Lake Powell Pipeline

Final Study Report 14 - Transportation

April 2016

Final Study Report 14 - Transportation
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Appendix A Transportation Management Plan

Final Study Report 14 - Transportation
Executive Summary

ES.1 Introduction

This study report describes the results and findings of an analysis to evaluate transportation impacts along the proposed alternative alignments of the Lake Powell Pipeline Project (LPP Project), No Lake Powell Water Alternative, and No Action Alternative. The purpose of the analysis, as defined in the 2008 Transportation Study Plan prepared for the Federal Energy Regulatory Commission (FERC), was to identify potential impacts on transportation in the region during construction and operation of the alternatives, identify the impacts of transportation on the LPP Project, and identify and document measures to mitigate impacts from the various transportation impacts as necessary.

ES.2 Methodology

The analysis of impacts on transportation follows methodology identified and described in the Preliminary Application Document, Scoping Document No. 1 and Transportation Study Plan filed with and approved by FERC.

ES.3 Key Results of the Transportation Impact Analyses

The significance criteria for the LPP Project are based on impacts and changes to traffic control, Level of Service (LOS), resource management goals, right-of-way (ROW) compliance, and compliance with the Federal Land Policy and Management Act (FLPMA), Highway Beautification Act, National Scenic Byway Program and Revised Statute 2477.

ES.3.1 LPP Project Alternatives

The alternative alignments of the LPP Project would have minor measurable impacts and no significant impacts on transportation. The Level of Service would not change with construction or operation of the LPP Project. Minor traffic delays could occur during pipeline construction of highway crossings and on highways where the construction activity is near the roadway surface. Traffic on some local roads could be delayed during specific pipeline construction activities and traffic controls would be required.

ES.3.2 No Lake Powell Water Alternative

The No Lake Powell Water Alternative would have no significant impacts on transportation. The Level of Service would not change with construction or operation of the No Lake Powell Water Alternative. Minor traffic delays could occur during pipeline construction of highway crossings and on highways where the construction activity is near the roadway surface. Traffic on some local roads could be delayed during specific pipeline construction activities and traffic controls would be required.

ES.3.3 No Action Alternative

The No Action Alternative would have no impacts on transportation.

Chapter 1
Introduction

1.1 Introduction

This chapter presents a summary description of the Lake Powell Pipeline (LPP) Project alignment alternatives, the No Lake Powell Water Alternative, and the No Action Alternative. It introduces the area studied for environmental resources. It provides an overview of the proposed LPP Project, including each alignment alternative and locator maps.

The LPP Project would deliver Utah's Colorado River water from Lake Powell to the service areas of Washington County Water Conservancy District (WCWCD) and Kane County Water Conservancy District (KCWCD). The LPP Project action alternatives studied include various pipeline and penstock system configurations. Each action alternative would deliver 86,249 acre-feet of municipal and industrial (M&I) use water to the following southwest Utah water conservancy district service areas:

- WCWCD would receive 82,249 acre-feet annually.
- KCWCD would receive up to 4,000 acre-feet annually.

One of the LPP systems previously studied included a conveyance system for the Central Iron County Water Conservancy District (CICWCD), which would have delivered approximately 13,249 acre-feet annually to the Cedar Valley area. The various alternatives were under study when the CICWCD decided to withdraw from the LPP Project, and this conveyance system is no longer being considered.

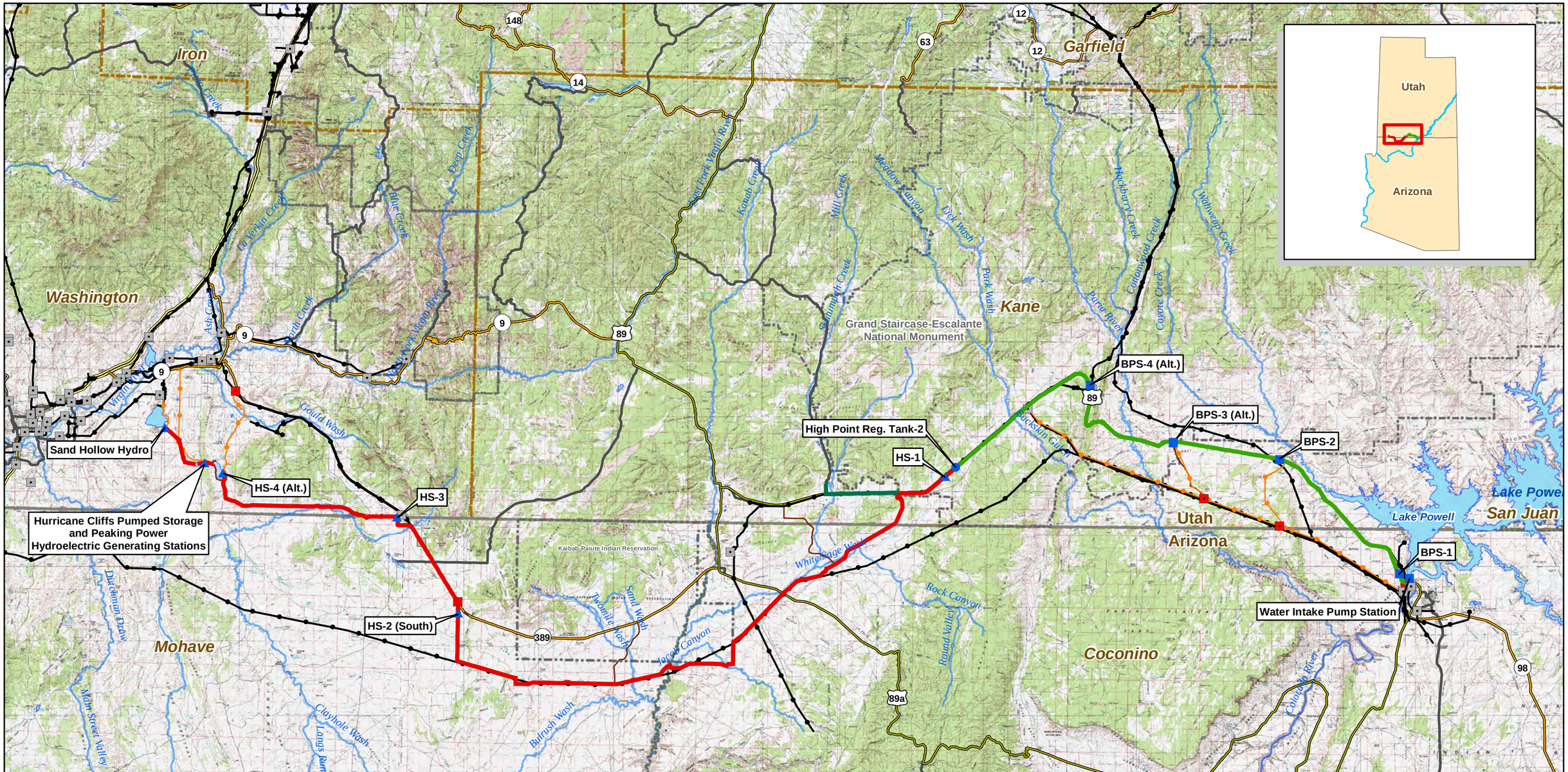
1.2 Summary Description of LPP Project Alignment Alternatives

Three primary pipeline and penstock alignment alternatives are described in this section, along with the electrical power transmission line alignments for providing power to the pump stations and a natural gas supply line alignment alternative. The pipeline and penstock alignment alternatives share common segments between the intake at Lake Powell and delivery at Sand Hollow Reservoir, and they differ spatially in, through and around Kaibab-Paiute Indian Reservation.

The South Alternative (Proposed Action) extends south around Kaibab-Paiute Indian Reservation. The Existing Highway Alternative follows an Arizona state highway through Kaibab-Paiute Indian Reservation. The Southeast Corner Alternative follows the Navajo-McCullough Transmission Line corridor through the southeast corner of Kaibab-Paiute Indian Reservation. The Electric Transmission Line alignments are common to all the pipeline and penstock alignment alternatives. The Natural Gas Supply Line Alignment Alternative is common to all pipeline and penstock alignment alternatives. The natural gas pipeline alignment would be coincident to the buried waterline and would not have a different alignment, as compared to transmission line alignments. Figure 1-1 shows the overall proposed project from Lake Powell near Page, Arizona to Sand Hollow Reservoir, Utah.

1.2.1 South Alternative

The South Alternative consists of four systems: **Water Intake, Water Conveyance, Hydro,** and **KCWCD** (see Figure 1-1).



Project Pump Station
Project Regulating Tank
Project Hydro Station
Substation
Proposed Substation

Water Conveyance System
Hydro System - South Alternative (Penstock Segment)
KCWCD System
Project Transmission Lines
Existing Transmission Lines

Interstate
US Highway
ST Highway
Hwy
Major Road
Access Roads

Hurricane Cliffs Forebay/Afterbay
Lakes & Reservoirs
Major Rivers & Streams

National Park/Monument
GSENM-Boundary
Tribal Lands
State Boundaries
County Boundaries

FERC Project Number:
12966-001
BLM Serial Numbers:
AZA-34941
UTU-85472

N

0 2.5 5 10 15 20 Miles

Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWRe **Figure 1-1** MWH

Lake Powell Pipeline Proposed Action

The **Water Intake System** would pump Lake Powell water via submerged horizontal tunnels and vertical shafts into the LPP. The intake pump station would be constructed and operated adjacent to the west side of Lake Powell, approximately 2,000 feet northwest of Glen Canyon Dam in Coconino County, Arizona. An enclosed pump station building would house vertical turbine pumps with electric motors, electrical controls, and other equipment at a ground level elevation of 3,745 feet above mean sea level (AMSL).

The **Water Conveyance System** would convey water diverted from Lake Powell at the Intake System through a buried 69-inch diameter pipeline for about 51 miles, parallel with Highway 89 in Coconino County, Arizona and Kane County, Utah, to a buried regulating tank (High Point Regulating Tank-2) along Highway 89 at ground level elevation 5,691 feet AMSL. The pipeline would be a line of connected pipes used for carrying water over a long distance. Figure 1-2 shows the LPP Project Water Intake and Water Conveyance systems. The High Point Regulating Tank-2 would be the LPP Project topographic high point (Figure 1-2). The pipeline would be sited within a utility corridor established by Congress in 1998 that extends 500 feet south and 240 feet north of the Highway 89 centerline on public land administered by Bureau of Land Management (BLM) (U.S. Congress 1998). Figure 1-3 shows the typical 100-foot-wide right-of-way and 20-foot-wide temporary construction easement for the water conveyance system pipeline, adjacent to and away from the highway.

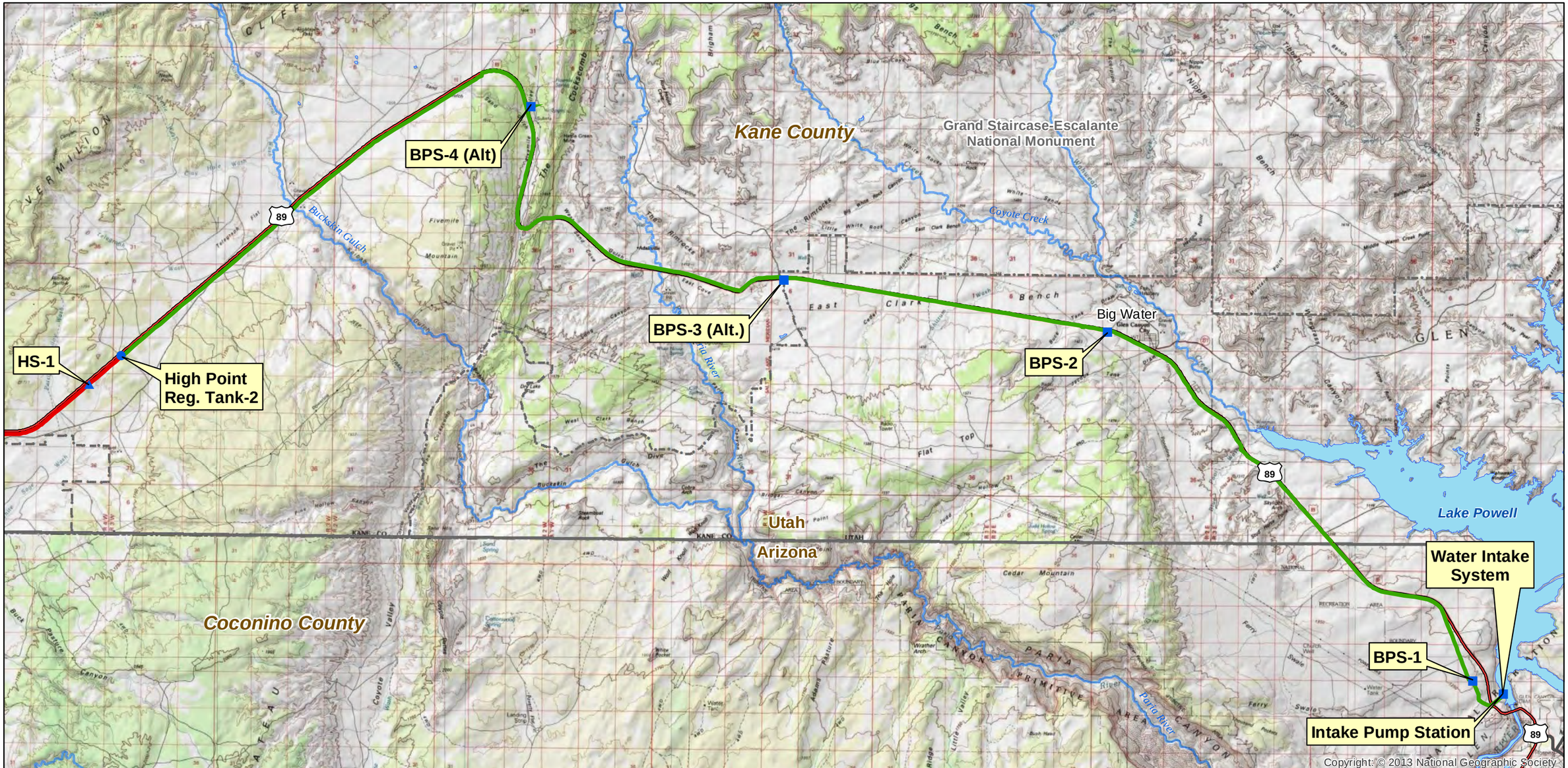
Four booster pump stations (BPS) along the pipeline would pump water to the high point regulating tank. Each BPS would house vertical turbine pumps with electric motors, electrical controls, and other equipment. Additionally, each BPS site would have a buried forebay tank, buried surge tanks, pig retrieval and launching stations, and a surface emergency overflow detention basin. BPS-1 would be located within Glen Canyon National Recreation Area (GCNRA) adjacent to an existing Arizona Department of Transportation maintenance facility, along a segment of abandoned highway, west of Highway 89. The BPS-1 site would cover about six acres and be surrounded by security fencing.

