5.3.2 Water Supply

5.3.2.1 Affected Environment

5.3.2.1.1 Washington County and WCWCD Overview.

The Washington County and Washington County Water Conservancy District (WCWCD) water supplies come from a combination of groundwater (springs and wells) and surface water (direct diversions and reservoirs). The Navajo sandstone aquifer and shallow alluvial aquifers provide groundwater resources. Surface water sources consist of the Virgin River and its tributaries. In 2010, approximately 20 percent of the developed potable water supplies for public community water systems in Washington County were from groundwater sources and 80 percent were from surface water sources (UDWRe 2013a). Groundwater supplies developed by public drinking water systems are generally of high quality and can be used directly for potable uses after disinfection. Surface water supplies are used directly to meet secondary water demands or are treated to meet culinary demands. The cities and towns in Washington County have historically developed independent water collection and treatment systems; however, since WCWCD's first project in the mid-1980s, the major municipal water systems have become increasingly integrated.

Groundwater sources within the WCWCD service area are considered to be fully appropriated and closed to further appropriations at this time by the State Engineer (UDWRi 2008b), with the exception of the Canaan Gap drainage east of the Hurricane Cliffs and the Beaver Dam Wash drainage, which are open to small underground water appropriations for domestic filings. New diversions and uses must be accomplished by change applications filed on previously approved water rights. Changes between surface and underground sources are reviewed for 5

5.3.2.1.2 Water Quality Limitations.

Water quality, primarily arsenic and TDS concentration, limits current use of a substantial portion of Washington County's water supplies. Arsenic concentrations of groundwater in the Navajo sandstone aquifer often exceed the maximum contaminant level (MCL) set by EPA, and many groundwater sources must be either treated or blended with low arsenic concentration water in order to be used for culinary purposes. The concentration of TDS of a water source also limits what uses are appropriate. A large portion of Virgin River water is unsuitable for culinary and even landscape irrigation use because of the high TDS discharge from the LaVerkin Hot Springs.

In 2000, EPA lowered the primary MCL for arsenic in drinking water from 50 micrograms per liter (µg/L) to 10 µg/L. Many local wells that recover water from the Navajo Sandstone Aquifer naturally exceed this limit. Consequently, several high-production, culinary wells in Washington County were converted to secondary wells because of the new arsenic limit. Other wells require blending with waters containing less arsenic in order to comply with the new MCL. Because future recharge and recovery projects will likely occur in the Navajo sandstone aquifer, arsenic concentration will continue to be a challenge, and additional treatment processes will be needed to use the affected groundwater for culinary purposes.

Water supplies that meet the EPA's secondary MCL for drinking water of TDS less than 500 mg/L are deemed usable for culinary purposes. The EPA's secondary MCLs are guidelines which address aesthetic concerns in potable water, such as taste, color and odor. The EPA does not establish MCLs for secondary water; therefore, an upper limit of 1,000 mg/L TDS was assumed for M&I secondary water use in this report, which is the maximum TDS level for the least salt tolerant residential ornamental landscape.

LaVerkin hot springs (also referred to as Pah Tempe) discharge water with a10,000 mg/L concentration of TDS at a rate of about 10 cubic feet per second into the Virgin River near the LaVerkin Bridge, thus rendering all downstream water unsuitable for culinary use or landscape irrigation. Virgin River water, diverted by the St. George and Washington Canal Company at the Washington Fields agricultural diversion, has an average TDS of approximately 1,500 mg/L because of the LaVerkin hot springs discharge (USEPA 2008). Because TDS at the

agricultural diversion exceeds 2,500 mg/L when base river flows are low, agricultural users of this water must utilize flood irrigation to prevent salts from building up in the soil, an approach unsuitable for M&I purposes.

While reverse osmosis treatment has been considered, the high cost, high energy demand, and lack of an environmentally sound alternative for disposal of the waste brine stream is a deterrent to advanced water treatment of the Virgin River water supply. As technology improves over time and the costs of water treatment decline, it may become economically feasible to treat high TDS water for culinary use without the adverse environmental effects currently of concern.

Current TDS concentrations of the water supply in the WCWCD service area ranges from 100 to 800 mg/L, with an average of about 450 mg/L. Total hardness of the water supply in the WCWCD service area ranges from approximately 100 to 400 mg/L as calcium carbonate.

