 100 feet wide) along the areas directly affected by construction of pipelines, access roads, pump stations, power lines, power generation facilities and diversion structures
- Streams and rivers and associated riparian vegetation that could have alterations in flow from baseline conditions under operation of the ULS
- Wetlands potentially affected by ULS alternatives

3.8.6 Methodology

See Wildlife Resources and Habitat Technical Report for the Utah Lake Drainage Basin Water Delivery System (CUWCD 2004d) for additional details of the methodology used to analyze impacts of the ULS alternatives on wildlife resources and habitats. The impact analysis considered the standard operating procedures (SOPs) and project design features that the District will implement as part of the project.

3.8.6.1 Assumptions

- Highway and high-traffic urban roadways are linear sound sources (i.e., they occur along a linear area instead of in one place).

- Construction sites are point sound sources (i.e., they occur in one place instead of moving along a linear area).

- The noise threshold for possible effects on wildlife is 60 decibels, which is considered by American National Standards Institute guidelines to be compatible with land use for extensive natural wildlife and recreation areas (ANSI 1990). Multiple references were reviewed to evaluate noise effects on wildlife; the most comprehensive reference was Manci et al. 1988. As a best professional judgement, 60 decibels was selected as the threshold for wildlife effects (see CUWCD 2004d, Appendix A).

- Construction noise would not affect areas that are predominantly urban in character. Wildlife would not be expected to occur in habitats that are predominantly urban and have relatively high (greater than 60 decibels) ambient noise levels.

3.8.6.2 Impact Analysis Methodology

3.8.6.2.1 Habitats. The amount of general upland habitat disturbance and removal that would occur from construction and operation of the ULS was obtained from the project land disturbance tables (see Chapter 1, Section 1.8.6, Tables 1-31, and 1-32) and wetlands disturbance from Chapter 3, Section 3.7, Wetlands. Maps showing critical range habitat (see Section 3.8.7.1.9 for definition) were developed for each alternative by species in geographic information systems (GIS) format for the impact area of influence.

The amount and location of the general habitat types that would be affected by an increase in noise levels was determined and mapped (See Appendix A of the Wildlife Resources and Habitat Technical Report for the Utah Lake Drainage Basin Water Delivery System (CUWCD 2004d) for details of the methodology, including a map of habitats subject to noise impacts).

Habitats adjacent to high-traffic corridors (Interstate 15, Highways 40, 6, 189 and 89) were excluded from habitat noise impacts because of the high ambient noise levels in these areas. Areas designated as urban in vegetation habitat maps were not included in noise impact areas. Critical big-game winter range was analyzed for potential impacts.

3.8.6.2.2 Populations. The numbers and type of wildlife species within each habitat type was developed from species habitat preferences and from range maps and occurrence data. The impact on these species from habitat loss or disruption was analyzed by habitats utilized and the changes in those habitats that would be caused by construction or operation of ULS features. The impacts on populations from loss or fragmentation of habitat were evaluated in terms of minimum home range requirements of species, where known. Some species, such as long-eared owl (*Asio otus*), may require a critical amount of contiguous forest amid a larger area of hunting meadow and open land. Where such species have been found in the study area in recent surveys, the available habitat and potential changes were evaluated based on their critical habitat needs.

Indirect impacts on wildlife populations, including changes in noise levels, were determined based on best professional judgment. Direct and indirect impacts were quantified and compared to the significance criteria to determine significant impacts.

3.8.7 Affected Environment (Baseline Conditions)

3.8.7.1 Habitats

3.8.7.1.1 Aspen/Conifer. This habitat is generally found at elevations over 7,500 feet above mean sea level (MSL). Species include aspen (*Populus tremuloides*) in monotypic stands, and aspen-conifer associations where most conifers are firs (*Abies spp.*). This community occurs at the head of the Diamond Fork drainage, in elevations above the Rays Valley, and in higher elevations along the Wasatch Front.

3.8.7.1.2 Oak Woodland. The oak woodland/scrub oak community is found widely throughout the upper foothills of the impact area of influence between 5,500 and 6,500 feet MSL. The dominant species is scrub oak (*Quercus gambellii*), which has a shrub or small deciduous tree growth form and a clonal (clumped) growth pattern with space between trees that often contain big sagebrush (*Artemesia tridentata*) and native grasses. This community is found in lower Spanish Fork Canyon, the Sixth Water/Diamond Fork Creek drainages, Rays Valley, Provo Canyon below Deer Creek Reservoir, and the middle to lower elevations of the Wasatch Front.

3.8.7.1.3 Pinyon/Juniper. This community of pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) is found in the Diamond Fork drainage and across portions of the Sixth Water Transmission Line upgrade corridor.

3.8.7.1.4 Mountain Brush. Oak brush and snowberry (*Symphoricarpos longiflorus*) dominate this shrub community, which includes big sagebrush, true mountain mahogany (*Cerocarpus montanus*) and rabbitbrush (*Ericameria spp.*). This community occurs widely in Spanish Fork Canyon, Diamond Fork drainage, Provo River Canyon, Rays Valley, and along the Wasatch Front, generally between 8,000 and 5,000 feet elevation MSL.

3.8.7.1.5 Sagebrush/Grass. Big sagebrush dominates this woody species in dry areas; silver sagebrush (*Artemisia cana*) dominates in wetter areas. This community covers much of the mountains, foothills and valleys of the Wasatch Mountains and Wasatch Front. It is common in the Diamond Fork drainage.

3.8.7.1.6 Wetlands. The acreage of wetland habitat in the impact area of influence is 5.7 acres along construction corridors and an unknown amount in the operations impact area of influence in southern Utah County. Five primary wetland community types have been identified within the impact area of influence: wet meadow, emergent marsh, riparian forest, riparian scrub-shrub, and aquatic bed/open water. See Chapter 3, Section 3.7, Wetlands, for details of wetland community locations and representative species.

3.8.7.1.7 Agricultural Lands. Large areas have been converted from native vegetation to dryland and irrigated agriculture (cultivated crops, orchards, alfalfa and pasture). This agricultural land provides varying habitat value for wildlife. Agricultural lands under active management with regular disking, mowing, burning, harvesting, flooding, application of fertilizers and pesticides have low wildlife value, species and structural diversity. Native wildlife have often been replaced by species that are tolerant of human activity and are adaptable to dynamic land-use practices, such as regular disking, mowing, burning, harvesting, flooding and application of fertilizers and pesticides. Large tracts or agricultural lands are found in southern Utah County.

3.8.7.1.8 Previously Disturbed Lands. This includes all areas disturbed by activities other than cultivation, including areas adjacent to highways, railroads and other rights-of-way. Most of these areas have been reseeded to a grass/forb community for erosion control, enhancement of wildlife food and cover, or aesthetics. Dominant species in these reseeded areas include yellow sweet clover (*Melitotus officinalis*), pepperweed (*Lepidium montanum*), gumweed (*Grindelia squarrosa*), sunflower (*Helianthus annuus*) and bluegrass (*Poa pretensis*). Wildlife values are limited in these areas due to high levels of human presence, activity and noise.

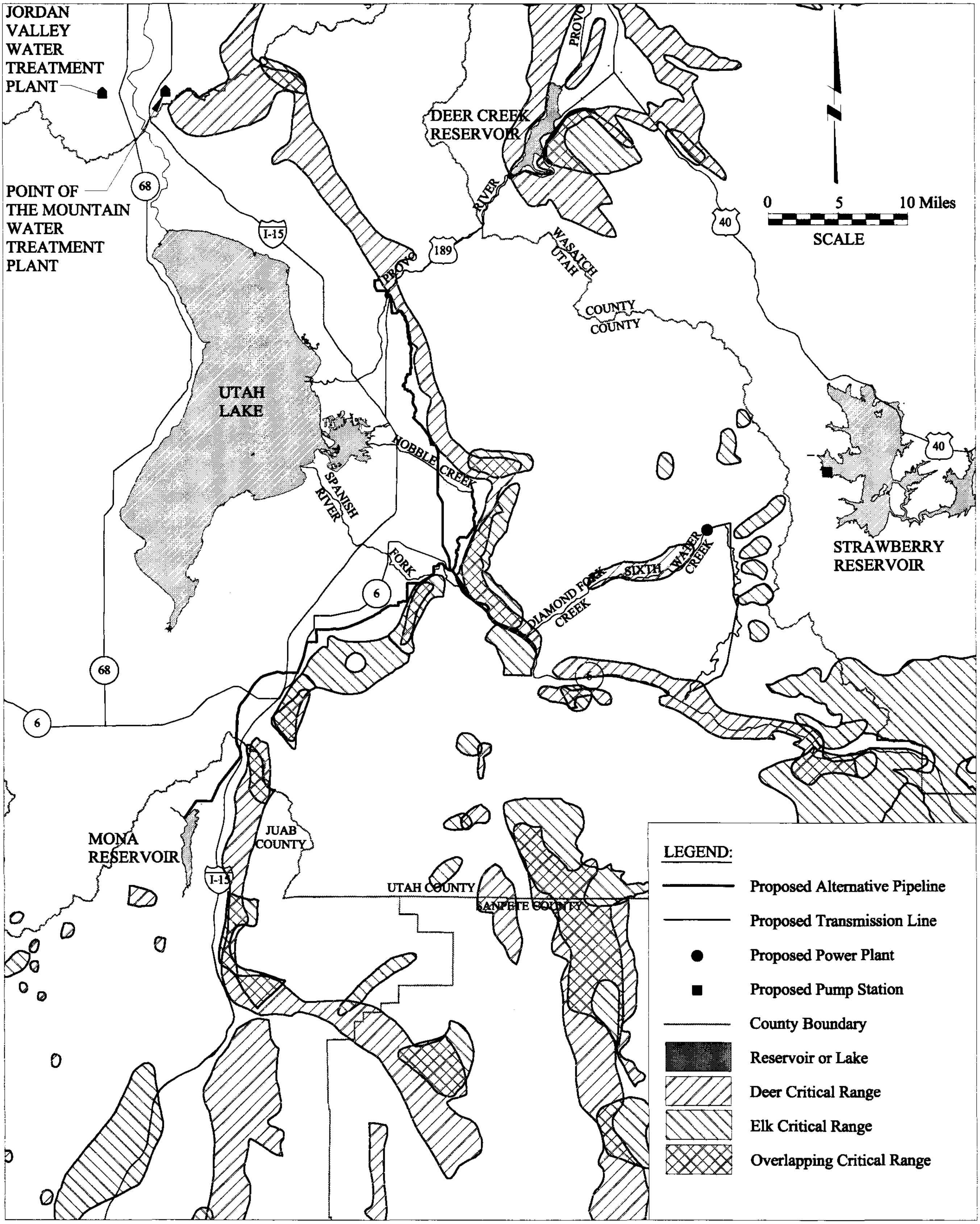
3.8.7.1.9 Big Game Winter Range. The Utah Division of Wildlife Resources has established areas that are critical winter ranges for mule deer, elk and moose. Important winter foraging areas for mule deer and elk that summer in the Wasatch Mountains include the foothills of the Wasatch Front, Spanish Fork Canyon and the Salem and Santaquin benches. Utah Division of Wildlife Resources has classified wintering habitat on the basis of distribution, abundance, forage value and availability to wintering animals. The agency defines as "critical" any habitat "comprised of sensitive use areas that, because of limited abundance and/or unique qualities, constitute irreplaceable, critical requirements for 'high interest wildlife.' For big game, these areas include the most critical summer and/or winter ranges (concentration areas) and critical movement corridors" (CUWCD 1998a).

Map 3-9 shows the "critical" big-game winter ranges in the impact area of influence.

3.8.7.2 Populations

3.8.7.2.1 Game Species. Potential big game species include mule deer (*Odocoileus hemionus*) and elk (*Cervus elaphus*). Moose (*Alces alces*) are potential inhabitants in the Uinta Range in Wasatch County, but are more common to the north in Summit County, well away from the impact area. Rocky Mountain bighorn sheep (*Ovis canadensis canadensis*) were reintroduced to the Mount Nebo area, but a population large enough to sustain its self has not survived.

Large mammalian predators occupy areas of the impact area of influence with adequate prey populations. Predator species include black bears (*Ursus americanus*) and cougar (*Felis concolor*) in mountainous areas, and coyotes (*Canis latrans*) that are widely distributed in most habitats, including suburban areas.



Map 3-9

Big Game Critical Winter Range

Furbearers in the general project area include spotted skunk (*Spilogale putorius*) in wooded areas, long-tailed weasel (*Mustela frenata*) and mink (*Mustela vison*) in riverine and riparian areas, badger (*Taxidea taxus*) in open grasslands, beaver (*Castor canadensis*) in rivers and streams, and bobcat (*Lynx rufus*) in mixed woodlands with rocky outcrops.

Upland gamebirds can be found throughout the impact area of influence. Ring-necked pheasants (*Phasianus colchicus*) utilize farmlands and bordering brushy areas and woodland edges. Mourning doves (*Zenadia macroura*) and California quail (*Callipepla californica*) are found from mountains to valleys in open or brushy areas near water. Chukar (*Alectoris chukar*), sage grouse (*Centrocercus urophasiensis*) and blue grouse (*Dendragapus obscurus*) are found in sagebrush areas at middle to high elevations. Wild turkeys (Rio Grande subspecies, *Meleagris gallopavo*) have been introduced in the Hobble Creek (Wasatch County) and Diamond Fork drainages.

Characteristic waterfowl game species include Canada goose (*Branta canadensis*), mallard (*Anas platyrhnchos*), northern pintail (*Anas acuta*), gadwall (*Anas strepera*) and American widgeon (*Anas americana*), and blue-winged (*Anas discors*), cinnamon (*Anas cyanoptera*) and green-winged (*Anas crecca*) teal.

3.8.7.2.2 Non-Game Species. A variety of small mammals are potentially present in the impact area. Striped skunk *(Mephites mephites)* can be found throughout the region, often in association with suburban areas. Red fox (*Vulpes vulpes*) habitat preference is similar to the coyote, although there is some evidence that their home ranges do not overlap in specific areas (Major and Sherburne 1987).

Mammalian prey species include the following: shrews – Merriam's shrew (*Sorex merriami*), masked shrew *(Sorex cinereus*); voles – long-tailed vole (*Microtus longicaudus*), meadow vole (*Microtus pennsylvanicus*), montane vole (*Microtus montanus*); mice – deer mouse (*Peromyscus maniculatus*); ground squirrels – golden-mantled ground squirrel (*Spermophilus lateralis*), Piute ground squirrel (*S. mollis*), rock squirrel (*S. variegatus*); pocket gopher – Botta's pocket gopher (*Thomomys bottae*)); and lagomorphs – mountain cottontail (*Sylvilagus nuttallii*) and snowshoe hare (*Lepus americanus*). Bat species include little brown myotis (*Myotis lucifugus*), long-legged myotis, (*Myotis volans*) and big brown bat (*Eptesicus fuscus*). These species occupy a wide range of habitats, although agricultural practices and irrigation have affected distribution and abundance.

Non-game birds include raptors, passerine birds and water-related species. Raptors (eagles, hawks and falcons, owls, vultures) occupy habitats throughout the impact area of influence. Golden eagle (*Aquila chrysaetos*), red-tailed hawk (*Buteo jamaicensis*), Merlin (*Falco columbarius*), American Kestrel (*Falco sparverius*) and turkey vulture (*Cathartes aura*) can be found from the mountains to the Utah Lake valley. Northern harrier (*Circus cyaneus*) hunts over wetlands and open fields. Potential owl species include great horned (*Bubo virginianus*), long-eared (*Asio otus*), barn (*Tyto alba*), western screech-owl (*Otus kennicottii*) and northern pygmy-owl (*Glaucidium gnoma*).

Numerous species of passerine (perching) birds and neotropical migrants are found throughout the impact area of influence in a wide variety of habitats. Major groups include sparrows, warblers, flycatchers, woodpeckers, finches, thrushes and swallows. Typical species are listed in the Wildlife Resources and Habitat Technical Report for the Utah Lake Drainage Basin Water Delivery System (CUWCD 2004d).

Water-related birds include shorebirds, wading birds and other species that are seasonally common in wetland habitats and water bodies. Irrigation canals provide some marginal habitat for water birds. Characteristic species include double-crested cormorant (*Phalacrocorax auritus*), black-crowned night-heron (*Nycticorax nycticorax*), sandhill crane (*Grus canadensis*), common snipe (*Capella gallinago*), killdeer (*Charadrius vociferous*), black-necked stilt (*Himantopus mexicanus*), Wilson's phalarope (*Steganopus tricolor*), pied-billed grebe (*Podilymbus podiceps*), western grebe (*Aechmophorus occidentalis*), and California (*Larus californicus*) and ring-billed (*Larus delawarensis*) gulls.

Foothill shrub and grassland provide habitat for a number of reptiles, including common sagebrush lizard (*Sceloporus graciosus*), common side-blotched lizard (*Uta stansburiana*), tiger whiptail (*Cnemidophorus tigris*) and greater short-horned lizard, *Phrynosoma hernandesi*). Snake species which may occur in the area include garter snakes (*Thamnophis spp.*), common gopher snake (*Pituophis catenifer*), rattlesnake (*Crotalus*), and eastern racer (*Coluber constrictor*).

3.8.8 Environmental Consequences (Impacts)

3.8.8.1 Significance Criteria

Significance criteria are based on past experience with similar projects and best professional judgment, since there are no regulatory guidelines for wildlife habitat loss or impacts.

Habitat disturbances may be caused directly by construction or indirectly by noise or human activity that would reduce wildlife habitat values. Substantial disturbance is based on the status, population dynamics, behavior, habitat availability and quality for each species group (game or non-game) relative to the type, intensity and duration of a specific impact. For example, some species would not be significantly affected by ULS development, such as Brewer's blackbird (*Euphagus cyanocephalus*), which is locally common, or the deer mouse (*Peromyscus maniculatus*), which can rapidly reproduce and recolonize disturbed sites.

Impacts on wildlife resources and habitats are considered significant if construction, maintenance and operation of the Proposed Action and other alternatives would result in one or more of the following conditions:

- Substantial disturbance of wildlife habitat, which includes destruction of a large area of utilized habitat, disturbance or displacement of a resident population or sub-population, or loss of a large number of individuals of a species in Wasatch, Utah and Salt Lake counties.
- Temporary or permanent loss or unavailability of "critical" big game winter range habitat (as officially designated by the Utah Division of Wildlife Resources) from December 1 to April 15.

3.8.8.2 Potential Impacts Eliminated From Further Analysis

3.8.8.2.1 Construction Phase

- Big game critical habitat would not be impacted because none of the proposed features would be constructed in or cross any designated big game critical habitat.
- The Spanish Fork Canyon Pipeline would be constructed entirely within the shoulder of Highway 6 and there is no wildlife habitat within the area of construction disturbance.

3.8.8.2.2 Operations Phase

- Changes in reservoir levels would not impact wildlife habitat and populations because the incremental changes would be small relative to baseline reservoir operations and within normal yearly fluctuations (see Chapter 3, Section 3.2.8.2.6, Surface Water Hydrology).

- Changes in Provo and Spanish Fork rivers and Hobble Creek flows would not impact wildlife habitat or populations because the changes would be confined within the current stream channel and would not create or destroy any riparian habitat.

- Wildlife habitat and populations would not be impacted by noise from operation of the Sixth Water and Upper Diamond Fork Power Facilities. These features would not cause measurable noise disturbance outside of the facility structures (see Chapter 3, Section 3.17.8.3.2, Noise).

3.8.8.3 Spanish Fork Canyon-Provo Reservoir Canal Alternative (Proposed Action)

3.8.8.3.1 Construction Phase. No direct mortality would be expected for big game, mammalian predators, most small mammals, all adult birds and many reptiles because they would disperse from construction sites. Construction could cause mortality of some small mammals and reptiles that could fall into open trenches and be buried by placement of fill or concrete.

Clearing of vegetation and trees could cause mortality of bird eggs or nestlings if done during the nesting season. Procedures to avoid and minimize these effects are described in Chapter 1, Section 1.8.8, Standard Operating Procedures (SOPs) During Construction. Some areas would be converted from forested habitats to grasses and shrubs. The Noxious Weed Control Plan (Appendix B) would be implemented to prevent invasion of noxious weeds in construction disturbance areas.

3.8.8.3.1.1 Sixth Water Power Facility and Transmission Line

A. Habitat

The Sixth Water Power Facility would be placed adjacent to the existing Sixth Water Flow Control Structure and would disturb 0.7 acre of previously disturbed land. Power facility construction noise would temporarily disturb approximately 736 acres that are primarily mountain brush, and pinyon/juniper habitat, along with small areas of oak woodland, sagebrush/grass and riparian corridor habitat.

The Sixth Water Transmission Line would follow and upgrade an existing powerline. This would permanently disturb 1.1 acres, including 0.3 acre of sagebrush/grass for a substation at Sixth Water, 0.5 acre of sagebrush/grass for a substation at Highway 6, and 0.3 acre for power poles and associated structures. Construction directly under the transmission lines would change about 37.5 acres of aspen/conifer, oak woodland, pinyon/juniper, mountain brush, and sagebrush/grass habitat to a grass habitat. Approximately 56.2 acres of trees, shrubs and grass habitat would be changed to grass and shrub habitat within the 60-foot wide transmission line right-of-way. Revegetation would change the habitat plant community type, but would restore or, in some circumstances, enhance habitat values because of edge effects (a mixture of habitats with open spaces) for some species and could cause a loss of habitat value for other species. Noise and construction activity, including helicopter operations, would temporarily disturb approximately 8,931 acres.

B. Populations

Impacts on wildlife populations and species diversity from the power facility would not exceed the significance criteria because the area of disturbance does not include high-value habitat for game or non-game species, and the small area does not support significant populations.

Power facility and transmission line construction could impact small mammals and reptiles similar to those described in Section 3.8.8.3.1.

Although noise-sensitive game and non-game wildlife would be dispersed into abundant adjacent habitats by temporary noise disturbances, they would not be affected over the long term as they would return upon completion of construction activities.

3.8.8.3.1.2 Upper Diamond Fork Power Facility

A. Habitat

The Upper Diamond Fork Power Facility would be adjacent to the existing Upper Diamond Fork vortex structure. The power facility and access roads would permanently disturb about 0.3 acre of oak woodland/mountain brush. Impacts on wildlife and habitat would not exceed the significance criteria.

Construction noise would temporarily impact about 736 acres of habitat, predominantly oak woodland, pinyon/juniper, and mountain brush.

B. Populations

Impacts would be the same as in Section 3.8.8.3.1.1 above.

3.8.8.3.1.3 Spanish Fork-Santaquin Pipeline

A. Habitat

Habitats that would be disturbed by this alternative have marginal wildlife value because they are within or adjacent to highways and urban streets.

Table 3-47 shows the acreage that would be disturbed (both permanent and temporary). Wildlife home ranges would not be affected because abundant habitat of equivalent or higher value is available adjacent to the pipeline corridor.

The 35.4 acres of vegetation that would be changed (as shown in Table 3-47) involves orchards that would not be allowed to grow back on the pipeline corridor as they could interfere with pipeline operation and maintenance.

Major areas affected by temporary noise disturbance (pipeline mileposts 1.8 to 5.7, 8.4 to 9.0, 9.5 to 9.7, 12.1 to 17.5, Map A-1), would include agricultural land which has marginal wildlife habitat values, mountain brush and sagebrush/grass habitats.

Table 3-47
Land Disturbed by the Spanish Fork-Santaquin Pipeline
(acres)

Permanent Disturbance	Habitat Revegetated	Vegetation Changed*	Temporary Noise Disturbance
0.3	78.3	35.4	7,499

*This area would revert back to grass or an agricultural crop besides trees.

B. Populations

Impacts on wildlife populations and species diversity would not exceed the significance criteria because the small and dispersed area of disturbance does not include high-value habitat for game species.

Some small non-game species could be supported within the corridor, but it is unlikely that they would be significant populations. Revegetation of disturbed areas would restore habitat values.

Construction could cause minor mortality of small wildlife species, however, impacts on wildlife populations and species diversity would not exceed the significance criteria because any loss of habitat would be temporary. Noise-sensitive game and non-game wildlife would disperse from temporary noise disturbances into adjacent abundant habitats.

3.8.8.3.1.4 Santaquin-Mona Reservoir Pipeline

A. Habitat

Habitats that would be disturbed by this alternative have marginal wildlife value because they are within or adjacent to a railroad right-of-way.

Table 3-48 shows the acreage that would be disturbed, including staging areas at Spanish Fork (10 acres) and Santaquin (7.9 acres). The pipeline would cause minimal permanent loss of habitat. Revegetated habitats would include open areas, grasses and shrubs. The disturbed habitats have marginal wildlife value because they would be within or adjacent to roadways, urban streets and railroad right-of-way. No critical or unique habitat would be disturbed. Abundant equivalent or higher value habitat is available adjacent to the pipeline corridor, and wildlife home ranges would not be affected.

Habitats disturbed by temporary construction noise (pipeline mileposts 0 to 6.7, Map A-1) would be comprised of agricultural lands (1,349 acres) and sagebrush/grass (1,485 acres). The disturbed agricultural lands would have marginal wildlife habitat values.

Table 3-48
Land Disturbed by the Santaquin-Mona Reservoir Pipeline
(acres)

Permanent Disturbance	Habitat Revegetated	Vegetation Changed	Temporary Noise Disturbance
0.2	70.9	0	2,807

B. Populations

The Santaquin-Mona Reservoir Pipeline corridor contains some habitat that could be used by game and non-game species, but there is abundant adjacent alternative habitat, and revegetation of disturbed areas would restore their wildlife habitat values. Noise-sensitive wildlife would disperse from temporary noise impacts into abundant adjacent habitats. Impacts on wildlife populations and species diversity would not exceed the significance criteria.

3.8.8.3.1.5 Mapleton-Springville Lateral Pipeline

A. Habitat

Wildlife home ranges would not be affected by this alternative. The habitats disturbed have marginal wildlife value because they would be within or adjacent to urban areas, streets and the irrigation canal channel.

Table 3-49 shows the acreage disturbed by the Mapleton-Springville Lateral Pipeline (permanent and temporary impacts). Approximately 1 acre of riparian forest and scrub-shrub wetland habitat adjacent to the Mapleton Lateral in the construction corridor would be revegetated to upland grasses and shrubs after construction. Loss of this habitat would not exceed the significance criteria because this vegetation is subject to periodic clearing during canal maintenance, and abundant habitat of equivalent or higher value is available adjacent to the pipeline corridor

Construction noise (pipeline mileposts 0.7 to 1.5, Map A-1) would disturb agricultural lands and mountain brush. Noise-sensitive wildlife along the pipeline corridor would disperse into abundant adjacent habitats and impacts on wildlife populations would be negligible. The disturbed agricultural lands have marginal wildlife habitat values.

Table 3-49
Land Disturbed by the Mapleton-Springville Lateral Pipeline
(acres)

Permanent Disturbance	Habitat Revegetated	Vegetation Changed	Temporary Noise Disturbance
0.1	60.2	0	282

B. Populations

This pipeline would cause minimal permanent loss of wildlife habitat. Impacts on wildlife populations and species diversity would not exceed the significance criteria because the pipeline corridor does not have high-value game species habitat.

Some small non-game species could utilize the habitats within the corridor, but it is unlikely that they would be significant populations. Revegetation of disturbed areas would restore habitat values for non-game species, and construction could cause only minor mortality of small wildlife species.

3.8.8.3.1.6 Spanish Fork-Provo Reservoir Canal Pipeline

A. Habitat

This pipeline would have little or no impact on wildlife habitat values, and wildlife home ranges would not be affected because the pipeline would be constructed within existing highway shoulders and city streets.

Table 3-50 shows the acreage disturbed by the Spanish Fork-Provo Reservoir Canal Pipeline (permanent and temporary impacts). Only a small area (pipeline mileposts 0.4 to 1.5, 17.8 to 17.9, 18.0 to 18.3, Map A-1) of non-urban mountain brush habitat would be affected by pipeline construction noise.

Table 3-50 Land Disturbed by the Spanish Fork-Provo Reservoir Canal Pipeline (acres)			
Permanent Disturbance	**Habitat Revegetated**	**Vegetation Changed**	**Temporary Noise Disturbance**
0.4	20.0	17.7	268

B. Populations

Wildlife populations and species diversity would not be affected by this alternative because game and non-game wildlife habitat is minimal in the pipeline corridor and the presence of significant wildlife populations is unlikely. Revegetation of disturbed areas would restore those minimal habitat values. Pipeline construction could cause minor mortality of small wildlife species. Noise-sensitive wildlife would disperse into abundant adjacent habit during construction.

3.8.8.3.1.7 Spanish Fork Canyon Pipeline

A. Habitat

This pipeline would have little or no impact on wildlife habitat values, and wildlife home ranges would not be affected because the pipeline would be constructed within existing highway shoulders.

Table 3-51 shows the acreage disturbed by the Spanish Fork Canyon Pipeline (permanent and temporary impacts). Only a small area of non-urban mountain brush habitat would be affected by pipeline construction noise.

Table 3-51 Land Disturbed by the Spanish Fork Canyon Pipeline (acres)		
Permanent Disturbance	**Habitat Revegetated**	**Vegetation Changed**
0	38.4	0

B. Populations

Wildlife populations and species diversity would not be affected by this alternative because game and non-game wildlife habitat is minimal in the pipeline corridor and the presence of significant wildlife populations is unlikely. Revegetation of disturbed areas would restore those minimal habitat values. Pipeline construction could cause minor mortality of small wildlife species. Noise-sensitive wildlife would disperse into abundant adjacent habit during construction.

3.8.8.3.2 Operations Phase. Delivery of M&I water under this alternative would have no impact on wildlife habitat or populations as it would not create or eliminate any wildlife habitat.

3.8.8.3.3 Summary of Proposed Action Impacts

3.8.8.3.3.1 Habitat. Table 3-52 summarizes habitats that would be disturbed by construction of the Proposed Action.

Table 3-52
Land Disturbed by Proposed Action Construction (acres)

Permanent Disturbance	Habitat Revegetated	Vegetation Changed	Temporary Noise Disturbance
2.4	269.7	146.8	21,259

Permanently disturbed habitats have marginal wildlife values, and abundant equivalent or higher value habitat is available adjacent to all features constructed for this alternative. Impacts on game and non-game wildlife home ranges would be minimal. Construction and operation of the alternative would not cause a substantial disturbance to wildlife habitats. Impacts on wildlife habitat disturbance would not exceed the significance criteria.

3.8.8.3.3.2 Populations. Some small mammals and reptiles could be lost to construction mortality. This mortality would be minimized by the construction SOPs and would not affect a large number of any wildlife species population or sub-population. Construction and noise disturbance would not permanently displace any significant game or non-game wildlife populations or sub-populations. Some minor sub-populations of wildlife may be unable to disperse into adjacent upland habitats or could encounter habitats at carrying capacity and be unable to survive. It is unlikely that any species would be placed at risk by this loss of upland habitats. Impacts on wildlife populations would not exceed the significance criteria.

3.8.8.4 Bonneville Unit Water Alternative

3.8.8.4.1 Construction Phase. The impacts of the following features of this alternative are the same as described for the Spanish Fork-Provo Reservoir Canal Alternative and are not repeated in this section:

- Sixth Water Power Facility and Transmission Line – Section 3.8.8.3.1.1
- Upper Diamond Fork Power Facility – Section 3.8.8.3.1.2
- Spanish Fork-Santaquin Pipeline – Section 3.8.8.3.1.3
- Mapleton-Springville Lateral Pipeline – Section 3.8.8.3.1.5
- Spanish Fork Canyon Pipeline – Section 3.8.8.3.1.7

General construction impacts on wildlife are described in Section 3.8.8.3.1.

3.8.8.4.2 Operations Phase. Impacts would be the same as the Proposed Action (Section 3.8.8.3.2).

3.8.8.4.3 Summary of Bonneville Unit Water Alternative Impacts

3.8.8.4.3.1 Habitat. Table 3-53 summarizes the acreage that would be disturbed by construction of the Bonneville Unit Water Alternative.

Table 3-53 Land Disturbed by Bonneville Unit Water Alternative Construction (acres)			
Permanent Disturbance	**Habitat Revegetated**	**Vegetation Changed**	**Temporary Noise Disturbance**
1.8	178.8	129.1	18,980

Permanently disturbed habitats have marginal wildlife values and abundant equivalent or higher value habitat is available adjacent to all features constructed for this alternative. Impacts on game and non-game wildlife habitat and home ranges would not exceed the significance criteria.

The alternative would not cause a substantial disturbance to wildlife habitats. Impacts on habitat disturbance would not exceed the significance criteria.

3.8.8.4.3.2 Populations. Some small mammals and reptiles could be lost to construction mortality. This mortality would be minimized by the construction SOPs and would not affect a large number of any wildlife species population or sub-population. Construction and noise disturbance would not permanently displace any significant game or non-game wildlife populations or sub-populations. Some minor sub-populations of wildlife may be unable to disperse into adjacent upland habitats or could encounter habitats at carrying capacity and be unable to survive. It is unlikely that any species would be placed at risk by this loss of upland habitats.

3.8.8.5 No Action Alternative

3.8.8.5.1 Construction Phase. No features would be constructed under this alternative.

3.8.8.5.2 Operations Phase

3.8.8.5.2.1 Habitat. No ULS water would be delivered to southern Utah County under this alternative. Groundwater levels in southern Utah County would be lowered by pumping to support continued population growth (see Map 3-6, Section 3.4.8.5) Wetlands in areas of groundwater drawdown of one foot or greater could be lost. It is expected that a considerable amount of wetland area could be potentially impacted. The wetland acreage and specific locations of potential wetland impacts relative to baseline is not measurable based on the information available for use in the analysis (see Section 3.7.8.5.2.1).

3.8.8.5.2.2 Populations. Sub-populations of wetland-associated wildlife could be placed at risk because of the area of wetland reduction, the distances required for dispersal into equivalent wetland habitat and the smaller area of alternative wetland habitat available. However, from a regional perspective, it would be unlikely that any species as a whole would be placed at risk by the loss of wetland habitat.

3.8.8.5.3 Summary of No Action Alternative Impacts. The No Action Alternative could cause significant impacts on wetland wildlife habitats in southern Utah County. Local sub-populations of wetland-associated wildlife could be adversely impacted, although it is unlikely that any regional species population would have impacts that would exceed the significance criteria.

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3.9 Threatened and Endangered Species

3.9.1 Introduction

This analysis addresses potential effects on threatened and endangered (T&E) species and their habitat from construction, operation and maintenance of the Proposed Action and other alternatives.

3.9.2 Issues Raised in Scoping Meetings

- What would be the effects on wetlands, aquatic life and T&E species from overuse of groundwater?
- What would be the effects of possible catastrophic failure of the pipeline through Utah Lake?
- What effects would occur on the June sucker from the pipeline through Utah Lake?
- What effects would occur on June sucker and habitat for endangered species because of groundwater pumping?
- What would be the effects of the ULS Project on Utah Lake June sucker?
- What effects would occur on the Utah Lake ecosystem in terms of June sucker recovery?
- What would be the effects of the ULS on the June sucker Recovery Implementation Program?
- What would be the effects of any of the ULS concepts on federally listed species within the effect area of influence?
- What would be the effects of any of the ULS concepts on the endangered June sucker?
- What would be the effects on threatened and endangered species from each of the ULS concepts?
- What are the operating constraints on the Provo River related to demands for water and habitat for the June sucker?

3.9.3 Scoping Issues Eliminated From Further Analysis

What would be the effects on wetlands, aquatic life and T&E species from overuse of groundwater?

What effects would occur on June sucker and habitat for endangered species because of groundwater pumping?

The ULS project does not involve use of any groundwater, and therefore would not result in any effects associated with use or overuse of groundwater.

What would be the effects of possible catastrophic failure of the pipeline through Utah Lake?

What effects would occur on the June sucker from the pipeline through Utah Lake?

The Spanish Fork-Bluffdale Alternative, the only alternative that would have included a pipeline across Utah Lake, was eliminated from further analysis (see Chapter 1, Section 1.11).

3.9.4 Scoping Issues Addressed in the Effect Analysis

All issues are addressed except those listed in Section 3.9.3.

3.9.5 Description of Area of Potential Effect (APE)

Map 3-2 shows the area of potential effect for the ULS project. The threatened and endangered species area of potential effect includes the following:

- The area directly affected by pipelines, access roads, pump stations, power lines, power facilities, and diversion structures
- All streams and rivers and associated riparian corridors that would have alterations in flow from baseline conditions
- Wetlands affected by ULS alternatives

3.9.6 Methodology

The effects analysis considered the standard operating procedures (SOPs) and project design features that the District would implement as part of the project.

3.9.6.1 Assumptions

None

3.9.6.2 Effects Analysis Methodology

See Appendix E.

3.9.7 Affected Environment (Baseline Conditions)

3.9.7.1 Overview

Table 3-54 lists the 12 threatened, endangered or candidate species identified by the U.S. Fish and Wildlife Service (USFWS) as occurring in the impact area of influence (see Appendix F).

Table 3-54 Threatened and Endangered Species in the ULS Area of Potential Effect			
Common Name	**Scientific Name**	**Status[1]**	**Group[2]**
Canada Lynx	*Lynx canadensis*	T	W
Bald Eagle	*Haliaeetus leucocephalus*	T	W
Western Yellow-billed Cuckoo	*Coccyzus americanus occidentalis*	C	W
June sucker	*Chasmistes liorus*	E	A
Bonytail	*Gila elegans*	E	A
Colorado Pikeminnow	*Ptychocheilus lucius*	E	A
Humpback Chub	*Gila cypha*	E	A
Razorback Sucker	*Xyrauchen texanus*	E	A
Utah Valvata Snail	*Valvata utahensis*	E	A
Ute Ladies'-tresses	*Spiranthes diluvialis*	T	P
Deseret Milkvetch	*Astragalus desereticus*	E	P
Clay Phacelia	*Phacelia argillacea*	E	P

[1]E = Endangered, T= Threatened, C = Candidate
[2]W = Wildlife, A = Aquatic, P = Plant

3.9.7.2 Wildlife Species

3.9.7.2.1 Canada Lynx. The Canada lynx (*Lynx canadensis*) was listed as threatened in 2000 (USFWS 2003). In the western U.S., lynx habitat occurs in spruce/fir forests at higher elevations. Downed logs and windfalls provide cover for denning sites, escape, and protection from severe weather. The lynx range in the contiguous United States includes 16 states-Oregon, Idaho, Washington, Montana, Wyoming, Utah, Colorado, Maine, New Hampshire, Vermont, New York, Michigan, Wisconsin, and Minnesota. Lynx infrequently dispersed into Nevada, North Dakota, South Dakota, Iowa, Indiana, Ohio, and Virginia (USFWS 2000). Lynx are believed to currently remain in small populations in only three states-Montana, Washington, and Maine (ENN 1999).

Mid-successional boreal forest stages provide habitat for the lynx's primary prey, the snowshoe hare (*Lepus americanus*). The effect area of influence contains no primary or secondary snowshoe hare habitat. The plant community types preferred by snowshoe hare for cover, reproduction and food do not occur in the vegetation types that would be disturbed by the project construction. The project elevations are lower than those described for snowshoe hare and potential lynx habitat in Utah.

Although sightings of the Canada lynx in Utah over the past 20 years are exceedingly rare, the U.S. Forest Service recently announced that Canada lynx hair was found in the Manti-La Sal National Forest south of the impact area of influence during 2002 (UDNR 2003a). The USFWS considers that any lynx occurring in Utah are dispersers from other populations rather than residents, because most of the few existing records correspond to cyclic population highs, there is no evidence of reproduction, and boreal forest habitat in Utah is remote and far from source lynx populations (USFWS 2003).

3.9.7.2.2 Bald Eagle. The bald eagle (*Haliaeetus leucocephalus*) was originally listed as endangered in 1967. Its status was changed to threatened in 1995, and was then proposed for delisting in the lower 48 United States. Bald eagles are always found near substantial bodies of water that provide their primary diet of fish. Breeding sites require tall trees that project above the general forest crown (Kaufman 1996). Winter range requires unfrozen lakes or rivers with nearby adequate roost and perching sites. Bald eagles have ranged historically throughout

North America except for extreme northern and southern latitudes (USFWS 1994). They nest on both coasts from Florida to Baja California in the south and from Labrador to the western Aleutian Islands and Alaska in the north. Wintering eagle populations in Utah are substantial, with 1,263 recorded in 1985 at scattered locations during the National Wildlife Federation's midwinter survey (Henny and Anthony 1989). Counts conducted by the Utah Division of Wildlife Resources also indicate a general increase in wintering eagles (Bunnell 1994). Individuals are seen commonly in small numbers within the effect area of influence from October through March (Smith and Murphy 1973, Reclamation 1988b). During this period, eagles are frequently observed around Utah Lake, Mona Reservoir, and lower Diamond Fork Creek, as well as in scattered wetlands throughout central Utah (Reclamation 1988). Night roosts are located sparsely throughout the area, including timbered canyons and in groves of trees within the valley. They are often occupied by several to many eagles at once. Known roosting sites are located at Utah Lake, Mona Reservoir, and within cottonwood stands along lower Diamond Fork Creek near Palmyra Campground. Bald eagles frequently use trees around Utah Lake as daytime perches. The primary food sources for this species are fish, rabbits, waterfowl, and carrion (Smith and Greenwood 1983). There is also a bald eagle nesting territory near the Great Salt Lake in northern Utah.

3.9.7.2.3 Yellow-billed Cuckoo. The western subspecies of the yellow-billed cuckoo (*Coccyzus americanus occidentalis*) was listed as a candidate species in the western United States in 2001 (USFWS 2003). These cuckoos are closely associated with riparian areas containing tall cottonwood trees (*Populus spp.*) and an abundant sub-canopy or shrub layer at elevations between 2,500 and 6,000 feet mean sea level (MSL) in Utah. The cuckoo stays in the dense canopy of trees or tangles of undergrowth. They are one of the latest migrant species to nest in the state, arriving in late May or early June and breeding through July. Southward migration usually begins in late August or early September (UDNR 2003b). Records in the impact area of influence are clustered near Deer Creek Reservoir along the Provo River and Provo City, with other observations at the Brigham Young University Agricultural Station north of Salem City and in Santaquin City (UDNR 2003a).

3.9.7.3 Aquatic Species

3.9.7.3.1 June sucker. The June sucker (*Chamistes liorus*) is listed as endangered under the Federal Endangered Species Act (ESA). The species was listed under the ESA with critical habitat on April 30, 1986 (51 FR 10857). The lower 4.9 miles of the main channel of the Provo River, from the Tanner Race diversion downstream to Utah Lake, was designated as critical habitat. At the time of its listing, the population was fewer than 1,000 individuals (51 FR 10857), but more recent estimates of adult spawning populations have been closer to 300 individuals (Keleher et al. 1998). Its Natural Heritage Status in Utah is unranked.

This species is endemic to Utah Lake and its tributaries and is closely associated with habitat in braided, slow, meandering channels (USFWS 1999). Rivers with tree-lined banks and slow-water pools provide habitats suitable for larval development. Larvae drift downstream to Utah Lake at night after emerging from spawning beds (Modde and Muirhead 1990). Since the early 1990's, June sucker have been monitored annually in the Provo River during their spawning migration. Because of the limited size of the population and the relatively large size of Utah Lake, in-lake observations of June sucker have been rare; however, using techniques employed by local commercial fishing experts, researchers collected several June sucker in Utah Lake in 2004 (Keleher 2004). A questionable sighting of June sucker was reported in Hobble Creek in 1980 (USFWS 1999; UDNR 2003a). Cope and Yarrow (1875) reported that the June sucker spawned historically in tributaries to Utah Lake.

The number of adult June sucker remaining in Utah Lake is estimated each spring based on the number spawning in the Provo River (USFWS 1995b). From 1979 to 1985, the number of spawners never exceeded 500 fish, and 1985 was the last year in which aggregations of 30 to 50 June sucker spawners were observed in the Provo River. During the 1990s, collections of June sucker spawners in the Provo River have been less than 100 fish, and occasionally were less than 50 fish. Recent estimates placed the wild population size at approximately 300 individuals (Keleher et al. 1998). Recruitment to the adult population is thought to be poor as a result of predation by white bass and other introduced predators. Aging of various groups of June sucker collected in the 1980s and 1990s found few fish less than 10 years of age, suggesting recruitment and survival of juveniles is inadequate (USFWS 1999).

The Provo River, the largest tributary of Utah Lake, historically has been the major spawning tributary for June sucker, but other tributaries were likely used prior to changes that made them unavailable or unsuitable for the species. Carter (1969) notes that early explorers and indigenous Native Americans also keyed fishing activities on the lower Spanish Fork River, Hobble Creek, and the mouth of Peteetneet Creek. All three of these streams have considerably reduced flows from pre-irrigation times. Radant and Sakaguchi (1980) noted adult June sucker in spawning condition near the mouth of the Spanish Fork River, but later studies failed to find either spawning suckers or suitable habitat in that stream. The Utah Division of Wildlife Resources found spawning June suckers in the lower Spanish Fork River in 2002. The lowermost irrigation diversion structure on the Spanish Fork River prevents the species from accessing potential spawning habitat (Radant and Shirley 1987). Peteetneet Creek no longer reaches Utah Lake, as it is dewatered near the High Line Canal. Flow in Hobble Creek has been significantly reduced and no longer provides suitable habitat for a large species such as the June sucker.

Various historic riverine habitat characteristics, many of which no longer exist, are presumed to be favorable to June sucker spawning success. These features include multiple, meandering channels at the inlet of tributaries to Utah Lake and riparian zones. These components are thought to create microhabitats that benefit June sucker as their ecological needs change associated with development through life history stages. Advantages of these habitats include cover from predators and slow, warm pools, which support larval growth.

Factors that have contributed to the reduction in June sucker numbers include changes that have occurred both in Utah Lake and in historical spawning tributaries. In the tributaries, these effects include water management (primarily irrigation use) that has reduced streamflows during critical spawning times, reductions in available spawning habitat caused by impassable barriers associated with irrigation diversions, introduction of exotic predators, introduction of other species (carp), loss of spawning habitat, poor water quality, reduced aquatic vegetation, and channelization or channel simplification. In Utah Lake, contributing factors include changes in chemical and physical habitat, introduction of exotic predators, and lake level management.

The life history of the June sucker involves both Utah Lake and its tributaries. One of only four "lake suckers," the mouth of the June sucker is terminal, and the lips and gill rakers of adults are adapted to feed on microscopic plankton. Adults live in Utah Lake, apparently moving about the lake considerably. Sexual maturity likely occurs at 5 to 7 years of age, but most adults are from older age classes (Scoppettone and Vinyard 1991). During June, reproductive adults move into the Provo River to spawn. During most water years spawning is limited to the lower 3 miles because of a partial passage barrier at the Fort Field diversion. However in very high water years adults have been seen above this partial barrier using the next 1.9 miles of habitat up to the Tanner Race diversion dam. Spawning typically occurs in mid- to late June, with the eggs hatching in 1.5 to 2 weeks. Adults move back into the lake shortly after spawning. A post-spawning aggregation of adult June sucker was found in Provo Bay by Radant and Shirley (1987) and recent findings based on radio-tagged June sucker confirm this (Crowl 2003). This portion of Utah Lake has higher than normal plankton densities during this period, and the fish may be responding to this food source following relatively little feeding during their stay in the Provo River.

The early life history of the species is poorly understood. Larvae apparently drift down to the lake relatively quickly after spawning (Radant and Sakaguchi 1980; Radant and Shirley 1987; Modde and Muirhead 1990). It is thought that many of the spawning tributaries originally had deltas into the lake that would have provided young suckers with food, cover, and space for growing. These habitats no longer exist. It is thought that juveniles live in or around the lake. Recent research (Crowl 1994) indicates young are very susceptible to predation by white bass, although they will seek cover if it is available. Current thinking on limiting factors for the species suggests that predation on the young, either in the dredged lower Provo River channel, or in Utah Lake, is the major factor in poor recruitment to the adult population (USFWS 1995b). Lack of hiding cover in the lower Provo River and in the lake may be a contributing factor to predation. Poor water quality conditions and a large carp population appear to be factors in young sucker survival.

In 1999, the USFWS adopted a recovery plan for the June sucker to prevent extinction, downlist the species to threatened status, and to delist (USFWS 1999). The immediate objective of the recovery plan was to prevent extinction of the June sucker by establishing at least one secure refuge population and halting and reversing the decline of the extant population in Utah Lake. Additional criteria related to habitat, population size, and non-native species were specified to downlist the species and to delist (USFWS 1999). The target date of recovery listed in the recovery plan was 2040.

3.9.7.3.2 Bonytail. The bonytail (*Gila elegans*) is listed as endangered under the ESA and by the State of Utah. Bonytail was listed under the federal ESA in 1980 (45 FR 27710), with a final determination of critical habitat on March 21, 1994 (59 FR 13374). An unknown small number of wild adults exist in Lake Mohave on the mainstem Colorado River of the Lower Colorado River Basin (i.e., downstream of Glen Canyon Dam, Arizona), and there are small numbers of wild individuals in the Green River and upper Colorado River sub-basins of the Upper Colorado River Basin (USFWS 2002a). Its Natural Heritage Status in Utah is S1 (critically imperiled).

Currently no self-sustaining populations of bonytail exist in the wild, and very few individuals have been caught throughout its range (USFWS 2002a). The bonytail is considered adapted to mainstem rivers where it has been observed in pools and eddies. Similar to other closely related *Gila* sub-species, bonytails in rivers probably spawn in spring over rocky substrates, while spawning in reservoirs has been observed over rocky shoals and shorelines. There are no documented collections of bonytail from the impact area of influence.

3.9.7.3.3 Colorado Pikeminnow. The Colorado pikeminnow (*Ptychocheilus lucius*) is listed as endangered under the ESA and by the State of Utah. This species was first included in the List of Endangered Species issued by the Office of Endangered Species on March 11, 1967 (32 FR 4001) and was considered endangered under provisions of the Endangered Species Conservation Act of 1969 (U.S. Code 1973).

The Colorado squawfish (pikeminnow) was included in the United States List of Endangered Native Fish and Wildlife issued on June 4, 1973 (38 FR No. 106), and it received protection as endangered under Section 4(c)(3) of the original ESA of 1973. The final rule for determination of critical habitat was published on March 21, 1994 (59 FR 13374).

Wild, reproducing populations occur in the Green River and upper Colorado River sub-basins of the Upper Colorado River Basin (i.e., upstream of Glen Canyon Dam, Arizona). There are small numbers of wild individuals (with limited reproduction) in the San Juan River sub-basin (USFWS 2002b). The species was extirpated from the Lower Colorado River Basin in the 1970s but has been reintroduced into the Gila River sub-basin, where it exists in small numbers in the Verde River (USFWS 2002b). Its Natural Heritage Status in Utah is S1 (critically imperiled).

Currently, three wild populations of Colorado pikeminnow are found in more than 1,000 miles of riverine habitat in the Green River, upper Colorado River, and San Juan River sub-basins (USFWS 2002b). The Colorado pikeminnow is a long-distance migrator, moving many miles to and from spawning areas. Adults require pools, deep runs and eddy habitats maintained by high spring flows (USFWS 2002b). After hatching and emerging from spawning substrate, larvae drift downstream to nursery backwaters that are restructured by high spring flows and maintained by relatively stable base flows (USFWS 2002b). There are no documented collections of Colorado pikeminnow from the impact area of influence.

3.9.7.3.4 Humpback Chub. The humpback chub (*Gila cypha*) is listed as endangered under the ESA and by the State of Utah. This species was first included in the List of Endangered Species issued by the Office of

Endangered Species on March 11, 1967 (32 FR 4001) and was considered endangered under provisions of the Endangered Species Conservation Act of 1969 (U.S. Code 1973).

The humpback chub was included in the United States List of Endangered Native Fish and Wildlife issued on June 4, 1973 (38 FR No. 106), and received protection as endangered under Section 4(c)(3) of the original ESA of 1973. The final rule for determination of critical habitat was published on March 21, 1994 (59 FR 13374). Six extant populations are known: the first five are in the Upper Colorado River Basin (i.e., upstream of Glen Canyon Dam, Arizona), and the sixth is in the Lower Colorado River Basin (USFWS 2002c). Its Natural Heritage Status in Utah is S1 (critically imperiled).

Populations of humpback chub are restricted to deep, swift canyon-bound regions of the mainstem and large tributaries of the Colorado River Basin (USFWS 2002c). Adults require eddies and sheltered shoreline habitats maintained by high spring flows. Young require low-velocity shoreline habitats, including eddies and backwaters, that are more prevalent under base-flow conditions. There are no documented collections of humpback chub from the impact area of influence.

3.9.7.3.5 Razorback Sucker. The razorback sucker (*Xyrauchen texanus*) is listed as endangered under the ESA and by the State of Utah. The species was listed under the ESA in 1991 (56 FR 54957), with critical habitat designated on March 21, 1994 (59 FR 13374). The species is endemic to the Colorado River Basin of the southwestern United States (USFWS 2002d).

Razorback suckers are currently found in small numbers in the Green River, upper Colorado River, San Juan River sub-basins, and the lower Colorado River between Lake Havasu and Davis Dam; reservoirs of Lakes Mead and Mohave; small tributaries of the Gila River sub-basin (Verde River, Salt River and Fossil Creek); and in local areas under intensive management such as Cibola High Levee Pond, Achii Hanyo Native Fish Facility, and Parker Strip (USFWS 2002d). There are no documented collections of razorback suckers from the impact area of influence. Its Natural Heritage Status in Utah is S1 (critically imperiled).

Historically, razorback sucker were widely distributed in warm-water reaches of larger rivers of the Colorado River Basin from Mexico to Wyoming (USFWS 2002d). Habitats required by adults in rivers include deep runs, eddies, backwaters, and flooded off-channel environments in spring; runs and pools often in shallow water associated with submerged sandbars in summer; and low-velocity runs, pools and eddies in winter.

Spring migrations of adult razorback sucker were associated with spawning in historic accounts, and a variety of local and long-distance movements and habitat-use patterns have been documented. Young require nursery environments with quiet, warm, shallow water such as tributary mouths, backwaters or inundated floodplain habitats in rivers, and coves or shorelines in reservoirs.

3.9.7.3.6 Desert Valvata (UtahValvata). The desert (or Utah) valvata (*Valvata utahensis*) is listed as endangered under the ESA and by the State of Utah. Its Natural Heritage Status Rank in Utah is SX (presumed extirpated). The species was federally listed in 1992 as endangered throughout its known range in Idaho and Utah.

Desert valvata occurs in free-flowing waters near rapids, but avoids areas of fast currents. This species utilized habitat with aquatic plants in well-oxygenated areas with sand or mud substrates and is not found in gravel or boulders. The desert valvata historically occurred in Utah Lake, but, based on recent statewide surveys, the USFWS currently considers the species to be extirpated from Utah (UDNR 2003b, USFWS 1995a). The last recorded observation at Utah Lake was in 1883 (UDNR 2003a). Extant populations are confined to the Snake River Basin (57 FR 59244 59257, CUWCD 1998a, Oliver and Bosworth 1999). Because it is suspected that this species is extirpated in the project area, no field surveys were performed to determine the presence of species or habitat.

3.9.7.4 Plant Species

3.9.7.4.1 Ute Ladies'-tresses. Ute ladies'-tresses (*Spiranthes diluvialis*) were listed as threatened on January 17, 1992 (57 FR 2053). Ute ladies'-tresses (ULT) are a perennial orchid found along riparian edges, gravel bars, old oxbows and moist to wet meadows along perennial freshwater streams and springs at elevations ranging from approximately 4,300 to 7,000 feet (USFWS 1992; Stone 1993).

It is an early to mid successional species that is well adapted to low floodplain terraces along alluvial streams where scouring and sediment deposition are natural processes. It has been found in irrigated and sub-irrigated pastures that are mowed or moderately grazed In general, the orchid occurs in relatively open grass and forb-dominated habitats, and seems intolerant of dense shade. The plants bloom from late July through August (sometimes September), setting seed in the early fall. A colony is defined as any location where flowering plants have been found in a similarly delineated habitat on that geomorphic surface. Therefore, a colony may be comprised of one or more individuals on a sandbar (large or small) or on a large flood plain delineated by topographical changes in slope or elevation.

There are a total of seven known occurrences along the Spanish Fork River from the confluence with Diamond Fork Creek down to the Castilla gauging station, just upstream of the Spanish Fork Diversion Dam. Five of the known occurrences are on island gravel bars and low floodplains adjacent to the main channel. These are located within approximately 0.5 miles of the confluence with Diamond Fork Creek. There are two known occurrences between the Covered Bridge Canyon residential area access bridge and the Castilla gauging station. These colonies are located in or around an old oxbow near the Cold Springs gaging station and are believed to be supported by secondary hydrology and seepage not associated with river flows.

3.9.7.4.2 Deseret Milkvetch. Deseret milkvetch (*Astragalus desereticus*) grows exclusively on sandy-gravelly soils weathered from conglomerate outcrops of the Moroni Formation. It is found on south-facing, west-facing (and rarely north-facing) slopes, and does well on larger, west-facing road cuts. This species occurs in open pinion-juniper-sagebrush communities at elevations from 5,400 to 5,700 feet. Deseret milkvetch is endemic to central Utah and known from only one occurrence in the Thistle Creek Valley near the town of Birdseye in Utah County. This one known occurrence is not within or adjacent to the impact area of influence.

3.9.7.4.3 Clay Phacelia. Clay phacelia (*Phacelia argillacea*) is found in pinion-juniper and mountain brush communities on sparsely vegetated slopes of the Green River Shale at about 6,600 feet elevation. This species occurs along the Douglas Creek and Gordon Gulch members of the Green River formation in the Wasatch Mountains in Pleasant Valley. Known occurrences are limited to two sites, the Tucker rest area along SR-6 in Spanish Fork Canyon and 5 miles west-northwest of the Tucker population. Neither known occurrence is within or adjacent to the impact area of influence.

3.9.8 Environmental Consequences (Effects)

Only those features of the Proposed Action and other alternatives that may affect T&E species are discussed, and only those species that may be affected are identified.

3.9.8.1 Evaluation Criteria

This section describes the criteria used to determine the magnitude of effects from the Proposed Action and other alternatives. The ESA establishes the legal criteria for determining effects on federally threatened and endangered species. Under the ESA, the USFWS has sole authority to determine effects on threatened and endangered species. The ESA uses the terms "affect" and "may affect" to indicate degree of effect. The following general evaluation criteria apply to all species.

- Taking of threatened or endangered species
- Loss or degradation of utilized or potentially utilized habitat that would exceed the estimated level necessary to maintain viable populations or sub-populations of each species
- Actions that lead to long-term disturbance in species migration and dispersal, breeding behavior or pollination that would threaten the viability of the population or sub-population

3.9.8.1.1 Plant Species

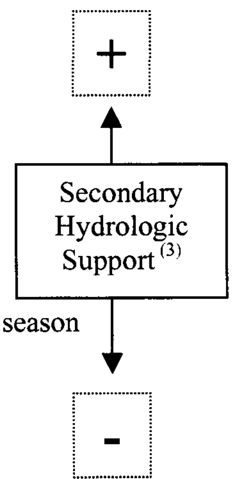
In addition to those listed in Section 3.9.8.1, effects on T&E plant species were evaluated based on the following additional criteria:

- Any loss of individuals or adverse modification of critical habitat as designated under the ESA or that conflict with the objectives of an official recovery plan for the species
- Substantial population reductions that would destroy a large area of utilized habitat (more than 25 percent of habitat in the area of potential effect), disturb or displace a resident sub-population, or result in losses of large numbers of individuals (more than 20 percent of a local colony or population) of the species
- Direct removal or degradation of potential habitat
- Negative effect on vegetative communities that support pollinators of listed plants

Three categories of "potential for effect" have been developed for ULT – high, moderate and low. Habitat described as having a high potential for effect will be considered as "may affect" on the population for purposes of this analysis. Each occupied habitat was placed in one of the three categories for potential for effect according to the following criteria (which are defined below):

LOW POTENTIAL

- Low to Moderate drying or wetting [1] in the first two critical depths during the growing season
- Secondary Hydrologic Support
- Knowledge of Site Characteristics [2]



MODERATE POTENTIAL

- Moderate to High drying [1] in the first two critical depths during the growing season
- Secondary Hydrologic Support
- Knowledge of Site Characteristics [2]

HIGH POTENTIAL

- High Drying [1] in three or four critical depths
- No Secondary Hydrologic Support
- Knowledge of Site Characteristics [2]

[1] **Drying/Wetting:**
The proposed project would result in flow changes that will determine the amount of time a particular elevation would be inundated. A drying is a negative change in the percentage of time a particular elevation is inundated; a wetting is a positive change in the percentage of time an elevation is inundated.

[2] **Site Characteristics:**

- Geomorphology: oxbows, bars, flood plains etc.
- Microtopography
- Manmade structures: berms, dikes, culverts

[3] **Secondary Hydrologic Support (may increase or decrease the categorical placement):**

- Site location in relation to river geometry
- Head source
- Proximity to bank
- Springs or seeps present

ULTs have been identified as sensitive to pollination needs for reproduction. Pollinator species need a general vegetative community type in ULT habitat in order for pollinators to be present in numbers great enough to successfully pollinate an orchid population. A change in condition (direct effect by construction, or change in hydrologic operation of a system) that may decrease favorable associated plant species by greater than 50 percent in occupied habitat would be considered a significant effect.

3.9.8.2 Potential Effects Eliminated From Further Analysis

There would be no effects on Bonytail, Colorado pikeminnow, Humpback chub, Razorback sucker, Desert valvata, Deseret milkvetch and Clay phacellia because no occurrence of these species has been found within the impact area of influence.

There would be no effects on June sucker and Ute ladies'-tresses from construction of any of the ULS features because no construction activities would occur in or near the habitats of these species.

There would be no effects on western yellow-billed cuckoo from construction of the following ULS features because these would not be located in or near any recorded habitats of the species.