BPS-2 would be on land administered by Utah School and Institutional Trust Lands Administration (SITLA) near Big Water, Utah, on the south side of Highway 89. The BPS-2 site would cover about five acres and be surrounded by security fencing.

BPS-3 (Alt.) would be on land administered by BLM Kanab Field Office, near the east boundary of Grand Staircase-Escalante National Monument (GSENM) on the south side of Highway 89, within the Congressionally-designated utility corridor. The BPS-3 (Alt.) site would cover about five acres and be surrounded by security fencing.

BPS-4 (Alt.) would be located on private land east of Highway 89 and west of the Cockscomb geologic feature (Figure 1-2). The BPS-4 (Alt.) site would cover about six acres and be surrounded by security fencing. The proposed pipeline alignment west of the Cockscomb geologic feature would be situated adjacent to the south boundary of the Congressionally-designated utility corridor.

The proposed pipeline alignment would continue parallel to Highway 89 to the buried High Point Regulating Tank-2 at 5,691 feet AMSL, which would be the topographic high point of the LPP Project (Figure 1-2). The Water Conveyance System would terminate at High Point Regulating Tank-2. The buried High Point Regulating Tank-2 would cover about four acres and be surrounded by security fencing.



- Project Pump Station
- Project Regulating Tank
- Project Hydro Station
- Water Conveyance System
- Hydro System - South Alternative (Penstock Segment)
- KCWCD System
- Interstate
- US Highway
- ST Highway
- Hwy
- Major Road
- Lakes & Reservoirs
- Major Rivers & Streams
- National Park/Monument
- GSENM Boundary
- State Boundaries

FERC Project Number: 12966-001
BLM Serial Numbers: AZA-34941 UTU-85472

N

0 0.5 1 2 3 4 Miles

Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWRe **Figure 1-2** MWH

Lake Powell Pipeline Intake and Water Conveyance System

Figure 1-3 shows the typical 100-foot-wide right-of-way and 20-foot-wide temporary construction easement for the hydro system penstock adjacent to, and away from, the highway. Four in-line hydro generating stations (HS-1, HS-2 [South], HS-3, and HS-4 [Alt.]), with substations located along the penstock, would generate electricity and help control water pressure in the penstock. Each in-line hydro station would consist of a building housing the generator units, an afterbay reservoir, retention basin, pig retrieval and launching stations, switchyard, and maintenance parking area, all surrounded by perimeter security fencing.

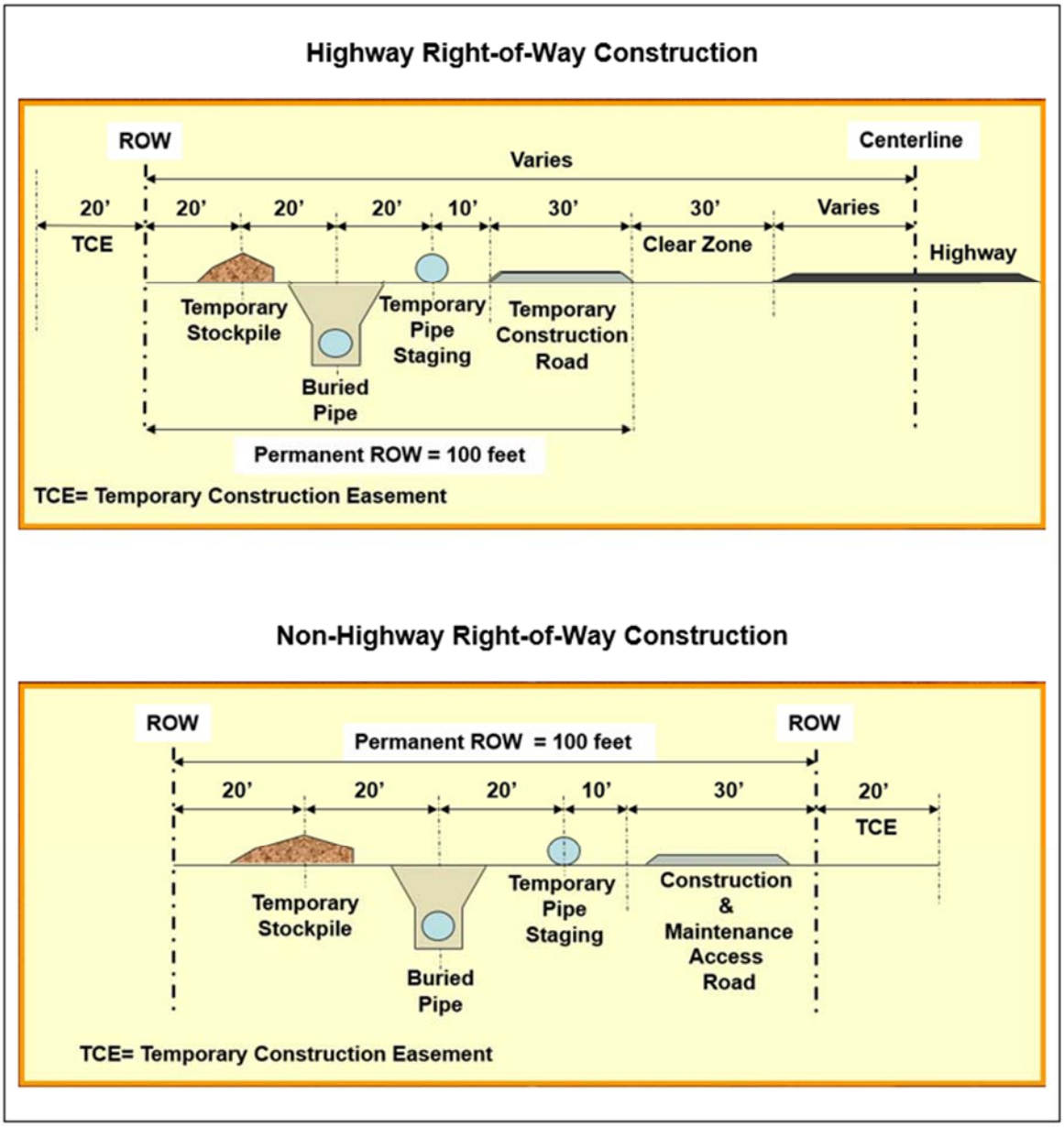


Figure 1-3
Pipeline and Penstock Right-of-Way

The **Hydro System** would convey the water from High Point Regulating Tank-2, at a topographic high point in the LPP Project with ground level elevation 5,691 feet AMSL, for about 87.5 miles through a buried 69-inch diameter penstock in Kane and Washington counties, Utah, and Coconino and Mohave counties, Arizona, to Sand Hollow Reservoir near St. George, Utah (Figure 1-4). A penstock is an enclosed pipe that delivers water to hydroelectric turbines.

A short penstock segment would convey the water to HS-1. This in-line hydro station would generate up to one megawatt (MW) of electricity at a site along Highway 89 within GSENM, and the penstock would continue west along Highway 89 to the GSENM west boundary. The HS-1 site would cover about five acres.

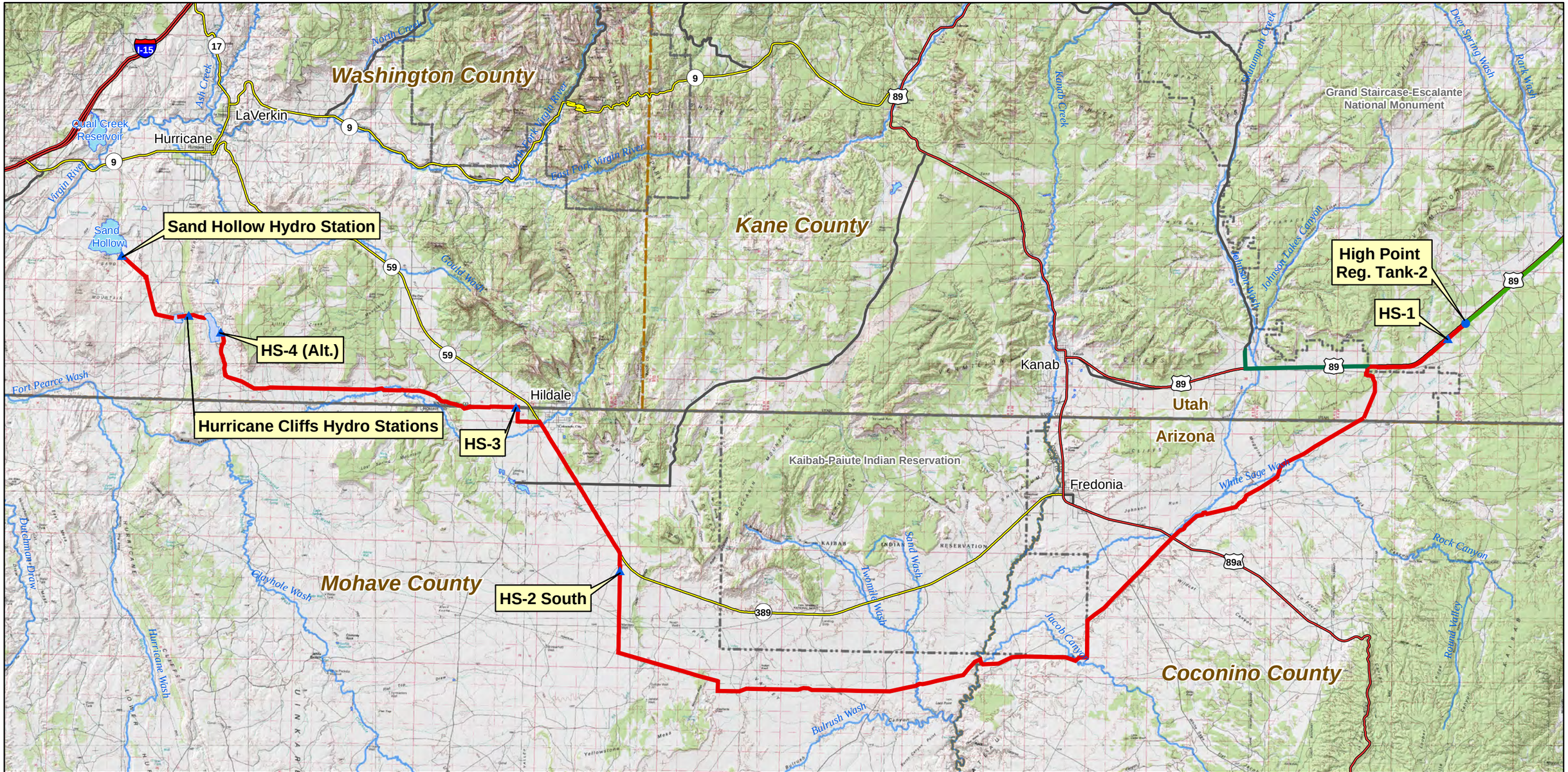
The penstock alignment would turn south from Highway 89 through private land and BLM-administered public lands into White Sage Wash. It would continue across White Sage Wash and then parallel Navajo-McCullough Transmission Line, crossing Highway 89 Alt. and Forest Highway 22 toward the southeast corner of Kaibab-Paiute Indian Reservation. The penstock alignment would run parallel to and south of the Kaibab-Paiute Indian Reservation south boundary, crossing Kanab Creek and Bitter Seeps Wash. It would continue across Moonshine Ridge and Cedar Ridge to Yellowstone Road. At this point, the penstock alignment would run north along Yellowstone Road to Arizona State Route 389 west of Kaibab-Paiute Indian Reservation. HS-2 (South) would be located west of Kaibab-Paiute Indian Reservation on private land east of Yellowstone Road. HS-2 (South) would generate up to one MW of electricity. The HS-2 (South) site would cover about five acres. The penstock alignment would continue northwest along the south side of Arizona State Route 389 past Colorado City to Hildale City, Utah, and HS-3. HS-3 would be located on private land west of Hildale City, Utah, north of and adjacent to Uzona Road. HS-3 would generate up to one MW of electricity. The HS-3 site would cover about five acres. A turnout for future delivery of 13,249 acre-feet of WCWCD's allocation of LPP Project water to Apple Valley would be located immediately west of HS-3.

The penstock alignment would follow Uzona Road west through Canaan Gap and south of Little Creek Mountain, turning north to HS-4 (Alt.) above the proposed Hurricane Cliffs forebay reservoir. HS-4 (Alt.) would be located on about three acres of public land administered by the BLM. HS-4 (Alt.) would generate up to 1.7 MW of electricity and would discharge into the forebay reservoir.

The forebay reservoir would be contained in a valley between two dams (south and north), maintaining active storage of 11,255 acre-feet of water. The forebay reservoir and two dams would cover about 500 acres of public land administered by BLM and would be surrounded by security fencing. A low-pressure tunnel would convey the water to a high-pressure vertical shaft in the bedrock forming the Hurricane Cliffs, connected to a high-pressure tunnel near the bottom of the Hurricane Cliffs. The high-pressure tunnel would connect to a penstock conveying the water to a 35-MW-capacity peaking power hydroelectric generating station and a 300-MW-capacity pumped storage hydroelectric generating station.

The Hurricane Cliffs hydroelectric generating stations and tailrace channel would cover about 50 acres of public land administered by BLM and would be surrounded by security fencing. The tailrace channel would discharge into an afterbay reservoir with 3,551 acre-feet of operating capacity, which is contained by a single dam in the valley below the Hurricane Cliffs. The afterbay reservoir and dam would cover about 200 acres of public land administered by BLM and would be surrounded by security fencing.

