Section 3
River Basin Description

3.1 Project Area Overview

The Project area extends from the Lower Lake Powell watershed incorporating a portion of Lake Powell adjacent to Glen Canyon Dam in Coconino County, Arizona to the Virgin River watershed and Sand Hollow Reservoir in Washington County, Utah. The Cedar Valley Pipeline System would extend north from the Hurricane Cliffs afterbay into the upper Ash Creek basin in Iron County, Utah.

The Project has three distinct geographical sections. The Water Intake System and Water Conveyance System are situated in the east portion of the Project area. The Hydro System, which would be physically interconnected to the Water Conveyance System, would terminate in a powerhouse discharge at Sand Hollow Reservoir in the west portion of the Project area. The Cedar Valley Pipeline System would connect to the Hydro System and terminate at a regional water treatment plant in the north portion of the Project area. The Applicant proposes to obtain a FERC license for the Hydro System. This section describes the watersheds and river basins for the Water Intake System, Water Conveyance System, Hydro System, and the Cedar Valley Pipeline System.

3.1.1 Water Intake System

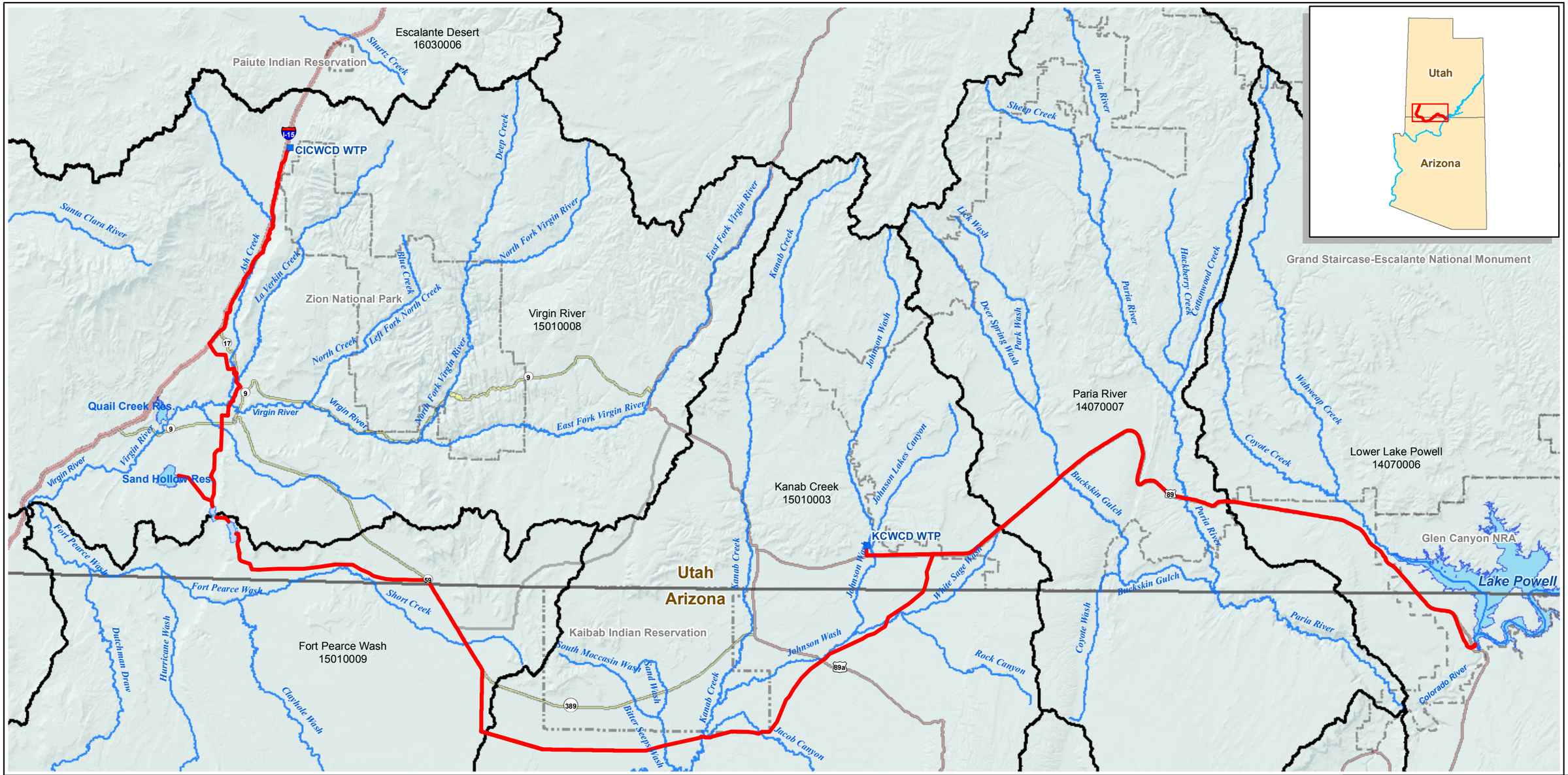
The Water Intake System at Lake Powell would be located within the Lower Lake Powell watershed (hydrologic unit code or HUC 14070006). The watershed covers about 3,150 square miles. The Lower Lake Powell watershed originates at Canaan Peak, elevation 9,293 feet MSL, on the Dixie National Forest and is drained by Wahweap Creek, which flows south and southeast to its confluence with Lake Powell (Figure 3-1). Wahweap Creek flows through the Lower Wahweap Creek basin (HUC 1407000609) where it discharges into Lake Powell within the Glen Canyon National Recreation Area (Figure 3-2). The Lower Wahweap Creek basin originates along the east side of The Cockscomb near Cads Crotch at an elevation of 6,161 feet MSL and is drained by Coyote Creek, which flows into Wahweap Creek at elevation 4,030 feet MSL.

The Water Intake System site is directly adjacent to Lake Powell and precipitation falling on the site drains directly to the lake. The ground elevation at the Water Intake System site is 3,743 feet MSL.

The Water Intake System would pump water from multiple depths in Lake Powell through inlet tunnels into two vertical intake shafts and up into the Water Conveyance System. The water collected into the intake tunnels and shafts would consist of a portion of Utah's undeveloped share of its Upper Colorado River Compact allocation. The UBWR would pump 100,000 acre-feet annually of its undeveloped Upper Colorado River Compact water through the Water Intake System to supply water for the Project.