- Sixth Water Power Facility and Transmission Line
- Upper Diamond Fork Power Facility and Buried Transmission Line
- Spanish Fork Canyon Pipeline
- Santaquin-Mona Reservoir Pipeline

There would be no effects on Canada lynx and western yellow-billed cuckoo from operation and maintenance of the Proposed Action and other alternatives. Operation and maintenance activities would not affect any habitat or potential habitat for these species. Flow changes would be minimal in the area that these species would occur and maintenance activities would not involve major changes or activities.

Bald eagles would not be adversely affected by the construction or operation of the Proposed Action and other alternatives. Construction of ULS features would not affect known nesting or primary roosting sites, or foraging habitats. Operations would increase the forage base for bald eagles.

There would be no effects on June sucker in Utah Lake from operation of the Proposed Action and other alternatives. The change in reservoir storage volume and stage are shown in Chapter 3, Section 3.2.8.2.4 Surface Water Hydrology. The incremental change would be small relative to baseline reservoir operations, and would be within the normal historic fluctuations of Utah Lake. June sucker larval recruitment into Utah Lake would be improved from the Provo River (see Section 3.9.8.3.2.1).

There would be no effects on June sucker in Hobble Creek from operation of the Proposed Action and other alternatives. June suckers do not currently use Hobble Creek and other elements of the June sucker Recovery Program (re-channeling Hobble Creek, removal of beaver dams, etc.). These would need to be implemented before increased flows, per se, would affect June sucker spawning in Hobble Creek.

3.9.8.3 Spanish Fork Canyon-Provo Reservoir Canal Alternative (Proposed Action)

3.9.8.3.1 Construction Phase

3.9.8.3.1.1 Sixth Water Power Facility and Transmission Line Upgrade

A. Canada Lynx. The Sixth Water Power Facility would be located at the existing Sixth Water Flow Control Structure along Sixth Water Creek about 4 miles from the lynx key linkage route and about 10 miles southwest of the closest historical sighting. The Sixth Water Transmission Line upgrade would run parallel to and about 2 miles west of the lynx key linkage route for about 4 miles, and then would run southwest away from the lynx key linkage route. The upgraded transmission line would be about 9 miles southwest of the closest historical sighting. Construction of the power facility and transmission line upgrade would have no effect on the key linkage route, lynx habitat, or lynx since there is no documented historical use of the area by lynx and there are no known lynx populations or individuals in the effect area of influence.

3.9.8.3.1.2 Spanish Fork-Santaquin Pipeline

A. Yellow-billed Cuckoo. The pipeline corridor would pass close to a recorded cuckoo nest site at the Brigham Young University Agricultural Station and within 1 mile of a Santaquin City site. The construction SOPs (Chapter 1, Section 1.8.8, Standard Operating Procedures During Construction) would prevent construction from affecting these potential nesting sites. Construction of the Spanish Fork-Santaquin Pipeline would not exceed the evaluation criteria (Section 3.9.8.1 above).

3.9.8.3.1.3 Mapleton-Springville Lateral Pipeline

A. Yellow-billed Cuckoo. There are narrow patches of riparian habitat scattered along the Mapleton-Springville Lateral, but these would not be high quality cuckoo nesting habitat because of the absence of mature cottonwood overstory in most of these areas and because of their small size and narrow profile. No cuckoo nest sites have been recorded in the construction corridor. Construction of the Mapleton-Springville Lateral Pipeline would not cause exceed the evaluation criteria (Section 3.9.8.1 above).

3.9.8.3.1.4 Spanish Fork-Provo Reservoir Canal Pipeline

A. Yellow-billed Cuckoo. There are historic records of yellow-billed cuckoo occurrences within 1 mile of the proposed pipeline corridor through Provo City, including records on the Brigham Young University campus and the Provo City Cemetery. Disturbance from pipeline construction would be minimal because of the amount of current human presence and activity in these areas. Construction activities would not exceed the evaluation criteria (Section 3.9.8.1 above).

3.9.8.3.2 Operations Phase

3.9.8.3.2.1 Aquatic Species

A. June Sucker

Provo River Murdock Diversion to Interstate 15. The average monthly flows in the Provo River between Murdock Diversion and Interstate 15 under the Proposed Action represent a projected increase compared to baseline conditions (See Section 3.2.8.3.1, Table 3-4, Surface Water Hydrology). Under the Proposed Action, the reach of the Provo River between Murdock Diversion and Interstate 15 would receive flow increases in all months. These increased flows would be created from conserved water, the 3,300 acre-feet of purchased water, and the 16,000 acre-feet of in-stream flow water, which would benefit June sucker. The Fort Field Diversion at Interstate 15 is a partial passage barrier during June sucker spawning. During very high water years, adults can utilize an additional 1.9 miles of habitat up to the Tanner Race Diversion Dam. Flows in the Murdock Diversion to Interstate 15 reach were used to predict habitat availability for June sucker between Tanner Race Diversion and Interstate 15. Increased flow during May, June, (spawning) and July (larval/young-of-year/out migration) in this reach was designed to benefit June sucker spawning and early life history. In-stream flows would be targeted during summer months to support incubation and facilitate out-migration of juvenile suckers to Utah Lake.

In the reach between Tanner Race Diversion and Interstate 15, predicted spawning habitat for June sucker during May-June would be greater than baseline. The moderate/mid-depth habitat niche would increase 192 percent in May and 122 percent in June compared to baseline conditions (Table 3-55). In summary, monthly average flows in May and June under the Proposed Action would produce significant increases in the amount of June sucker spawning habitat in the reach of the Provo River between Tanner Race Diversion and Interstate 15 compared to baseline conditions. Furthermore, the total amount of available spawning habitat in the Provo River would slightly increase under the Proposed Action.

Additional habitat niche modeling in the reach of the Provo River between Tanner Race Diversion and Interstate 15 indicated that predicted backwater/edge and slow/shallow habitat in July would decrease compared to baseline conditions.

The 50-year average WUA values for the backwater/edge habitat niche would decrease by 61 percent compared to baseline conditions (Table 3-56). Projected habitat for the slow/shallow habitat niche would decrease by 8 percent. Although the backwater/edge habitat niche was predicted to experience a large proportional decrease in predicted habitat, the actual magnitude of the decrease was relatively small (2,007 ft^2) compared to the amount of new habitat available in the slow/shallow habitat niche (14,637 ft^2).

June sucker in their early life history stages would be expected to use habitat in both slow-flow niches. The total habitat decrease in both niches was predicted to be 3,226 ft^2 under the Proposed Action, with total available habitat in both of these niches decreased by approximately 20 percent compared to baseline conditions. Predicted decreases in habitat for early life stages may be offset by gains in spawning habitat for adult June sucker, particularly since available literature indicates larval June sucker drift downstream immediately after emerging (Modde and Muirhead 1990).

Table 3-55
PHABSIM Predictions for Moderate/Mid-depth Habitat Niche Under Proposed Action Flows in the Provo River From Tanner Race Diversion to Interstate 15 [a,b,d]

Flow Scenario	Month	Average Monthly Flow (cfs)	Moderate/Mid-Depth Habitat Niche: Average WUA (ft^2)	Moderate/Mid-Depth Habitat Niche: Percent Change from Baseline
Baseline Condition	May	352	3,198	--
	June	381	3,409	--
Proposed Action	May	441	9,326	192
	June	429	7,565	122

Notes:
[a] WUA results were expressed as square feet per 1,000 feet of river
[b] Results from Site 1 were extrapolated to represent habitat throughout this Provo River reach
[c] Existing condition data taken from USGS Gage Provo River at Provo during 1950-1999
[d] Average monthly flow and average WUA calculated over period of record (1950-1999)

Table 3-56
PHABSIM Predictions for Slow Flow Habitat Niches in July Under Proposed Action Flows in the Provo River From Tanner Race Diversion to Interstate 15 [a,b,d]

Flow Scenario	July Average Monthly Flow (cfs)	Backwater/Edge Habitat Niche: WUA (ft^2)	Backwater/Edge Habitat Niche: Percent Change from Baseline	Slow/Shallow Habitat Niche: WUA (ft^2)	Slow/Shallow Habitat Niche: Percent Change from Baseline
Baseline	57	3,311	--	15,856	--
Proposed	58	1,304	-61	14,637	-8

Notes:
[a] WUA results were expressed as square feet per 1,000 feet of river
[b] Results from Site 1 were extrapolated to represent habitat throughout this Provo River reach
[c] Existing condition data taken from USGS Gage Provo River at Provo during 1950-1999
[d] Average monthly flow and average WUA calculated over period of record (1950-1999)

Provo River Interstate 15 to Utah Lake. The reach of the Provo River between Interstate 15 and Utah Lake would receive higher flows compared to baseline conditions in all months (See Section 3.2.8.3.1, Table 3-4, Surface Water Hydrology) with the highest proportional flow increases projected to occur in August and September.

Simulated habitat during May-June (spawning niche) would be greater than baseline under the Proposed Action, with the moderate/mid-depth habitat niche increasing 96 to 181 percent compared to baseline conditions (Table 3-57). Habitat in this niche was projected to increase 181 percent in May and 96 percent in June. The increased flows would produce significant increases in June sucker spawning habitat in this reach of the Provo River.

Table 3-57
PHABSIM Predictions for Moderate/Mid-depth Habitat Niche
Under Proposed Action Flows in the Provo River
From Interstate 15 to Utah Lake [a,b,d]

			Moderate/Mid-Depth Habitat Niche	
Flow Scenario	**Month**	**Average Monthly Flow (cfs)**	**Average WUA (ft^2)**	**Percent Change from Baseline**
Baseline Condition	May	347	6,570	--
	June	374	7,011	--
Proposed Action	May	445	18,467	181
	June	433	13,763	96

Notes:
[a] WUA results were expressed as square feet per 1,000 feet of river
[b] Results from Site 1 were extrapolated to represent habitat throughout this Provo River reach
[c] Existing condition data taken from USGS Gage Provo River at Provo during 1950-1999
[d] Average monthly flow and average WUA calculated over period of record (1950-1999)

In general, hydrologic changes in July would have potential positive effects on the early life history stages of June sucker. Projected flow increases during July of 68 cfs would aid the dispersal of June sucker larvae as they drift downstream to Utah Lake. Habitat modeling of the backwater/edge and slow/shallow habitat niches in July from 1950 to 1999 indicated another benefit to early life stages of June sucker. Additional flow to this reach under the Proposed Action resulted in modeled average monthly flows for July that never declined to zero. Under baseline conditions, 31 of 50 modeled July average monthly flows would be zero. Based on historical flows and habitat modeling during the month of July, a significant benefit to the early life history stages of June sucker would be achieved because water would be available in the Provo River downstream of Interstate 15 every year.

Habitat niche modeling over the entire period of record indicated that backwater/edge and slow/shallow habitat niches showed negligible changes compared to baseline conditions (Table 3-58). Average WUA values for these niches would change less than two percent over the entire time period. Although 50-year averages of flow and available habitat in July would experience minor changes between baseline conditions and the Proposed Action, a significant benefit to the early life history stages of June sucker would be achieved under the Proposed Action because water would be available in the Provo River downstream of Interstate 15 every year.

Table 3-58 PHABSIM Predictions for Slow Flow Habitat Niches in July Under Proposed Action Flows in the Provo River From Interstate 15 to Utah Lake [a,b,d]					
		Backwater/Edge Habitat Niche		Slow/Shallow Habitat Niche	
Flow Scenario	July Average Monthly Flow (cfs)	WUA (ft^2)	Percent Change from Baseline	WUA (ft^2)	Percent Change from Baseline
Baseline	57	9,647	--	16,885	--
Proposed	58	9,638	No Change	17,079	1

Notes:
[a] WUA results were expressed as square feet per 1,000 feet of river
[b] Results from Site 1 were extrapolated to represent habitat throughout this Provo River reach
[c] Existing condition data taken from USGS Gage Provo River at Provo during 1950-1999
[d] Average monthly flow and average WUA calculated over period of record (1950-1999)

Based on modeling results for all three habitat niches used by June sucker in the Provo River, total available habitat would significantly increase compared to baseline conditions. Habitat niche modeling in both reaches of the Provo River indicated that the moderate/mid-depth habitat niche would experience significant increases, although predicted habitat increases in the moderate/mid-depth habitat niche could cause some indirect negative effects on June sucker by improving habitat suitability for predatory fish species, such as brown trout, white bass and walleye. In contrast to moderate flow habitats, slow water habitats were projected to decrease significantly in the reach between Tanner Race Diversion and Interstate 15, and less significantly in the reach between Interstate 15 and Utah Lake compared to baseline conditions. In both reaches of the Provo River, the small magnitude of projected habitat decreases for early life stages would be offset by large predicted habitat gains for spawning June sucker. July flow increases in both reaches of the Provo River would provide a benefit to young-of-year June sucker by restoring the hydrograph to a more natural condition.

3.9.8.3.2.2 Plant Species

A. Ute Ladies'-tresses

Spanish Fork River From Diamond Fork Creek to the Spanish Fork Diversion Dam. There are seven known occurrences of Ute ladies'-tresses in this reach of the Spanish Fork River. River flows in this reach are shown in Section 3.2.8.3, Table 3-2.

The effects analysis was performed by simulating the changes in Spanish Fork River using HEC-RAS analysis of two Spanish Fork River cross sections (CUWCD 1999a). The baseline and Proposed Action flows (Table 3-3) were evaluated in the HEC-RAS analysis. The HEC-RAS results, which include river flow and stage, water velocity and backwater elevation at each cross section, indicate that the Proposed Action flows may result in a decrease in river stage at the two cross sections from baseline conditions ranging from 0.1 to 0.7 feet. These simulated flows are not expected to change the hydrology around the Spanish Fork River Ute Ladies'-tresses colonies because the majority of the individuals are situated outside direct influence of these simulated river stages, and are primarily supported by a secondary hydrology. One of these colonies is supported in part from drainage of an off-channel pond, others may be supported by springs and seep, and still others may be supported by subsurface flows through the alluvium. Those colonies associated more closely with Spanish Fork River hydrology are located on flat bars in the river, and are so close to the river surface that they potentially may not be negatively impacted by this proposed change in river stage. If the potential 0.1- to 0.7-foot reduction in Spanish Fork River stage were to result in a comparable decrease in water flow through side channels, it is assumed that colonies in these side channels would emerge in lower portions of the side channels, analogous to their relative position to the current river stage. Projected decreased flows in the Spanish Fork River are not likely to adversely affect ULT individuals or habitat.

3.9.8.3.3 Summary of Proposed Action Effects

3.9.8.3.3.1 Yellow-billed Cuckoo. Construction activities would not exceed the evaluation criteria.

3.9.8.3.3.2 June sucker. Proposed flows would provide a 192 percent higher WUA in May and 122 percent higher WUA in June for the moderate flow – mid-depth habitat on an annual basis for June sucker specific spawning habitat in the Provo River between the Tanner Diversion and Interstate 15 compared to baseline conditions. Proposed flows would provide a 181 percent higher WUA in May and 96 percent higher WUA in June for the moderate flow – mid-depth habitat on an annual basis for June sucker specific spawning habitat in the Provo River between the Interstate 15 and Utah Lake compared to baseline conditions. Backwater/edge habitat niche would decrease by 61 percent and slow flow/shallow habitat would decrease by 8 percent from baseline from Tanner Diversion to Interstate 15. Backwater/edge and slow flow/shallow habitat would not change from Interstate 15 to Utah Lake. The small magnitude of projected habitat decreases for early life stages would be offset by large predicted habitat gains for spawning June sucker. July flow increases in both reaches of the Provo River would provide a benefit to young-of-year June sucker by restoring the hydrograph to a more natural condition. Changes in predation on June sucker from increased populations of predator studies were not analyzed.

3.9.8.3.3.3 Ute Ladies'-tresses. Projected decreased flows in the Spanish Fork River are not likely to adversely affect ULT individuals or habitat.

3.9.8.5 Bonneville Unit Water Alternative

3.9.8.5.1 Construction Phase

3.9.8.5.1.1 Yellow-billed Cuckoo. The effects on the yellow-billed cuckoo from the Spanish Fork-Santaquin Pipeline (Section 3.9.8.3.1.1), and the Mapleton-Springville Lateral Pipeline (Section 3.9.8.3.1.2) would be the same as described under the Spanish Fork Canyon -Provo Reservoir Canal Alternative.

3.9.8.5.2 Operations Phase

3.9.8.5.2.1 June sucker

Provo River Murdock Diversion to Interstate 15. The average monthly flows in the Provo River from the Murdock Diversion to Interstate 15 under the Bonneville Unit Water Alternative represent a projected increase compared to baseline conditions (See Section 3.2.8.4.1, Table 3-4, Surface Water Hydrology). This reach of the Provo River between Murdock Diversion and Interstate 15 would receive equal or increased flow in all months. The Fort Field Diversion at Interstate 15 is a partial passage barrier during June sucker spawning. During very high water years, adults can utilize an additional 1.9 miles of habitat up to the Tanner Race Diversion Dam. Flows in the Murdock Diversion to Interstate 15 reach were used to predict habitat availability for June sucker between Tanner Race Diversion and Interstate 15. Increased flow during May, June, (spawning) and July (larval/young-of-year/out migration) in this reach was designed to benefit June sucker spawning and early life history. In-stream flows would be targeted during summer months to support incubation and facilitate out-migration of juvenile suckers to Utah Lake.

In the reach of the Provo River between Tanner Race Diversion and Interstate 15, predicted spawning habitat for June sucker during May-June would be greater than baseline. In this alternative, the moderate/mid-depth habitat niche would increase 134 percent in May and 64 percent in June compared to baseline conditions (Table 3-59). In summary, monthly average flows in May and June would produce significant increases in the amount of June sucker spawning habitat in the reach of the Provo River between Tanner Race Diversion and Interstate 15 compared to baseline conditions. Furthermore, the total amount of available spawning habitat in the Provo River would slightly increase under the Bonneville Unit Water Alternative.

Table 3-59
PHABSIM Predictions for Moderate/Mid-depth Habitat Niche Under Bonneville Unit Water Alternative Flows in the Provo River From Tanner Race Diversion to Interstate 15 [a,b,d]

			Moderate/Mid-Depth Habitat Niche	
Flow Scenario	**Month**	**Average Monthly Flow (cfs)**	**Average WUA (ft^2)**	**Percent Change from Baseline**
Baseline Condition	May	352	3,189	--
	June	381	3,409	--
Bonneville Unit Water Alternative	May	399	7,461	134
	June	410	5,604	64

Notes:
[a] WUA results were expressed as square feet per 1,000 feet of river
[b] Results from Site 1 were extrapolated to represent habitat throughout this Provo River reach
[c] Existing condition data taken from USGS Gage Provo River at Provo during 1950-1999
[d] Average monthly flow and average WUA calculated over period of record (1950-1999)

Additional habitat niche modeling in the reach of the Provo River between Tanner Race Diversion and Interstate 15 indicated that predicted backwater/edge and slow/shallow habitat in July would decrease under this alternative compared to baseline conditions.

The 50-year average WUA values for the backwater/edge habitat niche would decrease by 55 percent compared to baseline conditions (Table 3-60). Projected habitat for the slow/shallow habitat niche would increase by 10 percent. Although the backwater/edge habitat niche was predicted to experience a large proportional decrease in predicted habitat, the actual magnitude of the decrease was relatively small (1,808 ft^2) compared to the amount of new habitat available in the slow/shallow habitat niche (17,433 ft^2).

June sucker in their early life history stages would be expected to use habitat in both slow-flow niches. The total habitat decrease in both niches was predicted to be 231 ft^2, with total available habitat in both of these niches decreased by approximately 1 percent compared to baseline conditions. Predicted decreases in habitat for early life stages may be offset by gains in spawning habitat for adult June sucker, particularly since available literature indicates larval June sucker drift downstream immediately after emerging (Modde and Muirhead 1990).

Table 3-60 PHABSIM Predictions for Slow Flow Habitat Niches in July Under Bonneville Unit Water Alternative Flows in the Provo River From Tanner Race Diversion to Interstate 15 [a,b,d]					
		Backwater/Edge Habitat Niche		**Slow/Shallow Habitat Niche**	
Flow Scenario	**July Average Monthly Flow (cfs)**	**WUA (ft^2)**	**Percent Change from Baseline**	**WUA (ft^2)**	**Percent Change from Baseline**
Baseline	50	3,311	--	15,856	--
Bonneville Unit Water	94	1,503	-55	17,433	10

Notes:
[a] WUA results were expressed as square feet per 1,000 feet of river
[b] Results from Site 1 were extrapolated to represent habitat throughout this Provo River reach
[c] Existing condition data taken from USGS Gage Provo River at Provo during 1950-1999
[d] Average monthly flow and average WUA calculated over period of record (1950-1999)

Provo River Interstate 15 to Utah Lake. The reach of the Provo River between Interstate 15 and Utah Lake would receive equal or higher flows compared to baseline conditions in all months, with the highest proportional flow increases projected to occur in July and August (Table 3-61).

Table 3-61 Estimated Average Flow (cfs) and Percent Change in Provo River From Interstate 15 to Utah Lake for the Bonneville Unit Water Alternative Compared to Baseline Flows (average water year)												
	Month											
Flow Condition	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
Baseline	32	76	56	51	64	142	168	347	374	42	4	6
Proposed	41	76	56	52	68	145	213	404	414	93	30	26
% Change	28	0	0	2	6	2	27	16	11	121	650	333

In the lower Provo River from Interstate 15 to Utah Lake, simulated habitat during May-June (spawning niche) would be greater than baseline under the Bonneville Unit Water Alternative. Habitat in this niche was projected to increase 111 percent in May and 64 percent in June (Table 3-62). The increased flows would produce significant increases in June sucker spawning habitat in the reach of the Provo River between Interstate 15 and Utah Lake.

Table 3-62
PHABSIM Predictions for Moderate/Mid-depth Habitat Niche Under Bonneville Unit Water Alternative Flows in the Provo River From Interstate 15 to Utah Lake [a,b,d]

			Moderate/Mid-Depth Habitat Niche	
Flow Scenario	**Month**	**Average Monthly Flow (cfs)**	**Average WUA (ft^2)**	**Percent Change from Baseline**
Baseline Condition	May	340	6,441	--
	June	374	7,011	--
Bonneville Unit Water Alternative	May	404	13,568	111
	June	414	11,488	64

Notes:
[a] WUA results were expressed as square feet per 1,000 feet of river
[b] Results from Site 1 were extrapolated to represent habitat throughout this Provo River reach
[c] Existing condition data taken from USGS Gage Provo River at Provo during 1950-1999
[d] Average monthly flow and average WUA calculated over period of record (1950-1999)

In general, hydrologic changes in July would have potential positive effects on the early life history stages of June sucker. Projected flow increases during July of 68 cfs would aid the dispersal of June sucker larvae as they drift downstream to Utah Lake. Habitat modeling of the backwater/edge and slow/shallow habitat niches in July from 1950 to 1999 indicated another benefit to early life stages of June sucker. Additional flow to this reach under the Bonneville Unit Water Alternative resulted in modeled average monthly flows for July that never declined to zero. Under baseline conditions, 31 of 50 modeled July average monthly flows would be zero. Based on historical flows and habitat modeling during the month of July, a significant benefit to the early life history stages of June sucker would be achieved because water would be available in the Provo River downstream of Interstate 15 every year.

Habitat niche modeling over the entire period of record indicated that backwater/edge and slow/shallow habitat niches showed significant increases compared to baseline conditions (Table 3-63). Although 50-year averages of flow and available habitat in July would experience minor changes between baseline conditions and the Bonneville Unit Water Alternative, a significant benefit to the early life history stages of June sucker would be achieved because water would be available in the Provo River downstream of Interstate 15 every year.

Table 3-63
PHABSIM Predictions for Slow Flow Habitat Niches in July Under Bonneville Unit Water Alternative Flows in the Provo River From Interstate 15 to Utah Lake [a,b,d]

		Backwater/Edge Habitat Niche		Slow/Shallow Habitat Niche	
Flow Scenario	**July Average Monthly Flow (cfs)**	**WUA (ft^2)**	**Percent Change from Baseline**	**WUA (ft^2)**	**Percent Change from Baseline**
Baseline	42	1,506	--	5,011	--
Bonneville Unit Water	93	3,910	160	21,263	324

Notes:
[a] WUA results were expressed as square feet per 1,000 feet of river
[b] Results from Site 1 were extrapolated to represent habitat throughout this Provo River reach
[c] Existing condition data taken from USGS Gage Provo River at Provo during 1950-1999
[d] Average monthly flow and average WUA calculated over period of record (1950-1999)

Based on modeling results for all three habitat niches used by June sucker in the Provo River, total available habitat under this alternative would significantly increase compared to baseline conditions. Habitat niche modeling in both reaches of the Provo River indicated that the moderate/mid-depth habitat niche would experience significant increases, although predicted habitat increases in the moderate/mid-depth habitat niche could cause some indirect negative effects on June sucker by improving habitat suitability for predatory fish species, such as brown trout, white bass and walleye. In contrast to moderate flow habitats, slow water habitats were projected to decrease significantly in the reach between Tanner Race Diversion and Interstate 15, and less significantly in the reach between Interstate 15 and Utah Lake compared to baseline conditions. In both reaches of the Provo River, the small magnitude of projected habitat decreases for early life stages would be offset by large predicted habitat gains for spawning June sucker. July flow increases in both reaches of the Provo River would provide a benefit to young-of-year June sucker by restoring the hydrograph to a more natural condition.

The Utah Division of Wildlife Resources issued a final management plan for the Provo River in August 2003 (UDNR 2003a). The management plan for the lower 4.9 miles of the Provo River is focused on special fish species – June sucker. The management plan identifies six objectives: 1) to provide a recreational sport fishery that meets public demands; 2) meet goals and objectives established in conservation agreements developed for sensitive species through implementation of identified conservation actions; 3) implement or assist in the actions required for recovery of June sucker; 4) obtain population, distribution, and/or life history information for native fish, amphibians, reptiles, and mollusks that occur in this hydrological unit with emphasis on sensitive species communities; 5) Identify and enhance aquatic habitats cooperatively through watershed improvement projects; and 6) coordinate actions taken in Objectives 1 through 5 in order to avoid conflicts. This management plan does not address the problem of predatory fishes in Utah Lake and the lower Provo River, and it does not address the effect of predatory fishes on June sucker recruitment and how the Division of Wildlife Resources would correct this problem to achieve recovery of the June sucker.

Brown trout, walleye, and white bass occur in the two Provo River reaches being managed for June sucker, and these and other non-native species are likely predators on June sucker larvae. Objective 3 of the Utah Division of Wildlife Resources management plan includes monitoring effectiveness of any non-native control methods implemented in the Provo River. The summary of actions needed to meet Objective 3 for June sucker recovery is taken from the June Sucker (*Chasmistes liorus*) Recovery Plan (USFWS 1999). The non-native control action is to investigate feasibility of mechanically controlling non-native fish predators within the Provo River. If this action is determined to be feasible, then mechanical means would be used to control non-native fish predators in the Provo River. A second task identified as a needed action is to assist in providing flows that minimize non-native fish use of the Provo River. A third task identified as a needed action is to monitor effectiveness of non-native control methods in the Provo River.

The joint lead agencies (JLA) are actively involved in the JSRIP and they have dedicated budgets and programs to accomplish the actions listed in the June sucker recovery plan. The JLA are actively working with other partners in the JSRIP to provide flows and habitat conditions to help achieve June sucker recovery. The flows that would be provided under the ULS are only part of the actions needed to achieve species recovery, and other inter-related actions include non-native fish control and habitat restoration and enhancement. The JSRIP's role is to ensure a diversified and balanced approach to recovery. The flows are one component of the actions needed to recover June sucker.

3.9.8.5.2.2 Ute Ladies'-tresses

Spanish Fork River From Diamond Fork Creek to Spanish Fork Diversion Dam. Flows in the Spanish Fork River in this reach are shown in Section 3.2.8.4, Table 3-4.

Projected decreased flows in July through September are not likely to adversely affect ULT individuals or habitat.

3.9.8.5.3 Summary of Bonneville Unit Water Alternative Effects

3.9.8.5.3.1 Yellow-billed Cuckoo. Construction activities would not exceed the evaluation criteria (see Section 3.9.8.1.

3.9.8.5.3.2 June sucker. Proposed flows would provide a 134 percent higher WUA in May and 64 percent higher WUA in June for the moderate flow – mid-depth habitat on an annual basis for June sucker specific spawning habitat in the Provo River between the Tanner Diversion and Interstate 15 compared to baseline conditions. Proposed flows would provide a 111 percent higher WUA in May and 64 percent higher WUA in June for the moderate flow – mid-depth habitat on an annual basis for June sucker specific spawning habitat in the Provo River between the Interstate 15 and Utah Lake compared to baseline conditions. Backwater/edge habitat niche would decrease by 55 percent and slow flow/shallow habitat would increase by 10 percent from baseline from Tanner Diversion to Interstate 15. Backwater/edge habitat would increase by 160 percent and slow flow/shallow habitat would increase by 324 percent over baseline from Interstate 15 to Utah Lake. The large predicted habitat gains for spawning June sucker would provide a benefit to young-of-year June sucker by restoring the hydrograph to a more natural condition. Changes in predation on June sucker from increased populations of predator studies were not analyzed.

3.9.8.6.3.3 Ute Ladies'-tresses. Projected decreased flows in July through September are not likely to adversely affect ULT individuals or habitat.

3.9.8.6 No Action Alternative

No features would be constructed under this alternative. However, under this alternative the JLA would deliver water previously secured for June sucker benefits in the amount of 12,165 acre-feet as described for the other two alternatives. This water has been secured and would be delivered on a pattern deemed best to optimize June sucker spawning generally in the months of April through July of each year. In addition, water acquired by the Mitigation Commission (water shares representing about 3,300 acre-feet) would be delivered under the No Action Alternative. See Section 3.2, Table 3-4 for quantification of flow changes in the Provo River reflecting these releases under the No Action Alternative.

3.9.8.6.1 Operations Phase

3.9.8.6.1.1 June sucker. The effect on June sucker would be the same as described under the Bonneville Unit Water Alternative (Section 3.9.8.5.2.2).

3.9.8.6.1.2 Ute Ladies'-tresses. There would be no effect as flows in the Spanish Fork River would be the same as under baseline.

3.9.8.6.2 Summary of No Action Alternative Effects

3.9.8.6.2.1 June sucker. Proposed flows would provide a 134 percent higher WUA in May and 64 percent higher WUA in June for the moderate flow – mid-depth habitat on an annual basis for June sucker specific spawning habitat in the Provo River between the Tanner Diversion and Interstate 15 compared to baseline conditions. Proposed flows would provide a 111 percent higher WUA in May and 64 percent higher WUA in June for the moderate flow – mid-depth habitat on an annual basis for June sucker specific spawning habitat in the Provo River between the Interstate 15 and Utah Lake compared to baseline conditions. Backwater/edge habitat niche would decrease by 55 percent and slow flow/shallow habitat would increase by 10 percent from baseline from Tanner Diversion to Interstate 15. Backwater/edge habitat would increase by 160 percent and slow flow/shallow habitat would increase by 324 percent over baseline from Interstate 15 to Utah Lake. The large predicted habitat gains for spawning June sucker would provide a benefit to young-of-year June sucker by restoring the hydrograph to a more natural condition. Changes in predation on June sucker from increased populations of predator studies were not analyzed.

3.9.8.6.2.2 Ute Ladies'-tresses. There would be no effect as flows in the Spanish Fork River would be the same as under baseline.

3.10 Sensitive Species

3.10.1 Introduction

This analysis addresses potential impacts on sensitive species and their habitat from construction and operation of the Proposed Action and other alternatives. Potential effects on threatened and endangered species are discussed in Section 3.9.

3.10.2 Issues Raised in Scoping Meetings

- What would be the impacts of possible catastrophic failure of the pipeline through Utah Lake?
- What would be the impacts of the ULS project on least chub and spotted frog?
- What would be the impacts of each of the ULS concepts on any species covered by Conservation Agreements or Strategies?
- What would be the impacts of any of the ULS concepts on the endangered June sucker and Bonneville cutthroat trout?
- What would be the impacts on threatened, endangered and sensitive species from each of the ULS concepts?
- What would be the effect on the boreal toad in the Bryants Fork and Mud Creek areas of Strawberry Valley?

3.10.3 Scoping Issues Eliminated From Further Analysis

What would be the impacts of possible catastrophic failure of the pipeline through Utah Lake?

The Spanish Fork-Bluffdale Alternative, the only alternative that would have included a pipeline across Utah Lake, has been dropped from further analysis (see Chapter 1, Section 1.11.1).

What would be the effect on the boreal toad in the Bryants Fork and Mud Creek areas of Strawberry Valley?

The Strawberry Reservoir – Deer Creek Reservoir Alternative, the only alternative with facilities in the Strawberry Valley, has been eliminated from detailed analysis. Please see Chapter 1, Section 1.11.8.

3.10.4 Scoping Issues Addressed in the Impact Analysis

All the issues identified in Section 3.10.2 are addressed except the issue listed in Section 3.10.3.

3.10.5 Description of Impact Area of Influence

The ULS overall impact area of influence is shown on Map 3-2. The specific sensitive species impact area of influence within the overall area includes the following:

- The area directly affected by pipelines, access roads, pump stations, power lines, power facilities, and diversion structures
- All streams and rivers and associated riparian corridors that would have alterations in flow from baseline conditions
- Wetlands affected by changes in surface or groundwater flows (see Map 3-6)

3.10.6 Methodology

The impact analysis considered the standard operating procedures (SOPs) and project design features that the District will implement as part of the project.

3.10.6.1 Assumptions

None.

3.10.6.2 Impact Analysis Methodology

3.10.6.2.1 Wildlife Species. See Appendix E, Section E.2.1.

3.10.6.2.2 Aquatic Species. The methodology was the same as described in Appendix E, Section E.2.2, except as described in the following sections:

IFIM/PHABSIM – The leatherside chub was the only sensitive fish species identified as occurring in the impact area of influence. Habitat availability information specific for leatherside chub was not available. Instead, a more general, modeling approach was used to evaluate flow effects on seven niche habitats (backwater/edge, slow flow/shallow, moderate flow/shallow, fast flow/shallow, moderate flow/mid-depth, fast flow/mid-depth, moderate flow/deep).

This approach provides a more coarse measure of habitat usage than the habitat suitability by species model. A given habitat niche may be the only one used by a species during a certain life stage, but the niche could include areas used by other species. Leatherside chub habitats were modeled as a backwater/edge habitat niche. Adult, juvenile and young-of-year fish use this niche in the presence of adult brown trout. Habitat availability, calculated in WUA, was determined for each niche for each alternative.

Spanish Fork River – Water flow-elevation data was available for only two cross-sections near the Castilla gage in the Diamond Fork Creek-Spanish Fork Diversion Dam reach. Analysis of fish habitat in the Spanish Fork River was based on those cross-sections and applied to the entire reach of the river from Diamond Fork Creek to Utah Lake.

3.10.6.2.3 Plant Species. See Appendix E, Section E.2.3.

3.10.7 Affected Environment (Baseline Conditions)

Table 3-64 lists Utah State species of concern and Uinta National Forest sensitive species that may be impacted by construction or operation of ULS project features (UDNR 2003b; Larson 2004, USFS 2003a).

Table 3-64
Utah State Wildlife Species of Concern and Uinta National Forest Sensitive Species Potentially Present in the Impact Area of Influence

Common Name	Scientific Name	Group	Utah Status[1]
Fisher	*Martes pennanti*	Wildlife	*
Spotted Bat	*Euderma maculatum*	Wildlife	WSC*
Western Red Bat	*Lasiurus blossevillii*	Wildlife	WSC
Townsend's (Western) Big-Eared Bat	*Plecotus townsendii*	Wildlife	WSC *
Peregrine Falcon	*Falco peregrinus*	Wildlife	*
American White Pelican	*Pelecanus erythrorhynchos*	Wildlife	WSC
Northern Goshawk	*Accipiter gentilis*	Wildlife	CS
Short-eared Owl	*Asio flammeus*	Wildlife	WSC
Black Swift	*Cypseloides niger*	Wildlife	WSC
Bobolink	*Dolichonyx oryzivorus*	Wildlife	WSC
Long-billed Curlew	*Numenius americanus*	Wildlife	WSC
Ferruginous Hawk	*Buteo regalis*	Wildlife	WSC
Flammulated Owl	*Otus flammeolus*	Wildlife	*
Three-toed Woodpecker	*Picoides tridactylus*	Wildlife	WSC *
Smooth Greensnake	*Opheodrys vernalis*	Wildlife	WSC
Bonneville Cutthroat Trout	*Oncorhynchus clarki utah*	Aquatic	CS*
Colorado River Cutthroat Trout	*Oncorhynchus clarki pleuriticus*	Aquatic	CS*
Least Chub	*Iotichthys phlegethontis*	Aquatic	CS
Bluehead Sucker	*Catostomus discobolus*	Aquatic	WSC
Flannelmouth Sucker	*Catostomus latipinnis*	Aquatic	WSC
Leatherside Chub	*Gila copei*	Aquatic	WSC
Columbia Spotted Frog	*Rana luteiventris*	Aquatic	CS*
Western Toad	*Bufo boreas*	Aquatic	WSC
Utah Physa	*Physella utahensis*	Aquatic	WSC
California Floater	*Anodonta californiensis*	Aquatic	WSC
Barneby Woody Aster	*Aster kingii var barnebyana*	Plant	*
Dainty Moonwort	*Botrychium crenulatum Wagner*	Plant	*
Garrett's Bladderpod	*Lesquerella garretti*	Plant	*
Rockcress Draba	*Draba globulosa Payson*	Plant	*
Wasatch Jamesia	*Jamesia americana var. macrocalyx*	Plant	*

[1] CS = Conservation Species, WSC = Wildlife Species of Concern, * = Uinta National Forest Sensitive Species.

3.10.7.1 Wildlife Species

3.10.7.1.1 Fisher. The fisher (*Martes pennanti*) is the second largest member of the weasel family in North America and occupies closed-canopy mixed forest habitat in northern New England, upper Wisconsin and Minnesota, the Rocky Mountains and Sierra Nevada (Burt and Grossenheider 1980). In Utah, it has only been recorded once, not in the impact area of influence (UDNR 2003b). The fisher is listed by the Uinta National Forest because potential habitat is present within the forest boundary (USFS 2003a).

3.10.7.1.2 Spotted Bat. The spotted bat (*Euderma maculatum*) occupies a broad range of habitats at elevations from sea level to 10,000 feet MSL. It is believed to roost in crevices in rock outcrops and canyons. It has been recorded in the Provo City area (UDNR 2003a).

3.10.7.1.3 Western Red Bat. The western red bat (*Lasiurus blossevillii*) is found in wooded areas near water, but is uncommon in Utah. The bat roosts in caves or mines. Two occurrences are recorded in Mapleton City near Hobble Creek (UDNR 2003a).

3.10.7.1.4 Townsend's Big-eared Bat. Townsend's big-eared bat (*Corynorhinus townsendii pallescens*) usually lives near forested areas, roosting in both natural and man-made structures (UDNR 2003b). It is not uncommon in Utah, but populations are thought to be declining. It has been recorded in the impact area of influence in Provo City and along the Provo River.

3.10.7.1.5 Peregrine Falcon. The peregrine falcon (*Falco peregrinus*) was removed from the endangered species list in 1999 after the North American population recovered from serious declines caused by DDT in the mid-1900s. It is considered a Uinta National Forest sensitive species. Peregrine habitat is usually associated with cliffs or tall buildings for nesting, but foraging takes place over any open areas with other birds available for prey. Historically, it has nested along the Wasatch Front, but recent active nests have not been found. Utah Division of Wildlife Resources sightings have been recorded along the Wasatch Front from Provo to Springville.

3.10.7.1.6 American White Pelican. The American white pelican (*Pelecanus erythrorhynchos*) is an aquatic species that relies on large open water bodies for its primary food source of fish and associated islands or marshes for nesting. Currently, the only Utah nesting colony is on Gunnison Island in the Great Salt Lake (UDNR 2003a), but pelicans use Utah Lake for foraging and have been observed soaring over the Provo area.

3.10.7.1.7 Northern Goshawk. Northern goshawk (*Accipiter gentilis*) habitat is montane conifer/aspen forest and it is found widely throughout North American mountains. Populations in Utah are believed to be declining (UDNR 2003b), although populations in the Uinta National Forest are considered to be viable and stable (USFS 2003a).

3.10.7.1.8 Short-eared Owl. The short-eared owl (*Asio flammeus*) has the unusual habit of ground nesting. Widely distributed in North America, it hunts over any open terrain that supports populations of small rodents. Utah populations and habitats, including marshes, prairies, grasslands and shrub lands, are believed to be declining (UDNR 2003b). Sightings in the project area include the Heber Valley, Provo and Nephi.

3.10.7.1.9 Black Swift. The Black swift (*Cypseloides niger*) is the largest of North American swifts, nests in steep mountain canyons adjacent to or behind waterfalls, and forages high in the air, well above other swifts (Kaufman 1996). It is uncommon in Utah, but nesting sites have been confirmed in Provo Canyon and on Mount Timpanogos (UDNR 2003a).

3.10.7.1.10 Bobolink. The bobolink (*Dolichonyx oryzivorus*) breeds in moist grasslands and hayfields and, although common in the east, populations in the west, including Utah, now tend to be patchy (UDNR 2003b).

Their occurrences in the impact area of influence are heavily concentrated in the Heber Valley with a few records along the base of the Wasatch Front. None are close to proposed ULS features.

3.10.7.1.11 Long-billed Curlew. Long-billed curlew (*Numenius americanus*) is a large shorebird that actually utilizes upland habitats, particularly agricultural grasslands and meadows. They seem to be most successful nesting in mixed fields with adequate, but not tall, grass cover and fields with elevated points (UDNR 2003b). Breeding range in Utah is centered on the Great Salt Lake. There are Utah County records for the Provo area, Lakeshore and Nephi.

3.10.7.1.12 Ferruginous Hawk. The ferruginous hawk (*Buteo regalis*) is a large buteo species of open country in the western United States. Preferred habitat is sagebrush plains and dry grasslands where it hunts rabbits, ground squirrels and gophers (Kaufman 1996). Populations in Utah have been declining (USFS 2003a) and the species is classified as threatened. There is only one Utah Division of Wildlife Resources record in the project area, north of the Provo airport.

3.10.7.1.13 Flammulated Owl. The flammulated owl (*Otus flammeolus*) is an elusive small owl of mature and old growth conifer forests where it nests in woodpecker holes (UDNR 2003b). It is widespread and not thought to be declining in Utah, although its habitat may be at risk from timber harvesting (USFS 2003a).

3.10.7.1.14 Three-toed Woodpecker. The three-toed woodpecker (*Picoides tridactylus*) is a high mountain species that is common throughout its range and in the Uinta National Forest (USFS 2003a). It is classified as a sensitive species because of potential loss of preferred habitat in spruce/fir forests from timber harvesting. None of the preferred habitat would be affected by ULS alternatives.

3.10.7.1.15 Smooth Greensnake. The smooth greensnake (*Opheodrys vernalis*) prefers moist areas, especially moist grassy areas and meadows where the snake is camouflaged due to its solid green dorsal coloration. Preferred habitat is usually at higher elevations (UDNR 2003b). Uncommon in Utah, populations are declining. Utah Division of Wildlife Resources records indicate smooth greensnake occurrences in Provo City and lower Diamond Fork Creek.

3.10.7.2 Aquatic Species

3.10.7.2.1 Bonneville Cutthroat Trout. The Bonneville cutthroat trout (*Oncorhynchus clarki utah*) is found in relatively isolated habitats throughout its historical range. The Utah Conservation Agreement for Bonneville cutthroat trout has identified streams in the impact area of influence as potential locations for establishment of populations (Lentsch and Perkins 1997). Potentially pure strains occur in Wardsworth Creek (tributary to Hobble Creek) and the Right and Left forks of Hobble Creek, in Sixth Water Creek (Spanish Fork River basin), and in tributaries of the Provo River (Lentsch and Perkins 1997). Populations in Strawberry Reservoir have unknown genetic purity (Lentsch and Perkins 1997). Although they have historically occurred in the Provo River and Utah Lake, they are currently confined to headwater habitats that are not within the impact area of influence (USFWS 2001).

Bonneville cutthroat trout is currently considered sensitive by the U.S. Forest Service (Lentsch and Perkins 1997) as a management indicator species under the revised Land and Resource Management Plan (USFS 2003b). The primary goal is to conserve populations within significant portions of their historic range to provide for their continued existence (Lentsch and Perkins 1997). Conservation objectives written jointly for the Provo and Jordan Rivers are intended to: 1) maintain three populations and 16.4 miles of occupied stream and 350 surface acres of lentic habitat in the Jordan River drainage, and 2) maintain six populations and 88 miles of occupied stream and 350 surface acres of lentic water to Utah Lake and Provo River drainage (Lentsch and Perkins 1997). Sport fishing objectives in the Provo and Jordan Rivers are to: 1) maintain two populations, 30.2 occupied stream miles and 350 surface acres water in Jordan drainage, and 2) maintain two populations and 33 occupied stream miles in the Utah Lake/Provo River drainage (Lentsch and Perkins 1997).

The abundance and quality of the stream and lake habitat formerly available to the subspecies has declined as a result of over-harvesting and water diversion and degradation of riparian habitats from grazing, road building, mining and timber harvest (Addley and Hardy 1998, USFWS 2001). Rainbow trout have hybridized with cutthroat throughout the West, and competition and predation from brook and brown trout are suspected to have significantly reduced cutthroat numbers (Kershner 1995). Hybridization with other subspecies of cutthroat trout has reduced pure strains of Bonneville cutthroat trout (Lentsch and Perkins 1997).

3.10.7.2.2 Colorado River Cutthroat Trout. The Colorado River cutthroat trout (*Oncorhynchus clarki pleuriticus*) is native to the upper Colorado River drainage of Utah, Wyoming, Colorado, Arizona and New Mexico (Sigler and Sigler 1996). This subspecies prefers cool, clear water in high-elevation streams and lakes. Rainbow trout have hybridized with cutthroat throughout the West, and competition and predation from brook and brown trout are suspected to have significantly reduced cutthroat numbers (Kershner 1995). Hybridization with other subspecies of cutthroat trout has reduced pure strains of this subspecies.

Colorado River cutthroat trout are currently classified as a conservation species by the State of Utah and are designated as a sensitive species by the U.S. Forest Service. The Uinta National Forest considers it a management indicator species under the revised Land and Resource Management Plan (USFS 2003b). While its range includes some portions of Summit and Wasatch counties, it is not likely to occur in the impact area of influence.

3.10.7.2.3 Least Chub. The least chub (*Iotichthys phlegethontis*) is associated with springs at the base of the mountains and in the valley floors (Perkins et al. 1998). Historically the species was found in streams near Salt Lake City, freshwater ponds, swamps, tributaries around the Great Salt Lake, in Utah Lake, and in and around the Provo River. In 1995, the U.S. Fish and Wildlife Service determined that listing least chub as an endangered species was warranted and on September 29, 1995, proposed to list the species as endangered with critical habitat pursuant to the federal ESA (60 FR 50520). The State of Utah classifies least chub as a conservation species (Perkins et al. 1998).

The current distribution of this species is associated with springs in Snake Valley and in a small spring complex near the town of Mona in Juab County, and in the Mills Valley marsh complex in the Sevier River drainage (Perkins et al. 1998). These locations are not in the impact area of influence. Least chub typically are found in association with moderate to dense vegetation and in areas with moderate to no current (Sigler and Miller 1963). Declining groundwater and non-native predators are thought to pose significant risk to this species (Perkins et al. 1998).

3.10.7.2.4 Leatherside Chub. Leatherside chubs were found historically in streams and rivers of the eastern Bonneville Basin of Utah, the Sevier River system, and a few streams in Idaho and Wyoming (Sigler and Miller 1963). This species is a generalist occupying a wide variety of habitats, including a range of substrate types, flows, cover types and instream microhabitats (Sigler and Sigler 1987; Keleher 1994; Wilson and Belk 1996). The current abundance and distribution of leatherside chub is not well understood, but central Utah population numbers are substantially lower than historic levels (UDNR 2003b, Ellsworth and Keleher 1998). Potential causes for declines include habitat degradation from water diversions and competition from non-native species (Ellsworth and Keleher 1998).

The Utah Division of Wildlife Resources initiated sampling in the Utah Lake drainage in 1987 to determine the distribution and abundance of this species. Populations were found in the Provo River, Hobble Creek, Diamond Fork Creek, Sixth Water Creek, Spanish Fork River (including its tributaries), and the lower American Fork River near Utah Lake (CUWCD 1998c). Spring Lake, Spring Creek and Hop Creek in southern Utah County and Juab

County contained populations of leatherside chub. The State of Utah currently classifies leatherside chub as a species of special concern.

In the Spanish Fork Creek and Diamond Fork Creek systems, leatherside chub have been found predominantly in areas where braided channels and backwaters are abundant. These areas include Thistle Creek, Soldier Creek and portions of the Mill Race Canal near Spanish Fork. Leatherside chub have been observed occupying sheltered habitat with low to moderate current velocities, typically consisting of undercut banks with tree roots, backwaters, small eddies along the edges of rip-rapped banks, and the edges of runs adjacent to stream banks.

3.10.7.2.5 Flannelmouth Sucker. The flannelmouth sucker (*Catostomus latipinnis*) historically occurred throughout the entire Colorado River Basin. This species occupies moderate to large rivers, and is likely absent from impoundments (CUWCD 1998c). It is found in large rivers throughout its native range (Lee et al. 1980; Minckley 1973). The State of Utah currently classifies flannelmouth sucker as a species of special concern. Its National Heritage Status in Utah is S2 (imperiled). While its range includes some portions of Utah County, this species is endemic to the Colorado River drainage and is not likely to occur in the impact area of influence.

3.10.7.2.6 Bluehead Sucker. The bluehead sucker (*Catostomus discobolus*) is native to the upper Colorado River system, the Snake River system, and waters in the Lake Bonneville basin (Sigler and Sigler 1996). In Utah, bluehead suckers have been reduced in numbers and distribution due to flow alteration, habitat loss and alteration, and the introduction of nonnative fishes. This species occupies high gradient reaches of mountain rivers. The State of Utah classifies bluehead suckers as a species of special concern. Its National Heritage Status in Utah is S3 (vulnerable). While its range includes some portions of Utah and Summit counties, this species is endemic to the Colorado River drainage and not likely to occur in the impact area of influence.

3.10.7.2.7 California Floater. The California floater (*Anodanta californiensis*) is listed as threatened by the State of Utah. Its National Heritage Status in Utah is S1 (critically imperiled). There is some debate that the California floater may be the same species as several other mussels (*A. nuttalliana, A. wahlamatensis, A. oregonenesis*). If these species were lumped together, it is likely that the status could be downgraded (NatureServe 2003).

This mussel species has been found in various habitats, including creeks 6 to 12 inches deep with substrates of mud, gravel and sand, and supporting aquatic plants and algae (Oliver and Bosworth 1999). Other sources list habitat as "lakes and lake-like stream environments" (NatureServe 2003). This species is particularly sensitive to the addition of nutrients (e.g. from agriculture and urban runoff). California floater is known to exist in several locations in Utah, including at least one report of abundant local distribution. The California floater was documented in Utah Lake until the 1930s, but is now assumed to be extirpated there (NatureServe 2003, CUWCD 1998c).

The Utah Conservation Data Center reports recent observations of the California floater in the area of Mona Reservoir (GIS data records observation by Peter Hovingh, Department of Biochemistry, University of Utah – identification checked but uncertain or disputed, no date given, but threatened and endangered species data last updated May 31, 2002). Burraston Pond, located about 1.5 miles south of Mona Reservoir, is listed as "draft at-risk essential wildlife habitat" for the California floater by the Utah Division of Wildlife Resources. Occurrence of the California floater in the impact area of influence is unlikely.

3.10.7.2.8 Utah Physa. The Utah physa (*Physella utahensis*) is considered a species of special concern by the State of Utah with "declining populations and a limited range" (UDNR 1997). Its National Heritage Status in Utah is S1 (critically imperiled). Reported habitats are vegetated spring-fed pools and backwater sloughs with various substrates, usually rocky (Oliver and Bosworth 1999; NatureServe 2003, CUWCD 1998c). Utah physa has historically been found in Utah Lake (last reported here in 1940) and tributaries, but some now believe those populations are extirpated (Oliver and Bosworth 1999). Presence of this species in the impact area of influence is unlikely.

3.10.7.2.9 Columbia Spotted Frog. The Columbia spotted frog (*Rana luteiventris*) is identified as a conservation species in the State of Utah. Its range extends from southeastern Alaska to central Utah and east to central Wyoming. The Wasatch Front population of the Columbia spotted frog occurs in the impact area of influence. This population is disjoined from other populations of the species. Between the early to mid 1900s, the Wasatch Front population declined from historic levels. Information suggests that historically the Columbia spotted frog may have been the most abundant frog species (USFWS 2002e). Because of this, a petition for listing under the ESA was forwarded by the Utah Nature Study Society.

The U.S. Fish and Wildlife Service concluded that a threatened listing was warranted, but declined to list the species in favor of other higher priority listings. In response to this, a multi-agency conservation agreement to provide protection for the species was drafted and signed in February 1998. Based on species status improvement resulting from actions related to the conservation agreement, the U.S. Fish and Wildlife Service subsequently concluded that listing was no longer warranted for the Wasatch Front population.

In the project area, Columbia spotted frog generally occurs in cool water riparian or spring-fed wetlands. Various species of wetland vegetation are associated with spotted frog habitat, including sedges (*Carex* spp), rushes (*Juncus* spp.), bulrush (*Scirpus* sp.), cattails (*Typha* sp.), and grasses (*Graminae*) (USFWS, 2002). Other sources indicate that the frogs in the Wasatch Front occur in ponds with a bottom floor of stonewort (*Chara spp.*) and layers of *Spirogyra* occurring by mid-June (UDNR 1997). The Wasatch Front population begins breeding in early March at perennially wet sites such as springs. Insects serve as the primary food source for adults, while tadpoles generally feed on algae and plankton (UDNR 2003b).

Decline of the Wasatch Front population of the Columbia spotted frog was attributed to a number of possible factors primarily related to habitat loss (USFWS 2002e). Eight sub-populations are known to comprise the Wasatch Front population. These occur at Mona Springs/Burraston Ponds, Springville Hatchery/T-Bone Bottom, Holladay Springs, Jordanelle/Francis, Heber Valley, Fairview, Vernon (USFWS 2002e) and a recently discovered sub-population in Diamond Fork Canyon (Wilson 2003). Of these, the populations in Springville Hatchery (Spanish Fork River) and Heber Valley (Provo River above and below Jordanelle Reservoir) are within or near the project area. These sites are monitored yearly by Utah Division of Wildlife Resources.

3.10.7.2.10 Boreal (Western) Toad. The boreal toad (*Bufo boreas boreas*), a subspecies of the western toad, is listed as a sensitive species in the State of Utah by the Utah Division of Wildlife Resources because of rapidly declining populations. The reasons for decline are uncertain but may be attributed to increased UV radiation, water pollution, habitat loss, and/or disease (UDNR 1997). Its range extends from western Canada southeast into Wyoming and parts of Colorado and New Mexico. In Utah, it occurs at high elevations in perennially wet spring-fed or riparian wetlands, primarily in the Wasatch Mountains and central Utah High Plateaus. A variety of insect species serve as the primary food source for adults of this species, while tadpoles generally feed on algae and plankton (UDNR 2003b). The Utah Division of Wildlife Resources has records of boreal toad occurrences in the Strawberry Reservoir, Provo River below Jordanelle Reservoir, Provo River below Deer Creek Reservoir and in the City of Provo (UDNR 2003a).

3.10.7.3 Plant Species

3.10.7.3.1 Barneby Woody Aster. The Barneby wood aster (*Aster kingii var barnebyana*) is a small perennial that forms low clumps from a branching woody caudex and taproot. It rarely exceeds 4 to 5 inches in height, with large showy flowers that are white to pinkish. Preferred habitat is crevices in rock outcrops, cliffs and ledges on northern exposures and protected sites at lower elevations from 5,000 to 11,750 feet.

3.10.7.3.2 Dainty Moonwort. The dainty moonwort (*Botrychium crenulatum Wagner*) consists of a single leaf and a cluster of fruiting bodies resembling a bunch of grapes, rarely over 3 inches tall. It grows in drier areas of wet meadows, marshes and bogs, and in wetlands dominated by shrubs and trees. Presence in the impact area of influence is unlikely.

3.10.7.3.3 Garrett's Bladderpod. The Garrett's bladderpod (*Lesquerella garretti*) is a low-growing herbaceous perennial. Its prostrate spreading branches grow in tufts from a caudex or taproot. Leaves and stems have stellate pubescence; small flowers are yellow. It is found on talus slopes and weathered rock outcrops along ridge tips at elevations from 8,900 to 11,400 feet. ULS construction and operation would not affect these habitats.

3.10.7.3.4 Rockcress Draba. The rockcress draba (*Draba globulosa Payson*) is a small herbaceous perennial, almost always found above timberline in gravelly tundra soils and often in moist soils near edges of receding snowbanks. ULS construction and operation would not affect this habitat.

3.10.7.3.5 Wasatch Jamesia. The Wasatch jamesia (*Jamesia americana var. macrocalyx*) is a shrubby species found on cliffs and in bedrock at the base of cliffs, preferring north-facing slopes or well-shaded cracks at 5,700 to 9,000 feet elevation. ULS construction and operation would not affect this habitat.

3.10.8 Environmental Consequences (Impacts)

Only those features of the Proposed Action and other alternatives that may impact sensitive species are discussed, and only those species that may be impacted are analyzed.

3.10.8.1 Significance Criteria

Impacts on sensitive species and their habitats are considered significant if construction, operation or maintenance activities would result in either of the following conditions:

3.10.8.1.1 Wildlife Species

- Taking of species of special concern
- Loss or degradation of utilized or potentially utilized habitat that would exceed the estimated level necessary to maintain viable populations or sub-populations of each species
- Actions that lead to long-term disturbance in species migration and dispersal, breeding behavior or pollination that would threaten the viability of the population or sub-population.

3.10.8.1.2 Aquatic Species

- Impacts that result in any mortality or loss of individuals or adverse modification of critical habitat, or that conflict with the objectives of an official recovery plan for the species
- Impacts that result in substantial population reductions (destroying more than 25 percent of utilized or potential habitat in the eco-region), disturb or displace a resident sub-population, or cause losses of more than 20 percent of a local species population

- A reduction in numbers and/or biomass in an affected stream section as a result of change in habitat conditions (quantity and quality of instream flows or water quality) as defined by a sensitivity analysis on existing HQI and IFIM/PHABSIM data

- A 10 nephelometric turbidity unit (NTU) increase in the turbidity of receiving waters (UDEQ 2003b)

- Waters classified as 3A (protected for coldwater fish) have temperatures exceeding 68°F (81°F for waters classified 3B [warmwater fisheries]) (UDEQ 2003b). If existing temperatures periodically exceed this standard, the assessment of effect would be based on frequency and duration.

- Waters classified as 3A have dissolved oxygen concentrations of less than a 30-day average of 6.5 parts per million (ppm); a seven-day average greater than 5.0 ppm or less than 9.5 ppm; or a one-day average greater than 4.0 ppm or less than 8.0 ppm (UDEQ 2003b). For waters classified as 3B, the dissolved oxygen standards are a 30-day average of 5.5 ppm, seven-day average of 4.0 to 6.0 ppm, and one-day average of 3.0 to 5.0 ppm (UDEQ 2003b).

The "potential for impact" for both wildlife and aquatic species has been determined using three categories: high, moderate or low, as defined below. Habitats are categorized based on the following evaluation criteria and professional judgment. Habitats described as having a "high potential for impact" are considered "likely to be adversely impacted."

Low Potential

- Low to moderate potential for impact will be based on low magnitude, short-term changes of water quality parameters beyond their natural range (e.g., temp, pH) in project waters. Low potential for impacts would be considered if spring discharge was reduced by less than 10 percent.

Moderate Potential

- Moderate to high potential for impact based on moderate- to high-magnitude, short- or long-term changes in water quality parameters beyond their natural range (e.g., temp, pH) in project waters.

- Moderate to high impacts would be considered if spring discharge was reduced 10 to 40 percent.

High Potential

- High potential for impact based on high-magnitude, short- or long-term changes in water quality parameters beyond their natural range (e.g., temp, pH) in project waters

- High potential for impacts would be considered if spring discharge was reduced by greater than 40 percent.

3.10.8.1.3 Plant Species. The significance criteria are the same as described in Section 3.10.8.1.1.

3.10.8.2 Potential Impacts Eliminated From Further Analysis

Impacts on the following species have been eliminated because they are not currently known to occur in the impact area of influence or their habitat would not be affected by construction or operation of any of the ULS project features or alternatives.

- Fisher
- Spotted bat
- Townsend's (Western) big-eared bat
- Western red bat
- Bobolink
- Flammulated owl
- Three-toed woodpecker
- Colorado River cutthroat trout
- Bonneville cutthroat trout
- Least chub
- Bluehead sucker
- Flannelmouth sucker
- Utah physa
- California floater
- Barneby woody aster
- Dainty moonwort
- Garrett's bladderpod
- Rockcress draba
- Wasatch jamesia

The Spanish Fork Canyon Pipeline would have no impacts because it would be constructed entirely within the shoulder and right-of-way of U.S. Highway 6 and would not impact the habitat of any of the identified sensitive species.

3.10.8.3 Spanish Fork Canyon-Provo Reservoir Canal Alternative (Proposed Action)

3.10.8.3.1 Construction Phase

3.10.8.3.1.1 Sixth Water Power Facility and Transmission Line

A. Smooth Greensnake. Greensnakes utilize a wide range of habitats in the impact area of influence, and populations could be affected directly by construction mortality and indirectly by temporary exclusion from potential habitat during construction. Implementation of Standard Operating Procedures (SOPs) (see Chapter 1, Section 1.8.8) would prevent or minimize potential construction mortality. Construction would not affect greensnake populations because of abundant equivalent or higher value habitat in the area during the period of disturbance..