Water would be released from the forebay reservoir through the hydro generating system to meet peak power demands. Water would be pumped from the afterbay reservoir into the forebay reservoir during periods of off-peak power demand. The forebay and afterbay reservoirs would not be open to public access because the water levels would fluctuate rapidly during daily operations. A low pressure tunnel would convey the water northwest from the afterbay reservoir to a penstock, continuing to the Sand Hollow Hydro Station, which would generate up to 4.2 MW of electricity.



Project Pump Station
Project Regulating Tank
Project Hydro Station
Hurricane Cliffs Forebay/Afterbay
Lakes & Reservoirs

Water Conveyance System
Hydro System - South Alternative (Penstock Segment)
KCWCD System
Major Rivers & Streams

Interstate
US Highway
ST Highway
Hwy
Major Road

National Park/Monument
GSENM Boundary
Tribal Lands
State Boundaries
County Boundaries

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N

0 1 2 4 6 8 Miles

Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWRe **Figure 1-4** MWH

Lake Powell Pipeline Hydro System South Alternative

The Sand Hollow Hydro Station would be located on land owned by WCWCD and cover about five acres adjacent to Sand Hollow Reservoir. The LPP Project water would discharge from the Sand Hollow Hydro Station into the existing Sand Hollow Reservoir.

The **KCWCD System** would convey water diverted from Lake Powell through the LPP at the west GSENM boundary for about eight miles through a buried 24-inch diameter pipeline in Kane County, Utah, near the mouth of Johnson Canyon. The pipeline would parallel the south side of Highway 89 across Johnson Wash and then run north for 5000 feet to the mouth of Johnson Canyon (Figure 1-4).

1.2.2 Existing Highway Alternative

The Existing Highway Alternative consists of four systems: **Water Intake, Water Conveyance, Hydro,** and **KCWCD**. The **Water Intake** and **Water Conveyance** systems would be the same as described for the South Alternative. The **Hydro System** would convey water diverted at Lake Powell from High Point Regulating Tank 2 at the LPP Project topographical high point (5,691 feet AMSL) for about 80.5 miles through a buried 69-inch diameter penstock in Kane and Washington counties, Utah, and Coconino and Mohave counties, Arizona, to Sand Hollow Reservoir near St. George, Utah (Figure 1-5). The alternative alignment parallels Highway 89 to the west and south boundary of GSENM and continues along Highway 89 to Lost Spring Gap. Four in-line hydro generating stations (HS-1, HS-2 [Hwy], HS-3, and HS-4 [Alt.]) located along the penstock would generate electricity and help control water pressure in the penstock. The HS-1, HS-3 and HS-4 (Alt.) hydro stations would be the same as described for the South Alternative.

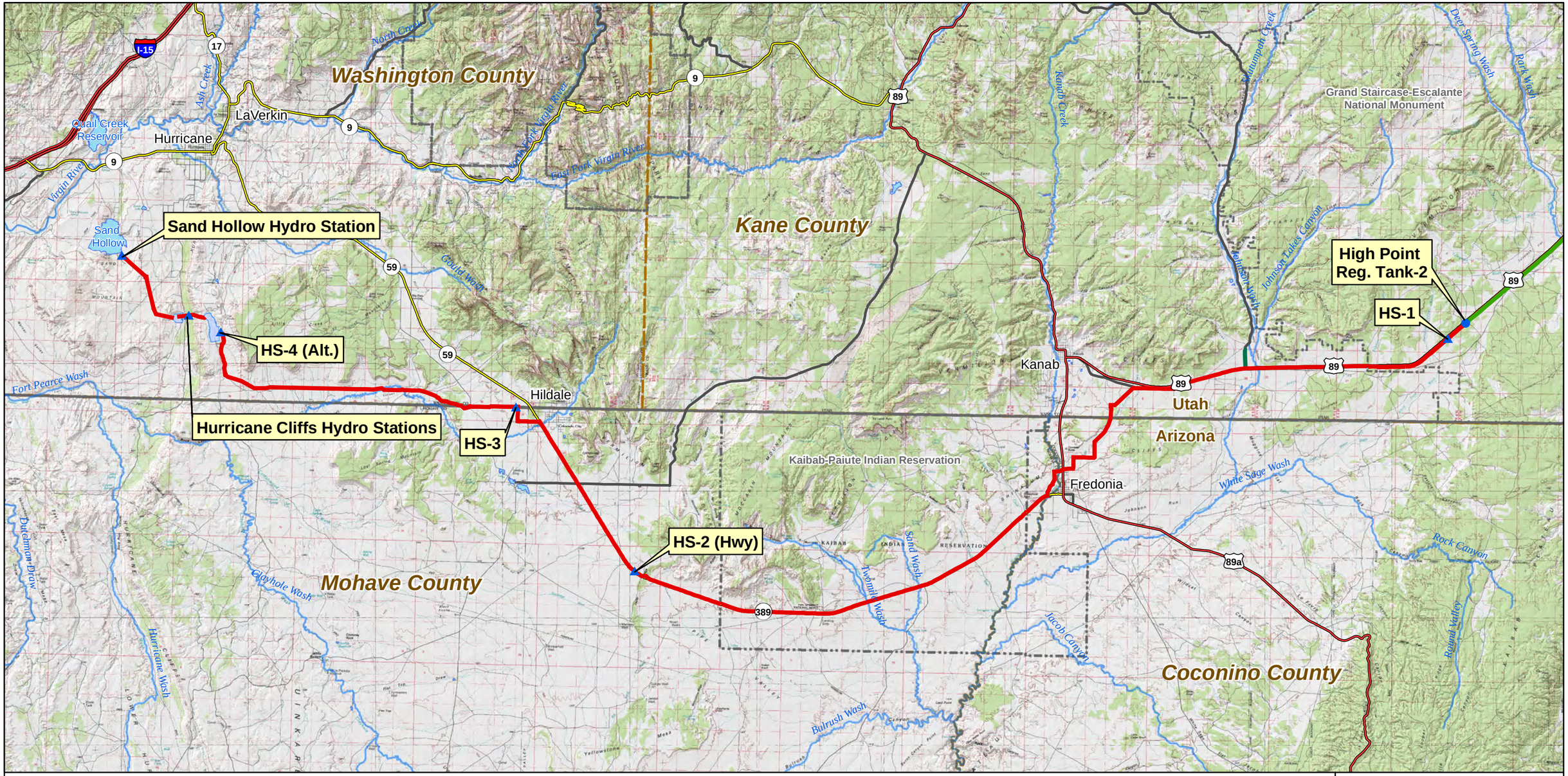
The penstock downstream from the proposed HS-1 would be sited along the south side of Highway 89 within GSENM. The penstock would parallel the south side of Highway 89 west of GSENM, continue past Johnson Wash and follow Lost Spring Gap southwest, crossing Highway 89 Alt. and Kanab Creek in the north end of Fredonia, Arizona. It would continue south, paralleling Kanab Creek to Arizona State Route 389, where it would run west, adjacent to the north side of Route 389 through Kaibab-Paiute Indian Reservation past Pipe Spring National Monument. The penstock would continue along the north side of Arizona State Route 389 through the west half of Kaibab-Paiute Indian Reservation to 1.8 miles west of Cedar Ridge (intersection of Yellowstone Road with Highway 89), where it would then follow the same alignment as the South Alternative to Sand Hollow Reservoir. HS-2 (Hwy) would be sited 0.5 miles west of Cedar Ridge along the north side of Arizona State Route 389. HS-2 (Hwy) would generate approximately 0.8MW of electricity and cover 8.7 acres of private land.

The **KCWCD System** would convey water diverted at Lake Powell from the LPP Project along Highway 89 north along Johnson Canyon Road for 5,000 feet through a buried 24-inch diameter pipeline in Kane County, Utah to the mouth of Johnson Canyon (Figure 1-5).

1.2.3 Southeast Corner Alternative

The Southeast Corner Alternative consists of four systems: Water Intake, Water Conveyance, Hydro, and KCWCD. The Water Intake, Water Conveyance, and KCWCD systems would be the same as described for the South Alternative.

The Hydro System would be the same as described for the South Alternative from High Point Regulating Tank 2 at the LPP Project topographical high point (5,691 feet AMSL) to the east boundary of Kaibab-Paiute Indian Reservation. At the east boundary of Kaibab-Paiute Indian Reservation, the penstock alignment would parallel the north side of the Navajo-McCullough Transmission Line corridor in Coconino County, Arizona, through the southeast corner of the Kaibab-Paiute Indian Reservation for about 3.8 miles. The penstock would then follow the South Alternative alignment south of the south boundary of the Kaibab-Paiute Indian Reservation, continuing to Sand Hollow Reservoir (Figure 1-6). The Southeast Corner Alternative would be about 85.7 miles long from High Point Regulating Tank-2 to Sand Hollow Reservoir.



Project Pump Station
Project Regulating Tank
Project Hydro Station
Hurricane Cliffs Forebay/Afterbay
Lakes & Reservoirs

Water Conveyance System
Hydro System - Existing Highway Alternative (Penstock Segment)
KCWCD System
Major Rivers & Streams

Interstate
US Highway
ST Highway
Hwy
Major Road

National Park/Monument
GSENM Boundary
Tribal Lands
State Boundaries
County Boundaries

FERC Project Number: 12966-001
BLM Serial Numbers: AZA-34941 UTU-85472

N

0 1 2 4 6 8 Miles

Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWRe **Figure 1-5** MWH

Lake Powell Pipeline Hydro System Existing Highway Alternative

1.2.4 Transmission Line Alignments

Transmission line alignments have been identified to transmit electric power to pump stations in the Water Intake and Water Conveyance systems, and to transmit electric power generated by hydroelectric stations in the Hydro System. The transmission lines that would serve the Water Intake and Water Conveyance systems are located in the east half of the LPP Project. The transmission lines that would serve the Hydro System are located in the west half of the LPP Project.

The proposed new **Water Intake Transmission Line** would begin at Glen Canyon Substation and run parallel to Highway 89 for about 2,500 feet to a new switch station, cross Highway 89 at the Intake access road intersection, and continue northeast to a new electrical substation on the Intake Pump Station site. This 69 kV transmission line would be 0.9 mile long in Coconino County, Arizona (Figure 1-7).

The proposed new **BPS-1 Transmission Line** would begin at the new switch station located on the south side of Highway 89 and parallel the LPP Project Water Conveyance System alignment to a new electrical substation on the BPS-1 site west of Highway 89. The 69 kV transmission line would be about one mile long in Coconino County, Arizona (Figure 1-7).

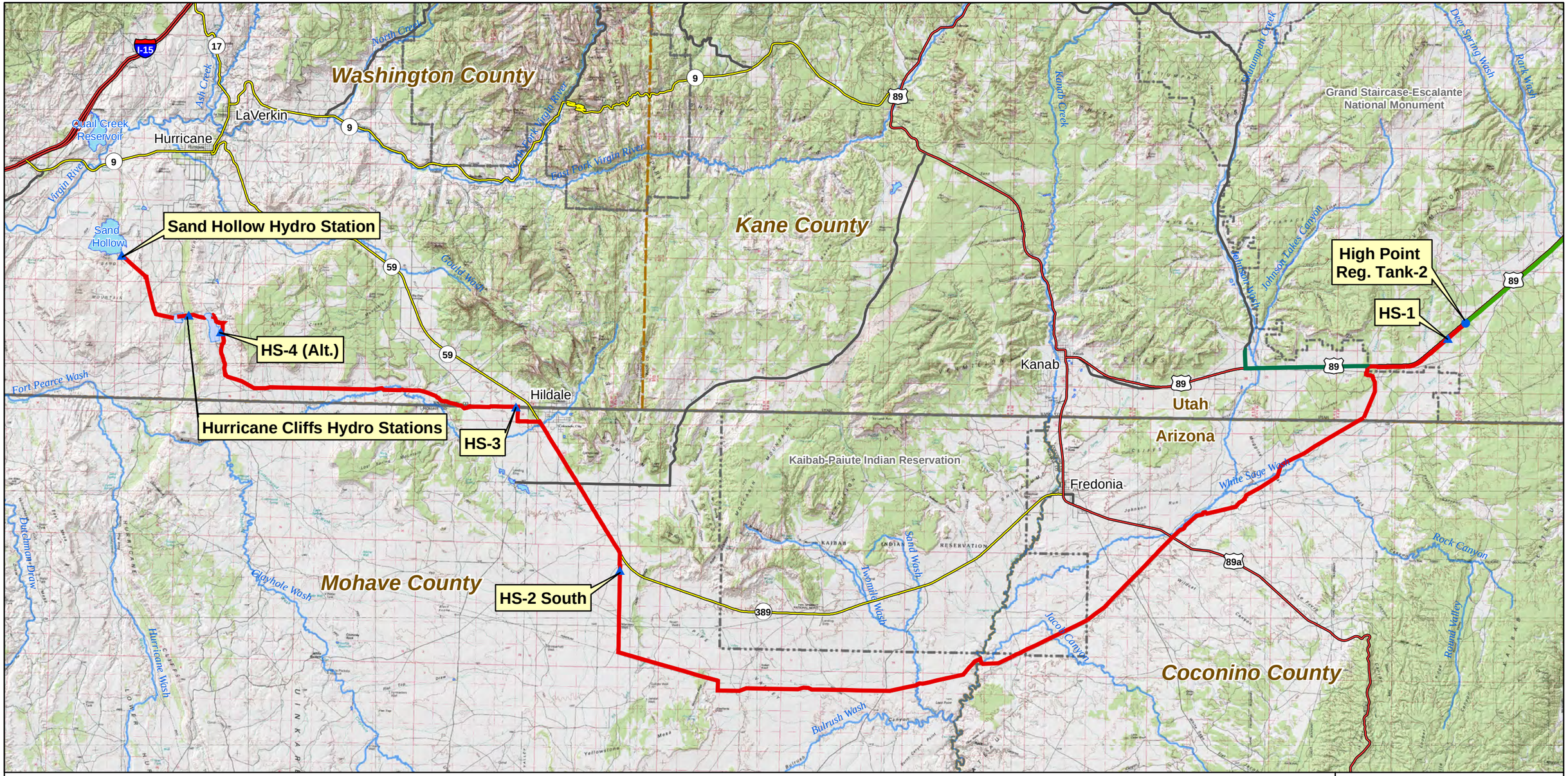
The proposed new **Glen Canyon to Buckskin Transmission Line** would consist of a 230 kV transmission line from the Glen Canyon Substation to the Buckskin Substation, running parallel to the existing 138 kV transmission line. This transmission line upgrade would be about 36 miles long through Coconino County, Arizona, and Kane County, Utah (Figure 1-7).

