

**This document includes extended narratives for all resources, please see the 20190118 Comments Table to determine which narrative applies to a specific resource.**

## **EXTENDED NARRATIVES**

### **BLM 70**

Rationales for including the action alternatives as described in Sections 3.1, 3.3, 3.4 and 3.5 of Chapter 3, Exhibit E of the License Application are added to the appropriate locations in Chapter 3.

- 1) Add a new subsection 3.1.4 at Chapter 3 of the License Application, to read:  
**3.1.4 Rationale for the Proposed Action**

**The State believes the Proposed Action would accomplish the following:**

- **Develop additional water supplies legally available from the Colorado River System to meet the water demands of the existing and projected future population of Washington and Kane counties through 2060, with a necessary margin of safety, while maximizing the use of existing available and identified water supplies.**
- **Diversify the primary municipal and industrial (“M&I”) water sources for the counties**
- **Add resiliency and reliability to the water delivery system to address the risk of variability associated with water supplies and the water delivery system.**
- **Develop clean, renewable energy sources**

**The EIS analysis will fully inform the agencies and the Kaibab Band of Paiute Indians as to the comparative benefits and adverse effects of the alternatives.**

- 2) Revise the title for Section 3.3 Description of Existing Highway Alternative in Chapter 3 of the License Application to read: 3.3 Description of Existing Highway **Action** Alternative.
- 3) Add a new subsection 3.3.3 at Chapter 3 of the License Application, to read:  
**3.3.3 Rationale for Including the Existing Highway Action Alternative**

**Several parties, including the Kaibab Band of Paiute Indians, commented during the 2008 scoping period that the EIS should consider pipeline route alternatives across the Kaibab-Paiute Indian Reservation. FERC responded in its August 21, 2008 Scoping Document 2 (SD2) to include an alternative pipeline route across the Kaibab-Paiute Indian Reservation in the NEPA process. This decision was affirmed in FERC’s Study Plan Determination issued on January 21, 2009. Subsequently on May 17, 2012, the Kaibab Band of Paiute Indians passed “Resolution of the Governing Body of the Kaibab Band of Paiute Indians K-30-12, Permission for Lake Powell Pipeline Project To Cross Kaibab Indian Reservation Lands”. By means of this Resolution, the Tribal Council determined to permit and give consent for the LPP to cross the Kaibab-Paiute Indian Reservation following Highway 389, in exchange for appropriate compensation to the Tribe. The EIS analysis will fully inform the agencies and the Kaibab Band of Paiute Indians as to the comparative benefits and adverse effects of the alternatives.**

- 4) Revise the title for Section 3.4 Description of Southeast Corner Alternative in Chapter 3 of the License Application to read: 3.4 Description of Southeast Corner **Action** Alternative

- 5) Add a new subsection 3.4.3 in Chapter 3 of the License Application, to read: **3.4.3 Rationale for Including the Southeast Corner Action Alternative**

**The Southeast Corner Action Alternative maximizes the distance the LPP coincides with the Navajo-McCullough Energy Corridor and conforms with FERC’s SD2 decision to include alternatives that cross the Reservation. The Tribe, however, has not yet endorsed this alignment through issuance of a Tribal Council Resolution as it has for the Existing Highway Action Alternative. The EIS analysis will fully inform the agencies and the Kaibab Band of Paiute Indians as to the comparative benefits and adverse effects of the Proposed Action and the alternatives.**

- 6) Revise the title for Section 3.5 Description of No Lake Powell Water Alternative in Chapter 3 of the License Application to read: 3.5 Description of No Lake Powell Water **Action** Alternative

- 7) Add a new subsection 3.5.3 in Chapter 3 of the License Application, to read: **3.5.3 Rationale for Including the No Lake Powell Water Action Alternative**

**Several parties commented during the 2008 scoping period that alternative sources of water such as pumping from aquifers or building new reservoirs should be considered. In contrast, Washington County commented that the high cost of treating high concentrations of total dissolved solids in the Virgin River caused by La Verkin Hot Springs would need to be considered by FERC in evaluating alternative sources of water. In response to these comments, FERC committed to examine in the EIS the most likely ways for the sponsoring water districts to develop water supplies apart from a Lake Powell water source, and to consider the comparable water quality and treatment costs of the alternatives.**

### **BLM 463**

Information on and discussion of biological soil crusts is added to several sections as follows:

A new subsection, 5.3.1.1.6.1 Biological Soil Crusts, is added within Section 5.3.1.1.6, Chapter 5, Exhibit E of the License Application as follows:

#### **5.3.1.1.6.1 Biological Soil Crusts.**

**Biological soil crusts, also referred to as cryptobiotic, cryptogamic, microbiotic, or cyanobacterial-lichen soil crusts occur along portions of the LPP alignments. The soil crusts consist of lichens, mosses, and algae usually binding a matrix of clay, silt, and sand soil particles together. Biological soil crusts are formed by living organisms and their by-products, creating a surface crust of soil particles bound together by organic materials (USDA 1997). Biological soil crusts occur in the Colorado Plateau and Mojave Desert ecological regions, and they play an important ecological role in the functioning of soil stability and erosion, water infiltration, atmospheric nitrogen fixation, nutrient contributions to plants, soil-plant-water relations, seedling germination, and plant growth (BLM 1999). Biological soil crusts documented along the LPP alignments are generally associated with the presence of gypsum soils, and in some places sandy soils.**

**Gypsum minerals occur in specific rock types and soils derived from gypsum-bearing rocks west of The Cockscomb geological feature. Gypsum rock types and gypsiferous soils are not known to occur east of The Cockscomb. The Kane County soil survey including location of gypsum soils is pending publication for BLM Kanab Field Office-administered land, state land and private land between the GSENM west boundary and Kanab. Soil surveys for areas within administrative boundaries of GSENM, Arizona Strip Field Office, Kaibab-Paiute Indian Reservation, and St. George Field Office are completed and identify gypsiferous soils. Gypsiferous soils consisting of Clayhole, Gypsiorthids and Saido soils identified within Arizona Strip Field Office administrative boundaries correlate 100 percent with delineated microbiotic soil data (BLM 2014).**

A new second paragraph is added to Section 5.3.1.2.2.4 Expandable, Collapsible or Subsiding Soils or Rocks in Chapter 5, Exhibit E of the License Application as follows:

**There are approximately 657 acres of potential biological soil crusts within the Proposed Action rights-of-way, including areas that would be affected by the water conveyance system pipeline, hydroelectric system penstock, hydroelectric system facility sites, reservoir, transmission lines, staging areas, and access roads (Table 5-14A). The Proposed Action would cross through large gypsiferous soil areas with potential biological soil crusts in common with the other action alternatives. Proposed Action impacts on potential biological soil crusts would be long-term and represent approximately 12 percent of the total soils area disturbed by construction activities within LPP rights-of-way. Where actively grazed by livestock, the soil crusts may already be broken and trampled in some areas.**

New second and third paragraphs are added to Section 5.3.1.2.4.4 Expandable, Collapsible or Subsiding Soils or Rocks in Chapter 5, Exhibit E of the License Application, as follows:

**There are approximately 833 acres of potential biological soil crusts within the Existing Highway Alternative Action rights-of-way, including areas that would be affected by the water conveyance system pipeline, hydroelectric system penstock, hydroelectric system facility sites, reservoir, transmission lines, staging areas, and access roads (Table 5-14A). The Proposed Action would cross through large gypsiferous soil areas with potential biological soil crusts in common with the other action alternatives. Proposed Action impacts on potential biological soil crusts would be long-term and represent approximately 17 percent of the total soils area disturbed by construction activities**

**within LPP rights-of-way. Where actively grazed by livestock, the soil crusts may already be broken and trampled in some areas.**