B. Boreal (Western) Toad. Boreal toads have been documented to occur near Sixth Water Creek (UDNR 2003a). Although the permanent disturbance area for the power facility would not be primary habitat for boreal toads, they could be temporarily displaced by construction activity disturbing the riparian zone. Construction SOPs (see Chapter 1, Section 1.8.8) would prevent or minimize mortality of boreal toads in riparian drainages crossed by the power line upgrade. Construction has potential to result in temporary and negligible impacts on boreal toad populations or sub-populations.

3.10.8.3.1.2 Upper Diamond Fork Power Facility and Buried Transmission Line. Species and impacts would be the same as those described in Sections 3.10.8.3.1.1.A through 3.10.8.3.1.1.B).

3.10.8.3.1.3 Spanish Fork-Santaquin Pipeline

A. Ferruginous Hawk. Ferruginous hawks have not been recorded in the vicinity of the pipeline, but they could utilize open habitats along the pipeline corridor for foraging. There would be no impacts on ferruginous hawk populations because of abundant equivalent or higher value habitat in the area.

B. Long-billed Curlew. Curlews have not been recorded along the pipeline corridor, but they have occurred in similar habitat near Provo Bay. Pipeline construction could temporarily disturb curlew nesting and foraging, but impacts would be highly unlikely because of abundant equivalent or higher value habitat in the immediate area.

C. Peregrine Falcon. Peregrine falcons have not been recorded along the pipeline corridor, but it is possible that they could use the area for foraging. Temporary disturbance of the foraging habitat would not affect populations because of abundant equivalent or higher value habitat in the immediate area.

D. Short-eared Owl. Short-eared owls have not been recorded along the pipeline corridor, but they have utilized similar habitats in the Provo and Nephi areas. Pipeline construction could temporarily disturb potential foraging habitat, but there would be no impacts on short-eared owl populations because of abundant equivalent or higher value habitat in the immediate area.

3.10.8.3.1.4 Santaquin-Mona Reservoir Pipeline. The following sensitive wildlife species would be subject to temporary disturbance by pipeline construction:

- Ferruginous hawk
- Long-billed curlew
- Peregrine falcon
- Short-eared owl

Pipeline construction would permanently disturb 0.1 acre, and 61.8 acres would be revegetated. Construction noise would temporarily disturb agricultural land and sagebrush/grass habitat. None of the permanently disturbed habitat is critical or important habitat for any of the sensitive species under consideration, and there is abundant equivalent or higher value habitat adjacent to the pipeline corridor. Impacts, if any, would be minimal.

3.10.8.3.1.5 Mapleton-Springville Lateral Pipeline. The following sensitive wildlife species would be subject to temporary disturbance by pipeline construction:

- Ferruginous hawk
- Long-billed curlew
- Peregrine falcon
- Short-eared owl

Pipeline construction would permanently disturb 0.1 acre, and temporarily disturb 60.2 acres that would be revegetated to grasses and shrubs. Approximately one acre of riparian forest and scrub shrub wetland habitat would be permanently converted to upland vegetation. Construction activity and noise would disturb small areas of agricultural land and mountain brush habitat. None of the permanently disturbed habitat is critical or important to any of the sensitive species under consideration, and there is abundant equivalent or higher value habitat adjacent to the pipeline corridor. Impacts, if any, would be minimal.

3.10.8.3.1.6 Spanish Fork-Provo Reservoir Canal Pipeline. The following sensitive wildlife species would be subject to temporary disturbance from pipeline construction:

- Short-eared owl
- Peregrine falcon

Pipeline construction would permanently disturb 0.4 acres, and 20 acres would be revegetated to grasses and shrubs. The pipeline corridor would be constructed entirely in highway shoulders or within city streets; most disturbed areas would be previously disturbed lands. None of the disturbed habitats is critical or important habitat for sensitive wildlife species. There are historic records of sensitive wildlife species within one mile of the pipeline corridor, but it is highly unlikely that any sensitive wildlife species currently utilizes the pipeline corridor. Impacts, if any, would be minimal.

A. Columbia Spotted Frog. A known population of Columbia spotted frogs inhabits isolated springs near the Springville Hatchery adjacent to Hobble Creek. The proposed pipeline alignment passes near this location and erosion and sedimentation from construction could cause indirect water quality degradation. Construction SOPs (see Chapter 1, Section 1.8.8) would prevent or minimize effects on spotted frog habitat, and construction would cause negligible impacts on spotted frog populations.

3.10.8.3.2 Operations Phase

3.10.8.3.2.1 Leatherside Chub

A. Spanish Fork River. Flow would decrease by 89 to 130 cfs during January through April and by lesser amounts in other months. This would reduce the area of in-channel habitat for fish. Water surface elevations would be expected to decrease by about one foot during January through April. Based on modeled average monthly flows, these changes could result in a long-term decrease in leatherside chub population because habitat would be reduced throughout much of the year. This analysis does not take into consideration potential effects from changes in species populations and communities resulting in changes in competition and predation.

3.10.8.3.2.2 Wildlife Species. The delivery of M&I water under this alternative could have some beneficial impact on southern Utah County wetlands. Some increased level of groundwater recharge resulting from the application of the secondary use M&I water would cause the impact. The amount and location of the wetlands impacted is not measurable based on the information available for use in the analysis (see EIS Chapter 3, Section 3.7 Wetland Resources). Some wetlands-associated species (long-billed curlew) could be benefited, but the benefit is not measurable.

3.10.8.3.3 Summary of Proposed Action Impacts. There would be no significant impacts on the following species:

- Ferruginous hawk

- Long-billed curlew
- Peregrine falcon
- Short-eared owl
- Smooth greensnake
- Columbia spotted frog
- Boreal toad

Construction would permanently disturb only 2.0 acres of marginal habitat. Implementation of the SOPs (see Chapter 1, Section 1.8.8) would minimize any impact from construction activities. Impacts on these species would not exceed the significance criteria identified in Section 3.10.8.1.

Leatherside chub would be significantly impacted in the Spanish Fork River. Although the change in habitat is not expected to be substantial (i.e., greater than 25 percent of habitat in the eco-region), the impact can be considered significant because it meets the following previously determined significance criteria (see Section 3.10.8.1):

- A reduction in fish numbers and/or biomass in an affected stream section as a result of change in habitat conditions (quantity and quality of instream flows or water quality) as defined by a sensitivity analysis on existing HQI and IFIM/PHABSIM data.

3.10.8.4 Bonneville Unit Water Alternative

3.10.8.4.1 Construction Phase. The impact on the following species would be the same as described under the construction phase of the Spanish Fork Canyon – Provo Reservoir Canal Alternative (Proposed Action):

- Ferruginous hawk
- Long-billed curlew
- Peregrine falcon
- Short-eared owl
- Boreal toad

3.10.8.4.2 Operations Phase

3.10.8.4.2.1. Leatherside Chub

A. Spanish Fork River. Flow would decrease by 2 to 111 cfs during June through August and the in-channel habitat available for fish would decrease slightly. Water surface elevations would be projected to decrease by less than one foot in the upper reaches under this alternative during summer months; changes in lower reaches would be insignificant. Overall, operational impacts of this alternative could result in a small negative impact on leatherside chub. This analysis does not take into consideration potential effects from changes in species populations and communities resulting in changes in competition and predation.

3.10.8.4.2.2 Wildlife Species. Impacts would be the same as the Proposed Action (Section 3.10.8.4.2.4).

3.10.8.4.3 Summary of Bonneville Unit Water Alternative Impacts. There would be no significant impacts on the following species:

- Ferruginous hawk
- Long-billed curlew
- Peregrine falcon
- Short-eared owl
- Smooth greensnake
- Columbia spotted frog
- Boreal toad

Construction activities would permanently disturb only 2.0 acres of marginal habitat. Implementation of the SOPs (see Chapter 1, Section 1.8.8) would minimize any impact from construction. None of the significance criteria identified in Section 3.10.8.1) would be exceeded for these species.

Leatherside chub would be significantly impacted in the Spanish Fork River. Although the change in habitat is not expected to be substantial (i.e., greater than 25 percent of habitat in the eco-region), the impact can be considered significant because it exceeds the following previously determined significance criteria (see Section 3.10.8.1).

- A reduction in fish numbers and/or biomass in an affected stream section as a result of change in habitat conditions (quantity and quality of instream flows or water quality) as defined by a sensitivity analysis on existing HQI and IFIM/PHABSIM data.

3.10.8.5 No Action Alternative

3.10.8.5.1 Operations Phase

3.10.8.5.1.1 Leatherside Chub. Small flow increases during April through September could provide a benefit to fish species because of more in-channel habitat. Flow changes and impacts on habitat would be negligible during the remainder of the year. Based on modeled average monthly flows, these flow changes would not result in a long-term change in fish numbers and/or biomass because habitat changes would be negligible for eight of twelve months. Overall, the flow changes could result in a slight positive impact on leatherside chub. This analysis does not take into consideration potential effects from changes in species populations and communities resulting in changes in competition and predation.

3.10.8.5.1.2 Wildlife Species. Under operation of the No Action Alternative there may be a loss of wetland habitat in southern Utah County (EIS Chapter 3, Section 3.7, Wetland Resources). This loss of wetland habitat would be likely to impact local populations of wetland-associated species (long-billed curlew), but would not threaten species survival on a regional basis. Other species that could potentially use wetlands for foraging (short-eared owl and peregrine falcon) would not be impacted because upland prey species would replace wetland prey species as wetlands convert to upland habitat.

3.10.8.5.2 Summary of No Action Alternative Impacts

3.10.8.5.2.1 Leatherside Chub. No impact.

3.10.8.5.2.2 Wildlife Species. Wetland habitat loss could impact local populations of wetland-associated species (long-billed curlew), but would not place regional populations at risk.

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3.11 Agriculture and Soil Resources

3.11.1 Introduction

This analysis addresses potential changes in agriculture and soil resources from construction of the Proposed Action and other alternatives. Impact topics include the following:

- Soil resource quality
- Cropland
- Prime farmland

3.11.2 Issues Raised in Scoping Meetings

- What would be the impacts from delivering ULS water to Juab County?
- What would be the impacts on agriculture in Utah and Salt Lake counties if all ULS delivered water were designated for municipal and industrial (M&I) use?
- How much agricultural land would be developed for urban uses from supplying ULS M&I water to the north?
- What would be the impacts of losing irrigated agricultural land in Utah and Salt Lake counties?
- What impacts would occur from not converting SVP irrigation water to M&I use until after 2030?
- What would be the impacts of converting SVP water to M&I uses?
- What would be the impacts on agricultural production from providing irrigation water rather than M&I water through the ULS?

3.11.3 Scoping Issues Eliminated From Further Analysis

What would be the impacts from delivering ULS water to Juab County?

When scoping meetings were held, one of the proposed concepts included delivery of water to Juab County. However, no need was identified for M&I water in Juab County within the planning horizon for the ULS project, so none of the alternatives analyzed in this document include this concept (see Chapter 1, Section 1.2.1.1).

What would be the impacts on agriculture in Utah and Salt Lake counties if all ULS delivered water were designated for M&I use?

How much agricultural land would be developed for urban uses from supplying ULS M&I water to the north?

What would be the impacts of losing irrigated agricultural land in Utah and Salt Lake counties?

The ULS would not cause any conversion of agricultural land to urban uses. The project water supply and delivery alternatives would not be the direct cause of population or economic growth, as would be the case for a new industry locating in a community or a new agricultural project siting within the region. The project alternatives represent infrastructure development, specifically water supply, to service future growth in the region, induced by more direct economic forces and actions. The growth projected for this area would occur with or without the ULS water supply project alternatives as shown in the Economic Report to the Governor 2002, prepared by the Governor's Office of Planning and Budget.

What impacts would occur from not converting SVP irrigation water to M&I use until after 2030?

What would be the impacts of converting SVP water to M&I uses?

SVP water cannot be converted to M&I use under the water user's existing contracts with the Federal government.

3.11.4 Scoping Issues Addressed in the Impact Analysis

The impact analysis addresses the impacts on agricultural production from construction of project features rather than impact from delivery of M&I water. All other scoping issues listed in Section 3.11.2 were eliminated.

3.11.5 Description of Impact Area of Influence

The impact area of influence includes corridors along areas directly affected by construction of pipelines, access roads, pump stations, power lines and power generation facilities.

3.11.6 Methodology

The impact analysis considered the standard operating procedures (SOPs) and project design features that the District will implement as part of the project.

3.11.6.1 Assumptions

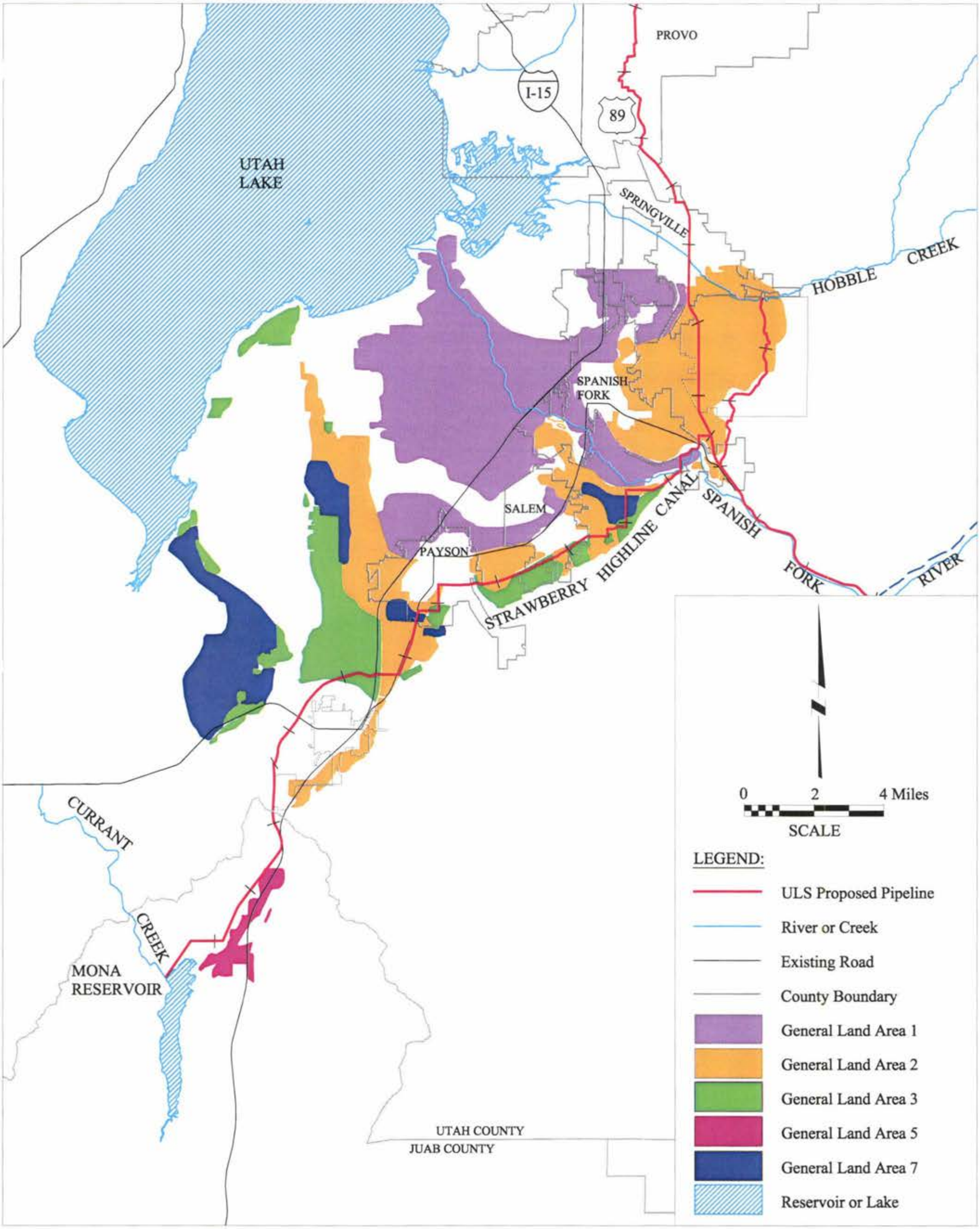
Appendix E, Impact Analysis Methodologies, provides a detailed description of the methodology and assumptions used to analyze impacts on agriculture and soils resources.

3.11.6.2 Impact Analysis Methodology

The basis of the impact analysis is the data developed for the Spanish Fork-Nephi Irrigation System (SFN) Draft Environmental Impact Statement (CUWCD 1998a). The geographic area analyzed by that effort encompassed the irrigated agricultural land in southern Utah County and dryland agricultural land in Juab County that would be affected by the ULS alternatives. The SFN data provide the basis for analyzing construction impacts on agricultural production in southern Utah County and Juab County. The SFN analysis resulted in development of general land areas for purposes of characterizing cropping pattern, crop yield and crop production requirements. Five of these general land areas (1, 2, 3, 5 and 7 in Map 3-10) occur in the ULS impact area of influence.

3.11.7 Affected Environment (Baseline Conditions)

Table 3-65 lists baseline agricultural production by pipeline segment for purposes of analyzing construction impacts.



Map 3-10
General Land Areas

Table 3-65
Baseline Agricultural Production by Pipeline Segment

Pipeline	Crop	Unit	Yield/Acre
Spanish Fork-Santaquin[1]	Alfalfa	Ton	3.5
	Barley	Bushel	95
	Corn, Grain	Bushel	100
	Corn, Silage	Ton	20
	Oat Hay	Ton	2.5
	Apple	Pound	20,000
	Tart Cherry	Pound	10,000
Mapleton-Springville Lateral[1]	Alfalfa	Ton	3.6
	Barley	Bushel	94
	Corn, Grain	Bushel	100
	Corn, Silage	Ton	20
	Oat Hay	Ton	2.5
Santaquin-Mona Reservoir[1]	Alfalfa	Ton	1.3
	Winter Wheat	Bushel	12.5

[1] Spanish Fork-Nephi Irrigation System Draft Environmental Impact Statement (CUWCD 1998a).

The impact area of influence contains approximately 44,910 acres of farmland defined as prime farmland (CUWCD 1998a). The USDA defines prime farmland as the land best suited to produce food, feed, forage, fiber and oilseed crops. It has the soil quality, length of growing season and moisture supply needed to economically produce a sustained high yield of crops when managed properly (USDA 1984).

3.11.8 Environmental Consequences (Impacts)

3.11.8.1 Significance Criteria

No significance criteria were developed for potential cropland impacts because no consistent and quantitative threshold for determining the significance of changes in agricultural production could be applied to all agricultural operations. The significance of these potential impacts would likely vary among individual operations based on the characteristics of the operation, cropping pattern, market conditions and other factors that influence profit margins. The significance of such impacts could only be determined on an individual basis that is beyond the scope of this EIS.

Any loss of prime farmland would be considered a significant impact. The impact of economic losses on the farmer would be addressed by the easement acquisition procedures (see Chapter 1, Section 1.4.3.1 Permanent Easements and Section 1.4.3.2 Temporary Easements) that would pay for right-of-way acquisition and crop loss. Since the significance of impacts on crop production is based on how such impacts would affect the economics of the local agricultural sector, the significance of potential agricultural production impacts are defined and addressed in the Socioeconomics section of this EIS (see Chapter 3, Section 3.12).

3.11.8.2 Potential Impacts Eliminated From Further Analysis

The following potential agriculture and soil impacts were eliminated from further analysis because they are not expected to occur under the Proposed Action and other alternatives.

3.11.8.2.1 Soil Resource Quality. Construction of the ULS would not cause impacts on soil resource quality because the Standard Operating Procedures (SOPs) are designed to stabilize the soil surface and restore vegetation to avoid erosion and sedimentation problems (see Chapter 1, Section 1.8.8). The SOPs would restore areas disturbed by construction to near their original condition by removing and stockpiling all topsoil before construction and replacing it after construction. Areas in native vegetation would be restored and agricultural lands replanted.

3.11.8.2.2 Prime Farmland. Construction of project features associated with the ULS would not result in irreversible conversion of prime farmland to other uses because the Standard Operating Procedures (SOPs) are designed to restore vegetation and soil to original condition (see Chapter 1, Section 1.8.8). No prime farmland would be lost because no features of any of the alternatives would be constructed on prime land.

3.11.8.3 Spanish Fork Canyon-Provo Reservoir Canal Alternative (Proposed Action)

The only features of this alternative that would impact agriculture resources are the Spanish Fork-Santaquin, Mapleton-Springville Lateral and Santaquin-Mona Reservoir pipelines.

3.11.8.3.1 Spanish Fork-Santaquin Pipeline. Table 3-66 lists the agricultural acreage that would be removed from production by construction of the Spanish Fork-Santaquin Pipeline. Temporary impacts would occur on rotational cropland in both the temporary and permanent construction easements, but these areas would be replanted immediately after construction. Orchard crops would be re-established in the temporary construction easement, but not in the permanent easement because of deed restrictions. These areas, once used for orchard crops, would be available for planting rotational crops.

Table 3-66
Agricultural Acreage Removed From Production by Construction of Spanish Fork-Santaquin Pipeline

Approximate Pipeline Milepost	Temporary Impact (acres)		Permanent Impact (acres)	Total
	Rotational Cropland	Orchard Crops	Orchard Crops	
1.1 to 1.7	2.4	0.0	0.0	2.4
3.5 to 4.2	3.4	0.0	0.0	3.4
4.4 to 4.5	0.3	0.0	0.0	0.3
5.0 to 5.8	1.1	0.0	0.0	1.1
8.8 to 8.9	1.4	0.0	0.0	1.4
13.2 to 13.7	2.6	0.0	0.0	2.6
13.9 to 17.4	0.0	16.7	15.4	32.1
Total	**11.2**	**16.7**	**15.4**	**43.3**

Table 3-67 lists the temporary acreage and crop loss for rotational cropland from construction of the Spanish Fork-Santaquin Pipeline.

Table 3-67
Temporary Crop Loss for Rotational Cropland From Construction of Spanish Fork-Santaquin Pipeline

Crop	Unit	Loss in Production		
		Yield/Acre	Acreage	Total
Alfalfa	Ton	3.5	7.8	27.3
Barley	Bushel	95.0	2.0	190.0
Corn, Grain	Bushel	100.0	0.3	30.0
Corn, Silage	Ton	20.0	0.9	18.0
Oat Hay	Ton	2.5	0.2	0.5

Temporary orchard crop production losses would occur over several years because it takes 11 years to re-establish and return an orchard to full production. Table 3-68 lists the annual crop yield during orchard establishment and the annual loss in crop production from construction of the Spanish Fork-Santaquin Pipeline. The table is based on crop yield data from Utah State University crop budgets, with yield prorated based on the SFN orchard crop yield (CUWCD 1998a).

Table 3-68
Annual Crop Yield During Orchard Establishment and Temporary Crop Loss From Construction of Spanish Fork-Santaquin Pipeline

Year	Crop Yield (lbs/acre)		Loss in Production (lbs/acre)	
	Apple	Tart Cherry	Apple	Tart Cherry
1	0	0	20,000	10,000
2	0	0	20,000	10,000
3	0	0	20,000	10,000
4	1,110	0	18,890	10,000
5	3,335	0	16,665	10,000
6	7,780	2,270	12,220	7,730
7	11,110	3,635	8,890	6,365
8	13,995	5,455	6,005	4,545
9	15,555	6,820	4,445	3,180
10	17,780	8,765	2,220	1,235
11	20,000	8,765	0	1,235
12	20,000	10,000	0	0
Total			**129,335**	**74,290**

Table 3-69 lists the temporary loss of orchard crop production from construction of the Spanish Fork-Santaquin Pipeline. Temporary losses consider the time required to re-establish an orchard and the annual yield losses incurred until the orchard returns to full production.

Table 3-69
Temporary Loss of Orchard Crop Production
From Construction of Spanish Fork-Santaquin Pipeline

Crop Acreage		Loss in Production (lbs/acre)		Total Loss in Production (lbs)	
Apple	**Tart Cherry**	**Apple**	**Tart Cherry**	**Apple**	**Tart Cherry**
7.7	9.0	129,335	74,290	995,880	668,610

Table 3-70 lists the annual permanent loss of orchard crops within the permanent easement right-of-way from construction of the Spanish Fork-Santaquin Pipeline.

Table 3-70
Annual Permanent Loss in Orchard Crop Production
From Construction of Spanish Fork-Santaquin Pipeline

Crop Acreage		Loss in Production (lbs/acre)		Total Loss in Production (lbs)	
Apple	**Tart Cherry**	**Apple**	**Tart Cherry**	**Apple**	**Tart Cherry**
7.1	8.3	20,000	10,000	142,000	83,000

3.11.8.3.2 Mapleton-Springville Lateral Pipeline. Table 3-71 lists the agricultural acreage that would be removed from production by construction of the Mapleton-Springville Lateral Pipeline. Temporary impacts would occur on rotational cropland in both the temporary and permanent construction easements, but these areas would be replanted immediately after completion of construction.

Table 3-71
Agricultural Acreage Removed from Production by Construction
of Mapleton-Springville Lateral Pipeline

Approximate Pipeline Milepost	Temporary Impact (acres)		Permanent Impact (acres)	Total
	Rotational Cropland	**Orchard Crops**	**Orchard Crops**	
2.0 to 2.7	2.3	0.0	0.0	2.3
4.7 to 4.9	0.8	0.0	0.0	0.8
Total	**3.1**	**0.0**	**0.0**	**3.1**

Table 3-72 lists the temporary crop loss for rotational cropland from construction of the Mapleton-Springville Lateral Pipeline.

Table 3-72
Temporary Crop Loss for Rotational Cropland
From Construction of Mapleton-Springville Lateral Pipeline

Crop	Unit	Loss in Production		
		Yield/Acre	Acreage	Total
Alfalfa	Ton	3.6	2.1	7.6
Barley	Bushel	94.0	0.6	56.4
Corn, Grain	Bushel	100.0	0.1	10.0
Corn, Silage	Ton	20.0	0.2	4.0
Oat Hay	Ton	2.5	0.1	0.3

3.11.8.3.3 Santaquin-Mona Reservoir Pipeline. Table 3-73 lists the agricultural acreage that would be removed from production by construction of the Santaquin-Mona Reservoir Pipeline. Temporary impacts would occur on dryland rotational cropland in both the temporary and permanent construction easements, but these areas would be replanted immediately after completion of construction.

Table 3-73
Agricultural Acreage Removed from Production by Construction of Santaquin-Mona Reservoir Pipeline

Approximate Pipeline Milepost	Temporary Impact (acres)		Permanent Impact (acres)	Total
	Rotational Cropland	Orchard Crops	Orchard Crops	
2.8 to 6.6	28.8	0.0	0.0	28.8

Table 3-74 lists the temporary crop loss for dryland rotational cropland from construction of the Santaquin-Mona Reservoir Pipeline.

Table 3-74
Temporary Crop Loss for Dryland Rotational Cropland
From Construction of Santaquin-Mona Reservoir Pipeline

Crop	Unit	Loss in Production		
		Yield/Acre	Acreage	Total
Alfalfa	Ton	1.3	2.9	3.8
Winter Wheat	Bushel	12.5	25.9	323.8

3.11.8.3.4 Summary of Proposed Action Impacts. Table 3-75 summarizes the temporary crop loss for rotational cropland from construction of the Spanish Fork Canyon-Provo Reservoir Canal Alternative (Proposed Action).

Table 3-75
Summary of Temporary Crop Loss for Rotational Cropland From Construction of Spanish Fork Canyon-Provo Reservoir Canal Alternative (Proposed Action)

Crop	Unit	Acreage	Total
Alfalfa	Ton	12.8	38.7
Barley	Bushel	2.6	246.4
Corn, Grain	Bushel	0.4	40.0
Corn, Silage	Ton	1.1	22.0
Oat Hay	Ton	0.3	0.8
Winter Wheat	Bushel	25.9	323.8

Tables 3-76 and 3-77 summarize the temporary and permanent loss of orchard crop production from construction of the Spanish Fork Canyon-Provo Reservoir Canal Alternative (Proposed Action).

Table 3-76
Summary of Temporary Loss of Orchard Crop Production From Construction of Spanish Fork Canyon-Provo Reservoir Canal Alternative (Proposed Action)

Crop Acreage		Loss in Production (lbs/acre)		Total Loss in Production (lbs)	
Apple	Tart Cherry	Apple	Tart Cherry	Apple	Tart Cherry
7.7	9.0	129,335	74,290	995,880	668,610

Table 3-77
Summary of Annual Permanent Loss of Orchard Crop Production From Construction of Spanish Fork Canyon-Provo Reservoir Canal Alternative (Proposed Action)

Crop Acreage		Loss in Production (lbs/acre)		Total Loss in Production (lbs)	
Apple	Tart Cherry	Apple	Tart Cherry	Apple	Tart Cherry
7.1	8.3	20,000	10,000	142,000	83,000

3.11.8.4 Bonneville Unit Water Alternative

The only features of this alternative that would impact agriculture resources are the Spanish Fork-Santaquin, and Mapleton-Springville Lateral pipelines. The following features of this alternative are the same as analyzed under the Spanish Fork Canyon-Provo Reservoir Canal Alternative and are not repeated here:

- Spanish Fork-Santaquin Pipeline-Section 3.11.8.3.1
- Mapleton-Springville Lateral Pipeline-see Section 3.11.8.3.2

3.11.8.4.1 Summary of Bonneville Unit Water Alternative Impacts. Table 3-78 summarizes the temporary crop loss for rotational cropland from construction of the Bonneville Unit Water Alternative.

Table 3-78
Summary of Temporary Crop Loss for Rotational Cropland From Construction of Bonneville Unit Water Alternative

Crop	Unit	Acreage	Total
Alfalfa	Ton	9.9	34.9
Barley	Bushel	2.6	246.4
Corn, Grain	Bushel	0.4	40.0
Corn, Silage	Ton	1.1	22.0
Oat Hay	Ton	0.3	0.8

Tables 3-79 and 3-80 summarize the temporary and annual permanent loss in orchard crop production from construction the Bonneville Unit Water Alternative.

Table 3-79
Summary of Temporary Loss in Orchard Crop Production From Construction of Bonneville Unit Water Alternative

Crop Acreage		Loss in Production (lbs/acre)		Total Loss in Production (lbs)	
Apple	Tart Cherry	Apple	Tart Cherry	Apple	Tart Cherry
7.7	9.0	129,335	74,290	995,880	668,610

Table 3-80 Summary of Annual Permanent Loss in Orchard Crop Production From Construction of Bonneville Unit Water Alternative					
Crop Acreage		**Loss in Production (lbs/acre)**		**Total Loss in Production (lbs)**	
Apple	**Tart Cherry**	**Apple**	**Tart Cherry**	**Apple**	**Tart Cherry**
7.1	8.3	20,000	10,000	142,000	83,000

3.11.8.5 No Action Alternative

There would be no loss of production associated with construction of ULS project features. Factors not associated with the ULS project, such as population growth, would continue to impact agriculture, resulting in loss of agricultural land and associated production.

3.12 Socioeconomics

3.12.1 Introduction

This analysis addresses potential socioeconomics impacts from construction and operation of the Proposed Action and other alternatives. Impact topics include the following:

- Population
- Employment (Regional & Local)
- Income (Regional & Local)
- Housing and Property Values
- Public and business services and fiscal conditions
- Agriculture
- Recreational Fishing

3.12.2 Issues Raised in Scoping Meetings

3.12.2.1 Economics

- What would be the impacts of providing M&I water to an arid area and how would it affect urban growth?
- What would be the economic impacts of constructing project facilities through the communities of Provo, Orem, Springville, and Mapleton?
- What would be the impacts on urban development from delivering ULS water to Juab County?
- What would be the impacts on socioeconomic and transportation infrastructure from more development in Salt Lake County?
- What is the potential for reuse of ULS water and what impacts would this have on groundwater and secondary growth?
- What would be the economic impacts of delivering water to south Utah County?
- What would be the impacts from underestimating future population projections on planning for water supply and delivery?
- What impacts would occur from not converting SVP irrigation water to M&I uses?
- What would be impacts on the cities in the ULS planning area if no federal facilities to convey water were constructed under the No Action Alternative?
- What would be the impacts on Utah Lake from a pipeline rupture, since the area is in a zone of high earthquake risk?
- What would be the impacts of not delivering water to south Utah County in light of the investments made in system design, right-of-way obtained, and planned community development?
- What would be the impacts on the south Utah Valley communities from not providing ULS water?
- What would be the impacts on the south Utah Valley communities from providing ULS water?
- What would be the economic impacts of building the pipeline down Daniels Canyon?
- What would be the impacts of saving ¼ of Mapleton's water?
- If Mapleton does not receive ULS water, what impacts would occur on Mapleton City if existing contamination prevented use of groundwater for M&I purposes?

- What would be the economic impacts of not providing ULS water to cities that have made infrastructure investments in anticipation of receiving that water?
- What would be the impacts of increased treatment cost from taking water directly from the Spanish Fork River?
- What impacts would occur from not converting SVP irrigation water to M&I use until after 2030?
- What would be the impacts of converting SVP water to M&I uses?
- What impacts would occur on the Utah Lake ecosystem in terms of associated local economic effects?
- Develop an economic analysis in the EIS that supports the benefit-cost projections.
- What would be the impacts on funding under Section 207?
- What would be the impacts of the ULS water delivery concepts on urban sprawl?
- What would be the impacts of the ULS Project on Utah Lake property values?
- What would be the economic impacts of not delivering water to Utah and Juab Counties?
- What would be the impacts of each of the ULS concepts on the economic value of environmental benefits, including increased natural resources such as increased outdoor recreation, renewable consumptive wildlife resources, and secondary economic benefits of these?
- What impacts would occur in south Utah County from underestimating future population projections in the planning process to determine water needs?
- To what extent was potential growth in unincorporated areas in the south end of the valley included in population projections?

3.12.3 Scoping Issues Eliminated From Further Analysis

What would be the impacts of providing M&I water to an arid area and how would it affect urban growth?

All of the areas in southern Utah County are irrigated and are not arid. ULS water would only be delivered to areas where urban development has already occurred.

What would be the impacts on urban development from delivering ULS water to Juab County?

None of the ULS project alternatives include delivery of any water to Juab County.

What would be the impacts on socioeconomic and transportation infrastructure from more development in Salt Lake County?

ULS water would only be delivered to areas where urban development has already occurred.

What would be the impacts of the ULS water delivery concepts on urban sprawl?

ULS water would only be delivered to areas where urban development has already occurred.

What would be the impacts on Utah Lake from a pipeline rupture, since the area is in a zone of high earthquake risk?

During the scoping process, one of the alternatives showed a pipeline crossing Utah Lake. That particular alternative has been eliminated from further consideration (see Section 1.11.1, Chapter 1).

What impacts would occur from not converting SVP irrigation water to M&I uses?
What impacts would occur from not converting SVP irrigation water to M&I use until after 2030?
What would be the impacts of converting SVP water to M&I uses?

SVP water cannot be converted to M&I use under the water user's existing contracts with the Federal government.

What would be the impacts of not delivering water to south Utah County in light of the investments made in system design, right-of-way obtained, and planned community development?

This is beyond the scope of this EIS, and those cities or other entities that have engaged in system design, right-of-way acquisition, and planned community development should be contacted to determine their plans.

If Mapleton does not receive ULS water, what impacts would occur on Mapleton City if existing contamination prevented use of groundwater for M&I purposes?

This is beyond the scope of this EIS, Mapleton City should be contacted to determine what their plans are if this scenario was to occur.

What would be the economic impacts of not providing ULS water to cities that have made infrastructure investments in anticipation of receiving that water?

This is beyond the scope of this EIS, and those cities should be contacted to determine their plans.

What would be the economic impacts of not delivering water to Utah and Juab Counties?

This issue is beyond the scope of this EIS.

What would be the impacts from underestimating future population projections on planning for water supply and delivery?
What impacts would occur in south Utah County from underestimating future population projections in the planning process to determine water needs?
To what extent was potential growth in unincorporated areas in the south end of the valley included in population projections?

The project was designed based on the population projections made by the Governor's Office of Planning and Budget (State of Utah Governor's Office of Planning and Budget 2003a). These projections were based on the best data available, and were felt to be reliable. As stated above, the purpose of the EIS is to examine the impacts on the human environment of the proposed alternatives, not to analyze impacts of "what-if scenarios." The validity of the population projections are not subject to analysis under the NEPA process.

Develop an economic analysis in the EIS that supports the benefit-cost projections.

The purpose of the EIS is to present the potential environmental impacts of constructing and operating a proposed project, not to justify the project. Other documents such as the Definite Plan Report, are being prepared by the joint-lead agencies, which does provide a detailed benefit-cost analysis for the project. These documents are available for agency and public review.

What would be the impacts on funding under Section 207?

All Section 207 projects have feasibility reports and NEPA compliance before they are considered for approval.

What would be the impacts of increased treatment cost from taking water directly from the Spanish Fork River?

Planned use of ULS water flowing down the Spanish Fork River does not include culinary use. The cities have indicated that the water would be used in their secondary systems for outside M&I use. Therefore, there would be no increased treatment cost involved in using this water.

What would be the economic impacts of building the pipeline down Daniels Canyon?

The Strawberry Reservoir–Deer Creek Reservoir Alternative was eliminated from detail analysis. Please see Chapter 1, Section 1.11.8.

3.12.4 Scoping Issues Addressed in the Impact Analysis

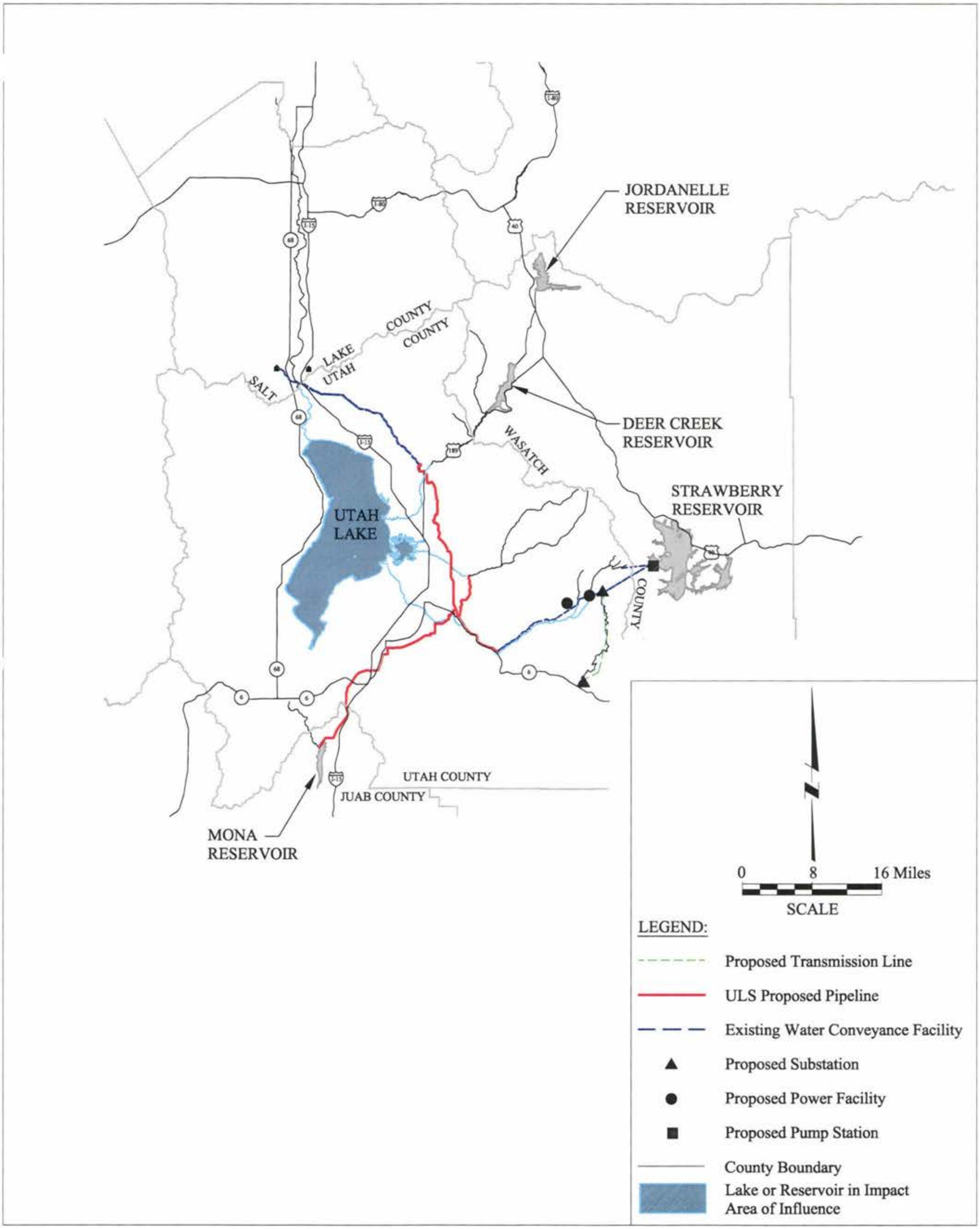
- What would be the economic impacts of constructing project facilities through the communities of Provo, Orem, Springville, and Mapleton?
- What would be the economic impacts of delivering water to south Utah County?
- What would be impacts on the cities in the ULS planning area if no federal facilities to convey water were constructed under the No Action Alternative?
- What would be the impacts on the south Utah Valley communities from providing ULS water?
- What would be the impacts of saving ¼ of Mapleton's water?
- What impacts would occur on the Utah Lake ecosystem in terms of associated local economic effects?
- What would be the impacts of the ULS Project on Utah Lake property values?
- What would be the impacts of each of the ULS concepts on the economic value of environmental benefits, including increased natural resources such as increased outdoor recreation, renewable consumptive wildlife resources, and secondary economic benefits of these?

3.12.5 Description of Impact Area of Influence

The impact area of influence consists of communities that would be affected during construction (short-term impacts), and communities that would receive ULS water (long-term impacts). Most of the potentially affected communities are located west of the Wasatch Front. The potential impact area is somewhat different for each of the ULS alternatives. However, southern Salt Lake County, Utah County, and the northern part of Juab County can be viewed as a functional economic unit, subject to the project alternatives. These areas are viewed as a whole in terms of potential economic impacts, and on an independent county level (see Map 3-11).

The impact area of influence for the ULS project includes all of the following communities.

- Provo City
- Orem City
- Springville City
- Mapleton City
- Spanish Fork City
- Woodland Hills
- Elk Ridge
- Salem City
- Payson City
- Santaquin City
- Communities within the Jordan Valley Water Conservancy District service area
- Salt Lake City
- Sandy City



Map 3-11
Socioeconomic
Impact Area of Influence

3.12.6 Methodology

Please refer to Appendix E for a description of the methodology used to estimate the economic impacts. The impact analysis considered the standard operating procedures (SOPs) and project design features that the District will implement as part of the project.

3.12.7 Affected Environment (Baseline Conditions)

A small portion (approximately two miles) of the Santaquin–Mona Reservoir Pipeline would be constructed in Juab County. This construction would require a short period of time and would not cause any measurable socioeconomic impacts in Juab County. The ULS project would not deliver any water to Juab County.

3.12.7.1 Population

Population growth in the state of Utah has exceeded the U.S. average annual rate of growth (AARG) for the past two decades (Mountainlands Association of Governments 2003).

Within the impact area of influence, population growth since the 1990s has been substantial (see Figures 3-1 and 3-2). Combined, the counties have witnessed about a 2.5 percent average annual rate of growth. For the most recent 2000 to 2002 period, Salt Lake County is estimated to have about a 1.6 percent average annual rate of growth, for Utah County, about 3.9 percent, and for Wasatch County, about 5.2 percent (Mountainland Association of Governments 2003; U.S. Census 2003a).

In the 1990s, population growth in Utah was influence by net in-migration, along with birth rates exceeding mortality rates. In the years prior to and after the 2002 Olympic games, about 40 percent of the new population growth was attributed to the Olympic event. However, current and future growth rates are based almost solely on state birth rates exceeding mortality rates, with net in-migration having a very small impact on growth (State of Utah Bureau of Health Statistics and Utah Office of Vital Statistics 2003c).

Future population growth is expected to track past trends as displayed in Figures 3-1 and 3-2. For the period 2000 through 2010, the combined population growth for the affected counties is estimated to be about 1.7 percent AARG. By 2010, the population forecast for Salt Lake County is estimated at 1,028,500; Utah County is estimated at 469,700; and Wasatch County is estimated at 19,800.

Thereafter, this 1.7 percent AARG is anticipated to remain steady. By 2020, the total percentage increase in population above the 2000 Census counts is forecast for Salt Lake County at 36 percent; for Utah County at 52 percent; and for Wasatch County at 63 percent. By 2040, the population in each county is forecast to be approximately double the 2000 Census counts. The combined counties' population forecast for 2050 is about 2,900,000 people (State of Utah Governors Office of Planning and Budget 2003a; and Mountainlands Association of Governments 2003).

The affected area counties' population growth basically reflects the growth that has already occurred within many municipalities and that which is expected for the future. This is illustrated by the 2000 Census counts and forecast population growth rates.

For the future, significant growth is expected to occur for many municipalities within Salt Lake and Utah counties. During the next 30-year period, communities such as Sandy and South Jordan will likely experience average annual rates of growth within the 7 percent to 3.1 percent range; and within southern Utah County, growth rates above 2.0 percent will be the norm.

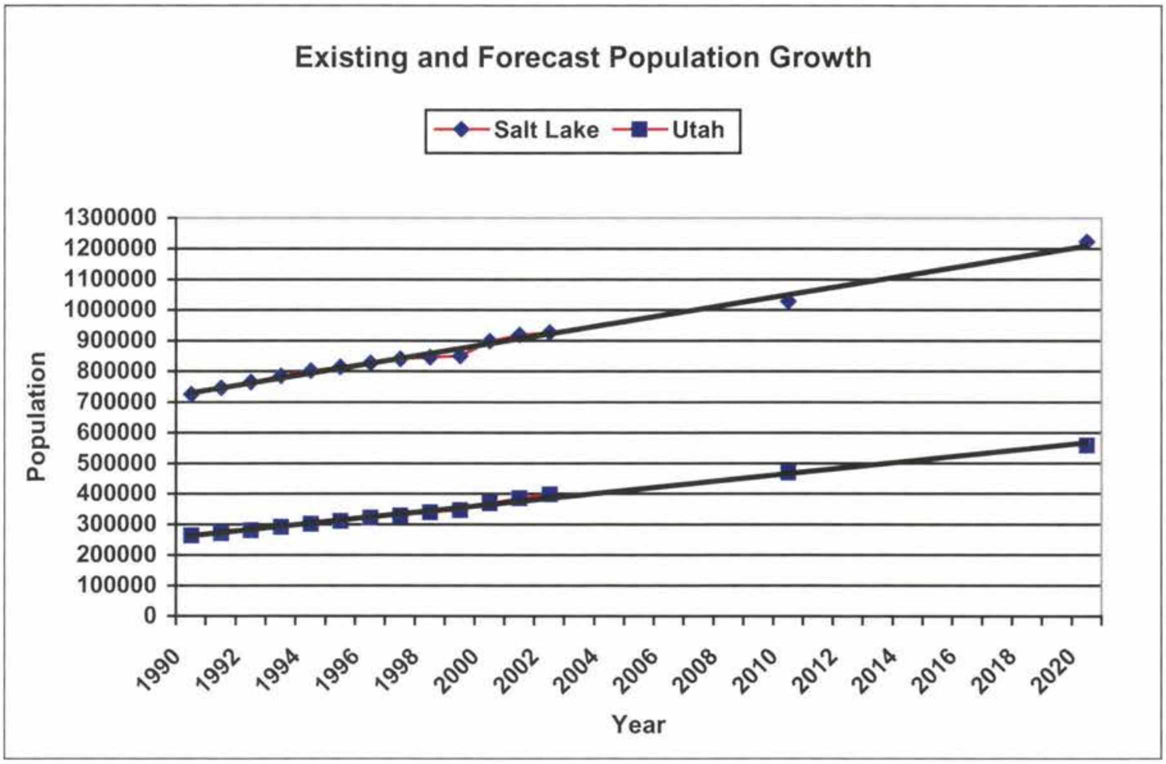


Figure 3-1
Population Trends in Salt Lake and Utah Counties

Source: Governor's Office of Planning and Budget, 2003a.

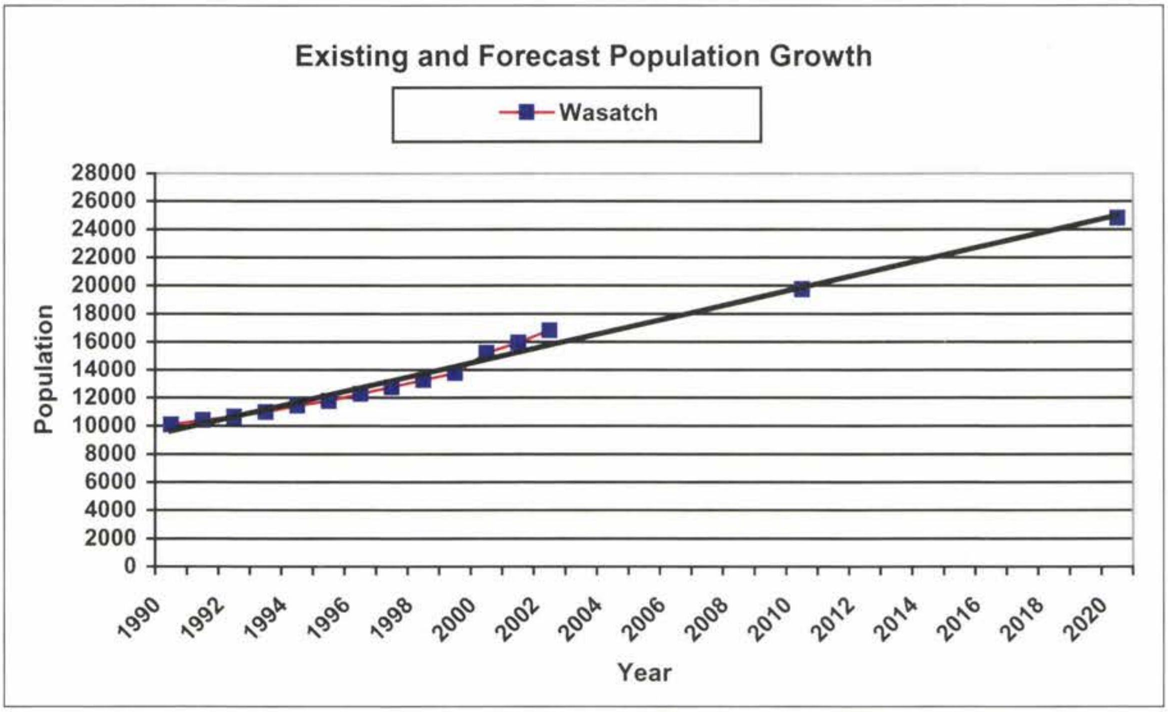


Figure 3-2
Population Trends in Wasatch County

Source: Governor's Office of Planning and Budget, 2003a.

3.12.7.2 Employment

Salt Lake and Utah counties hosted 874,000 jobs, or about 62 percent of all statewide employment. The leading employment sectors for the counties are similar to that of the state, with the retail sector being the largest employer in Utah County. The construction job force is a leading employment sector within both counties, representing about 60,000 jobs (see Figure 3-3).

The state's unemployment rate has paralleled the direction of the U.S. unemployment rate, but at a slightly lower percentage level. By the end of the 1990s, the rate was about 3.7 percent, and by 2000, it reached a low of about 3.2 percent -- with Salt Lake and Utah counties retaining some of the lowest county rates within the state (Utah Department of Workforce Services 2003). In the following years, the unemployment rate has moved moderately upward, with the current 2003 rate estimated to be about 5.3 percent. Near-term unemployment rate forecasts suggest that the rate will stabilize at about 5 percent through 2004 (State of Utah Governor's Office of Planning and Budget 2003a).

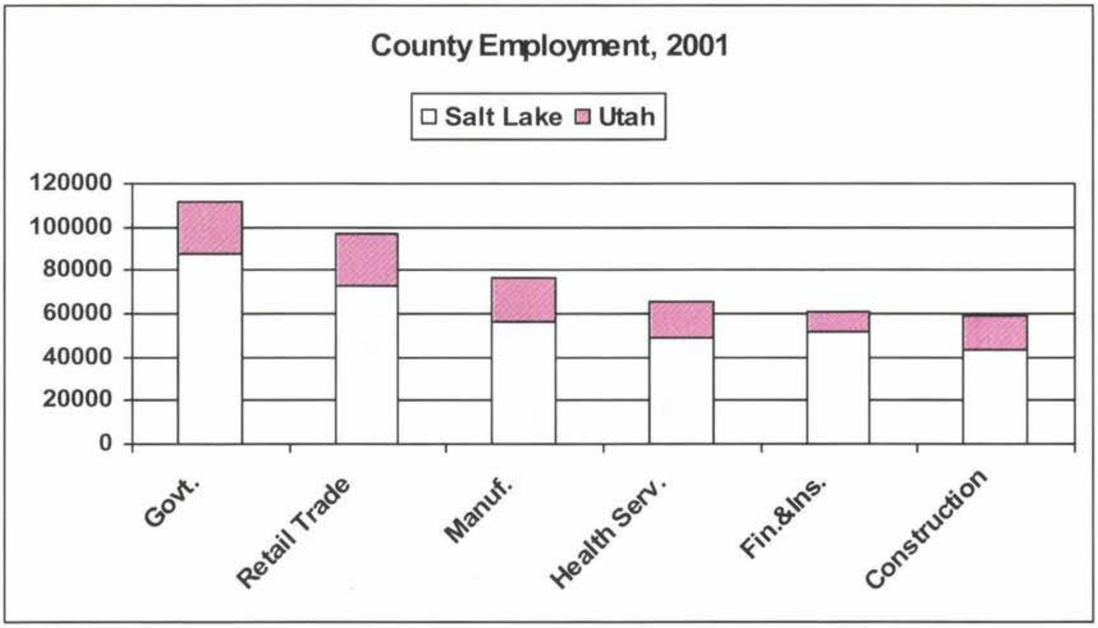


Figure 3-3
Employment by Major Sector for Salt Lake and Utah Counties

Source: U.S. Bureau of Economic Analysis, 2003a. Numbers include total full-time and part-time employment.

Historical, current, and projected employment for the affected counties is presented in Table 3-81. The current leading economic sectors are expected to remain strong within the long-range future, though some changes would likely occur. The service sector, in general, is forecast to increase as a percentage of the total labor force, continuing a trend established since 1970, and the manufacturing sector is expected to decline slightly. The construction and retail trade sectors are likely to hold at about the same relative percentage of total employment in the future as that of current levels (State of Utah Governor's Office of Planning and Budget 2003a).

Table 3-81
Total County Employment with Future Projections

County	1980	1990	2000	2005	2010	2015	2020	2030	2000-2030 AARG*
Salt Lake	331,115	442,285	648,003	696,595	779,843	857,292	913,143	1,002,915	1.5%
Utah	79,565	118,018	195,169	217,906	254,702	288,166	310,925	350,741	2.0%
Wasatch	3,151	3,863	7,234	8,612	10,427	12,130	13,388	15,640	2.6%

Notes:
Mountainland Association of Governments 2003; and State of Utah Governor's Office of Planning and Budget 2003a.
*Average Annual Rate of Growth.

3.12.7.3 Income

Table 3-82 shows income for Salt Lake and Utah counties by major economic sectors. The leading economic sectors for the counties include construction, retail trade, information and communications, finance and insurance, professional services, health care, and government services (federal, state, and local). The leading income sector for both counties is government services; with professional services and finance leading within Salt Lake County; and information and communication, professional services, and health care leading within Utah County. Both counties display strong construction force and development income.

Table 3-82
Economic Income Sectors for Salt Lake and Utah Counties

Major Economic Sectors and Services	Salt Lake County Total Income ($1,000)	Percent of Total Salt Lake County Industry Income	Utah County Total Income ($1,000)	Percent of Total Utah County Income
Agriculture, Forestry, Fishing	6,462	<1%	40,589	<1%
Mining	175,568	<1%	4,451	<1%
Utilities	201,486	<1%	16,558	<1%
Construction	1,562,361	6.8%	455,082	8.3%
Manufacturing (Durable Goods)	1,649,175	7.2%	D*	------
Manufacturing (Non-Durable Goods)	740,445	3.2%	D*	------
Wholesale Trade	1,488,410	6.5%	218,719	4%
Retail Trade	1,718,467	7.5%	430,056	7.9%
Transportation and Warehousing	1,277,501	5.6%	94,138	2%
Information and Communications	882,680	3.8%	509,426	9.3%
Finance-Insurance	1,857,016	8.1%	174,075	3.2%
Real Estate	363,396	1.6%	58,620	1.1%
Professional Services	2,229,214	9.7%	462,337	8.4%
Business Management	895,144	3.9%	<1%	
Administrative Services	957,852	4.2%	3.5%	
Education	185,026	<1%	393,476	7.2%
Health Care	1,589,608	6.9%	461,806	8.4%
Entertainment	242,228	1%	56,762	1%
Accommodation and Food Services	686,234	3%	133,452	2.4%
Other Services	790,407	3.4%	227,095	4.1%
Government (Federal, State, Local)	3,409,235	14.9%	765,056	14%

Notes:
Source: U.S. Bureau of Economic Analysis 2003a.
*Bureau of Economic Analysis non-disclosure provision.

3.12.7.4 Housing and Property Values

Like much of the nation, Utah's housing construction industry has been vibrant despite stagnation in the general economy since 2001. During the first quarter of 2003, building permits were issued for 3,458 new single-family homes, a level not previously reached since 1978. The value of these new homes exceeds $500 million (approximately $145,000 per unit); in conjunction with the construction of new apartments and multi-family units, first-quarter housing valuation soared beyond $600 million (Utah Bureau of Economic and Business Research 2003a). On an annual basis, Salt Lake and Utah counties have consistently had over 5,000 and 4,000 new homes built since 1998 (State of Utah Governor's Office of Planning and Budget 2003b).

The high demand for new housing is prompted by low vacancy rates within the Greater Salt Lake area. The home-owner vacancy rate has dipped below 2.0 percent for several years; and the rental vacancy rate is under 7.0 percent (U.S. Census Bureau 2003b). Overall, home ownership rates for Utah and the affected project area counties are higher than the national average.

The median value (2001$) for existing owner-occupied housing in Utah is above $146,000. By comparison, the median value for owner-occupied housing in Salt Lake County, $157,000; in Utah County, $156,000; and in Wasatch County, $185,000 (U.S. Census Bureau 2003b). The average value for new residential housing construction (2001) within Juab, Salt Lake, and Utah counties is approximately equal to the estimated median home values, but the average value of new residential construction in Wasatch County exceeds current median values (Utah Bureau of Economics and Business Research 2003b).

In 2001, the total assessed property valuation for Salt Lake County was about $46 billion; for Utah County, about $14 billion; and for Wasatch County, about $1.5 billion. Corresponding property taxes amounted to about $666 million in Salt Lake County; $158 million in Utah County; and $15 million in Wasatch County (Utah Bureau of Economic and Business Research 2003a).

3.12.7.5 Public and Business Services and Fiscal Conditions

Existing public services and the fiscal conditions of the cities and towns in the impact area of influence are being strained by the current population growth. This is especially true for Southern Utah County communities.

The Governor's "Baseline 2020" project evaluated future state services, multiple public facility needs, as well as the likely costs for such services.

Concerning water resources, state agencies, municipal jurisdictions, special service districts, and private sector representatives identified the necessary infrastructure and cost components for successfully meeting new water supply needs (State of Utah Office of the Governor, Baseline 2020 2003).

Water supply infrastructure and fiscal requirements developed for the Baseline 2020 project are summarized below:

- All existing developed water supplies will continue to be available.
- Municipal and industrial supplies will be shared by all users in the Greater Wasatch Area, without regard to current distribution networks and water rights.
- The Central Utah Project will be completed as now envisioned.

- Additional groundwater will be developed.
- Considerable infrastructure development including water treatment plants and distribution systems will be developed.
- New secondary systems in Utah County and other counties will convert agricultural water to secondary use as agricultural land becomes urbanized.
- Conservation will reduce water demand by 12.5 percent by 2020 based on programmatic measures and price increases.
- The costs for most major water infrastructure developments in the State Division of Water Resources, water district, and large municipality plans have been included.
- Water rates are projected to continue to increase through 2020. Salt Lake City just announced a 50 percent increase in their water rates by 2020. Inflation adjusted water rates in Baseline 2020 are projected to increase by a similar amount in the Greater Wasatch Area through 2020.
- The most significant water issue is the cost of paying for future new water infrastructure and water development. These costs are expected to be higher because of aging delivery systems, environmental and health regulations, less federal government financial assistance, and the higher costs of the next new sources of supply.
- Water infrastructure development is projected to cost more than $3.1 billion between 1995 and 2020 (current 1997 dollars). This equates to approximately $1,200 per person and $3,300 per household.

The Baseline 2020 project participants concluded that water is not a constraint to population growth in Central Utah, as long as water providers are willing to work jointly to deliver adequate supplies, and Utah residents are willing to pay for additional water development. The marginal costs for new water supplies can vary greatly given the source available and the purpose of use.

For the impact area of influence, the current end-user water rates generally range between $1.05 to $1.75 per 1,000 gallons (includes some secondary municipal irrigation use), with some separate secondary municipal irrigation costs ranging between $150-300 per acre-foot (Pacific Northwest Project 2003). Statewide, about 67 percent of the water service providers have some portion of their service territories under separate secondary irrigation systems (UDEQ 2002). The impact areas of influence service providers retain a mix of systems, some having separate secondary irrigation systems.

3.12.7.6 Agriculture

Table 3-83 summarizes some of the baseline economic features for the affected counties. The counties represent about 16 percent of the state's total farm-gate value for 2001. Reflecting the state agricultural industry at large, the bulk of the farm-gate value is credited to livestock and livestock product sales. Within Salt Lake County, significant food processing occurs, bolstering the amount of total income stemming from the broad agricultural industry designation. In terms of the percentage of total workplace-earned county income (direct income), the agricultural industry represents about 2 percent in Utah County, and less than 1 percent for the other counties.