The existing **Buckskin Substation** would be upgraded as part of the proposed project to accommodate the additional power loads from the new 230 kV Glen Canyon to Buckskin transmission line. The substation upgrade would require an additional five acres of land within GSENM adjacent to the existing substation in Kane County, Utah (Figure 1-7).

The existing **Paria Substation** would be upgraded as part of the proposed project to accommodate the additional power loads to BPS-4 (Alt.). The substation upgrade would require an additional two acres of privately-owned land adjacent to the existing substation in Kane County, Utah (Figure 1-7).

The proposed new **BPS-2 Transmission Line** would consist of a new three-ring switch station along the new 230 kV Glen Canyon to Buckskin Transmission Line, a new transmission line from the switch station to a new substation west of Big Water, and a connection to BPS-2 substation in Kane County, Utah. The new transmission line would parallel an existing distribution line that runs northwest, north, and then northeast to Big Water. This new 138 kV transmission line alignment would be about seven miles long across Utah SITLA-administered land, with a 138 kV connection to a new electrical substation on the BPS-2 site (Figure 1-7).

The proposed new **BPS-3 Alt. Transmission Line South** would consist of a new three-ring switch station along the new 230 kV Glen Canyon to Buckskin Transmission Line, and a new transmission line from the switch station north along an existing BLM road to a new electrical substation on the BPS-3 (Alt.) site near the GSENM east boundary and within the Congressionally-designated utility corridor. This new 138 kV transmission line alignment would be about 5.9 miles long in Kane County, Utah (Figure 1-7).



- Project Pump Station
- Project Regulating Tank
- Project Hydro Station
- Hurricane Cliffs Forebay/Afterbay
- Lakes & Reservoirs
- Water Conveyance System
- Hydro System - Southeast Corner Alternative (Penstock Segment)
- KCWCD System
- Major Rivers & Streams
- Interstate
- US Highway
- ST Highway
- Hwy
- Major Road
- National Park/Monument
- GSENM Boundary
- Tribal Lands
- State Boundaries
- County Boundaries

FERC Project Number:
12966-001
BLM Serial Numbers:
AZA-34941
UTU-85472

N

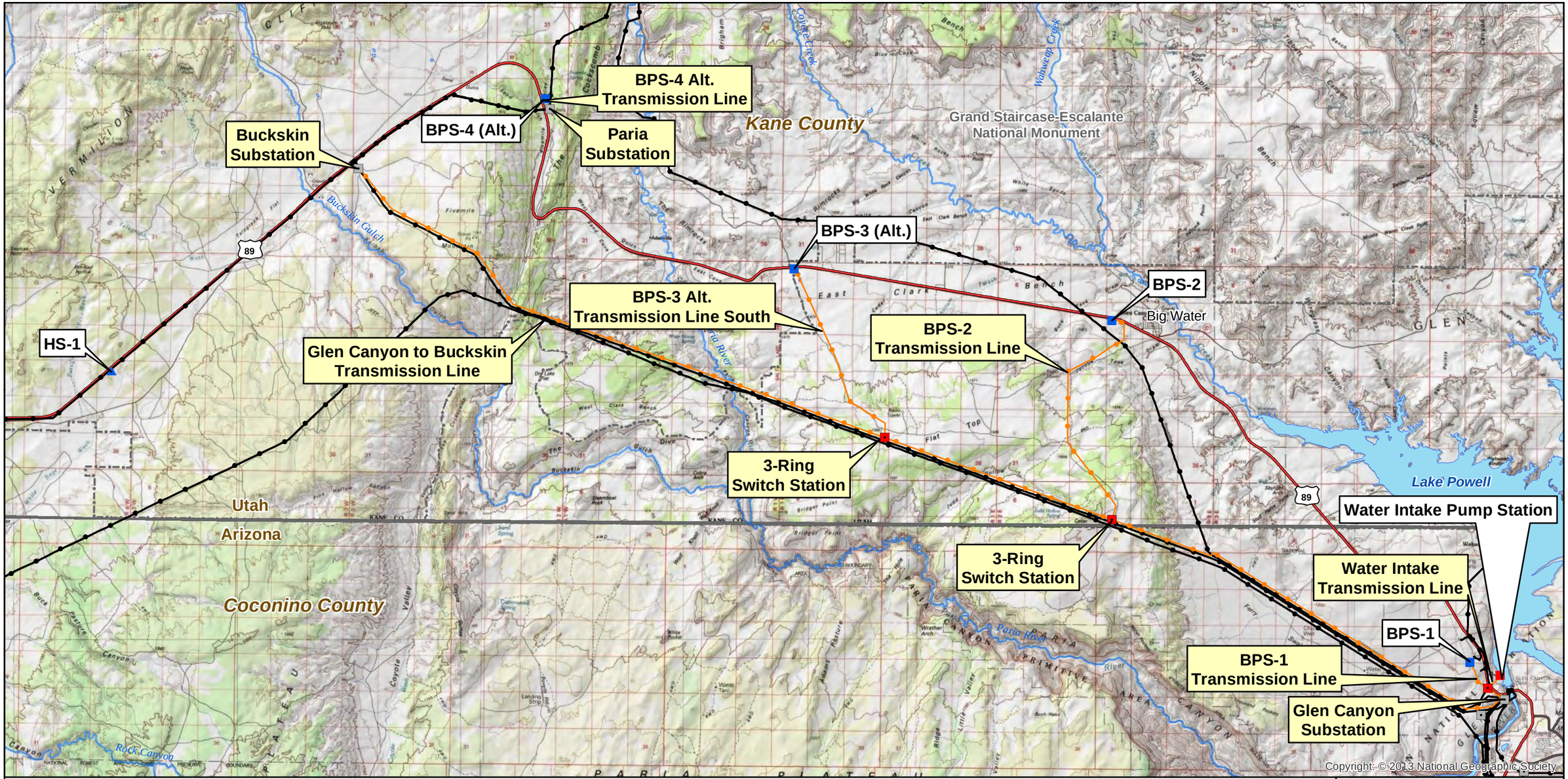
0 1 2 4 6 8 Miles

Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWRe **Figure 1-6** MWH

Lake Powell Pipeline
Hydro System
Southeast Corner Alternative



Project Intake Pump Station
Project Pump Station
Project Hydro Station
Substation
Proposed Substation
Project Transmission Lines
Existing Transmission Lines
Interstate
US Highway
ST Highway
Hwy
Major Road
Lakes & Reservoirs
Major Rivers & Streams
National Park/Monument
GSENM Boundary
State Boundaries

FERC Project Number:
12966-001
BLM Serial Numbers:
AZA-34941
UTU-85472

0 0.5 1 2 3 4 Miles

N

Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWRe **Figure 1-7** MWH

Lake Powell Pipeline Proposed Transmission Lines East

The proposed new **BPS-4 Alt. Transmission Line** would begin at the upgraded Paria Substation and run north to a new electrical substation on the BPS-4 Alternative site. This 69 kV transmission line would be about 0.4 mile long in Kane County, Utah (Figure 1-7).

The proposed new **HS-1 Transmission Line** would begin at the new HS-1 and tie into the existing 69 kV transmission line along Highway 89 from the Buckskin Substation to the Johnson Substation. The HS-1 69 kV transmission line would be about 400 feet long in Kane County, Utah (Figure 1-8).

The proposed new **HS-2 (South) Transmission Line** would connect the HS-2 hydroelectric station and substation along the South Alternative to an existing 138 kV transmission line paralleling Arizona State Route 389. This new 34.5 kV transmission line would be about 0.9 mile long in Mohave County, Arizona (Figure 1-8).

The new **HS-2 (Highway) Transmission Line** alternative would directly connect the HS-2 hydroelectric station and substation along the Existing Highway Alternative to an existing 138 kV transmission line paralleling Arizona State Route 389. This new 34.5 kV transmission line would be about 200 feet long in Mohave County, Arizona.

The proposed new **HS-3 Transmission Line** would connect the HS-3 hydroelectric station and substation to the existing Twin Cities Substation in Hildale City, Utah. The new 12.47 kV transmission line would be about 0.6 mile long in Washington County, Utah (Figure 1-8).

The proposed new **HS-4 (Alt.) Transmission Line** would connect the HS-4 (Alt.) hydroelectric station and substation to an existing transmission line parallel to Utah State Route 59. The new 69 kV transmission line would be about 7.5 miles long in Washington County, Utah (Figure 1-8).

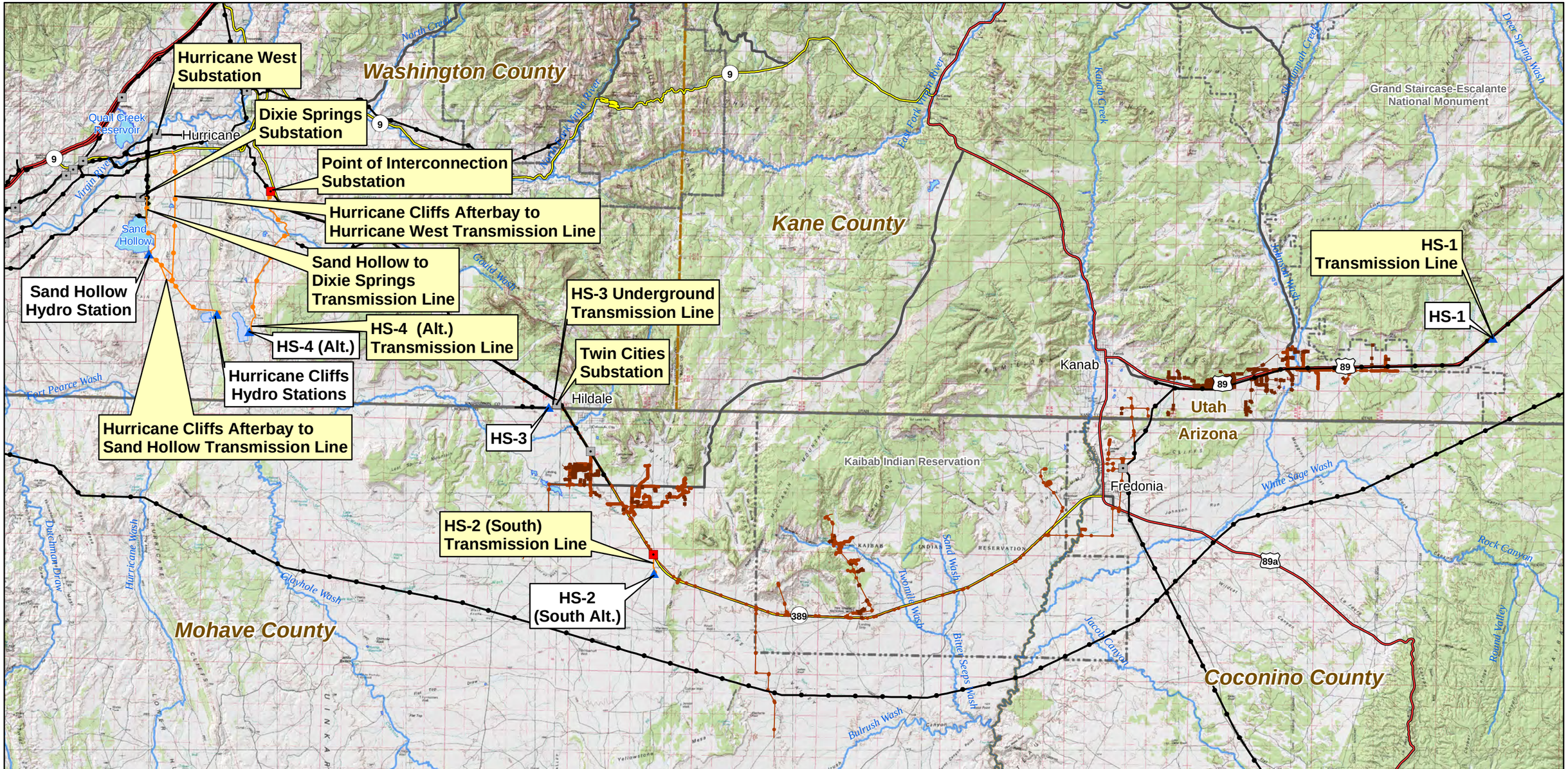
The proposed new **Hurricane Cliffs Afterbay to Sand Hollow Transmission Line** would consist of a new 69 kV transmission line, which would run northwest from the Hurricane Cliffs peaking power plant and substation to the Sand Hollow Hydro substation. This new 69 kV transmission line would be about 4.9 miles long in Washington County, Utah (Figure 1-8).

The proposed new **Hurricane Cliffs Afterbay to Hurricane West Transmission Line** would consist of a new 345 kV transmission line, running from the Hurricane Cliffs pumped storage power plant northwest and then north to the planned Hurricane West 345 kV substation. This new 345 kV transmission line would be about 10.9 miles long in Washington County, Utah (Figure 1-8).

The proposed new **Sand Hollow to Dixie Springs Transmission Line** would consist of a new 69 kV transmission line, running from the Sand Hollow Hydro substation around the east side of Sand Hollow Reservoir and north to the existing Dixie Springs Substation. This new 69 kV transmission line would be about 3.4 miles long in Washington County, Utah (Figure 1-8).

1.2.5 Natural Gas Pipeline and Generators Alternative

Natural gas engine-driven generation systems to power electric pumps would be an alternative to powering the LPP Project pump stations by electricity via transmission lines. Recent discussions with Questar Gas Company (local natural gas supplier) indicated that capacity would be available in the Kern River natural gas pipeline, which is located west of St. George, Utah, to supply natural gas for this alternative. Questar Gas Company indicated the company has future plans to extend a high pressure natural gas pipeline from the Kern River line to Hurricane, Utah. The Questar Gas pipeline would be sized to supply natural gas to the LPP Project if it is determined that a single-purpose, dedicated high pressure gas line would be extended to service the LPP pump stations. Based on the preliminary pump selection and fuel requirements, the natural gas supply pipeline would be 12 inches in diameter to provide natural gas supply for the LPP Project pump stations. The pipeline would likely be successively reduced in size as it delivers gas to each of the pump stations.