**The Existing Highway Alternative alignment across the Kaibab-Paiute Indian Reservation would be constructed on the north side of Highway 389 and north of the Arizona Department of Transportation (ADOT) right-of-way (ROW). The 150-foot wide LPP construction ROW would be located north of and outside of the ADOT Highway 389 ROW because ADOT does not have authority to grant a utility ROW within their Highway 389 ROW across the Kaibab-Paiute Indian Reservation. Soils that can form biological soil crusts are more prevalent closer to the Vermilion Cliffs, which contain gypsum minerals. Erosional processes occurring along the gypsum-bearing Vermilion Cliffs have deposited gypsum minerals in large areas of down-gradient soils that promote formation of biological soil crusts. Soils containing more than five percent gypsum, including Clayhole and Gypsiorthids, are prevalent along Highway 389 and the Existing Highway Alternative alignment. Therefore, the Existing Highway Alternative construction would disturb significant areas of gypsiferous soils, which potentially form biological soil crusts, north of the Highway 389 ROW.**

Additional Reference:

**BLM. 2014. Proposed Lake Powell Pipeline Right-of-Way AZA-034941, Map showing Microbiotic Soil Crusts, Saline Soils, and Compactible Soils. USDI-Bureau of Land Management, Arizona Strip Field Office. Map created February 25, 2014.**

**Table 5-14A  
Construction Impacts on Gypsiferous Soils and Potential Biological Soil Crusts<sup>1</sup> Within  
LPP Rights-of-Way<sup>2</sup>**

<b>Administrative Boundary Area<sup>3</sup>/ LPP Right-of-Way Component</b>	<b>Proposed Action (approximate acres)</b>	<b>Existing Highway Alternative (approximate acres)</b>
<b>Kanab Field Office Administrative Boundary Area<sup>3</sup></b>		
Water Conveyance System Pipeline	55	55
Hydroelectric System Penstock	59	59
Hydroelectric System Facility	13	13
Transmission Line	0	0
Access Road	0	0
<b>Subtotal Impact Area (acres)</b>	<b>127</b>	<b>127</b>
<b>Arizona Strip Field Office Administrative Boundary Area<sup>3</sup></b>		
Hydroelectric System Penstock	30	33
Hydroelectric System Facility	0	0
Transmission Line	0	0
Access Road	7	0
<b>Subtotal Impact Area (acres)</b>	<b>37</b>	<b>33</b>
<b>Kaibab-Paiute Indian Reservation Administrative Boundary Area<sup>4</sup></b>		
Hydroelectric System Penstock	0	180
Hydroelectric System Facility	0	0
Transmission Line	0	0
Access Road	0	0
<b>Subtotal Impact Area (acres)</b>	<b>0</b>	<b>180</b>
<b>St. George Field Office Administrative Boundary Area<sup>3</sup></b>		
Hydroelectric System Penstock	173	173
Hydroelectric System Facility	2	2
Transmission Line <sup>5</sup>	55	55
Access Road	2	2
Reservoir	261	261
<b>Subtotal Impact Area (acres)</b>	<b>493</b>	<b>493</b>
<b>TOTAL IMPACT AREA (acres)</b>	<b>657</b>	<b>833</b>

**Notes:**

<sup>1</sup>Gypsiferous soils identified in NRCS-published soil surveys containing  $\geq 5$  percent gypsum and have potential for developing biological soil crusts or are documented to have biological soil crusts (BLM 2014)

<sup>2</sup>LPP Rights-of-Way include construction rights-of-way for pipelines (150 feet wide), penstocks (150 feet wide), hydroelectric system facilities (facility footprint plus 100-foot wide buffer), transmission lines (100 feet wide), access roads (30 feet wide), staging areas (footprint plus 100-foot wide buffer), and reservoirs (reservoir facility footprint plus 100-foot wide buffer)

<sup>3</sup>Administrative boundaries include BLM-administered land, state lands, and private lands where they occur

<sup>4</sup>Administrative boundary includes all land within Kaibab-Paiute Indian Reservation boundary

<sup>5</sup>Includes two temporary construction staging areas with impacts on gypsiferous soils along one transmission line in the St. George Field Office administration boundary area

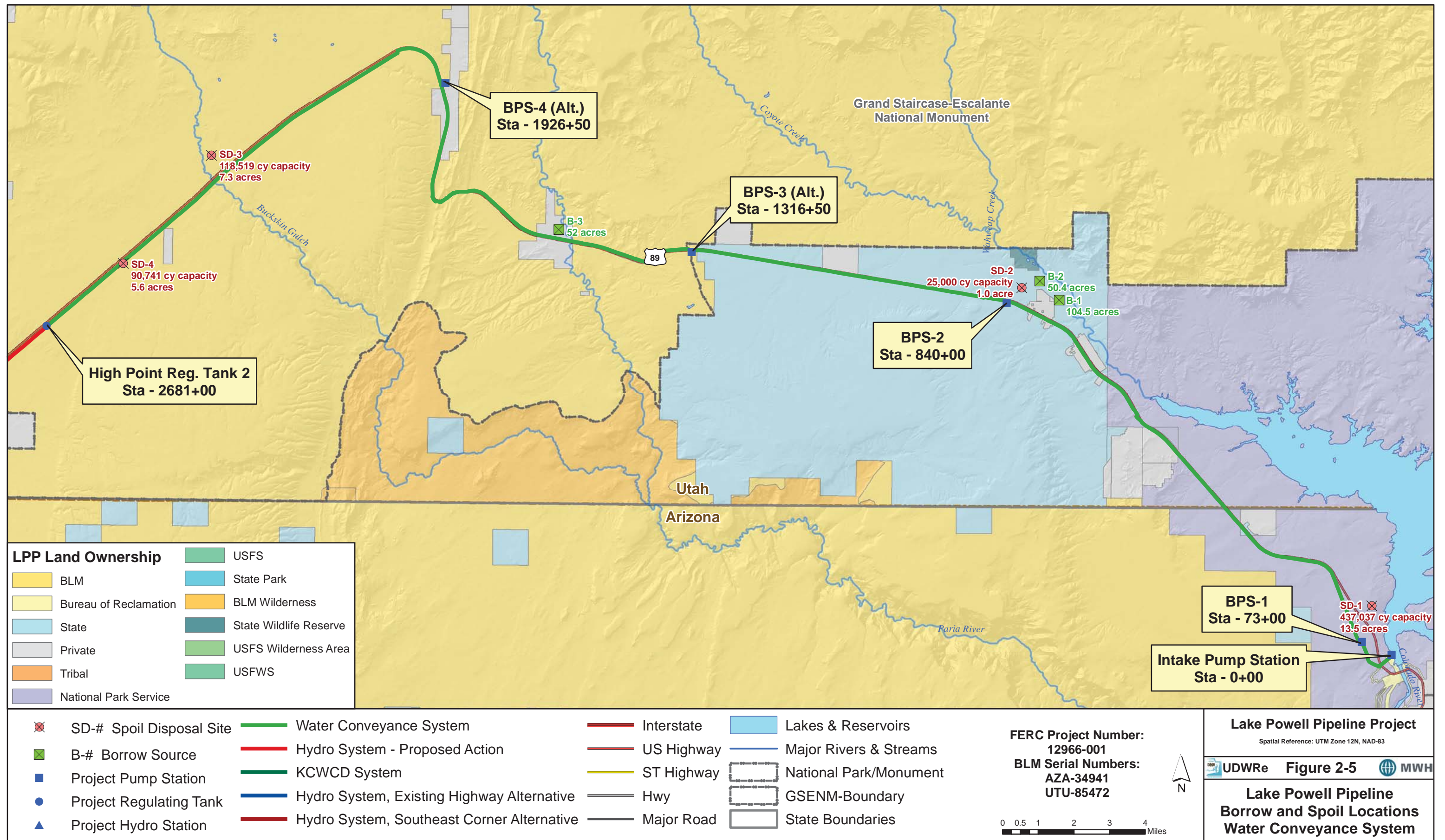
**BLM 522**

The first paragraph in Section 5.3.1.2.4.7, Chapter 5, Exhibit E of the License Application is revised to read: **The Existing Highway Alternative could have measurable effects on borrow material development for pipeline and penstock bedding. Rock excavated along the alignment and from road cuts that would be suitable for crushing and bedding would meet 42.2 percent of the pipeline and penstock bedding requirements (assuming 75 percent of blasted rock is usable for pipe bedding), and approximately 1,223,300 cubic yards of bedding material would need to be developed from excavated soil along the alignment. If there is insufficient suitable soil for this volume of bedding, the deficit would need to be imported from commercial gravel pits. If the volume of soil suitable for bedding is insufficient to meet the needs of bedding construction, the Existing Highway Alternative would require expanding or developing additional gravel resources by as much as 1.223 million cubic yards to meet construction demands for the LPP pipeline and penstock alignments. If this occurs, the bedding material requirements and the associated land disturbance under the Existing Highway Alternative would be a significant effect on existing commercial gravel pits and currently undisturbed land areas suitable for producing construction bedding materials. Three existing commercial gravel pits (see B-1 and B-3 on attached Figure 2-5, and see B-5 on attached Figure 2-6) would have available rock materials to meet borrow needs for pipeline and penstock bedding. Fifty acres in the three commercial gravel pits would be newly disturbed: 7 acres in pit B-1; 6 acres in gravel pit B-3; and 37 acres in gravel pit B-5.**