3.1.2 Water Conveyance System

The Water Conveyance System, consisting of a buried pipeline, booster pump stations, and regulating tanks would be located within the Lower Lake Powell watershed (HUC 14070006) and the Paria River watershed (HUC 14070007) (Figure 3-1). The Lower Lake Powell watershed and Lower Wahweap Creek basin are described in Section 3.1.1. The Water Conveyance System would transition from the Lower Wahweap Creek basin into the Paria River watershed at an elevation of approximately 4,450 feet MSL,



Legend

- Water Treatment Plant
- Project Alignment
- Hurricane Cliffs Forebay/Afterbay
- HUC 8 Boundaries
- Watershed Reach
- Interstate
- US Highway
- ST Highway
- Hwy
- Major Road
- State Boundaries
- Tribal Lands
- National Parks & Monuments
- Lakes & Reservoirs

0 2 4 8 12 16 Miles

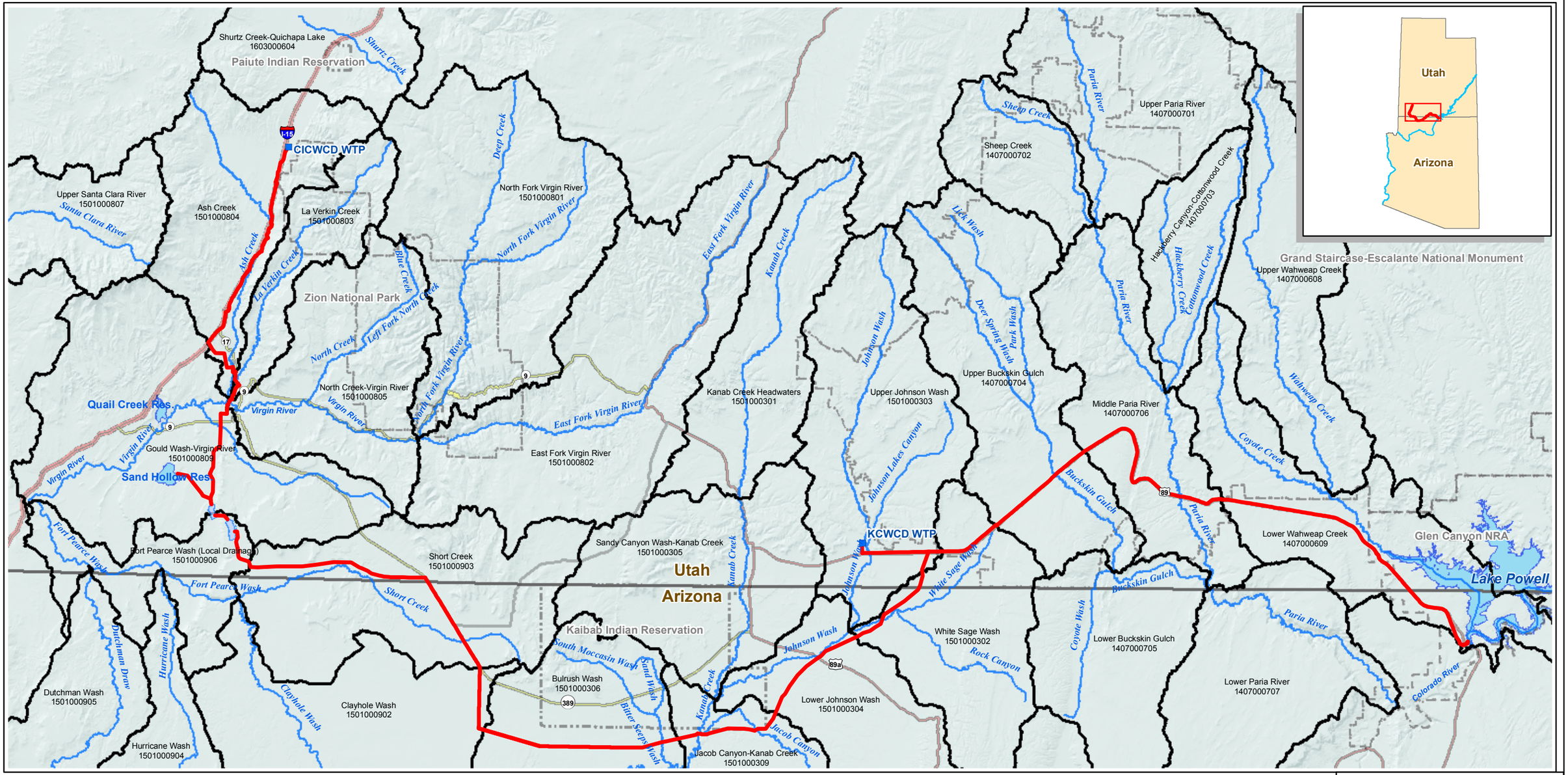
Watershed Data Source:
Utah Automated Geographic Reference Center (AGRC)
- http://gis.utah.gov/component/option,com_dbquery/Itemid,87/task,ExecuteQuery/qid,2/previousTask,PrepareQuery/
BLM Arizona Strip
- http://www.blm.gov/az/st/en/prog/maps/gis_files.html

Lake Powell Pipeline Project

1:500,000 Scale
Spatial Reference: UTM Zone 12N, NAD-83

UDWR Figure 3-1 MWH

HUC 8 Watershed Areas



Legend

- Water Treatment Plant
- Project Alignment
- Hurricane Cliffs Forebay/Afterbay
- HUC 10 Boundaries
- Watershed Reach
- Interstate
- US Highway
- ST Highway
- Hwy
- Major Road
- State Boundaries
- Tribal Lands
- National Parks & Monuments
- Lakes & Reservoirs

0 2 4 8 12 16 Miles

Watershed Data Source:
Utah Automated Geographic Reference Center (AGRC)
- http://gis.utah.gov/component/option,com_dbquery/Itemid,87/task,ExecuteQuery/qid,2/previousTask,PrepareQuery/
BLM Arizona Strip
- http://www.blm.gov/az/st/en/prog/maps/gis_files.html