Project Hydro Station
Substation
Proposed Substation
Project Transmission Lines
Existing Transmission Lines
Existing OH Primary Line
Existing UG Primary Line
Hurricane Cliffs Forebay/Afterbay
Lakes & Reservoirs
Major Rivers & Streams
Interstate
US Highway
ST Highway
Hwy
Major Road
National Park/Monument
GSENM Boundary
Tribal Lands
State Boundaries
County Boundaries

FERC Project Number:
12966-001
BLM Serial Numbers:
AZA-34941
UTU-85472

N

0 1 2 4 6 8 Miles

Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWRe **Figure 1-8** MWH

Lake Powell Pipeline Proposed Transmission Lines West

1.2.5.1 Natural Gas Transmission Line Connection

The natural gas supply line alternative would connect to the proposed Questar Gas Transmission Line from the existing Kern River line to Hurricane City. The natural gas supply line would connect to the high pressure gas transmission line at a proposed gate station southeast of Sand Hollow Reservoir. The proposed gate station would be located adjacent to the alignment of the extension of the Southern Corridor Highway, which is the existing alignment of Sand Hollow Road east of Sand Hollow Reservoir (Figure 1-9).

1.2.5.2 Natural Gas Supply Line

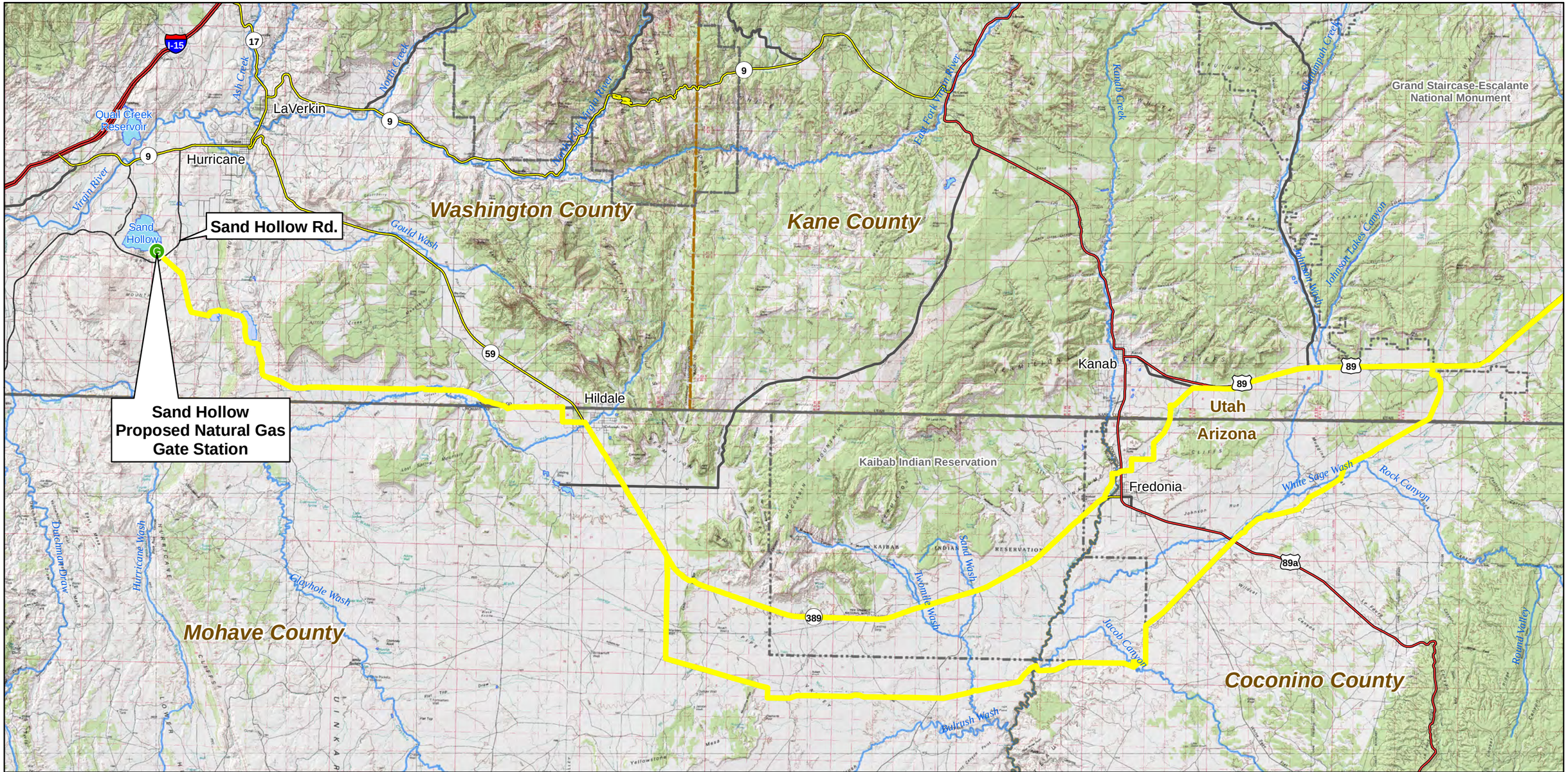
The proposed natural gas supply line would be an intermediate high pressure line and would operate between approximately 250 to 300 psi at the gate station connection. Because of pressure losses in the pipeline it is anticipated that the pressure at each of the LPP pump stations would vary between 50 and 100 psi, which would meet the requirements of the natural gas generators. The pipeline would be constructed of strong carbon steel and have a dielectric coating, such as a fusion bonded epoxy or extruded polyethylene. It would be installed with a minimum four feet of cover and be provided with cathodic protection (a technique that involves inducing an electric current through the pipe to ward off corrosion and rusting). The pipeline would be designed, constructed, tested, and operated at a minimum in accordance with all applicable requirements included in the U.S. DOT regulations in 49 CFR Part 192, “Transportation of Natural Gas and other Gas by Pipeline: Minimum Federal Safety Standards,” and other applicable federal and state regulations.

The natural gas supply line would follow the proposed LPP ROW from the Sand Hollow Gate Station to the intake pump station near Page, Arizona. The line would be about 138.5 miles long and installed a minimum of 10 feet from the edge of the proposed water pipeline in a separately excavated trench within the LPP ROW. Figure 1-9 shows the west alignment of the natural gas supply line as proposed and an alternative alignment along Arizona State Route 389 and through Fredonia, Arizona, parallel to the Existing Highway Alternative alignment, both to the west GSENM boundary. Figure 1-10 shows the east alignment of the natural gas supply line as proposed from the west GSENM boundary to the water intake pump station.

Sectionalizing valves would be required along the natural gas supply line alignment. These valves are safety devices used for emergency shut down or maintenance. The natural gas supply line sectionalizing valves would be required at approximately 20-mile intervals because of the gas line’s remoteness. The main line valve sites would cover a 40-foot by 40-foot area surrounded by a chain link fence within the confines of the permanent LPP pipeline ROW. The valves would be above ground and connected to the buried natural gas supply line. Additionally, pig launching or receiving equipment would be installed within the fenced areas. Pigs are devices that are placed into a natural gas supply line to clean the inside walls or to monitor its internal and external condition. Launching and receiving equipment is connected to the natural gas supply line to enable pigs to be inserted into or removed from the pipeline.

1.2.5.3 Natural Gas Generators

Natural gas generators would be used to supply power to operate the electric pumps at the LPP pump stations. The size of the electric pumps is approximately 18 feet from center to center when configured. The overall pump station building size would be 14 feet wider and 18 feet longer than the pump stations which are powered by electricity from transmission lines.



Natural Gas Gate Station
Natural Gas Supply Line Alignment
Hurricane Cliffs Forebay/Afterbay
Lakes & Reservoirs
Major Rivers & Streams
Interstate
US Highway
ST Highway
Hwy
Major Road
National Park/Monument
GSENM Boundary
Tribal Lands
State Boundaries
County Boundaries

FERC Project Number:
12966-001
BLM Serial Numbers:
AZA-34941
UTU-85472

N

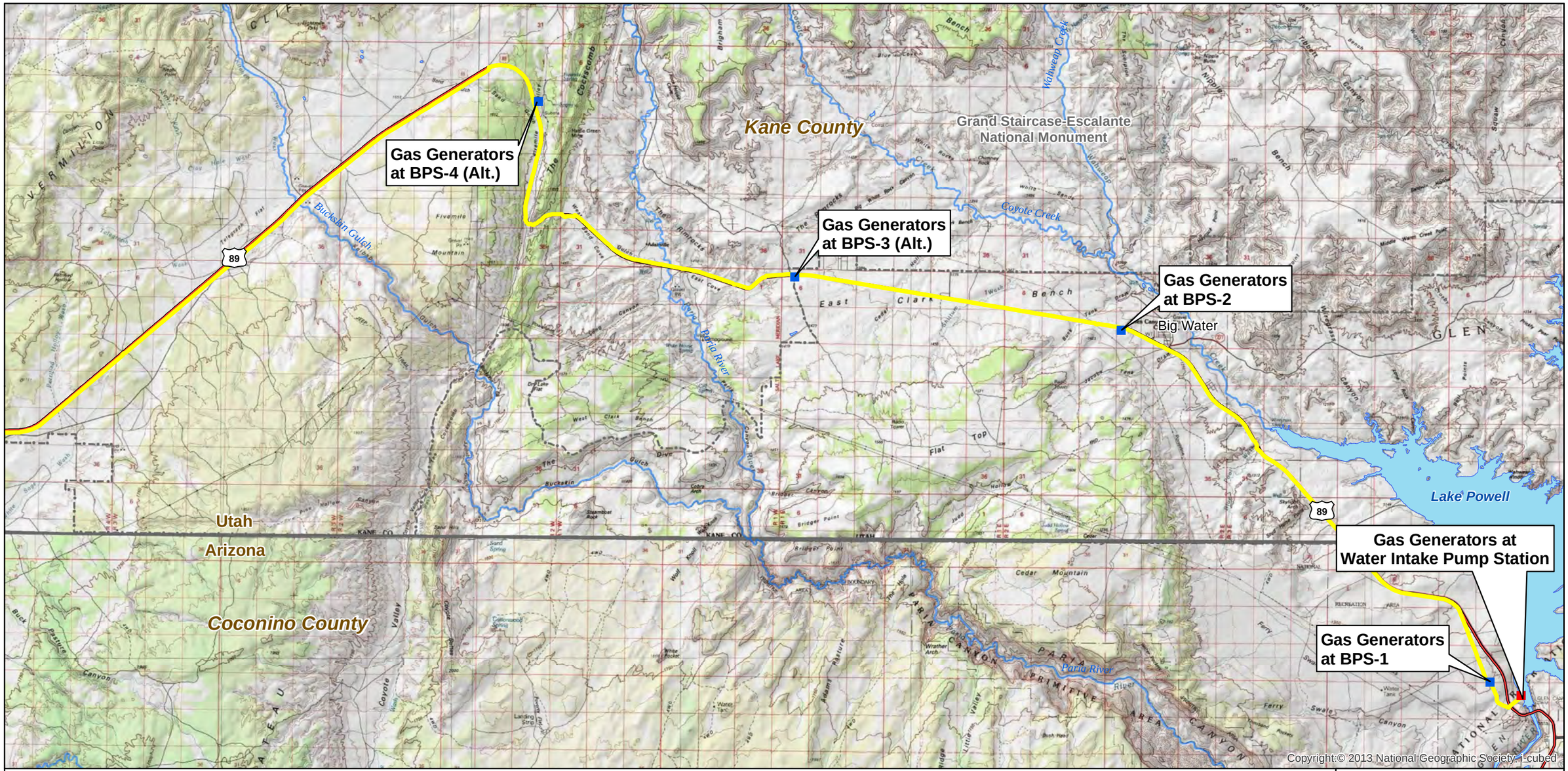
0 2 4 6 8 10 Miles

Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWRe **Figure 1-9** MWH

Lake Powell Pipeline
Natural Gas Supply Line and Generators West Alternatives



Project Water Intake Pump Station
Gas Generators at Booster Pump Station
Natural Gas Supply Line Alignment

Interstate
US Highway
ST Highway
Hwy
Major Road

Lakes & Reservoirs
Major Rivers & Streams
National Park/Monument
GSENM Boundary
State Boundaries

FERC Project Number:
12966-001
BLM Serial Numbers:
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UTU-85472

N

0 1 2 3 4 Miles

Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWRe **Figure 1-10** MWH

Lake Powell Pipeline Natural Gas Supply Line and Generators East Alternative

The natural gas generators would be approximately 35 feet long by eight feet wide by nine feet high. The intake pump station building size for the natural gas generators would be approximately 65 feet wide by 170 feet long by 50 feet high, and located adjacent to the pump station electrical room within the five-acre site designated for each pump station. The booster pump station building size for the natural gas generators would be 65 feet wide and 39 feet high, with lengths ranging from 114 feet to 162 feet long. Each natural gas generator would require a 24-inch diameter stack, with guide wires, extending above the building roof to disperse the exhaust gases. The five stacks (four operating natural gas generators plus one standby natural gas generator) at the intake pump station would extend 20 feet above the top of the 55-foot tall building. The stacks at BPS-1, BPS-2, BPS-3 (Alt.), and BPS-4 (Alt.) would extend 61 feet above the top of the buildings to a total height of 100 feet above the ground surface. The natural gas generators at the intake pump station and BPS-4 (Alt.) would require emission control systems to meet air quality standards.

The natural gas generators alternative at the LPP pump stations would require an annual natural gas supply of 2,855,400 million British thermal units (MMBtu). Table 1-1 shows the annual natural gas consumption at the proposed project intake pump station and booster pump stations 1 through 4.