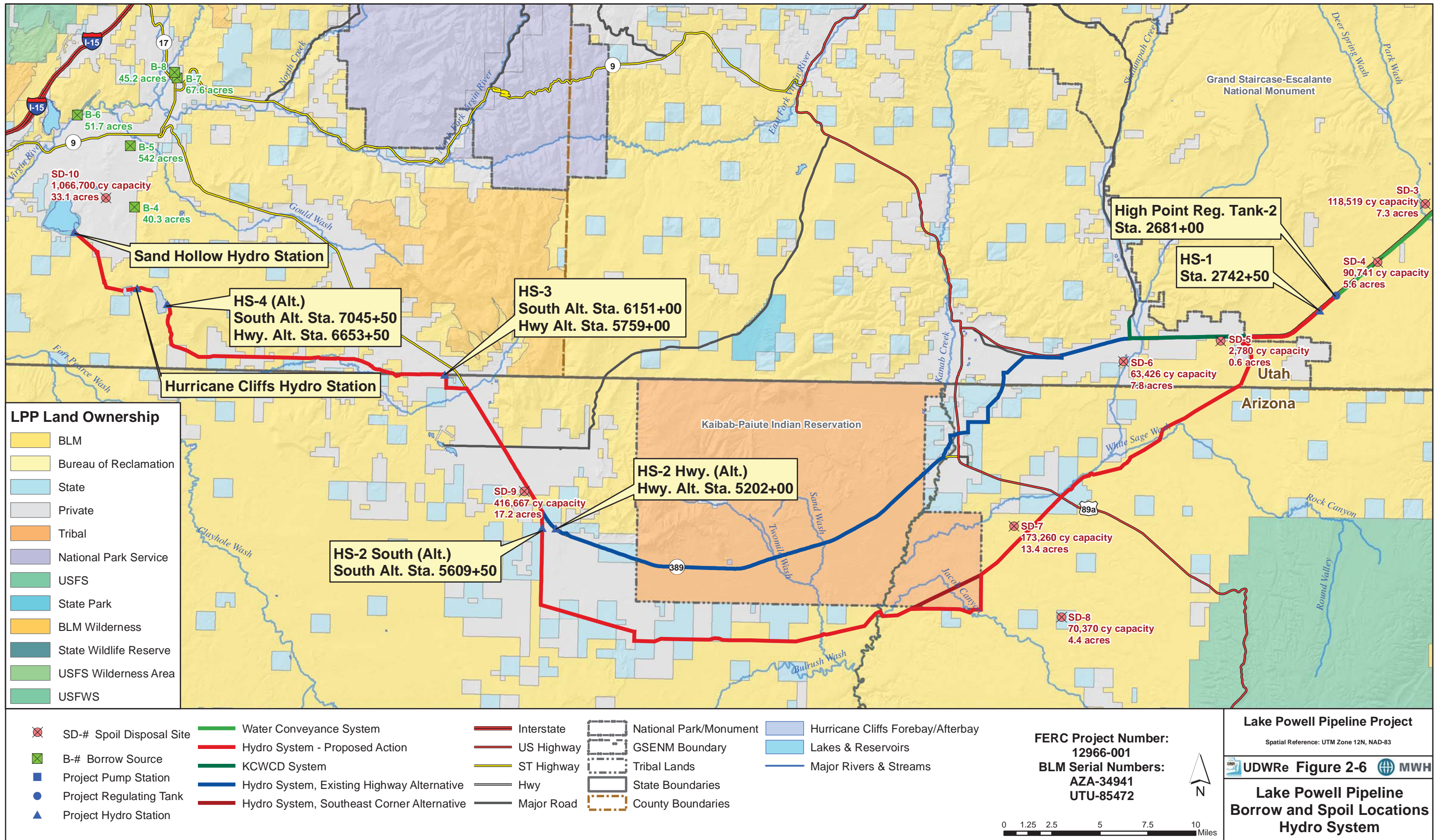
The second paragraph in Section 5.3.1.2.4.7 is revised to read: **The volumes of material generated (neat lines excluding expansion) in cubic yards are summarized below:**

- **Blastable** **732,800**
- **Rippable** **1,655,300**
- **Mixed Soil over Blastable** **452,400 (293,600 soil – 158,800 rock)**
- **Mixed Soil over Rippable** **599,700 (389,200 soil – 210,500 rock)**
- **Excavatable** **2,696,400**











**BLM 668**

The fifth paragraph of Section 5.3.4.2.5, Chapter 5, Exhibit E of the License Application is revised to read: **Therefore, the No Lake Powell Water Alternative may indirectly result in violation of applicable surface water quality standards for temperature and cause substantial degradation of surface water quality for beneficial uses. This would be a significant effect on water quality in the Virgin River.**

The following sections in this comment response contain additional evaluation of No Lake Powell Water Alternative effects on Virgin River flows and temperatures.

**Virgin River Flows**

Natural Virgin River mean monthly flows are significantly reduced in the reach downstream from Washington Fields Diversion, especially during June through February (Table 1). Mean monthly flows then successively increase after that reach because of irrigation return flows and non-sewered residential outdoor irrigation return flows (Table 1). UDWR agrees the majority of groundwater recharge into the overall Virgin River basin and discharge to the Virgin River occurs upstream from the St. George metropolitan area. Residential outdoor irrigation non-sewered return flows, however, along with secondary water return flows constitute a significant portion of Virgin River flow during the months of June through February in the reach downstream from the Washington Fields Diversion.

Table 1 Virgin River Daily Simulation Model Flow Results for 2052 with Existing Facilities and Projected Climate Change												
Location on Virgin River	Virgin River Mean Monthly Flows (cfs) for Water Year Months											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Highway 9 Bridge	96	95	116	112	132	235	296	253	103	92	97	103
Washington Fields Diversion	11	9	30	36	46	149	210	167	17	6	11	17
South Mall Drive Bridge	40	46	75	78	100	199	253	201	46	31	36	43
Interstate 15 Bridge	58	68	110	118	149	259	291	231	68	47	52	60
Utah/Arizona State Line	61	76	117	123	154	262	291	231	68	47	52	61

**Note:**  
Data is summarized from simulated mean monthly flows from UDWR's Virgin River Daily Simulation Model shown in Table 5-24 in Section 5.3.3.2.2.2, Chapter 5, Exhibit E of the License Application.

**Virgin River Recharge from Non-Sewered Return Flows**

An analysis of Washington County urban area soil depths indicates that 59 percent of the soils within the urban areas comprised by the six St. George metropolitan area cities have shallow soils with depths to bedrock less than 5 feet. The 1977 soil survey indicates all soils within the urban area are classified as well-drained or excessively well-drained, which means water flows through the soils quickly. The bedrock in the Washington County urban areas is characterized in the 1977 soil survey as being relatively flat and gently sloping toward the south. The Virgin River is the low point in the valley and surface water, shallow subsurface water, and discharging groundwater all flow to the river. Therefore, water applied to outdoor landscapes drains quickly through the relatively shallow soils to the bedrock, where it flows vertically and then laterally across the bedrock surface toward the Virgin River.