Table 3-83
Key Agricultural Economics For Affected Counties

County/ State	Total Farm Acreage (1997 Census)	Harvested Cropland (1997 Census)	Irrigated Lands[1] (1997 Census)	Average $ Value Per Acre[2]	Total Farm-Gate $ for 2001 (x1,000,000)	Livestock $ for 2001 (x1,000,000)	Agriculture Industry 2001 Direct Income (x1,000,000)	Agriculture Industry 2001 Indirect Income[3] (x1,000,000)
Salt Lake	113,912	20,319	14,647	$2,100	$26.7	$16.3	>$145.5	>$116.0
Utah	374,933	86,976	81,168	$2,200	$111.4	$73.5	$111.4	$89.1
State of Utah	12,024,661	1,107,928	1,212,201	$580	$1,116	$853.3	$730	$803

Notes:
U.S. Bureau of Economic Analysis 2003a, 2003b.
USDA 2003 (1997 Census data).
Utah Department of Agriculture 2003.
[1]Includes pasture lands.
[2]1997 $ based on Agricultural Census Data.
[3]The agricultural industry includes agricultural production, agricultural services, and food processing sectors. Income multiplier used here for the counties is 1.8, for estimating indirect income impacts (multiplier based on IMPLAN analyses for Western States).

The contribution of irrigated lands to the counties' agricultural base and economy is diverse, but significant amounts of irrigated lands (hay and pasture lands) are linked to livestock production and livestock products. Some higher value, irrigated tree-fruit crops are grown in southern Utah County.

In the future, population growth and urban land use expansion are expected to overtake some existing agricultural lands within the affected counties. In southern Utah County, general estimates for irrigated lands taken out of production suggest that about 13,000 acres, or 16 percent of existing irrigated acres, would be affected by 2050. In Salt Lake County, about 5,000 acres or 30 percent of the existing 15,000 irrigated acres is assumed to be removed from agricultural production (CUWCD 2003).

3.12.7.7 Recreational Fishing

Recreational fishing or angling provides economic values measured in terms of both direct net value (National Economic Development) and regional (Regional Economic Development) economic impacts. The NED values are used for formal benefit-cost analyses and the RED values are an estimate of local economic impacts within a region or state.

Two rivers within the impact area of influence provide publicly accessible fishing opportunities. The lower Provo River from the Deer Creek Reservoir outlet to Utah Lake is accessible for public fishing except for short reaches in Provo City. Baseline angler-day use in the lower Provo River is estimated at 127,958 angler-days per year (see Section 3.15.7.3.4.3). The Spanish Fork River downstream from its confluence with Diamond Fork Creek provides public fishing access in two reaches upstream from Spanish Fork City. Baseline angler-day use of the publicly accessible reaches of the Spanish Fork River is estimated at 6,992 angler-days per year (see Section 3.15.7.3.4.).

The direct net economic value per angler-day for Utah is $35.35, indexed to June 2004 using the CPI for all urban consumers from the average 2001 value of $33.00 reported in the 2001 National Survey of Fishing, Hunting, and Wildlife Associated Recreation for Utah (March 2003), published by the U.S. Department of the Interior, Fish and Wildlife Service and the U.S. Department of Commerce (DOI and U.S. Department of Commerce 2003). The baseline direct net value of trout fishing on the Provo River and Spanish Fork River is estimated at $4,770,483 per year.

Regional economic impacts under the baseline condition were estimated by relying on the 2001 National Survey for state recreational fishing expenditures (DOI and U.S. Department of Commerce 2003). The average direct expenditures for recreational fishing in Utah are estimated to be about $75 per angler day (2001 dollars). The regional economic multiplier effect (total regional/state output or sales multipliers) for recreational fishing expenditures ranges between 1.5 to 2.5 consistent with state agency estimates and recreation economics studies (Loomis and Walsh, 1994). Consequently, for baseline conditions, the direct regional expenditures are estimated to be about $9,598,875 annually, with total direct and indirect expenditures amounting to about $19 million (with a regional sales multiplier of 2.0).

3.12.8 Environmental Consequences (Impacts)

3.12.8.1 Significance Criteria

3.12.8.1.1 Economics. Table 3-84 identifies economic impacts that would be considered significant as a result of construction and operation of any of the alternatives. These criteria are based on professional judgment, other NEPA analysis projects and other economic impact assessments related to water resources development.

Table 3-84
Significance Criteria for Economic Impacts Caused by the ULS Project

Area/Impact Topic	Significance Criteria
Employment	A change greater than 5 percent in annual construction employment within the local county.
Personal Income	A change greater than 5 percent in annual personal income to the construction labor sector within the local county; or a change greater than 5 percent to agricultural sector income, due to project construction impacts.
Population	A change greater than 5 percent in population within the local county.
Public and Utility Services, and Related Fiscal Impacts	A change to direct service levels of 5 percent; or a change greater than 5 percent in tax revenue collected and level or quality of public services; and changes to water supply rates (or service delivery taxes).
Property Value or Local Business Impacts	A change greater than 5 percent in the average market value of residential properties within a city or township; or 5 percent change/impact on local business (for example, construction impacts).
Housing	A change greater than 5 percent in demand for housing, within the local county.
Recreation	A change greater than 5 percent in recreation values or economic impacts, for a specific area, such as sport fishing.

3.12.8.2 Potential Impacts Eliminated From Further Analysis

3.12.8.2.1 Economics

Impacts on the Utah Lake ecosystem in terms of associated local economic effects

Impacts of the ULS Project on Utah Lake property values

Operation of Utah Lake would not vary from normal operations and historic levels under all of the ULS alternatives (see Chapter 3, Section 3.2 Surface Water Hydrology). During the scoping process one of the alternatives showed a pipeline crossing Utah Lake. That particular alternative has been eliminated from further consideration (see Chapter 1, Section 1.11.1).

Impacts of each of the ULS concepts on the economic value of environmental benefits, including increased natural resources such as increased outdoor recreation, renewable consumptive wildlife resources, and secondary economic benefits of these

For environmental and natural resource changes, the most significant, and measurable, economic impact is related to recreational fishing values. Both direct net values and regional (secondary) impacts are identified within the impact analysis sections. Other economic values associated with environmental changes from the project are considered to be small and insignificant.

Impacts on Population

The project water supply and delivery alternatives, per se. would not be the direct cause of population or economic growth, such as would be the case for a new industry locating within a community or a new agricultural project siting within the region. The project alternatives represent infrastructure development, specifically water supply, to service the future growth that occurs within the region, induced by more direct economic forces and actions. The growth projected for this area as shown in the Economic Report to the Governor 2002, prepared by the Governor's Office of Planning and Budget would occur "with or without" the ULS water supply project alternatives. Construction workers would not create additional use on the recreation resources in the impact area of influence as the local (Salt Lake City and surrounding cities and towns) labor pool would supply the necessary workforce.

Impacts on Housing

The construction of the ULS project would not create a demand for new housing or impact the housing industry. The local labor pool in the impact area of influence is more than sufficient to supply the necessary construction labor (see Section 3.12.7.2). Therefore there would not be a large influx of workers into the area that would require housing.

Property Values

Direct property value impacts would be negligible, as project facilities are being largely constructed in established rights-of-way, and disruptions to travel routes and access points would be temporary. Implementation of the standard operating procedures (SOPS) as described in Chapter 1, Section1.8.8 Standard Operating Procedures would minimize any impacts associated with these temporary disruptions.

What is the potential for reuse of ULS water and what impacts would this have on groundwater and secondary growth?

Plans for reuse or recycling of ULS water are described in Chapter 1, Sections 1.4.9.3, 1.5.9.2, and 1.6.3.2. The impacts on secondary growth would be negligible because the water would be delivered through existing water transmission facilities to areas already developed.

3.12.8.3 Spanish Fork Canyon – Provo Reservoir Canal Alternative (Proposed Action)

3.12.8.3.1 Construction Phase

3.12.8.3.1.1 Employment. Building new pipeline, power generation, and power transmission infrastructure would create additional employment within the construction sector. Most jobs would be filled by the existing construction force labor pool located within the impact area of influence. Over the entire construction period, total labor requirements are estimated to be between 1,200 and 1,800 jobs (annual equivalent). In addition, some senior engineering and professional management staff would be employed by the project (labor estimates are preliminary based on developing construction cost estimates). Impacts on employment would not exceed the significance criteria.

3.12.8.3.1.2 Income. Within the impact area of influence, both direct and indirect income impacts would result from project construction. The direct income impacts are estimated to be about $72 million. Relying on state-wide economic multipliers, from the Bureau of Economic Analysis, the additional indirect income generated by the project is estimated to be about $79 million. Total direct and indirect income impacts are estimated to be about $151 million (labor estimates are preliminary based on developing construction cost estimates). Impacts on income would not exceed the significance criteria.

In addition to direct labor force costs, other expenditures would be made to cover the costs of new and rental construction equipment and project materials. These expenditures are estimated to be about $270 million. These expenditures would be distributed across the impact area of influence, state, and national economies, with both direct and indirect effects. These impacts would not exceed the significance criteria.

3.12.8.3.1.3 Public and Business Services and Fiscal Conditions. The pipeline corridor and pipeline construction would follow existing utility rights-of-way along state and local roadways, and pass through some agricultural lands and some residential/commercial properties (see Map A-1). There would be some site-specific impacts affecting transportation routes and travel time (see Chapter 3, Section 3.19), and disrupting access points for some local business and residential homes. However, all direct construction impacts would be short-term in nature, not affecting most site locations for more than 30 days, and most impacts would be similar to standard road construction and improvement impacts. The Standard Operating Procedures (SOPs) (see Chapter 1, Section 1.8.8.11) would help minimize the impacts; however some disruptions would still occur. The level and magnitude of disruption impacts on public and business services and local fiscal conditions would not exceed the significance criteria.

3.12.8.3.1.4 Agriculture. The pipeline corridor and pipeline construction would pass through some agricultural production lands (see Map A-1), leading to minor, site-specific impacts. It is estimated that construction phase impacts—including both temporary and permanent land impacts—would disturb about 52.6 acres for the Spanish Fork–Santaquin Pipeline, about 28.8 acres for the Santaquin–Mona Reservoir Pipeline, and about 3.1 acres for the Mapleton–Springville Lateral Pipeline. During the year of the peak construction phase, this rotational crop and orchard acreage reduction would correspond to a decrease in annual gross revenues of approximately $75,000, $1,500, and $800 respectively. In terms of regional net household income, the total direct and indirect impact would be less than $100,000.

Some permanent losses in agricultural production would result from construction of features. It is estimated that permanent production losses would affect about 15.4 acres for the Spanish Fork–Santaquin Pipeline, and no acreage losses for the Santaquin–Mona Reservoir and Mapleton–Springville Lateral pipelines. This would correspond to a reduction in annual gross revenues of about $34,600. In terms of regional net household income, the total direct and indirect impact would be less than $50,000.

Although farm operators would be compensated for their crop losses through the easement acquisition process (see Chapter 1, Section 1.4.3) this loss of crop revenue would result in a loss to the agriculture sector. Impacts on the agricultural sector at the county level would not exceed the significance criteria.

3.12.8.3.2 Operations Phase

3.12.8.3.2.1 Employment. Project operations would be limited to maintenance and monitoring by the District. It is anticipated that modest increases in existing District staff would be needed, along with periodic hiring of contractors. Impacts on employment would not exceed the significance criteria.

3.12.8.3.2.2 Income. The increase in the operations work force would not cause a measurable impact on income levels within the impact area of influence.

3.12.8.3.2.3 Public and Business Services and Fiscal Conditions. Operation of the project is not expected to cause any impacts on direct business service levels, or level or quality of public services that would exceed the significance criteria.

The decrease in Strawberry Water Users Association power generation revenue would be about $6,125 per year from the decrease in SVP water flowing through the Upper Generator. This decrease would be about 1.2 percent of the estimated baseline power generation revenue of $508,467 per year, resulting in estimated annual power generation revenue of $502,342 per year under the Proposed Action.

There would likely be an increase in the per acre-foot water rates charged by the District for the Bonneville Unit M&I water delivered to southern Utah County and Salt Lake County. The exact amount of the increase would vary by city but would likely exceed the significance criteria. The cost of ULS water in Salt Lake County and southern Utah County is projected to be $301.73 per acre-foot.

3.12.8.3.2.4 Recreational Fishing. Recreational fishing or angling would increase under the Proposed Action. Table 3-85 displays the estimated direct net economic value and regional impacts of increased angler days per year from improved aquatic habitat (see Chapter 3, Section 3.15, Recreation Resources, for a description of angler-use estimates in the impact area of influence).

Table 3-85
Economic Impacts of Angler-Use Resulting From the Proposed Action

	Baseline	Proposed Action	Impact (Change)
Total Angler-Use Days per Year	134,950	171,388	+36,438
Total Annual Direct Net Value	$4,770,483	$6,058,566	+$1,288,083
Total Recreational Fishing Expenditures (Direct and Indirect Expenditures)	$20,242,500	$25,708,200	+$5,465,700
Percentage Direct and Indirect Expenditures Increase from Baseline	Not Applicable	Not Applicable	+27.0%

Note: The estimated angler day value is $35.35, based on the net economic value per angler day indexed using the Consumer Price Index (CPI) for all urban consumers to June 2004 from the average 2001 value of $33.00 reported in the 2001 National Survey of Fishing, Hunting, and Wildlife Associated Recreation for Utah (March 2003) published by the U.S. Department of the Interior, Fish and Wildlife Service and U.S. Department of Commerce.

Based on the increase in angler-use over the baseline, the overall impact on the economy would be an increase of about $5,465,700 in regional/state expenditures. This represents a 27 percent increase over baseline conditions and would be a significant beneficial impact.

3.12.8.3.3 Summary of Proposed Action Impacts

3.12.8.3.3.1 Employment. Construction activities would create about 800 to 1,190 jobs (annual equivalent). Most jobs are expected to be filled by the existing construction force labor pool located within the impact area of influence. Project operations would slightly increase District operations staff. The impacts on employment would not exceed the significance criteria.

3.12.8.3.3.2 Income. Construction activities would result in an increase of approximately $72 million in direct impacts. The additional indirect income that would be generated by construction activities is estimated to be about $79 million. Total direct and indirect impacts would equal approximately $151 million. Construction activities would result in $270 million in new equipment and materials purchases spread throughout the local, state, and national economies. Operations would not create any measurable income impacts.

3.12.8.3.3.3 Public and Business Services and Fiscal Conditions. Some construction and operation impacts would occur on local businesses and landowners, but the magnitude of such impacts would be minimized by the SOPs (see Chapter 1, Section 1.8.8.11). However, some disruptions of public and business services would occur, and would be of short duration.

Strawberry Water Users Association power generation revenue from the Upper Generator would be about $502,342 per year, which would be a decrease of about $6,125 per year (-1.2 percent) from baseline conditions.

There would be an increase in the water rates, which would be a significant impact.

3.12.8.3.3.4 Agriculture. Construction would result in a peak annual reduction in gross crop revenues of approximately $77,300, with a permanent annual reduction of about $34,600. Peak decreases in regional household income for the construction phase would be less than $100,000, with permanent decreases being less than $50,000.

3.12.8.3.3.5 Recreational Fishing. Operation of the Proposed Action would result in increased recreational fishing that would generate an additional $1,288,083 in direct net value and about $5,465,700 in total regional/state expenditures. This impact represents about a 27 percent increase above baseline conditions and would be a significant impact.

3.12.8.4 Bonneville Unit Water Alternative

3.12.8.4.1 Construction Phase

3.12.8.4.1.1 Employment. Building new pipeline, power generation, and power transmission infrastructure would create additional employment within the construction sector. Most jobs would be filled by the existing construction force labor pool located within the impact area of influence. Over the entire construction period, total labor requirements would be between 620 to 930 jobs (annual equivalent). In addition, some senior engineering and professional management staff would be employed by the project. Impacts on employment would not exceed the significance criteria.

3.12.8.4.1.2 Income. Within the impact area of influence, both direct and indirect income impacts would result from the project construction. The direct income impacts would be about $37 million. Relying on state-wide economic multipliers, the additional indirect income generated by the project would be about $41 million. Total direct and indirect income impacts would be about $78 million.

In addition to direct labor force costs, other expenditures would be made to cover the costs of new and rental construction equipment and project materials. These expenditures would be about $147 million. These expenditures would be made within the impact area, state, and national economies, with both direct and indirect effects.

Impacts on income would not exceed the significance criteria.

3.12.8.4.1.3 Public and Business Services and Fiscal Conditions. The impacts would be mostly the same as described for the Proposed Action in Section 3.12.8.3.1.3.

3.12.8.4.1.4 Agriculture. The Spanish Fork – Santaquin Pipeline and Mapleton – Springville Lateral Pipeline impacts would be the same as under the Proposed Action (see Section 3.12.8.3.1.4). For construction related impacts, peak annual crop revenue reductions would be about $75,800, with peak regional income reductions under $100,000.

3.12.8.4.2 Operations Phase

3.12.8.4.2.1 Employment. The impacts would be the same as described for the Proposed Action in Section 3.12.8.3.2.1.

3.12.8.4.2.2 Income. The impacts would be the same as described for the Proposed Action in Section 3.12.8.3.2.2.

3.12.8.4.2.3 Public and Business Services and Fiscal Conditions. The impacts would be the same as described for the-Proposed Action in Section 3.12.8.3.2.3. The cost of ULS water in southern Utah County is projected to be $334 per acre-foot.

3.12.8.4.2.4 Recreational Fishing. Recreational fishing or angling would increase under the Bonneville Unit Water Alternative. Table 3-86 shows the estimated direct net economic value and regional impacts of increased angler days per year from improved aquatic habitat (see Chapter 3, Section 3.15, Recreation Resources, for a description of angler-use estimates in the impact area of influence).

Table 3-86 Economic Impacts of Angler-Use Resulting From the Bonneville Unit Water Alternative			
	Baseline	**Bonneville Unit Water Alternative**	**Impact Change**
Total Angler-Use Days per Year	134,950	153,004	18,054
Total Annual Direct Net Value	$4,770,483	$5,408,691	+$638,209
Total Recreational Fishing Expenditures (Direct and Indirect Expenditures)	$20,242,500	$22,950,600	+$2,708,100
Percentage Increase Direct and Indirect Expenditures from Baseline	Not Applicable	Not Applicable	+13.4%

Note: The estimated angler day value is $35.35, based on the net economic value per angler day indexed using the Consumer Price Index (CPI) for all urban consumers to June 2004 from the average 2001 value of $33.00 reported in the 2001 National Survey of Fishing, Hunting, and Wildlife Associated Recreation for Utah (March 2003) published by the U.S. Department of the Interior, Fish and Wildlife Service and U.S. Department of Commerce.

Operation of the Bonneville Unit Water Alternative would result in increased recreational fishing that would generate an additional $638,208 in direct net value, and about $2,708,100 in total regional/state expenditures. This impact represents about a 13.4 percent increase above baseline conditions and would be a significant impact.

3.12.8.4.3 Summary of Bonneville Unit Water Alternative Impacts

3.12.8.4.3.1 Employment. Construction activities would create about 620-930 jobs (annual equivalent). Most jobs would be filled by the existing construction force labor pool located within the impact area of influence. Project operations would slightly increase District operations staff.

3.12.8.4.3.2 Income. Construction activities would result in an increase of approximately $37 million in direct impacts. The additional indirect income that would be generated by construction activities is estimated to be about $41 million. Total direct and indirect impacts would equal approximately $78 million. Construction activities would result in $147 million in new equipment and materials purchases spread throughout the local, state, and national economies. Operations would not create any measurable income impacts.

3.12.8.4.3.3 Public and Business Services and Fiscal Conditions. Some construction and operation impacts would occur on local businesses and landowners, but the magnitude of such impacts would be minimized by the SOPs (see Chapter 1, Section 1.8.8.11). However, some disruptions of public and business services would occur, and would be of short duration.

Strawberry Water Users Association power generation revenue from the Upper Generator would be $502,342 per year, which would be a decrease of about $6,125 per year (-1.2 percent) from baseline conditions.

There would be an increase in the water rates, which would be a significant impact.

3.12.8.4.3.4 Agriculture. The Spanish Fork – Santaquin Pipeline, the Santaquin – Mona Reservoir Pipeline, and the Mapleton – Springville Lateral Pipeline agricultural economics impacts would be the same as described under he Proposed Action (see Section 3.12.8.3.3). For construction related impacts, peak annual crop revenue reductions would be about $75,800, with peak regional income losses under $100,000.

3.12.8.4.3.5 Recreational Fishing. Operation of the Bonneville Unit Water Alternative would result in increased recreational fishing that would generate annually an additional $638,208 in direct net value, and about $2,708,100 in total regional/state expenditures. This impact represents about a 13.4 percent increase above baseline conditions and would be a significant impact.

3.12.8.5 No Action Alternative

With the exception of the public and business services and fiscal conditions and recreational fishing sectors, the changes in the other sectors would be the same under the No Action Alternative as under the other alternatives. The changes in the public and business services and fiscal conditions and recreational fishing sectors are discussed below.

3.12.8.5.1 Public and Business Services and Fiscal Conditions. Water resource agency officials and local water delivery providers have determined that future population and economic growth would place new demands on water supply resources. Under the guidance of the Governor's "Baseline 2020" project, water resource planning requirements have been established, and cost estimates have been prepared for new water supply infrastructure. This management and fiscal analysis concludes that adequate water supply resources are available to meet projected needs, but the new resource alternatives would be more expensive than existing resources, and water delivery customers would bear higher water service taxes and rates.

Future water rates would be determined by increasing marginal resource costs. A review of the existing and marginal costs for new water supply delivery under the No Action Alternative is displayed in Table 3-87. These cost estimates cover several water supply options that have been identified for the general impact area of influence.

Table 3-87
Estimated Costs for New Water Resources

Water Resource	Volume (acre-feet)	Annual $/acre-foot	Purpose/Use
Salt Lake County			
Bear River Water	50,000	$417	Municipal
Efficiency Measures	12 to 25 percent of Existing Supplies	<$300	Municipal
Groundwater Wells	50,000	$460 to $522	Municipal
Water Recycling	18,000	$450 to $600	Secondary/Irrigation
Utah Lake RO Plant	50,000	$700 to $1,000	Municipal
Southern Utah County			
Efficiency Measures	12 to 25 percent of Existing Supplies	<$300	Municipal
Irrigation Private Wells to M&I	Undetermined	<$200	Municipal
Water Recycling	Undetermined	>$300	Secondary/Irrigation
Irrigation Surface Water to M&I	Undetermined	>$600 to 1,000	Municipal

Notes:
CUWCD 2003
Pacific Northwest Project 2003

3.12.8.5.2. Recreational Fishing. Recreational fishing or angling would increase under the No Action Alternative. Table 3-88 shows the estimated direct net economic value and regional impacts of increased angler days per year from improved aquatic habitat (see Chapter 3, Section 3.15, Recreation Resources, for a description of angler-use estimates in the impact area of influence).

Table 3-88
Economic Impacts of Angler-Use Resulting From the No Action Alternative

	Baseline	No Action Alternative	Impact Change
Total Angler-Use Days per Year	134,950	154,666	19,716
Total Annual Direct Net Value	\$4,770,483	\$5,467,443	\$696,960
Total Recreational Fishing Expenditures (Direct and Indirect Expenditures)	\$20,242,500	\$23,199,900	+\$2,957,400
Percentage Increase Direct and Indirect Expenditures from Baseline	Not Applicable	Not Applicable	+14.6%

Note: The estimated angler day value is \$35.35, based on the net economic value per angler day indexed using the Consumer Price Index (CPI) for all urban consumers to June 2004 from the average 2001 value of \$33.00 reported in the 2001 National Survey of Fishing, Hunting, and Wildlife Associated Recreation for Utah (March 2003) published by the U.S. Department of the Interior, Fish and Wildlife Service and U.S. Department of Commerce.

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3.13 Cultural Resources

3.13.1 Introduction

This analysis addresses potential impacts on cultural resources from construction and operation of the Proposed Action and other alternatives. For more detail refer to the Cultural Resources Technical Report for the Utah Lake Drainage Basin Water Delivery System (CUWCD 2004f). Impact topics include the following:

- Archaeological sites
- Historical sites
- Traditional cultural properties
- Cultural landscapes
- Archaeological districts
- Historical buildings and structures

3.13.2 Issues Raised in Scoping Meetings

None.

3.13.3 Scoping Issues Eliminated From Further Analysis

None.

3.13.4 Scoping Issues Addressed in the Impact Analysis

None.

3.13.5 Description of Impact Area of Influence

The impact area of influence includes the following:

- Areas directly affected by project features
- Streams or rivers and associated corridors that would be subject to water deliveries or alterations in flow

Map 3-2 shows the overall ULS impact area of influence, which includes all areas where the surface would be disturbed by construction activities. Potential impacts are possible along the Hobble Creek channel where increased water flows created by the ULS project may increase streambank erosion and could threaten archaeological site deposits and historical properties adjacent to the channel.

3.13.6 Methodology

3.13.6.1 Assumptions

None.

3.13.6.2 Impact Analysis Methodology

The impact analysis considered the standard operating procedures (SOPs) and project design features that the District will implement as part of the project. The analysis involved identifying properties eligible for, or listed on, the National Register of Historic Places (NRHP) within the impact area of influence, defining the characteristics of each property that contribute to their eligibility, and determining the impact of the alternatives on each property. The analysis was divided into three phases as described below.

Phase 1 – Compilation of Background Research and Information. This involved file and archival record searches at the U.S. Historical Preservation Office (USHPO), NRHP, Bureau of Land Management (BLM), Salt Lake City, the Bureau of Reclamation (Reclamation), Provo and the U.S. Forest Service, Provo. This step included obtaining existing information on known sites and previous cultural resource projects, and published sources from the files.

Phase 2 – Preparation of an Historic Context. Research was conducted using libraries, a variety of institutions, and data bases to obtain primary and secondary archaeological, ethnographic and historical source material. Some individuals with knowledge of irrigation facilities and other historic properties were sought out and interviewed to help gain a better understanding of the nature and significance of particular sites.

Phase 3 – Field Inspection and Recordation of Cultural Resources. Sites discovered during these field inventories were recorded and evaluated for NRHP eligibility. Prehistoric and historic archaeological sites (roads, canals, reservoirs and related features), were recorded on Intermountain Antiquities Computer System forms (see Appendix A in Cultural Resources Technical Report). Two field crews conducted walking field reconnaissance inventories and recorded and evaluated standing historical properties within the impact area of influence. Historic standing buildings and structures were recorded on Utah Historic Site forms and described, photographed and evaluated for NRHP eligibility (1953 or earlier). Previously recorded sites were revisited and reevaluated for NRHP eligibility.

Potential impacts on cultural resources were evaluated by first determining the NRHP eligibility of each recorded site based on physical integrity and whether it met at least one of the four NRHP criteria. Potential impacts on eligible properties from construction or operation were then evaluated (including physical, visual or other factors or conditions in the case of traditional cultural properties). After the impacts were determined, a recommendation was made on whether the project affected NRHP eligibility of the sites.

3.13.7 Affected Environment (Baseline Conditions)

If a feature is not listed in either or both sections, 3.13.7.2 Archaeological Sites and/or 3.13.7.3 Historical Sites, then no archaeological or historical sites were found in those areas.

3.13.7.1 Overview

The prehistory of the area begins near the end of the Pleistocene Epoch and generally parallels that of the eastern Great Basin. The cultural changes in the Great Basin are classified into six general chronological periods as defined by Jennings (1986): the Pre-Archaic (12,000 to 9,000 B.C.), Early Archaic (9,000 to 3,500 B.C.), Middle Archaic (3,500 B.C. to A.D. 500), Late Archaic (A.D. 400 to 1300), and Pre-Contact (A.D. 1200 to 1776). The basin is further divided into subregions, such as the eastern Great Basin, which is identified by a series of distinctive cultural phases marked by a distinct way of life defined by datable projectile points. These descriptions note significant traits, characteristics and artifacts associated with each phase or period.

The ethnographic period is characterized by the initial contact and ensuing relationship between the primary Native American tribe (the Ute) and Europeans and European-Americans. It includes developments and changes in the Ute culture and the restriction of indigenous peoples to reservation lands due to pressure by white settlers.

With the arrival of explorers, fur trappers and permanent settlers, the physical landscape and the culture of the indigenous populations began to change. The region passed from prehistory into recorded history. Utah Valley was settled and developed by Mormon pioneers.

The historic development of Utah Valley follows the same basic pattern as most of northern Utah, which began with the Exploration and Fur Trapping Period (1776 to 1846), followed by the Settlement Period (1847 to 1869). Settlement by Mormon Pioneers continued throughout the latter half of the nineteenth century, with some economic growth spurred by the arrival of the transcontinental railroad during the Railroad Era (1869 to 1919). This era was followed by an economic downturn shortly after World War I and the economic collapse of the Great Depression (1929 to 1940). Economic revival came with the United States entry into World War II (1941 to 1949).

During the Post-War Era (1950 to Present), the cities and towns of Utah Valley have experienced an economic revival. Changing market conditions and advances in technology have altered the make-up of the area's economy. Steel and iron smelting have given way to high-tech industries such as computer manufacturing and programming. These and other economic forces have contributed to shifts in the growth patterns and industries in the valleys. The long-term influence of these changes will become more evident over time.

Settlement of the Provo-Springville-Mapleton area occurred between 1849 and 1856 (Dixon 1974; Van Cott 1990) when the first permanent Mormon settlement in Utah Valley began with Provo. Another company of settlers began Springville the following year. Mapleton was settled in 1856 as an offshoot of Springville in 1856. The Spanish Fork-Payson-Santaquin area was settled between 1850 and 1852 (Dixon 1974; Van Cott 1990), starting with Payson.

3.13.7.2 Archaeological Sites

3.13.7.2.1 Sixth Water Power Facility and Transmission Line. The archaeological survey of the Sixth Water Power Facility and Transmission Line corridor resulted in the location of two archaeological sites: the First Water Cabin (42Ut649) remains of a Spanish Fork Livestock Association herder's cabin; and Site 42Ut1400 in Spanish Fork Canyon, an historic trash scatter.

3.13.7.2.2 Spanish Fork Canyon Pipeline. The segment of the project area paralleling U.S. Highway 6 from Diamond Fork Canyon (Milepost 184.3) to Moark Junction (Milepost 178) was previously surveyed as part of several cultural resource projects. As a result, no inventory was undertaken during the current project. Seven new and previously recorded archaeological sites were located during these previous surveys along this portion of U.S. Highway 6. (See Cultural Resource Technical Report for the Utah Lake Drainage Basin Water Delivery System (CUWCD 2004f). One site the Castilla Warm Springs Spa (42Ut362) is recommended eligible for the NRHP.

3.13.7.3 Historical Sites

3.13.7.3.1 Sixth Water Power Facility and Transmission Line. One site was identified, the Sheep Creek Road. Because the road historically appears to have served as an important corridor of travel between southern Utah Valley and Vernal, the site was recommended eligible under criterion A.

3.13.7.3.2 Spanish Fork-Santaquin Pipeline. The reconnaissance-level inventory through the cities of Spanish Fork, Salem, Payson and Spring Lake identified and resulted in the recordation of four canals (Salem, Mill Race, Strawberry Highline, and South Field), one gauging station building on Salem Canal, one irrigation system (Spring Lake irrigation distribution ditch), and 43 historic residential and agricultural properties.

The gauging station on Salem Canal consists of a small wooden gable roof structure adjacent to the canal. The Spring Lake irrigation distribution ditch is a largely abandoned system paralleling U.S. Highway 6 in Spring Lake. It is a shallow, concrete lined ditch that once carried water to serve adjacent residential properties. At least one lateral was observed which extends under Highway 6 to serve properties on the opposite side of the road.

The Salem Canal is large irrigation canal that begins at a diversion structure on the Spanish Fork River in Canyon View Park in Spanish Fork. South Fork Canal diverts from Salem Canal about a half mile to the southwest of the beginning of Salem Canal. The Salem Canal, which is earthen at its northern end and concrete lined further south, continues southwestward into Salem and Payson where it ends just north of Rocky Ridge. The Salem Canal Road parallels the canal most of its length. This canal serves agricultural and residential customers in Salem and Payson. The Mill Race Canal begins at a small diversion pond near the Spanish Fork River in Canyon View Park. Both the South Field and Mill Race canals serve agricultural interests in the area around Spanish Fork.

The Strawberry Highline Canal, which begins on the Spanish Fork River in Spanish Fork Canyon, courses high above the valley floor and continues through Payson and beyond to serve southern Utah County agricultural fields.

The reconnaissance-level inventory within Spring Lake resulted in recordation of seven houses and four farmstead properties (CUWCD 2004f). The sites date from 1910 to 1950, with most dating to 1935 or later. They represent a variety of styles and types of buildings.

In Payson City, 15 houses were identified and recorded, along with three farmsteads, and one commercial property where produce is sold (CUWCD 2004f). These properties range in date from 1890 to 1950, and, similar to those in Spring Lake, represent several different styles and types.

The survey of the project area within Salem City resulted in identification and recordation of eleven houses, two farmsteads, one agricultural property with a dilapidated building for which no house could be associated, and one University Agricultural Farm operated by Brigham Young University (CUWCD 2004f). This facility is called the Spanish Fork Farm, Agriculture Station, and includes more than a dozen buildings, most relating to crop production and cattle raising. A few date to the 1940s, but most appear to date after 1953.

3.13.7.3.3 Santaquin-Mona Reservoir Pipeline. The reconnaissance-level inventory through this area resulted in the identification and recordation of the Summit Creek Reservoir Drain structure. This very deep, poured concrete feature appears to be part of an overflow system for Summit Creek Reservoir dated at least as early as the 1940s. It is located east of the northern edge of the reservoir near the Union Pacific Railroad tracks.

3.13.7.3.4 Mapleton-Springville Lateral Pipeline. One historic site was found along route of the Mapleton-Springville Lateral Pipeline. Site 42Ut471 is the Mapleton-Springville Lateral, a canal constructed in 1918 that is part of the Strawberry Valley Project. Site 42Ut471 begins in Spanish Fork Canyon and extends north-northwest to Hobble Creek, east of Springville. The canal is approximately 6.75 miles long, with an average width of 4 feet and a water depth of 2.5 feet. The canal is concrete-lined in some sections and earthen in others. This site was originally recorded in 1981.

3.13.7.3.5 Spanish Fork-Provo Reservoir Canal Pipeline. The reconnaissance-level inventory through the cities of Orem and Provo identified and resulted in the recordation of a historic bridge (5600 North over the Provo River), three canals (Provo Reservoir Canal, Provo Bench Canal, and West Union Canal), and 12 historic properties, which included two buildings listed on the National Register of Historic Places. The historic bridge is a single span pony truss structure that carries 5600 North across the Provo River in Provo. Two of the canals, the Provo Reservoir (commonly known as the Murdock Canal in Orem) and the Provo Bench Canals, are both located south of 800 North. The Provo Reservoir Canal carries water from the Provo River under 800 North before emerging from a concrete culvert at about 1400 East. From this point the concrete-lined canal, which measures about 5 deep and 10 to 12 feet wide, parallels 800 North. The Provo Bench Canal carries water from the Provo River in an underground concrete box before emerging from the box just south of the Provo Reservoir Canal. This concrete-lined canal, which measures about 5 wide and 3 feet deep, follows the base of a hill to the southwest. The West Union Canal, a dirt lined structure, which measures about 3 feet wide and 2 feet deep, splits from the Provo River at about 5700 North in Provo. The canal parallels the Provo River along the Provo River flood plain in a southwesterly direction.

Eleven of the properties are located in Provo City while only one residence is in the City of Orem (CUWCD 2004f). These properties range in date from 1890 to 1950 and represent a variety of styles and types of buildings. Two of the properties are listed on the National Register of Historic Places. Theses buildings, an 1890 Victorian (physician's quarters) and a 1934 Art Deco (director's residence), are part of the Utah State Mental Hospital. Located on the west end of the hospital property, they are situated across the street from one another.

The reconnaissance-level inventory through the City of Springville identified and recorded 115 historic properties along 400 East. The majority of these properties are located within the Springville Historic District, which begins at approximately 400 North and terminates at about 800 South. The properties in this area range in date from 1870 to 1950 and represent a very wide variety of styles and types of buildings. While many of the properties face 400 East, a few of the properties are located at intersections that often face the cross street rather than 400 East (see CUWCD 2004f for a listing).

The reconnaissance-level inventory through the City of Mapleton identified and recorded 23 historic properties. These properties range in date from 1880 to 1950 and represent a wide variety of styles and types of buildings. All of these properties are aligned along 1600 West, which is known as U.S. 89 in Mapleton. The majority of these properties are active farms that are dispersed along the roadway. The only cluster of buildings occurs at Center Street, where several businesses are situated (CUWCD 2004f).

3.13.7.3.6 Hobble Creek From Mapleton-Springville Lateral to Utah Lake. The Hobble Creek channel from the Mapleton Lateral west to Utah Lake is crossed 23 times by various transportation structures that carry motorized vehicles, railroads, and pedestrian traffic. The pedestrian crossings consist of one of two types; concrete sidewalks and metal frame foot bridges. The sidewalks were located along both sides of the bridge deck, and the metal frame foot bridges, which parallel the vehicle bridges, were independent of the vehicle bridges. These bridges were located on one side or occasionally on both sides of the vehicle bridge. These light metal frame structures consisted of a metal grate deck and metal rails. The 14 historic vehicle and railroad transportation structures inventoried consisted of seven concrete slab bridges along with a concrete arch bridge, three concrete beams, two steel stringers and one box culvert.

3.13.8 Environmental Consequences (Impacts)

Only those sites that would be adversely impacted by the project are discussed below. If a feature is not listed in either or both sections (Archaeological Sites and/or Historical Sites), then no archaeological or historical sites were found in those areas.

3.13.8.1 Significance Criteria

Impacts on cultural resources were considered significant if resources were eligible for inclusion in the NRHP or were already listed. NRHP eligibility is determined by federal legislation 36 CFR Part 60.4, which states that consideration is given to:

> . . . districts, sites, buildings, structures and objects that possess integrity of location, design, setting, materials, workmanship, feeling and association, and; (a) that are associated with events that have made a significant contribution to the broad patterns of our history; or (b) that are associated with the lives of persons significant in our past; or (c) that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or (d) that have yielded, or may be likely to yield, information important in prehistory or history.

Federal legislation 36 CFR Part 800 states that cultural resource assessments of federal undertakings of eligible properties should result in one of three determinations; (a) no effect; (b) no adverse effect, i.e., one or more historic properties would be affected, but the historic qualities that make them significant would not be harmed; or (c) adverse effect, i.e., the undertaking would cause harm to one or more historic properties.

Ultimately, eligibility is determined by the lead federal agency in consultation with the federal land owning agency and the State Historic Preservation Office. The lead federal agency, in consultation with the federal land owning agency, as applicable, the SHPO and the Advisory Council on Historic Preservation (ACHP), determined the significance of impacts and treatment planning related to these resources. If the eligibility of a site was not determined, it was assumed, for the purpose of this analysis, that the site was eligible. Impacts on cultural resources were considered significant if either of the following occurred:

- Disturbance or alteration of cultural resource site surfaces and/or features, including traditional cultural properties; excavation, burial or inundation of any cultural resource that is listed in or is eligible for nomination to the NRHP

- Alteration of surrounding topographic features, cultural features that adversely affects the feeling, setting or association of a significant site

3.13.8.2 Potential Impacts Eliminated From Further Analysis

3.13.8.2.1 Traditional Cultural Properties and Sacred Sites Consultation

Consultation was carried out with five Native American tribes within the region who could have a potential interest in development activity within the project area, which was undertaken over a period of several months. These tribes included the Northwestern Band of Shoshone Tribe, the Shoshone-Bannock Tribes, the Ute Indian Tribe, the Skull Valley Band of Goshute, and the Southern Paiute Indian Tribe. The District sent letters to these tribes requesting information and consultation on traditional cultural properties and sacred sites. No comments or responses were received from these tribes concerning traditional cultural properties or sacred sites that may be located in or near the project area as discussed in Section 4.3.8.2 and Table 4-4.

3.13.8.3 Spanish Fork Canyon-Provo Reservoir Canal Alternative (Proposed Action)

3.13.8.3.1 Construction Phase

3.13.8.3.1.1 Sixth Water Power Facility and Transmission Lines

A. Archaeological Sites. Construction would not affect the historic herder's cabin (known as the First Water Cabin) and its associated features (42Ut649) or Site 42Ut1400 (historic trash scatter) because the treatment plan would require flagging the site before starting construction and briefing the contractor on procedures required to avoid the site (see Chapter 1, Section 1.8.8.8). To ensure that this commitment to avoid the site is met, construction activities near the ranger station will be monitored by a qualified archaeologist.

B. Historic Sites/Properties. Construction would not affect the Sheep Creek Road, an historic transportation corridor that would be used to transport materials and heavy equipment through the area. The treatment plan would require briefing the contractor on the historic significance of the road and procedures to preserve its historic integrity (see Chapter 1, Section 1.8.8.8).

3.13.8.3.1.2 Spanish Fork Canyon Pipeline

A. Archaeological Sites. This pipeline would adversely affect the Castilla Warm Springs Spa historic archaeological site (42Ut362) because it would be constructed through the area of the former spa. The placement of the pipeline through the site would alter the integrity of design, setting, materials, workmanship, feeling and association.

B. Historic Sites/Properties. None.

3.13.8.3.1.3 Spanish Fork-Santaquin Pipeline

A. Archaeological Sites. None.

B. Historic Sites/Properties. This alternative would have a "no adverse affect" on the historic Strawberry-Highline Canal in Payson, the Salem Canal in Payson and Salem, and the Mill Race Canal in Spanish Fork. The construction outlined in Chapter 1 (Section 1.4.4.3) has stated that "All canal crossings would be constructed as open cuts using the pipe trench excavation technique during the non-irrigation season." This construction technique would therefore require that each canal structure be breached. This breaching however is not considered significant enough to warrant an "adverse affect" determination.

The project would not adversely affect two historic residences in Payson. The treatment plan would stipulate that the site would be flagged prior to the commencement of construction activities and that the construction contractor would be briefed on the procedures required to avoid the site. Under these conditions, the "integrity of location, design, setting, materials, workmanship, feeling and association" would be maintained and therefore, the construction of the pipeline would have a "no adverse affect" on these sites.

The pipeline would have an adverse effect upon two farmsteads in Salem. The pipeline construction activity would physically affect these historic residences and farms. Such activities would have an "adverse affect" upon the "integrity of . . . design, setting, materials, workmanship, feeling, and association" of these properties.

3.13.8.3.1.4 Santaquin-Mona Reservoir Pipeline

A. Archaeological Sites. None.

B. Historic Sites/Properties. This pipeline would have an adverse effect on the Summit Creek Reservoir drain structure. The construction of the pipeline would require that the Summit Creek Reservoir drain structure be breached, which would have an "adverse affect". This construction technique would alter the integrity of design, materials, and workmanship of the structure.

3.13.8.3.1.5 Mapleton-Springville Lateral Pipeline

A. Archaeological Sites. None.

B. Historic Sites/Properties. This pipeline, which would replace the Mapleton Lateral with a pipeline, would have an "adverse effect" by altering the "integrity of . . . design, setting, materials, workmanship, feeling and association" of the historic canal.

3.13.8.3.1.6 Spanish Fork-Provo Reservoir Canal Pipeline

A. Archaeological Sites. None.

B. Historic Sites/Properties. The construction plans, outlined in Chapter 1, Section 1.4.4.4 indicate that a microtunnel would be constructed under the circa 1910 historic pony truss bridge and Provo River at 5600 North in Provo. This method would not affect the "integrity of location, design, setting, materials, workmanship, feeling, and association" of either the bridge or the river bed. Therefore, this pipeline would not have an affect upon this property.

This pipeline would have an "adverse affect" on the historic West Union Canal in Provo. (This canal is covered with thick vegetation that has grown over the site for a number of years. This canal is located along a scenic trail and bike path, and the removal of this vegetation in one section would adversely affect the setting and feeling of this canal and the aesthetics of the trail.) The construction outlined in Chapter 1 (Section 1.4.4.3) has stated that "All canal crossings would be constructed as open cuts using the pipe trench excavation technique during the non-irrigation season." In addition, construction plans (Chapter 1, Section 1.4.4.2) state that the vegetation that covers the canal would be removed. These construction methods would therefore require that the canal structure be breached and the vegetation removed, which would alter the "integrity of . . . design, setting, materials, workmanship, feeling, and association" of the canal.

Except for the removal of the vegetation, this same method of construction would be used in crossing the Provo Bench in Orem. Therefore, the impacts by the construction of the pipeline on this canal would be a "no adverse affect."

The Provo Reservoir Canal (commonly known as the Murdock Canal) in Orem would be adversely impacted by the placement of the pipeline immediately adjacent to the canal and along the back property lines of residences in northeast Orem for a distance of approximately .5 miles. This construction would alter the integrity of design, materials, and workmanship of a portion of the canal. This impact would be an "adverse affect."

3.13.8.3.2 Summary of Proposed Action Impacts

A. Archaeological Sites. None

B. Historic Sites/Properties. This alternative would adversely affect the Castilla Warm Springs Spa historic archaeological site, two farmsteads in Salem, the Summit Creek Reservoir Drain Structure, the Mapleton Lateral, and two canals. The canals include the West Union Canal in Provo, and the Provo Reservoir Canal in Orem.

3.13.8.4 Bonneville Unit Water Alternative

The impact on archaeological sites and historic sites/properties for the following features of this alternative would be the same as described under the Spanish Fork Canyon-Provo Reservoir Canal Alternative:

- Sixth Water Power Facility and Transmission Line – Section 3.13.8.3.1.1
- Spanish Fork-Santaquin Pipeline – Section 3.13.8.3.1.2
- Mapleton-Springville Lateral Pipeline – Section 3.13.8.3.1.4

3.13.8.4.1 Summary of Bonneville Unit Water Alternative Impacts

3.13.8.4.1.1 Archaeological Sites. None.

3.13.8.4.1.2 Historic Sites/Properties. This alternative would have an adverse impact on the Castilla Warm Springs Spa historic archaeological site, two historic farmsteads in Salem , the historic Summit Creek Reservoir drain structure, and the Springville-Mapleton lateral.

3.13.8.5 No Action Alternative

No cultural impacts would be associated with construction of ULS project features. Factors not associated with the ULS project, such as population growth, would continue to impact cultural resources.

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3.14 Visual Resources

3.14.1 Introduction

This analysis addresses potential visual resource impacts from construction and operation of the Proposed Action and other alternatives. Impact topics include the following:

- Visual resources in project area
- Forest Service visual quality objectives

3.14.2 Issues Raised in Scoping Meetings

- What impacts would occur on Wasatch Mountain State Park from a power line?
- What would be the impact of the McGuire power facility on visual quality in the Daniels Canyon corridor?

3.14.3 Scoping Issues Eliminated From Further Analysis

What impacts would occur on Wasatch Mountain State Park from a power line?

This issue was eliminated because none of the alternatives would involve constructing power transmission lines within the park boundary.

What would be the impact of the McGuire power facility on visual quality in the Daniels Canyon corridor?

The Strawberry Reservoir–Deer Creek Reservoir Alternative was eliminated from detailed analysis. Please see Chapter 1, Section 1.11.8.

3.14.4 Scoping Issues Addressed in the Impact Analysis

All issues except the ones listed in Section 3.14.3 are addressed in this section.

3.14.5 Description of Impact Area of Influence

Map 3-2 shows the overall impact area of influence for the ULS project. Within that area the visual resources impact area of influence includes any area that would be directly affected by construction of any of the features associated with the action alternatives.

3.14.6 Methodology

The impact analysis considered the standard operating procedures (SOPs) and project design features that the District will implement as part of the project.

3.14.6.1 Assumptions

None.

3.14.6.2 Impact Analysis Methodology

Two scenarios were addressed:

- Visual impacts during project construction
- Visual impacts after completion of reclamation

No visual quality objectives (VQOs) or scenic standards have been established for land not managed by the federal government in Utah. The impact evaluation on visual resources for non-federal lands was based on best professional judgment using baseline as a point of comparison. Any changes from baseline resulting from the alternatives were evaluated from key observation points (KOPs).

Visual baseline conditions were defined by documenting existing landscape character using photographs from the KOPs. The KOPs were identified from a field examination of the impact area of influence and established from primary and secondary travel routes only for permanent above-ground features such as the pumping station and power facilities.

Impacts on visual resources were measured by the capability of the landscape to absorb visual alteration without losing its character. The analysis compares landscape character changes in landform, line, color and texture between the baseline condition and each alternative as viewed from the KOPs. It considered the expected duration of visual alteration to identify short-term and long-term changes in visual resources through the various stages of construction and reclamation.

Visual quality was assessed for the project impact area of influence after completion of reclamation of construction impacts. Changes in the existing landscape character that would be caused by project features are documented as impacts and compared with VQOs when appropriate.

3.14.7 Affected Environment (Baseline Conditions)

Visual resource baseline conditions in the impact area of influence are 2003 conditions, which are similar to those expected to be in place when the project is constructed and placed in operation. The following sections describe the baseline conditions.

3.14.7.1 Visual Resources

3.14.7.1.1 Sixth Water Power Facility and Transmission Line. The Sixth Water Power Facility would be located at the Sixth Water Flow Control Structure. The District allows only non-motorized public access to this site (hiking and horseback), therefore the general public seldom views the site. In this area, Sixth Water Creek carves a narrow, "V"-shaped canyon bordered by steep slopes vegetated with shrubs and trees, interspersed with massive rock outcroppings. The area has been previously disturbed and already contains structures developed for past Central Utah Project facilities.

The Sixth Water Transmission Line would be constructed through Rays Valley, replacing an existing line carried by wooden poles. Portions of the transmission line corridor are visible from the Rays Valley and Sheep Creek roads at the foreground and middle-ground distance zones. Rays Valley is already crossed by other steel tower transmission lines. Rays Valley Road is a paved highway that curves through mountainous terrain. Sheep Creek road is a jeep-trail accessible by four-wheel drive vehicles. The characteristic landscape consists of mountainous terrain dominated by oak brush and sagebrush/grassland with sporadic aspen groves (See Figure D-1a through D-1g in Appendix D).

The proposed new substation would be located near the intersection of Rays Valley Road and Highway 6 on private property that would be acquired by the government. Views of the site from Highway 6 are obscured by existing buildings and a berm that runs southeasterly behind the structures and parking lot. Vegetation is grassland used for grazing. The site is visible from Rays Valley road for approximately 0.8 mile near the intersection with Highway 6 and from additional short sections along the road when traveling south.

3.14.7.1.2 Upper Diamond Fork Power Facility. The Upper Diamond Fork Power Facility would be located in the upper portion of Diamond Fork Canyon adjacent to Diamond Fork Creek and the newly constructed vortex structure associated with the Diamond Fork Project. The recent vortex construction has modified the existing landscape character of the site that is baseline for the ULS project. The foreground views are of Diamond Fork Road and Diamond Fork Creek. The middle-ground is the Diamond Fork Canyon walls (see Figure D-2 in Appendix D).

3.14.7.1.3 Spanish Fork Canyon Pipeline. Steep mountains characterize Spanish Fork Canyon located in southern Utah County east of the city of Spanish Fork, with abundant vegetation on both the canyon floor and the adjacent mountains. The Spanish Fork River flows through the canyon year-round, providing interesting visual features as well as plant and wildlife habitat. Apart from the river, adjacent mountain peaks and small adjoining canyons add to the canyon's scenic value. A number of facilities have been constructed in Spanish Fork Canyon. They include Highway 6, two parallel railroad lines (the Denver and Rio Grande Western Railroad), the Strawberry Diversion Dam on the Spanish Fork River, various electrical transmission and distribution lines, a number of residences, and one-and two-lane bridges crossing the Spanish Fork River.

3.14.7.1.4 Spanish Fork-Santaquin Pipeline. Portions of the Spanish Fork-Santaquin Pipeline facilities would be visible from Highway 6, Bottoms Road, East Powerhouse Road, East 8800 South, and Highway 198. Project facilities would be visible to recreationists at the Spanish Oaks municipal golf course and residents living near the pipeline corridor. The foreground views include scattered residential development, agricultural lands, the golf course, and the cities of Salem and Payson. Middle-ground views include reaches of the Power Canal, the Strawberry Highline Canal and scattered residential development and agricultural lands. The background view includes the high peaks of the Wasatch Mountains.

3.14.7.1.5 Santaquin-Mona Reservoir Pipeline. Portions of the Santaquin-Mona Reservoir Pipeline facilities would be visible to travelers on I-15, residents living in the area, and people traveling secondary roads. Much of the foreground and middle-ground views consists of agricultural land, scattered residences and the Union Pacific rail line. Mona Reservoir can be seen at the middle-ground view from I-15. The background consists of the Wasatch Mountains and the mountains of Long Ridge.

3.14.7.1.6 Mapleton-Springville Lateral Pipeline. The primary travel route from which ULS project features would be viewed is Mapleton Road within the Mapleton city boundary. The foreground and middle-ground views from Mapleton Road consist of scattered residential developments and agriculturally developed lands (orchards and irrigated farmlands). Levees of the Mapleton Canal can be seen as an elevated ridge running south to north through irrigated agricultural lands from various stretches of the road. The background view is the Wasatch Mountains.

3.14.7.1.7 Spanish Fork-Provo Reservoir Canal Pipeline. The landscape character associated with the Spanish Fork-Provo River Canal Pipeline consists of urbanized areas, urban streets, residential neighborhoods, and natural and landscaped areas within the city limits of Provo, Orem, Springville, Mapleton and Spanish Fork at the foreground and middle-ground views. The background view is the Wasatch Mountains.

3.14.7.2 Forest Service Visual Quality Objectives

Areas that would be impacted by construction of features within the Uinta National Forest are rated according to VQOs under Forest Service guidelines (USFS 2001b). These objectives are intended to limit visual impacts and retain the natural forest setting to the extent possible through restoration after construction.

Although the land for the proposed ULS project features would be withdrawn by the Department of the Interior for project purposes, the visual analysis was conducted using Forest Service objectives since the land is within a larger area managed by the Forest Service.

The Forest Service VQO ratings specify the visual absorption capability (VAC) of an area, which ranks the likelihood that the public would see an area. The VAC categories that apply to this project are "Seldom Seen," "Moderate," "High" and "Low." The high VAC rating includes areas viewed primarily from the middle-ground to background distance zone. These areas have a moderately high capacity for modifications and can absorb greater visual impact than areas seen at the foreground and middle-ground distances.

A moderate rating includes areas that are viewed primarily at the middle-ground distance zone with a moderate capacity to absorb modifications to the characteristic landscape. Areas in a low VAC designation usually have slopes steeper than 40 percent and can be seen from ¼- to 1-mile away. Seldom seen means an area cannot be seen from primary or secondary viewing areas such as highways or other roadways, and can tolerate higher levels of visual impact.

Table 3-89 shows the VQO ratings for affected areas of the Uinta National Forest. Map D-1 in Appendix D shows the VQOs for the Sixth Water power facility, transmission line and substation, and Map D-2 in Appendix D shows VQOs for the Upper Diamond Fork Power Facility.

Table 3-89
Visual Quality Objective Ratings for Affected Areas of the Uinta National Forest

Corridor Area	Visual Quality Objective	Proposed Action and Alternative Features in Corridor	VAC[1] Ranking of Affected Area
Sixth Water Creek at Sixth Water Aqueduct	Partial Retention	Sixth Water Power Facilities	Seldom Seen
Rays Valley Road, Sheep Creek Road	Partial Retention, Modification	Sixth Water Transmission Line	Low, Moderate
Upper Diamond Fork Road	Partial Retention	Upper Diamond Fork Power Facility	Low, Moderate

[1]Visual absorption capability.

Two ratings "Partial Retention" and "Modification" apply to the Proposed Action and other alternatives. In a partial retention area, visual impacts must be limited to 1 year. Restoration efforts (as described above) may be evident, but must not dominate the surrounding landscape. In a modification area, changes may dominate the original landscape character, but they must borrow from naturally established form, line, color or texture.

3.14.8 Environmental Consequences (Impacts)

3.14.8.1 Significance Criteria

Impacts on visual resources are considered significant if construction, maintenance and operation of the Proposed Action and other alternatives would cause one or more of the following conditions:

- Long-term degradation of visual quality as viewed from the sensitive viewpoints would occur on non-federally managed lands. Long-term as defined for this significance criterion is five growing seasons or more after reclamation of construction areas is completed.
- Existing landscape character would be changed in the short-term to the extent that the modification becomes the dominant feature in the viewshed. Short-term is defined as the period during construction of project features.
- Changes in VQO for partial retention or modification ratings on Forest Service managed lands. Changes would include the following:
    - Direct, permanent changes in the existing landscape character
    - Changes in a visual resource that cannot be rectified immediately following completion of construction for areas that are designated retention
    - Permanent changes in visual contrast related to spatial characteristics, visual scale, landform, texture, line and color that are not subordinate to the characteristic landscape

3.14.8.2 Potential Impacts Eliminated From Further Analysis

Operation of the project facilities would not cause any impacts. All visual impacts would be associated with construction activities or new facilities placed on the landscape during construction.

3.14.8.3 Spanish Fork Canyon-Provo Reservoir Canal Alternative (Proposed Action)

3.14.8.3.1 Sixth Water Power Facility and Transmission Line

3.14.8.3.1.1 Visual Resources. Construction of the Sixth Water Power Facility would cause minor visual changes to the characteristic landscape because the generator site has already been developed by past Central Utah Project facility construction. A minor amount of slope clearing and grading would be involved in the power facility construction, but these activities would not modify any existing landforms, soil colors or textures since the slope is already unvegetated with exposed soils (see Figure 1-1, Chapter 1, Section 1.4.2.1).

Construction of new transmission lines through Rays Valley would cause permanent visual impacts. Installation of 81-foot tall steel towers with three horizontal arms would be a visual change from the existing 30- to 35-foot wood poles (see Figure 1-2, Chapter 1, Section 1.4.2.1). The towers and lines would be visible at the foreground distance zone from various segments of Rays Valley Road. The vegetation along the visible reaches of the alignment is sagebrush and grass, which would not provide much screening of the new towers. The steel towers would oxidize to a rust color, which would reduce glare; however, the taller towers would still introduce an unnatural element into the characteristic landscape.

3.14.8.3.1.2 Visual Quality Objectives. The Sixth Water Power Facility would be constructed in a partial retention area, but the site is seldom seen because there is no public access. The site has been developed under past CUP projects (see Map D-1 in Appendix D).

The Rays Valley transmission line would be constructed in two VQO ratings: -partial retention and modification. The visual changes from introduction of the 81-foot tall steel towers would be long-term. The construction access corridor would be revegetated, but areas under the transmission lines would be permanently cleared of tree and shrub vegetation to protect the poles and lines from damage.

Table 3-90 lists segments of Rays Valley Road where the towers and transmission lines would be visible. The table lists the VQO and distance zone. Map D-2 and D-3 in Appendix D shows the location of the photographs and the segments of Rays Valley Road where the transmission line would be visible.

Table 3-90
Segments of Rays Valley Road Where Towers and Transmission Lines Would Be Visible

Milepost Segment[1]	Distance (miles)	Visual Quality Objective	View Distance Zone
MP Segment 0-0.8	0.8	Partial Retention	Foreground
MP Segment 2.4-2.8	0.4	Retention/Modification	Foreground/Middle-ground
MP Segment 6.8-7.1	0.5	Partial Retention	Foreground
MP Segment 8.35-14.25	5.9	Partial Retention	Foreground
MP Segment 14.55-15.15	0.6	Partial Retention	Foreground

[1] MP = Milepost. Milepost segments were determined by reading a vehicle odometer while traveling along Rays Valley Road beginning with zero at the intersection of Highway 6 and Rays Valley Road and proceeding north on Rays Valley Road to Sixth Water Creek.

3.14.8.3.2 Upper Diamond Fork Power Facility

3.14.8.3.2.1 Visual Resources. Construction of the Upper Diamond Fork Power Facility would cause long-term visual impacts because grading would modify an existing ridge landform and a permanent structure dominating the landscape would be built, changing the existing landscape character in form, color and texture. The building would be constructed of rustic concrete logs with a rock veneer foundation. The rock veneer foundation would add a reddish-brown texture matching the surrounding environment. The purpose of the log and rock architectural style is to reduce the visual impact of the structure and incorporate a more rustic character (see Figure 1-3, Chapter 1, Section 1.4.2.2). The existing culvert across Diamond Fork Creek at the Upper Diamond Fork Flow Control Structure would receive a similar rock veneer treatment, adding a reddish-brown texture to blend the culvert with the surrounding environment.

3.14.8.3.2.2 Visual Quality Objectives. The Upper Diamond Fork Power Facility would be constructed in an area designated as partial retention (see Map D-4 in Appendix D). The characteristic landscape has a low to moderate ability to absorb visual change because the site is viewed from a secondary travel route (Diamond Fork Road) at the foreground distance zone, and steep slopes characterize the canyon topography.

3.14.8.3.3 Spanish Fork Canyon Pipeline

3.14.8.3.3.1 Visual Resources. During the construction of the Spanish Fork Canyon pipeline, equipment used for excavating, pipe placement and material hauling would be visible in the foreground and midde-ground views of motorists traveling Highway 6 and Diamond Fork Road. Following completion of construction, disturbed areas would be reclaimed and returned to a vegetated condition or previous uses. Construction of permanent pipeline valves along the alignment would result in long-term visual impacts because of the introduction of new permanent features in the characteristic landscape.

3.14.8.3.3.2 Visual Quality Objectives. None.

3.14.8.3.4 Spanish Fork-Santaquin Pipeline

3.14.8.3.4.1 Visual Resources. Construction of the Spanish Fork-Santaquin Pipeline would cause short-term visual impacts during construction and until reclamation is completed along 17.5 miles of pipeline. No long-term visual impacts would be associated with the pipeline after reclamation. Construction of approximately 81 permanent pipeline valves and nine turnouts along the alignment would cause minor long-term visual impacts because of the introduction of new permanent features in the characteristic landscape.