Lake Powell Pipeline Project

1:500,000 Scale

Spatial Reference: UTM Zone 12N, NAD-83

UDWR Figure 3-2 MWH

HUC 10 Watershed Areas

which corresponds to the east boundary of the Grand Staircase-Escalante National Monument. The Paria River watershed originates at Table Cliff Plateau, elevation 10,287 feet MSL, on the Dixie National Forest and is drained by the Paria River south and southeast to its confluence with the Colorado River downstream of Glen Canyon Dam. The watershed covers about 1,570 square miles. No runoff generated from the Paria River watershed would flow through the Water Conveyance System. The Paria River watershed is comprised of seven basins (Figure 3-2), including: 1) Upper Paria River (HUC 1407000701), 2) Sheep Creek (HUC 1407000702), 3) Cottonwood Creek (HUC 1407000703), 4) Upper Buckskin Gulch (HUC 1407000704), 5) Lower Buckskin Gulch (HUC 1407000705), 6) Middle Paria River (HUC 1407000706), and 7) Lower Paria River (HUC 1407000707). The water conveyance system would be located within the Middle Paria River and the Upper Buckskin Gulch basins. The pressurized water pipeline would cross Buckskin Gulch (Figure 3-2). The Water Conveyance System would terminate at a regulating tank on the west boundary of the Upper Buckskin Gulch basin at elevation 5,695 feet MSL.

3.1.3 Hydro System

The Hydro System, consisting of penstocks, in-line turbine generators, regulating tanks, forebay, shafts, tunnels, powerhouses, afterbay, transmission lines, and substations would be located within the Paria River watershed (HUC 14070007), Kanab Creek watershed (HUC 15010003), Fort Pearce Wash watershed (HUC 15010009), and the Virgin River watershed (HUC 15010008) (Figure 3-1). No runoff generated from these watersheds would flow through the Hydro System. The pressurized penstock would cross the Paria River. The Paria River watershed is described in Section 3.1.2.

The Kanab Creek watershed originates at elevation 9,280 feet MSL on the Paunsaugunt Plateau and drains south and southwest through Kanab Creek to its confluence with the Colorado River in the Grand Canyon. The watershed covers about 2,550 square miles. The Kanab Creek watershed in which the Hydro System would be located includes six basins (Figure 3-2): 1) Kanab Creek Headwaters basin (HUC 1501000301), 2) Upper Johnson Wash basin (HUC 1501000303), 3) White Sage Wash basin (HUC 1501000302), 4) Lower Johnson Wash basin (HUC 1501000304), 5) Bulrush Wash basin (HUC 1501000306), and 6) Jacob Canyon-Kanab Creek basin (HUC 1501000309). Project penstocks would cross portions of these six basins within the Kanab Creek watershed. The upper most penstock in the Project would start at the east boundary of the White Sage Wash basin at elevation 5,695 feet MSL. The lowest elevation penstock crossing in the Kanab Creek watershed would be about 4,400 feet MSL.

The Fort Pearce Wash watershed originates at Canaan Mountain, elevation 7,259 feet MSL in Utah and at Hancock Knoll, elevation 6,453 feet MSL, in the Arizona Strip and drains southwest, north and northwest through Clayhole Wash, Hurricane Wash and Dutchman Wash into Fort Pearce Wash, which flows into the Virgin River at about elevation 2,550 feet MSL. The watershed covers about 1,940 square miles. The Fort Pearce Wash watershed in which the Hydro System would be located includes two basins (Figure 3-2): 1) Short Creek basin (HUC 1501000903), 2) Clayhole Wash basin (HUC 1501000902). Project penstocks would cross portions of these basins within the Fort Pearce Wash watershed. The lowest elevation penstock crossing in the Fort Pearce Wash watershed would be about 4,450 feet MSL.

The Virgin River watershed originates at Black Mountain, elevation 10,375 feet MSL, on the Dixie National Forest and drains south through Deep Creek and the North Fork Virgin River through Zion National Park, then west and southwest through the Virgin River to the Utah/Arizona state line. The watershed covers about 2,180 square miles including Zion National Park. Project penstocks, in-line turbine generators, forebay, shafts, tunnels, powerhouses, afterbay, transmission lines and substations would be sited within the Gould Wash-Virgin River basin (HUC 1501000809) (Figure 3-2). The remaining seven basins comprising the Virgin River watershed would be outside the Project area. The highest elevation within the Gould Wash-Virgin River basin is at 7,259 feet MSL. The Project penstock

would enter the Gould Wash-Virgin River basin at elevation 4,920 feet MSL. The Project tailrace elevation at the Sand Hollow Hydroelectric Facility in the Gould Wash-Virgin River basin would be 3,060 feet MSL.

3.1.4 Cedar Valley Pipeline System

The Cedar Valley Pipeline System, consisting of a pipeline, booster pumping stations and a terminal reservoir, would be located within the Virgin River watershed (HUC 15010008) (Figure 3-1).