5.3.2.1.3 WCWCD Existing Supplies.

Most of the readily available water in Washington County has been developed and most of the county is closed by the State Engineer to the acquisition of new water rights. The St. George area municipalities are generally relying upon the WCWCD for existing and future water supplies, most of which are and will be provided through large water projects that require a regional funding base.

WCWCD culinary water supplies are set forth in the Final Water Needs Assessment Report (UDWRe 2016b). Reliable secondary supply is assumed to be equivalent to current secondary use (UDWRe 2013a). Reliable supply for surface water sources was calculated with the Virgin River Daily Simulation Model (UDWRe 2015a, UDWRe 2015b) for a 90 percent reliability level (i.e., maximum surface water shortage of 10 percent in any given year that would be made up with groundwater supply). The Virgin River Daily Simulation Model was run with climate change reductions on supply based on the 50th percentile climate change scenario as modeled by Reclamation (Reclamation 2014). The yield estimates used for Washington County are considered reliable because groundwater supplies can be used to supplement surface water supplies to fully meet demands during extreme drought years. Additionally, operational flexibility is continually being enhanced by WCWCD in order to avert water supply shortages.

Table 5-15 summarizes the reliable yield for WCWCD projects for culinary and secondary purposes. Culinary supplies can also be used to meet secondary water demands if necessary.

Table 5-15
WCWCD Existing Projects and Water Uses

Project	Reliable Culinary Quality Water Yield (ac-ft/yr)[1]	Reliable Secondary Quality Water Yield (ac-ft/yr)[4]
Quail Creek and Sand Hollow Reservoirs[2]	24,922	0
Sand Hollow Non-Recharge Groundwater[3]	4,000	0
Cottam Well Field	875	0
Kayenta Water System (Ence Wells)	250	0
Crystal Creek Pipeline	2,000	0
Toquerville Secondary Water System	0	178
Total	**32,047**	**178**

Notes:
[1]Source of data: WCWCD 2008a; WCWCD 2014.
[2]Reliable yield for Quail and Sand Hollow Reservoirs includes yields from Kolob and Meadow Hollow Reservoirs. (UDWRe 2014a).
[3]Supply utilizes water rights and natural basin recharge.
[4]UDWRe 2013a. Assumed reliable supplies are equivalent to current secondary water use.

5.3.2.1.4 WCWCD Existing Facilities.

5.3.2.1.4.1 Quail Creek and Sand Hollow System.

Quail Creek and Sand Hollow reservoirs are a combined system, receiving Virgin River water from the Quail Creek Diversion structure through a pipeline network. Water delivery to these off-stream reservoirs is limited by the capacity and operational requirements of the diversion structure and pipeline system. Quail Creek Reservoir has a capacity of 40,000 ac-ft and supplies raw water to the Quail Creek Water Treatment Plant. Sand Hollow Reservoir has a 50,000 ac-ft capacity with an active pool of about 30,000 ac-ft and a drought pool of 20,000 ac-ft reserved for extreme drought. The drought pool is included in the reliable yield for Sand Hollow Reservoir. In addition, the reservoir serves as a groundwater recharge facility to the Navajo Sandstone Aquifer which currently stores about 100,000 ac-ft with an estimated future capacity of about 300,000 ac-ft. Water may be delivered from Sand Hollow to Quail Creek Reservoir or directly to the Quail Creek Water Treatment Plant.

5.3.2.1.4.2 Kolob Reservoir.

Kolob Reservoir, 5,586 ac-ft, on a tributary of the Virgin River, was built in 1956 and later acquired by WCWCD. Water from the reservoir is released to the Virgin River for diversion at the Quail Creek diversion structure.

5.3.2.1.4.3 Crystal Creek Pipeline.

Water is diverted from Crystal Creek and conveyed through a 12-mile pipeline to Kolob Reservoir to augment deliveries to Quail Creek and Sand Hollow reservoirs. The yield for the Crystal Creek Pipeline was assumed to be "new water" that would otherwise not be diverted from the Virgin River because it utilizes excess capacity in Kolob Reservoir.

5.3.2.1.4.4 Gunlock Reservoir.

Gunlock Reservoir, 10,884 ac-ft, was built on the Santa Clara River in 1970 for storage and delivery to irrigation companies in Gunlock, Santa Clara and Ivins. Most of the water stored in Gunlock Reservoir is diverted through the Gunlock to Santa Clara Pipeline to meet secondary water demands.