UDWR reported potable water use for 2010 is 41,875 acre-feet, including 23,542 acre-feet of residential indoor use and commercial, institutional and industrial/stock water purposes. Subtracting the 23,542 acre-feet from the total 41,875 acre-feet yields 18,333 acre-feet of estimated residential outdoor potable water use in 2010. A portion of the commercial, institutional, and industrial/stock water use (4,401 acre-feet) is estimated to also be used for outdoor watering. UDWR hydrologists estimate that 50 percent of the residential outdoor potable water use is consumed through evapotranspiration, surface evaporation, and storage as soil moisture. The remaining 50 percent (9,167 acre-feet) is estimated by UDWR to be non-

sewered return flow to the Virgin River (i.e. shallow subsurface water or “groundwater”). This non-sewered return flow to the Virgin River equals an average of 12.7 cfs continuous flow throughout 2010.

These 50 percent values are consistent with data in the Soil Conservation Service 1977 Soil Survey of Washington County and the Utah Agricultural Experimental Station 2011 Crop and Wetland Consumptive Use and Open Water Surface Evaporation for Utah Final Report. The 2011 Utah Agricultural Experiment Station report estimates evapotranspiration in the St. George area to average 37.9 inches of water per year (3.16 feet per year average for turfgrass). The 2015 residential outdoor watering area in urban Washington County as analyzed using GIS data is estimated at 3,371 acres. Projecting the 2010 estimated residential outdoor water use to 2015 results in 21,466 acre-feet per year, and the total water use in feet (21,466 acre-feet per year/3,371 acre) is 6.37 feet per year. Therefore, the estimated value of residential outdoor water use returning as non-sewered return flow to the Virgin River is 3.21 feet per year (6.37 feet minus 3.16 feet of evapotranspiration), which equals the UDWRe estimate of 50 percent of outdoor water use returning as non-sewered return flow to the Virgin River.

#### ***Effects of No Lake Powell Water Alternative Operation on Virgin River Flows***

UDWRe hydrologists project that by 2050 the 50 percent non-sewered return flow to the Virgin River will be reduced to 30 percent due to a decrease in water applied to outdoor landscapes as water conservation measures are implemented. Projecting the 2010 potable water use to 2052 (when LPP water is estimated to be fully consumed by the projected population) results in projected total potable water use of 130,245 acre-feet per year, including 73,521 acre-feet per year for indoor residential use and commercial, institutional, and industrial/stock water purposes. Using the same computations as used for 2010 and a 30 percent non-sewered return flow rate, the recharge occurring as residential outdoor non-sewered return flow to the Virgin River is projected at 17,017 acre-feet per year, equivalent to 23.5 cfs continuous flow throughout 2052.

Residential outdoor watering in the St. George metropolitan area generally occurs from March through October, and depending on the return flow distance to the Virgin River from application of residential landscape irrigation, a lag time for non-sewered return flows ranging from two to four months is expected to occur. Calculating non-sewered return flows from residential outdoor potable water use to occur from June through February, the 17,017 acre-feet discharged to the Virgin River would be a continuous flow of 35.0 cfs. Approximately 30 percent of the urban St. George metropolitan area that generates non-sewered return flows to the Virgin River occurs upstream from the Washington Fields Diversion; therefore, approximately 24.5 cfs (70 percent of 35.0 cfs) would return to the Virgin River as non-sewered return flow downstream of Washington Fields Diversion from June through February.

Under the No Lake Powell Water Alternative, the non-sewered return flows to the Virgin River would be reduced by eliminating residential outdoor watering. Table 2 demonstrates the potential effect of removing non-sewered return flows to the Virgin River during the June through February period under the No Lake Powell Water Alternative.

**Table 2**  
**Effects of No Lake Powell Water Alternative Operation on Removing Non-Sewered Return Flows by Eliminating Residential Outdoor Irrigation with Potable Water Using Virgin River Daily Simulation Model Flow Results for 2052 with Existing Facilities and Projected Climate Change**

Location on Virgin River	Estimated Virgin River Mean Monthly Flows (cfs) for Water Year Months <sup>1</sup>											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Highway 9 Bridge <sup>2</sup>	85	84	105	101	121	235	296	253	92	81	86	92
Washington Fields Diversion <sup>3</sup>	4	2	23	29	39	149	210	167	10	*3	4	10
South Mall Drive Bridge <sup>4</sup>	21	27	56	59	81	199	253	201	27	12	17	24
Interstate 15 Bridge <sup>5</sup>	33	43	85	93	124	259	291	231	43	22	27	35
Utah/Arizona State Line <sup>6</sup>	36	51	92	98	129	262	291	231	43	22	27	36

**Notes:**

- <sup>1</sup> Assumes effects of No Lake Powell Water Alternative operation occur on non-sewered return flows to Virgin River from June through February
- <sup>2</sup> Assumes 30 percent of 35 cfs non-sewered return flows from residential outdoor potable water use occurs upstream of Washington Fields Diversion
- <sup>3</sup> Virgin River flow would be zero; however, estimated outdoor use of potable water for commercial, institutional and industrial/livestock water purposes of 13,670 acre-feet per year in 2052 would occur at a 30 percent non-sewered return flow rate, resulting in approximately 2 cfs (20 percent of 8.5 cfs) of non-sewered return flow to the Virgin River between La Verkin and the Utah/Arizona state line from June through February
- <sup>4</sup> Assumes 20 percent of 35 cfs non-sewered return flows from residential outdoor potable water use occurs between Washington Fields Diversion and South Mall Drive Bridge
- <sup>5</sup> Assumes 55 percent of 35 cfs non-sewered return flows from residential outdoor potable water use occurs between Washington Fields Diversion and Interstate 15 Bridge
- <sup>6</sup> Assumes 70 percent of 35 cfs non-sewered return flows from residential outdoor potable water use occurs between Washington Fields Diversion and Utah/Arizona State Line

***Effects of No Lake Powell Water Alternative Operation on Virgin River Temperatures***

Water applied to residential outdoor landscapes that discharge as non-sewered return flow is affected by soil temperatures. The Natural Resources Conservation Service (NRCS) classifies the St. George metropolitan area as having thermic soil characteristics, where the mean annual soil temperature is 15°C (59°F) or higher but lower than 22°C (71°F), and the difference between mean summer and mean winter soil temperatures is more than 5°C (41°F) at a depth of approximately 20 inches. The temperature of water delivered from Quail Creek Water Treatment Plant during the outdoor irrigation season (March through October) ranges from 11.1°C (52°F) to 25.9°C (79°F) and is not expected to increase during distribution through underground piping. When the potable water is applied to outdoor landscapes during the outdoor irrigation season, the temperature increases upon contact with vegetation and near surface soil. Outdoor water use that infiltrates into the soil and becomes shallow subsurface water during the high air temperature months (June through September) is cooled by the lower soil temperatures (<22°C, <71°F), especially in soils deeper than 15 to 20 inches.

Virgin River water temperature data at USGS gage 09413500 (Virgin River near St. George, Utah) show a range of 15.5°C (60°F) to 28.7°C (84°F) during the months June through September. The non-sewered return flow of residential outdoor potable water use during these months acts to cool the shallow subsurface water to between 15°C (59°F) and 22°C (71°F). When this water discharges to the Virgin River, it cools the river flow through mixing, especially during periods when the river water temperatures are above 22°C (71°F).

Elimination of residential outdoor watering under the No Lake Powell Water Alternative would reduce the non-sewered return flow to the Virgin River by an estimated 77 to 80 percent, and would increase river water temperatures compared to baseline conditions. The temperature increases would be highest in the reach downstream from the Washington Fields Diversion where the river flow would be <5 cfs in July and August (Table 2). The Virgin River at these extremely low flows would be more vulnerable to heating by direct sunlight and high air temperatures.



The Utah water quality standard for temperature in the Virgin River downstream from Quail Creek Diversion Dam is 20°C (68°F). Under baseline conditions, measured Virgin River water temperatures at the Utah/Arizona state line have been below 20°C (68°F) during 46 percent of the sampling events between October 1969 and June 2017. Water temperature measurements during the same period at the same site have been below 20°C (68°F) 16 percent of the sampling events during the months June through September. The reduced river flows downstream of Washington Fields Diversion under the No Lake Powell Water Alternative could experience increased water temperatures above the Utah water quality standard for temperature during the months of July and August and likely during other months.