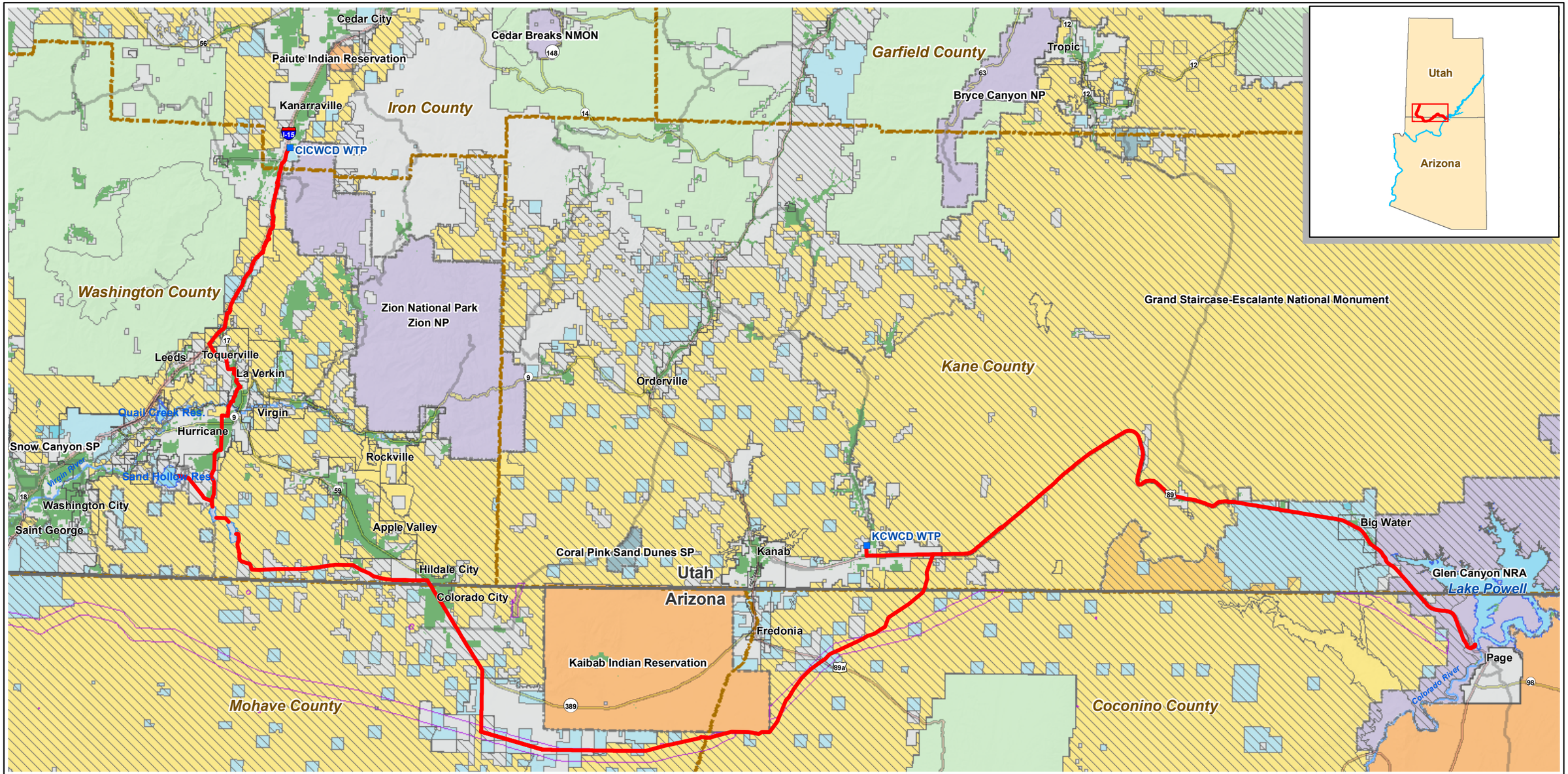
The Virgin River watershed is described in Section 3.1.3. The Virgin River watershed in which the Cedar Valley Pipeline System would be located includes three basins (Figure 3-2): 1) Gould Wash-Virgin River, described in Section 3.1.3; 2) LaVerkin Creek basin (HUC 1501000803); and 3) Ash Creek basin (HUC 1501000804). The pipeline would be located within the Gould Wash-Virgin River basin, however, no runoff water from this basin would be conveyed through the Cedar Valley Pipeline System. The pressurized water pipeline would cross the Virgin River at the Hurricane-LaVerkin boundary at elevation 3,030 feet MSL and extend for a short distance through the LaVerkin Creek basin. The pipeline and booster pumping stations 1, 2, 3, and 4 would be located near Ash Creek along the west toe of the Hurricane Cliffs in the Ash Creek basin, increasing to an elevation of about 5,400 feet MSL near the basin divide south of Kanarraville.

3.2 Major Land Uses

3.2.1 Project Area Land Uses

Lands within the Project watersheds and river basins include Federal lands open to public uses and managed through approved resource management plans. Other lands affected by the Project include state lands, part of Utah's School and Institutional Trust Lands Administration (SITLA) and Arizona's State Lands that are managed to enhance value and optimize economic return for beneficiaries such as public schools, state park lands, tribal lands belonging to Paiute Indians, water conservancy district lands used for water resources infrastructure, county and municipal lands used for public facilities, and private lands used for agriculture, livestock grazing, and residential, commercial and industrial development. The Federal lands along the Project alignment are managed and administered by the U.S. Department of the Interior, including the Bureau of Reclamation (Reclamation) (near Glen Canyon Dam and adjacent to Lake Powell at the proposed Project intake), National Park Service (NPS) (Glen Canyon National Recreation Area), and Bureau of Land Management (BLM) (Grand Staircase-Escalante National Monument, Kanab Field Office, Arizona Strip Field Office, St. George Field Office, and Cedar City Field Office) (Figure 3-3).

The Project alignment would generally follow the U.S. Highway 89 transportation corridor in Utah and Arizona, the Highway 389 corridor in Arizona, the Highway 59 corridor in Utah, the Interstate 15 corridor in Utah, and the Navajo-McCullough Transmission Line corridor in Arizona. Much of the land adjacent to these corridors is undeveloped and is open space and wildlife habitat and wildlife management uses. The Reclamation-managed land includes about 34 acres adjacent to Lake Powell and immediately north of Glen Canyon Dam; this land is used for construction material storage and is managed for controlled access. The NPS-administered land along the Project alignment is managed for open space, transportation, and wildlife habitat. The BLM administers the majority of the Federal land along the Project alignment. As specified resource management plans, these lands are primarily open space lands used for livestock grazing, wildlife habitat, transportation, and utility corridors. The state lands managed



Legend

- Water Treatment Plant
- Project Alignment
- Interstate
- US Highway
- ST Highway
- Hwy
- Major Road
- Utility Corridor
- Hurricane Cliffs Forebay/Afterbay
- State Boundaries
- County Boundaries
- Cities
- Agricultural Land
- Grazing Area
- Tribal Lands
- Parks_Monuments
- National Parks & Monuments
- gsenm-boundary
- Major Rivers
- Lakes & Reservoirs

LPP Land Ownership

- BLM
- State
- Private
- Tribal
- National Park
- USFS
- State Park
- BLM Wilderness
- State Wildlife Reserve

0 2 4 8 12 16 Miles

Land Uses Data Source:
Utah Automated Geographic Reference Center (AGRC)
- http://gis.utah.gov/component/option,com_dbquery/Itemid,87/task,ExecuteQuery/qid,2/previousTask,PrepareQuery/
Utah BLM
- http://www.blm.gov/ut/st/en/prog/more/geographic_information/gis_data_and_maps.html
Arizona Strip PRMP / FEIS
- http://www.blm.gov/az/st/en/prog/maps/gis_files.html#strip