Table 1-1
Water Conveyance System Natural Gas Generator Annual Fuel Consumption

Pump Station	Site Elevation Feet MSL	Number of Pumps	Motor (HP)	Total Motor (kW)	Natural Gas Generator GE Model	# of Units [1]	Emission Control Required	Generator Total kW[2]	Annual Fuel Consumption (MMbtu)[3]
IPS	3,750	5	3000	11,190	JGS 620 F09	4+1	Yes	12,120	729,000
BPS-1	4,111	5	1500	5,595	JGS 620 F09	2+1	No	5,992	364,500
BPS-2	4,311	5	1750	6,530	JGS 620 F09	3+1	No	8,895	425,400
BPS-3 Alt.	4,657	5	2500	9,325	JGS 620 F09	4+1	No	11,652	607,500
BPS-4 Alt.	5,001	5	3000	11,190	JGS 620 F09	5+1	Yes	14,430	729,000
Total	**25**			**43,830**		**18+5**		**53,089**	**2,855,400**

Notes:
[1] Number of operating units plus standby generator
[2] Total generator capacity without standby generator
[3] The annual fuel consumption is based on all pumps operating at rated motor horsepower, 8400 hours/year operation with generators loaded at 87 percent on the average.

1.3 Summary Description of No Lake Powell Water Alternative

The No Lake Powell Water Alternative would involve a combination of developing remaining available surface water and groundwater supplies, developing reverse osmosis (RO) treatment of existing low quality water supplies, and eliminating residential outdoor water use in the WCWCD service area. This alternative could provide a total of 86,249 acre-feet of water annually to WCWCD and KCWCD for M&I use without diverting Utah's water from Lake Powell.

1.3.1 WCWCD No Lake Powell Water Alternative

1.3.1.1 Background

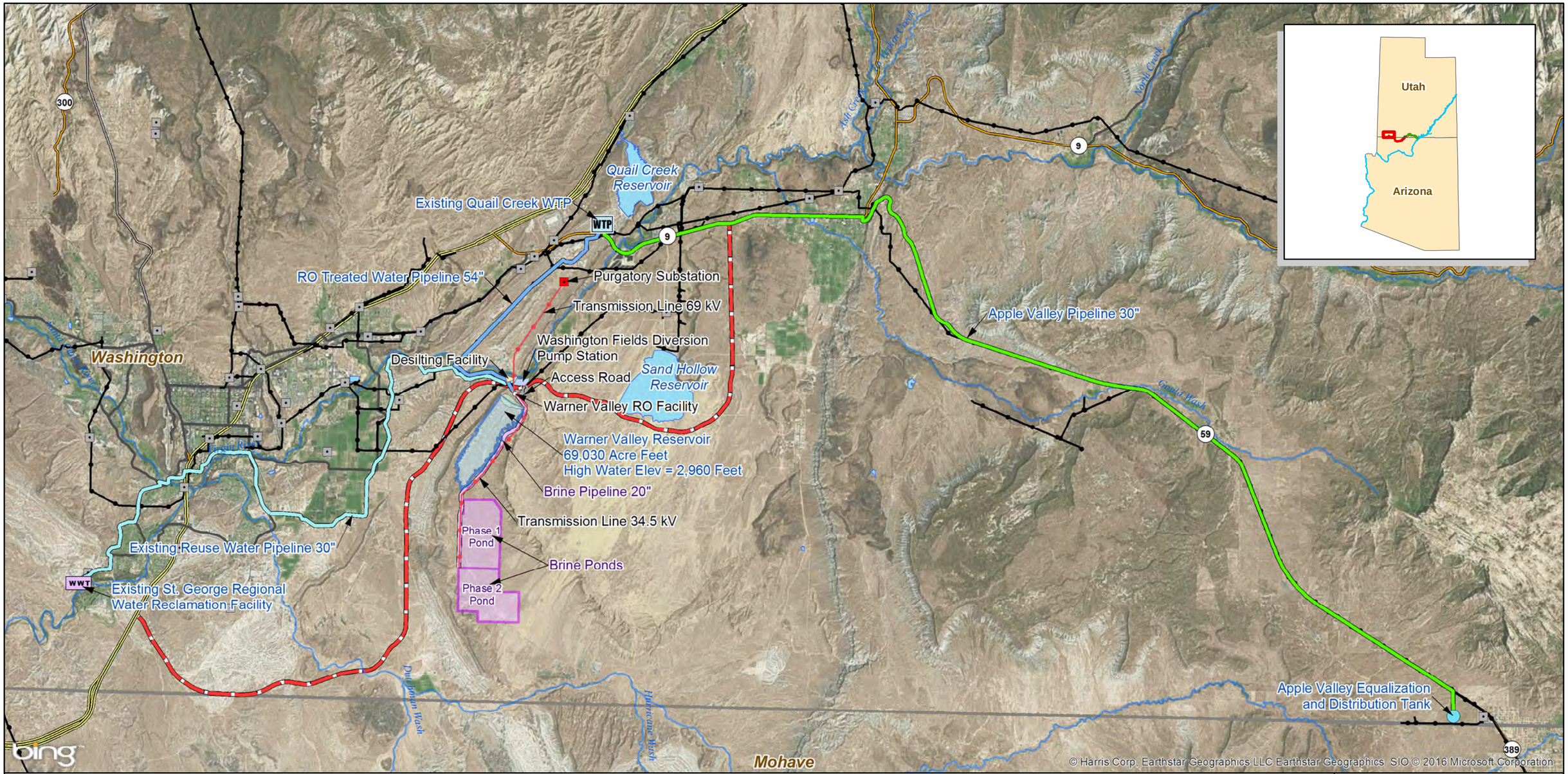
The WCWCD LPP allocation would be 82,249 acre-feet per year, and the WCWCD No Lake Powell Water alternative would need to supply 82,249 acre-feet per year to meet the same future water demands. In addition to the direct supply from Utah's Colorado River water, the water supplied by the LPP Project would provide additional wastewater reuse supply provided that sufficient storage is available.

The No Lake Powell Water Alternative would serve the same population as the LPP Project. WCWCD would implement other future water development projects currently planned by the District, develop additional water reuse/reclamation programs, continue to implement new water conservation measures, and convert additional agricultural water use to M&I use as a result of urban development in agricultural areas through 2028. Remaining planned and future water supply projects include the Ash Creek Pipeline (2,840 acre-feet per year), Sand Hollow recharge/recovery (3,000 acre-feet per year), Westside groundwater wells arsenic treatment (5,000 acre-feet per year), and development/yield increase of existing groundwater wells (2,830 acre-feet per year). Along with existing supplies, these future water supplies would yield an estimated 72,842 acre-feet per year of potable water and 8,505 acre-feet per year secondary water by 2028.

Under the No Lake Powell Water Alternative, actions in addition to the currently planned WCWCD projects would be taken to meet the water demand that would have been supplied by the Lake Powell Pipeline, as described below.

1.3.1.2 WCWCD No Lake Powell Water Alternative Features

Beginning in 2025, Washington County residential outdoor potable water use would be permanently re-purposed to indoor potable water use to help meet increasing indoor potable water demands. The WCWCD would develop a reverse osmosis (RO) advanced water treatment facility near the Washington Fields Diversion in Washington County, Utah, to treat up to 50,000 acre-feet per year of diverted Virgin River water, which has a high total dissolved solids (TDS) concentration, mixed with an additional 19,030 acre-feet per year of reuse water. WCWCD would develop the Warner Valley Reservoir to store the reuse water and diverted Virgin River water prior to RO treatment. A water distribution pump station and pipeline would be constructed to convey 13,249 acre-feet of potable water from Quail Creek Water Treatment Plant to the Apple Valley area of Washington County. Figure 1-11 shows the primary conceptual components of the No Lake Powell Water Alternative. Table 1-2 summarizes available supplies and projected demands under the No Lake Powell Water Alternative and the LPP Project alternatives.



WTP Quail Creek WTP (Existing)
WWT St. George Regional Water Reclamation Facility (Existing)
Substation
Substation (Future)
Warner Valley Transmission Line
Existing Transmission Lines
Desilting Facility
RO WTP
Washington Fields Diversion Pump Station
Lakes & Reservoirs
Brine Evaporation Ponds
Access Road
Apple Valley Pipeline 30"
Brine Pipeline 20"
Existing Reuse Water Pipeline 30"
RO Treated Water Pipeline 54"
Major Rivers & Streams
Interstate
US Highway
ST Highway
Hwy
Major Road
Southern Corridor Highway
State Boundaries
County Boundaries

FERC Project Number:
12966-001
BLM Serial Numbers:
AZA-34941
UTU-85472

N

0 0.75 1.5 3 4.5 6 Miles

Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWRe **Figure 1-11** MWH

No Lake Powell Water Alternative Primary Infrastructure

Table 1-2 Available Supplies and Projected Demands Under the No Lake Powell Water and Lake Powell Pipeline Project Alternatives		
	No Lake Powell Water Alternative	**Lake Powell Pipeline Project Alternative**
Existing Supplies	67,677	67,677
Planned Projects	13,670	13,670
Lake Powell Pipeline Project	0	82,249
RO Treatment of Virgin River and Reuse Water	57,883	0
Agricultural Conversion	0[1]	10,080
Reuse	17,100[2]	36,130
2060 Total Supply	156,330	209,806
2060 Total Demand	133,119[3]	185,285
Surplus in 2060	**23,211**	**24,521**

Notes:
[1]Agricultural conversion water included in RO treatment.
[2]19,030 acre-feet per year additional reuse included in RO treatment.
[3]Demand reduced 52,166 acre-feet per year from elimination of residential outdoor watering.

1.3.1.2.1 Re-Purposing Potable Water Use. The No Lake Powell Water Alternative would permanently eliminate residential outdoor potable water use in Washington County, re-purposing the portion of potable water used for residential outdoor watering to indoor potable use. Projections of future water use through 2060 account for population growth, climate change (projected 6 percent reduction of Virgin River flows by 2050 [Reclamation 2014]), and water conservation (35 percent reduction in per capita water use from 2000 to 2060). Potable water in Washington County is consumed for residential indoor and outdoor uses, commercial uses, institutional uses, and industrial uses. These potable water uses would total 130,245 acre-feet per year by 2052, the year the LPP Project water is anticipated to be fully utilized (UDWRe 2015). Gradually eliminating residential outdoor potable water use starting in 2025 would provide the growing population with potable water for indoor use through 2045; however, re-purposing residential outdoor potable water use to indoor use would not increase the water supply and would have to be accompanied by adding another water supply to meet the growing demand. Re-purposing residential outdoor potable water use to indoor potable use would require converting traditional residential outdoor landscapes and uses to either landscaping requiring no irrigation or desert landscapes compatible with the local climate. Residential water users would be responsible for converting their traditional outdoor landscapes to non-irrigated or desert landscapes. If no additional water supply was added in Washington County after 2025 and potable water use continued to meet residential indoor and outdoor purposes, then the projected population would completely utilize the potable water supply of 72,842 acre-feet per year by 2028.

1.3.1.2.2 Reverse Osmosis Water Treatment. Washington County's additional future water supply under the No Lake Powell Water Alternative would be dependent on two water sources: 1) Virgin River water diverted at the Washington Fields Diversion; and 2) reuse water from an expanded St. George Regional Water Reclamation Facility. WCWCD would develop a RO advanced water treatment facility near Washington Fields Diversion in Washington County, Utah. The RO facility would be designed to treat 50,000 acre-feet of de-silted water per year diverted from the Virgin River at Washington Fields

Diversion. St. George Regional Wastewater Reclamation Facility would provide an additional 19,030 acre-feet of water per year to be treated at the RO facility. The RO facility would be necessary to remove the high concentrations of TDS present in both the Virgin River and the effluent from the St. George Regional Wastewater Reclamation Facility. The reuse facility has a current capacity of approximately 7,800 acre-feet per year, with a future design capacity of 11,760 acre-feet per year. An additional 7,830 acre-feet per year of future wastewater reclamation capacity would need to be added to meet the total reuse water requirement of 19,030 acre-feet per year for RO processing inflow. The RO process would separate the TDS from the water, resulting in two products: 1) a treated water product; and 2) a brine product consisting of highly concentrated salts. A two-stage RO process would be applied to the brine solution to recover additional water and reduce the brine volume for enhanced evaporation. The RO-treated water product would be pH-adjusted to neutral pH, dosed with sodium silicate, mixed with conventionally-treated water from the Quail Creek Water Treatment Plant, and disinfected for distribution throughout the WCWCD service area. The RO advanced water treatment facility would process up to 64,313 acre-feet per year and produce up to 57,883 acre-feet per year of water suitable for M&I potable indoor use. The two-stage RO process would remove 90 percent of the TDS. The remaining 10 percent rejection (6,430 acre-feet per year) of brine by-product from the RO treatment process would require evaporation and disposal meeting State of Utah water quality regulations. The RO water treatment plant would process approximately 64,313 acre-feet per year of inflow water from Warner Valley Reservoir storage to meet the 2052 water demand under the No Lake Powell Water Alternative.

The RO water treatment plant processes would consist of pressurized, parallel ultra-filtration units, an influent storage tank with acid added to adjust the pH, pressurized cartridge filtration to remove additional particles from the water, high pressure pumping to pass the water through the parallel RO membrane units, a product water storage tank with saturated lime solution added to adjust the pH of the treated product water prior to disinfection and distribution as potable water, and brine storage tanks in series with the two-stage RO process units for further brine reduction. These water treatment processes would be housed in a water treatment building with electrical, mechanical, chemical storage and metering, heating/air conditioning/ventilation, and Supervisory Control and Data Acquisition (SCADA) systems. A seven-mile long buried 54-inch diameter pipeline would convey the product water from a pump station at the RO water treatment plant to the Quail Creek Water Treatment Plant. The RO water treatment plant would add RO membrane units in phases as necessary to meet the growing water demand. The RO water treatment plant would be powered by electricity, requiring a 2.8-mile long 69-kV power transmission line from the proposed Purgatory Substation.