5.3.2.1.4.5 Meadow Hollow Reservoir.

Meadow Hollow Reservoir, 600 ac-ft, is located on Spring Creek and LaVerkin Creek in Iron County and was built in 1948 for irrigation purposes.

5.3.2.1.4.6 Ash Creek Reservoir.

Ash Creek Reservoir receives snowmelt and peak flow runoff from the Ash Creek drainage basin. The reservoir seldom fills, does not retain water, and the storage capacity has been restricted significantly because of dam safety concerns by the Utah State Engineer. The Ash Creek Pipeline is currently being built to convey water from Ash Creek Reservoir to the proposed Toquer Reservoir near Anderson Junction.

5.3.2.1.5 Culinary Water Systems.

5.3.2.1.5.1 Quail Creek Water Treatment Plant.

The Quail Creek Water Treatment Plant is an integral component of WCWCD's water system. This 60 million gallon per day (mgd) plant can receive water from three sources: Quail Creek Reservoir, Sand Hollow Reservoir and the Virgin River and delivers culinary water to Regional Water Service Agreement (RWSA) municipal customers. Located just below Quail Creek Reservoir, this conventional filtration plant will eventually be expanded to treat 80 mgd.

5.3.2.1.5.2 Sand Hollow Wells.

The Sand Hollow Well Field includes 13 wells that draw water from pre-reservoir groundwater rights and from water recharged to the Navajo Sandstone Aquifer by Sand Hollow Reservoir. Water is chlorinated and pumped to two storage tanks with a total of 3 million gallons of storage capacity prior to delivery to RWSA municipal customers and Sky Ranch and Cliff Dwellers retail customers.

An evaluation of aquifer storage and recovery at Sand Hollow is presented in the Groundwater Resources Technical Report, (UDWRe 2016b). Currently WCWCD estimates there is approximately 120,000 ac-ft stored in the aquifer that could be used for this purpose (WCWCD 2008a). Most of the recharged water stored in the Navajo sandstone aquifer would be reserved for use during dry periods to compensate for any deficit between annual supply and demand.

5.3.2.1.5.3 Cottam Wells System.

The Cottam Well system delivers water from two wells via pipeline to Toquerville, LaVerkin and Virgin and, if needed, to Hurricane and Leeds. This system also supplies water to about 20 customers in WCWCD's retail system, Casa de Oro, near Leeds.

5.3.2.1.5.4 Kayenta (Ence Wells) Water System.

The Kayenta Wells (also known as the Ence Wells) are two wells with a total pumping capacity of 310 gallons per minute located within the incorporated boundary of Ivins. They provide water to the residential community of Kayenta.

5.3.2.1.5.5 Regional Pipeline Transmission System.

The Regional Pipeline transmission system (pipeline, 500,000 gallon tank and two pump stations) conveys water from the Quail Creek Water Treatment Plant and Sand Hollow Wells to St. George, Santa Clara, Washington and Ivins.

5.3.2.1.5.6 Retail Water Systems.

The WCWCD delivers retail water to the residential communities of Sky Ranch and Cliff Dwellers, south of Hurricane, the Casa de Oro subdivision near Leeds and certain areas on Kolob Plateau.

5.3.2.1.6 Secondary Water Systems.

Secondary water is non-potable water that may be used for outdoor landscape irrigation. Secondary water is a significant factor in assessing WCWCD service area supplies because of the significant amount of untreated water that cannot be economically used any other way. Secondary water systems water quality is compromised by the LaVerkin hot springs inflow. Historically, secondary water was available in certain communities based upon surface water diversions developed by irrigation companies. Currently, secondary water deliveries may be provided from these untreated water sources and from treated municipal reuse water. In all cases, infrastructure, including main delivery lines and lateral pipelines, can limit the ability to deliver secondary water to neighborhoods and communities. Meeting outdoor irrigation or industrial demands with secondary water allows higher quality potable supplies to be reserved for culinary purposes. Secondary water is delivered to public parks, golf courses and other areas over the entire 24-hour period the water is available regardless of time of day water restrictions because of the value of secondary water in offsetting demand on culinary systems, and because of the limited secondary water system infrastructure.

Current secondary water systems in Washington County are operated in Toquerville, St. George, Hurricane City, LaVerkin City, Ivins City, Santa Clara City, and Washington City. The Gunlock to Santa Clara Pipeline consolidated four diversions and delivers secondary water to numerous users in the St. George metropolitan area.