#### **BLM 694**

The effects of the No Lake Powell Water Alternative were discussed during the meeting between BLM and UDWR on March 17, 2017. Based on these discussions we understand that BLM's primary concern is that USGS documents cited in the analysis of changes to urban groundwater recharge appear to contradict the conclusions of the groundwater impact analysis in the environmental report. The impact analysis for the alternative is based on localized recharge of the shallow subsurface soils in the vicinity of the urban irrigation and describes the potential effects of changes to this groundwater resource from the alternative. UDWR agrees with BLM that these site-specific changes in groundwater conditions are not in total agreement with conditions described in the two USGS reports. We recognize these differences do exist and suggest the cited USGS documents describe groundwater conditions at a different scale than is described in the impact analysis for the alternative as the reason for the differences.

The following sentence is added as the first sentence of Section 5.3.5.2.5, Chapter 5, Exhibit E of the License Application: **The effects of the No Lake Powell Water Alternative presented below are localized, anthropomorphic changes imposed in addition to other natural and man-made conditions described in other reports.**

The Groundwater-Surface Water Interactions paragraph in Section 5.3.5.2.5.1, Chapter 5, Exhibit E of the License Application is revised to read: **The No Lake Powell Water Alternative would lead to an elimination of culinary water use for outdoor landscapes that would then in turn reduce groundwater discharge to surface water (i.e. Virgin River and its tributaries) throughout the urban portion of the St. George metropolitan area. The reduced groundwater discharge to surface waters would result in less groundwater-surface water interactions in the St. George metropolitan area and that could lead to reduced flows in the Virgin River and its tributaries.**

### **BLM 718**

The following two paragraphs added to Section 5.3.6.2.2, Chapter 5, Exhibit E of the License Application: **The Proposed Action construction would have no measurable effects on aquatic resources in Kanab Creek, the Virgin River, and Sand Hollow Reservoir. Construction would be performed during one of the periods when Kanab Creek is dry and has no surface flow. The Proposed Action would have no short term effects on aquatic resources in the Virgin River during construction because no construction would be performed in or near the river. Proposed Action construction would terminate at the east shoreline of Sand Hollow Reservoir, more than four miles from the Virgin River. Proposed Action construction would have no measurable effects on aquatic resources in Sand Hollow Reservoir because construction would be performed above the reservoir water surface along the east shoreline, with BMPs and SCPs for sediment control in place to avoid sediment recruitment to the reservoir.**

**The Proposed Action operation would have no measurable effects on aquatic resources in Kanab Creek, the Virgin River, and Sand Hollow Reservoir. Temporary discharges from the penstock into Kanab Creek during some years to drain the adjacent penstock segment would persist less than one week during a period when the creek typically has no flow and no aquatic resources are present. The Proposed Action operation would not directly discharge any LPP water into the Virgin River, and the LPP would have no measurable effect on Virgin River flows throughout the St. George metropolitan area. The Proposed Action flows into Sand Hollow Reservoir during operation would have marginally lower TDS concentrations, similar dissolved oxygen concentrations, and similar water temperatures resulting in no measurable effects on aquatic resources in the reservoir.**



## **BLM 721**

Section 5.3.6.2.6 - No Action Alternative, Chapter 5, Exhibit E of the License Application is revised to read:

**The No Action Alternative would not supply water from Lake Powell to Washington County or Kane County. WCWCD's water supply from the Virgin River would be completely used by approximately 2028 and no additional water would be available to meet growing population demands, even with existing water conservation measures. Potable water shortages would occur each year following 2028. Residential outdoor watering and resulting shallow subsurface recharge and then discharge to the Virgin River from non-sewered return flows within the St. George metropolitan area would continue, maintaining riverine aquatic resource habitat conditions.**

**The No Action Alternative would have no effect on aquatic resources in the LPP study area as there would be no federal action requiring a water pipeline crossing of the Paria River and there would be no pipeline water releases to the Paria River which could risk aquatic biota transfer to the river. Existing aquatic resource conditions would continue subject to natural or other anthropogenic influences and factors.**

**The No Lake Powell Water Alternative would not supply water from Lake Powell to Washington County or Kane County, the same as the No Action Alternative. The No Lake Powell Water Alternative constitutes four primary actions:**

- 1) eliminate residential outdoor watering with potable water by repurposing the conserved water for indoor use only**
- 2) maximize treatment of wastewater effluent in an expanded wastewater reuse plant and reverse osmosis treatment for potable water use**
- 3) divert high-TDS Virgin River water at the Washington Fields Diversion and reverse osmosis treatment for potable water use**
- 4) construct an expanded Warner Valley Reservoir to store reuse effluent and diverted Virgin River water with high TDS concentrations prior to reverse osmosis treatment for potable water use**

**These actions would significantly reduce discharge from non-sewered return flows to the Virgin River in the St. George metropolitan area. Reduced discharge would reduce Virgin River streamflow during summer and fall months, reduce Virgin River streamflow downstream from the Washington Fields Diversion, and decrease the weighted usable aquatic resource habitat within the Virgin River flowing through the St. George metropolitan area.**

## **BLM 770**

The requested section re-organization of the aquatic special status species section is provided. All of the following sections, text and tables comprise the re-organized and simplified insert from Section 5.3.7.2 through Section 5.3.7.3, Chapter 5, Exhibit E of the License Application.

### **5.3.7.2 Environmental Effects**

This section analyzes LPP Project effects on federally listed threatened and endangered aquatic species and designated critical habitat, federal sensitive species, and state and local agency aquatic species of concern.

#### **5.3.7.2.1 Effects Determinations and Significance Criteria.**

*NO CHANGE IS PROPOSED FOR THIS SECTION*

#### **5.3.7.2.2 Proposed Action.**

##### ***5.3.7.2.2.1 Threatened, Endangered and Candidate Species.***

#### **Apache Trout**

Apache trout (*Oncorhynchus apache*) is historically and currently distributed in rivers and streams that would not be directly or indirectly affected by Proposed Action or LPP alternative construction or operation. The Verde River and several tributary streams including North Canyon on the Kaibab National Forest are the closest habitat and location of known populations, which extend into southern Coconino County south of the Grand Canyon. The Proposed Action and LPP alternative features would cross through the northern half of Coconino County north of the Grand Canyon. The Proposed Action and LPP alternative construction and operation would have no effect on Apache trout or its habitat. Potential effects of the Proposed Action and LPP alternatives on Apache trout and its habitat are eliminated from further analysis.

#### **Kanab Ambersnail**

Kanab ambersnail (*Oxyloma haydeni kanabensis*) is currently distributed in three known locations, including two springs within the Grand Canyon and at springs near Three Lakes six miles north of Kanab, Utah. The Proposed Action and LPP alternative construction would not occur within ten miles of any known Kanab ambersnail population. Proposed Action and LPP alternative operation would not measurably affect Colorado River flows in the Grand Canyon and would not affect the spring flows at known population locations. The Proposed Action and LPP alternative construction and operation would have no effect on Kanab ambersnail or its habitat. Potential effects of the Proposed Action and LPP alternatives on Kanab ambersnail and its habitat are eliminated from further analysis.

#### **Colorado River Listed Species**

##### ***Construction Effects***

Construction activities in Lake Powell would occur at the Water Intake System approximately 2,100 feet northwest of Glen Canyon Dam on the right bank of the reservoir. These construction activities would include completion of six horizontal borings with a six-foot diameter micro-tunnel boring machine (MTBM) at three elevations within Lake Powell. Each time the MTBM completes a tunnel excavation through the Navajo sandstone bedrock, the MTBM breakthrough would cause approximately 0.5 cubic yard of sandstone rock to fall into Lake Powell. The MBTM would be attached to a cable and hoisted up through the water to a barge for transport to Wahweap Marina and reuse for excavating the next tunnel at the intake site.