The concentrated brine product (6,430 acre-feet per year) would be pumped from the brine tanks through a pipeline to an evaporation apron, spray system and double-lined pond, and then pumped into spray headers over a series of double-lined ponds with leak detection and recovery systems. The enhanced evaporation ponds would be located south of Warner Valley Reservoir and would cover approximately 2,000 acres, developed in two phases. A buried brine conveyance pipeline approximately 4.4 miles long would convey the concentrated brine to the enhanced evaporation ponds. A 4.4-mile long 34.5-kV power transmission line would be extended from the RO water treatment plant to the enhanced evaporation ponds to provide electricity for the pumps spraying the brine solution. The brine solids would be evaporated for approximately 25 years in the Phase 1 ponds, and then dried, collected and disposed in an approved solid waste landfill. The Phase 2 enhanced evaporation ponds would be used during the following 25 years to continue evaporating the brine by-product. Additional infrastructure would be required as part of this alternative, including a de-silting facility, pump stations, pipelines, switch stations and substations, blending and storage tanks, and other associated earthwork.

1.3.1.2.3 Secondary Water Storage in Warner Valley Reservoir. WCWCD would develop the Warner Valley Reservoir to store diverted Virgin River water and reuse water from the St. George Regional Water Reclamation Facility, which would be delivered as inflow to the RO advanced water treatment facility. Warner Valley Reservoir would be located south-southwest of the Washington Fields Diversion. An earth-fill embankment with a clay core and rock-riprap facing would be constructed across the north entrance to the natural valley. The reservoir would have a maximum active storage volume of 69,030

acre-feet and would cover approximately 1,130 acres, including the earth-fill embankment. A large pump station would be constructed at the Washington Fields Diversion to pump the diverted Virgin River water into the Warner Valley Reservoir. The pump station would be powered by electricity via the 69-kV transmission line from the Purgatory Substation to the RO water treatment plant. The reservoir would store Virgin River water diverted at the Washington Fields Diversion (50,000 acre-feet per year) mixed with St. George Regional Water Reclamation Facility effluent (19,030 acre-feet per year), accounting for annual average evaporation (4,717 acre-feet per year), to produce up to 57,883 acre-feet of RO product water (assuming 90 percent recovery). The brine product from RO treatment would total approximately 6,430 acre-feet per year.

1.3.1.2.4 Water Distribution to Apple Valley. The largest remaining contiguous land area available for development in Washington County would be in Apple Valley. WCWCD would develop a pump station and 28-mile long pipeline to deliver 13,249 acre-feet per year of potable water from the Quail Creek Water Treatment Plant near Hurricane City to the Apple Valley area to meet future residential and commercial water demands.

1.3.2 KCWCD No Lake Powell Water Alternative

The KCWCD No Lake Powell Water Alternative would rely on existing water supplies, water conservation measures resulting in reduced water use, and future water development projects consisting of new groundwater production. Reliable water supplies (projected to be 2,170 acre-feet per year in 2035) for the area served by KCWCD (Kanab City and Johnson Canyon), adjusted for projected stream flow reductions (4.2 percent in 2035) resulting from climate change and a planning reserve (10 percent), would be exceeded by projected M&I water demands by 27 acre-feet per year within the KCWCD service area in 2035. KCWCD projected potable water demand in 2060 would be 3,435 acre-feet per year, with a potable water deficit of 1,334 acre-feet per year. Additional groundwater in the Kanab Creek drainage basin could be developed to provide up to 6,615 acre-feet per year of potable water within the aquifer's estimated safe yield. The quality of this water would likely require advanced water treatment. The developed groundwater from the Kanab Creek drainage basin would be pumped and conveyed through an eight-mile long pipeline to the Johnson Canyon drainage basin. The Johnson Canyon drainage basin comprises the potable water supply service area served by KCWCD in the area that could be served by the LPP Project.

1.4 Summary Description of the No Action Alternative

No new intake, water conveyance or hydroelectric features would be constructed or operated under the No Action Alternative. FERC would not issue a license for the LPP Project. The Utah Board of Water Resources' Colorado River water rights consisting of 86,249 acre-feet per year would not be diverted from Lake Powell and would continue to flow into the lake until the water is used for another State of Utah purpose.

1.4.1 WCWCD No Action Alternative

Under the No Action Alternative, WCWCD would complete the Ash Creek Project, planned groundwater development and continue to implement planned conservation programs. Wastewater reuse would be utilized to the maximum extent storage allows. Existing and future water supplies totaling 72,840 acre-feet per year potable and 8,505 acre-feet per year secondary would meet projected M&I water demand within the WCWCD service area through approximately 2028, exhausting all water planning reserves. Each supply source would be phased in to meet the M&I potable and secondary water demand associated with the forecasted population.

The No Action Alternative would not provide WCWCD with any reserve water supply (e.g., water to meet annual shortages because of drought, emergencies, and other losses). The No Action Alternative would not provide adequate water supply to meet projected water demands beyond 2028. There would be

a projected water shortage of approximately 102,903 acre-feet per year in 2060 within the WCWCD service area under the No Action Alternative.

1.4.2 KCWCD No Action Alternative

KCWCD would use existing water supplies to meet potable water demands through 2035. Reliable water supplies are projected to be 2,101 acre-feet per year in 2060.

The No Action Alternative would not provide KCWCD with any reserve water supply (e.g., water to meet annual shortages because of drought, emergencies, and other losses). The No Action Alternative would not provide adequate water supply to meet projected water demands beyond 2035. There would be a projected water shortage of approximately 1,334 acre-feet per year in 2060 within the KCWCD service area under the No Action Alternative.

1.5 Identified Issues

1.5.1 Purposes of Study

The purpose of this study is to document impacts on transportation resulting from the proposed Lake Powell Pipeline Project. This information will be a factor in determining the methods for planning and design of the LPP Project, herein collectively referred to as the LPP Project, as previously defined and addressed by the Pre-Application Document (PAD) submitted to the Federal Energy Regulatory Commission (Commission) on March 4, 2008. This study addresses comments made at the June 2008 public scoping meetings and responds to comments received on review of the PAD and Scoping Documents 1 and 2, as well as those provided in the September and October 2008 study plan meetings in Salt Lake City and St. George, Utah. This study also presents the knowledge and understanding of transportation conditions and potential impacts associated with the LPP alignment alternatives.

This study report describes the results and findings of a preliminary transportation analysis to evaluate conditions along the proposed alternative pipeline alignments of the LPP Project. The purpose of the analysis, as defined in the 2008 Transportation Study Plan prepared for the Commission, was to identify potential impacts from the LPP Project on transportation in the region during construction and operations, identify the impacts of transportation on the LPP Project, and identify and document measures to mitigate impacts from the various transportation impacts as necessary, such as pipeline design and routing changes.

1.5.2 Identified Issues

The transportation issues identified for analysis include the following:

- Identify the roadways being affected by the Project
- Determine local traffic levels in terms of Average Annual Daily Traffic (AADT) for the affected roadways
- Determine the impacts to level of service (LOS) for the roads impacted by the Project
- Calculate new and existing access road lengths
- Determine the construction type (paved or gravel) of new access roads
- Calculate expected additional traffic on existing roadways
- Calculate expected traffic on new access roads
- Identify Federal, State, and local roadway construction requirements

1.6 Impact Topics

The following impact topics are addressed by the Transportation Study:

- How much additional traffic would be caused by LPP Project construction?
- Would this additional traffic result in unacceptable levels of service (LOS) on the various roadways?
- What are the requirements for installation of the pipelines across the roadways?
- What access roads are needed for the LPP Project?
- What scenic byways and sensitive cultural, environmental and aesthetic resources in the study area would be affected by traffic associated with the LPP Project?

Chapter 2
Methodology

2.1 General

The methodology for the Transportation Report analysis includes making assumptions about the Project, obtaining and reviewing transportation data, reviewing agency goals and requirements, calculating and estimating additional traffic, determining impacts on Average Annual Daily Traffic (AADT) and Level of Service (LOS), determining lengths of access roads to be installed, and determining areas where traffic controls may be needed.

2.2 Assumptions

Assumptions made during the study development and analysis include the following:

- Best Management Practices (BMPs) would be developed and implemented during construction and operation of the LPP Project to reduce or eliminate adverse impacts associated with traffic and transportation.
- As traffic data indicate and Arizona Department of Transportation (ADOT) personnel confirmed, the affected Arizona roads have a Level of Service (LOS) of A or B.
- As traffic data indicate and Utah Department of Transportation (UDOT) personnel confirmed, the affected Utah roads have a LOS of A or B.
- State Highway (SR) crossings will involve open cut construction methods. If required by permit, trenchless technologies for pipeline installation will be considered on a case by case basis.
- County and local roadways will be open cut for pipe installation.
- New and improved access roads to various facilities will be graveled.
- Minor access road upgrades will include clearing brush and grading to enable equipment and vehicles (non 4-wheel drive type) to access.
- New access roads will include clearing, grading, minor excavation for roadway and placement of roadway gravel.
- The spur access roads are assumed to be between 200 and 500 feet long.
- Imported roadway gravel material will typically be 1-inch minus material. In situ graded material can vary significantly.
- The LPP Project will take into account Utah and Arizona transportation goals and will not adversely affect the effort to maintain these goals.
- Regional roadway projects will not conflict with the LPP Project. Final design/pre-construction efforts will be coordinated with all regional projects to confirm that conflicts do not exist.
- Appropriate traffic control plans will be submitted by the construction entities to the appropriate agencies during construction and will be implemented for all roadway conflicts.
- Pipeline installation will be allowed in State rights-of-way (ROWs).

- Utility easements will be needed for the transmission lines where ROWs cannot be used.
- Vehicles added to a specific highway segment, i.e., “local” traffic from facility, pipeline and reservoir construction would not exceed 28 vehicles per day as calculated from estimated construction spreads for the various efforts. These calculations included 6 worker vehicles to and from site, 16 delivery and hauling vehicles, and 6 visitors to and from the site.
- Vehicles added to local traffic from transmission line construction would not exceed 8 vehicles per day with two service vehicles, two delivery trucks, two surveyor vehicles, a heavy equipment operator and a supervisor as calculated from estimated transmission line construction spreads.

2.3 Data Used

The following data and information was used in the study (complete references are found at the end of this study report):

- ADOT and UDOT - Resource management goals from various agencies
- UDOT - Traffic data
- ADOT - Traffic data
- ADOT – Arizona Scenic Roads Map
- Southern Corridor Project – Growth Forecasts
- ADOT – 5-Year Bid Date Report
- Dixie Metropolitan Planning Organization – 2007-2030 Regional Transportation Plan
- UDOT – Monthly Hourly Volume for July 2009 (various counties)
- UDOT – 2008 Traffic on Utah Highways
- ADOT – Arizona State Highway System Log
- Transportation Research Board – Highway Capacity Manual

2.4 Agency Resource Management Goals

The study included a review of agency and tribal resource management goals to better understand the transportation strategies of the States and other agencies and to identify any goals, projects or information that may conflict or interfere with the LPP Project. The Kaibab Tribe Resource Management Goals were reviewed in incorporated as part of this report.

These goals and planned regional projects are detailed in the following sections.

2.4.1 UDOT Resource Management Goals

The Utah Department of Transportation (UDOT) is guided by a set of strategic goals known as the "Final Four." UDOT's strategic goals provide guidance to the department's efforts to improve the quality of life and economic vitality of the State (UDOT 2007a).

The Final Four Goals include:

1. ***Take Care of What We Have*** **-** UDOT has a multi-billion dollar asset to maintain and preserve. By focusing on keeping the transportation system in good condition, its serviceable life can be maximized. If the transportation system deteriorates, then reconstruction will be at much higher cost.

2. ***Make the System Work Better*** **-** Managing traffic congestion is an ongoing challenge. Incorporating new technologies, strategies and design features, can optimize the performance of the existing system.

3. ***Improve Safety*** **-** The most important goal of the department is to provide transportation facilities that safely deliver users from one point to another. UDOT is committed to doing all it can to reduce the number of traffic-related fatalities.

4. ***Increase Capacity*** **-** As Utah continues to grow, adding capacity to the transportation system will remain necessary.

Every capacity improvement project is guided by the "Final Four" goals.

2.4.1.1 Utah Regional Road Projects

The planned projects for Utah roadways and highways that may coincide with the pipeline project include (note that all these projects are well outside the construction areas for the LPP Project):

- I-15 Widening – Hurricane Exit 16 to Ranch Exit 33 (2016 to 2025)
- I-15 Widening – Ranch Exit 33 to N. Cedar interchange (Unfunded)
- SR-9 Widening – I-15 to 520 W. Hurricane (2016 to 2025)
- SR-17 Widening – LaVerkin to I-15 Toquerville (Unfunded)

The Dixie Metropolitan Planning Organization 2007 to 2030 Regional Transportation Plan shows several local improvements to the roads near St. George (DTPO 2007). An improvement which may affect the LPP Project and would require coordination is the roadway south and east of Sand Hollow Reservoir to the vicinity of LaVerkin. This includes possible improvements to SR-9 and other new roadways in the area.

Any new road construction that is planned in the area should be coordinated with the LPP Project as installation of piping during road construction would be much less disruptive and cost effective rather than installing the piping across the roadways at a later date.

The Utah counties that are affected by the project were contacted to see if any local transportation projects are planned.

Washington County – No major road or improvement projects were identified by County officials in the expected LPP Project area except for the improvements as identified in the Dixie Metropolitan Planning Organization Regional Transportation Plan (DTPO 2007).

Kane County – No major road or improvement projects were identified by County officials in the expected LPP Project area (Pratt 2009).

It is not anticipated that any of these projects would create a conflict with the LPP Project. Final design/pre-construction efforts would be coordinated with all regional projects to confirm that conflicts do not exist.

2.4.2 ADOT Resource Management Goals

There are five transportation goals identified in the ADOT 5-Year Plan (ADOT 2009a). They include:

1. Enhance the movement of people and products throughout Arizona
2. Optimize the quality, timeliness and cost effectiveness of products and services
3. Strive to develop and retain a high performing, successful workforce that is competitively paid
4. Use innovative and creative techniques to optimize the use of all resources
5. Build the public and political support necessary to meet Arizona's transportation needs

2.4.2.1 Arizona Regional Road Projects

The only future regional projects in the 5-year plan involve the Glen Canyon Bridge deck repair. The work in the 20-year "wish list" includes projects that have not been funded yet, such as the widening of SR-389 in unspecified areas for uphill passing lanes and the widening of Highway 89 through Page to four lanes.