5.3.2.1.7 Total Washington County Municipal and Industrial Water Supplies.

Total reliable existing and near-term water supply for Washington County is approximately 67,677 ac-ft per year, comprised of potable (culinary) and secondary (non-potable) supplies. The total reliable culinary water supply in Washington County, including WCWCD, is approximately 59,172 ac-ft per year. A number of irrigation companies deliver secondary water to M&I systems in Washington County. The 2010 secondary water use data are considered reliable because of the extensive validation process followed by UDWRe; however, reliable data for previous years are not available with enough frequency to assess possible trends in use within the county or on a per capita basis. Total secondary use in Washington County, including systems owned by WCWCD, is approximately 8,505 ac-ft per year (UDWRe 2013a).

5.3.2.1.8 Kane County and KCWCD Overview.

Kane County Water Conservancy District (KCWCD) was formed in 1992. It has a limited customer base and limited supply sources at present. While the entire county is considered part of KCWCD's service area, existing KCWCD customers are rural developments located in the Cedar Mountain and Johnson Canyon areas. KCWCD owns and operates its own wells in the Johnson Canyon area to meet these demands. The only substantial

community in Kane County – the City of Kanab – has developed its own municipal water supply system over time, and may continue to meet the needs of M&I customers within its current city boundaries, and within future annexation areas as well.

All existing M&I supplies in Kane County are derived from groundwater resources (wells and springs). Most existing water supplies in Kane County are derived from groundwater from the Navajo sandstone aquifer. This groundwater is of high quality, and is used directly for culinary purposes after disinfection.

Kane County encompasses parts of four different watershed basins: (1) Kanab Creek/Virgin River, (2) Southeastern Colorado River, (3) Western Colorado River, and (4) Sevier River. Surface and groundwater are considered to be fully appropriated at this time in the Kanab Creek/Virgin River and Southeastern Colorado River Basins. New diversions and uses must be accomplished by change applications filed on owned or acquired existing rights.

The Navajo sandstone aquifer is the primary water source for the Kanab Creek and Johnson Wash drainages. The water from the Navajo sandstone aquifer is usually of good quality. However, throughout the Kanab Creek and Johnson Wash drainage areas both good and poor water quality are found. The groundwater at lower elevations of the basins tends to have poorer quality because of soluble minerals that are discharged from some geological formations (UDWRe 1993). Available data suggest that groundwater quality in wells drilled in the Johnson Wash area is of poor quality and generally not favorable for potable use (Appendix A, MWH 2015). As a result, the water from the lower elevations of the basins can only be used as secondary water unless treated by advanced processes such as reverse osmosis.

Both surface water and groundwater supplies are anticipated to be affected by climate change in the future. Existing supply yields are anticipated to decline from 3 percent in 2020 to 7.2 percent in 2060 based on the statistical analysis of streamflow projections conducted by the U.S. Bureau of Reclamation (Reclamation 2014).

5.3.2.1.9 Kane County Existing Water Supplies.

A summary of the reliable culinary water supply sources for all of Kane County is provided in Table 5-16 and existing reliable supplies are separated into four subbasins. Fredonia, Arizona, receives its water supply from Kane County, but it is not located within the county and is not included in population or water demand values. Therefore, Fredonia supplies are not included in the existing reliable potable supply total for Kane County. Therefore it is also not included as reliable potable water supplies for KCWCD. There is currently no aquifer recharge in Kane County recovered for water supply (UDWRe 2011b). The reliable supplies are reducing over time and include climate change projections. A ten percent planning reserve is incorporated into the reliable supply quantities to avoid using water supplies up to the maximum and to provide a buffer against annual variability in water supplies affected by precipitation runoff and groundwater recharge. The Kane County water supplies shown in Table 5-16 do not include a reduction in reliable water supply to accommodate the ten percent planning reserve.

Table 5-16
Kane County Reliable Potable Water Supplies

Water Supplier	Reliable Potable Water Supply (ac-ft/yr)			
	Springs	Wells[1]	Surface	Total[1]
Alton[2]	34	0	0	34
Church Wells Special Service District[3]	0	225	0	225
Glen Canyon Special Service District #1 (Big Water)[3]	0	506	0	506
Glendale Town Corp.[2]	105	15	0	120
Kanab Municipal Water System[2,4]	105	2,182	0	2,287
KCWCD (Johnson Canyon) [2,4]	0	150	0	150
Orderville Town Water System[2]	79	384	0	463
Total Kane County Reliable Supply	**323**	**3,462**	**0**	**3,785**