3.14.8.3.4.2 Visual Quality Objectives. None.

3.14.8.3.5 Santaquin-Mona Reservoir Pipeline

3.14.8.3.5.1 Visual Resources. Construction of the Santaquin-Mona Reservoir Pipeline would cause short-term visual impacts during construction and until reclamation is completed along 6.4 miles of pipeline. No long-term visual impacts would be associated with the pipeline after reclamation. Construction of approximately 24 permanent pipeline valves and one turnout along the alignment would cause minor long-term visual impacts because of the introduction of new permanent features in the characteristic landscape.

3.14.8.3.5.2 Visual Quality Objectives. None.

3.14.8.3.6 Mapleton-Springville Lateral Pipeline

3.14.8.3.6.1 Visual Resources. During construction of the Mapleton-Springville Lateral Pipeline, equipment used for excavating, pipe placement and material hauling would be visible in the foreground and middle-ground views of eastbound Mapleton Road motorists and residents in the vicinity of the construction. However, construction would occur in a relatively limited space and would not dominate a major portion of the view. Following completion of construction, disturbed areas would be reclaimed and returned to a vegetated condition with the possible exception of a gravel access road remaining along portions of the right-of-way. Construction of approximately 25 permanent pipeline valves and 11 turnouts along the alignment would cause minor long-term visual impacts because of the introduction of new permanent features in the characteristic landscape.

The Mapleton-Springville Lateral canal would be permanently dewatered and removed from service by construction of the Mapleton-Springville Lateral Pipeline. However, the impacts on visual resources would not exceed the significance criteria because water flowing in the canal cannot be seen from most primary or secondary travel routes. The line feature created by the canal may become less recognizable because the canal embankment would likely be removed and recontoured during reclamation of the disturbance. This would cause a minor visual improvement but a change in the historical landscape character.

3.14.8.3.6.2 Visual Quality Objectives. None.

3.14.8.3.7 Spanish Fork-Provo Reservoir Canal Pipeline

3.14.8.3.7.1 Visual Resources. During construction of the Spanish Fork-Provo Reservoir Canal Pipeline, equipment used for excavating, pipe placement and material hauling would be visible in the foreground views of motorists traveling Highway 89 in Mapleton, Springville and Provo, State Route 52 in Orem and city streets in Springville, Provo and Orem. Construction activities would be visible in foreground and middle-ground views to residents in the vicinity of the construction. However, construction would occur in a relatively limited space and would not dominate a major portion of the view. Following completion of construction, disturbed areas would be reclaimed and returned to a vegetated condition, with the possible exception of a maintenance corridor remaining along portions of the right-of-way. Construction of approximately 91 permanent pipeline valves along the alignment would cause minor long-term visual impacts because of the introduction of new permanent features in the characteristic landscape. Construction of a flow control structure at the pipeline crossing of the Provo River would cause a minor long-term visual impact because of the introduction of a new permanent concrete feature in the characteristic landscape along the river.

3.14.8.3.7.2 Visual Quality Objectives. None.

3.14.8.3.8 Summary of Proposed Action Impacts

3.14.8.3.8.1 Visual Resources. Construction impacts of the Sixth Water Power Facility would not exceed the significance criteria because the site is already developed and the area is seldom seen by the public.

Construction of the Sixth Water Transmission Line would cause long-term, significant visual impacts because the new 81-foot steel towers would permanently change visual quality and would be visible in the foreground view from Rays Valley Road for about 8.2 miles.

Construction of the Upper Diamond Fork Power Facility would cause long-term, significant visual impacts because grading would modify an existing ridge landform and a permanent structure would be built, changing the existing form, color and texture of the landscape.

Construction impacts of the Spanish Fork River, the Spanish Fork-Santaquin, the Santaquin-Mona Reservoir, the Mapleton-Springville Lateral, and the Spanish Fork-Provo Reservoir Canal pipelines on visual resources would not exceed the significance criteria during construction. In most cases the pipeline construction activity would not dominate the viewshed. The pipeline corridors would be reclaimed to previous uses immediately following construction, restoring the visual quality to pre-construction conditions. Installation of permanent valves would introduce new, long-term man-made features into the characteristic landscape, however, visual impacts would not exceed the significance criteria because they would not dominate the viewshed.

3.14.8.3.8.2 Visual Quality Objectives. The Sixth Water Transmission Line would cause long-term significant visual impacts because the 81-foot steel towers would be constructed in partial retention areas, causing permanent changes in visual scale, line, color and texture that are not compatible with the characteristic landscape.

Construction of the Upper Diamond Fork Power Facility would cause long-term, significant visual impacts since it would be located in a partial retention area. The power facility structure would cause permanent changes in visual scale, landform, line, color and texture that are not compatible with the characteristic landscape.

3.14.8.4 Bonneville Unit Water Alternative

The impacts of the following features of this alternative are the same as described for the Spanish Fork-Provo Reservoir Canal Alternative and are not repeated here.

- Sixth Water Power Facility and Transmission Line – Section 3.14.8.3.1
- Upper Diamond Fork Power Facility – Section 3.14.8.3.2
- Spanish Fork Canyon Pipeline – Section 3.14.8.3.3
- Spanish Fork-Santaquin Pipeline – Section 3.14.8.3.4
- Mapleton-Springville Lateral Pipeline – Section 3.14.8.3.1.6

3.14.8.4.1 Summary of Bonneville Unit Water Alternative Impacts

3.14.8.4.1.1 Visual Resources. Construction impacts of the Sixth Water Power Facility on visual resources would not exceed the significance criteria because the site is already developed and the area is seldom seen by the public.

Construction of the Sixth Water Transmission Line would cause long-term, significant visual impacts because the new 81-foot tall steel towers would permanently change visual quality and be visible in the foreground view from Rays Valley Road for about 8.2 miles.

Construction of the Upper Diamond Fork Power Facility would cause long-term, significant visual impacts because grading would modify an existing ridge landform and a permanent structure would be built, changing the existing landscape character in visual scale, form, color and texture.

Construction of the Spanish Fork Canyon, the Spanish Fork-Santaquin, and the Mapleton-Springville Lateral pipelines would cause short-term visual impacts during construction, but these impacts on visual resources would not exceed the significance criteria because construction activities would not dominate the viewshed. Operation of construction equipment and temporary land disturbance would be visible from primary and secondary travel routes during the construction period. These impacts on visual resources would not exceed the significance criteria. Construction of permanent valves in vaults along the pipeline corridors would cause long-term visual impacts, however, they would not exceed the significance criteria.

3.14.8.4.1.2 Visual Quality Objectives. Construction of the Sixth Water Transmission Line upgrade would cause long-term, significant visual impacts because the 81-foot tall steel towers would be constructed in partial retention areas, causing permanent changes in visual scale, line, color and texture that are not compatible with the characteristic landscape.

Construction of the Upper Diamond Fork Power Facility would cause long-term, significant visual impacts because it would be located in a partial retention area, causing permanent changes in visual scale, landform, line, color and texture that are not compatible with the characteristic landscape.

3.14.8.5 No Action Alternative

No visual impacts would be associated with construction of ULS project features. Factors not associated with the ULS project, such as population growth, would continue to impact visual resources.

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3.15 Recreation Resources

3.15.1 Introduction

This section analyzes potential impacts on recreation resources and visitor use from construction and operation of the Proposed Action and other alternatives.

3.15.2 Issues Raised in Scoping Meetings

- What would be the impacts of high flows in the Provo River on recreation resources and recreational fishing?
- What would be the impacts on recreation from pipeline placement and project operation along the Bonneville Shoreline Trail?
- What impacts would occur on Wasatch Mountain State Park from a power line?
- What would be the impacts of increased flows in the Provo River on anglers?
- What would be the short-term impacts of construction of a pipeline from Strawberry Reservoir to Daniels Pass, with particular concern for water quality, sediment yield, noxious weed invasion, and ORV use of disturbed sites?
- What would be the impacts of increased ATV traffic on the Bonneville Shoreline Trail under Concept 2?
- What would be the impacts of the June sucker recovery on recreational users of Utah Lake and its tributaries?
- What impacts would occur on the upper Strawberry River as a result of constructing a pipeline from the proposed pump station to Daniels Pass?

3.15.3 Scoping Issues Eliminated From Further Analysis

What impacts would occur on Wasatch Mountain State Park from a power line?

None of the alternatives would include a power line in the vicinity of Wasatch Mountain State Park.

What would be the impacts of increased ATV traffic on the Bonneville Shoreline Trail under Concept 2?

What would be the impacts on recreation from pipeline placement and project operation along the Bonneville Shoreline Trail?

Concept 2, now known as the Spanish Fork Canyon Canyon-Provo Reservoir Canal Alternative (Proposed Action), would not include construction or operation of any project features within 1,000 feet of the Bonneville Shoreline Trail. Construction and operation of this alternative would not provide any access to the trail for ATVs.

What would be the short-term impacts of construction of a pipeline from Strawberry Reservoir to Daniels Pass, with particular concern for water quality, sediment yield, noxious weed invasion, and ORV use of disturbed sites?

What impacts would occur on the upper Strawberry River as a result of constructing a pipeline from the proposed pump station to Daniels Pass?

The Strawberry Reservoir–Deer Creek Reservoir Alternative was eliminated from detail analysis. Please see Chapter 1, Section 1.11.8.

3.15.4 Scoping Issues Addressed in the Impact Analysis

All of the issues identified in Section 3.15.2, are addressed except those listed in Section 3.15.3.

3.15.5 Description of Impact Area of Influence

Map 3-2 shows the overall impact area of influence for the ULS project. Within that area the recreation resources impact area of influence includes the following:

- One thousand-feet from the area directly affected by pipelines, access roads, pump stations, power lines, power facilities, and diversion structures, and any access routes that would be affected by construction traffic
- All streams and rivers and associated riparian corridors that would have alterations in flow from baseline conditions

3.15.6 Methodology

The impact analysis considered the standard operating procedures (SOPs) and project design features that the District will implement as part of the project.

3.15.6.1 Assumptions

None.

3.15.6.2 Impact Analysis Methodology

3.15.6.2.1 Data and Information Collection. Information on changes in fish production was obtained from Section 3.6, Aquatic Resources, and used to address impacts on fishing use. Information on access to recreation resources was obtained from Section 3.19, Transportation Networks and Utilities, and used to address impacts on recreation access. Information on wildlife was obtained from Section 3.8, Wildlife Resources, and used to address impacts on wildlife viewing and hunting.

Data and information was collected from a variety of sources to accomplish the following:

- Identify all recreation resources within the impact area of influence
- Determine the types and amounts of recreation uses that occur within the impact area of influence

A list of all federal, state, county and local agencies that manage recreation resources within the impact area of influence was developed. Information on the location of resources was obtained from the agencies. Additional information, such as use types, use amounts, duration and seasons of use, was collected to the extent possible. In instances where information was not available for specific resources, estimates were derived from other sources. For example, the Uinta National Forest provides use estimates for all sites within the forest; estimates for specific sites within the impact area of influence were developed from the "all sites" estimate.

Impacts on recreation resources and visitor use were determined by identifying the resources in the immediate area of the project and along the transportation routes that would be used during project construction and operation. These changes were evaluated using best professional judgment and past experience to determine if they resulted in any impacts on the recreation resource. Potential impacts from changes in traffic flows on existing sites were evaluated to determine what effect they may have on existing sites and their use.

3.15.6.2.2 Calculation of Angler Days. An angler-day use factor was developed to estimate the number of angler days that may be associated with changes in fish biomass. The methods used to calculate the angler-day use factor for Spanish Fork River, Hobble Creek and Provo River are based on the angler-day methodology reported in the Angler-Day Methodology Technical Memorandum (CUWCD 1999b). This methodology starts with the 2.81 angler-days per pound of wild trout standing crop in the Provo River (Wiley and Thompson 1997) and adjusts this value in Spanish Fork River and Hobble Creek for months accessible, fishability because of high irrigation flows, and reputation based on proximity and easy access to major population centers. In the Spanish Fork River from Diamond Fork Creek to Spanish Fork Diversion Dam, the high SVP irrigation flows reduce the fishability for 6 months each year (50 percent reduction), and the reputation factor was adjusted down 10 percent compared to the Provo River in these streams with the ULS flows and the resulting changes in fish biomass. The remaining reaches of the Spanish Fork River are not subject to the high SVP irrigation flows and only the 10 percent reputation factor adjustment was made. Since fishing in Hobble Creek would be similar to the lower Spanish Fork River reaches if public access were available under the ULS flows and resulting trout biomass, the same values were applied to Hobble Creek.

The estimated angler-use factors were applied to the estimated fish biomass increase or decrease for selected river stretches. Table 3-91 shows the adjustments in angler use per pound of fish under baseline conditions and alternatives. The fish biomass for the selected stream reaches is shown in Section 3.6.

Table 3-91
Adjustments in Angler Use Per Pound of Fish Under Baseline Conditions and Alternatives
Page 1 of 2

Stream Reach	Adjustment Factor(s)	Angler Day Use Factor (Days per pound of trout standing crop)
Spanish Fork River[1]		
Diamond Fork Creek to Spanish Fork Diversion Dam	Fishability and reputation	1.26
Spanish Fork Diversion Dam to East Bench Diversion	Reputation	2.53
East Bench Diversion to Mill Race Diversion	Reputation	2.53
Mill Race Diversion to Utah Lake	Reputation	2.53
Hobble Creek[2]		
Mapleton-Springville Lateral Discharge to Kolob Park in Springville	Reputation	2.53
Kolob Park in Springville to Utah Lake	Reputation	2.53

Table 3-91 Adjustments in Angler Use Per Pound of Fish Under Baseline Conditions and Alternatives Page 2 of 2		
Stream Reach	**Adjustment Factor(s)**	**Angler Day Use Factor (Days per pound of trout standing crop)**
	Provo River[3]	
Deer Creek Dam outlet to North Fork of Provo River	Accessibility, fishability, and reputation	2.81
North Fork of Provo River to Olmsted Diversion	Accessibility, fishability, and reputation	2.81
Olmsted Diversion to Murdock Diversion	Accessibility, fishability, and reputation	2.81
Murdock Diversion to Interstate 15	Accessibility, fishability, and reputation	2.81
Interstate 15 to Utah Lake	Accessibility, fishability, and reputation	2.81

[1]Based on Diamond Fork FS-FEIS Interim Proposed Action.
[2]Angler day use factor on Hobble Creek is assumed to be similar to Spanish Fork River.
[3]Angler day use factor on Provo River is 2.81 angler-days of use per pound of wild trout standing crop (Wiley and Thompson 1997).

Angler-day estimates for the lower Provo River (below the Murdock Diversion) were then adjusted to reflect the proportion of the River that is currently accessible to anglers. The following reaches are publicly accessible:

- Spanish Fork – Provo Reservoir Canal Pipeline Discharge to Riverside Country Club = 57.1 percent
- Riverside Country Club to Tanner Race Diversion = 48.5 percent
- Tanner Race Diversion to Fort Field Diversion = 100 percent
- Fort Field Diversion to Utah Division of Wildlife Resources Weir = 86.2 percent

Angler-day estimates for the Spanish Fork River (below Diamond Fork Creek) were adjusted to reflect the proportion of the river that is currently accessible to anglers. The following reaches are publicly accessible:

- Spanish Fork Diversion Dam to East Bench Dam = 76 percent
- East Bench Dam to Mill Race Diversion = 15 percent

3.15.7 Affected Environment (Baseline Conditions)

3.15.7.1 Overview

This section describes recreation resources and visitor use for areas within the impact area of influence that may be affected by construction and operation of the Proposed Action and other alternatives. Resources that would not be affected are not described.

More than 10 entities manage recreation resources in the impact area of influence, including federal and state agencies, and county and local governments. Resources include: developed and undeveloped campgrounds; day use areas, such as city parks, picnic areas and roadside attractions; scenic byways; trails for hiking, bicycling, horseback riding and off-road vehicles; lakes and reservoirs; rivers and streams; boat launches; and marinas.

Visitor use in the impact area of influence includes: walking and hiking; bicycling; driving off road, including ATVs, motorcycles and snowmobiles; driving for pleasure; fishing; rafting, kayaking and canoeing; motor boating and jet skiing; and sailing. Many of these uses occur seasonally, but summer is the predominant use season.

Fishing is a significant use. The Provo River has been identified as a Blue Ribbon Trout Stream (Lilieholm and Krannich 2001). Visitor use statistics provided in subsequent sections have been obtained from other sources or estimated.

3.15.7.2 Recreation Resources

3.15.7.2.1 Diamond Fork and Rays Valley Area. The Diamond Fork and Rays Valley area is under the jurisdiction of the U.S. Forest Service (Forest Service), Uinta National Forest-Spanish Fork Ranger District. Developed resources in this area consist of trails and associated trailheads, and campgrounds. The two developed campgrounds, Palmyra and Diamond, are located along the Diamond Fork Road. The entire area contains numerous undeveloped (dispersed) camping and picnicking sites. Access to this area is provided by the Diamond Fork Road, Right Fork of Hobble Creek Road, Springville Crossing-Rays Valley Road, Sheep Creek-Rays Valley Road, and U.S. Highway 6.

3.15.7.2.2 Moark Junction to Provo Reservoir Canal. A number of recreation resources occur within the impact area of influence of the Spanish Fork-Provo Reservoir Canal Pipeline (from milepost 0 to 19.7, Map A-1). This pipeline would cross several roads that provide access to recreation resources east of the proposed pipeline. The Forest Service manages these resources, consisting primarily of motorized and non-motorized trails. They include the Bonneville Shoreline Trail, a 100-mile statewide trail managed by multiple communities and agencies throughout Utah. The proposed pipeline would cross roads that provide access to city parks managed by the Provo City Parks and Recreation Department, Peaks Ice Arena, and Seven Peaks Water Park.

The proposed pipeline would cross a portion of Rock Canyon Park, managed by the Provo City Parks and Recreation Department. This 55-acre park provides recreation resources such as ball fields, restrooms, play areas, picnic areas, interpretive areas, trails, and access to the Bonneville Shoreline Trail.

3.15.7.2.3 Provo River Canyon. Recreation resources along Provo River below Deer Creek Reservoir are managed by private owners, a number of agencies and jurisdictions, including the Forest Service, Utah Department of Transportation, Utah County and Provo City. The area contains a number of recreation resources, including developed recreation sites, private recreation vehicle park, scenic overlooks, and developed and undeveloped trails. The Provo River Parkway is a 6-mile paved trail that runs along this stretch of the Provo River from Vivian Park to Provo City. Informal walking trails extend to the Deer Creek Dam area. The Great Western

Trail, which runs from Mexico to the Canadian border, can be accessed along this corridor. The area is marked by scenic pullouts. Access to many recreation resources in the area is provided by U.S. 189, which is nationally recognized as the Provo Canyon Scenic Byway.

3.15.7.3 Visitor Use

3.15.7.3.1 Diamond Fork and Rays Valley Area. The Forest Service does not track overall visitor use numbers for these areas, which are used primarily for pleasure driving, sightseeing, hiking, biking, horseback riding, dispersed camping, hunting, and motorcycling in the summer and fall. During summer the area along Diamond Fork Creek is heavily used for dispersed camping and picnicking. The Forest Service estimates that in 1997 the Palmyra campground had 74,000 visitor days (a visitor day equals 12 hours of use), and Diamond Fork Canyon had 720,000 visitor days (USFS 1998a). No creel censuses have been conducted by the Utah Division of Wildlife Resources on Diamond Fork or Sixth Water creeks, but fishing is known to be popular in the area.

3.15.7.3.2 Moark Junction to Provo Reservoir Canal. Primary use seasons for Forest Service trails in the area are summer and fall. The Forest Service does not record visitor use numbers for this area. The Bonneville Shoreline Trail and Rock Canyon Park are used year-round by a variety of users. The only permitted use at Rock Canyon Park is for rental of four pavilions. Based on permit information, Provo City Parks and Recreation Department estimated that approximately 13,000 people used the pavilions from May through September of 2003 (Mitchell 2003). There are no estimates for the number of people who visit the park for other uses. Rock Canyon Park is visited year-round for day use by park visitors who walk, bike or run on trails, use playground equipment and picnic tables, and play on ball fields.

The Peaks Arena is a year-round facility that receives approximately 390,000 visits per year, and is expected to grow. The 8,000-seat arena was used for ice hockey during the 2002 Olympic Winter Games and currently provides hockey, figure skating and indoor soccer programs for all ages. Seven Peaks Water Park is a day use facility that provides swimming and swimming-related activities for 150,000 to 200,000 visitors a year between Memorial Day and Labor Day.

3.15.7.3.3 Provo River Canyon. Recreation uses include fishing, boating, tubing, hunting, picnicking, swimming, hiking, backpacking, walking, in-line skating, bicycling and mountain biking. Total usage of the area is unknown, but most activity occurs during spring, summer and fall. The Provo River is the most heavily fished stream in Utah. It received 375,639 angler days, according to the 2000 Statewide Survey of Utah Anglers report (Lilieholm and Krannich 2001).

3.15.7.3.4 Angler Days

3.15.7.3.4.1 Spanish Fork River From Diamond Fork Creek to Utah Lake. Public access is limited to two reaches of USA-owned land along the Spanish Fork River. Based on the estimated fish biomass in these publicly accessible reaches of the Spanish Fork River, 6,992 angler-days of use occurs annually. Any angler use of other reaches is by trespass or permission of the landowner. Based on the estimated fish biomass in these other reaches, another 34,240 angler-days of use annually would be possible if public access were available. The total annual predicted baseline fishing use of the Spanish Fork River reaches would be 41,232 angler-days if public access were available.

3.15.7.3.4.2 Hobble Creek From Mapleton-Springville Lateral Discharge to Utah Lake. Public access along this stretch of the creek is not available. Any use that occurs is by trespass or permission of the landowner. Based on the estimated fish biomass in this stretch a total of 476 angler days of use annually would be possible if public access was available.

3.15.7.3.4.3 Provo River From Deer Creek Dam Outlet to Utah Lake. Public access is available along the lower Provo River except for portions of three reaches. Based on the estimated fish biomass in the lower Provo River from Deer Creek Dam Outlet to the Utah Division of Wildlife Resources weir near Utah Lake, 127,958 angler-days of use occurs annually in the publicly accessible reaches. Based on the estimated fish biomass in the Provo River reaches not publicly available for fishing, another 3,526 angler-days of use annually would be possible if public access were available. The total annual predicted baseline fishing use of the lower Provo River reaches would be 131,484 angler-days if public access were available.

3.15.8 Environmental Consequences (Impacts)

3.15.8.1 Significance Criteria

Impacts on recreational resources are considered significant if construction, operation or maintenance activities would result in either of the following conditions:

- A reduction or increase of at least 5 percent in recreational use of existing facilities and/or resources during or after construction
- Elimination of any designated recreation facilities or resources

3.15.8.2 Potential Impacts Eliminated From Further Analysis

What would be the impacts of the June sucker recovery on recreational users of Utah Lake and its tributaries?

This is beyond the scope of this EIS.

What would be the impacts of increased visitor use?

The issue is unclear as to where in the impact area the commenter is referring.

3.15.8.3 Spanish Fork Canyon-Provo Reservoir Canal Alternative (Proposed Action)

3.15.8.3.1 Construction Phase

3.15.8.3.1.1 Sixth Water Power Facility and Transmission Line, Upper Diamond Fork Power Facility

A. Recreation Resources. Impacts on recreation resources from these facilities would not exceed the significance criteria because the facilities would not affect designated recreation facilities or resources.

B. Visitor Use. Construction would not prevent any visitor use during the non-winter months. The Average Annual Daily Traffic (AADTs) on the Sheep Creek-Rays Valley Road would likely increase by more than 10 percent, which could cause delays in traffic and access to some recreation sites. However, the roads would remain open and public access would be available. Diamond Fork Road would be closed to snowmobiling during the winter months while the Upper Diamond Fork Power Facility is under construction. This would be a two-year, temporary impact on snowmobiling in upper Diamond Fork Canyon. Impact on visitor use at recreation sites and areas would not exceed the significance criteria.

3.15.8.3.1.2 Spanish Fork-Santaquin Pipeline

A. Recreation Resources. There would be no impacts on recreation resources because this pipeline would permanently remove only 0.3 acre of non-recreation land.

B. Visitor Use. There would be no impacts on visitor use because traffic and activities associated with construction of this pipeline would not affect access to recreation sites.

3.15.8.3.1.3 Santaquin-Mona Reservoir Pipeline

A. Recreation Resources. There would be no impacts on recreation resources because this pipeline would not permanently remove any recreation land.

B. Visitor Use. There would be no impacts on visitor use because traffic and activities associated with construction of this pipeline would not affect access to recreation sites.

3.15.8.3.1.4 Mapleton-Springville Lateral Pipeline

A. Recreation Resources. There would be no impacts on recreation resources because this feature would not permanently remove any recreation land.

B. Visitor Use. There would be no impacts on visitor use because traffic and activities associated with construction of this pipeline would not affect access to recreation sites.

3.15.8.3.1.5 Spanish Fork-Provo Reservoir Canal Pipeline

A. Recreation Resources. There would be no impacts on recreation resources. As part of this pipeline feature, a small valve vault would be located in Rock Canyon Park, but it would not permanently displace more land than the 5 percent significance criteria.

B. Visitor Use. Access to Rock Canyon Park, Peaks Ice Arena and Seven Peaks Water Park would be temporarily disrupted by increased construction traffic and temporary lane closures. The amount of construction trips in this area would likely increase the annual average daily traffic by more than 10 percent. However, at least one lane of traffic would remain open to the public at all times during construction to provide access to recreation sites. Portions of the park would be inaccessible during construction of the pipeline, but the closure would be temporary.

3.15.8.3.2 Operations Phase

3.15.8.3.2.1 Spanish Fork River From Diamond Fork Creek to Utah Lake. Based on the change in biomass as detailed in Section 3.6, there would be an estimated increase of 96 angler-days per year over baseline in the publicly accessible reaches of the Spanish Fork River. There would be an overall 10,200 angler-day loss per year from baseline if public fishing access were available along all Spanish Fork River reaches.

3.15.8.3.2.2 Hobble Creek From Mapleton-Springville Lateral Discharge to Utah Lake. Based on the change in biomass as detailed in Section 3.6 there would be an estimated increase of 13,509 angler days over baseline if public access were available.

3.15.8.3.2.3 Provo River From Deer Creek Dam Outlet to Utah Lake. Based on the change in biomass as detailed in Section 3.6, there would be an estimated increase of 36,342 angler-days per year over baseline in the publicly accessible reaches of the lower Provo River. There would be an overall increase of 50,807 angler-days per year over baseline if public fishing access were available along all lower Provo River reaches.

3.15.8.3.3 Summary of Proposed Action Impacts. Construction impacts on recreation resources from the Spanish Fork Canyon-Provo Reservoir Canal Alternative would not exceed the significance criteria.

Impacts on visitor use at recreation sites would not exceed the significance criteria. Construction traffic and activities would delay traffic and access to some recreation sites in the Sheep Creek-Rays Road area, but the roads would remain open and access would be available.

Access to Rock Canyon Park, Peaks Ice Arena and Seven Peaks Water Park would be temporarily delayed by construction traffic and activities, but one lane of traffic would remain open to the public during construction to allow access. This disrupted access would only occur during part of the 30-month construction period for the Spanish Fork-Provo Reservoir Canal Pipeline.

There would be a significant impact on angler-day use on the Provo and Spanish Fork rivers. Angler-day use would increase by 36,438 angler-days per year in these rivers under the Proposed Action. Table 3-92 summarizes the estimated changes in angler-day use under the Proposed Action.

Table 3-92
Estimated Angler Day Per Year Use of Key Stream Segments for the Spanish Fork Canyon-Provo Reservoir Canal Alternative (Proposed Action)

Page 1 of 2

Stream Reach	Baseline Predicted Angler Day Per Year Use	Proposed Action Predicted Angler Day Per Year Use	Impact (Change In Angler Days Per Year Use From Baseline)
Spanish Fork River			
Diamond Fork Creek to Spanish Fork Diversion Dam*	5,043	5,310	+267
Spanish Fork Diversion Dam to East Bench Dam*	1,754	1,840	+86
Spanish Fork Diversion Dam to East Bench Dam	5,553	5,826	+273
East Bench Dam to Mill Race Diversion*	8,157	7,150	-1,007
East Bench Dam to Mill Race Diversion	1,439	1,262	-177
Mill Race Diversion to Utah Lake*	19,286	9,644	-9,642
Subtotal with Existing Public Access	**6,992**	**7,088**	**+96**
Subtotal all Reaches	**41,232**	**31,032**	**-10,200**
Hobble Creek*			
Mapleton-Springville Lateral Discharge to Kolob Park in Springville	142	5,014	+4,872
Kolob Park in Springville to Utah Lake	334	8,971	+8,637
Subtotal all Reaches	**476**	**13,985**	**+13,509**

Table 3-92 Estimated Angler Day Per Year Use of Key Stream Segments for the Spanish Fork Canyon-Provo Reservoir Canal Alternative (Proposed Action) Page 2 of 2			
Stream Reach	**Baseline Predicted Angler Day Per Year Use**	**Proposed Action Predicted Angler Day Per Year Use**	**Impact (Change In Angler Days Per Year Use From Baseline)**
Provo River			
Deer Creek Dam outlet to North Fork of Provo River	44,196	44,196	0
North Fork of Provo River to Olmsted Diversion Dam	45,216	45,216	0
Olmsted Diversion Dam to Murdock Diversion Dam	23,433	28,505	+5,072
Murdock Diversion Dam to Spanish Fork-Provo Reservoir Canal Pipeline Discharge	8,287	8,287	0
Spanish Fork-Provo Reservoir Canal Pipeline Discharge to Riverside Country Club*	1,747	8,900	+7,153
Spanish Fork-Provo Reservoir Canal Pipeline Discharge to Riverside Country Club	2,325	11,846	+9,521
Riverside Country Club to Tanner Race Diversion Dam*	1,502	7,755	+6,253
Riverside Country Club to Tanner Race Diversion Dam	1,415	7,304	+5,889
Tanner Race Diversion Dam to Fort Field Diversion	1,357	10,602	+9,245
Fort Field Diversion to UDWR Weir*	277	1,336	+1,059
Fort Field Diversion to UDWR Weir	1,729	8,344	+6,615
Subtotal with Existing Public Access	**127,958**	**164,300**	**+36,342**
Subtotal all Reaches	**131,484**	**182,291**	**+50,807**
Grand Total with Existing Public Access	**134,950**	**171,388**	**+36,438**
Grand Total all Reaches	**173,192**	**227,308**	**+54,116**
*The use shown for these reaches of Spanish Fork River, Hobble Creek, and Provo River is potential use that could occur if public access were acquired. At the present time, little or no public access exists along these reaches and the only use that occurs is by trespass or permission of the landowner.			

3.15.8.4 Bonneville Unit Water Alternative

Impacts of the following features of this alternative would be the same as described for the Proposed Action (see following sections).

- Sixth Water Power Facility and Transmission Line – Section 3.15.8.3.1.1
- Upper Diamond Fork Power Facility – Section 3.15.8.3.1.1
- Spanish Fork-Santaquin Pipeline – Section 3.15.8.3.1.2
- Mapleton-Springville Lateral Pipeline – Section 3.15.8.3.1.4

3.15.8.4.1 Operations Phase

3.15.8.4.1.1 Spanish Fork River From Diamond Fork Creek to Utah Lake. Based on the change in biomass as detailed in Section 3.6, there would be an estimated decrease of 1,662 angler-days per year from baseline in the publicly accessible reaches of the Spanish Fork River. There would be an overall 15,859 angler-day loss per year from baseline if public fishing access were available along all Spanish Fork River reaches.

3.15.8.4.1.2 Hobble Creek From Mapleton-Springville Lateral Discharge to Utah Lake. Based on the change in biomass as detailed in Section 3.6 there would be an estimated increase of 17,166 angler days over baseline if public access were available.

3.15.8.4.1.3 Provo River From Deer Creek Dam Outlet to Utah Lake. Based on the change in biomass as detailed in Section 3.6, there would be an estimated increase of 19,716 angler-days per year over baseline in the publicly accessible reaches of the lower Provo River. There would be an overall increase of 27,265 angler-days per year over baseline if public fishing access were available along all lower Provo River reaches.

3.15.8.4.2 Summary of Bonneville Unit Water Alternative Impacts. Construction impacts on visitor use at recreation sites in the Sheep Creek-Rays Valley Road area would not exceed the significance criteria. Construction traffic and activities would cause delays to traffic and access to some recreation sites, but the roads would remain open and access would be available.

There would be a significant impact on angler day use on the Provo and Spanish Fork Rivers. Angler-day use would increase by 18,054 angler-days per year in these rivers under the Bonneville Unit Water Alternative. Table 3-93 summarizes the changes in angler day use under the Bonneville Unit Water Alternative.

Table 3-93
Estimated Angler Day Per Year Use of Key Stream Segments for the Bonneville Unit Water Alternative
Page 1 of 2

Stream Reach	Baseline Predicted Angler Day Per Year Use	Alternative Predicted Angler Day Per Year Use	Impact (Change in Angler Days Per Year Use From Baseline)
Spanish Fork River			
Diamond Fork Creek to Spanish Fork Diversion Dam*	5,043	5,043	0
Spanish Fork Diversion Dam to East Bench Dam*	1,754	1,466	-288
Spanish Fork Diversion Dam to East Bench Dam	5,553	4,643	-910
East Bench Dam to Mill Race Diversion*	8,157	3,890	-4,267
East Bench Dam to Mill Race Diversion	1,439	687	-752
Mill Race Diversion to Utah Lake*	19,286	9,644	-9,642
Subtotal with Existing Public Access	**6,992**	**5,330**	**-1,662**
Subtotal all Reaches	**41,232**	**25,373**	**-15,859**

Table 3-93
Estimated Angler Day Per Year Use of Key Stream Segments for the Bonneville Unit Water Alternative
Page 2 of 2

Stream Reach	Baseline Predicted Angler Day Per Year Use	Alternative Predicted Angler Day Per Year Use	Impact (Change in Angler Days Per Year Use From Baseline)
Hobble Creek*			
Mapleton-Springville Lateral Discharge to Kolob Park in Springville	142	6,333	+6,191
Kolob Park in Springville to Utah Lake	334	11,309	+10,975
Subtotal all Reaches	**476**	**17,642**	**+17,166**
Provo River			
Deer Creek Dam outlet to North Fork of Provo River	44,196	44,196	0
North Fork of Provo River to Olmsted Diversion Dam	45,216	45,216	0
Olmsted Diversion Dam to Murdock Diversion Dam	23,433	28,505	+5,072
Murdock Diversion Dam to Spanish Fork-Provo Reservoir Canal Pipeline Discharge	8,287	8,287	0
Spanish Fork-Provo Reservoir Canal Pipeline Discharge to Riverside Country Club*	1,747	5,507	+3,760
Spanish Fork-Provo Reservoir Canal Pipeline Discharge to Riverside Country Club	2,325	7,329	+5,004
Riverside Country Club to Tanner Race Diversion Dam*	1,502	4,699	+3,197
Riverside Country Club to Tanner Race Diversion Dam	1,415	4,425	+3,010
Tanner Race Diversion Dam to Fort Field Diversion	1,357	4,288	+2,931
Fort Field Diversion to UDWR Weir*	277	869	+592
Fort Field Diversion to UDWR Weir	1,729	5,428	+3,699
Subtotal with Existing Public Access	**127,958**	**147,674**	**+19,716**
Subtotal all Reaches	**131,484**	**158,749**	**+27,265**
Grand Total with Existing Public Access	**134,950**	**153,004**	**+18,054**
Grand Total all Reaches	**173,192**	**201,764**	**+28,572**

*The use shown for these reaches of Spanish Fork River, Hobble Creek and Provo River is potential use that could occur if public access were acquired. At the present time, little or no public access exists along these reaches, and the only use that occurs is by trespass or permission of the landowner.

3.15.8.5 No Action Alternative

No features would be constructed under the No Action Alternative. There would be no change in potential angler day use on the Spanish Fork River and Hobble Creek from baseline conditions. Based on the change in biomass as detailed in Section 3.6, there would be an estimated increase of 19,716 angler days over baseline on the Provo River from Deer Creek Dam Outlet to Utah Lake, which would be the same as under the Bonneville Unit Water Alternative (see Table 3-93).

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3.16 Noise

3.16.1 Introduction

This section identifies potential changes in noise levels from construction and operation of the Proposed Action and other alternatives. This information is used by other resource specialists to determine the impacts and significance of the change in noise levels on their resources.

3.16.2 Issues Raised in Scoping Meetings

None.

3.16.3 Scoping Issues Eliminated From Further Analysis

None.

3.16.4 Scoping Issues Addressed in the Impact Analysis

This analysis addresses potential changes in noise levels resulting from construction and operation of the Proposed Action and other alternatives.

3.16.5 Description of Impact Area of Influence

The impact area of influence includes areas where the action alternatives would be constructed and operated (see Map 3-2).

3.16.6 Methodology

The impact analysis considered the standard operating procedures (SOPs) and project design features that the District will implement as part of the project.

3.16.6.1 Assumptions

- A one-hour period of interest, since most construction equipment operates continuously for one hour. The A-weighted, hourly equivalent sound level, Leq(h), was calculated. Each piece of equipment associated with the construction phase was assumed to be operating during the hour. The hourly equivalent sound level was used since most construction equipment operates continuously for one hour. Assuming that all equipment associated with the construction phase was operating at the same time is a conservative assumption that results in a conservatively high, worst-case calculation of noise levels.

- Free field conditions, where the sound field is free from enclosures or boundaries that would interfere with the propagation of sound waves. Ground effects (the difference in soft versus hard ground on sound wave propagation) were ignored. Each piece of construction equipment was assumed to act as a point source of noise (essentially concentrated at a single point). Free field conditions were assumed as representative since a typical construction site analysis was used, and a typical construction site could occur in varying types of field conditions. The construction equipment used would not travel like traffic on a road (a line source of noise), and therefore would act as a point source of noise.

- A representative noise emission level for a class of construction equipment. It is not known at this time exactly what type of equipment would be used by the contractor at the construction site. Therefore, a representative noise emission level that would be conservative for an entire class of construction equipment was used.

- The equipment operates on the centerline of the pipeline or construction area. The centerline of the pipeline would be the average location where the equipment operates.

- Vehicle speeds within the construction site would be 25 miles per hour. This assumption was based on engineering experience at previous construction sites of the typical rate of travel within a construction site.

3.16.6.2 Impact Analysis Methodology

Construction noise was analyzed following the procedures for projects not yet under construction contained in "Highway Construction Noise: Measurement, Prediction and Mitigation" (FHWA 1977). Noise emission levels for all construction equipment were obtained from "Noise from Construction Equipment and Operations, Building Equipment and Home Appliances" (EPA 1971). Noise emission levels for pickup trucks were obtained from "FHWA Traffic Noise Model Technical Manual" (FHWA 1998). Noise emission levels for helicopters were obtained from the Everyday Noise List (DB Engineering 2003) and the Alternative Heliport Site Analysis for the City and Borough of Juneau (Michael Baker Corporation 2001). Typical day-night noise levels for different areas were obtained from "Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare With an Adequate Margin of Safety" (EPA 1974)

3.16.6.2.1 Description. Sound levels are measured in decibels (dB). A "weighted" scale that reflects human hearing is used to interpret sound levels since the human ear has a limited range of sensitivity to sound levels. This is better known as the "A-weighted" scale, and is denoted as dBA. The "A-weighted" scale is used in this analysis to measure projected sound levels resulting from ULS construction and operation.

The noise impact analysis identified the main construction phases for two typical construction sites (pipeline construction, and power plant and pump station construction), the different transmission line construction sites, the types of equipment required for each construction phase, and a representative noise emission level for each equipment type. The decibel noise levels at 50 feet for each piece of equipment were added together for each phase of construction.

Table 3-94 lists guidelines for adding decibels to an accuracy of plus or minus 1 decibel.

Table 3-94
Decibel Addition Rules

When two decibel values differ by:	Add the following amount to the higher value:
0 or 1 dB	3 dB
2 or 3 dB	2 dB
4 to 9 dB	1 dB
10 dB or more	0 dB

Decibel addition begins with the lowest numbers and works up to the highest numbers. Table 3-95 shows an example of decibel addition using the decibel addition rules.

Table 3-95
Decibel Addition Example

Step 1	Step 2	Step 3	Step 4	Step 5
Start with the five decibel values shown below.	Add the two values of 60 (the two lowest numbers) together, resulting in 63.	Add the 63 and 79 together (the remaining two lowest numbers), resulting in 79.	Add the 79 and 80 together, resulting in 83.	Add the 83 and 91 together, giving the final result of 92.
60	–	–	–	–
60	63	–	–	–
79	79	79	–	–
80	80	80	83	–
91	91	91	91	92

Adding the noise emission levels at 50 feet for each piece of construction equipment resulted in a maximum expected noise level for each construction phase at 50 feet. The decay rate, or the rate at which sound levels decrease with increasing distance from a noise source, was used to calculate maximum expected construction noise levels at varying distances from the construction site. The construction sites were assumed to act as point sources having a decay rate of 6 dBA per doubling of distance. For example, from 50 to 100 feet from the centerline, the noise level would decrease by 6 dBA. From 100 to 200 feet from the centerline, the noise level would decrease by another 6 dBA.

3.16.6.2.2 Verification and Calibration. Conservative estimates were used for each input parameter. Therefore, the calculated noise levels are expected to represent maximum, worst-case noise levels that could occur. The accuracy of the noise level estimate for projects not yet under construction is unknown since most of the input parameters must be assumed. These include the equipment that would actually be used at the site, noise emission levels for each piece of equipment, topographic and geographic spreading characteristics of the sound waves distance from the receptor to the equipment, and the percent of time that the equipment would actually be in use.

3.16.7 Affected Environment (Baseline Conditions)

3.16.7.1 Overview

Existing noise levels in the impact area of influence vary greatly. Areas considered in the analysis include everything from serene forested areas, such as along Sixth Water Creek, to heavily urbanized areas, such as those found in Provo.

3.16.7.2 Noise Levels

Table 3-96 shows typical day-night (Ldn) noise levels for different types of residential areas. Ldn represents the day-night average sound level, and is defined as the 24-hour A-weighted equivalent sound level with a 10 percent decibel reduction applied to nighttime levels to account for most receptors' increased sensitivity to nighttime noises.

Table 3-96 Typical Day-Night Noise Levels for Different Areas		
Description	**Typical Range, Ldn (dBA)**	**Average Ldn (dBA)**
Quiet Suburban Residential	48-52	50
Normal Suburban Residential	53-57	55
Urban Residential	58-62	60
Noisy Urban Residential	63-67	65
Very Noisy Urban Residential	68-72	70

Traffic noise may add to construction noise in heavy traffic areas, but noise levels from traffic in construction areas cannot be accurately quantified at this time. Existing traffic noise in the impact area of influence varies greatly. Chapter 3, Section 3.19, Transportation Networks and Utilities, describes baseline Average Annual Daily Traffic (AADT) along with anticipated construction traffic routes to each project feature and the construction corridors. Specific traffic noise levels depend on traffic speed and volume, and have not been measured or calculated. It is anticipated that speed and volume would be reduced from normal levels during construction operations. Noise levels are influenced by the travel surface, and traffic that is normally traveling on pavement may be traveling on dirt or gravel temporary construction bypass roads.

3.16.8 Environmental Consequences (Impacts)

Noise levels generated by construction of each pipeline and power facility would be the same, regardless of location because the same type of equipment would be used. The only difference between the features would be the duration, which depends on the duration of construction. Since this analysis only generates noise levels that are expected to occur, the location of the noise is not considered for pipelines and pump station and power facilities. Therefore, this section presents only the analysis to estimate noise levels that would be expected from pipeline construction (Tables 3-97 and 3-98), a power facility (Tables 3-99 and 3-100), and power transmission lines (Tables 3-101 and 3-102). Table 3-103 shows the duration of the noise for each facility.

Construction traffic is not expected to noticeably increase sound levels on major roadways used to access the construction area since a doubling of traffic volumes raises sound levels only 3 dBA, which is not a perceptible change to the human ear. On some residential streets and remote roads with low traffic volume, construction traffic traveling to the construction area may temporarily increase local noise levels.

3.16.8.1 Significance Criteria

No significance criteria were developed as the noise analysis only identifies potential changes in noise levels that are used by other specialists to determine impacts on their resource.

3.16.8.2 Potential Impacts Eliminated From Further Analysis

Noise levels could not be quantified for the various power facilities associated with the alternatives, which are the only facilities that would create noise during the operations phase. Exterior noise levels from such facilities are usually low, and noise attenuation provisions in the buildings would keep maximum allowable noise levels from being exceeded.

3.16.8.3 Pipeline Construction

Table 3-97 lists the maximum expected hourly equivalent noise level [Leq(h)] for each construction phase at the typical pipeline construction site.

Table 3-97
Maximum Expected Hourly Equivalent Noise Level
for Each Construction Phase at Typical Pipeline Construction Site

Page 1 of 2

Construction Phase and Equipment Used in Each Phase	Quantity	Average Noise Level at 50 Feet for Each Piece of Equipment (dBA)	Maximum Expected Hourly Equivalent Noise Level at 50 Feet for Each Construction Phase Leq(h) (dBA)
Clearing and Grubbing			**92**
Pickup Truck	4	60	–
Dozer	1	80	–
Loader	1	79	–
Dump Truck	1	91	–
Trench Excavation			**95**
Pickup Truck	4	60	–
Backhoe	1	85	–
Dump Truck	2	91	–
Dewatering Pump	2	76	–
Loader	1	79	–
Dozer	1	80	–
Crane	1	83	–
Placing Pipe in Trenches and Connecting			**92**
Pickup Truck	4	60	–
Pipelayer/Crane	1	83	–
Truck	1	91	–
Welder	1	78	–
Forklift	1	79	–
Backfilling Trenches and Grading			**95**
Pickup Truck	4	60	–
Backhoe	1	85	–
Compactor	1	74	–
Dump Truck	2	91	–
Loader	1	79	–
Grader	1	85	–

Table 3-97
Maximum Expected Hourly Equivalent Noise Level for Each Construction Phase at Typical Pipeline Construction Site

Construction Phase and Equipment Used in Each Phase	Quantity	Average Noise Level at 50 Feet for Each Piece of Equipment (dBA)	Maximum Expected Hourly Equivalent Noise Level at 50 Feet for Each Construction Phase Leq(h) (dBA)
Cleaning and Restoring			**95**
Pickup Truck	4	60	–
Backhoe	1	85	–
Dump Truck	1	91	–
Roller	1	74	–
Dozer	1	80	–
Grader	1	85	–
Roller	1	74	–
Paver	1	89	–

The loudest hourly equivalent sound level of 95 dBA would occur during trench excavation, backfilling trenches and grading, and cleaning and restoring. Since the typical construction site is assumed to act as a point source of noise, noise levels would decrease by 6 dBA with each doubling of distance from the construction area.
Table 3-98 lists maximum expected hourly equivalent noise levels at varying distances from the typical pipeline construction site.

Table 3-98
Maximum Expected Hourly Equivalent Noise Level Variation at Varying Distances From Typical Pipeline Construction Site

Distance From Typical Pipeline Construction Site (feet)	Maximum Expected Hourly Equivalent Noise Level Leq(h) (dBA)
50	95
100	89
200	83
400	77
800	71
1,600	65

Noise from blasting and jackhammers would be localized and temporary. Blasting or jackhammers may be required in some areas along the pipeline alignment where bedrock cannot be loosened by mechanical ripping. Blasting would occur largely underground, and is not expected to have a high noise level. The nominal noise level for jackhammers at 50 feet is 88 dBA.

3.16.8.4 Power Facilities

Table 3-99 lists hourly equivalent noise levels for each construction phase of a power facility construction site.

Table 3-99
Maximum Expected Hourly Equivalent Noise Level Expected for Each Construction Phase of A Power Facility

Construction Phase and Equipment Used in Each Phase	Quantity	Average Noise Level at 50 Feet for Each Piece of Equipment (dBA)	Maximum Expected Hourly Equivalent Noise Level at 50 Feet for Each Construction Phase Leq(h) (dBA)
Clearing and Grubbing/Earthwork			**95**
Pickup Truck	4	60	–
Dozer	1	80	–
Loader	1	79	–
Dump Truck	2	91	–
Grader	1	85	–
Piping			**95**
Pickup Truck	4	60	–
Backhoe	1	85	–
Dump Truck	2	91	–
Pipelayer/Crane	1	83	–
Structure			**89**
Pickup Truck	4	60	–
Concrete Pump	1	82	–
Backhoe	1	85	–
Crane	1	83	–
Compactor	1	74	–
Welder	1	78	–
Cleaning and Restoring			**95**
Pickup Truck	4	60	–
Backhoe	1	85	–
Dump Truck	1	91	–
Grader	1	85	–
Roller	1	74	–
Paver	1	89	–

The loudest hourly equivalent sound level expected from the typical power facility construction site (95 dBA) would occur during the clearing and grubbing/earthwork, piping, and cleaning and restoring phases. Since the typical construction site is assumed to act as a point source of noise, noise levels would decrease by 6 dBA with each doubling of distance from the construction area. Table 3-100 lists maximum expected hourly equivalent noise levels at varying distances from the typical pipeline construction site.

Table 3-100 Maximum Expected Hourly Equivalent Noise Level at Varying Distances From Power Facility Construction Site	
Distance From Typical Power Plant Construction Site (feet)	**Maximum Expected Hourly Equivalent Noise Level Leq(h) (dBA)**
50	95
100	89
200	83
400	77
800	71
1,600	65

3.16.8.5 Power Transmission Lines

Table 3-101 lists hourly equivalent noise levels [Leq(h)] for construction associated with the different overhead and underground power transmission lines.

Table 3-101 Maximum Expected Hourly Equivalent Noise Level for Typical Power Transmission Line Construction Page 1 of 2			
Construction Phase and Equipment Used in Each Phase	**Quantity**	**Average Noise Level at 50 Feet for Each Piece of Equipment (dBA)**	**Maximum Expected Hourly Equivalent Noise Level at 50 Feet for Each Construction Phase Leq(h) (dBA)**
Sixth Water Transmission Line Overhead Power Line			
New Access Road and Clearing			**98**
Pickup Truck	4	60	–
Dozer	2	80	–
Loader	2	79	–
Dump Truck	4	91	–
Foundation and Erection of Poles			**97**
Pickup Truck	4	60	–
Backhoe	2	85	–
Digger Truck	2	91	–
Haul Truck	1	91	–
Crane	1	83	–
Transporting Poles (Sixth Water Only)			**105**
Helicopter (assuming they are flying separately)	2	105 (65 dBA 1,600 feet from the flight route)	–

Table 3-101 Maximum Expected Hourly Equivalent Noise Level for Typical Power Transmission Line Construction Page 2 of 2			
Construction Phase and Equipment Used in Each Phase	**Quantity**	**Average Noise Level at 50 Feet for Each Piece of Equipment (dBA)**	**Maximum Expected Hourly Equivalent Noise Level at 50 Feet for Each Construction Phase Leq(h) (dBA)**
Sixth Water Transmission Line Overhead Power Line			
Stringing Conductors			**95**
Pickup Truck	2	60	–
Haul Truck	2	91	–
Bucket Truck	2	83	–
Cable Puller	2	78	–
Cleaning and Revegetation			**95**
Backhoe	1	85	–
Dump Truck	2	91	–
Dozer	1	80	–

The loudest hourly equivalent sound levels for power transmission line construction would be as follows:

- 98 dBA for the Sixth Water Transmission Line would occur during new access road construction and clearing

Transporting the power poles by helicopter for the Sixth Water Transmission Line would result in noise levels of approximately 105 dBA 50 feet from the helicopter (DB Engineering 2003) and 65 dBA 1,600 feet from the flight route (Michael Baker Corporation 2001) based on actual measurements that were available in the literature. Sound levels intermediate to these distances were not available. It is assumed that the helicopters would stage from the Rays Valley Transmission Line Substation area.

Since the construction sites are assumed to act as a point source of noise, noise levels would decrease by 6 dBA with each doubling of distance from the construction area. Table 3-102 lists maximum expected hourly equivalent noise levels at varying distances from the transmission line construction sites.

Table 3-102 Maximum Expected Hourly Equivalent Noise Levels at Varying Distances From Power Transmission Line Construction Sites		
Distance From Transmission Line Construction Site (feet)	**Sixth Water Transmission Line Maximum Expected Hourly Equivalent Noise Level Leq(h) (dBA)**	
	Along Transmission Line Corridor	**Helicopter**
50	98	105
100	92	N/A
200	86	N/A
400	80	N/A
800	74	N/A
1600	68	65

3.16.8.6 Duration of Noise Levels

Table 3-103 lists duration of construction noise levels for each feature. Construction is expected to take place five days per week, Monday through Friday, from 7 a.m. to 6 p.m.

Table 3-103 Duration of Construction Noise Levels for Each Feature	
Project Feature	**Construction Duration (months)**
Sixth Water Power Facility & Transmission Line	12 (power facility) 5 (transmission line)
Upper Diamond Fork Power Facility	12
Spanish Fork-Santaquin Pipeline	30
Mapleton-Springville Lateral Pipeline	12
Spanish Fork-Provo Reservoir Canal Pipeline	30

3.16.8.7 No Action Alternative

No changes in noise levels would be associated with construction of ULS project features. Factors not associated with the ULS project, such as population growth, would continue to affect noise levels.

3.17 Public Health and Safety

3.17.1 Introduction

This analysis addresses potential public safety and health hazards from construction and operation of the Proposed Action and other alternatives. Impact topics include the following:

- Health and safety hazards related to construction workers
- Health and safety hazards related to the general population during construction
- Health and safety impacts of a major break in the pipeline during operation

3.17.2 Issues Raised in Scoping Meetings

- What would be the impacts of catastrophic failure of the pipeline through Utah Lake?
- What would be the impacts of pipeline construction along busy highways and city street corridors?

3.17.3 Scoping Issues Eliminated From Further Analysis

Potential failure of a pipeline through Utah Lake was eliminated from further analysis (see Chapter 1, Section 1.11.1).

3.17.4 Scoping Issues Addressed in the Impact Analysis

This analysis addresses the impacts of pipeline construction along busy highways and city street corridors.

3.17.5 Description of Impact Area of Influence

The impact area of influence includes areas where the Proposed Action and other alternatives would be constructed, near pipeline construction, where roads would be used for construction, and where normal traffic flow would be disrupted as pipeline construction proceeds from unpopulated areas to residential and business areas. Map 3-2 shows the overall impact area of influence.

3.17.6 Methodology

The impact analysis considered the standard operating procedures (SOPs) and project design features that the District will implement as part of the project.

3.17.6.1 Assumptions

- The risk of health and safety impacts would be low in rural areas and high in urban areas.
- Standard Operating Procedures (SOPs) (see Chapter 1, Section 1.8.8, Standard Operating Procedures during construction) for construction health and safety, air quality and noise would be enforced and successfully implemented during construction and operation.

3.17.6.2 Impact Analysis Methodology

Potential changes in air quality, noise levels and transportation during construction and operation were examined and compared against baseline conditions to determine the potential for health and safety impacts to occur and their significance.

> **Related Data Sections**
>
> This section uses results from other analyses in this Draft Environmental Impact Statement. For details on how these results were developed, see the following sections of Chapter 3:
>
> <u>Noise</u>
> Section 3.16.8.3
> Section 3.16.8.4
> Section 3.16.8.5
> Section 3.16.8.6
>
> <u>Transportation Networks and Utilities</u>
> Section 3.19.8.3
> Section 3.19.8.4
> Section 3.19.8.5
>
> <u>Air Quality</u>
> Section 3.20.8.3
> Section 3.20.8.4
> Section 3.20.8.5

The impact area of influence was divided into rural areas (outside of town and city limits) and urban areas (inside of town and city limits). A worst-case scenario was examined to assess potential risks of a major pipeline breach during operations by examining the flow rate that would pass through pipes at key stations, and calculating water loss that would occur within 15 minutes. The selection of the key stations was based on the locations where the pipe diameter changed.

3.17.7 Affected Environment (Baseline Conditions)

3.17.7.1 Population

The population within the impact area of influence ranges from very low in rural areas to very high in urban areas. The towns and cities that would be affected by construction of the ULS are the cities of Provo, Orem, Spanish Fork, Springville, Salem, Payson, and Mapleton.

3.17.7.2 Construction Access

Expected construction access routes to construction areas are described in Chapter 3, Section 3.19.7.1, Transportation Networks and Utilities. Affected areas include major highways and minor access roads, public schools and parks, medical facilities and private dwellings. Highways include four-lane interstate highways (I-15 ınd I-80), four-lane, limited-access highways (U.S. Highway 189), two-lane roads with turn lanes and passing ıanes on some steep grades, dirt and gravel two-lane roads, and urban streets.

3.17.7.3 Utilities

Density of existing utilities, above and below ground, varies from high in larger cities to low in rural areas and smaller cities and communities.

3.17.7.4 Noise Levels

Existing noise levels in the impact area of influence fluctuate from rural roads with little traffic noise to major streets and roads in highly populated areas with elevated traffic and noise levels 24 hours a day.

3.17.7.5 Air Quality

Provo and Orem in Utah County have been classified as non-attainment for Carbon Monoxide (CO) and particulate matter (PM_{10}) by the U.S. Environmental Protection Agency (EPA). Air quality in the remainder of Utah County is excellent.

3.17.8 Environmental Consequences (Impacts)

In the following analysis, two features were handled as one group instead of individually. They were handled as one group because they are located in the same general area, occur in a rural area, and would have the same impacts.

3.17.8.1 Significance Criteria

Impacts on public safety and health are considered significant if construction, maintenance and operation of the Proposed Action and other alternatives would result in one or more of the following conditions.

- Public exposure to toxic materials and pollutants due to violations of federal or state ambient air-quality standards or noncompliance with guidelines for trace elements in vegetation and wildlife that could threaten public safety if consumed
- Disruption of a utility, especially electrical service for life support systems, for longer than two hours
- A pipeline rupture or other system component failure that floods neighborhoods or affects recreational users
- Public exposure to increased risk of accidents or an increase of more than 15 minutes in emergency vehicle response times over normal traffic conditions
- Violation of federal, state and local noise level standards

These criteria are based on the Utah Occupational and Health Act, Federal Occupational Safety and Health Standards, and professional experience with similar projects.

3.17.8.2 Potential Impacts Eliminated From Further Analysis

- Emergency vehicle response times are not expected to increase because the road would remain open during construction and emergency vehicles would have priority through the construction zone (see Chapter 1, Section 1.8.8 Standard Operating Procedures during construction, and Section 1.10.8.11 Transportation Networks and Utilities).

- Soils disturbed by construction are not expected to be contaminated because an inventory of potential underground storage tanks sites determined that none would be disturbed.

- It is not likely that utility services would be disrupted. All utilities would be identified, located and protected or relocated as required prior to pipeline construction (See Chapter 1, Section 1.8.8.11). There is a slight possibility that a utility line could be broken during construction. If this occurred for any feature, utility service could be disrupted for an unknown amount of time.

3.17.8.3 Spanish Fork Canyon-Provo Reservoir Canal Alternative (Proposed Action)

3.17.8.3.1 Construction Phase

3.17.8.3.1.1 Sixth Water Power Facility and Transmission Line and Upper Diamond Fork Power Facility

A. Construction Workers

Workers could be at risk of accidents during construction of these two power facilities despite following all required safety procedures. However, the risk and severity of accidents would be minimized if contractors fully implement the standard operating procedures (SOPs) for health and safety (see Chapter 1, Section 1.8.8, Standard Operating Procedures during construction).

B. General Population

These facilities are in unpopulated areas (see Map A-1), therefore impacts on the general population would be limited to recreationists and Forest Service permitees who use the surrounding area. Potential impacts include increased traffic on Sheep Creek-Rays Valley Road, the Sixth Water flow control structure access road, and Diamond Fork Road. Traffic on these roads would likely increase by more than 10 percent over current levels during construction, which would increase the risk of accidents during construction.

3.17.8.3.1.2 Spanish Fork Canyon Pipeline

A. Construction Workers

The potential impacts on construction workers would be the same as described in Section 3.17.8.3.1.1 A.

B. General Population

The entire pipeline (7 miles) would be constructed through a rural area. Construction trips along Highway 6 are not expected to increase the AADT by more than 10 percent. At least one lane of traffic would be open for travel at all times. The increase in traffic could cause an increase in accidents.

The increase in noise associated with construction would not cause any impact on the general population because construction would occur in a rural area and along Highway 6.

The 24-hour standard for PM_{10} could be exceeded during construction. However, impacts on the general population would not exceed the significance criteria because the area is rural.

3.17.8.3.1.3 Spanish Fork-Santaquin Pipeline

A. Construction Workers

The potential impacts on construction workers would be the same as described in Section 3.17.8.3.1.1 A.

B. General Population

The pipeline would be constructed through rural and urban areas. Table 3-104 shows the location and lengths of pipelines in these areas.

Table 3-104
Location and Lengths of the Spanish Fork-Santaquin Pipeline

Location	Pipeline Mileposts*	Total Miles
Rural Areas	1.8 to 5.7 8.4 to 9.0 9.5 to 9.7 12.1 to 17.5	10.1
Towns:		7.4
Spanish Fork	0.0 to 1.8	1.8
Salem	5.7 to 8.4	2.7
Payson	9.0 to 9.5 9.7 to 12.1	2.9

*Mileposts are shown on Map A-1.

No traffic counts are available for rural roads and residential streets that would be affected by this pipeline. However, average annual daily traffic (AADT) is likely to increase more than 10 percent during pipeline construction, which would increase the risk of accidents, especially in urban areas.

Pipeline construction would increase noise levels to 95 A-weighted decibels (dBA) within 50 feet of the construction site and 89 dBA at 100 feet from the construction site. This level would occur up to 8-hours a day and could potentially cause health problems. The risk of impact would be high in urban areas and low in rural areas.

The 24-hour standard for PM_{10} (particulate matter less than 10 microns in diameter) could be exceeded during construction, which could lead to a high risk of health problems in the immediate vicinity in the urban areas.