The four Colorado River federally listed fish species include bonytail chub (*Gila elegans*), Colorado pikeminnow (*Ptychocheilus lucius*), humpback chub (*Gila cypha*), and razorback sucker (*Xyrauchen texanus*). Two of these species (Colorado pikeminnow and razorback sucker) are documented in Lake Powell in the San Juan arm, near the San Juan River confluence with the reservoir. Critical habitat for Colorado pikeminnow, humpback chub, and razorback sucker is designated in the San Juan arm of Lake Powell at Neskahai Canyon, approximately 83 river miles upstream from the LPP water intake site, and extends upstream into the San Juan River. Critical habitat for bonytail chub and humpback chub is designated in the upper Colorado River approximately 139 river miles upstream from the LPP water intake site, and extends upstream in the Colorado River. The minimum distance of at least 83 miles from the water intake site to documented occurrence of these species in Lake Powell supports the conclusion that LPP construction activities would have no effect on the listed species. The minimum distance of at least 83 miles from the water intake site to their critical habitat supports the conclusion that LPP construction activities would have no effect on the designated critical habitats.

Downstream releases from Lake Powell through Glen Canyon Dam to the Colorado River in Glen Canyon would occur during the LPP water intake construction. The MTBM breakthrough from the Navajo sandstone bedrock tunnel excavations into the reservoir would not result in measurable turbidity or other water quality effects in the Colorado River downstream of Glen Canyon Dam. There would be no effect on the Colorado River federally listed fish species or their designated critical habitat downstream from Glen Canyon Dam.

The reach of the lower Paria River which maintains perennial stream flow without interruption and contains suitable habitat for federally listed aquatic species is located miles downstream from Highway 89 where the Proposed Action and alternative alignments would cross the river. The federally listed aquatic species known to inhabit the lower Paria River is razorback sucker (*Xyrauchen texanus*). The Paria River is listed as a perennial stream by the U.S. Geological Survey (USGS), however, the USGS streamflow records for the Paria River at Highway 89 demonstrate the river has sustained periods during the summer months when there is no flow. The only potential effect of the temporary construction on the Paria River would be changes in water quality that could affect fish and habitat in downstream reaches. Construction of the pipeline crossing of the Paria River at Highway 89 would be performed during the summer period when there is no flow or low flow to avoid effects on surface water quality (turbidity and sediment transport). If the Paria River has low flows during the temporary construction of the pipeline crossing, then a temporary cofferdam would be constructed to divert the flow to another part of the 340-foot wide river bottom to avoid active construction in the flowing portion of the river. The Paria River channel bed and banks would be restored to original conditions following the temporary construction activities. Construction of transmission lines across the lower Paria River would have no effect on razorback chub or its designated critical habitat. The LPP construction would have no effect on razorback chub or its critical habitat in the lower Paria River. More detailed stream flow information, data and analyses are provided in the final Surface Water Resources Study Report (UBWR 2016a). More detailed water quality information, data and analyses are provided in the final Surface Water Quality Study Report (UDWRe 2016b)

### ***Operations and Maintenance Effects***

The proposed LPP diversions and depletion from Lake Powell could potentially affect federally listed aquatic resource species and critical habitats in the Colorado River downstream from Glen Canyon Dam. The federally listed species with critical habitat downstream of Glen Canyon Dam include bonytail chub, Colorado pikeminnow, humpback chub, and razorback sucker. Measurable changes in Glen Canyon Dam releases and water quality could affect these listed species and their designated critical habitat.

UDWRe contracted with the Department of the Interior's designated expert agency, the Bureau of Reclamation (Reclamation) to simulate the potential effects of the LPP diversions and depletion from



Lake Powell on reservoir levels, Glen Canyon Dam releases, and water quality in Lake Powell and in releases from Glen Canyon Dam. Reclamation performed multiple hydrologic modeling runs using their long-term planning model, CRSS. The results of these model runs were provided to UDWR for use in its planning studies for the LPP to determine potential effects on the hydrology of the Colorado River system. Reclamation also provided water quality modeling results to UDWR for use in its planning studies for the LPP to determine potential effects on water quality of the Colorado River system. The results of hydrologic and water quality modeling runs are summarized in Section 5.3.3 and Section 5.3.4 of this Chapter 5, Exhibit E of the License Application.

**Summary of Potential Hydrologic Effects - Lake Powell Elevations.** The LPP operations effects on Lake Powell elevations under DNF inflow hydrology at the 90<sup>th</sup>, 50<sup>th</sup> and 10<sup>th</sup> percentile probabilities would be within the normal operation fluctuations of the reservoir. There would be no measurable effects on the federally listed Colorado River fishes or their designated critical habitat upstream of the LPP water intake site. The LPP operations effects on Lake Powell elevations under CC inflow hydrology at the 90<sup>th</sup> and 50<sup>th</sup> percentile probabilities would be within the normal operation fluctuations of the reservoir. There would be no measurable effects on the federally listed Colorado River fishes or their designated critical habitat upstream of the LPP water intake site. The LPP operations effects on Lake Powell elevations under CC inflow hydrology at the 10<sup>th</sup> percentile probability would be substantially below the minimum power pool elevation because of the effect of CC inflow hydrology, and these conditions would affect designated critical habitat for the federally listed Colorado River fish in the San Juan arm of Lake Powell and at the confluence of the Dirty Devil River with the Colorado River.

**Summary of Potential Hydrologic Effects - Glen Canyon Dam Releases.** Flow release differences under DNF inflow hydrology would be within normal operation release fluctuations and there would be no measurable flow effects on the federally listed Colorado River fishes or their designated critical habitat downstream from Glen Canyon Dam. Flow release differences under CC inflow hydrology between the Proposed Action and No Action alternative would be within normal operation release fluctuations and there would be no measurable flow effects on the federally listed Colorado River fishes or their designated critical habitat downstream from Glen Canyon Dam.

**Summary of Potential Water Quality Effects – Lake Powell and Glen Canyon Dam Releases. -** Reclamation water quality modeling of Lake Powell and Glen Canyon Dam releases demonstrate that the water quality effects of the Proposed Action and LPP alternatives would not be measurable, especially within the variation of conditions resulting from Glen Canyon Dam water releases. Reclamation water quality modeling results indicate that the Proposed Action and LPP alternatives would not measurably or adversely affect water quality in the Colorado River downstream from Glen Canyon Dam. The Proposed Action and LPP alternatives would have no effect on the four listed fish species in the Colorado River and would have no effect on their critical habitat. The potential water quality effects of the Proposed Action and LPP alternatives on the listed aquatic species and their critical habitat in the Colorado River are eliminated from further analysis.

**Interbasin Transfer of LPP Water to Tributaries.** Interbasin transfer of LPP water from Lake Powell to tributaries such as the Paria River with downstream federally listed species and designated critical habitat could occur through a pipeline and could result in transfer of undesirable and invasive aquatic organisms from the upper Colorado River basin to the Paria River basin. However, no LPP water would be discharged into the Paria River or any of its tributary streams as part of regular operation. All of the LPP water conveyed through the pipeline would flow into Sand Hollow Reservoir for the specific purpose of providing municipal and industrial (M&I) raw water supply for treatment in a water treatment facility and distribution as culinary water. The LPP would be designed to avoid transfer of aquatic organisms from Lake Powell to tributaries crossed by the pipeline. The intake water would be dosed with an EPA-approved molluscicide in the intake tunnels and passed through 25-micron filters in the intake pump

station (or other approved action would be taken) to remove undesirable and invasive aquatic organisms from the diverted water. Inspection and maintenance shutdowns of the LPP during two weeks in January each year could result in temporary release of LPP water to the Paria River through a manual drain valve at the Highway 89 crossing. This temporary water release to the Paria River could occur at 5 cfs for 4.5 days during winter periods with historical river flows at the Highway 89 gage ranging from 20 to 260 cfs and would not result in measurable flow changes in the lower Paria River where razorback sucker and designated critical habitat occur. There would be no measurable effects on razorback sucker or designated critical habitat in the lower Paria River from LPP operation and maintenance resulting from potential interbasin transfer of water, and no effects from invasive aquatic species resulting from pipeline drainage release of LPP water in the Paria River.

**Paria River Effects.** The LPP would not deliver or discharge any water to the Paria River under daily operations. Inspection and maintenance shutdowns of the LPP during two weeks in January each year could result in temporary release of LPP water to the Paria River through a manual drain valve at the Highway 89 crossing. This temporary water release to the Paria River could occur at 5 cfs for 4.5 days during winter periods with historical river flows at the Highway 89 gage ranging from 20 to 260 cfs and would not result in measurable flow changes in the lower Paria River where razorback sucker and designated critical habitat occur. There would be no measurable effects on razorback sucker or designated critical habitat in the lower Paria River from LPP operation and maintenance temporary drainage water releases from the pipeline.