Notes:
[1]Wells are limited to 50% of their "maximum" capacity for reliable supply when well/pump capacity is the limiting factor. Springs and surface water supplies are equal to their respective "maximum" capacities.
Sources: [2]UDWRe 2013b; [3]UDWRe, 2014b
[4]Kanab City and Johnson Canyon would be served by KCWCD in the future

5.3.2.1.10 KCWCD Reliable Water Supplies for Kanab City and Johnson Canyon.

The two public community water systems to be served in the future by KCWCD are Kanab City and the Johnson Canyon subbasin. Reliable potable and secondary water supplies for this group are summarized in Table 5-17. The total culinary reliable water supply for the basin is 2,437 ac-ft per year and secondary supply of 80 ac-ft per year (UDWRe 2014b). Annual total potable use for 2010 was 1,535 ac-ft per year or 61 percent of the reliable potable water supply.

Table 5-17
KCWCD Reliable Water Supplies

Water Source	Reliable Supply (ac-ft/yr)		
	Potable	Secondary	Total
Kanab City	2,287	80	2,367
Johnson Canyon	150	0	150
Total	**2,437**	**80**	**2,517**

5.3.2.2 Environmental Effects

5.3.2.2.1 Projected Water Demands.

Projected water demands are dependent on projected population, per capita use, water conservation, service areas, and design standards for source sizing. The Utah Governor's Office of Management and Budget (GOMB) projected in 2012 that the southwest Utah population will continue to grow and more than quadruple between 2010 and the planning horizon of 2060. Most of the population growth is projected to occur in the WCWCD service area, with continued steady growth in the KCWCD service area comprised by Kanab City and the Johnson Canyon area.

The population in the WCWCD service area is projected to increase from 138,530 in 2010 to 576,846 in 2060. The State of Utah has established a goal of 35 percent per capita water use reduction between 2000 and 2060 for the Kanab Creek/Virgin River basin, which includes Washington County. The per capita use reduction is to be achieved by implementing water conservation measures including reuse, recycling, higher efficiency plumbing and appliances, education, and improved efficiency in outdoor water use. Per capita water use is expected to be 285 gallons per capita per day (gpcd) by 2060 with conservation measures implemented. The projected M&I water demand is approximately 184,245 ac-ft per year in the WCWCD service area by 2060 (UDWRe 2014b).

Similarly, the population in the KCWCD service area (Kanab City and Johnson Canyon area) is projected by GOMB to increase from 4,780 in 2010 to 12,480 in 2060. The State of Utah has established a goal of 35 percent per capita water use reduction between 2000 and 2060 for the Kanab Creek/Virgin River basin, which includes a portion of Kane County. The per capita use reduction is to be achieved by implementing water conservation measures including reuse, recycling, higher efficiency plumbing and appliances, education, and improved efficiency in outdoor water use. Per capita water use is expected to be 246 gpcd by 2060 with conservation measures implemented. The projected water demand is approximately 3,440 ac-ft per year in the KCWCD service area (Kanab City and Johnson Canyon area) by 2060 (UDWRe 2014b).

5.3.2.2.2 Projected Water Supply Deficits.

Projected water supply deficits in the WCWCD and KCWCD service areas that could use the water supplied by the LPP Project would occur many years before 2060. Climate change model results by the Bureau of Reclamation (Reclamation 2014) project Virgin River basin streamflows would be reduced by six percent from 2025 to 2054. Incorporating a ten percent planning reserve into the reliable supply quantities allows the water districts to avoid using water supplies up to the maximum and to provide a buffer against annual variability in water supplies affected by precipitation runoff and groundwater recharge.

WCWCD would have a projected water supply deficit beginning in 2025, accounting for ongoing water conservation measures, climate change projections, and a ten percent planning reserve. WCWCD would have an 116,570 ac-ft per year M&I water supply deficit by 2060 with no new M&I water supplies added to reliable existing and future planned supplies.

KCWCD would have a projected water supply deficit beginning in 2035, accounting for ongoing water conservation measures, climate change projections, and a ten percent planning reserve. KCWCD would have a 1,338 ac-ft per year M&I water supply deficit by 2060 with no new M&I water supplies added to reliable existing and future planned supplies.