3.17.8.3.1.4 Santaquin-Mona Reservoir Pipeline

A. Construction Workers

The potential impacts on construction workers would be the same as described in Section 3.17.8.3.1.1 A.

B. General Population

This pipeline would be constructed through (6.4 miles) of rural area and no urban areas (see Map A-1, mileposts 0.0 to 6.4).

No traffic counts are available for roads that would be affected by this pipeline. AADT is likely to increase more than 10 percent during pipeline construction. This could increase the risk of accidents, but the probability would be low.

Noise levels would be the same as described in Section 3.17.8.3.1.2 B for rural and urban areas, but the probability of health problems would be low.

Air quality health-related impacts would be the same as described in Section 3.17.8.3.1.2 B.

3.17.8.3.1.5 Mapleton-Springville Lateral Pipeline

A. Construction Workers

The potential impacts on construction workers would be the same as described in Section 3.17.8.3.1.1 A.

B. General Population

This pipeline would be constructed through 0.8 miles of rural area (see Map A-1, mileposts 0.7 to 1.5) and 4.9 miles of urban area in the cities of Spanish Fork and Mapleton (see Map A-1, mileposts 0.0 to 0.7 and 1.5 to 5.7, respectively).

Potential health and safety impacts related to increased traffic would be the same as described in Section 3.17.8.3.1.2 B.

Noise levels would be the same as described in Section 3.17.8.3.1.2 B.

Air quality health-related impacts would be the same as described in Section 3.17.8.3.1.2 B for rural areas and Section 3.17.8.3.1.3 B for urban areas.

3.17.8.3.1.6 Spanish Fork-Provo Reservoir Canal Pipeline

A. Construction Workers

The potential impacts on construction workers would be the same as described in Section 3.17.8.3.1.1 A.

B. General Population

This pipeline would be constructed through rural areas and the following towns and cities: Spanish Fork, Mapleton, Springville, Provo and Orem.

Table 3-105 shows areas within town and city limits that would most likely have health and safety impacts.

Table 3-105
Location and Lengths for the Spanish Fork-Provo Reservoir Canal Pipeline

Location	Pipeline Mileposts*	Total Miles
Rural Areas	0.8 to 1.5 17.8 to 17.9 18.0 to 18.3	1.1
Towns		18.6
Mapleton	1.5 to 4.5	3.0
Springville	4.5 to 7.7	3.2
Provo	7.7 to 17.8 17.9 to 18.0 18.3 to 18.9	10.8
Orem	18.9 to 19.7	1.6

*Pipeline mileposts are shown on Map A-1.

AADT is likely to increase more than 10 percent during pipeline construction, including 11.1 percent for Foothill Drive Traffic, the only street for which traffic counts were available. The probability of increased accidents is very high because of high population density in this urban area.

The noise level would be the same as described in Section 3.17. 8.3.1.2 B. The probability of health impacts would be high because of population density surrounding the pipeline construction site in urban areas.

Air quality health-related impacts would be the same as described in Section 3.17.8.3.1.2 B for rural areas and Section 3.17.8.3.1.3 B for urban areas.

3.17.8.3.2 Operations Phase. The pipeline would be designed to withstand an earthquake (magnitude to be determined), so a catastrophic rupture is highly unlikely. The worst-case scenario would be a complete rupture of the pipeline from a major earthquake during operation, which could cause health and safety impacts adjacent to the break. The three component assumptions of the total spillage are as follows:

1) The flow capacity in the pipeline for the length of time to begin closing the valve (15 minutes)
2) A linear reduction from flow capacity to zero flow for the length of time to close the valve (45 minutes)
3) The volume of water that would gravity drain from pipes above the breach and below valves or high points

Approximately 60 minutes would elapse before a worker could react and close an upstream shutoff valve or divert the water flow. After that, spillage would continue to include gravity drain that would not be caught above valves or between high points. Table 3-106 estimates the water that could be released from ruptured pipelines for this alternative.

Table 3-106 Estimated Water Release Rates From Ruptured Pipelines Spanish Fork Canyon-Provo Reservoir Canal Alternative (Proposed Action)					
Reach	Mileposts	Pipeline Length (miles)	Pipeline Diameter (inches)	Pipeline Capacity (cfs)	Release Volume* (acre-feet)
Spanish Fork Canyon Pipeline	0.0 to 7.0	7.0	84	365	30.5
Spanish Fork-Santaquin Pipeline	0.0 to 1.3	1.3	60	120	11.9
	1.3 to 6.5	5.2	54	120	15.7
	6.5 to 9.7	3.2	48	105	12.5
	9.7 to 14.8	5.1	48	70	12.2
	14.8 to 16.4	1.6	42	60	6.9
	16.4 to 17.5	1.1	36	50	4.5
Mapleton-Springville Lateral Pipeline	0.0 to 4.7	4.7	48	125	8.8
	4.7 to 5.5	0.8	36	64	6.3
	5.5 to 5.7	0.2	30	36	5.0
Santaquin-Mona Reservoir Pipeline	0.0 to 1.8	1.8	24	20	2.4
	1.8 to 7.0	5.2	24	20	2.2
Spanish Fork-Provo Reservoir Canal Pipeline	0.0 to 1.1	1.1	60	120	9.8
	1.1 to 17.5	16.4	48	120	20.2
	17.5 -19.7	1.9	48	90	6.2
*Includes piping areas above valve that continue to drain as valve is being closed.					

3.17.8.3.3 Summary of Proposed Action Impacts. Table 3-107 shows impacts that could exceed the health and safety significance criteria under the Proposed Action.

Table 3-107 Potential Health and Safety Impacts From Construction of Spanish Fork Canyon-Provo Reservoir Canal Alternative (Proposed Action)	
Potential Impact	**Significance Criteria**
Emissions of particulate matter less than 10 microns in diameter during construction (PM_{10})	Public exposure to toxic material and pollutants that violate federal air quality standards
Increased traffic flow	Public exposed to increased risk of accidents
Increased noise levels	Federal, state and local noise level standards exceeded

These potential health and safety impacts would occur in both rural and urban areas, but are more likely in urban areas. However, the risk of health and safety problems for the general population would be greater in urban areas. The Sixth Water Power Facility and Transmission Line and the Upper Diamond Fork Power Facility are in rural areas with no nearby residences. The Santaquin-Mona Reservoir Pipeline would not pass through any urban areas.

Table 3-108 shows only high-risk urban areas by feature, pipeline milepost, number of miles, and towns and cities where the impact would occur.

Table 3-108
Location of High-Risk Urban Areas for PM_{10}, Traffic and Noise Significant Impacts

Feature	Pipeline Mileposts*	Miles	Towns/Cities Affected
Spanish Fork-Santaquin Pipeline	0.0 to 1.8 5.7 to 8.4 9.0 to 9.5 9.7 to 12.1	7.4	Spanish Fork, Salem, Payson
Mapleton-Springville Lateral Pipeline	0.0 to 0.7 1.5 to 5.7	4.9	Spanish Fork, Mapleton
Spanish Fork-Provo Reservoir Canal Pipeline	0.7 to 17.8 17.9 to 18.0 18.3 to 19.7	18.6	Spanish Fork, Mapleton, Springville, Provo, Orem

*Mileposts are shown on Map A-1.

A complete pipeline rupture is unlikely, but there is a high probability of some health and safety impacts if a rupture occurred in densely populated urban areas.

3.17.8.4 Bonneville Unit Water Alternative

The impacts of the following features of this alternative are the same as for the Spanish Fork Canyon-Provo Reservoir Canal Alternative (see following sections):

- Sixth Water Power Facility and Transmission Line – Section 3.17.8.3.1.1
- Upper Diamond Fork Power Facility and Transmission Line – Section 3.17.8.3.1.1
- Spanish Fork Canyon Pipeline – Section 3.17.8.3.1.2
- Spanish Fork-Santaquin Pipeline – Section 3.17 3.17.8.3.1.3
- Mapleton-Springville Lateral Pipeline – 3.17.8.3.1.5

3.17.8.4.1 Operations. The type of impact that could occur is shown in Section 3.17.8.3.2. Table 3-109 lists the volume of water that could be released from a pipeline rupture.

Table 3-109 Estimated Water Release Rates From Ruptured Pipelines Bonneville Unit Water Alternative					
Reach	**Mileposts**	**Pipeline Length (miles)**	**Pipeline Diameter (inches)**	**Pipeline Capacity (cfs)**	**Release Volume* (acre-feet)**
Spanish Fork Canyon Pipeline	0.0 to 7.0	7.0	72	240	19.6
Spanish Fork-Santaquin Pipeline	0.0 to 1.3	1.3	48	115	8.5
	1.3 to 6.5	5.2	48	115	12.1
	6.5 to 9.7	3.2	48	83	10.1
	9.7 to 14.8	5.1	48	50	10.2
	14.8 to 16.4	1.6	36	50	5.4
	16.4 to 17.5	1.1	30	36	3.6
Mapleton-Springville Lateral Pipeline	0.0 to 4.7	4.7	48	125	8.8
	4.7 to 5.5	0.8	36	64	6.3
	5.5 to 5.7	0.2	30	36	5.0
*Includes piping areas above valve that continue to drain as valve is being closed.					

3.17.8.4.2 Summary of Bonneville Unit Water Alternative Impacts. Table 3-110 shows the impacts that could exceed the health and safety significance criteria under the Bonneville Unit Water Alternative.

Table 3-110
Potential Health and Safety Impacts from Construction of the Bonneville Unit Water Alternative

Impact	Significance Criteria
Emissions of particulate matter less than 10 microns in diameter during construction (PM_{10})	Public exposure to toxic material and pollutants which violate federal air quality standards
Increased traffic flow	Public exposed to increased risk of accidents
Increased noise levels	Federal, state and local noise level standards exceeded

These impacts would occur in both rural and urban areas. However, the risk of these impacts causing health and safety problems for the general population would be greater in urban areas. The Sixth Water Power Facility and Transmission Line and the Upper Diamond Fork Power Facility are in rural areas with no nearby residences. Table 3-111 shows only high-risk urban areas by feature, pipeline milepost, number of miles, and towns and cities where the impact would occur.

Table 3-111 Location of High-Risk Urban Areas for PM_{10}, Traffic and Noise Significant Impacts			
Feature	**Pipeline Mileposts***	**Miles**	**Towns/Cities Affected**
Spanish Fork-Santaquin Pipeline	0.0 to 1.8 5.7 to 8.4 9.0 to 9.5	5.0	Spanish Fork, Salem, Payson
Mapleton-Springville Lateral Pipeline	0.0 to 0.7 1.5 to 5.7	4.9	Spanish Fork, Mapleton
*Pipeline mileposts are shown on Map A-2			

A complete pipeline rupture is unlikely, but there is a high probability of some health and safety impacts if a rupture occurred in densely populated urban areas.

3.17.8.5 No Action Alternative

No public health and safety hazards would be associated with construction of ULS project features. Factors not associated with the ULS project, such as population growth, would continue to impact public health and safety.

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3.18 Paleontological Resources

3.18.1 Introduction

This analysis addresses potential impacts on paleontological resources from construction of the Proposed Action and other alternatives. There would be no operational impacts on paleontological resources. Construction impact topics include the following:

- Paleontological formations
- Paleontological localities

3.18.2 Issues Raised In Scoping Meetings

None.

3.18.3 Scoping Issues Eliminated From Further Analysis

None.

3.18.4 Scoping Issues Addressed in the Impact Analysis

Even though no issues were identified during the public scooping process, potential impacts on paleontological resources resulting from construction of the ULS project are identified.

3.18.5 Description of Impact Area of Influence

The overall impact area of influence for the ULS project is shown on Map 3-2. Within that area the paleontology impact area of influence includes the following:

- Any area that would be directly affected by project features
- Any stream or river and associated corridor that would be subject to water deliveries or alterations in flow

3.18.6 Methodology

The impact analysis considered the standard operating procedures (SOPs) and project design features that the District will implement as part of the project.

3.18.6.1 Assumptions

See Appendix E.

3.18.6.2 Impact Analysis Methodology

See Appendix E.

3.18.7 Affected Environment (Baseline Conditions)

3.18.7.1 Overview

The ULS impact area of influence sits at the junction of two major physiographic areas, the Middle Rocky Mountain Province and the Basin and Range Province. Two sections of the Middle Rocky Mountain Province, the Wasatch Hinterland and Wasatch Range, occur on the east side of the impact area of influence. The Wasatch Front Valleys section of the Basin and Range Province occurs on the west side of the project area (Stokes 1977). Geologic units in these areas range from recent alluvium to rocks of Mississippian age, deposited over 300 million years ago. The various rock types present and the fossils found within them indicate a broad range of ancient environments and ancient life.

The Wasatch Front Valleys are part of the Basin and Range Province that extends westward from the Wasatch Front and across most of Nevada. This area has no drainage to the sea and is characterized by elongate valleys and ranges trending north-south (Hintze 1988). These valleys have been filling with sediment over the past 15 million years as the present physiographic features were forming. The valleys were occupied by Lake Bonneville during the last million years. Therefore the sediments found in and around the edges of the valleys are of Pleistocene age (2 million to 10,000 years ago). The Wasatch Front Valleys region is known to have a number of Pleistocene fossil localities, primarily containing remains of ice-age mammals, but birds, reptiles, invertebrates and plants (Miller 2002).

A number of fossil localities have been recorded by various workers over the years throughout the impact area of influence. Most are not located close to proposed features of the Proposed Action and other alternatives, but do provide important paleontological information on formations that could be impacted.

Field surveys were conducted on the various features in the impact area of influence during May and June, 2003. Twenty five new fossil localities were recorded during field inventory surveys. All of these were in the Wasatch Hinterland (east of the Wasatch Range) in the Green River Formation, Duchesne River/Uinta Formation, or Oquirrh Formation.

A file search at the Office of the State Paleontologist, Utah Geological Survey, showed that at least 16 Pleistocene fossil localities have been recorded previously over the years along the Wasatch Front Valleys from Pleasant Grove to Genola and Santaquin. The exact location of some of these is not known, but most were found in gravel pits or during excavation for construction. Pleistocene mammals (musk ox and mammoths being the most common) along with reptiles, birds, invertebrates, and plants (see maps with Paleontological Locality Data Sheets in Appendix H). These localities illustrate the potential for encountering Pleistocene fossils during construction along the Wasatch Front Valleys.

More detailed information of fossil localities for each newly discovered locality can be found in Appendix H.

3.18.7.2 Sixth Water Power Facility and Transmission Line

3.18.7.2.1 Paleontological Formations. According to the geologic map by Contenius and Coogan (2002) the proposed Sixth Water power facility sits in the North Horn Formation (Paleocene). The transmission line begins in the North Horn Formation and crosses the Flagstaff and Colton formations (both Eocene), and into the Green River Formation (Eocene).

The North Horn Formation is well known for its fossil mammals (Robinson 1986; Gazin 1941). Mammals, fish, reptiles, invertebrates and plants have been found in the Flagstaff Formation (La Roque 1960; Rich 1973, and Stanley and Collinson 1979). Reptiles, fish, birds, invertebrates, plants, and trace fossils have been found in the

Colton Formation (Smith, J.D. 1986; Zawiskie, Chapman, and Alley 1982). The Green River Formation has a well known flora including many different kinds of Eocene plants. It has a well known fauna of reptiles, mammals, birds, invertebrates and trace fossils (Grande 1984). The North Horn, Flagstaff, Colton and Green River formations are Condition 1 formations. One hundred percent of these features are in Condition 1 formations.

3.18.7.2.2 Paleontological Localities. Thirteen fossil localities were recorded in the Green River Formation along the proposed transmission line (locality numbers 42Ut462PI through 42Ut475P – see Paleontology Locality Data Sheets in Appendix H). Of these, two are classified as significant (Class 2), and 11 as important (Class 3) (see Section 3.18.6.2 for classification system).

3.18.7.3 Upper Diamond Fork Power Facility

3.18.7.3.1 Paleontological Formations. The Upper Diamond Fork power facility sits in the North Horn Formation (Paleocene). The North Horn Formation is well known for its fossil mammals (Robinson 1986; Gazin 1941). It is a Condition 1 Formation. One hundred percent of this feature is in a Condition 1 Formation.

3.18.7.3.2 Paleontological Localities. None.

3.18.7.4 Spanish Fork-Santaquin Pipeline

3.18.7.4.1 Paleontological Formations. The Spanish Fork-Santaquin Pipeline would pass through a combination of recent (Holocene) alluvium and Pleistocene Lake Bonneville sediments. As mapped by Davis (1983) the Pleistocene formations include the Bonneville and Alpine formations, and the Provo Formation with either Younger Shore Facies (having the characteristic of young Lake Bonneville shoreline deposits) or Younger Lake Bottom Facies (having the characteristic of young Lake Bonneville lake bottom deposits). Table 3-112 shows the paleontological formations along the Spanish Fork-Santaquin Pipeline route by age, condition, pipeline milepost and length. Eighty-four percent of the area is Condition 1 and 16 percent is Condition 3.

Table 3-112
Paleontological Formation Along Spanish Fork-Santaquin Pipeline Route

Geologic Unit/Formation	Age	Condition	Pipeline Milepost	Length
Alluvium	Holocene	3	0.0-0.3	0.3
Provo Formation – shore facies	Pleistocene	1	0.3-0.9	0.6
Alluvium and floodplain	Holocene	3	0.9-1.8	0.9
Provo and Alpine formations	Pleistocene	1	1.8-4.0	2.2
Alluvium	Holocene	3	4.0-4.3	0.3
Provo Formation – shore facies	Pleistocene	1	4.3-9.3	5.0
Bonneville and Alpine formations	Pleistocene	1	9.3-9.8	0.5
Alluvium	Holocene	3	9.8-10.2	0.4
Provo Formation – shore facies	Pleistocene	1	10.2-12.8	2.6
Alluvium	Holocene	3	12.8-13.0	0.2
Provo Formation – shore and lake bottom facies	Pleistocene	1	13.0-15.2	2.2
Alluvium	Holocene	3	15.2-15.9	0.7
Bonneville and Alpine formations	Pleistocene	1	15.9-17.5	1.6

3.18.7.4.2 Paleontological Localities. No new localities were found during the field survey in May and June of 2003. All but one of the seven previously known localities in the general area of the proposed pipeline included vertebrates (mostly mammoths and musk oxen). The exact locations of some of the old localities are not known, but they were found in gravel pits and construction excavations (Miller 2002). The vertebrate localities are all Class 1 localities and illustrate the potential for encountering vertebrate fossils, particularly Pleistocene mammals, during pipeline construction. See Paleontological Locality Data Sheets and maps in Appendix H.

3.18.7.5 Santaquin-Mona Reservoir Pipeline

3.18.7.5.1 Paleontological Formations. The Santaquin-Mona Reservoir Pipeline would pass through a combination of recent alluvium and Pleistocene Lake Bonneville sediments. As mapped by Davis (1983) the Pleistocene formations include the Bonneville and Alpine formations. Table 3-113 shows the paleontological formations along Santaquin-Mona Reservoir Pipeline route by age, condition, pipeline milepost and length. Ninety two percent of the area is Condition 1 and 8 percent is Condition 3.

Table 3-113
Paleontological Formations Along Santaquin-Mona Reservoir Pipeline Route

Geologic Unit/Formation	Age	Condition	Pipeline Milepost	Length
Bonneville and Alpine formations	Pleistocene	1	0.0-2.5	2.5
Alluvium	Holocene	3	2.5-3.0	0.5
Alpine Formation	Pleistocene	1	3.0-6.4	3.4

3.18.7.5.2 Paleontological Localities. No new localities were found during the survey in May and June of 2003. One previously known locality is several miles west of Santaquin. See Paleontological Locality Data Sheets and maps in Appendix H.

3.18.7.6 Mapleton-Springville Lateral Pipeline

3.18.7.6.1 Paleontological Formations. The Mapleton-Springville Lateral Pipeline would pass through a combination of recent alluvium and Pleistocene Lake Bonneville sediments. As mapped by Davis (1983) the Pleistocene formations include the Bonneville and Alpine formations. Table 3-114 shows the paleontological formations along the Mapleton-Springville Lateral Pipeline route by age, condition, pipeline milepost and length. Ninety three percent of the area is Condition 1 and 7 percent is Condition 3.

Table 3-114
Paleontological Formations Along Mapleton-Springville Lateral Pipeline Route

Geologic Unit/Formation	Age	Condition	Pipeline Milepost	Length
Alluvium	Holocene	3	0.0-0.4	0.4
Alpine Formation	Pleistocene	1	0.4-3.9	3.5
Bonneville and Alpine formations	Pleistocene	1	3.9-5.7	1.8

3.18.7.6.2 Paleontological Localities. No new localities were found during the survey in May and June of 2003. Three previously known localities are in the general area of this pipeline route. The exact locations of some of the old localities are not known, but they were found in gravel pits and construction excavations (Miller 2002). The vertebrate localities are all Class 1 localities and illustrate the potential for encountering vertebrate fossils, particularly Pleistocene mammals, during pipeline construction. See Paleontological Locality Data Sheets and maps in Appendix H.

3.18.7.7 Spanish Fork-Provo Reservoir Canal Pipeline

3.18.7.7.1 Paleontological Formations. The Spanish Fork-Provo Reservoir Canal Pipeline passes through a combination of recent alluvium and Pleistocene pre-Lake Bonneville and Lake Bonneville sediments. As mapped by Davis (1983) the pre-Lake Bonneville deposit is a fanglomerate (near the south end of Slate Canyon Drive). The other Pleistocene formations include the Bonneville and Alpine formations and the Provo Formation with either Younger Shore Facies or Younger Lake Bottom Facies. Table 3-115 shows the paleontological formations along the Spanish Fork-Provo Reservoir Canal Pipeline route by age, condition, pipeline milepost and length. Fifty six percent of the area is Condition 1 and 44 percent is Condition 3.

Table 3-115
Paleontological Formations Along Spanish Fork-Provo Reservoir Canal Pipeline Route

Geologic Unit/Formation	Age	Condition	Pipeline Milepost	Length
Alluvium	Holocene	3	0.0-1.8	1.8
Alpine Formation	Pleistocene	1	1.8-2.0	0.2
Provo Formation – shore facies	Pleistocene	1	2.0-4.8	2.8
Floodplains	Holocene	3	4.8-6.5	1.7
Provo Formation – lake bottom facies	Pleistocene	1	6.5 -6.8	0.3
Alluvium	Holocene	3	6.8-7.6	0.8
Provo Formation – lake bottom facies	Pleistocene	1	7.6-8.0	0.4
Alluvium	Holocene	3	8.0-9.2	1.2
Fanglomerate	Pleistocene	1	9.2-9.8	0.6
Alluvium	Holocene	3	9.8-10.2	0.4
Provo Formation – shore facies	Pleistocene	1	10.2-10.4	0.2
Alluvium	Holocene	3	10.4-11.0	0.6
Fanglomerate	Pleistocene	1	11.0-11.5	0.5
Provo Formation – lake bottom facies	Pleistocene	1	11.5-12.4	0.9
Alluvium	Holocene	3	12.4-12.9	0.5
Fanglomerate	Pleistocene	1	12.9-13.1	0.2
Alpine and Bonneville formations	Pleistocene	1	13.1-14.2	1.1
Alluvium	Holocene	3	14.2-14.6	0.4
Alpine and Bonneville formations	Pleistocene	1	14.6-15.5	0.9
Alluvium	Holocene	3	15.5-15.9	0.4
Alpine and Bonneville formations	Pleistocene	1	15.9-17.6	1.7
Alluvium	Holocene	3	17.6-18.9	1.3
Provo, Alpine and Bonneville formations	Pleistocene	1	18.9-20.5	1.6

3.18.7.7.2 Paleontological Localities. No new localities were found during the field survey in May and June of 2003. Six or seven previously known localities are in the general area of the proposed pipeline. The exact locations of some of the old localities are not known, but they were found in gravel pits and construction excavations (Miller 2002). This illustrates the potential for encountering vertebrate fossils, particularly

Pleistocene mammals, during pipeline construction. See Paleontological Locality Data Sheets and maps in Appendix H.

3.18.8 Environmental Consequences (Impacts)

3.18.8.1 Significance Criteria

Impacts on paleontological resources are considered significant if project implementation results in adverse effects on areas or geologic units classified Condition 1 or Condition 2 or in paleontologically sensitive localities rated Class 1 (critical), Class 2 (significant), or Class 3 important as defined in Section 3.18.6.2 of this chapter. The SOPs listed in Chapter 1, Section 1.8.8, establish a procedure for protecting paleontological resources encountered during construction.

3.18.8.2 Potential Impacts Eliminated From Further Analysis

None.

3.18.8.3 Spanish Fork Canyon-Provo Reservoir Canal Alternative (Proposed Action)

3.18.8.3.1 Sixth Water Power Facility and Transmission Line

3.18.8.3.1.1 Paleontological Formations. The small area affected by the Sixth Water Power facility limits impacts on the North Horn Formation. Potential for encountering critical, significant or important (Class 1, 2 or 3) fossils at this facility should be low. Impacts on paleontological formations would not exceed the significance criteria.

The transmission line affects a much larger area (15.5 miles), but the nature of construction (power poles and towers are spaced some distance apart) limits the actual impact area. Condition 1 formations make up 98 percent of the surface along the transmission line – primarily the Green River Formation. Two percent of the route is Holocene alluvium in valley bottoms. The nature of construction of transmission lines (power poles and towers spaced some distance apart) limits the actual impact area.

There is a moderate potential for encountering critical, significant or important (Class 1, 2 or 3) paleontological resources when excavating for power poles and towers in the Green River Formation. This could have a positive impact by providing additional invertebrate and plant fossil material for collection and study. Impacts on paleontological formations would not exceed the significance criteria.

3.18.8.3.1.2 Paleontological Localities. Paleontological resources could be impacted if power poles and towers are placed at or near (within 50 feet) any known localities. The impact could be positive by providing additional material for collection and study.

3.18.8.3.2 Upper Diamond Fork Power Facility

3.18.8.3.2.1 Paleontological Formations. The small area affected by the Upper Diamond Fork power facility would limit impacts on the North Horn Formation. The formation is a conglomerate, but potential for encountering critical, significant or important (Class 1, 2 or 3) fossils should be low. Impacts on paleontological formations would not exceed the significance criteria.

3.18.8.3.2.2 Paleontological Localities. None.

3.18.8.3.3 Spanish Fork-Santaquin Pipeline

3.18.8.3.3.1 Paleontological Formations. Condition 1 formations make up approximately 84 percent of this pipeline route. Although there is moderate potential for encountering Pleistocene fossils at almost any construction excavation location in these formations, the impact would be very significant if Pleistocene vertebrate fossils are encountered. The remaining 16 percent of the pipeline is in sections of Holocene alluvium (Condition 3).

3.18.8.3.3.2 Paleontological Localities. No known fossil localities would be impacted.

3.18.8.3.4 Santaquin-Mona Reservoir Pipeline

3.18.8.3.4.1 Paleontological Formations. Condition 1 formations make up approximately 92 percent of this pipeline route. Although there is moderate potential for encountering Pleistocene fossils at almost any construction excavation location in these formations, the impact would be very significant if Pleistocene vertebrate fossils are encountered. The remaining 8 percent of the pipeline is in sections of Holocene alluvium (Condition 3).

3.18.8.3.4.2 Paleontological Localities. No known fossil localities would be impacted.

3.18.8.3.5 Mapleton-Springville Lateral Pipeline

3.18.8.3.5.1 Paleontological Formations. Condition 1 formations make up approximately 93 percent of this pipeline route. Although there is moderate potential for encountering Pleistocene fossils at almost any construction excavation location in these formations, the impact would be very significant if Pleistocene vertebrate fossils are encountered. The remaining 7 percent of the pipeline is in sections of Holocene alluvium (Condition 3).

3.18.8.3.5.2 Paleontological Localities. No known fossil localities would be impacted.

3.18.8.3.6 Spanish Fork-Provo Reservoir Canal Pipeline

3.18.8.3.6.1 Paleontological Formations. Condition 1 formations make up approximately 56 percent of this pipeline route. Although there is moderate potential for encountering Pleistocene fossils at almost any construction excavation location in these formations, the impact would be very significant if Pleistocene vertebrate fossils are encountered. The remaining 44 percent of the pipeline is in sections of Holocene alluvium (Condition 3).

3.18.8.3.6.2 Paleontological Localities. No known fossil localities would be impacted.

3.18.8.3.7 Summary of Proposed Action Impacts

3.18.8.3.7.1 Paleontological Formations. A number of Condition 1 formations would be affected by alternative features, including small sections of the North Horn (Paleocene), Flagstaff (Eocene) and Colton (Eocene) Formations, and a large section of the Green River Formation (Eocene) on the Sixth Water transmission line. Pipeline features in the Wasatch Front Valleys would affect Condition 1 Pleistocene formations from Lake Bonneville, including the Provo, Alpine and Bonneville formations and other associated deposits. 33.8 miles of pipeline features would be constructed on Condition 1 formations and 12.8 miles would be constructed on Condition 3 formations. Construction of the Sixth Water Transmission Line would be unlikely to affect paleontological resources.

3.18.8.3.7.2 Paleontological Localities. Impacts on fossil localities along the Sixth Water transmission line would depend on placement of power poles and towers. Impacts would generally be low because of spacing between poles and towers along the line. However, localities could be impacted if they are within 50 feet of a transmission line. Some impacts could be positive by providing additional plant and invertebrate specimens for collection and study.

3.18.8.4 Bonneville Unit Water Alternative

Construction impacts of the following features are the same as described for the Spanish Fork Canyon-Provo Reservoir Canal Alternative and are not repeated here.

- Sixth Water Power Facility and Transmission Line – Section 3.18.8.3.1
- Upper Diamond Fork Power Facility – Section 3.18.8.3.2
- Spanish Fork-Santaquin Pipeline – Section 3.18.8.3.3
- Mapleton-Springville Lateral Pipeline – Section 3.18.8.3.5

3.18.8.4.1 Summary of Bonneville Unit Water Alternative Impacts

3.18.8.4.1.1 Paleontological Formations. A number of Condition 1 formations would be affected by alternative features, including small sections of the North Horn (Paleocene), Flagstaff (Eocene) and Colton (Eocene) formations, and a large section of the Green River Formation (Eocene) on the Sixth Water transmission line. Pipeline features in the Wasatch Front Valleys would affect Condition 1 Pleistocene formations from Lake Bonneville, including the Provo, Alpine and Bonneville formations, and other associated deposits. 20.0 miles of pipeline would be constructed on Condition 1 formations and 3.2 miles would be constructed on Condition 3 formations. The Sixth Water Transmission Line would be unlikely to affect paleontological resources.

3.18.8.4.1.2 Paleontological Localities. Impacts on fossil localities along the Sixth Water Transmission Line would depend on placement of power poles and towers. Impacts generally would be low because of spacing between poles and towers. Known localities could be impacted if they are within 50 feet of features. Some impacts could be positive by providing additional plant and invertebrate specimens for collection and study.

Only one possible known fossil locality would be impacted in the Wasatch Front Valleys. This is along the Mapleton-Springville Lateral Pipeline. This locality has yet to be confirmed as Pleistocene or Holocene.

3.18.8.5 No Action Alternative

No paleontological impacts would be associated with construction of ULS project features. Factors not associated with the ULS project, such as population growth, would continue to impact paleontological resources.

3.19 Transportation Networks and Utilities

3.19.1 Introduction

This analysis addresses potential changes to transportation networks and utilities from construction, operation and maintenance of the Utah Lake System. Impact topics include the following:

- Average Annual Daily Traffic (AADT)
- Utility service disruptions

3.19.2 Issues Raised in Scoping Meetings

The following transportation and utility issues were raised during the public and agency scoping process.

- What would be the impacts of providing M&I water to North Utah and Salt Lake Counties on the existing transportation infrastructure?
- What would be the impacts on socioeconomic and transportation infrastructure from more development in Salt Lake County?
- What would be the impacts on existing utilities of constructing and operating the pipeline from the pump station on the west side of Utah Lake to the JVWCD water treatment plant?
- What would be the impacts of constructing the pipeline along Highway 6 and within communities in Utah County?
- What would be the impacts on transportation networks from pipeline construction?
- What would be the impacts of constructing a pipeline along Daniels Creek on riparian habitat, water quality and transportation networks?
- What would be the impacts of the ULS water delivery concepts on roads and urban sprawl?

3.19.3 Scoping Issues Eliminated From Further Analysis

The following issues were eliminated from further analysis:

What would be the impacts on socioeconomic and transportation infrastructure from more development in Salt Lake County?

What would be the impacts of the ULS water delivery concepts on roads and urban sprawl?

The project water supply and delivery alternatives, per se. would not be the direct cause of population or economic growth, such as would be the case for a new industry locating within a community or a new agricultural project siting within the region. The project alternatives represent infrastructure development, specifically water supply, to service the future growth that occurs within the region, induced by more direct economic forces and actions. The growth projected for this area as shown in the Economic Report to the Governor 2002, prepared by the Governor's Office of Planning and Budget would occur "with or without" the ULS water supply project alternatives (see Socioeconomics, Section 3.12.7.1).

What would be the impacts on existing utilities from constructing and operating the pipeline from the pump station on the west side of Utah Lake to the JVWCD water treatment plant?

The Spanish Fork-Bluffdale Alternative, the only alternative that would have included a pipeline across Utah Lake, has been dropped from further analysis (see Chapter 1, Section 1.11.1.

What would be the impacts of constructing a pipeline along Daniels Creek on riparian habitat, water quality and transportation networks?

Concept 1, which included a pipeline from Strawberry Reservoir to Deer Creek Reservoir, was eliminated from detailed analysis. Please see Chapter 1, Section 1.11.8.

3.19.4 Scoping Issues Addressed in the Impact Analysis

All issues in Section 3.19.2 are addressed in the impact analysis except those listed in Section 3.19.3.

3.19.5 Description of Impact Area of Influence

The overall impact area of influence for the ULS project is shown on Map 3-2. The transportation and utilities impact area of influence includes all roads and utilities directly affected by construction, construction traffic, and operations and maintenance within the overall impact area of influence.

3.19.6 Methodology

The impact analysis considered the standard operating procedures (SOPs) and project design features that the District will implement as part of the project.

3.19.6.1 Assumptions

- 2001 is the base year for AADT counts (the most current data available). 2001 AADT counts were the most current data available. Since AADT counts would be expected to increase over time, using 2001 data rather than data from a later year provides a conservative estimate of the percentage increase in traffic.

- Construction workers would come from Utah, Juab and Salt Lake counties, taking I-15 (from the south or north) to specific construction segments. These three counties contain the majority of the population base near the project that construction workers would come from. If out-of-area contractors are working on the project, workers would likely stay in one of these three counties while they were working on the project.

- Under the worst-case scenario, all workers would come from the same area. This assumption provides for calculating the worst-case percentage increase in traffic, which gives the most conservative estimate of what could happen.

- Maximum and minimum AADT counts were used for stretches of roadway where more than one count applies. For some roads, there was multiple AADT counts available relating to different stretches of the road. Where this was the case, the maximum and minimum numbers were given in order to indicate the full range of AADT counts for that entire road.

- Under the worst-case percentage increase, the lowest AADT count was used to calculate the percentage increase in AADT calculation. This assumption provides for calculating the worst-case percentage increase in traffic, which gives the most conservative estimate of what could happen.

3.19.6.2 Impact Analysis Methodology

3.19.6.2.1 Description. AADT counts for 2001 (UDOT 2003) were obtained from the Utah Department of Transportation (UDOT). Peak construction trips were calculated by adding construction and construction worker trips for features of each alternative where construction would occur simultaneously.

Construction schedules for each alternative (see Chapter 1, Section 1.8.1, and Tables 1-24, and 1-25) were used to determine when features would be constructed. The schedules include time for engineering, bidding and other non-construction-related activities. Construction durations for each feature represent estimated time of actual construction.

Percentage increase in AADT was calculated as follows:

> Percentage increase in AADT = peak construction trips divided by base year AADT x 100
>
> For example:
> If peak construction trips = 414
> and base year AADT = 3,555,
> then percentage increase in AADT = 11.6% (414 divided by 3,555 x 100)

3.19.7 Affected Environment (Baseline Conditions)

3.19.7.1 Average Annual Daily Traffic

The affected environment for transportation networks includes roads that would be used during construction, operation and maintenance of the-Proposed Action and other alternatives. Table 3-116 shows expected construction corridors and access routes to construction areas for each ULS feature. Table 3-117 shows the 2001 AADT for affected roadways for each ULS feature.

Table 3-116
Expected Roads in Which Construction Would Occur and Access Routes to Construction Areas for ULS Features
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Feature	Roads In Which Construction Would Occur	Access Routes to Construction Areas
Sixth Water Power Facility and Transmission Line	None	Sixth Water Flow Control Structure Access Road, Sheep Creek-Rays Valley Road, Highway 6, I-15
Upper Diamond Fork Power Facility	None	Diamond Fork Road, Highway 6, I-15
Spanish Fork Canyon Pipeline	Highway 6	I-15, Highway 6

Table 3-116
Expected Roads in Which Construction Would Occur and Access Routes to Construction Areas for ULS Features

Feature	Roads In Which Construction Would Occur	Access Routes to Construction Areas
Spanish Fork-Santaquin Pipeline	Spanish Fork: River Bottoms Road, Powerhouse Road, 8800 South, 800 East, 9600 South, 9650 South, 400 East, 9800 South, Salem Canal Road, 700 South, East Main Street Payson: 1400 South, Highway 6/State Route 198, 12800 South	Highway 6, I-15, Highway 178 (Payson)
Santaquin-Mona Reservoir Pipeline	County Road	Frontage/county road, I-15
Mapleton-Springville Lateral Pipeline	Mapleton: Mapleton Lateral Maintenance Road	Existing dirt roads, Maple Road, Maple Street, 1200 North, 1600 North, Highway 89, Highway 6, I-15
Spanish Fork-Provo Reservoir Canal Pipeline	Mapleton: Highway 89, 400 East, 1400 North Springville: Slate Canyon Drive, Provo: Seven Peaks Boulevard, Oak Cliff Drive, 1450 East, Foothill Drive, 4525 North, Heritage Drive, 800 North/State Route 52, 300 South, Oakmont Lane, Iroquois Drive, Piute Drive, 5600 North	Highway 6, I-15, Highway 75, 800 North (Orem)

Table 3-117
2001 AADTs for Affected Roadways for Each ULS Feature

Transportation Corridor	2001 AADT (maximum/minimum for stretch of road if more than one AADT is available)
Sixth Water Power Facility and Transmission Line	
I-15	112,716/25,935
Highway 6	18,185/9,405
Upper Diamond Fork Power Facility	
I-15	112,716/25,935
Highway 6	18,185/9,405
Spanish Fork Canyon Pipeline	
I-15	112,716/25,935
Highway 6	18,185/9,405

Table 3-117
2001 AADTs for Affected Roadways for Each ULS Feature

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Transportation Corridor	2001 AADT (maximum/minimum for stretch of road if more than one AADT is available)
Spanish Fork-Santaquin Pipeline	
Highway 6/ State Route 198 (Payson)	8,440
I-15	112,716/25,935
Highway 6	18,185/9,405
Highway 178 (Payson)	7,955
Santaquin-Mona Reservoir Pipeline	
I-15	112,716/25,935
Mapleton-Springville Lateral Pipeline	
I-15	112,716/25,935
Highway 6	18,185/9,405
Highway 89	6,690
Spanish Fork-Provo Reservoir Canal and Pipeline	
Highway 89 (Mapleton)	9,285/6,690
400 East (Springville)	5,545/4,800
Highway 89 (Springville)	19,975/18,810
Foothill Drive (Provo)	2,160
800 North(Orem)	32,900/14,085
I-15	112,716/25,935
Highway 6 (Spanish Fork Canyon)	18,185/9,405
Highway 75	11,550

3.19.7.2 Utility Service Disruptions

Table 3-118 lists types of existing utilities known to be located in the proposed construction corridors for each pipeline feature. A detailed inventory has not been conducted. No utilities are known to exist in the proposed pump station or power plant locations.

Table 3-118
Types of Affected Utilities for Each ULS Pipeline Feature

Spanish Fork Canyon Pipeline
Water, power, telephone, fiber optic
Spanish Fork-Santaquin Pipeline
Overhead and underground electric, overhead and underground telephone, water, sanitary sewer, natural gas line, storm drain, irrigation line, propane line, irrigation canal
Santaquin-Mona Reservoir Pipeline
No known existing utilities
Mapleton-Springville Lateral Pipeline
Overhead and underground electric, water, sanitary sewer, overhead telephone, natural gas line
Spanish Fork-Provo Reservoir Canal Pipeline
Overhead and underground electric, overhead and underground telephone, water, natural gas line, sanitary sewer, storm drain

3.19.8 Environmental Consequences (Impacts)

3.19.8.1 Significance Criteria

Impacts on transportation networks and utilities are considered significant if construction, maintenance and operation of the Proposed Action and other alternatives would result in one or more of the following conditions:

- A change in AADT of 10 percent or more for affected roadways
- Vehicular travel delays of more than 20 minutes
- Rerouting of emergency response vehicles
- Rerouting of normal traffic patterns
- Accelerated roadway deterioration and increased maintenance costs
- Disruption in utility service of more than 2 hours

These criteria were identified based on discussions with UDOT traffic engineers, review of common traffic practices, discussions with utility engineers, and best professional judgment.

AADT was chosen as a significance criterion over peak hour traffic counts because AADT counts are widely available in the impact area of influence and peak hour counts are limited. AADT counts more-realistically represent traffic patterns since construction worker trips are likely to occur during peak hours and throughout the day.

3.19.8.2 Potential Impacts Eliminated From Further Analysis

- Railroad traffic would not be impacted because all pipeline crossings would be bored and jacked underneath the rails. In all other locations the pipeline would be located outside the railroad right-of-way.

- Transportation networks and utilities would not be impacted during operation and maintenance because these activities would cause almost no traffic or utility disruptions.

- The public bus system would not be impacted because transportation providers would be notified at least 30 days before construction to accommodate alternate routes (see Chapter 1, Section 1.8.8.12).

- Roads would not be permanently impacted by heavy equipment and other construction-related traffic because any road damaged by construction activities would be restored equal to or better than its preconstruction condition (see Chapter 1, Section 1.8.8.12).

- Snow removal SOPs would be followed (see Chapter 1, Section 1.8.8.12).

- Emergency response vehicles would not have to be rerouted because they would have access along construction corridors, as necessary (see Chapter 1, Section 1.8.8.12).

- It is not likely that utility services would be disrupted. All utilities would be identified, located and protected or relocated as required prior to pipeline construction (See Chapter 1, Section 1.8.8.12). There is a small possibility that a utility line could be broken during construction. If this occurred for any feature, utility service could be disrupted for an unknown amount of time.

- UDOT does not allow travel delays of more than 20 minutes. The traffic control plans for all construction areas would be designed to keep travel delays less than 20 minutes. There is a low probability that travel delays could exceed 20 minutes due to unforeseen circumstances.

3.19.8.3 Spanish Fork Canyon-Provo Reservoir Canal Alternative (Proposed Action)

Table 3-119 shows construction duration and maximum number of construction-related trips per day for features of the Spanish Fork Canyon-Provo Reservoir Canal Alternative.

Table 3-119
Construction Duration and Maximum Number of Construction-Related Trips Per Day for Spanish Fork Canyon-Provo Reservoir Canal Alternative (Proposed Action)

Feature	Construction Duration (days)	Maximum Number of One-Way Construction-Related Trips Per Day
Sixth Water Power Facility and Transmission Line	312 (power facility) 154 (transmission line)	46 (power facility) 30 (transmission line)
Upper Diamond Fork Power Facility	312 (power facility)	46 (power facility)
Spanish Fork Canyon Pipeline	404	124
Spanish Fork-Santaquin Pipeline	369	124
Santaquin-Mona Reservoir Pipeline	164	124
Mapleton-Springville Lateral Pipeline	120	124
Spanish Fork-Provo Reservoir Canal Pipeline	1,039	240

3.19.8.3.1 Sixth Water Power Facility and Transmission Line. Traffic counts are not available for the smaller access routes, but 76 construction-related trips per day would likely increase AADTs on the Sheep Creek-Rays Valley Road and the Sixth Water Flow Control Structure Access Road by more than 10 percent, which would be considered a significant impact.

No traffic delays or rerouting of normal traffic patterns are expected during construction of the Sixth Water Power Facility and Transmission Line.

3.19.8.3.2 Upper Diamond Fork Power Facility. Traffic counts are not available for the smaller access routes, but 46 construction-related trips per day would not likely increase AADTs on Diamond Fork Road by more than 10 percent. Impacts on transportation facilities from increased AADTs would not exceed the significance criteria.

3.19.8.3.3 Spanish Fork Canyon Pipeline. Construction-related trips per day would not increase AADTs on I-15 or Highway 6 by more than 10 percent. Impacts on these transportation facilities from increased AADTs would not exceed the significance criteria.

A minimum of one lane of traffic would remain open for use, requiring pilot cars to direct traffic through the construction area. This would likely result in traffic delays of less than 20 minutes. Impacts on normal traffic patterns would not exceed the significance criteria because one lane would remain open.

3.19.8.3.4 Spanish Fork-Santaquin Pipeline. Traffic counts are not available for the rural and residential streets in this area, but 124 construction trips per day associated with this feature would likely increase AADTs more than 10 percent, which would be considered a significant impact.

A minimum of one lane of traffic would remain open for use, requiring pilot cars to direct traffic through the construction area. This would likely result in traffic delays of less than 20 minutes during peak travel times Impacts on normal traffic patterns would not exceed the significance criteria because one lane would remain open.

3.19.8.3.5 Santaquin-Mona Reservoir Pipeline. Traffic counts are not available for the county roads in this area, but 124 construction trips per day on these roads near the pipeline alignment would likely increase AADTs more than 10 percent, which would be considered a significant impact.

No traffic delays, or rerouting of normal traffic patterns, are expected on roads around the Santaquin-Mona Reservoir Pipeline.

3.19.8.3.6 Mapleton-Springville Lateral Pipeline. Traffic counts are not available for roads in this area, but 124 construction trips per day on the Mapleton Lateral maintenance road and access roads to the pipeline alignment would likely increase AADTs more than 10 percent, which would be considered a significant impact.

No traffic delays, or rerouting of normal traffic patterns, are expected on roads around the Mapleton-Springville Lateral Pipeline.

3.19.8.3.7 Spanish Fork-Provo Reservoir Canal Pipeline. Traffic counts are not available for minor roads in the area, but 240 construction trips per day on the urban residential streets would likely increase AADTs more than 10 percent, which would be considered a significant impact. Construction trips would increase AADT on Provo's Foothill Drive by 11.1 percent, which would be considered a significant impact.

At least one lane of traffic would remain open to the public, requiring pilot cars to direct traffic through the construction area. This would likely result in delays of less than 20 minutes during peak travel times. In addition, construction on urban and residential streets could cause delays of less than 20 minutes for people attempting to access their homes or businesses.

Normal traffic patterns may be rerouted, most likely on a city block basis. This would be a significant impact.

3.19.8.3.8 Summary of Proposed Action Impacts. Maximum, worst-case increases in traffic impacts for the alternative would occur with the minimum AADT and maximum number of construction trips. Table 3-120 shows the percentage increase in AADT for access routes for the Spanish Fork Canyon-Provo Reservoir Canal Alternative.

Table 3-120
Traffic Increases for Roadways During Construction of
Spanish Fork Canyon-Provo Reservoir Canal Alternative (Proposed Action) Features

Transportation Corridor	2001 AADT (Minimum for stretch of road)	Peak Construction Trips (one-way)	Maximum Expected Peak Construction Duration (years)	Contributing Features	Percent Increase in AADT
I-15	25,935	316	1.5	Sixth Water Power Facility and Transmission Line, Spanish Fork-Provo Reservoir Canal Pipeline	1.2%
Highway 6	9,405	316	1.5	Sixth Water Power Facility and Transmission Line, Spanish Fork-Provo Reservoir Canal Pipeline	3.4%
Highway 6/ State Route 198 (Payson)	8440	124	1.0	Spanish Fork-Santaquin Pipeline	1.5%
Highway 178 (Payson)	7,955	124	1.0	Spanish Fork-Santaquin Pipeline	1.6%
Highway 89	6,690	240	3.0	Spanish Fork-Provo Reservoir Canal Pipeline	3.6%
400 East	4,800	240	3.0	Spanish Fork-Provo Reservoir Canal Pipeline	5.0%
Foothill Drive (Provo)	2,160	240	3.0	Spanish Fork-Provo Reservoir Canal Pipeline	11.1%
800 North (Orem)	14,085	240	3.0	Spanish Fork-Provo Reservoir Canal Pipeline	1.7%
Highway 75	11,550	240	3.0	Spanish Fork-Provo Reservoir Canal Pipeline	2.1%

The AADT on Provo's Foothill Drive would increase 10 percent or more, but only for a portion of the 30-month construction period for the Spanish Fork-Provo Reservoir Canal Pipeline. This would be considered a significant impact.

Traffic counts are not available for rural, county, and residential streets but AADTs would likely increase more than 10 percent from construction-related trips on these roads associated with the Sixth Water Power Facility and Transmission Line, Spanish Fork-Santaquin Pipeline, Santaquin-Mona Reservoir Pipeline, Mapleton-Springville Lateral Pipeline, and Spanish Fork-Provo Reservoir Canal Pipeline. This would be considered a significant impact.

Normal traffic patterns would likely be rerouted during construction of the Spanish Fork-Provo Reservoir Canal Pipeline. This would be considered a significant impact.

3.19.8.4 Bonneville Unit Water Alternative

All of the individual features of this alternative would be the same as for the Spanish Fork-Provo Reservoir Canal Alternative and the individual feature impacts would be the same (see following sections):

- Sixth Water Power Facility and Transmission Line – 3.19.8.3.1
- Upper Diamond Fork Power Facility –3.19.8.3.2
- Spanish Fork Canyon Pipeline – 3.19.8.3.3
- Spanish Fork-Santaquin Pipeline – 3.19.8.3.4
- Mapleton-Springville Lateral Pipeline – 3.19.8.3.6

3.19.8.4.1 Summary of Bonneville Unit Water Alternative Impacts. Maximum, worst-case increases in traffic impacts would occur with the minimum AADT and maximum number of construction trips. Table 3-121 shows the percentage increase in AADT for access routes for the Bonneville Unit Water Alternative. As indicated in this table, there would not be more than a 10-percent increase in AADT on any major roads associated with this alternative.

Table 3-121
Traffic Increases for Roadways During Construction of Bonneville Unit Water Alternative

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Transportation Corridor	2001 AADT (Minimum for stretch of road)	Peak Construction Trips (one-way)	Maximum Expected Peak Construction Duration (years)	Contributing Features	Percent Increase in AADT
I-15	25,935	170	1.0	Mapleton-Springville Upper Diamond Fork Power Facility Spanish Fork Canyon Pipeline	0.7%
Highway 6	9,405	170	1.0	Upper Diamond Fork Power Facility, Spanish Fork Canyon Pipeline	1.8%

Table 3-121
Traffic Increases for Roadways During Construction of Bonneville Unit Water Alternative

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Transportation Corridor	2001 AADT (Minimum for stretch of road)	Peak Construction Trips (one-way)	Maximum Expected Peak Construction Duration (years)	Contributing Features	Percent Increase in AADT
Highway 6/State Route 198 (Payson)	8,440	124	1.0	Spanish Fork-Santaquin Pipeline	1.5%
Highway 178 (Payson)	7,955	124	1.0	Spanish Fork-Santaquin Pipeline	1.6%
Highway 89	6,690	124	0.5	Mapleton-Springville Lateral	1.9%

Traffic counts are not available for all roadways, but AADTs would likely increase more than 10 percent on the rural roads and residential streets associated with the Sixth Water Power Facility and Transmission Line, Spanish Fork-Santaquin Pipeline, Santaquin-Mona Reservoir Pipeline, and Mapleton-Springville Lateral Pipeline. This would be considered a significant impact.

3.19.8.5 No Action Alternative

No transportation or utility impacts would be associated with construction of ULS project features. Factors not associated with the ULS project, such as population growth, would continue to impact these resources.

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3.20 Air Quality

3.20.1 Introduction

This analysis addresses potential impacts on air quality from construction and operation of the Proposed Action and other alternatives.

3.20.2 Issues Raised in Scoping Meeting

- What would be the impacts on urban development from delivering ULS water to Juab County?
- What would be the impacts on air quality in the Wasatch Front if ULS water were used for agriculture rather than M&I purposes?

3.20.3 Scoping Issues Eliminated From Further Analysis

Both issues listed in Section 3.20.2 were eliminated from further analysis because the ULS project water supply would not directly cause population or economic growth like a new industry in a community or a new agricultural project in the region. The project alternatives represent infrastructure development, specifically water supply, to service the future growth that would occur within the region, induced by more direct economic forces and actions. The growth projected for this area would occur "with or without" the ULS water supply project alternatives as described in the Economic Report to the Governor 2002 (State of Utah, Governor's Office of Planning and Budget 2003a) (see Chapter 3, Section 3.12.7.1 Socioeconomics).

3.20.4 Scoping Issues Addressed in the Impact Analysis

This section addresses a variety of air quality issues as required by the Council on Environmental Quality.

3.20.5 Description of Impact Area of Influence

The overall impact area of influence for the ULS project is shown on Map 3-2. The air quality impact area of influence would be the area around construction corridors that could be impacted by equipment emissions or fugitive dust from construction activities.

3.20.6 Methodology

The impact analysis considered the standard operating procedures (SOPs) and project design features that the District will implement as part of the project.

3.20.6.1 Assumptions

- Emissions from ULS pipeline construction activities could be represented by emissions calculated from a typical construction site. The typical construction site analysis approach was chosen based on the preliminary level of detail and accuracy available at the time the analysis was performed.

- The construction phase that resulted in the worst-case emissions was assumed as the standard, and calculations were based on this worst-case estimate. This assumption provides for calculating the worst-case emissions, which gives the most conservative estimate of what could happen.

- All equipment exhaust particulate emissions for the project would occur as PM_{10} (particulate matter less than 10 microns in diameter). This assumption provides for calculating the worst-case emissions, which gives the most conservative estimate of what could happen.

- A representative emission level for each class of construction equipment was used. It is not known at this time exactly what type of equipment the contractor at the construction site would use. Therefore, a representative emission level that would be conservative for an entire class of construction equipment was used.

- Each piece of construction equipment would operate eight hours per day. This assumption was based on engineering experience at previous construction sites of the typical hours of operation for a piece of equipment each day. It is also a conservative estimate of what is expected to occur.

- Each pickup truck on the construction site would travel 100 miles per day. This assumption was based on engineering experience at previous construction sites of the typical travel miles for pickup trucks.

- All construction equipment associated with each phase of construction would operate at the same time and would operate within the disturbance area. This assumption provides for calculating the worst-case emissions, which gives the most conservative estimate of what could happen.

- Background pollutant concentrations were assumed to be the highest measured concentration that occurred in 2001, 2000 or 1999 (see Table 3-122). In many cases, the measured background concentrations occurred in urban areas many miles from the actual construction sites. Background pollutant concentrations may increase or decrease by the first year of project construction. This was the latest available data. Using the highest concentration from the available data calculates worst-case emissions, which gives the most conservative estimate of what could happen.

- Fugitive dust emissions for the typical ULS construction sites could be represented by a dust emission estimate from EPA's AP-42 document (EPA 1995a) that was based on field measurements made during construction of apartments and shopping centers that measured total suspended particulates (TSP), typically accepted as particulate matter less than 30 microns in diameter. This dust emission estimate was the best available data.

- The dust emission rate was calculated based on dust emissions occurring eight hours per day. This assumption was based on engineering experience at previous construction sites of the typical total work hours during a day. It is also a conservative estimate of what is expected to occur.

- The SCREEN3 model (EPA 1995b) could represent worst-case pollutant concentrations after dispersion from the construction site. The SCREEN3 model is a preferred and recommended screening tool (see Section 3.20.6.2.2). The screening model approach was chosen because of the preliminary level of detail and accuracy of the available input data and the typical construction site approach chosen for the analysis.

- Stability class A (extremely unstable air conditions, representative of a hot summer day) was used in the SCREEN3 model, based on Pasquill stability categories (Webmet 2003). Stability class A results in the most pollutant dispersion, and therefore lowest pollutant concentrations, of any of the stability classes. A large portion of the construction is expected to take place during summer months, therefore stability class A was taken as representative of typical conditions.

- Equipment and fugitive dust emissions can be represented as an area source. Construction emissions, which include stack and dust emissions, will typically occur from an approximately rectangular area, represented in the SCREEN3 model as an area source.

- Topography around the typical construction site can be represented by simple terrain. Simple terrain was assumed as representative since a typical construction site analysis was used, and a typical construction site could occur in varying types of field conditions.

- For area sources, the SCREEN3 model estimates maximum short-term (1-hour) pollutant concentrations. Concentrations close to an area source are not expected to vary as much as point-sources in response to varying wind directions and weather conditions that result in maximum 1-hour concentrations can last for several hours. This assumption provides for calculating the worst-case emissions, which gives the most conservative estimate of what could happen.

- Source release height is entered in the model as 9.8 feet for gaseous emissions (based on stack heights of typical construction equipment), and 3.3 feet for PM_{10} emissions, which can include both equipment exhaust and dust emissions (based on stack heights in combination with ground level emissions). This is an assumption that was made in the model inputs. The gaseous emissions number is typical of stack heights for various pieces of construction equipment. The PM10 emissions number is based on stack heights and ground level emissions.

- Receptor height above the ground is assumed to be zero in all cases. Standard for calculating ground level concentrations.

3.20.6.2 Impact Analysis Methodology

3.20.6.2.1 Description. The impact analysis addresses only the temporary effects of construction activities from two primary sources:

- Exhaust from heavy equipment
- Dust produced during construction

A typical pipeline construction site was simulated in the SCREEN3 model to represent ULS pipeline construction. In addition, specific pump station, power facility, and transmission line construction sites were simulated. The construction sites were analyzed for total emission levels, which were entered into the model to determine ambient air impacts compared to National Ambient Air Quality Standards (NAAQS).

Table 1-35, Section 1.8.7 in Chapter 1, lists emissions levels for equipment that would be used at a typical ULS construction site. The data is from the U.S. Environmental Protection Agency and the Federal Highway Administration.

The main construction phases for a typical pipeline, power facility and transmission line construction site were identified. The types of equipment required for each construction phase were identified, and representative pollutant emissions levels for each type of equipment obtained. For each phase of construction, the total daily emissions for each pollutant were calculated. An example of this calculation for NO_2 from dump trucks is as follows:

Example daily emission calculation for a Cat 740 dump truck:
Horsepower = 440 hp
Daily Usage = 8 hours/day
NO_2 emissions = 9.6 grams/hp-hour

NO_2 (pounds/day) = 440 hp x 8 hours/day x 9.6 grams/hp-hour x 0.0022 pounds/gram = 74.3 pounds/day

The equipment daily emissions for each pollutant were added together for each construction phase. The phase that resulted in the highest emissions was used as the worst-case, most conservative equipment emissions estimate, and assumed to apply for the duration of construction.

The PM_{10} equipment and dust emissions estimates were added together for the construction sites. These numbers were then run in the SCREEN3 model to calculate pollutant concentrations after dispersion from the construction site. This concentration was added to the background pollutant concentration to calculate the total peak pollutant concentration for comparison with NAAQS.

The urban versus rural analysis available in the SCREEN3 model accounts for the interference of buildings in wind patterns. Air flow over and around buildings and other solid structures may restrict dispersion of a pollutant source. The modeling analysis presented here assumes urban conditions within city limits and rural conditions outside of city limits.

The 1-hour, 3-hour, 8-hour and 24-hour NAAQSs are based on the average concentration over that particular averaging time. These standards are not to be exceeded more than once per year. The annual standard is the annual arithmetic mean pollutant concentration (Cooper and Alley 1994). Violations of the NAAQS are only measured in the ambient air, with EPA defining ambient air as "that portion of the atmosphere, external to buildings, to which the general public has access. Exemption from ambient air is available only for the atmosphere over land owned or controlled by the source and/or to which public access is precluded by a fence or other physical barriers." (UDEQ 2000a). In this analysis, ambient air is interpreted to mean all areas outside of the construction site boundaries.

SCREEN3 modeling output is available upon request from the Central Utah Water Conservancy District.

3.20.6.2.2 Verification and Calibration. The SCREEN3 model is listed by the EPA's Support Center for Regulatory Air Models as a preferred and recommended screening tool. It is recommended in the Utah Division of Air Quality Modeling Guidelines as an approved screening technique (UDEQ 2000a). It is a screening version of the ISC3 (Industrial Source Complex) Model, which is a preferred and recommended air quality model. SCREEN3 is a single-source Gaussian plume model that provides maximum ground-level concentrations for point, area, flare and volume sources, as well as concentrations in the cavity zone, and concentrations from inversion break-up and shoreline fumigation. Section 4.2.1. of the EPA's Appendix W to Part 51 – Guideline on Air Quality Models (EPA 2001) recognizes screening techniques as an acceptable approach to air quality analyses. The screening model approach was chosen because of the preliminary level of detail and accuracy of the available input data and the typical construction site approach chosen for the analysis. The screening model provides a conservative, worst-case estimate of pollutant concentrations compared to the refined model.

While the SCREEN3 model has been verified and calibrated, the accuracy of the emissions estimates calculated in this analysis are unknown since most of the input parameters must be assumed. These parameters include the emissions levels from equipment that would actually be used at the site, the actual source release height, and the actual size of the construction area. Conservative estimates were used in this analysis for each input parameter, and the model is designed to compute a conservative pollutant concentration. Therefore, the calculated emission levels are expected to represent maximum, worst-case emission levels from construction for the assumed meteorological conditions.