Lake Powell Pipeline Project

1:500,000 Scale

Spatial Reference: UTM Zone 12N, NAD-83

N

UDWR **Figure 3-3** MWH

Major Land Uses

by Utah's SITLA include about 54,000 acres adjacent to the Glen Canyon National Recreation Area and about 12,000 acres along and near the Project alignment. State lands managed by Arizona's State Land Department include about 19,000 acres along and near the Project alignment. State park lands near or along the proposed Project alignment include Sand Hollow State Park in Utah. Tribal lands on the Kaibab Indian Reservation include about 125,000 acres used for livestock grazing, pasture, wildlife habitat, tribal enterprises, highway corridors and small residential communities. Tribal lands on the Paiute Indian Reservation in the Cedar Valley include about 2,600 acres used for livestock grazing, open range, wildlife habitat and highway corridors. County lands occurring in the five counties (Kane, Washington and Iron counties in Utah; Coconino and Mohave counties in Arizona) near the Project alignment are primarily used for county roads and rights-of-way. Municipal lands along the proposed Project alignment include the communities of Big Water, Kanab, Hildale, Apple Valley, Hurricane, La Verkin, Toquerville, and Kanarraville in Utah, and Fredonia and Colorado City in Arizona. Private land includes about 44,000 acres along and near the Project alignment used for livestock grazing, open range, hay production, residential communities, commercial developments, and industrial purposes.

3.3 Major Water Uses

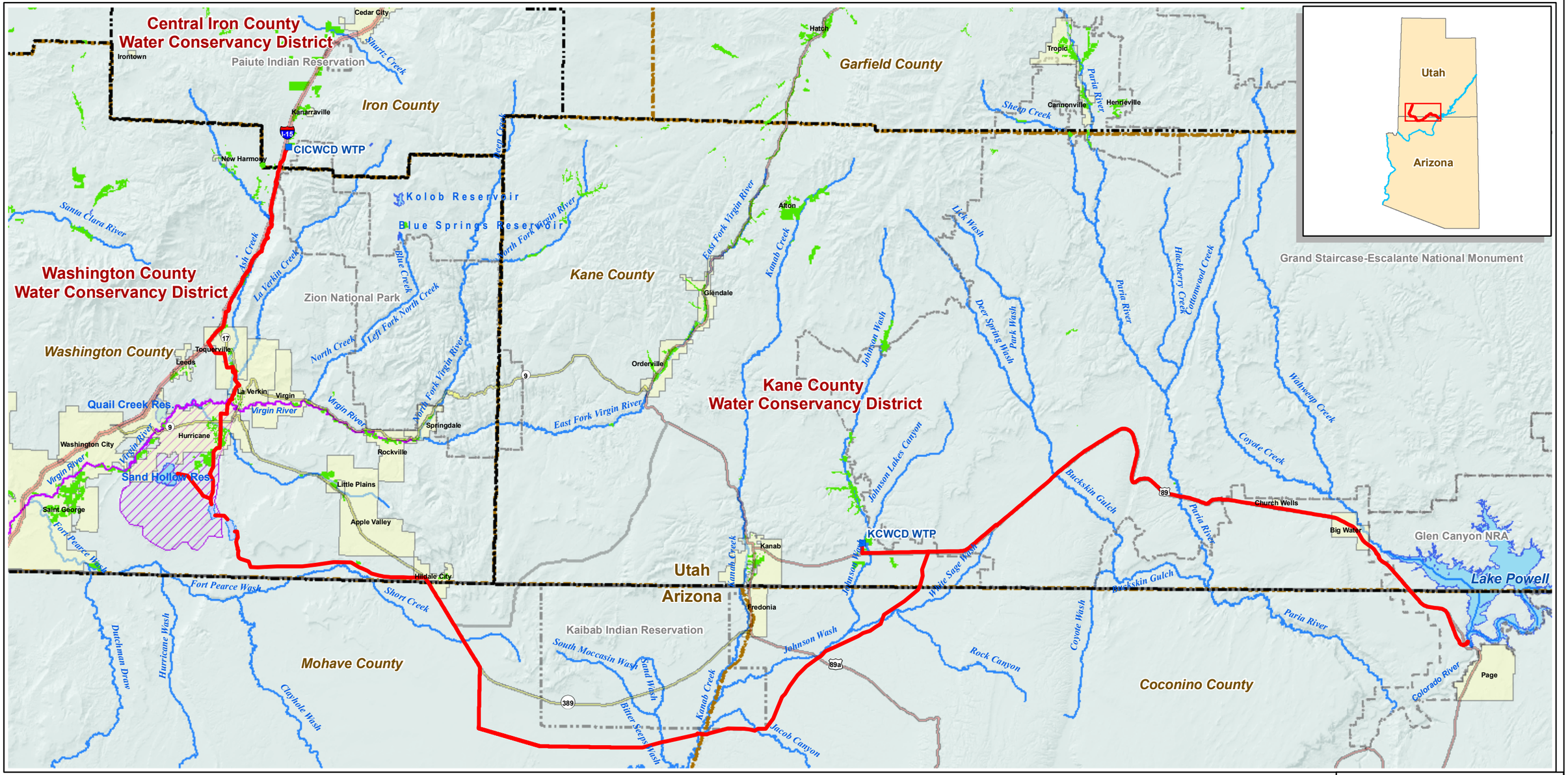
Major water uses of the five watersheds that would be crossed by the Project include extraction and storage for municipal and industrial uses, irrigation, groundwater recharge/recovery, and in-stream flows for fish, wildlife, and recreation. Figure 3-4 shows the locations where most of the water in the five watersheds is used.

Municipal and industrial (M&I) water is pumped from groundwater wells and diverted from surface streams, treated to meet drinking water quality standards, and used to supply culinary water to people in southwest Utah communities. Lower quality M&I water is conveyed in secondary systems (canals and pipelines) to communities for outdoor landscape watering use. Some of the M&I water is used for commercial, institutional and industrial purposes.

Irrigation water is pumped from groundwater wells and diverted from surface streams for use in growing agricultural crops including hay, fruit, and pasture grass for livestock grazing. Alfalfa and grass hay production yields 4 to 5 cuttings per year, typically over a 180-day growing season. Other irrigated crops include corn and small grains, and fruit and nut orchards. Agriculture is practiced on about 123,000 acres in Iron, Kane and Washington counties.