5.3.2.2.3 Proposed Lake Powell Pipeline Water Supply.

The Proposed Action, Existing Highway Alternative, and Southeast Corner Alternative would each have the same environmental effects on water supply. These are referred to in this environmental effects section as the LPP alternatives. The water supply for the LPP alternatives, diverted from Lake Powell using the State of Utah's unused Colorado River water from Green River water rights, would total 86,249 ac-ft per year. The LPP water would be used to meet water supply deficits in the WCWCD and KCWCD service areas.

WCWCD would receive 82,249 ac-ft per year from the LPP Project at full utilization, in approximately 2052. The LPP water would be conveyed to WCWCD for use to meet expected M&I water demand beginning in approximately 2025. All of the LPP water utilized by WCWCD could be treated for potable water use and distributed through the existing water distribution system, combined with existing supplies, to meet potable water demands as the Washington County population grows. Existing wastewater reuse could be maximized at a rate of 7,300 ac-ft per year of secondary water. Future wastewater reuse of the LPP water could add approximately 27,620 ac-ft per year of secondary water to the WCWCD M&I supply. Therefore, with the LPP Project and maximizing future wastewater reuse, WCWCD could meet all of the projected future M&I water demand through

2060. The LPP Project would have a positive long-term effect on water supply in the WCWCD service area, meeting projected M&I water demands through the planning horizon.

KCWCD would receive 4,000 ac-ft per year from the LPP Project at full utilization. The LPP water would be conveyed to KCWCD for use to meet expected M&I water demand beginning in approximately 2035. All of the LPP water utilized by KCWCD could be treated for potable water use and distributed through the existing water distribution system, combined with existing supplies, to meet potable water demands as the Kane County population grows. KCWCD could meet all of the projected future M&I water demand through 2060 with the LPP Project water. The LPP Project would have a positive long-term effect on water supply in the KCWCD service area, meeting projected M&I water demands through the planning horizon.

5.3.2.2.4 No Lake Powell Water Alternative Water Supply.

The No Lake Powell Water Alternative water supply would "harden" the WCWCD M&I water supply by removing outdoor use of potable water and allowing only indoor use of potable water to meet the growing population demands. Water system "hardening" means that all the water supply is progressively used to meet M&I demands, regardless of drought conditions, low stream flows, low reservoir storage, and other limitations on water supply. Re-purposing the use of potable water for outdoor watering to only indoor use would provide no flexibility or buffer in the WCWCD management of water supplies. Future secondary water produced by the St. George Regional Wastewater Treatment Facility would be stored in the future Warner Valley Reservoir and mixed with low quality Virgin River water diverted at the Washington Fields Diversion and treated with reverse osmosis processes to produce potable water. Therefore, no future secondary water from wastewater reclamation would be used for outdoor watering, eliminating watering of parks, golf courses, and other open spaces that currently rely on the reuse water. Additionally, the agricultural water supply for farming activities in the Washington Fields Area would be re-purposed for storage in the future Warner Valley Reservoir and treated using reverse osmosis processes for distribution as potable water for indoor use only. The No Lake Powell Water Alternative effects on the M&I water supply would be long-term, adverse effects.

5.3.2.2.5 No Action Alternative Water Supply.

The No Action Alternative would have no effect on water supply.

5.3.2.3 Protection, Mitigation and Enhancement Measures

There are no proposed protection, mitigation and enhancement measures for WCWCD and KCWCD water supply. This applies to all of the pipeline action alternatives.

5.3.2.4 Cumulative Effects

The Proposed Action, Existing Highway Alternative, and Southeast Corner Alternative would each have the same cumulative effects on water supply. These are referred to in this cumulative effects section as the LPP alternatives. The No Lake Powell Water Alternative would have a separate set of cumulative effects on water supply. There would be no cumulative effects from the No Action Alternative.

5.3.2.4.1 LPP Alternatives.

The LPP alternatives would have cumulative effects with three present and future interrelated actions on water supply. The St. George Wastewater Reuse project would be expanded beyond its existing production of secondary water with the LPP alternatives adding additional water supply in the St. George metropolitan area. As the population grows and more municipal wastewater would be generated, the effluent available for reclamation and reuse would exceed the existing production and the St. George Regional Wastewater Reclamation Facility would be expanded to capacity. Additional wastewater generated by the growing population using LPP water would require expansion of the existing facility beyond its future capacity or development of a second wastewater

reclamation facility in the St. George metropolitan area. The cumulative effect on water supply would be to generate more secondary water for outdoor use and allow potable water being used for outdoor watering to be utilized for indoor uses, resulting in more efficient use of the M&I water supply to meet the population demands. The Jackson Flat Reservoir project provides more secondary water to KCWCD service area water users for outdoor use and allows groundwater pumped by KCWCD being used for outdoor watering to be utilized for indoor uses, resulting in more efficient use of the M&I water supply to meet the population demands. These cumulative effects on water supply would be long-term.