3.20.7 Affected Environment (Baseline Conditions)

3.20.7.1 Ambient Air Quality

Cumulative ambient air impacts from the ULS project, existing background emission sources and natural background activities must comply with NAAQS standards to protect the public from air pollutant exposure that may be injurious to health and detrimental to the public's welfare. These standards apply to the criteria pollutants designated as nitrogen dioxide (NO_2), sulfur dioxide (SO_2), ozone (O_3), carbon monoxide (CO), particulate matter (PM_{10}), and lead (Pb). Lead is only monitored at one site in Utah, near an industrial source that emits lead. Data for lead is not included in this analysis. The federal NAAQS for criteria pollutants have been adopted by the State of Utah, with the exception of the 1-hour ozone standard, which is not used by Utah.

Table 3-122 lists the highest measured pollutants in the impact area of influence for 2001, 2000 and 1999, along with NAAQS standards. All data are from the North Provo station in Utah County, except for the sulfur dioxide measurements. Since SO_2 is not measured at North Provo, the SO_2 concentrations from Salt Lake City are included in Table 3-122.

Table 3-122
Highest Measured Pollutants in the Impact Area of Influence Compared to National Ambient Air Quality Standards

Station	Pollutant	Averaging Time	Highest Measured Concentrations (parts per million) 2001	2000	1999	Highest Measured Background Concentration (ug/m^3)[a]	National Ambient Air Quality Standard
North Provo (Utah County)	CO	8-hour	4.4 (4.3)[b]	3.6 (3.4)	4.9 (4.2)	5,610	9 ppm (10,000 ug/m^3)
		1-hour	6.3 (6.3)	6.2 (5.7)	8.1 (7.5)	9,275	35 ppm (40,000 ug/m^3)
North Provo (Utah County)	NO_2	Annual	0.024	0.024	0.024	45	0.053 ppm (100 ug/m^3)
North Provo (Utah County)	O_3	8-hour	0.076 (0.070)	Not Available	Not Available	Not Used	0.08 ppm
		1-hour	0.095 (0.086)	0.115 (0.099)	0.105 (0.096)	Not Used	0.12 ppm
North Provo (Utah County)	PM_{10}	Annual	29	26	27	29	50 ug/m^3
		24-hour	95 (93)	70 (66)	68 (64)	95	150 ug/m^3
North Salt Lake (Salt Lake County)	SO_2	Annual	0.004	0.004	0.004	11	0.03 ppm (80 ug/m^3)
		24-hour	0.013 (0.013)	0.014 (0.013)	0.012 (0.010)	37	0.14 ppm (365 ug/m^3)
		3-hour	0.041 (0.036)	0.042 (0.038)	0.033 (0.030)	110	0.50 ppm (1300 ug/m^3)

Sources: UDEQ 2001a, 2000b, 1999b; EPA 2003b
[a] ug/m^3 = micrograms per cubic meter.
[b] Values in parentheses indicate second highest concentration measured during the year.

If a particular area cannot demonstrate compliance with one or more National Ambient Air Quality Standards, it is designated as a non-attainment area for those pollutants. The only non-attainment areas in the ULS air quality impact area of influence are in Utah County for PM_{10} and the Provo-Orem area for carbon monoxide (UDEQ 1999). Utah County's PM_{10} attainment status is currently under review, and may be changed in the future (Reiss 2003). The Utah Division of Air Quality requires a dust control plan for construction projects in PM_{10} non-attainment areas. The Provo-Orem area is expected to change to attainment status for carbon monoxide by the end of 2005 (Miller 2004).

3.20.7.2 Climate

Climate represents the long-term average weather patterns of a given area. Weather affects air quality through its impact on the dispersion of pollutants emitted into the atmosphere – for example, wind blowing dust into the air. Table 3-123 summarizes climatic parameters for the impact area of influence (temperature, precipitation and wind speed), that are considered important in air quality modeling.

Table 3-123
Climatic Parameters for Impact Area of Influence

Month	Temperature		Precipitation		Wind
	Average Maximum (Degrees F)	Average Minimum (Degrees F)	Average Total Precipitation (inches)	Average Total Snowfall (inches)	Mean Wind Speed (mph)
January	39.8	21.6	2.11	15.8	4.8
February	46.0	24.8	2.03	12.3	5.7
March	56.8	32.8	2.11	6.3	7.2
April	65.1	38.8	1.86	3.3	7.9
May	74.8	46.2	2.25	0.4	7.2
June	85.7	53.4	1.29	0.0	7.6
July	93.1	59.8	0.95	0.0	6.7
August	92.0	59.1	1.25	0.0	6.7
September	81.6	50.2	1.67	0.0	6.3
October	67.7	39.0	2.07	1.0	5.8
November	51.6	30.2	1.84	8.2	5.4
December	40.5	22.9	1.68	13.2	5.2
Average	66.2	39.9	21.12	60.4	6.4

Source: WRCC 2001, except wind speed (WRCC 2003)

3.20.8 Environmental Consequences (Impacts)

As it is not possible to determine the exact number of hours of operation for each piece of equipment, or which ones would be operated at the same time, the estimate of impacts is a conservative estimate (that is, a worst case estimate) for the modeled meteorological conditions. In addition it was not possible to determine the number of days during the construction period that an estimated 24 hour, 8-hour, 3-hour, or 1-hour exceedance could occur. They would not occur every day during the entire construction period. The annual emissions estimate assumes the worst case possible conditions, which was all equipment for the highest emissions phase of construction running eight hours a day for five days a week for the entire construction period.

3.20.8.1 Significance Criteria

Impacts on air quality are considered significant if construction of the Proposed Action and other alternatives would result in a short- or long-term violation of primary or secondary national ambient air quality standards for the criteria pollutants outside of the construction site boundaries. The NAAQS are shown in Table 3-124.

Table 3-124
National Ambient Air Quality Standards

Pollutant	Averaging Time	Primary National Ambient Air Quality Standard	Secondary National Ambient Air Quality Standard
CO	8-hour	10,000 ug/m^{3} [(a)]	None
	1-hour	40,000 ug/m^{3}	None
NO_2	Annual	100 ug/m^{3}	100 ug/m^{3}
O_3	8-hour	157 ug/m^{3}	157 ug/m^{3}
	1-hour[b]	235 ug/m^{3}	235 ug/m^{3}
PM_{10}	Annual	50 ug/m^{3}	50 ug/m^{3}
	24-hour	150 ug/m^{3}	150 ug/m^{3}
SO_2	Annual	80 ug/m^{3}	None
	24-hour	365 ug/m^{3}	None
	3-hour	None	1300 ug/m^{3}

Source: EPA 2003b, UDEQ 2000a
[a] ug/m^{3} = micrograms per cubic meter.
[b] 1-hour ozone standard is a national standard only and is not used by the State of Utah

3.20.8.2 Potential Impacts Eliminated From Further Analysis

Air quality impacts from operation of the project were eliminated because project features would generate no significant air quality pollutants.

Annual impact estimates for criteria pollutants from construction of pipeline and transmission line features were eliminated because the location of emissions – and their impacts – would constantly change.

Impacts from ozone were eliminated because, unlike the other criteria pollutants, ozone is formed from precursor compounds (volatile organic compounds and nitrogen oxides) that are emitted from a source. A photochemical reaction occurs in the hours after the precursor compounds are emitted that creates ozone, which can form several hours downwind. Since the impact area of influence is an attainment area for ozone, no ozone modeling was performed.

3.20.8.3 Spanish Fork Canyon-Provo Reservoir Canal Alternative (Proposed Action)

3.20.8.3.1 Sixth Water Power Facility. Table 3-125 lists estimated daily equipment emissions for each construction phase of the Sixth Water power facility. The highest total emission levels occur during construction of the structure for CO and during clearing, grubbing and earthwork for NO_2, PM_{10}, and SO_2.

Table 3-125
Estimated Daily Equipment Exhaust and Dust Emissions for Each Construction Phase of Sixth Water Power Facility

Construction Phase And Equipment Used in Each Phase	Quantity	Daily Usage	Hydrocarbons (from Exhaust) (lbs/day)	CO (lbs/day)	NO_2 (lbs/day)	PM_{10} (lbs/day)	SO_2 (lbs/day)
Clearing and Grubbing/Earthwork							
Pickup Truck	4	100 miles	0.28	3.00	0.35	0.07	0.00
Dozer (Cat D8)	1	8 hours	7.56	25.78	61.76	6.66	5.10
Loader (Cat 928)	1	8 hours	2.22	12.70	27.25	3.41	2.28
Dump Truck (Cat 725)	2	8 hours	8.89	21.16	101.59	8.47	9.42
Grader (Cat 12-H)	1	8 hours	4.35	10.72	27.09	2.82	2.46
Total			**23.30**	**73.36**	**218.04**	**21.43**	**19.26**
Piping							
Pickup Truck	4	100 miles	0.28	3.00	0.35	0.07	0.00
Backhoe (Cat 235)	1	8 hours	4.94	23.99	35.63	3.70	3.00
Dump Truck (Cat 725)	2	8 hours	8.89	21.16	101.59	8.47	9.42
Pipelayer/Crane (Cat 572R)	1	8 hours	5.56	18.52	45.41	6.35	4.10
Total			**19.67**	**66.67**	**182.98**	**18.59**	**16.52**
Structure							
Pickup Truck	4	100 miles	0.28	3.00	0.35	0.07	0.00
Concrete Pump	1	8 hours	2.96	8.02	37.20	2.65	2.46
Backhoe (Cat 235)	1	8 hours	4.94	23.99	35.63	3.70	3.00
Crane (Grove TMS 700E)	1	8 hours	8.89	29.63	72.66	10.16	6.56
Compactor (Cat 815F)	1	8 hours	3.39	13.12	39.37	3.81	3.85
Welder (300 amp)	1	8 hours	0.63	2.65	4.23	0.53	0.49
Total			**21.09**	**80.41**	**189.44**	**20.92**	**16.36**
Cleaning and Restoring							
Pickup Truck	4	100 miles	0.28	3.00	0.35	0.07	0.00
Backhoe (Cat 235)	1	8 hours	4.94	23.99	35.63	3.70	3.00
Dump Truck (Cat 725)	1	8 hours	4.44	10.58	50.79	4.23	4.71
Grader (Cat 12-H)	1	8 hours	4.35	10.72	27.09	2.82	2.46
Roller (Hyster C350C)	1	8 hours	1.13	4.37	13.12	1.10	1.41
Paver (Blaw-Knox PF-3200)	1	8 hours	3.30	15.01	35.92	2.94	3.03
Total			**18.44**	**67.67**	**162.90**	**14.86**	**14.61**

Note: Data calculated from Table 1-35 in Chapter 1 and from daily usage assumptions.

Construction dust PM_{10} emissions would occur from construction activities such as travel over unpaved surfaces, clearing, grading, loading of debris into trucks, dumping debris onto storage piles, bulldozing, compacting, and wind erosion of temporary storage piles and cleared areas. EPA's AP-42 document (EPA 1995a) provides a dust emission estimate based on field measurements made during construction of shopping centers and apartments of 1.2 tons per acre per month, based on 30 days of construction per month. This is a total suspended particulate (TSP) concentration, which is generally accepted to be particles 30-microns in diameter and less.

Much of the fugitive dust would be on the larger end of the 30-micrometer range, and would tend to settle out of the air quickly. Experiments on construction dust have concluded that at 164 feet downwind of the source, a maximum 30 percent of the remaining suspended particulates were in the PM_{10} range (Grelinger 1988). Based on this factor, only 30 percent of the total suspended particulates were assumed to be emitted as PM_{10}. The standard operating procedures (see Chapter 1, Section 1.10.8.13) call for dust control measures to be implemented at ULS construction sites. It was assumed that construction dust would be reduced 50 percent by watering at all construction sites (EPA1995a). Other dust control measures, such as chemical stabilization, could be used in addition to watering.

The Sixth Water Power Facility construction site would be 150 feet by 200 feet, or 0.7 acres. This equates to:

Dust emissions = 1.2 tons per acre per month of activity x 0.7 acres x 1 month divided by 30 days x 2,000 pounds per ton

Dust emissions = 56 pounds per day

With reductions for 30 percent PM_{10} and watering 50 percent:
Dust emissions = 56 pounds per day x 0.3 x 0.5 = 8.4 pounds per day

Table 3-126 summarizes daily equipment exhaust and dust emissions estimates for the Sixth Water Power Facility construction site.

Table 3-126
Estimated Daily Equipment Exhaust and Dust Emissions for Sixth Water Power Facility Construction Site

Emission Source Category	Emissions (pounds/day)			
	CO	NO_2	PM_{10}	SO_2
Equipment Exhaust	80.41	218.04	21.43	19.26
Construction Dust	0.0	0.0	8.4	0.0
Total	**80.41**	**218.04**	**29.83**	**19.26**

Table 3-127 summarizes modeling results for equipment and dust emissions at the Sixth Water Power Facility construction site. The Sixth Water Power Facility would be located in a rural area, and construction would last 12 months.

The annual and 24-hour averages are determined from the 1-hour maximum concentration by averaging for the time when work would occur. For example, the maximum 1-hour concentration for PM_{10} would be 739.4. The following equations show how these averages were calculated:

24-hour average:
8 hours of emissions generation per day, divided by 24 hours per day x 739.4 = 246

Annual average:
12 months construction duration (see note below) x 52 weeks per year x 40 hours of emissions per week x 739.4, divided by 12 months per year x 52 weeks per year x 168 hours per week = 176

Note: If the construction duration is less than 12 months, use that number. For construction durations longer than 12 months, use 12 months to compute the annual average.

Total peak concentration is the sum of the modeled peak impact and the maximum measured background concentration.

Table 3-127
Modeling Results for Equipment Exhaust and Dust Emissions at Sixth Water Power Facility Construction Site

Pollutant	Averaging Time	Modeled Peak Impact Past Construction Site Boundary (ug/m^3)*	Maximum Measured Background Concentration (ug/m^3)	Total Peak Concentration (ug/m^3)	NAAQS (ug/m^3)
CO	8-hour	1,027	5,610	6,637	10,000
	1-hour	1,027	9,275	10,302	40,000
NO_2	Annual	669	45	714	100
SO_2	Annual	65	11	76	80
	24-hour	91	37	128	365
	3-hour	274	110	384	1,300
PM_{10}	Annual	176	29	205	50
	24-hour	246	95	341	150

*ug/m^3 = micrograms per cubic meter.

The annual standard for NO_2, and the annual and 24-hour standards for PM_{10} could be exceeded during construction of the Sixth Water power facility, which would be considered a significant impact. Pollutant concentrations would decrease rapidly with distance from the construction site, so any exceedances are expected to be highly localized. All assumptions used to determine the total peak concentrations are worst-case estimates for the modeled meteorological conditions, therefore the calculated peak concentrations are worst-case estimates for the modeled meteorological conditions. Any actual exceedances would likely be temporary.

3.20.8.3.2 Sixth Water Transmission Line. Table 3-128 lists estimated daily equipment emissions for each construction phase of the Sixth Water overhead transmission line. The highest total emission levels would occur during construction of the transmission line alignment and clearing.

The helicopters that would be used to transport transmission towers are not included in the air quality modeling, as they would not be in the emissions source area for a significant period of time.

Table 3-128
Estimated Daily Equipment Exhaust and Dust Emissions for Each Construction Phase of Sixth Water Transmission Line

Construction Phase and Equipment Used in Each Phase	Quantity	Daily Usage	Hydrocarbons (from Exhaust) (lbs/day)	CO (lbs/day)	NO_2 (lbs/day)	PM_{10} (lbs/day)	SO_2 (lbs/day)
New Access Road and Clearing							
Pickup Truck	4	100	0.28	3.00	0.35	0.07	0.00
Dozer (Cat D5N)	2	8	5.33	18.20	43.60	4.70	3.60
Loader (Cat 966G)	2	8	7.70	44.02	94.46	11.83	7.89
Dump Truck (Cat 740)	4	8	26.07	62.08	297.99	24.83	27.63
Total			**39.38**	**127.30**	**436.40**	**41.43**	**39.12**
Foundation and Erection of Poles							
Pickup Truck	4	100	0.28	3.00	0.35	0.07	0.00
Backhoe (Cat 235)	2	8	9.88	47.97	71.25	7.41	6.00
Digger Truck[a]	2	8	8.89	21.16	101.59	8.47	9.42
Dump Truck (Cat 740)	1	8	6.52	15.52	74.50	6.21	6.91
Crane (Grove TMS 700E)	1	8	8.89	29.63	72.66	10.16	6.56
Total			**34.46**	**117.28**	**320.35**	**32.32**	**28.89**
Stringing Conductors							
Pickup Truck	2	100	0.14	1.50	0.18	0.04	0.00
Dump Truck (Cat 740)	2	8	13.04	31.04	148.99	12.42	13.81
Bucket Truck[b]	2	8	11.11	37.04	90.83	12.70	8.20
Cable Puller (bull-wheel)	2	8	7.46	48.68	58.25	7.62	4.92
Total			**31.75**	**118.26**	**298.25**	**32.78**	**26.93**
Cleaning and Revegetation							
Backhoe (Cat 235)	1	8	4.94	23.99	35.63	3.70	3.00
Dump Truck (Cat 740)	2	8	13.04	31.04	148.99	12.42	13.81
Dozer (Cat D5N)	1	8	2.67	9.10	21.80	2.35	1.80
Total			**20.65**	**64.13**	**206.42**	**18.47**	**18.61**

Notes:
[a]Assume same emissions as Cat 725
[b]Assume same emissions as Grove RT 875C

It is assumed that no dust would occur from construction of any of the ULS transmission lines. Clearing operations would leave a short layer of vegetation intact on top of the soil, preventing particulate matter from entering the air. Only very small areas around the transmission towers would be completely cleared of vegetation. The emissions source area for transmission lines is assumed to be 40 by 400 feet.

No annual emissions calculations were made for the transmission line construction. Since construction would constantly move along the alignment, any air quality impacts would be brief at any one location.

Table 3-129 summarizes equipment and dust emissions during construction of the Sixth Water transmission line.

Table 3-129
Estimated Daily Equipment and Dust Emissions During Construction of Sixth Water Transmission Line

Emission Source Category	Emissions (pounds/day)			
	CO	NO_2	PM_{10}	SO_2
Equipment Exhaust	127.3	436.4	41.43	39.12
Construction Dust	0.0	0.0	0.0	0.0
Total	**127.3**	**436.4**	**41.43**	**39.12**

Table 3-130 summarizes emissions modeling results for construction of the Sixth Water transmission line. The Sixth Water Transmission Line would be located in a rural area, and construction would last five months.

Table 3-130
Modeling Results for Equipment and Dust Emissions From Construction of Sixth Water Transmission Line

Pollutant	Averaging Time	Modeled Peak Impact Past Construction Site Boundary (ug/m^3)*	Maximum Measured Background Concentration (ug/m^3)	Total Peak Concentration (ug/m^3)	NAAQS (ug/m^3)
CO	8-hour	1,951	5,610	7,561	10,000
	1-hour	1,951	9,275	11,226	40,000
NO_2	Annual	Not Modeled	45	Not Modeled	100
SO_2	Annual	Not Modeled	11	Not Modeled	80
	24-hour	202	37	239	365
	3-hour	607	110	717	1,300
PM_{10}	Annual	Not Modeled	29	Not Modeled	50
	24-hour	217	95	312	150

****ug/m*^{3} *= micrograms per cubic meter.***

The 24-hour standard for PM_{10} could be exceeded during construction of the Sixth Water transmission line, which would be considered a significant impact. Pollutant concentrations would decrease rapidly with distance from the construction site, so any exceedances are expected to be highly localized. All assumptions used to determine the total peak concentrations are worst-case estimates for the modeled meteorological conditions, therefore the calculated peak concentrations are worst-case estimates for the modeled meteorological conditions. Any actual exceedances would likely be temporary.

3.20.8.3.3 Upper Diamond Fork Power Facility. Table 3-125 lists emissions for each construction phase associated with the typical power facility site. The highest total emission levels occur during construction of the structure for CO and during clearing and grubbing/earthwork for NO_2, PM_{10}, and SO_2.

The Upper Diamond Fork power facility construction site would be 90 feet by 150 feet, or 0.3 acres. This equates to:

Dust emissions = 1.2 tons per acre per month of activity x 0.3 acres x 1 month divided by 30 days x 2,000 pounds (ton)

Dust emissions = 24 pounds per day

With reductions for 30-percent PM_{10} and watering 50 percent,
Dust emissions = (24 pounds per day) x (.3) x (.5) = 3.6 pounds per day

Table 3-131 lists estimated daily equipment and construction dust emissions during construction of the Upper Diamond Fork power facility.

Table 3-131
Estimated Daily Equipment Exhaust and Dust Emissions for the Upper Diamond Fork Power Facility Construction Site

Emission Source Category	**Emissions (pounds/day)**			
	CO	**NO_2**	**PM_{10}**	**SO_2**
Equipment Exhaust	80.41	218.04	21.43	19.26
Construction Dust	0.0	0.0	3.6	0.0
Total	**80.41**	**218.04**	**25.03**	**19.26**

Table 3-132 summarizes modeling results for equipment and dust emissions for the Upper Diamond Fork power facility construction site. The Upper Diamond Fork Power Facility would be located in a rural area, and construction would last 12 months.

Table 3-132 Modeling Results for Gaseous Equipment and Dust Emissions for the Upper Diamond Fork Power Facility Construction Site					
Pollutant	**Averaging Time**	**Modeled Peak Impact Past Construction Site Boundary (ug/m^3)***	**Maximum Measured Background Concentration (ug/m^3)**	**Total Peak Concentration (ug/m^3)**	**NAAQS (ug/m^3)**
CO	8-hour	1,683	5,610	7,293	10,000
	1-hour	1,683	9,275	10,958	40,000
NO_2	Annual	1,084	45	1,129	100
SO_2	Annual	94	11	105	80
	24-hour	132	37	169	365
	3-hour	396	110	506	1,300
PM_{10}	Annual	267	29	296	50
	24-hour	374	95	469	150
*ug/m^3 = micrograms per cubic meter					

The annual standards for NO_2 and SO_2, and the annual and 24-hour standards for PM_{10} could be exceeded during construction of the Upper Diamond Fork power facility, which would be considered a significant impact. Pollutant concentrations would decrease rapidly with distance from the construction site, so any exceedances are expected to be highly localized. All assumptions used to determine the total peak concentrations are worst-case estimates for the modeled meteorological conditions, therefore the calculated peak concentrations are worst-case estimates for the modeled meteorological conditions. Any actual exceedances would likely be temporary.

3.20.8.3.4 Spanish Fork Canyon Pipeline. Table 3-133 lists estimated daily emissions for each construction phase of a typical pipeline. The highest total emissions levels would occur during trench excavation.

Table 3-133 Estimated Daily Equipment Exhaust and Dust Emissions for Each Construction Phase of Typical Pipeline Page 1 of 2							
Construction Phase and Equipment Used in Each Phase	**Quantity**	**Daily Usage**	**Hydrocarbons (from Exhaust) (lbs/day)**	**CO (lbs/day)**	**NO_2 (lbs/day)**	**PM_{10} (lbs/day)**	**SO_2 (lbs/day)**
Clearing and Grubbing							
Pickup Truck	4	100 miles	0.28	3.00	0.35	0.07	0.00
Dozer (Cat D5N)	1	8 hours	2.67	9.10	21.80	2.35	1.80
Loader (Cat 966G)	1	8 hours	3.85	22.01	47.23	5.92	3.94
Dump Truck (Cat 740)	1	8 hours	6.52	15.52	74.50	6.21	6.91
Total			**13.32**	**49.63**	**143.88**	**14.55**	**12.65**

Table 3-133
Estimated Daily Equipment Exhaust and Dust Emissions for Each Construction Phase of Typical Pipeline

Construction Phase and Equipment Used in Each Phase	Quantity	Daily Usage	Hydrocarbons (from Exhaust) (lbs/day)	CO (lbs/day)	NO_2 (lbs/day)	PM_{10} (lbs/day)	SO_2 (lbs/day)
Trench Excavation							
Pickup Truck	4	100 miles	0.28	3.00	0.35	0.07	0.00
Backhoe (Cat 235)	1	8 hours	4.94	23.99	35.63	3.70	3.00
Dump Truck (Cat 740)	2	8 hours	13.04	31.04	148.99	12.42	13.81
Dewatering Pump	2	8 hours	1.69	7.05	8.47	1.41	1.28
Loader (Cat 966G)	1	8 hours	3.85	22.01	47.23	5.92	3.94
Dozer (Cat D5N)	1	8 hours	2.67	9.10	21.80	2.35	1.80
Crane (Grove RT 875C)	1	8 hours	5.56	18.52	45.41	6.35	4.10
Total			**32.03**	**114.71**	**307.88**	**32.22**	**27.93**
Placing Pipe in Trenches and Connecting							
Pickup Truck	4	100 miles	0.28	3.00	0.35	0.07	0.00
Pipelayer/Crane (Cat 572R)	1	8 hours	5.56	18.52	45.41	6.35	4.10
Truck (Cat 740)	1	8 hours	6.52	15.52	74.50	6.21	6.91
Welder (300 amp)	1	8 hours	0.63	2.65	4.23	0.53	0.49
Forklift (Cat IT12F)	1	8 hours	2.33	14.11	11.29	2.26	1.31
Total			**15.32**	**53.80**	**135.78**	**15.42**	**12.81**
Backfilling Trenches and Grading							
Pickup Truck	4	100 miles	0.28	3.00	0.35	0.07	0.00
Backhoe (Cat 235)	1	8 hours	4.94	23.99	35.63	3.70	3.00
Compactor (Cat 815F)	1	8 hours	3.39	13.12	39.37	3.81	3.85
Dump Truck (Cat 740)	2	8 hours	13.04	31.04	148.99	12.42	13.81
Loader (Cat 966G)	1	8 hours	3.85	22.01	47.23	5.92	3.94
Grader (Cat 12-H)	1	8 hours	4.35	10.72	27.09	2.82	2.46
Total			**29.85**	**103.88**	**298.66**	**28.74**	**27.06**
Cleaning and Restoring							
Pickup Truck	4	100 miles	0.28	3.00	0.35	0.07	0.00
Backhoe (Cat 235)	1	8 hours	4.94	23.99	35.63	3.70	3.00
Dump Truck (Cat 740)	1	8 hours	6.52	15.52	74.50	6.21	6.91
Roller (Cat PS-150B)	1	8 hours	0.99	3.83	11.48	0.96	1.23
Dozer (Cat D5N)	1	8 hours	2.67	9.10	21.80	2.35	1.80
Grader (Cat 12-H)	1	8 hours	4.35	10.72	27.09	2.82	2.46
Roller (Hyster C350C)	1	8 hours	1.13	4.37	13.12	1.10	1.41
Paver (Blaw-Knox PF-3200)	1	8 hours	3.30	15.01	35.92	2.94	3.03
Total			**24.18**	**85.54**	**219.89**	**20.15**	**19.84**

The typical pipeline construction site would be 50 feet by 500 feet, or 0.57 acres. This equates to:

Dust emissions = 1.2 tons per acre per month of activity x 0.57 acres x 1 month divided by 30 days x 2,000 pounds (ton)

Dust emissions = 45.6 pounds per day

With reductions for 30-percent PM_{10} and watering 50 percent:
Dust emissions = 45.6 pounds per day x 0.3 x 0.5 = 6.84 pounds per day

No annual emissions calculations were made for pipeline construction. Construction would be constantly moving along the alignment; therefore any air quality impacts would be brief at any one location.

Table 3-134 lists estimated daily equipment and dust emissions during construction of the Typical Pipeline.

Table 3-134
Estimated Daily Equipment Exhaust and Dust Emissions From Construction of Typical Pipeline

Emission Source Category	Emissions (pounds/day)			
	CO	NO_2	PM_{10}	SO_2
Equipment Exhaust	114.71	307.88	32.22	27.93
Construction Dust	0.0	0.0	6.84	0.0
Total	**114.71**	**307.88**	**39.06**	**27.93**

Table 3-135 summarizes modeling results for the typical rural pipeline construction site.

Table 3-135
Modeling Results for Gaseous Equipment and Dust Emissions for Typical Rural Pipeline Construction Site

Pollutant	Averaging Time	Modeled Peak Impact Past Construction Site Boundary (ug/m³)*	Maximum Measured Background Concentration (ug/m³)	Total Peak Concentration (ug/m³)	NAAQS (ug/m³)
CO	8-hour	1,352	5,610	6,962	10,000
	1-hour	1,352	9,275	10,627	40,000
NO_2	Annual	Not Modeled	45	Not Modeled	100
SO_2	Annual	Not Modeled	11	Not Modeled	80
	24-hour	104	37	141	365
	3-hour	312	110	422	1300
PM_{10}	Annual	Not Modeled	29	Not Modeled	50
	24-hour	308	95	403	150

*ug/m³ = micrograms per cubic meter

The Spanish Fork Canyon Pipeline is located in a rural area. The 24-hour standard for PM_{10} could be exceeded during construction, which would be considered a significant impact. Construction duration for the Spanish Fork Canyon Pipeline would be 14 months. Pollutant concentrations would decrease rapidly with distance from the construction site, so any exceedances are expected to be highly localized. All assumptions used to determine the total peak concentrations are worst-case estimates for the modeled meteorological conditions, therefore the calculated peak concentrations are worst-case estimates for the modeled meteorological conditions. Any actual exceedances would likely be temporary.

3.20.8.3.5 Spanish Fork-Santaquin Pipeline. Impacts for rural sections of the Spanish Fork-Santaquin Pipeline would be the same as in Section 3.20.8.3.4. Table 3-136 shows modeling results for the typical urban pipeline construction site.

Table 3-136
Modeling Results for Gaseous Equipment and Dust Emissions for Typical Urban Pipeline Construction Site

Pollutant	Averaging Time	Modeled Peak Impact Past Construction Site Boundary (ug/m^3)*	Maximum Measured Background Concentration (ug/m^3)	Total Peak Concentration (ug/m^3)	NAAQS (ug/m^3)
CO	8-hour	1,099	5,610	6,709	10,000
	1-hour	1,099	9,275	10,374	40,000
NO_2	Annual	Not Modeled	45	Not Modeled	100
SO_2	Annual	Not Modeled	11	Not Modeled	80
	24-hour	85	37	122	365
	3-hour	254	110	364	1,300
PM_{10}	Annual	Not Modeled	29	Not Modeled	50
	24-hour	230	95	325	150

*ug/m^3 = micrograms per cubic meter

The Spanish Fork-Santaquin Pipeline has both rural and urban sections. For both sections, the 24-hour standard for PM_{10} could be exceeded during construction, which would be considered a significant impact. Construction duration for the Spanish Fork-Santaquin Pipeline would be 30 months. Pollutant concentrations would decrease rapidly with distance from the construction site, so any exceedances are expected to be highly localized. All assumptions used to determine the total peak concentrations are worst-case estimates for the modeled meteorological conditions, therefore the calculated peak concentrations are worst-case estimates for the modeled meteorological conditions. Any actual exceedances would likely be temporary.

3.20.8.3.6 Santaquin-Mona Reservoir Pipeline. Impacts would be the same as described in Section 3.20.8.3.4. The Santaquin-Mona Reservoir Pipeline would be located in a rural area, and construction would last 18 months.

3.20.8.3.7 Mapleton-Springville Lateral Pipeline. Impacts would be the same as described in Section 3.20.8.3.4. The Mapleton-Springville Lateral Pipeline would be located in a rural area, and construction would last 12 months.

3.20.8.3.8 Spanish Fork-Provo Reservoir Canal Pipeline. Impacts would be the same as described in Section 3.20.8.3.4 and 3.20.8.3.5. The Spanish Fork-Provo Reservoir Canal Pipeline would pass through both rural and urban areas, and construction would last 30 months.

3.20.8.3.9 Summary of Proposed Action Impacts. Table 3-137 lists estimated exceedances of NAAQS standards from construction of the Spanish Fork Canyon-Provo Reservoir Canal Alternative. Exceedances are expected to be temporary and localized, but would still be considered significant impacts.

Table 3-137
Estimated Exceedances of NAAQS Standards From Construction of Spanish Fork Canyon-Provo Reservoir Canal Alternative (Proposed Action)

Feature	Pollutant	Averaging Time	NAAQS (ug/m^3)	Total Peak Concentration From Construction Activities (ug/m^3)	Exceedance (ug/m^3)
Sixth Water Power Facility	PM_{10}	Annual 24-hour	50 150	205 341	155 191
	NO_2	Annual	100	714	614
Sixth Water Transmission Line	PM_{10}	24-hour	150	312	162
Upper Diamond Fork Power Facility	PM_{10}	Annual 24-hour	50 150	296 469	246 319
	NO_2	Annual	100	1129	1029
	SO_2	Annual	80	105	25
Spanish Fork Canyon Pipeline	PM_{10}	24-hour	150	403	253
Spanish Fork-Santaquin Pipeline	PM_{10}	24-hour	150	Rural - 403 Urban - 325	Rural - 253 Urban - 175
Santaquin-Mona Reservoir Pipeline	PM_{10}	24-hour	150	403	253
Mapleton-Springville Lateral Pipeline	PM_{10}	24-hour	150	403	253
Spanish Fork-Provo Reservoir Canal Pipeline	PM_{10}	24-hour	150	Rural - 403 Urban - 325	Rural - 253 Urban - 175

3.20.8.4 Bonneville Unit Water Alternative

All of the individual features of this alternative are the same as described for the Spanish Fork Canyon-Provo Reservoir Canal Alternative, and the individual feature impacts would be the same :

- Sixth Water Power Facility – Section 3.20.8.3.1
- Sixth Water Transmission Line – Section 3.20.8.3.2
- Upper Diamond Fork Power Facility – Section 3.20.8.3.3
- Spanish Fork Canyon Pipeline – Section 3.20.8.3.4
- Spanish Fork-Santaquin Pipeline – Section 3.20.8.3.5
- Mapleton-Springville Lateral Pipeline – Section 3.20.8.3.7

3.20.8.4.1 Summary of Bonneville Unit Water Alternative Impacts. Table 3-138 lists estimated exceedances of NAAQS standards from construction of the Bonneville Unit Water Alternative. Exceedances are expected to be temporary and localized, but would still be considered significant impacts.

Table 3-138
Estimated Exceedances of NAAQS Standards from Construction of Bonneville Unit Water Alternative

Feature	Pollutant	Averaging Time	NAAQS (ug/m³)	Total Peak Concentration From Construction Activities (ug/m³)	Exceedance (ug/m³)
Sixth Water Power Facility	PM_{10}	Annual 24-hour	50 150	205 341	155 191
	NO_2	Annual	100	714	614
Sixth Water Transmission Line	PM_{10}	24-hour	150	312	162
Upper Diamond Fork Power Facility	PM_{10}	Annual 24-hour	50 150	296 469	246 319
	NO_2	Annual	100	1129	1029
	SO_2	Annual	80	105	25
Spanish Fork Canyon Pipeline	PM_{10}	24-hour	150	403	253
Spanish Fork-Santaquin Pipeline	PM10	24-hour	150	Rural - 403 Urban - 325	Rural - 253 Urban - 175
Mapleton-Springville Lateral Pipeline	PM_{10}	24-hour	150	403	253

3.20.8.5 No Action Alternative

No air quality impacts would be associated with construction of ULS project features. Factors not associated with the ULS project, such as population growth, would continue to impact air quality.

3.21 Mineral and Energy Resources

3.21.1 Introduction

This analysis addresses potential impacts on mineral and energy resources from construction and operation of the Proposed Action and other alternatives. Impact topics include the following:

- Existing and planned mineral resource sites
- Consumption or production of energy products and sources

3.21.2 Issues Raised In Scoping Meetings

No mineral resources related issues were raised during the public or agency scoping process. One energy-related issue was raised:

- What impacts would occur on water quality and energy usage from delivering water from the Spanish Fork River?

3.21.3 Scoping Issues Eliminated From Further Analysis

None.

3.21.4 Scoping Issues Addressed in the Impact Analysis

The issue identified in Section 3.21.2 is addressed in the impact analysis.

3.21.5 Description of Impact Area of Influence

3.21.5.1 Mineral Resources

The mineral resources impact area of influence would include the immediate area around all pipeline construction corridors and power generation facilities. The overall impact area of influence including the construction corridors is shown on Map 3-2.

3.21.5.2 Energy Resources

The impact area of influence related to energy consumption for project construction and operations would primarily be Salt Lake, and Utah counties. It would include the State of Utah when considering refinery production and imports, and the multi-state service territory of the Western Area Power Administration (WAPA) for project operations electric power use and production.

3.21.6 Methodology

The impact analysis considered the standard operating procedures (SOPs) and project design features that the District will implement as part of the project.

3.21.6.1 Mineral Resources

3.21.6.1.1 Assumptions. Baseline conditions consist of the following:

- Known locations of mineral resource extraction facilities and viable mineral resources at the time of preparation of this document, as identified by the Utah Geological Survey mine and mineral resources online database (UGS 2003), energy and minerals resources maps (UGMS 1983a, 1983b), and field observations along the pipeline alignments of the Proposed Action and other alternatives.

- No additional mines, gravel pits, or other mineral extraction facilities would be initiated, but existing facilities may be expanded. The rationale for this assumption was that the only identified mineral resources within the mineral resources impact area of influence are gravel pits and rock quarries, and none of the existing undeveloped mineral resources in this area have been identified by the Utah Geological Survey as favorable for development. Existing mineral resource operations are currently extracting from sources favorable for development, and it is assumed that these sources will continue to be exploited until further expansion is unprofitable. It is likely that all economically viable, extractable mineral resources have been identified and developed within the pipeline alignment and associated disturbed area. Known mineral resources have been identified and compiled by UGS/UGMS as part of their survey mission. Field observations do not suggest that additional mineral resources are likely to be encountered within the pipeline alignment or immediate vicinity. Because most of the alignment falls within or immediately adjacent to existing roadways, further exploration and/or exploitation of mineral resources is unlikely to occur within the foreseeable future.

3.21.6.1.2 Impact Analysis Methodology. The mineral resources impact analysis consists of two parts: a) the temporary impacts of construction activities on mineral resources in the impact area of influence and b) mineral resources operational impacts from lost access because of pipeline obstructions or rights-of-way.

Construction impacts were assessed using the following methods:

- Determining the proximity of pipeline alignments to known mineral extraction facilities.

- Evaluating the probability of interfering with existing active extraction operations by blocking access. Access was considered blocked if construction activities would unavoidably prevent or substantially limit normal transport of extracted mineral resources.

Operation impacts were assessed using the following methods:

- Determining whether proposed pipeline alignments or rights-of-way would encroach on existing boundaries of mineral extraction facilities in a way that would inhibit or reduce extraction activities

3.21.6.2 Energy Resources

3.21.6.2.1 Assumptions. None.

3.21.6.2.2 Impact Analysis Methodology. The impacts of petroleum and energy products use for construction and operations were assessed using the following methods:

- Reviewing the engineering construction cost estimates for materials and equipment use, including rental equipment charges, and the estimated hours of operation for construction site equipment
- Accounting for construction crew travel to and from the project site
- Estimating potential fuel use from the above activities
- Reviewing state and federal data on fuel and energy products use

The impacts for power use and production were assessed using the following methods:

- Estimating power usage for primary water pumping using available engineering estimates
- Estimating power generation from the proposed units, based on generator capacity and projected monthly flows through pipelines
- Reviewing power resources and marketing conditions from WAPA

3.21.7 Affected Environment (Baseline Conditions)

3.21.7.1 Mineral Resources

3.21.7.1.1 Overview. Mineral resources in the impact area of influence include mineral extraction facilities (gravel pits, quarries, and mines) in existence when this document was prepared that are crossed by proposed pipeline alignments or accessed by roads that would be temporarily closed during pipeline construction.

3.21.7.1.2 Existing Mineral Resources. Three extraction sites may be impacted. Two of them – the Utah County Public Works facility and Evans Grading and Paving – are adjacent to each other on the east side of Highway 89 (State Street) between Provo and Springville, just south of the Provo City limits. Utah County Public Works operates a gravel and rock extraction pit in the hillside behind the facility offices and maintenance shops. Gravel and rock is sorted and crushed on site and used for road construction and maintenance. Evans Grading and Paving extracts from a hillside pit just south of the Utah County Public Works site, and crushes and processes earth materials on site.

Access to both sites would be affected during construction of the Spanish Fork-Provo Reservoir Canal/Pipeline in the Highway 89 alignment since they are accessed by turnoffs from the highway and backed up to the adjacent hillside.

The third site – the Gomex gravel pit at the mouth of Spanish Fork Canyon south of the Spanish Fork River and Highway 89 – is connected to the highway by a paved road that serves as the main access to the pit. An unpaved road that is not used regularly could provide access from the southwest side of the site.

3.21.7.2 Energy Resources

3.21.7.2.1 Overview. Utah consumes about 50 million barrels of petroleum products annually (40 million in the transportation sector, 9 million in commercial and industrial) (Utah Energy Office 2002).

WAPA sells 37.9 billion kilowatt hours (kwhr) of power annually to 680 wholesale power customers in 15 states, and markets electricity from 56 federal hydroelectric projects in the northwest and coal-fired plants in the Three Corners Area (WAPA 2003).

3.21.7.2.2 Existing Energy Resources. Utah refines state reserves and imported crude oil and imports a wide variety of secondary petroleum products to meet its energy needs. State proven crude oil reserves are estimated to be more than 250 million barrels, while imported reserves reflect world-wide reserves managed by international production companies. Petroleum product distribution centers are located throughout the state.

WAPA primarily depends on hydroelectric power generation to meet its wholesale customer needs and maintains a regional transmission grid to distribute power throughout the western states. Available power supplies depend primarily on regional water-year conditions at the major hydroelectric projects.

Strawberry Electric operates two power generators by diverting natural flow and SVP water from the Power Canal. The Upper Generator has a rated generating capacity of 3000 kilowatts (kw) and the Lower Generator has a rated generating capacity of 375 kw. The natural flow through the Upper Generator averages about 88,000 acre-feet per year, and the SVP water flowing through the Upper Generator averages about 8,300 acre-feet per year. The total flow through the Upper Generator is about 93,500 acre-feet per year under baseline conditions. This combined flow generates an estimated 6,355,835 kilowatt-hours per year.

3.21.8 Environmental Consequences (Impacts)

3.21.8.1 Significance Criteria

3.21.8.1.1 Mineral Resources. Impacts on mineral resources are considered significant if construction, maintenance and operation of the Proposed Action and other alternatives would measurably reduce mineral extraction or transport because of unavoidable restricted access, resulting in adverse economic effects on private extraction operations or requiring public entities to use alternative sources at higher material or transportation costs.

No significant impact was determined if an alternative transportation route in and out of a facility would be available during construction, or if Standard Operating Procedures could be applied to maintain access during construction.

3.21.8.1.2 Energy Resources. Impacts on energy resources are considered significant if construction, maintenance and operation of the Proposed Action and other alternatives would result in energy consumption or production of petroleum and electric power equal to or greater than 1 percent of the baseline consumption for the local, state or regional area, or if consumption would measurably affect existing supply and demand trends.

3.21.8.2 Potential Impacts Eliminated From Further Analysis

3.21.8.2.1 Mineral Resources. Mineral resources would not be impacted by construction or operation of any ULS features because none of the identified mineral sites would be directly crossed or affected, and access to the sites would be maintained to the extent possible during construction using SOPs (see Chapter 1, Section 1.9.8.11, SOPs for Transportation Networks and Utilities).

3.21.8.2.2 Energy Resources. Energy resources would not be impacted because consumption is estimated to be a small fraction of the baseline supply and demand for the impact area of influence and the heavy-construction sector. The project would not require additional petroleum or energy products for the area beyond what is already scheduled for delivery by distributors.

3.21.8.3 Spanish Fork Canyon–Provo Reservoir Canal Alternative (Proposed Action)

3.21.8.3.1 Operations Phase

3.21.8.3.1.1 Power Generation Facilities. Additional power generation (average annual water-year conditions) would be provided by the Sixth Water Power Facility (about 134,269,000 kwhr) and Upper Diamond Fork Power facility (about 30,874,000 kwhr).

The Strawberry Water Users Association Upper Generator would generate an estimated 6,279,275 kwhr under the Proposed Action. This would be a decrease of about 76,560 kwhr per year from baseline conditions (-1.2 percent). The decreased power generation would result from delivery of 1,160 acre-feet of SVP water through the Spanish Fork Canyon Pipeline and Spanish Fork-Santaquin Pipeline to Salem City and Spanish Fork City. This water currently flows through the Power Canal as part of the 8,300 acre-feet of SVP water flowing through the Upper Generator. Under the Proposed Action, only 1,160 acre-feet of the 10,200 acre-feet of SVP water that could be delivered to SUVMWA and/or its member cities would not be available for power generation. The remaining 9,040 acre-feet of SVP water has historically been delivered to either the Mapleton-Springville Lateral or the Strawberry Highline Canal and never was available for power generation.

3.21.8.3.2 Summary of Proposed Action Impacts

3.21.8.3.2.1 Energy Resources. The new Sixth Water Power and Upper Diamond Fork Power facilities would generate about 165,143,000 kwhr annually of additional power (average water-year conditions). The Strawberry Water Users Association Upper Generator would generate 76,560 kwhr less power annually. The net additional power generation would be about 165,066,440 kwhr annually.

3.21.8.4 Bonneville Unit Water Alternative

3.21.8.4.1 Operations Phase

3.21.8.4.1.1 Power Generation Facilities. Additional power generation (average annual water-year conditions) would be provided by the Sixth Water Power Facility (about 142,000,000 kwhr) and Upper Diamond Fork Power facility (about 37,000,000 kwhr).

The Strawberry Water Uses Association Upper Generator would generate the same amount as under the Proposed Action.

3.21.8.4.2 Summary of Bonneville Unit Water Alternative Impacts

3.21.8.4.2.1 Energy Resources. The new Sixth Water Power and Upper Diamond Fork Power facilities would generate about 179,000,000 kwhr annually of additional power (average water-year conditions). The Strawberry Electric Upper Generator would generate 76,560 kwhr less power annually. The net additional power generation would be about 178,923,440 kwhr annually.

3.21.8.5 No Action Alternative

None.

3.22 Land Use Plans and Conflicts

3.22.1 Introduction

This analysis addresses potential conflicts from construction of the Proposed Action and other alternatives with current land use plans or ordinances maintained by cities and communities, counties, and state or federal agencies.

3.22.2 Issues Raised in Scoping Meetings

The following issues were raised during the public and agency scoping process:

- What would be the impact of new power lines across Wasatch Mountain State Park?
- What would be the impact of the McGuire Power Facility and transmission lines on the Uinta National Forest Land and Resource Management Plan?

3.22.3 Scoping Issues Eliminated From Further Analysis

Potential impacts of new power lines across Wasatch Mountain State Park was eliminated from further analysis because none of the alternatives would involve constructing power transmission lines within the park boundary.

Potential impacts of the McGuire Power Facility and transmission lines on the Uinta National Forest Land and Resource Management Plan was eliminated because Concept 1 (latter named the Strawberry Reservoir-Deer Creek Reservoir Alternative) was eliminated from detailed analysis. Please see Chapter 1, Section 1.11.8.

3.22.4 Scoping Issues Addressed in the Impact Analysis

Although no publicly raised issues are addressed, potential conflicts with existing land use plans and ordinances are analyzed and documented in Section 3.22.8.

3.22.5 Description of Impact Area of Influence

The impact area of influence includes all land on which project facilities would be located (see Map 3-2).

3.22.6 Methodology

3.22.6.1 Assumptions

None.

3.22.6.2 Impact Analysis Methodology

Existing land use plans and ordinances covering the affected areas were reviewed to determine if any conflicts would occur from construction or operation of any of the alternatives.

3.22 7 Affected Environment (Baseline Conditions)

3.22.7.1 Overview

The impact area of influence is covered by a variety of land use plans, zoning ordinances, general plans, and municipal codes prepared by federal and local agencies.

Portions of the project are within Utah Department of Transportation (UDOT) right-of-way, but no land use plans would be involved.

3.22.7.2 Land Use Plans

Land use plans for cities, counties, and other public entities within the study area include the Provo City and Orem City General Plan, and Utah County General Plan Federal land management plans relevant to the project include the U.S. Forest Service 2003 Land and Resource Management Plan for the Uinta National Forest.

3.22.7.3 Zoning Ordinances

The principal zoning ordinances applicable within the project area include Provo City Code and Orem Municipal Code, and Utah County Zoning Ordinance The cities of Spanish Fork, Santaquin and Springville provided information on zoning and/or land use through written response to letters of inquiry.

3.22.8 Environmental Consequences (Impacts)

3.22.8.1 Significance Criteria

Impacts on any type of land use regulation, management plan or zoning ordinance would be considered significant if construction of project features would require amending the management plan or cause a conflict with a land use plan objective, management prescription or zoning ordinance.

3.22.8.2 Potential Impacts Eliminated From Further Analysis

The following were eliminated from further consideration: Potential conflicts with the U.S. Forest Service Land and Resource Management Plan from the Sixth Water Power Facility and Transmission Line, and the Upper Diamond Fork Power Facility. The land that would be affected by these facilities is already withdrawn or in the process of being withdrawn by the U.S. Department of the Interior for project purposes.

Potential conflicts from project operation were eliminated from further analysis because all plans and ordinances cover construction and placement of facilities and do not deal with operation of underground pipelines.

3.22.8.3 Spanish Fork Canyon-Provo Reservoir Canal Alternative (Proposed Action) and Bonneville Unit Water Alternative

A thorough review of existing land use plans and zoning ordinances determined that none of the proposed ULS project features would cause any conflicts.

3.22.8.4 No Action Alternative

No land use plans and conflicts would be associated with construction of ULS project features. Factors not associated with the ULS project, such as population growth, would continue to impact land use plans.

3.23 Environmental Justice

3.23.1 Introduction

On February 11, 1994, the President of the United States issued Executive Order 12898 on Environmental Justice in Minority Populations and Low Income Populations (DOI 1994). The policy required the analysis and evaluation of impacts of any proposed project, action, or decision on minority and low-income populations and communities, as well as the equity of the distribution of the benefits and risks of those decisions. This analysis examines the potential for disproportionate environmental impacts (including human health, economic, and social effects) of the ULS alternatives on minority populations and low-income communities.

3.23.2 Issues Raised in Scoping Meetings

During the ULS scoping and planning process, no issues were identified that would impact only minority populations or low-income communities.

3.23.3 Description of Impact Area of Influence

The impact area of influence for environmental justice is Utah and Salt Lake counties.

3.23.4 Affected Environment (Baseline Conditions)

Socioeconomic data analyzed for Utah County indicates that people of minority races constitute 14.6 percent of the Utah County total population. People of Hispanic origin constitute 7.0 percent of the Utah County population, and the remaining 7.6 percent of the Utah County population consists of people from other minority races including black/African American, American Indian and Alaska Native, Asian, and Native Hawaiian and other Pacific Islanders. Data indicating the number of minority representatives located specifically in southern Utah County is not available.

Low-income populations (i.e., families whose annual income is less than $9,999) represent 9.4 percent of families in Utah County.

3.23.5 Environmental Consequences (Impacts)

3.23.5.1 Spanish Fork Canyon-Provo Reservoir Canal Alternative (Proposed Action)

The Proposed Action pipelines and other features would be constructed in areas of Utah County where there are no concentrated Hispanic or other minority communities. Likewise, the Proposed Action pipelines and other features would be constructed in areas of Utah County where there are no concentrated low-income populations. The pipelines and other features would be constructed along highways, city and county streets, and railroads and through agricultural lands. Construction of the pipelines and other features would not cause disproportionate health, economic, or other social impacts on minority populations or low-income communities in Utah County. The benefits (see Chapter 3, Section 3.12) derived from the ULS construction and operation would accrue to the entire population in the socioeconomic impact area of influence. No disproportionate negative impact on Hispanic or other minority populations or low-income communities is expected.

3.23.5.2 Bonneville Unit Water Alternative

The Bonneville Unit Water Alternative pipelines and other features would be the same as most of the features of the Proposed Action. The potential impacts would be the same as described for the Proposed Action in Section 3.23.5.1.

3.23.5.3 No Action Alternative

None.

3.24 Indian Trust Assets

3.24.1 Introduction

This analysis addresses the potential impacts on Indian trust assets (ITA) or other reserved treaty rights that could result from actions associated with the construction and operation of the Proposed Action and other ULS alternatives.

The United States has a trust responsibility to protect and maintain rights reserved by or granted to Indian tribes by treaty, statutes, and executive orders. This trust responsibility requires that the DOI take actions reasonably necessary to protect ITA. The Department of the Interior Secretarial Order Number 3215, dated April 28, 2000, further states:

> The proper discharge of the Secretary's trust responsibility requires, without limitation, that the Trustee, with a high degree of care, skill, and loyalty: Protect and preserve Indian trust assets from loss, damage, unlawful alienation, waste, and depletion.

Further, the Department of Interior's ITA policy states that the DOI will carry on its activities in a manner which protects ITA and avoids adverse impacts on ITA when possible. When the DOI cannot avoid adverse impacts, it will provide appropriate mitigation or compensation (1994).

A basic description of ITA is as follows:

> ITA means lands, natural resources, money, or other assets held by the Federal Government in trust or that are restricted against alienation for Indian Tribes and individual Indians.
>
> Assets are anything owned that has monetary value. The assets need not be owned outright, but could be some other type of property interest, such as a lease or a right to use something. Assets can be real property, physical assets, or intangible property rights.
>
> A trust has three components: the trustee, the beneficiary, and the trust asset(s). The beneficiary is also sometimes referred to as the beneficial owner of the trust asset. In this trust relationship, title to ITA is held by the United States (trustee) for the benefit of a Federally recognized tribe (beneficiary).
>
> Legal interest means there is a property interest for which a legal remedy, such as compensation or injunction, may be obtained if there is improper interference.
>
> ITA do not include things in which a tribe has no legal interest. For example, off-reservation sacred sites in which a tribe has no legal property interest are generally not considered ITA.
>
> ITA cannot be sold, leased, or otherwise alienated without the United States' approval. Examples of ITA include money, claims, lands, minerals, and water rights.

In addition to ITA, there are reserved rights with agencies need to consider. Examples of treaty-based rights include access for hunting, fishing, and gathering rights, and similar rights of access and resource use on traditional tribal lands, i.e. aboriginal use areas or areas ceded by treaty. It should be remembered that some resource gathering and other use areas may be considered under the National Historic Preservation Act (NHPA) as Traditional Cultural Properties (TCP).

3.24.2 Description of Impact Area of Influence

The overall impact area of influence for the ULS project is shown on Map 3-2.

3.24.3 Methodology

The DOI has a fiduciary responsibility to establish the area of effect for any and all ITA or other reserved treaty rights for each of the five tribes with an interest in the proposed ULS area. This process is on-going at this time through consultation meetings.

Initial consultation letters were sent to five Indian tribes regarding ITA or other reserved treaty rights. The consultation letters asked for tribal concerns about primary ITA such as water and land issues. It also inquired about hunting, fishing, gathering or other traditional use areas which may be considered to be other reserved treaty rights. Government-to-government consultation in the form of meetings were held with five tribes (the Northwest Band Shoshone, the Pauite Indian Tribes of Utah, the Northern Ute Tribe, the Shoshone-Bannock Tribe, and the Skull Valley Goshute Tribe), which included a presentation of literature accompanied by ULS maps and an explanation of the Proposed Action. Specific inquiry regarding access to traditional plant gathering areas was addressed. The results of the meetings are included in Section 3.24.4.

Location information on certain ITA or other reserved treaty rights such as baseline data (i.e. the locale of important plant material) may be held to be private by the Tribes and will remain so throughout this consultation process.

3.24.4 Results of Meetings and Consultation

3.24.4.1 Northern Ute Tribe

An initial consultation letter and general ULS area map was sent to the Northern Ute Tribe at Fort Duchesne, Utah, in October 2003, inquiring about ITA or access to other reserved treaty rights concerns. There was no reply from the tribe to the initial request. Thereafter, in compliance with The Secretary's Principle for Managing Indian Trust Assets, published in the Department Manual (303 DM 2), the American Indian Trust Fund Management Reform Act (25 USC 162 a (d) and 25 USC 4001-4061, and in a manner of good faith, a government-to-government meeting was held in February 2004 with all of the members of the Northern Ute Tribal Business Committee (Committee) and attended by representatives from the DOI and District. The meeting was prearranged and held at Tribal Headquarters in Fort Duchesne, Utah.

During this consultation, the purpose, goals and timing of ULS were explained to the Committee and literature explaining the ULS including the Proposed Action and maps were provided to each Committee member. Questions from Committee representatives regarding the proposed project were addressed at the meeting.

When discussing traditional plant gathering areas, the Committee Chairwoman, Maxine Natchees, asked that a tribal elder, Helen Wash, be consulted concerning this issue. Ms. Wash was contacted and a second face-to-face meeting was held at Tribal Headquarters in Fort Duchesne, Utah. The purpose of the meeting was for Ms. Wash to examine maps of proposed areas to be disturbed during construction of the proposed Proposed Action so she could identify areas that are unique to the needs of tribal member's access to plant gathering areas used for medicinal, edible, or ceremonial purposes. None were found. Plant gathering areas which contain plants found commonly in other areas will not be of concern for the purposed ULS project.

3.24 Indian Trust Assets

3.24.1 Introduction

This analysis addresses the potential impacts on Indian trust assets (ITA) or other reserved treaty rights that could result from actions associated with the construction and operation of the Proposed Action and other ULS alternatives.

The United States has a trust responsibility to protect and maintain rights reserved by or granted to Indian tribes by treaty, statutes, and executive orders. This trust responsibility requires that the DOI take actions reasonably necessary to protect ITA. The Department of the Interior Secretarial Order Number 3215, dated April 28, 2000, further states:

> The proper discharge of the Secretary's trust responsibility requires, without limitation, that the Trustee, with a high degree of care, skill, and loyalty: Protect and preserve Indian trust assets from loss, damage, unlawful alienation, waste, and depletion.

Further, the Department of Interior's ITA policy states that the DOI will carry on its activities in a manner which protects ITA and avoids adverse impacts on ITA when possible. When the DOI cannot avoid adverse impacts, it will provide appropriate mitigation or compensation (1994).

A basic description of ITA is as follows:

> ITA means lands, natural resources, money, or other assets held by the Federal Government in trust or that are restricted against alienation for Indian Tribes and individual Indians.
>
> Assets are anything owned that has monetary value. The assets need not be owned outright, but could be some other type of property interest, such as a lease or a right to use something. Assets can be real property, physical assets, or intangible property rights.
>
> A trust has three components: the trustee, the beneficiary, and the trust asset(s). The beneficiary is also sometimes referred to as the beneficial owner of the trust asset. In this trust relationship, title to ITA is held by the United States (trustee) for the benefit of a Federally recognized tribe (beneficiary).
>
> Legal interest means there is a property interest for which a legal remedy, such as compensation or injunction, may be obtained if there is improper interference.
>
> ITA do not include things in which a tribe has no legal interest. For example, off-reservation sacred sites in which a tribe has no legal property interest are generally not considered ITA.
>
> ITA cannot be sold, leased, or otherwise alienated without the United States' approval. Examples of ITA include money, claims, lands, minerals, and water rights.

In addition to ITA, there are reserved rights with agencies need to consider. Examples of treaty-based rights include access for hunting, fishing, and gathering rights, and similar rights of access and resource use on traditional tribal lands, i.e. aboriginal use areas or areas ceded by treaty. It should be remembered that some resource gathering and other use areas may be considered under the National Historic Preservation Act (NHPA) as Traditional Cultural Properties (TCP).

3.24.2 Description of Impact Area of Influence

The overall impact area of influence for the ULS project is shown on Map 3-2.

3.24.3 Methodology

The DOI has a fiduciary responsibility to establish the area of effect for any and all ITA or other reserved treaty rights for each of the five tribes with an interest in the proposed ULS area. This process is on-going at this time through consultation meetings.

Initial consultation letters were sent to five Indian tribes regarding ITA or other reserved treaty rights. The consultation letters asked for tribal concerns about primary ITA such as water and land issues. It also inquired about hunting, fishing, gathering or other traditional use areas which may be considered to be other reserved treaty rights. Government-to-government consultation in the form of meetings were held with five tribes (the Northwest Band Shoshone, the Pauite Indian Tribes of Utah, the Northern Ute Tribe, the Shoshone-Bannock Tribe, and the Skull Valley Goshute Tribe), which included a presentation of literature accompanied by ULS maps and an explanation of the Proposed Action. Specific inquiry regarding access to traditional plant gathering areas was addressed. The results of the meetings are included in Section 3.24.4.

Location information on certain ITA or other reserved treaty rights such as baseline data (i.e. the locale of important plant material) may be held to be private by the Tribes and will remain so throughout this consultation process.

3.24.4 Results of Meetings and Consultation

3.24.4.1 Northern Ute Tribe

An initial consultation letter and general ULS area map was sent to the Northern Ute Tribe at Fort Duchesne, Utah, in October 2003, inquiring about ITA or access to other reserved treaty rights concerns. There was no reply from the tribe to the initial request. Thereafter, in compliance with The Secretary's Principle for Managing Indian Trust Assets, published in the Department Manual (303 DM 2), the American Indian Trust Fund Management Reform Act (25 USC 162 a (d) and 25 USC 4001-4061, and in a manner of good faith, a government-to-government meeting was held in February 2004 with all of the members of the Northern Ute Tribal Business Committee (Committee) and attended by representatives from the DOI and District. The meeting was prearranged and held at Tribal Headquarters in Fort Duchesne, Utah.

During this consultation, the purpose, goals and timing of ULS were explained to the Committee and literature explaining the ULS including the Proposed Action and maps were provided to each Committee member. Questions from Committee representatives regarding the proposed project were addressed at the meeting.

When discussing traditional plant gathering areas, the Committee Chairwoman, Maxine Natchees, asked that a tribal elder, Helen Wash, be consulted concerning this issue. Ms. Wash was contacted and a second face-to-face meeting was held at Tribal Headquarters in Fort Duchesne, Utah. The purpose of the meeting was for Ms. Wash to examine maps of proposed areas to be disturbed during construction of the proposed Proposed Action so she could identify areas that are unique to the needs of tribal member's access to plant gathering areas used for medicinal, edible, or ceremonial purposes. None were found. Plant gathering areas which contain plants found commonly in other areas will not be of concern for the purposed ULS project.