Groundwater recharge and recovery has recently been implemented in Washington County, Utah at Sand Hollow Reservoir. Water diverted from the Virgin River is conveyed to and stored in Sand Hollow Reservoir, an off-stream storage facility constructed and operated by Washington County Water Conservancy District (WCWCD) to recharge the local Navajo sandstone aquifer. The reservoir has recharged about 50,000 acre-feet of water since it began filling in March 2002. This water use is unique because a portion of the diverted surface water is allowed to seep into the local aquifer, protected from high evaporation rates that occur in the desert environment, and then the water is pumped from the aquifer through local wells to meet peak water demands.

In-stream flows are maintained in rivers and streams that provide habitat for endangered and threatened fish and wildlife species. In some cases, in-stream flow regimes are incorporated into habitat conservation plans and recovery plans for federally-listed species and managed through water conservancy district operations.



Legend

- Water Treatment Plant
- Project Alignment
- Interstate
- US Highway
- ST Highway
- Hwy
- Major Road
- Water Conservancy Districts
- State Boundaries
- County Boundaries
- Tribal Lands
- National Parks & Monuments
- Cities
- In-stream Flow
- Irrigated Lands
- Groundwater Recharge/Recovery
- Rivers
- Lakes & Reservoirs
- Hurricane Cliffs Forebay/Afterbay

0 2 4 8 12 16 Miles

Watershed Data Source:
Utah Automated Geographic Reference Center (AGRC)
- http://gis.utah.gov/component/option,com_dbquery/Itemid,87/task,ExecuteQuery/qid,2/previousTask,PrepareQuery/
BLM Arizona Strip
- http://www.blm.gov/az/st/en/prog/maps/gis_files.html

Lake Powell Pipeline Project

1:500,000 Scale
Spatial Reference: UTM Zone 12N, NAD-83

UDWR Figure 3-4 MWH

Major Water Uses

3.4 Project Area Dams

The Project area contains several dams and reservoirs, including Glen Canyon Dam in Arizona, and Sand Hollow Dam, Quail Creek Dam, Quail Creek Diversion Dam, Kolob Reservoir, Gunlock Reservoir and Ash Creek Dam in Utah. Figure 3-5 shows the locations of existing dams, reservoirs and diversions in the Project area.

Glen Canyon Dam is a concrete arch dam completed in 1964 in Coconino County, Arizona on the Colorado River as part of the Colorado River Storage Project. The dam was constructed by Reclamation and is operated by Reclamation to store and deliver Upper Colorado River Basin water to Upper Basin states and Lower Basin states per the Colorado River Compact, and to generate hydroelectric power. Lake Powell is the reservoir impounded behind Glen Canyon Dam. Lake Powell has a design storage capacity of 24,322,000 acre-feet. Colorado River water stored in Lake Powell is the water source for the Project. Lake Powell is popular for recreational boating, water sports, fishing, swimming, diving, picnicking, and camping.

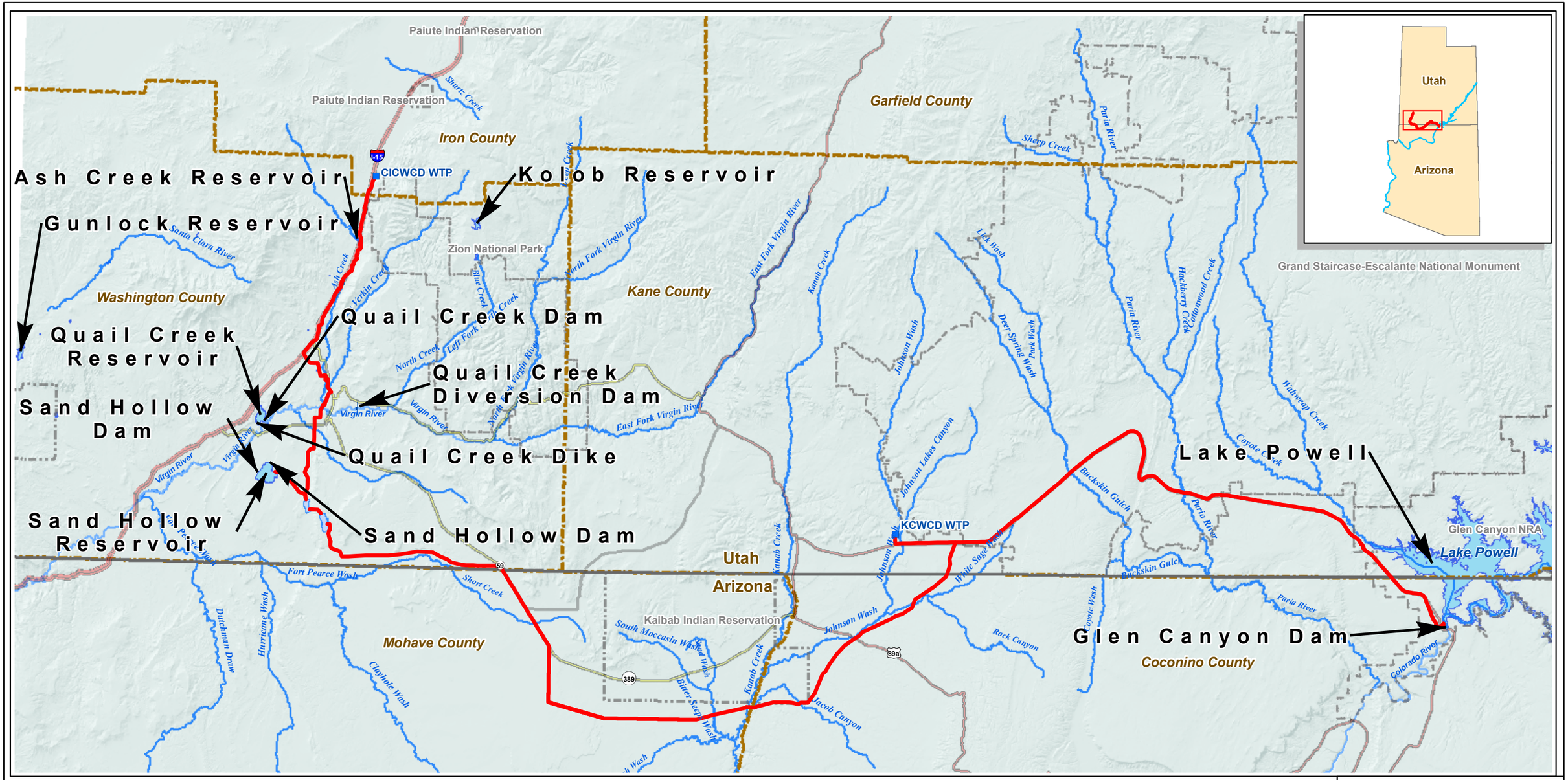
Sand Hollow Reservoir is an off-stream storage reservoir completed in 2002 in Washington County, Utah as part of the WCWCD Quail Creek system. The two rock-fill dams with clay cores and the reservoir were constructed by WCWCD. The dams contain water diverted from the Virgin River at the Quail Creek Diversion Dam, which is pumped from the Quail Creek system to Sand Hollow Reservoir during the increased flow period between mid-October and April. The reservoir has a design storage capacity of 50,000 acre-feet. Colorado River water conveyed through the Project penstocks would be discharged into the reservoir. Sand Hollow Reservoir is operated by WCWCD and includes a groundwater recharge feature (see Section 3.3). The reservoir is popular for recreational boating, water sports, fishing and camping.