The BLM St. George Field Office proposed draft Resource Management Plan (RMP) and amendments could have a cumulative effect on the St. George metropolitan area water supply, including the LPP water, by using a portion of the water supply for management activities to conserve, protect and enhance ecological, scenic, wildlife, recreational, natural, educational, and scientific resources. These future management activities could include resource protection to meet desired future conditions, species conservation, and habitat restoration involving Virgin River flows. Areas of Washington County identified by the BLM as a priority for biological conservation and the BLM undertaking future management activities to conserve and restore plant and animal species and natural communities within such areas could require a portion of the M&I water supply, which would remove some Virgin River water from being used by people to meet future M&I water demands. These cumulative effects on M&I water supply could be long-term.

5.3.2.4.2 No Lake Powell Water Alternative.

The No Lake Powell Water Alternative would expand the St. George Wastewater Reuse Project beyond its existing production of secondary water in the St. George metropolitan area. As the population grows and more municipal wastewater would be generated, the effluent available for reclamation and reuse would exceed the existing production and the St. George Regional Wastewater Reclamation Facility would be expanded to capacity. Under the No Lake Powell Water Alternative, all future secondary water produced by the St. George Regional Wastewater Reclamation Facility would be conveyed to the future Warner Valley Reservoir for mixing with Virgin River water diverted at the Washington Fields Diversion and treated using the reverse osmosis process to generate potable water for indoor uses within the WCWCD service area. The reduction in future reuse water to meet secondary demands along with no outdoor watering with potable water under the No Lake Powell Water Alternative would result in severely hardening the water supply obtained from the Virgin River basin, and there would be no water for future M&I water use beyond 2052. These cumulative effects on M&I water supply would be long-term.

The Jackson Flat Reservoir project provides more secondary water to KCWCD service area water users for outdoor use and allows groundwater pumped by KCWCD being used for outdoor watering to be utilized for indoor uses, resulting in more efficient use of the M&I water supply to meet the population demands. This cumulative effect on water supply would be long-term.

The BLM St. George Field Office proposed Resource Management Plan (RMP) and amendments could have the same cumulative effect on the St. George metropolitan area water supply as described in Section 5.3.2.4.1 for the LPP alternatives. However, there would be more competition for the limited and “hardened” Virgin River water supply under the No Lake Powell Water Alternative when combined with the potential effects of the BLM St. George Field Office proposed Resource Management Plan (RMP) and amendments. These cumulative effects on M&I water supply would be long-term.

5.3.2.5 Unavoidable Adverse Effects

The Proposed Action, Existing Highway Alternative, and Southeast Corner Alternative each could have an unavoidable adverse, long-term cumulative indirect effect on water supply in combination with the potential effects of future management activities by the BLM St. George Field Office proposed RMP and amendments. These potential future management activities could require the use of Virgin River water currently used for M&I

water supply to be used for habitat restoration, species conservation and resource protection to meet desired future conditions under the proposed RMP and amendments.

The No Lake Powell Water Alternative would have unavoidable adverse effects and unavoidable adverse long-term cumulative effects on water supply in the St. George metropolitan area. The unavoidable adverse effects would result from hardening the water supply to the point there would be no water system supply buffer from drought conditions, low stream flows, low reservoir storage and other water supply limitations. All potable water would have to be used to meet indoor water demands, and no outdoor water use of potable water would be allowed. The unavoidable adverse long-term cumulative effects of the No Lake Powell Water Alternative could occur in combination with the potential effects of future management activities by the BLM St. George Field Office proposed RMP and amendments. These potential future management activities could require the use of Virgin River water currently used for M&I water supply to be used for habitat restoration, species conservation and resource protection to meet desired future conditions under the proposed RMP and amendments. Under the No Lake Powell Water Alternative, the unavoidable adverse long-term cumulative effects could be magnified because of the water system hardening and potential reduction in water supply to meet required uses for biological conservation. Unavoidable, adverse indirect effects of eliminating residential outdoor watering would include increased overall water demand for energy generation required to meet higher electricity demands for air conditioning, known as the urban heat-island effect (Myrup 1969.)

5.3.2.6 References

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