The only other point of concern was expressed by Mr. Roland McCook, Committee member, who wanted assurance that since the proposed ULS project was long-term and covered a large area, any future significant changes in design would trigger further consultation with the tribes (see Section 3.24.2.) regarding ITA.

An Agreement was signed among the Bureau of Indian Affairs, the Bureau of Reclamation, and the Ute Tribe of the Uintah and Ouray Indian Reservation (Ute Indian Tribe) (Contract No. 14-06-W-194) on September 20, 1965. This Agreement, known as the Deferral Agreement, states that the Ute Indian Tribe has deferred irrigation development of 15,242 acres of Tribal land, enabling the United States Government to divert 35,500 acre feet of water per year to the Wasatch Front. The construction and implementation of the ULS would not affect this diversion in any way. There would be no affect on Ute Indian Tribal water rights from ULS.

Consultation with the Northern Ute tribe resulted in no concerns regarding ITA or other reserved treaty rights. Consultation is complete at this time.

3.24.4.2 Northwestern Band Shoshone

An initial consultation letter and general ULS area map was sent to the Northwest Band Shoshone, Brigham City, Utah, in October 2003 inquiring about ITA or other reserved treaty rights. There was no reply from the tribe to the initial request.

Thereafter, in compliance with The Secretary's Principle for Managing Indian Trust Assets (303 DM 2), the American Indian Trust Fund Management Reform Act (25 USC 162 a (d) and 25 USC 4001-4061, and in a manner of good faith, a government-to-government meeting was prearranged in February 2004 with the Northwest Band Shoshone Tribe was at the Tribal Headquarters in Brigham City, Utah. Attendees included the Northwest Band Shoshone Tribal Director, the Director of the Tribal Cultural Resource Department, and representatives from the DOI and District.

During this consultation, the purpose, goals and timing of the ULS Proposed Action was explained to the tribal representatives and literature explaining the project, and maps were provided to each tribal representative. All questions from the tribal representatives were addressed at this time.

The tribal representatives expressed no further concerns regarding ITA or other reserved treaty rights for the Northwest Band Shoshone. A letter dated February 13, 2004 was received from the Northwestern Band Shoshone, stating that they will exclude themselves from the ULS project. Consultation with the tribe is complete.

3.24.4.3 Shoshone-Bannock Tribes

An initial consultation letter, including a general ULS area map, was sent to the Shoshone-Bannock Tribes, Fort Hall, Idaho, in October 2003, inquiring about ITA concerns. There was no reply from the tribe to the initial request.

Thereafter, in compliance with The Secretary's Principle for Managing Indian Trust Assets (303 DM 2), the American Indian Trust Fund Management Reform Act (25 USC 162 a (d) and 25 USC 4001-4061, and in a manner of good faith, a government-to-government meeting was prearranged in February 2004 with the Shoshone-Bannock Tribes. The meeting was held at Tribal Headquarters in Fort Hall, Idaho.

Attendees included the Tribal Chairman, Program Manager, Tribal Librarian and representatives from the DOI and District. During this consultation, the purpose, goals and timing of the ULS were explained to the tribal representatives and literature explaining the ULS including the Proposed Action and maps were provided to each tribal representative. Questions from tribal representatives regarding aspects of the proposed ULS project were addressed during the meeting.

The tribal representatives expressed no further concerns regarding ITA or other reserved treaty rights for the Shoshone-Bannock Tribes. A letter dated March 2004 was received stating the Shoshone Bannock Tribe comprehends the ULS project. No objections or concerns were stated. Consultation with the tribe is complete.

3.24.4.4 Paiute Indian Tribes of Utah

An initial consultation letter, including a general ULS area map, was sent to the Paiute Indian Tribes of Utah, Cedar City, Utah, in October 2003, inquiring about ITA or other reserved treaty rights. There was no reply from the tribe to the initial request.

Thereafter, in compliance with The Secretary's Principle for Managing Indian Trust Assets (303 DM 2), the American Indian Trust Fund Management Reform Act (25 USC 162 a (d) and 25 USC 4001-4061, and in a manner of good faith, a government-to-government meeting was prearranged in February 2004 with the Paiute Indian Tribe of Utah. The meeting was held at the Tribal Headquarters in Cedar City, Utah.

Attendees included the Tribal Chairwoman, the Tribal Cultural Resource Department Director, the Tribal Trust Resource Director, the Tribal Director of Environmental Resources and representatives from the DOI and District. During this consultation, the purpose, goals and timing of the ULS were explained to the tribal representatives and literature explaining the ULS including the Proposed Action and maps was provided to each tribal member. Questions from tribal representatives regarding the proposed project were addressed at the meeting.

The tribal representatives expressed no further concerns regarding ITA or other reserved treaty rights for the Paiute Indian Tribes of Utah. A letter dated February 17, 2004 was received stating the Paiute Indian Tribes of Utah have no objections pertaining to the ULS project. Consultation with the tribe is complete.

3.24.4.5 Skull Valley Band of the Goshutes

An initial consultation letter, including a general ULS area map, was sent to the Skull Valley Band of Goshutes, in October 2003, inquiring about ITA or other reserved treaty rights. There was no reply from the tribe to the initial request.

Thereafter, in compliance with The Secretary's Principle for Managing Indian Trust Assets (303 DM 2), the American Indian Trust Fund Management Reform Act (25 USC 162 a (d) and 25 USC 4001-4061, and in a manner of good faith, a government-to-government meeting was held in March 2004, between representatives from the DOI, District, and Skull Valley Band of Goshutes at the Tribal Headquarters in Salt Lake City, Utah.

During this consultation, the purpose, goals and timing of the ULS were explained to the tribal representatives, and literature explaining the Proposed Action and maps were provided to each tribal member. Questions from tribal representatives regarding the Proposed Action were addressed at the meeting.

Since the meeting, tribal representatives have expressed no further concerns regarding ITA or other reserved treaty rights for the Skull Valley Goshute tribe.

3.24.5 Issues Raised in Consultation Meetings

Questions regarding possible impacts to traditional plant gathering areas and future design changes to the project were raised by the Northern Ute Tribe.

The areas of concern for traditional plant gathering would be those geographic regions slated for ground disturbing activities or changes to wetland areas where plant gathering may take place. Tribal consultation included discussion of areas which may be indirectly, directly, or cumulatively affected by the proposed ULS construction and operation.

If there are significant changes in the future to the design, including additions, regarding the ULS Proposed Action, the tribes have requested that they be informed and re-consulted for ITA or other reserved treaty rights regarding the changes. The results of tribal consultations are discussed in 3.24.4.

3.24.6 Affected Environment (Baseline Conditions)

No Indian reservation lands are located within the ULS impact area of influence.

No Indian Trust Assets or other reserved treaty rights have been identified for (any) (of) the five Federally recognized Tribes within the ULS impact area of influence: the Northern Ute Tribe of Fort Duchesne, Utah; the Northwestern Band Shoshone Tribe of Pocatello, Idaho and Brigham City, Utah; the Shoshone-Bannock Tribes of Fort Hall, Idaho; the Paiute Indian Tribes of Utah; and the Skull Valley Band of Goshute Indians of Salt Lake City, Utah.

3.24.7 Environmental Consequences (Impacts)

ITA or other reserved treaty rights have not been identified through consultation with any of the five Federally recognized tribes within the proposed ULS area: the Northern Ute Tribe of Fort Duchesne, Utah; the Northwestern Band Shoshone Tribe of Pocatello, Idaho and Brigham City, Utah; the Shoshone-Bannock Tribes of Fort Hall, Idaho; the Paiute Indian Tribes of Utah; and the Skull Valley Band of Goshute Indians of Salt Lake City, Utah.

Each tribe was contacted to discuss any concerns or questions in regard to ITA or other reserved treaty rights within either the aboriginal or present-day use areas of each tribe. During the government-to government meetings, all questions from tribal representatives were addressed. Please see Section 3.24.4.1 for specific concerns posed by the Northern Ute Tribe.

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3.25 Mitigation and Monitoring

3.25.1 Introduction

This section describes proposed practical and feasible mitigation measures and monitoring procedures for significant adverse impacts caused by the two action alternatives being considered: Spanish Fork Canyon–Provo Reservoir Canal Alternative (Proposed Action), and Bonneville Unit Water Alternative. This section only includes resources that would have significant impacts and for which feasible and practical means are available to mitigate those impacts.

3.25.2 Wetland Resources

3.25.2.1 Spanish Fork Canyon–Provo Reservoir Canal Alternative (Proposed Action)

3.25.2.1.1 Mitigation. Under the Proposed Action, a total of 1.03 acres comprised of 16 small, scattered, non-jurisdictional wetlands would be permanently lost, and a total of 0.27 acre comprised of 12 small, scattered non-jurisdictional wetlands would be temporarily impacted by construction. After construction is completed, the temporarily impacted wetlands would be restored by replacing wetland soils and revegetating the areas with plants that match existing species. These wetlands are expected to be fully restored and functional within three growing seasons.

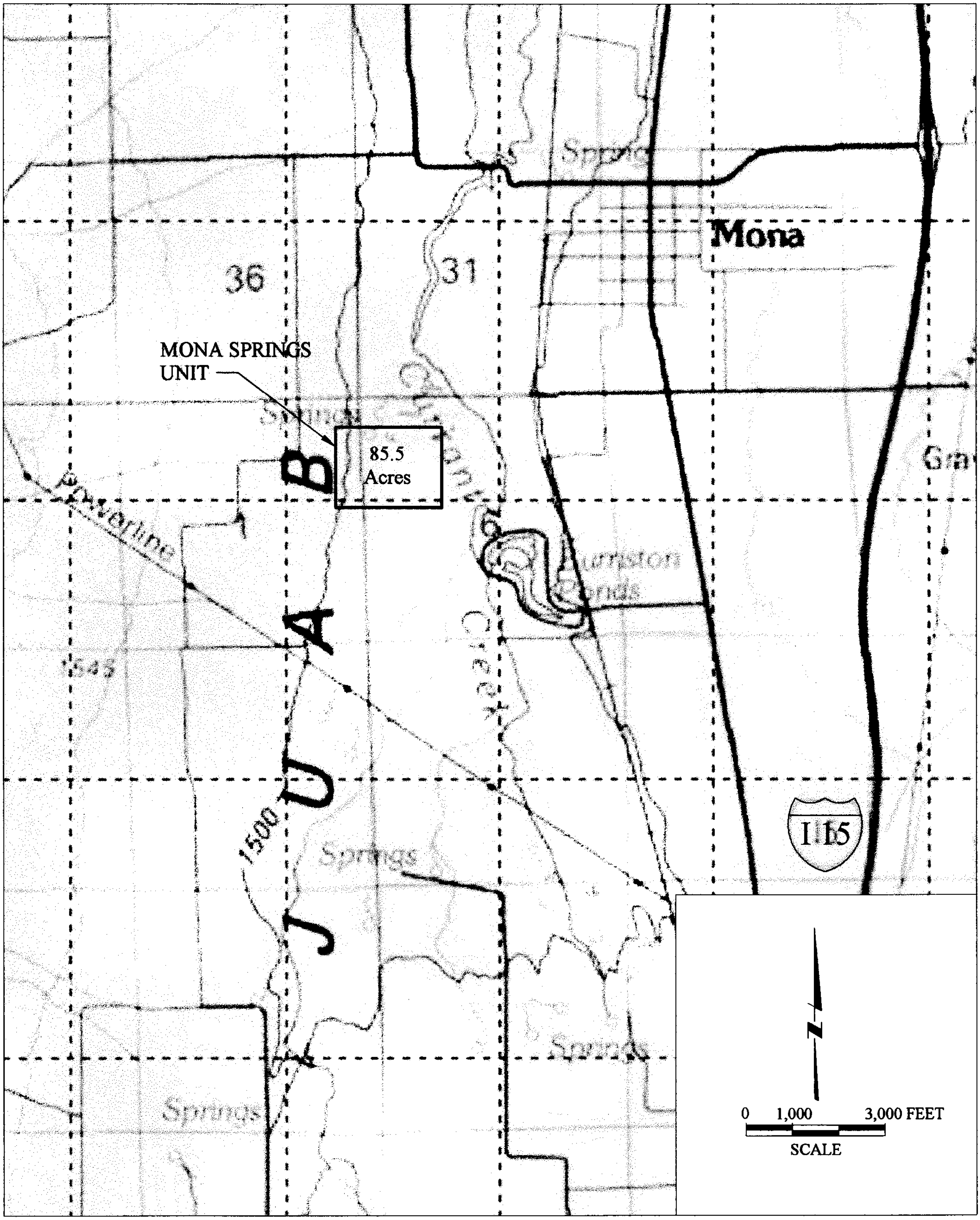
Mitigation for permanently lost and temporarily impacted non-jurisdictional wetlands would be off-site and out-of-kind, but would include wetlands in a much larger contiguous complex with high functional value and habitat for TES species.

The establishment of the Mona Springs Unit of the Burraston Ponds Wildlife Management Area in Juab County would mitigate these impacts. The Mitigation Commission acquired 85.5 acres of a natural spring-fed wetland complex in Juab County south of Mona Reservoir in 1998 as mitigation for anticipated wetland and riparian impacts of the then-planned SFN System. Subsequently, planning for the SFN System was abandoned. Therefore, a portion of this wetland area is available for mitigation for the ULS project.

The Mona Springs Unit is located in the northwest quarter of Section 6, Township 12 South, Range 1 East, approximately one mile southwest of the town of Mona and lies in the lowlands of Juab County between Burraston Ponds and Mona Reservoir (Map 3-12).

The 85 plus-acre parcel of land has abundant spring sources, but was historically used for grazing and other agricultural uses. Since acquiring the property, the Mitigation Commission entered into an operating agreement with the Utah Division of Wildlife Resources, and numerous habitat improvement measures have been implemented, including elimination of grazing, fencing of sensitive spring areas to protect against trespass grazing, and expansion of spring head pools. The wetland complex on the property supports viable populations of spotted frog, least chub, and California floater and is managed for the protection of those species, for miscellaneous migratory bird wildlife habitat and wetland values.

Proposed mitigation for the ULS project would include 10 acres of the 85.5-acre Mona Springs Unit. This would result in a mitigation ratio of approximately 9.7 to 1. This is substantial mitigation for both temporary and permanent loss of small, scattered, non-jurisdictional wetlands that currently have low functional value and do not support any TES species.



Map 3-12

Mona Springs Unit Location Map

3.25.2.1.2 Monitoring. None.

3.25.2.2 Bonneville Unit Water Alternative

3.25.2.2.1 Mitigation. There would be a direct significant permanent loss of approximately 1.02 acres of wetland from pipeline construction and drain or discharge structures. There would also be a temporary wetland loss of 0.18 acre, which would be restored upon completion of construction of the Bonneville Unit Water Alternative. The mitigation for this alternative would be identical to that of the Proposed Action.

3.25.2.2.2 Monitoring. None.

3.25.3 Sensitive Species

3.25.3.1 Spanish Fork Canyon–Provo Reservoir Canal Alternative (Proposed Action)

3.25.3.1.1 Mitigation and Monitoring. To offset potential impacts on leatherside chub, the Joint-Lead Agencies commit to supporting the Utah Division of Wildlife Resources in evaluating population and habitat status, or determining threats and/or identifying conservation actions that could protect and where appropriate enhance leatherside chub. This would occur first in the Spanish Fork River but if necessary, in other streams of the Utah Lake drainage.

3.25.3.2 Bonneville Unit Water Alternative

3.25.3.2.1 Mitigation and Monitoring. Same as for the Proposed Action.

3.25.4 Cultural Resources

3.25.4.1 Spanish Fork Canyon–Provo Reservoir Canal Alternative (Proposed Action)

Under the Proposed Action, there would be no significant impacts on archaeological sites, however, 10 historic sites/properties would be significantly adversely impacted. A Memorandum of Agreement (MOA) has been developed with the Utah State Historic Preservation Office (see Appendix G).

3.25.4.1.1 Mitigation. The mitigation measures for historic properties/sites would include:

1. Halting construction (federal legislation requires it); avoid site if possible, but if not possible:
2. Contacting SHPO, State Archaeologist, tribes (if necessary), Historic American Engineering Record or Historic American Buildings Survey documentation
3. Recordation (photos, etc.) and architectural descriptions
4. Excavation

If any archaeological sites would be significantly impacted by this alternative, measures for both prehistoric and historic archaeological properties/sites would include:

1. Test excavation
2. Full excavation

These excavations would be performed by archaeologists permitted by the Utah SHPO.

3.25.4.1.2 Monitoring. Since the project passes through some areas of cultural sensitivity that could contain evidence of Native American occupation or other activity, it would be necessary to implement a construction monitoring program. It is anticipated that this program would consist of a combination of construction worker training, excavation monitoring and trench inspection. This program would specifically require the training of field supervisors and equipment operators in the recognition of cultural resource material and features. It would involve the periodic monitoring of excavation by archaeologists permitted by the Utah SHPO. In addition, trench inspection would be carried out in culturally sensitive areas by qualified archaeologists. Stipulations are addressed in the MOA.

3.25.4.2 Bonneville Unit Water Alternative

Under the Bonneville Unit Water Alternative, there would be no significant impacts on archaeological sites, however, 5 historic sites/properties would be significantly adversely impacted.

3.25.4.2.1 Mitigation and Monitoring. Same as the Proposed Action for mitigation and monitoring measures.

3.25.5 Visual Resources

All measures to mitigate impacts of the two action alternatives on visual resources have been incorporated into the design and construction of visible features. No additional mitigation measures would be feasible to mitigate the adverse impacts, and no monitoring would be performed.

3.25.6 Paleontology

3.25.6.1 Spanish Fork Canyon–Provo Reservoir Canal Alternative (Proposed Action)

3.25.6.1.1 Mitigation. In addition to the standard operating procedures described in Chapter 1, Section 1.8.8.9 the following measures will be implemented.

A paleontologist will be provided to train construction workers prior to beginning construction on what to watch for in case any Pleistocene fossil material is encountered during excavation. This training will include photos, video and/or examples of fossils similar to what could be found.

3.25.6.1.2 Monitoring. None in addition to the requirement in Chapter 1, Section 1.8.8.9 for developing a detailed monitoring plan.

3.25.6.2 Bonneville Unit Water Alternative

3.25.6.2.1 Mitigation and Monitoring. Same as the Proposed Action.

3.26 Unavoidable Adverse Impacts

3.26.1 Introduction

This section describes unavoidable adverse impacts that would occur after implementing mitigation measures (described in Section 3.25) for the Proposed Action and other alternatives. Only resources that would have unavoidable adverse impacts are described here.

3.26.2 Surface Water Quality

3.26.2.1 Spanish Fork Canyon-Provo Reservoir Canal Alternative (Proposed Action)

None.

3.26.2.2 Bonneville Unit Water Alternative

3.26.2.2.1 Utah Lake. The increased TP load into Utah Lake would have a long-term unavoidable adverse impact on water quality. The increased TDS load into Utah Lake would have a long-term unavoidable adverse impact on water quality.

3.26.2.3 No Action Alternative

3.26.2.3.1 Utah Lake. The increased TP load into Utah Lake would have a long-term unavoidable adverse impact on water quality. The increased TDS load into Utah Lake would have a long-term unavoidable adverse impact on water quality.

3.26.3 Aquatic Resources

3.26.3.1 Spanish Fork Canyon-Provo Reservoir Canal Alternative (Proposed Action)

3.26.3.1.1 Provo River From Murdock Diversion Dam to Interstate 15. Decreased slow water habitat availability would have long-term unavoidable adverse impacts on redside shiner habitats in this reach of the Provo River.

3.26.3.1.2 Spanish Fork River From Diamond Fork Creek to Utah Lake. Reduced spring and fall flows in the Spanish Fork River would result in small, long-term unavoidable adverse impacts on game and non-game fish habitats because of decrease in overall habitat availability as well as a decrease in availability of off-channel habitats that are used by brown trout and other game and non-game fish species.

3.26.3.2 Bonneville Unit Water Alternative

Game and non-game fish habitat is projected to increase and decrease seasonally in the Spanish Fork River. Unavoidable adverse impacts would occur on game and non-game spawning habitat during summer months because of reduced flows and associated reduced habitats.

3.26.4 Agriculture and Soil Resources

All of the unavoidable adverse impacts on agriculture and soil resources would be associated with the construction phase, which would result in a one-season loss of rotational crops; a 11-year loss of orchard production from clearing associated with the temporary easement right-of-way; and a permanent annual loss of orchard production from the area located within the permanent easement right-of-way corridors.

3.26.4.1 Spanish Fork Canyon-Provo Reservoir Canal Alternative (Proposed Action)

Tables 3-139 through 3-141 list the temporary loss of rotational crops, temporary loss of orchard crop production and permanent annual loss of orchard crop under the Proposed Action.

Table 3-139
Temporary Loss of Rotational Crops Under the Proposed Action

Crop	Unit	Total
Alfalfa	Ton	38.7
Barley	Bushel	246.4
Corn, Grain	Bushel	40.0
Corn, Silage	Ton	22.0
Oat Hay	Ton	0.8
Winter Wheat	Bushel	323.8

Table 3-140
Temporary Loss of Orchard Crop Production Under the Proposed Action

Crop Acreage		Total (lbs)	
Apple	Tart Cherry	Apple	Tart Cherry
7.7	9.0	995,880	668,610

Table 3-141
Permanent Annual Loss of Orchard Crop Production Under the Proposed Action

Crop Acreage		Total (lbs)	
Apple	Tart Cherry	Apple	Tart Cherry
7.1	8.3	142,000	83,000

3.26.4.2 Bonneville Unit Water Alternative

Tables 3-142 through 3-144 list the temporary loss of rotational crops and orchard production, and the permanent annual loss of orchard production under the Bonneville Unit Water Alternative.

Table 3-142
Temporary Loss of Rotational Crops Under the Bonneville Unit Water Alternative

Crop	Unit	Total
Alfalfa	Ton	34.9
Barley	Bushel	246.4
Corn, Grain	Bushel	40.0
Corn, Silage	Ton	22.0
Oat Hay	Ton	0.8

Table 3-143
Temporary Loss In Orchard Crop Production Under the Bonneville Unit Water Alternative

Crop Acreage		Total (lbs)	
Apple	Tart Cherry	Apple	Tart Cherry
7.7	9.0	995,880	668,610

Table 3-144
Permanent Annual Loss In Orchard Crop Production Under the Bonneville Unit Water Alternative

Crop Acreage		Total (lbs)	
Apple	Tart Cherry	Apple	Tart Cherry
7.1	8.3	142,000	83,000

3.26.5 Socioeconomics

3.26.5.1 Spanish Fork Canyon–Provo Reservoir Canal Alternative (Proposed Action)

It is estimated that the increase in M&I water cost over baseline under this alternative could exceed the significance criteria of five percent which would be an unavoidable adverse impact.

3.26.5.2 Bonneville Unit Water Alternative

The unavoidable adverse impact would be the same as described for the Proposed Action.

3.26.5.3 No Action Alternative

It is estimated that new M&I water sources that would be developed if Bonneville Unit Water was not available would range from $200 to more than $1,000 per acre-foot depending on the source. This increase in rates would be an unavoidable adverse impact.

3.26.6 Visual Resources

3.26.6.1 Spanish Fork-Provo Reservoir Canal Alternative (Proposed Action)

The Sixth Water Transmission Line, Substation and the Upper Diamond Fork Power Plant Facility would be inconsistent with the Unita National Forest Plan VQO of partial retention because slope cuts, site grading and buildings would result in dominant elements in the foreground view from Sheep Creek-Rays Valley Road (FR #051) and the Diamond Fork Road. These Forest access routes are used by a large number of users.

3.26.6.2 Bonneville Unit Water Alternative

The Sixth Water Transmission Line, Substation and the Upper Diamond Fork Power Plant Facility would be inconsistent with the Unita National Forest Plan VQO of partial retention because slope cuts, site grading and buildings would result in dominant elements in the foreground view from Sheep Creek-Rays Valley Road (FR #051) and the Diamond Fork Road. These Uinta National Forest access routes are used by a large number of users.

3.26.7 Public Health and Safety

Unavoidable adverse health and safety impacts would result from the following:

- Emission of PM_{10}
- Increased traffic flow of more than 10 percent over current levels
- Increased noise levels that exceed federal and state standards

The risk of health and safety impacts would be high in urban areas and low in rural areas where alternative features are constructed. Therefore, the summary of unavoidable adverse impacts only covers impacts in urban areas.

A complete pipeline rupture is unlikely, but there is a high probability of some health and safety impacts if a rupture occurred in densely populated urban areas.

3.26.7.1 Spanish Fork Canyon-Provo Reservoir Canal Alternative (Proposed Action)

Table 3-145 shows only high-risk urban areas by feature, pipeline milepost, number of miles, and towns and cities where impacts would occur.

Table 3-145
Location of High-Risk Urban Areas for PM_{10}, Traffic and Noise Significant Impacts

Feature	Pipeline Milepost*	Miles	Towns/Cities Affected
Spanish Fork-Santaquin Pipeline	0.0 to 1.8 5.7 to 8.4 9.0 to 9.5 9.7 to 12.1	7.4	Spanish Fork, Salem, Payson
Mapleton-Springville Lateral Pipeline	0.0 to 0.7 1.5 to 5.7	4.9	Spanish Fork, Mapleton
Spanish Fork-Provo Reservoir Canal Pipeline	0.7 to 17.8 17.9 to 18.0 18.3 to 19.7	18.6	Spanish Fork, Mapleton, Springville, Provo, Orem

*Pipeline mileposts are shown on Map A-1

3.26.7.2 Bonneville Unit Water Alternative

Table 3-146 shows only high-risk urban areas by feature, pipeline milepost, number of miles, and towns and cities where impacts would occur.

Table 3-146
Location of High-Risk Urban Areas for PM_{10}, Traffic and Noise Significant Impacts

Feature	Pipeline Milepost*	Miles	Towns/Cities Affected
Spanish Fork-Santaquin Pipeline	0.0 to 1.8 5.7 to 8.4 9.0 to 9.5	5.0	Spanish Fork, Salem, Payson
Mapleton-Springville Lateral Pipeline	0.0 to 0.7 1.5 to 5.7	4.9	Spanish Fork, Mapleton

*Pipeline mileposts are shown on Map A-2

3.26.8 Transportation Networks and Utilities

3.26.8.1 Spanish Fork Canyon–Provo Reservoir Canal Alternative (Proposed Action)

The AADT on Foothill Drive would increase 10 percent or more, but only for a portion of the 30-month construction period for the Spanish Fork–Provo Reservoir Canal Pipeline. This would be an unavoidable adverse impact on traffic.

Traffic counts are not available for all roadways, but AADTs would likely increase more than 10 percent from construction-related trips on the rural roads and residential streets associated with the Sixth Water Power Facility and Transmission Line, Spanish Fork–Santaquin Pipeline, Santaquin–Mona Reservoir Pipeline, Mapleton–Springville Lateral Pipeline, and Spanish Fork–Provo Reservoir Canal Pipeline. The increase in AADTs would be an unavoidable adverse impact on traffic flow.

Normal traffic patterns would likely be rerouted during construction of the Spanish Fork–Provo Reservoir Canal Pipeline. This would be an unavoidable adverse impact on traffic flow.

3.26.8.2 Bonneville Unit Water Alternative

Traffic counts are not available for all roadways, but AADTs would likely increase more than 10 percent on rural roads and residential streets associated with the Sixth Water Power Facility and Transmission Line, Spanish Fork–Santaquin Pipeline, Santaquin-Mona Reservoir Pipeline, and Mapleton–Springville Lateral Pipeline. This would be an unavoidable adverse impact on traffic flow.

3.26.9 Air Quality

3.26.9.1 Spanish Fork Canyon–Provo Reservoir Canal Alternative (Proposed Action)

Table 3-147 lists estimated exceedances of NAAQS standards from construction of the Spanish Fork Canyon-Provo Reservoir Canal Alternative. Exceedances are expected to be temporary and localized, but would still be considered unavoidable adverse impacts.

Table 3-147
Estimated Exceedances of NAAQS Standards From Construction of Spanish Fork Canyon-Provo Reservoir Canal Alternative (Proposed Action)

Feature	Pollutant	Averaging Time	NAAQS (ug/m^3)	Total Peak Concentration From Construction Activities (ug/m^3)	Exceedance (ug/m^3)
Sixth Water Power Facility	PM_{10}	Annual	50	205	155
		24-hour	150	341	191
	NO_2	Annual	100	714	614
Sixth Water Transmission Line	PM_{10}	24-hour	150	312	162
Upper Diamond Fork Power Facility	PM_{10}	Annual	50	296	246
		24-hour	150	469	319
	NO_2	Annual	100	1129	1029
	SO_2	Annual	80	105	25
Spanish Fork Canyon Pipeline	PM_{10}	24-hour	150	403	253
Spanish Fork-Santaquin Pipeline	PM_{10}	24-hour	150	Rural – 403 Urban - 325	Rural – 253 Urban - 175
Santaquin-Mona Reservoir Pipeline	PM_{10}	24-hour	150	403	253
Mapleton-Springville Lateral Pipeline	PM_{10}	24-hour	150	403	253
Spanish Fork-Provo Reservoir Canal Pipeline	PM_{10}	24-hour	150	Rural – 403 Urban - 325	Rural – 253 Urban - 175

3.26.9.2 Bonneville Unit Water Alternative

Table 3-148 lists estimated exceedances of NAAQS standards from construction of the Bonneville Unit Water Alternative. Exceedances are expected to be temporary and localized, but would still be considered significant impacts.

Table 3-148
Estimated Exceedances of NAAQS Standards From Construction of Bonneville Unit Water Alternative

Feature	Pollutant	Averaging Time	NAAQS (ug/m^3)	Total Peak Concentration From Construction Activities (ug/m^3)	Exceedance (ug/m^3)
Sixth Water Power Facility	PM_{10}	Annual 24-hour	50 150	205 341	155 191
	NO_2	Annual	100	714	614
Sixth Water Transmission Line	PM_{10}	24-hour	150	312	162
Upper Diamond Fork Power Facility	PM_{10}	Annual 24-hour	50 150	296 469	246 319
	NO_2	Annual	100	1129	1029
	SO_2	Annual	80	105	25
Spanish Fork Canyon Pipeline	PM_{10}	24-hour	150	403	253
Spanish Fork-Santaquin Pipeline	PM10	24-hour	150	Rural – 403 Urban - 325	Rural – 253 Urban - 175
Mapleton-Springville Lateral Pipeline	PM_{10}	24-hour	150	403	253

3.26.10 Mineral and Energy Resources

Under each alternative with the exception of the No Action Alternative, there would be an estimated loss of 76,560 kwhr at the Strawberry Water Users Association hydropower facility because of reduced flows routed through the turbines.

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3.27 Cumulative Impacts

3.27.1 Introduction

This section describes the cumulative impacts that may occur as a result of construction and operation of any of the three alternatives---Spanish Fork Canyon-Provo Reservoir Canal Alternative (Proposed Action), Bonneville Unit Water Alternative, and the No Action Alternative---and after any proposed mitigation measures are implemented. Future projects included in the cumulative impact analysis are described in Chapter 1, Section 1.10.3. Only those resources with the potential to contribute to cumulative impacts are included in this section.

3.27.2 Surface Water Quality

3.27.2.1 Spanish Fork Canyon-Provo Reservoir Canal Alternative (Proposed Action)

The Proposed Action would have the following cumulative impacts on water quality. Of the projects listed in the EIS Chapter 1, Section 1.10.3 (Future Projects Included in the Cumulative Impact Analysis), one specific project would have the potential to create cumulative impacts on water quality. This project is the Lower Provo River Diversion Dam Modifications (Chapter 1, Section 1.10.3.5). Cumulative impacts also would occur on water quality from the State Engineer's operation of Utah Lake and wastewater treatment plant discharges to Utah Lake.

3.27.2.1.1 Lower Provo River Diversion Dam Modifications. During construction of the diversion dam modifications on the lower Provo River, additional earth fill material likely would be required to modify the diversion dams to allow fish passage and continue diverting water into canals. The additional earth fill material would cause some temporary turbidity and introduce new sources of sediment that would temporarily affect water quality and cause cumulative impacts with in-stream flow water discharged to the river for June sucker spawning and rearing and for fish and wildlife habitat improvement.

During ULS operation, the diversion dam modifications could potentially result in longer pools that could cause a cumulative impact on water temperatures. These cumulative impacts would not exceed the significance criteria for water quality supporting coldwater fish in the lower Provo River.

3.27.2.1.2 State Engineer's Operation of Utah Lake. Chapter 3, Surface Water Quality Section 3.3.8.3.1.1 B. Utah Lake describes the influence of multiple factors and actions on TDS concentrations in Utah Lake, such as evaporation, precipitation, wind mixing, tributary inflows from the Provo River, Hobble Creek, and Spanish Fork River, tributary inflows from other streams and rivers, wastewater treatment plant effluent inflows, other discharges, other inflows including salt springs in the lake and irrigation return flows, basin runoff, upstream water demands, and the State Engineer's operations of the lake level and volume. These factors and actions would combine with the ULS inflows to result in the projected TDS cumulative concentrations in Utah Lake reported in Table 3-21 in Chapter 3, Section 3.3.8.3.1.1 B. These cumulative impacts are not projected to exceed the significance criteria for water quality supporting agricultural irrigation. The correlation of increasing TDS concentration and decreasing Utah Lake volume is documented in Chapter 3, Section 3.3.7.1.1.2 A. TDS Concentrations and in the Surface Water Quality Technical Report for the Utah Lake Drainage Basin Water Delivery System (CUWCD 2004b). The correlation index of $r^2 = 0.811$ indicates that as the lake volume decreases below about 450,000 acre-feet, the TDS concentration could exceed the 1,200 mg/L water quality standard for agricultural water. The primary actions that affect Utah Lake level and volume are water storage and release by the State Engineer. The State Engineer's operation of releasing water from Utah Lake to meet water rights in Salt Lake County, resulting in decreased lake stage and volume, could lead to a cumulative water quality impact of TDS concentrations exceeding the 1,200 mg/L significance criterion.

3.27.2.1.3 Wastewater Treatment Plant Discharges to Utah Lake. Seven wastewater treatment plants (WWTPs) are located around Utah Lake and discharge treated effluent that flows either directly or indirectly into the lake. These WWTPs discharge effluent that contains high concentrations of TP, with maximum recorded concentrations ranging from 10.5 to 3.86 mg/L TP, average recorded concentrations ranging from 5.82 to 2.30 mg/L TP, and minimum recorded concentrations ranging from 2.71 to 0.82 mg/L TP. Map 4-1 in the Surface Water Quality Technical Report for the Utah Lake Drainage Basin Water Delivery System (CUWCD 2004b) shows the location of each WWTP and ranges of TP concentrations in their effluents, along with the baseline and Proposed Action TP concentrations in the affected tributary inflows. The WWTP effluents, even when mixed with the diluting concentrations of ULS inflows, and combined with other TP sources, would result in cumulative impacts on TP concentrations in Utah Lake. These cumulative impacts would be significant because the resulting TP concentrations in Utah Lake would exceed the pollution indicator of 0.025 mg/L.

3.27.2.2 Bonneville Unit Water Alternative

The cumulative impacts would be the same as or similar to those under the Proposed Action.

3.27.2.2.1 Lower Provo River Diversion Dam Modifications. Cumulative water quality impacts would be the same as documented in Section 3.27.2.1.1.

3.27.2.2.2 State Engineer's Operation of Utah Lake. The TDS concentrations in Utah Lake are influenced by the multiple factors and actions described in Section 3.27.2.1.2. These factors and actions would combine with the ULS inflows to result in the projected TDS cumulative concentrations in Utah Lake reported in Table 3-30 in Chapter 3, Section 3.3.8.4.1.1 B. These cumulative impacts are not projected to exceed the significance criteria for water quality supporting agricultural irrigation. The State Engineer's operation of releasing water from Utah Lake to meet water rights in Salt Lake County, resulting in decreased lake stage and volume, could lead to a cumulative water quality impact of TDS concentrations exceeding the 1,200 mg/L significance criterion.

3.27.2.2.3 Wastewater Treatment Plant Discharges to Utah Lake. Seven wastewater treatment plants (WWTPs) are located around Utah Lake and discharge treated effluent that flows either directly or indirectly into the lake, as described in Section 3.27.2.1.3. Map 4-2 in the Surface Water Quality Technical Report for the Utah Lake Drainage Basin Water Delivery System (CUWCD 2004b) shows the location of each WWTP and ranges of TP concentrations in their effluents, along with the baseline and Bonneville Unit Water Alternative TP concentrations in the affected tributary inflows. The WWTP effluents, even when mixed with the diluting concentrations of ULS inflows, and combined with other TP sources, would result in cumulative impacts on TP concentrations in Utah Lake. These cumulative impacts would be significant because the resulting TP concentrations in Utah Lake would exceed the pollution indicator of 0.025 mg/L.

3.27.2.3 No Action Alternative

The cumulative impacts would be the same as or similar to those under the Proposed Action.

3.27.2.3.1 Lower Provo River Diversion Dam Modifications. Cumulative water quality impacts would be the same as documented in Section 3.27.2.1.1.

3.27.2.3.2 State Engineer's Operation of Utah Lake. The TDS concentrations in Utah Lake are influenced by the multiple factors and actions described in Section 3.27.2.1.2. These factors and actions would combine with the ULS inflows to result in the projected TDS cumulative concentrations in Utah Lake reported in Table 3-37 in Chapter 3, Section 3.3.8.5.1.1 B. These cumulative impacts are not projected to exceed the significance criteria for water quality supporting agricultural irrigation. The State Engineer's operation of releasing water from Utah Lake to meet water rights in Salt Lake County, resulting in decreased lake stage and volume, could lead to a cumulative water quality impact of TDS concentrations exceeding the 1,200 mg/L significance criterion.

3.27.2.3.3 Wastewater Treatment Plant Discharges to Utah Lake. Seven wastewater treatment plants (WWTPs) are located around Utah Lake and discharge treated effluent that flows either directly or indirectly into the lake, as described in Section 3.27.2.1.3. Map 4-3 in the Surface Water Quality Technical Report for the Utah Lake Drainage Basin Water Delivery System (CUWCD 2004b) shows the location of each WWTP and ranges of TP concentrations in their effluents, along with the baseline and No Action Alternative TP concentrations in the affected tributary inflows. The WWTP effluents, even when mixed with the diluting concentrations of Bonneville Unit inflows, and combined with other TP sources, would result in cumulative impacts on TP concentrations in Utah Lake. These cumulative impacts would be significant because the resulting TP concentrations in Utah Lake would exceed the pollution indicator of 0.025 mg/L.

3.27.3 Aquatic Resources

3.27.3.1 Spanish Fork Canyon-Provo Reservoir Canal Alternative (Proposed Action)

The Proposed Action operation would result in fish habitat improvement in the lower Provo River and in Hobble Creek. Of the projects listed in the EIS Chapter 1, Section 1.10.3 (Future Projects Included in the Cumulative Impact Analysis) only three would have the potential to create cumulative impacts on aquatic resources. These projects are: June Sucker Recovery Implementation Program (Chapter 1, Section 1.10.3.1), Provo Reservoir Canal Enclosure (Chapter 1, Section 1.10.3.2), and Lower Provo River Diversion Dam Modifications (Chapter 1, Section 1.10.3.5).

The additional flows that would be provided as a result of the June sucker program and the Provo Reservoir Canal Enclosure have already been included in the ULS aquatic resources analysis. These improved flows along with the planned stream improvements in Hobble Creek under the June sucker program would improve fish habitat in the lower Provo River and Hobble Creek. This improvement along with the ULS improvements would result in a positive cumulative impact on fish habitat. In addition the dam modifications and stream restoration projects on the Provo would further improve the fish habitat in the lower Provo River. The overall cumulative impact of these projects along with the ULS project would be a significant improvement in fish habitat along with an increase in fish biomass. The total improvement can not be estimated until these projects have been specifically designed.

3.27.3.2 Bonneville Unit Water Alternative

The cumulative impacts would be similar to those under the Proposed Action.

3.27.3.3 No Action Alternative

The same cumulative impacts that would occur under the Proposed Action would occur under the No Action Alternative, except at a smaller magnitude.

3.27.4 Wildlife and Habitat Resources

No specific wildlife species would be impacted by the ULS project. Construction of the ULS project would result in the removal of only a small acreage of wildlife habitat scattered over a wide area within the impact area of influence. Of the projects listed in the EIS Chapter 1, Section 1.10.3 (Future Projects Included in the Cumulative Impact Analysis) only three would have the potential to create cumulative impacts on wildlife habitat. These projects are the Provo River Parkway Trail (Chapter 1, Section 1.10.3.3), Hobble Creek Trail (Chapter 1, Section 1.10.3.4), and Utah Lake Wetland Preserve (Chapter 1, Section 1.10.3.6).

3.27.4.1 Spanish Fork Canyon-Provo Reservoir Canal Alternative (Proposed Action)

This alternative would eliminate only 2.4 acres in parcels ranging from 0.1 acres to 0.7 acres of wildlife habitat scattered over a wide area along the Spanish Fork – Provo Reservoir Canal Pipeline, the Spanish Fork – Santaquin Pipeline and the Mapleton – Springville Lateral Pipeline. The Provo River Parkway Trail and the Hobble Creek Trail would eliminate an unknown amount of wildlife habitat. The habitat lost would occur in small fragments with the surrounding habitats being able to absorb any species that were displaced. Affected wetland habitat would be sparse riparian forest (willows and cottonwoods) or scrub-shrub wetland that could provide cover for a few bird or mammal species that would easily disperse to abundant nearby equivalent habitats. The Mitigation Commission has been acquiring land for the Utah Lake Wetland Preserve that could otherwise be drained and developed. Land and water acquired for the preserve will be managed by the Utah Division of Wildlife Resources for protection of migratory birds, wildlife habitat and wetland values. The resulting cumulative impact would be an overall cumulative impact on wildlife habitat within the impact area of influence.

3.27.4.2 Bonneville Unit Water Alternative

This alternative would eliminate only 1.8 acres of wildlife habitat in small parcels scattered over a wide area along the Spanish Fork – Santaquin Pipeline and the Mapleton – Springville Lateral Pipeline. The cumulative impact under this alternative would be the same as described for the Proposed Action in Section 3.27.4.1.

3.27.4.3 No Action Alternative

Potentially, a large acreage of wetlands may be converted to upland habitat with the projected groundwater extraction in southern Utah County. The Utah Lake Wetland Preserve would compensate for some of this potential wetland impact. The wetland preserve could provide alternative habitat for wetland-associated wildlife and replace wildlife habitat that could be lost in southern Utah County under the No Action Alternative. The wildlife species benefited by creation of the Utah Lake Wetland Preserve would be wetland-related species occurring in or utilizing wetlands potentially affected by draw down of groundwater in southern Utah County. Typical wetland-related mammals would include weasels, voles and shrews listed in Sections 3.8.7.2.1, Game Species and 3.8.7.2.2, Non-Game Species. Mammalian predators that could utilize wetland areas for foraging include coyote and red fox. Wetland-related birds and raptors that could use wetlands for foraging include multiple species that are listed in Chapter 3, Sections 3.8.7.2.1 and 3.8.7.2.2. Although no wildlife populations would be placed at risk on a regional basis, the acquisition of land and water for wetland preservation along the southeast portion of Utah Lake could benefit local wildlife populations that would be stressed as groundwater drawdown to support the estimated continued population growth would cause a reduction and fragmentation of historic wetland habitats.

3.27.5 Threatened and Endangered Species

The only T&E species affected by the ULS project would be the June sucker. Of the projects listed in Chapter 1, Section 1.10.3 (Future Projects Included in the Cumulative Impact Analysis) three would have the potential to create cumulative effects on the June sucker. These projects are the June Sucker Recovery Implementation Program (Chapter 1, Section 1.10.3.1), Provo Reservoir Canal Enclosure (Chapter 1, Section 1.10.3.2), and Lower Provo River Diversion Dam Modifications (Chapter 1, Section 1.10.3.5).

3.27.5.1 Spanish Fork Canyon-Provo Reservoir Canal Alternative (Proposed Action)

Cumulative effects on June sucker would be positive under the Proposed Action in conjunction with the potential improvements that could occur under each of the identified projects. The combination of flows the Proposed Action would provide to the lower Provo River and Hobble Creek and the in-stream habitat improvements proposed in the

June Sucker RIP likely would result in significant beneficial impacts with major improvements in June sucker habitat. The Provo Reservoir Canal enclosure would result in the saving of 8,000 acre-feet of water on an annual basis. These savings are included in the flows that the Proposed Action would deliver and the impact of this flow on June sucker is included in the analysis of the Proposed Action impacts. The modifications of the lower Provo River diversions dams along with the lower Provo River stream restoration, and with the increase flows provided by the Proposed Action this would increase the amount of the Provo River that would be available for June sucker spawning and rearing. This increase in spawning and rearing habitat would increase the number of June sucker that could be produced. The combination of all of these projects would likely result in a significant improvement in the June sucker population. However, until the exact details of the improvements to be undertaken are known, it is not possible to estimate the total effect on June sucker.

3.27.5.2 Bonneville Unit Water Alternative

Cumulative effects on the June sucker would be positive and similar to the Proposed Action.

3.27.5.3 No Action Alternative

Flows provided under the No Action Alternative for June sucker would be less than those provided under the Proposed Action and Bonneville Unit Water Alternative. These along with the interrelated actions described above would result in a positive cumulative impact on June sucker. However, until the exact details of the improvements to be undertaken are known, it is not possible to estimate the total effect on June sucker.

3.27.6 Visual Resources

Although the two ULS action alternatives would have an adverse impact on visual resources in the area of the Sixth Water Power Facility and the Upper Diamond Fork Power Facility, none of the other projects identified in Chapter 1, Section 1.10.3 would impact the visual resource in the same vicinity. Therefore, there would be no cumulative impacts on visual resources.

3.27.7 Recreation Resources

3.27.7.1 Spanish Fork Canyon-Provo Reservoir Canal Alternative (Proposed Action)

The Proposed Action would not cause any impacts on designated recreation facilities or resources. Construction activities would create increased traffic and would cause some delays in visitors reaching recreation sites. The major impact on recreation use in the impact area of influence would be the increase in angler days associated with the increase in fish biomass associated with the aquatic habitat improvements that would occur on the Provo and Spanish Fork rivers, and Hobble Creek. Of the projects listed in Chapter 1, Section 1.10.3 (Future Projects Included in the Cumulative Impact Analysis) only five projects would have the potential to create cumulative impacts on visitor use. These projects are: Provo River Parkway Trail (Chapter 1, Section 1.10.3.3), Hobble Creek Trail (Chapter 1, Section 1.10.3.4), Interstate 15 Widening from Point of the Mountain through Utah County (Chapter 1, Section 1.10.3.9), State Route 52 Upgrade from Geneva Road to U.S. Highway 189 (Chapter 1, Section 1.10.3.10), and Diamond Fork Campground (Chapter 1, Section 1.10.3.12).

The traffic delays that would be associated with the Interstate 15 widening, the State Route 52 upgrade, and the construction of a group-site facility in the Diamond Fork Campground would result in a cumulative impact on visitor use. These construction projects would increase the traffic on access routes used by recreationists within the impact area of influence. The exact amount of traffic increase and related delays can not be estimated until these projects have been designed and additional detail on construction timing identified.

Fish habitat improvements and increase in fish biomass under the Proposed Action would increase the potential angler-days on the Provo River by 36,342 angler-days per year. The Provo River Parkway Trail project would increase the length of the trail along the lower Provo River. This would increase the area accessible for angler use and could result in additional angler-days resulting in a cumulative impact.

Fish habitat improvements and increase in fish biomass under the Proposed Action could provide for 13,509 angler-days per year on Hobble Creek. Currently public access is not available along Hobble Creek. The Hobble Creek Trail project would provide a trail and public access along Hobble Creek, thereby making the creek accessible to anglers.

The total cumulative impact of the Proposed Action with interrelated actions would be an estimated 49,851 angler-day increase annually on the lower Provo River and Hobble Creek.

3.27.7.2 Bonneville Unit Water Alternative

The traffic delays under the Bonneville Unit Water Alternative and the effect on recreationists would be the same as described under the Proposed Action.

The cumulative impact on angler-days would be similar to that described under the Proposed Action, except the increase under the Bonneville Unit Water Alternative would be 27,265 angler-days on the Provo River and 17,166 angler-days on Hobble Creek. The total cumulative impact of the Bonneville Unit Water Alternative with interrelated actions would be an estimated 44,431 angler-day increase annually on the lower Provo River and Hobble Creek.

3.27.7.3 No Action Alternative

There would be no cumulative impacts associated with traffic delays on visitor use since there would be no ULS construction occurring under the No Action Alternative.

The cumulative impact on angler days would be limited to the Provo River. Angler-day use on the Provo River is estimated to increase by 27,265 days annually. The lengthening of the Provo River Trail would provide additional access to the lower Provo River creating a cumulative impact on angler-day use.

3.27.8 Socioeconomics

3.27.8.1 Spanish Fork Canyon-Provo Reservoir Canal Alternative (Proposed Action)

Socioeconomic impacts of the Proposed Action include impacts on employment, income, agriculture, and recreational fishing. Of the projects listed in Chapter 1, Section 1.10.3 (Future Projects Included in the Cumulative Impact Analysis) only seven projects would have the potential to create cumulative impacts on visitor use. These projects are: Provo River Parkway Trail (Chapter 1, Section 1.10.3.3), Hobble Creek Trail (Chapter 1, Section 1.10.3.4), Lower Provo River Diversion Dam Modifications (Chapter 1, Section 1.10.3.5), Interstate 15 Widening from Point of the Mountain through Utah County (Chapter 1, Section 1.10.3.9), State Route 52 Upgrade from Geneva Road to U.S. Highway 189 (Chapter 1, Section 1.10.3.10), Diamond Fork Campground (Chapter 1, Section 1.10.3.12), and Temporary Supplemental Irrigation Water (Chapter 1, Section 1.10.3.13).

The Proposed Action would create labor requirements of between 800 to 1,190 jobs (annual equivalent). All of the projects identified above, with the exception of the Temporary Supplemental Irrigation Water, would create additional labor requirements. The total cumulative impact can not be estimated, as detailed information on the labor needs of these other projects is unknown.

The construction of the Proposed Action would result in an income impact totaling an estimated $151 million in direct and indirect income impacts. With the exception of the Temporary Supplemental Irrigation Water the other projects identified above would result in an increase in direct and indirect income impacts. The total cumulative impact cannot be estimated, as detailed information on the cost of these other projects is unknown.

Construction of the Proposed Action would result in a loss of gross crop revenues of approximately $77,300 with a permanent annual reduction of about $34,000. The cumulative impact when considering Temporary Supplemental Irrigation Water would result in an overall positive cumulative impact as this project (assuming maximum delivery) would result in a gross revenue increase of about $3.7 million and net revenue increase of about $1.1 million. This would more than offset the losses that would occur under the Proposed Action.

Operation of the Proposed Action would result in increased recreational fishing that would generate an additional $1,288,083 in direct net value and about $5,465,700 in total regional/state expenditures. This impact is based only on the potential increase in angler-days on the Provo River that has public access. In conjunction with the Hobble Creek Trail project, which would provide public access along Hobble Creek for use of the potential increase in angler-days, the cumulative impact would be $1,765,626 in direct net value and about $7,492,050 in total regional/state expenditures.

3.27.8.2 Bonneville Unit Water Alternative

The Bonneville Unit Water Alternative would create labor requirements of between 620 to 930 jobs (annual equivalent). All of the projects identified above, with the exception of the Temporary Supplemental Irrigation Water, would create additional labor requirements. The total cumulative impact can not be estimated, as detailed information on the labor needs of these other projects is unknown.

The construction of the Bonneville Unit Water Alternative would result in an income impact totaling an estimated $78 million in direct and indirect income impacts. With the exception of the Temporary Supplemental Irrigation Water, the other projects identified above would result in an increase in direct and indirect income impacts. The total cumulative impact cannot be estimated, as detailed information on the cost of these other projects is unknown.

Construction of the Bonneville Unit Water Alternative would result in a loss of gross crop revenues of approximately $75,800 with a permanent annual reduction under $100,000. The cumulative impact when considering Temporary Supplemental Irrigation Water would result in an overall positive cumulative impact as this project (assuming maximum delivery) would result in a gross revenue increase of about $3.7 million and net revenue increase of about $1.1 million. This would more than offset the losses that would occur under the Bonneville Unit Alternative.

Operation of the Bonneville Unit Water Alternative would result in increased recreational fishing that would generate an additional $638,209 in direct net value and about $2,708,100 in total regional/state expenditures. This impact is based only on the potential increase in angler-days on the Provo River that has public access. In conjunction with the Hobble Creek Trail project which would provide public access along Hobble Creek for use of the potential increase in angler-days, the cumulative impact would be $1,245,027 in direct net value and about $5,283,000 in total regional/state expenditures.

3.27.8.3 No Action Alternative

There would be no cumulative impacts since there would be no ULS construction under the No Action Alternative. The increase in angler-days under the No Action Alternative would have the same cumulative impacts as the Bonneville Unit Water Alternative on the Provo River only.

3.27.9 Transportation

3.27.9.1 Spanish Fork Canyon-Provo Reservoir Canal Alternative (Proposed Action)

Transportation impacts of the Proposed Action include impacts on the Average Annual Daily Traffic (AADT) counts on roads within the Impact Area of Influence. Of the projects listed in Chapter 1, Section 1.10.3 (Future Projects Included in the Cumulative Impact Analysis) only six projects would have the potential to create cumulative impacts on visitor use. These projects are: Provo River Parkway Trail (Chapter 1, Section 1.10.3.3), Hobble Creek Trail (Chapter 1, Section 1.10.3.4), Lower Provo River Diversion Dam Modifications (Chapter 1, Section 1.10.3.5), Interstate 15 Widening from Point of the Mountain through Utah County (Chapter 1, Section 1.10.3.9), State Route 52 Upgrade from Geneva Road to U.S. Highway 189 (Chapter 1, Section 1.10.3.10), and Diamond Fork Campground (Chapter 1, Section 1.10.3.12).

It is likely that all of these proposed construction projects within the impact area of influence for the Proposed Action could cause significant cumulative adverse impacts because the increased AADT counts on affected roadways could change more than ten percent. There are insufficient data to quantify the extent of the cumulative impact from all of the projects.

3.27.9.2 Bonneville Unit Water Alternative

The cumulative impact would be similar to that discussed under the Proposed Action.

3.27.9.3 No Action Alternative

There would be no cumulative impacts as no ULS construction activities would occur.

3.28 Short-Term Use of Man's Environment Versus Maintenance of Long-Term Productivity

3.28.1 Introduction

This section provides a broad overview of the effect that construction and implementation of the Proposed Action and other alternatives would have on the long-term productivity of man's environment. This section discusses the tradeoffs (short-term impacts) and benefits (long-term productivity impacts) associated with the Proposed Action. Tradeoffs are adverse impacts that occur during the construction and operations period and benefits are positive impacts that occur over the life of the project. All discussions are based on significant impacts remaining after implementation of mitigation measures.

3.28.2 Spanish Fork Canyon-Provo Reservoir Canal Alternative (Proposed Action)

3.28.2.1 Trade-Offs

- Total phosphorus concentrations increased above pollution indicator levels in the Spanish Fork River
- Loss of 2.4 acres of wildlife habitat scattered throughout the impact area of influence
- Leatherside chub habitat reduced in lower Spanish Fork River
- Temporary loss of production on 43.1 acres of rotational crop land
- Temporary loss of production on 16.7 acres of orchard land
- Permanent loss of 15.4 acres of orchard land
- Violation of Forest Service visual quality objectives by two project features
- Potential temporary increase in risk of accidents resulting in serious injuries or death
- Temporary localized exceedance of the PM_{10}, NO_2, and SO_2 standards
- Temporary increase in the annual average daily traffic flow on roads associated with construction activities
- Loss of 76,560 kwh per year in power produced at the Strawberry Water Users Association power plant

3.28.2.2 Benefits

- In-stream flows would provide aquatic resource habitat, increase dissolved oxygen, and decrease summer water temperatures and increase winter water temperatures, benefiting game and non-game fish in the lower Provo River and Hobble Creek
- Increases game fish biomass by 19,496 pounds

- Increase of 3,374 percent in annual average WUA for June sucker
- Increase of 17 to 537 percent in the moderate flow/mid-depth habitat niche used by June suckers
- Increase of 36,342 angler days per year on the Provo River between Deer Creek Reservoir and Utah Lake
- Increase of 96 angler days per year in the Spanish Fork River from Diamond Fork Creek to Utah Lake
- Generation of 165,143,000 kwh annually
- Provides means of meeting water delivery needs for M&I secondary water
- Completes the Bonneville Unit by delivering 101,900 acre-feet of water
- Implements water conservation measures
- Addresses all remaining environmental commitments associated with the Bonneville Unit
- Maximizes current and future M&I water supplies associated with the Bonneville Unit

3.28.3 Bonneville Unit Water Alternative

3.28.3.1 Trade-Offs

- Total phosphorus concentrations increased above pollution indicator levels in upper Spanish Fork River
- Loss of 1.8 acres of wildlife habitat scattered throughout the impact area of influence
- Leatherside Chub habitat reduced in lower Spanish Fork River
- Temporary loss of production on 14.3 acres of rotational crop land
- Temporary loss of production on 16.7 acres of orchard land
- Permanent loss of 15.4 acres of orchard land
- Violation of Forest Service visual quality objectives by two project features
- Potential temporary increase in risk of accidents resulting in serious injuries or death
- Temporary localized exceedance of the PM_{10}, NO_2, and SO_2 standards
- Temporary increase in the annual average daily traffic flow on roads associated with construction activities
- Loss of 76,560 kwh per year in power produced at the Strawberry Water Users Association power plant

- Loss of 1,662 angler days per year in the Spanish Fork River from Diamond Fork Creek to Utah Lake

3.28.3.2 Benefits

- In-stream flows would provide aquatic resource habitat, increase dissolved oxygen, and decrease summer water temperatures and increase winter water temperatures, benefiting game and non-game fish in Hobble Creek
- Increase in game fish biomass of 10,220 pounds
- Increase of 3,374 percent in annual average WUA for June sucker
- Increase of 17 to 537 percent in the moderate flow/mid-depth habitat niche used by June suckers
- Increase of 19,716 angler days per year on the Provo River between Deer Creek Reservoir and Utah Lake
- Generation of 165,143,000 kwh annually
- Provides means of meeting water delivery needs for M&I secondary water
- Completes the Bonneville Unit by delivering 101,900 acre-feet of water
- Implements water conservation measures
- Addresses all remaining environmental commitments associated with the Bonneville Unit
- Maximizes current and future M&I water supplies associated with the Bonneville Unit

3.28.4 No Action Alternative

3.28.4.1 Trade-Offs

- Does not provide a means of meeting water delivery needs for M&I secondary water
- Does not complete the Bonneville Unit by delivering 101,900 acre-feet of water
- Does not result in the implementation of water conservation measures
- Fails to address all remaining environmental commitments associated with the Bonneville Unit
- Does not maximizes current and future M&I water supplies associated with the Bonneville Unit

3.28.4.2 Benefits

- Dissolved oxygen concentrations would increase in the Spanish Fork River
- Increase in game fish biomass of 9,703 pounds
- Increase of 3,374 percent in annual average WUA for June sucker
- Increase of 17 to 537 percent in the moderate flow/mid-depth habitat niche used by June suckers
- Increase of 19,716 angler days per year on the Provo River between Deer Creek Reservoir and Utah Lake

3.29 Irreversible and Irretrievable Commitment of Resources

3.29.1 Introduction

This section identifies resources that would be irreversibly (cannot be reversed, repealed or annulled) or irretrievably (cannot be retrieved, recovered, restored or recalled) committed to the project after all mitigation measures are applied.

3.29.2 Spanish Fork Canyon-Provo Reservoir Canal Alternative (Proposed Action)

Use of the following resources would be irreversible and irretrievable:

- Materials used during construction (see Table 1-29, in Section 1.8.4.1 of Chapter 1)
- An unknown amount of fuel that would be consumed during construction and operation
- Funds used for project construction and operation (approximate construction cost of the Proposed Action would be $458.8 million, however a portion of this funding would be re-captured through water sales at an estimated reimbursable cost of $301.73 per acre-foot of ULS M&I water in Salt Lake County and southern Utah County)

The following resources lost during the construction period or the life of the project would be irretrievable:

- Temporary loss of 0.27 acre of wetlands during construction
- Permanent loss of 2.0 acres of wildlife habitat
- Temporary loss of 269.7 acres of wildlife habitat during construction
- Temporary loss of production on 43.1 acres of rotational crop land, and 16.7 acres of orchard land during construction
- Permanent loss of 15.4 acres of orchard land
- Permanent loss of production of 76,560 kwh annually at the Strawberry Water Users Association hydropower facility
- Any loss of life caused by traffic accidents resulting from increased traffic during construction would be irreversible and irretrievable

3.29.3 Bonneville Unit Water Alternative

Use of the following resources would be irreversible and irretrievable:

- Materials used during construction (see Table 1-30, in Section 1.8.4.2 of Chapter 1)
- An unknown amount of fuel that would be consumed during construction and operation
- Funds used for project construction and operation (approximate construction cost of the Bonneville Unit Water Alternative would be $184 million, however a portion of this funding would be re-captured through water sales at an estimated reimbursable cost of $334 per acre-foot of ULS M&I water in southern Utah County)

The following resources lost during the construction period or the life of the project would be irretrievable:

- Temporary loss of 0.18 acre of wetlands during construction
- Permanent loss of 1.5 acres of wildlife habitat
- Temporary loss of 178.8 acres of wildlife habitat during construction
- Temporary loss of production on 14.3 acres of rotational crop land, and 16.7 acres of orchard land during construction
- Permanent loss of 15.4 acres of orchard land
- Permanent loss of production of 76,560 kwh annually at the Strawberry Water Users Association hydropower facility
- Any loss of life caused by traffic accidents resulting from increased traffic during construction would be irreversible and irretrievable

3.29.4 No Action Alternative

None.