The Quail Creek Dam and Dike impound Quail Creek and Quail Lake, an off-stream storage reservoir completed in 1985 in Washington County, Utah as part of the WCWCD Quail Creek system. A dam and dike constructed by WCWCD form the reservoir; the main dam is a rock-fill embankment dam with a clay core, and the south dike is a roller compacted concrete structure that replaced the original earth-fill dike. The reservoir's design storage capacity is 40,325 acre-feet and it contains water diverted from the Virgin River through an 8.7-mile long steel pipeline. Quail Lake reservoir is operated by WCWCD for irrigation and M&I raw water storage; it supplies raw water to the adjacent Quail Creek Water Treatment Plant. The reservoir is popular for recreational boating, water sports and fishing.

Quail Creek Diversion Dam is a concrete gravity dam completed in 1985 in Washington County, Utah on the Virgin River as part of the Quail Creek system. The dam was constructed by WCWCD and is operated to divert water into Quail Lake and Sand Hollow Reservoir, and to generate hydroelectric power.

Kolob Reservoir is impounded by an earth-fill dam completed in 1956 in Washington County, Utah on Kolob Creek in the Upper Virgin River basin north of Zion National Park. The maximum reservoir capacity is 6,914 acre-feet and it contains water flowing in from Kolob Creek and many springs. Kolob Reservoir is operated by WCWCD for irrigation storage. The reservoir is a popular destination for fishing, boating, picnicking, cross country skiing, and snowmobiling.

Gunlock Reservoir is impounded by an earth-fill dam completed in 1970 in Washington County, Utah on the Santa Clara River. The original recorded reservoir capacity is 10,884 acre-feet, with a current capacity of 7,783 acre-feet because of sedimentation, and it contains water flowing in from the Santa Clara River watershed. Gunlock Reservoir is operated by WCWCD and Lower Gunlock Reservoir Corporation for irrigation storage. The reservoir is a popular destination for fishing, boating, water sports, camping and



Legend

- Water Treatment Plant
- Project Alignment
- Interstate
- US Highway
- ST Highway
- Hwy
- Major Road
- State Boundaries
- County Boundaries
- Tribal Lands
- National Parks & Monuments
- Rivers
- Lakes & Reservoirs
- Hurricane Cliffs Forebay/Afterbay

0 2.5 5 10 15 20 Miles

Reservoir Data Source:
Utah Department of Water Resources GIS Department

Lake Powell Pipeline Project

1:550,000 Scale

Spatial Reference: UTM Zone 12N, NAD-83

UDWR Figure 3-5 MWH

Dams, Reservoirs & Diversions

swimming. Ash Creek Reservoir is impounded by an earth-fill dam incorporated into the Interstate 15 embankment constructed over Ash Creek in Washington County, Utah. The maximum reservoir capacity is 6,625 acre-feet and the reservoir stores seasonal runoff from streams draining the Ash Creek basin. The reservoir is operated by WCWCD for irrigation storage.

3.5 Drainage Basins and Tributary Streams

Four of the five drainage basins, watersheds and numerous tributary streams crossed by the Project would not contribute any flow to or convey water in the Project facilities. The five non-contributing watersheds crossed by the Project include the Paria River (HUC 14070007), Kanab Creek (HUC 15010003), Upper Virgin River (HUC 15010008), and Fort Pearce Wash (HUC 15010009) (Figure 3-1).

The Lower Lake Powell watershed (HUC 14070006) contributes flow directly to Lake Powell (Figure 3-1), which would supply water to the Project. The Water Intake System would pump water directly from Lake Powell through intake tunnels and shafts constructed in the sandstone adjacent to the reservoir. The Water Conveyance System would not collect flow from any tributaries in the Lower Lake Powell watershed; the pipeline would cross under tributary streams in its alignment paralleling U.S. Highway 89.

Table 3-1 provides information about the watersheds, drainage basins, and tributary streams that would be crossed by the Project. The watersheds, drainage basins, and tributary streams located above the Project would not be affected by the Project features. Some of the tributary streams listed in Table 3-1 would be crossed by the Project pipeline, and these streams could temporarily receive small quantities of water drained from the pipeline during annual operation and maintenance activities. The tributary basins are shown in Figure 3-2.

Table 3-1
Lake Powell Pipeline
Watershed and Tributary Stream Information

Watershed / Hydrologic Unit Code	Tributary Basin Name / Hydrologic Unit Code	Primary Tributaries	Tributary Length (mile)	Drainage Area ($mi.^2$)	Affected by Project Operation
Lower Lake Powell (14070006)	Upper Wahweap Creek (1407000608)	Wahweap Creek	46	215	No
	Lower Wahweap Creek (1407000609)	Coyote Creek	49	262	No
Paria River (14070007)	Upper Paria River (1407000701)	Paria River	26	265	No
	Sheep Creek (1407000702)	Sheep Creek	21	99	No
	Hackberry Canyon – Cottonwood Creek (1407000703)	Cottonwood Creek Hackberry Creek	31 19	108	No No
	Upper Buckskin Gulch (1407000704)	Buckskin Gulch Park Wash Deer Springs Wash	20 21 22	297	No
	Lower Buckskin Gulch (1407000705)	Buckskin Gulch Coyote Wash	12 16	191	No