### ***Effects Summary***

LPP construction would have no measurable effects on documented occurrence of federally listed fish species or their designated critical habitat at a minimum of 83 river miles upstream of the water intake site. LPP construction would have no measurable effects on documented occurrence of federally listed fish species or their designated critical habitat downstream of Glen Canyon Dam. LPP operation and maintenance would have no measurable effects on documented occurrence of federally listed fish species or their designated critical habitat at a minimum of 83 river miles upstream of the water intake site. LPP operation and maintenance would have no measurable effects on documented occurrence of federally listed fish species or their designated critical habitat downstream of Glen Canyon Dam. LPP operation and maintenance would have no measurable effects on razorback sucker or its designated critical habitat in the lower Paria River.

### **Virgin River Listed Species**

#### ***Construction Effects***

LPP construction would have no effect Virgin River listed species including Virgin River chub (*Gila seminuda* (=robusta)) and woundfin (*Plagopterus argentissimus*) or their designated critical habitat because the construction activities would terminate at the east edge of Sand Hollow Reservoir with construction of the Sand Hollow Hydro Station. The LPP construction activities at Sand Hollow Reservoir would be more than four miles east of the Virgin River.

#### ***Operations and Maintenance Effects***

Critical habitat for Virgin River chub (*Gila seminuda* (=robusta)) and woundfin (*Plagopterus argentissimus*) in the Virgin River would not be directly or indirectly affected by the LPP operation. LPP operation would supply raw water to Sand Hollow Reservoir for conveyance to and treatment in the Quail Creek Water Treatment Plant before distribution throughout the WCWCD service area. Following use in homes, businesses and institutions, the wastewater would be treated in wastewater treatment facilities and then further treated in the wastewater reclamation facility for reuse as secondary irrigation water. This water would be stored in existing and approved reservoirs in the St. George metropolitan area and used for outdoor watering. UDWR has modeled the Virgin River using the Virgin River Daily Simulation Model (VRDSM) for future scenarios involving no LPP water and with LPP water to determine the

potential for return flows to the Virgin River that could potentially affect designated critical habitat and riparian areas. The VRDSM results indicate that LPP return flows to the Virgin River would be within the measurement accuracy of the USGS gages on the Virgin River and changes in river flows would not be measurable. The VRDSM model results demonstrate no measurable changes (increases or decreases) in streamflows from the USGS gage at Virgin to the USGS gage near the Utah-Arizona state line by comparison of base case (full utilization of Virgin River water rights with current facilities) and LPP water deliveries to Sand Hollow Reservoir. Flow duration curves at key simulation nodes in the Virgin River compared between the future without the LPP and future with the LPP are statistically identical, indicating there would be no measurable difference in return flows to the river (see Section 5.3.3.2.2.2 in this chapter). The LPP operation would have no effect on Virgin River chub or woundfin and would have no effect on critical habitat for Virgin River chub and woundfin. A detailed description and analysis of the VRDSM model results is included in the final Surface Water Resources Study Report (UDWRe 2016a).

### ***Effects Summary***

LPP construction would have no direct or indirect effects on federally listed fish species or their critical habitat in the Virgin River. LPP operation would have no direct effects on federally listed fish species or their critical habitat in the Virgin River. LPP operation would not have any measurable indirect effects on federally listed fish species or their critical habitat in the Virgin River.

### ***5.3.7.2.2.2 Sensitive Species and Species of Concern.***

#### **Paria River Fishes**

##### ***Construction Effects***

The reach of the lower Paria River which maintains perennial stream flow without interruption and contains suitable habitat for aquatic sensitive species and aquatic species of concern is located miles downstream from Highway 89 where the Proposed Action and alternative alignments would cross the river. The sensitive and aquatic species of concern known to inhabit the lower Paria River include flannelmouth sucker (*Catostomus latipinnis*), bluehead sucker (*Catostomus discobolus*) and speckled dace (*Rhinichthys osculus reliquus*). The Paria River is listed as a perennial stream by the U.S. Geological Survey (USGS), however, the USGS streamflow records for the Paria River at Highway 89 demonstrate the river has sustained periods during the summer months when there is no flow. The only potential effect of the temporary construction on the Paria River would be changes in water quality that could affect fish and habitat in downstream reaches. Construction of the pipeline crossing of the Paria River at Highway 89 would be performed during the summer period when there is no flow or low flow to avoid effects on surface water quality (turbidity and sediment transport). If the Paria River has low flows during the temporary construction of the pipeline crossing, then a temporary cofferdam would be constructed to divert the flow to another part of the 340-foot wide river bottom to avoid active construction in the flowing portion of the river. The Paria River channel bed and banks would be restored to original conditions following the temporary construction activities. Construction of transmission lines across the lower Paria River would have no effect on flannelmouth sucker, bluehead sucker or speckled dace. The transmission lines would span across the Paria River canyon from towers constructed more than 200 feet from the canyon edge. The LPP construction would have no effect on flannelmouth sucker, bluehead sucker and speckled dace or their habitat in the lower Paria River. More detailed stream flow information, data and analyses are provided in the final Surface Water Resources Study Report (UBWR 2016a). More detailed water quality information, data and analyses are provided in the final Surface Water Quality Study Report (UDWRe 2016b)

##### ***Operations and Maintenance Effects***

The LPP would not deliver or discharge any water to the Paria River under daily operations. Inspection and maintenance shutdowns of the LPP during two weeks in January each year could result in temporary release of LPP water to the Paria River through a manual drain valve at the Highway 89 crossing. This

temporary water release to the Paria River could occur at 5 cfs for 4.5 days during winter periods with historical river flows at the Highway 89 gage ranging from 20 to 260 cfs and would not result in measurable flow changes in the lower Paria River where sensitive and aquatic species of concern including flannelmouth sucker, bluehead sucker and speckled dace occur. There would be no measurable effects on flannelmouth sucker, bluehead sucker and speckled dace or their habitat in the lower Paria River from LPP operation and maintenance temporary drainage water releases from the pipeline.

### ***Effects Summary***

LPP construction would have no measurable effect on aquatic sensitive species and aquatic species of concern or their habitat in the lower Paria River. LPP operation and maintenance would have no measurable effects on aquatic sensitive species and aquatic species of concern or their habitat in the lower Paria River.

### **Virgin River Fishes**

#### ***Construction Effects***

LPP construction would have no effect Virgin River aquatic sensitive species and aquatic species of concern including desert sucker (*Castostomus clarkia*) and Virgin spinedace (*Lepidomeda mollispinus*) or their crucial habitat because the construction activities would terminate at the east edge of Sand Hollow Reservoir with construction of the Sand Hollow Hydro Station. The LPP construction activities at Sand Hollow Reservoir would be more than four miles east of the Virgin River.

#### ***Operations and Maintenance Effects***

Crucial habitat for desert sucker (*Castostomus clarkia*) and Virgin spinedace (*Lepidomeda mollispinus*) in the Virgin River would not be directly or indirectly affected by the LPP operation. LPP operation would supply raw water to Sand Hollow Reservoir for treatment in the Quail Creek Water Treatment Plant before distribution throughout the WCWCD service area. Following use in homes, businesses and institutions, the wastewater would be treated in wastewater treatment facilities and then further treated in the wastewater reclamation facility for reuse as secondary irrigation water. This water would be stored in existing and approved reservoirs in the St. George metropolitan area and used for outdoor watering. The UDWRe has modeled the Virgin River using the Virgin River Daily Simulation Model (VRDSM) for future scenarios involving no LPP water and with LPP water to determine the potential for return flows to the Virgin River that could potentially affect designated critical habitat and riparian areas. The VRDSM results indicate that LPP return flows to the Virgin River would be within the measurement accuracy of the USGS gages on the Virgin River and changes in river flows would not be measurable. The VRDSM model results demonstrate no measurable changes (increases or decreases) in streamflows from the USGS gage at Virgin to the USGS gage near the Utah-Arizona state line by comparison of base case (full utilization of Virgin River water rights with current facilities) and LPP water deliveries to Sand Hollow Reservoir. Flow duration curves at key simulation nodes in the Virgin River compared between the future without the LPP and future with the LPP are statistically identical, indicating there would be no measurable difference in return flows to the river (see Section 5.3.3.2.2.2 in this chapter). The LPP operation would have no effect on crucial habitat for desert sucker and Virgin spinedace. A detailed description and analysis of the VRDSM model results is included in the final Surface Water Resources Study Report (UDWRe 2016a).