Table 3-1
Lake Powell Pipeline
Watershed and Tributary Stream Information

Watershed / Hydrologic Unit Code	Tributary Basin Name / Hydrologic Unit Code	Primary Tributaries	Tributary Length (mile)	Drainage Area ($mi.^2$)	Affected by Project Operation
Kanab Creek (15010003)	Kanab Creek Headwaters (1501000301)	Kanab Creek	40	194	No
	White Sage Wash (1501000302)	White Sage Wash Rock Canyon	17 21	214	No
	Upper Johnson Wash (1501000303)	Johnson Wash Johnson Lakes Can.	45 15	287	No
	Lower Johnson Wash (1501000304)	Johnson Wash	18	186	No
	Sandy Canyon Wash – Kanab Creek (1501000305)	Kanab Creek	24	242	No
	Bulrush Wash (1501000306)	Bulrush Wash Bitter Seeps Wash S. Moccasin Wash Sand Wash	30 6 11 8	290	No
	Jacob Canyon – Kanab Cr. (1501000309)	Jacob Canyon Kanab Creek	19 36	228	No
Virgin River (15010008)	North Fork Virgin River (1501000801)	N. Fork Virgin R. Deep Creek	38 19	360	No
	East Fork Virgin River (1501000802)	East Fork Virgin River	53	404	No
	La Verkin Creek (1501000803)	La Verkin Creek	33	94	No
	Ash Creek (1501000804)	Ash Creek	32	215	No
	North Creek – Virgin River (1501000805)	Virgin River North Cr. / Blue Cr.	21 20	217	No
	Upper Santa Clara River (1501000807)	Santa Clara River	28	138	No
	Gould Wash – Virgin River (1501000809)	Virgin River Gould Wash	26 22	353	No
Fort Pearce Wash (15010009)	Clayhole Wash (1501000902)	Clayhole Wash	50	352	No
	Short Creek (1501000903)	Short Creek	32	276	No
	Hurricane Wash (1501000904)	Hurricane Wash	55	359	No
	Dutchman Wash (1501000905)	Dutchman Draw	50	302	No
	Fort Pearce Wash (Local Drainage) (1501000906)	Rock Canyon	25	116	No

Source: Utah AGRC – http://gis.utah.gov and BLM Arizona Strip – http://www.blm.gov/az/st/en/prog/maps/gis_files

3.6 Climate

The Project region experiences hot, dry summers and moderate air temperatures during winter months at the lower elevations with cooler temperatures and snowfall at the higher elevations. Each of the six watersheds crossed by the Project has large areas above elevation 5,500 feet MSL where snowfall occurs and persists throughout much of the winter months. The highest elevations in the six watersheds range from 8,000 to 11,330 feet MSL; the mountain areas in these watersheds are sparsely inhabited. The Project facilities would be situated between elevations 5,700 and 3,060 feet MSL, where air temperatures are warmer and most of the precipitation occurs as rain or snow that melts quickly. The primary communities near the Project alignment are Page, AZ (elevation 4,300 feet MSL), Kanab, UT (elevation 4,970 feet MSL), the St. George, UT metropolitan area (elevation 3,000 feet MSL) and Cedar City, UT (elevation 5,623 feet MSL). Mild air temperatures during the winter months attract people to visit and live in the St. George metropolitan area. Average total precipitation in the primary communities near the Project alignment ranges from 6.46 inches in Page to 10.60 inches in Cedar City annually. The relatively low average total precipitation in the desert climates that predominate in the Project region translate to a need for water to meet the growing population demands. Table 3-2 summarizes the precipitation and temperature conditions during the period of record at National Weather Service stations in communities near the Project.

Table 3-2
Lake Powell Pipeline
Summary of Temperature and Precipitation Conditions in Regional Communities

Weather Station Name (Number) Elevation	Period of Record	Monthly Avg. Max. Temp.		Monthly Avg. Min. Temp.		Annual Avg. Max. Temp.	Annual Avg. Min. Temp.	Monthly Max. Avg. Total Precip.		Annual Avg. Total Precip.
	Years	(°F)	Mo.	(°F)	Mo.	(°F)	(°F)	(in.)	Mo.	(in.)
Page, AZ (026180) 4,270 ft. MSL	1957 to 2007	96.6	Jul.	25.5	Jan.	70.0	46.7	0.91	Oct.	6.46
Kanab, UT (424508) 4,950 ft. MSL	1899 to 2007	92.7	Jul.	22.0	Jan.	69.8	38.7	1.53	Jan.	13.49
St. George,UT (427516) 2,760 ft. MSL	1892 to 2007	101.7	Jul.	25.8	Jan.	77.8	44.5	1.07	Jan.	8.23
Cedar City,UT FAA (421267) 5,610 ft. MSL	1948 to 2007	90.1	Jul.	17.3	Jan.	65.1	35.8	1.20	Mar.	10.60

Source: Western Regional Climate Center, http://www.wrcc.dri.edu

3.7 Watershed Water Quality

Water quality in the watersheds crossed by the Project is typical of undisturbed desert and southwest upland and mountain environments. Lake Powell water quality at depths of 100 to 150 feet near the water intake site has pH ranging from 6.9 to 8.4 units, dissolved oxygen concentrations ranging from 2.4 to 11.0 mg/L, and total dissolved solids (TDS) concentrations ranging from 384 to 653 mg/L (USBR 2008). The Paria River at the US Highway 89 crossing has very high TDS concentrations, with mean TDS at 1,174 mg/L (132 samples collected from 1976 to 2002) and maximum recorded TDS at 2,564 mg/L during the

same time period. The Utah Division of Water Quality (DWQ) listed this reach of the Paria River as impaired in 2002 and recommended a site-specific criterion of 1,500 mg/L TDS as part of the Total Maximum Daily Load (TMDL) analysis. The US Environmental Protection Agency (EPA) considers that the Paria River water quality impairment is caused by mineralization and the probable source contributing to the impairment is natural. The Virgin River at the Highway 9 crossing near Hurricane, Utah has high TDS concentrations, with mean TDS at 1,470 mg/L and extremes ranging from 362 to 2,964 mg/L based on data collected from 1982 through 2002 (UDWQ 2004). The TDS concentrations in the Virgin River downstream from the town of Virgin are influenced by the 10 cfs flow from LaVerkin Springs, which has TDS concentrations ranging from 9,000 to 11,000 mg/L. This natural source of TDS in the Virgin River affects water uses including M&I supply, irrigation supply, and in-stream fish habitat.