### ***Effects Summary***

LPP construction would have no effects on aquatic sensitive species and aquatic species of concern or their crucial habitat in the Virgin River. LPP operation would have no direct effects on aquatic sensitive species and aquatic species of concern or their crucial habitat in the Virgin River. LPP operation would not have any measurable indirect effects on aquatic sensitive species and aquatic species of concern or their crucial habitat in the Virgin River.

### **5.3.7.2.3 Existing Highway Alternative.**

#### ***5.3.7.2.3.1 Threatened, Endangered and Candidate Species.***

The Existing Highway Alternative would have the same construction and operation and maintenance effects on federally listed threatened, endangered and candidate species as described for the Proposed Action in Section 5.3.7.3.2.1.

#### ***5.3.7.2.3.2 Sensitive Species and Species of Special Concern.***

The Existing Highway Alternative would have the same construction and operation and maintenance effects on aquatic sensitive species and aquatic species of concern as described for the Proposed Action in Section 5.3.7.3.2.2.

### **5.3.7.2.4 Southeast Corner Alternative.**

#### ***5.3.7.2.4.1 Threatened, Endangered and Candidate Species.***

The Southeast Corner Alternative would have the same construction and operation and maintenance effects on federally listed threatened, endangered and candidate species as described for the Proposed Action in Section 5.3.7.3.2.1.

#### ***5.3.7.2.4.2 Sensitive Species and Species of Special Concern.***

The Southeast Corner Alternative would have the same construction and operation and maintenance effects on aquatic sensitive species and aquatic species of concern as described for the Proposed Action in Section 5.3.7.3.2.2.

### **5.3.7.2.5 No Lake Powell Water Alternative.**

#### ***5.3.7.2.5.1 Threatened, Endangered and Candidate Species.***

The No Lake Powell Water Alternative construction could have direct effects on Virgin River chub (*Gila seminuda* (=robusta)) and woundfin (*Plagopterus argentissimus*) and their designated critical habitat in the Virgin River from pipeline crossings and upgrade of the Washington Fields diversion.

The No Lake Powell Water Alternative operation could have significant indirect effects on Virgin River chub and woundfin *and their designated critical habitat* in the Virgin River from reduced non-sewered return flows resulting from eliminating residential outdoor irrigation.

Virgin River chub in the Virgin River from Hurricane, Utah to the Utah-Arizona state line could be adversely affected by reduced streamflows, increased stream temperatures, and changes in food supply resulting from eliminating residential outdoor irrigation. Virgin River streamflows in the St. George metropolitan area would be reduced during the summer and fall months because of the reduced groundwater recharge from eliminating residential outdoor irrigation. Critical habitat for the Virgin River chub could be adversely affected by reduced streamflows and a diminished riparian corridor along both sides of the river. These effects could adversely affect Virgin River chub and its designated critical habitat.

Woundfin in the Virgin River from Hurricane, Utah to the Utah-Arizona state line could be adversely affected by reduced streamflows, increased stream temperatures, and changes in food supply resulting from eliminating residential outdoor irrigation. Virgin River streamflows in the St. George metropolitan area would be reduced during the summer and fall months because of the reduced groundwater recharge from eliminating residential outdoor irrigation. Critical habitat for woundfin could be adversely affected by reduced streamflows and a diminished riparian corridor along both sides of the river. These effects could adversely affect woundfin and its designated critical habitat.

#### **5.3.7.2.5.2 Sensitive Species and Species of Special Concern.**

The No Lake Powell Water Alternative construction could have direct effects on desert sucker (*Catostomus clarkii*) and Virgin spinedace (*Lepidomeda mollispinus*) and their crucial habitat in the Virgin River from pipeline crossings and upgrade of the Washington Fields diversion.

The No Lake Powell Water Alternative operation could have significant indirect effects on desert sucker and Virgin spinedace and their crucial habitat in the Virgin River from reduced non-sewered return flows resulting from eliminating residential outdoor irrigation.

Desert sucker in the Virgin River from Hurricane, Utah to the Utah-Arizona state line could be adversely affected by reduced streamflows, increased stream temperatures, and changes in food supply resulting from eliminating residential outdoor irrigation. Virgin River streamflows in the St. George metropolitan area would be reduced during the summer and fall months because of the reduced groundwater recharge from eliminating residential outdoor irrigation. Crucial habitat for desert sucker could be adversely affected by reduced streamflows and a diminished riparian corridor along both sides of the river. These effects could adversely affect desert sucker and its crucial habitat.

Virgin spinedace in La Verkin Creek and the Virgin River from Hurricane, Utah to the Utah-Arizona state line could be adversely affected by reduced streamflows, increased stream temperatures, and changes in food supply resulting from eliminating residential outdoor irrigation. Virgin River streamflows in the St. George metropolitan area would be reduced during the summer and fall months because of the reduced groundwater recharge from eliminating residential outdoor irrigation. Crucial habitat for Virgin spinedace could be adversely affected by reduced streamflows and a diminished riparian corridor along both sides of the river. These effects could adversely affect Virgin spinedace and its crucial habitat.

#### **5.3.7.2.6 No Action Alternative.**

The No Action Alternative would have no effects on the Colorado River federally listed species or their designated critical habitats. The No Action Alternative would have no effects on razorback sucker and its designated critical habitat in the lower Paria River. The No Action Alternative would have no effects on aquatic sensitive species or aquatic special status species or their habitats in the lower Paria River. The No Action Alternative would have no effects on Virgin River chub and woundfin or their designated critical habitat. The No Action Alternative would have no effects on desert sucker and Virgin spinedace or their crucial habitat in the Virgin River corridor.

### **5.3.7.3 Protection, Mitigation and Enhancement Measures**

#### **5.3.7.3.1 Proposed Action.**

The Proposed Action construction and operation would have no measurable effect on listed aquatic species or their designated critical habitat in the Colorado River, Paria River and Virgin River. No conservation measures for protection of these species and designated critical habitat have been identified. The Proposed Action construction and operation would have no measurable effects on sensitive aquatic species or their crucial habitat. No protection, mitigation or enhancement measures have been identified.

#### **5.3.7.3.2 Existing Highway Alternative.**

The Existing Highway Alternative construction and operation would have no measurable effect on listed aquatic species or their designated critical habitat in the Colorado River, Paria River and Virgin River. No conservation measures for protection of these species and designated critical habitat have been identified. The Existing Highway construction and operation would have no measurable effects on sensitive aquatic



species or their crucial habitat. No protection, mitigation or enhancement measures for protection of these species or their crucial habitat have been identified.

#### **5.3.7.3.3 Southeast Corner Alternative.**

The Southeast Corner Alternative construction and operation would have no measurable effect on listed aquatic species or their designated critical habitat in the Colorado River, Paria River and Virgin River. No conservation measures for protection of these species and designated critical habitat have been identified. The Southeast Corner construction and operation would have no measurable effects on sensitive aquatic species or their crucial habitat. No protection, mitigation or enhancement measures for protection of these species or crucial habitat have been identified.

#### **5.3.7.3.4 No Lake Powell Water Alternative.**

There are no conservation measures that would mitigate the potential significant, long-term, adverse indirect effects of the No Lake Powell Water Alternative on Virgin River chub and woundfin. Populations of these listed species could decrease in size and health within the Virgin River in the St. George metropolitan area. There are no mitigation measures to avoid, minimize or reduce the significant, permanent, adverse indirect effects of the No Lake Powell Water Alternative on desert sucker and Virgin spinedace. Populations of these species of concern could decrease in size and health within the Virgin River and its tributary streams in the St. George metropolitan area.

#### **5.3.7.3.5 No Action Alternative.**

No protection, mitigation, or enhancement measures would be implemented with the No Action Alternative.