The Arizona counties that are affected by the project were contacted to see if any local transportation projects are planned.

Mohave County – No major road project or improvements were identified by County officials in the expected LPP pipeline project area other than local mill and fill maintenance projects (ADOT 2008a). Coordination and additional clarification need to be performed upon final design of the LPP project.

Coconino County – No major road or improvement projects were identified by the agency officials in the expected LPP pipeline project area (ADOT 2008b).

2.4.3 Local Agencies

There were no resource management goals identified after researching and contacting the various Utah and Arizona municipalities in the LPP Project area.

2.4.4 Other Transportation Requirements and Considerations

2.4.4.1 Highway Beautification Act

The Highway Beautification Act was passed in 1965 and has had several amendments. The Act places limits and restrictions on signs and advertising along the Interstate Highway System. It also requires certain "junkyards" along highways to be removed and encourages scenic enhancement and roadside development (USDOT 2009a).

It is not anticipated that the project would be affected by this Act as there would be no signage or roadside advertising other than temporary information stations, and nearly all of the pipeline will be buried. All facilities constructed under the LPP Project would comply with the Highway Beautification Act.

2.4.4.2 Scenic Byway Program

Scenic Byways are roads recognized for their archeological, cultural, historic, natural, recreational, and/or scenic qualities. The national program was established by Congress in 1991 to preserve and protect the scenic but often less traveled roads and promote tourism and economic development. Forty-eight states and the District of Columbia have scenic byway programs to recognize outstanding roadways as part of the National Scenic Byway Program (USDOT 2009b).

There are several Scenic Byways in the region (ADOT 2010, USB 2008). They include:

- Kolob Fingers Road
- Markaguant High Plateau
- Zion Park
- Kanab to Mt. Carmel and Long Valley
- Fredonia – Vermillion Cliffs Road

The only Scenic Byway that could be affected by the LPP Project is the Fredonia – Vermillion Cliffs Road (along SR-89a). This road is intended to be crossed in the South Alternative; however, the impact to this Scenic Byway is expected to be minor during construction and no long-term impacts are expected.

2.4.4.3 Federal Land Policy and Management Act (FLPMA) Land Uses

The Federal Land Policy and Management Act (FLPMA) is a Federal law that governs the management of the public lands administered by the Bureau of Land Management. In the FLPMA, Congress recognized the value of public lands, declaring that these lands would remain in public ownership. Congress used the term "multiple use" management, defined as "management of the public lands and their various resource values so that they are utilized in the combination that will best meet the present and future needs of the American people." The FLPMA is found in the United States Code under Title 43 (BLM 2009a).

There are numerous potential uses of public land, including but not limited to:

- Grazing
- Agriculture
- Recreational use
- Mining

It is not expected that the facilities or pipeline would be a detriment to the multiple use of public lands as intended by the enactment of FLPMA. It is not expected that the new or improved access roads would be a detriment to public use except during construction in the temporarily closed areas.

2.4.4.4 Review of Revised Statute 2477

Revised Statute 2477 (RS 2477) was enacted by Congress in 1866 to encourage settlement in the western United States by the design of a system of highways. This law stated “the right-of-way for the construction of highways across public lands not otherwise reserved for public purposes is hereby granted.” This granted counties and states a right-of-way across federal land when a highway was built. RS 2477 was repealed in 1976 subject to “valid existing rights” (BLM 2009b). This definition has been

unclear since many RS 2477 road claims were never recorded. The “valid existing rights” clause appears to be open to interpretation and continuing disputes.

Roadways in the LPP Project route that potentially could be in the RS 2477 dispute will be under continued investigation.

2.5 Impact Analysis Methodology

The methodology used to determine transportation impacts included reviewing existing information, performing field investigations to verify existing information and determine potential construction issues, performing traffic analyses to estimate the additional traffic created as part of the LPP Project and the new expected Level of Service (LOS) on affected roadways, and determining required approvals and protocols for road closures and traffic controls.

2.5.1 Review of Existing Information

Information regarding local traffic is generally limited to Federal and State highway traffic data. Traffic surveys and LOS values for the region were reviewed. Documents and data reviewed are identified in Section 2.3.

2.5.2 Field Investigations

The field investigations for this study included reconnaissance of the alternative construction alignments to anticipate the potential construction and operation access points, inspect pipeline crossing locations, and anticipate any additional equipment requirements and traffic during construction. Other than reconnaissance level observations, local traffic count data were not collected during the field investigations because ADOT and UDOT traffic data were available.

The field investigation noted low traffic levels, confirming LOS A or B as typical for the area. The field notes indicate that the pipeline would be constructed in areas with little local traffic, typical of most rural high desert areas. Although variable, drivers in the region generally have extended fields of view, and obstructions other than construction traffic controls would be infrequent.

2.5.3 Traffic Analyses

Average Annual Daily Traffic (AADT), levels of service (LOS), and ROWs were evaluated under baseline and LPP Project conditions. These analyses are described in Chapter 3.

2.5.4 Road Closures and Traffic Controls

Road closures and traffic controls may be required during the construction of the LPP Project. All highway and road crossings that may be affected by the construction would be coordinated with the appropriate Federal, State, tribal and local jurisdictions. Traffic control plans are required to be submitted and reviewed by the appropriate agency prior to any construction.

Traffic controls would be approved and coordinated with either the State of Arizona or Utah.

Roadway crossings may be constructed using open cut unless trenchless technologies are required for the specific roadway conditions. The appropriate jurisdiction approvals would be coordinated and obtained. A Traffic Management Plan is included in the appendices of this study report.

Chapter 3
Affected Environment (Baseline Conditions)

3.1 Impact Area

The study encompasses the area surrounding the LPP Project features shown in Figures 1-1 through 1-9. The study involved determining potential transportation impacts from the LPP Project, and conversely, the impact of transportation on the LPP Project. The State highways possibly affected include:

- Highway 89 (from Lake Powell intake to Kanab)
- Highway 89A (from Kanab to south of Fredonia)
- Arizona State Route 389 (from Fredonia to Colorado City)
- Utah SR-59 (from Hurricane to Hildale City)
- Utah SR-9 (from Washington to Hurricane)

In addition, numerous county and local roads may be affected. Some of the roads are well maintained paved roads while some are seldom used unpaved, unimproved roads. A full list of roads that could be affected by the project is included in Table 3-1 below. The locations of the potential impacts are described in detail in Table 3-1 and are shown on Figures 3-1, 3-2, 3-3 and 3-4.

Table 3-1
LPP Project Road Crossings/Paralleling

Page 1 of 2

Road Description	Location Description	Cross or Parallel to Pipeline
Common to All Alignments		
Highway 89	1/3 mi SW of intake	Cross
Glen Canyon Access Road	1 mi NW of intake	Cross
Lakeshore Drive	3 mi NW of intake, west of Wahweap	Cross
Glen Canyon Access Road	S. of Greenhaven	Cross
North Wahweap Drive	Near Greenhaven S. of AZ/UT border	Cross
Glen Canyon Access Road	N of the UT/AZ Border	Cross
Glen Canyon Access Road	SE of Lower Big Water	Cross
American Way Road	Lower Big Water	Cross
Old Glory Road	Lower Big Water	Cross
Yankee Doodle Road	Lower Big Water	Cross
Cannon Ball Road	Lower Big Water	Cross
Ethan Allen	Upper Big Water	Cross
Cottonwood Canyon Road	W of Church Wells	Cross / Parallel

Table 3-1
LPP Road Crossings/Paralleling

Road Description	Location Description	Cross or Parallel to Pipeline
Highway 89	W of Church Wells	Cross
White House Campground Road	3 miles W of Church Wells	Cross
Long Valley Road	5 miles W of Church Wells	Cross
Highway 89	Near the Cockscomb	Cross
Old County Road	Near the Cockscomb	Cross
House Rock Valley Road	Near the Cockscomb	Cross
South Alternative		
Old Arizona Road	E of Seamans Canyon Rd	Parallel
Ryan Road	1 to 2 miles E of Kaibab Reservation	Cross / Parallel
Mt. Trumbull Road	6 mi W of Fredonia	Cross
Yellowstone Road	S of SR 389 Jct.	Parallel
SR-389	SE of Colorado City	Cross / Parallel
School Bound Road	3 mi N of 389 / 239 intersection	Cross
Clayhole Road	2 mi S of Colorado City	Cross
Central St.	Colorado City	Cross
Mojave Road	Colorado City	Cross
SR-389	Colorado City	Cross
Township Ave	Colorado City	Parallel
Arizona Ave	Colorado City	Cross / Parallel
Uzona Road	W of Colorado City	Parallel
Antelope Rd / Branham Ranch		Parallel
Existing Highway Alternative		
Old Arizona Road	E of Seaman Canyon Rd	Cross
Seaman Canyon Road	11 mi E of Kanab	Cross
N. Crescent Butte Trail	7 mi E of Kanab	Cross
Johnson Canyon Rd	6 mi E of Kanab	Cross
Bryce Canyon Way	5 mi E of Kanab	Cross
Kaibab Trail	5 mi E of Kanab	Cross
Boulder Bluff Blvd	4 mi E of Kanab	Parallel
Old Highway 89	3 mi E of Kanab	Parallel
Rhea Drive	Fredonia	Parallel
Highway 89A	Near Fredonia	Cross
Stagger Mtn. Road	W of Fredonia	Parallel
6 Mile Road	1.5 mi W of Fredonia	Cross
Magles Road	3 mi W of Fredonia	Cross
N. Pipe Springs Rd	Near Pipe Springs Monument	Cross

3.2 Overview of Baseline Conditions

The baseline study area has been evaluated based on regional traffic data. Traffic in this region is generally typical of high desert rural areas although some of the roads can experience levels of increased use due to the proximity to recreation and park areas. The following is an analysis of the traffic related baseline conditions and impact topics for the LPP Project.

3.2.1 Baseline Conditions

Existing Average Annual Daily Traffic (AADT), (ROWs, and existing levels of service (LOS) are discussed in this section.

3.2.1.1 Baseline AADT

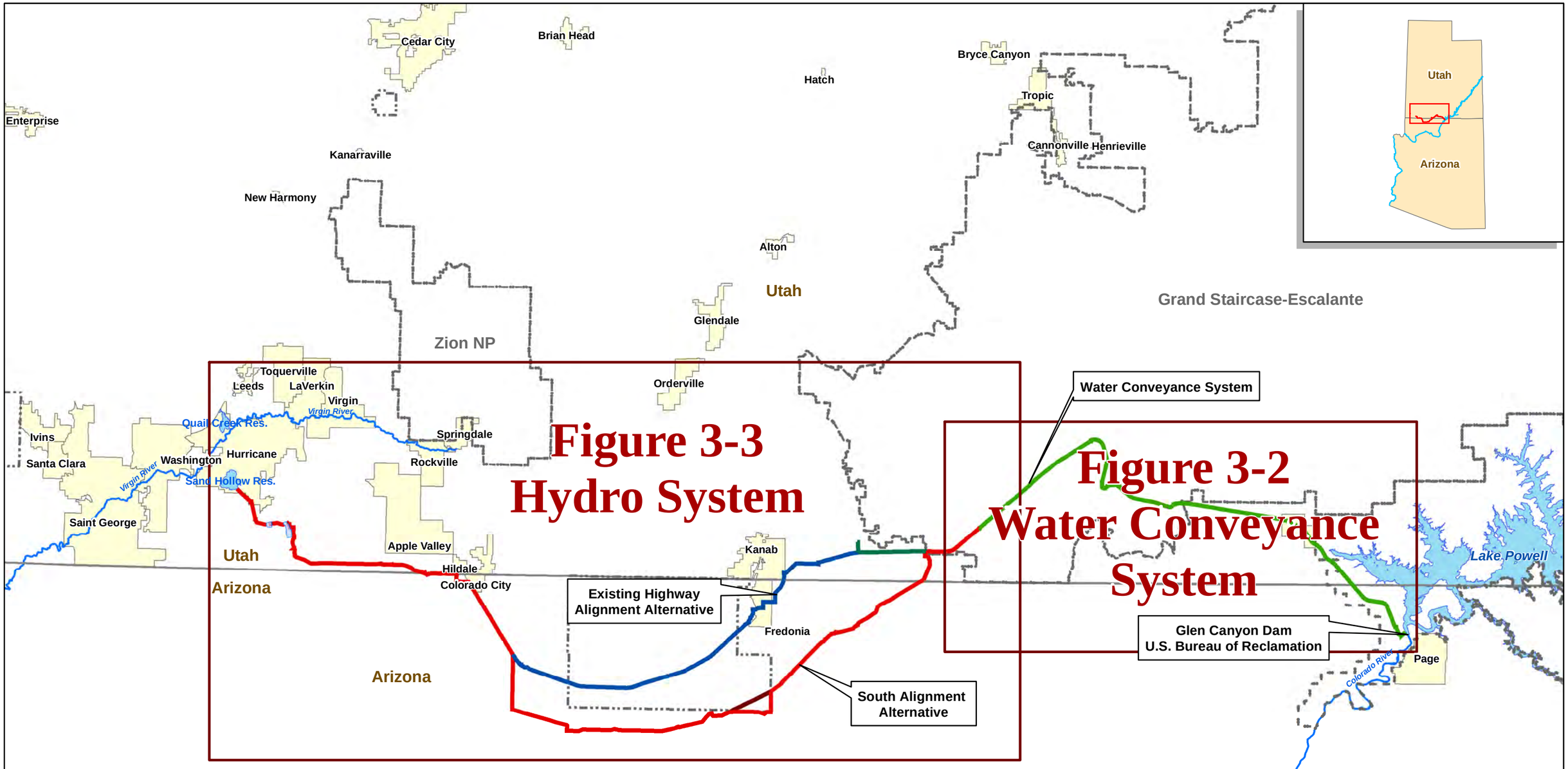
The AADT information was gathered to analyze the baseline traffic utilization of the possible affected roadways in the region (ADOT 2014b, Catchpole 2009, Torgersen 2009, UDOT 2014b). AADT data for the Federal and State highways and roads that may be affected by the LPP project are shown in Table 3-2. The roadways are identified and the locations of the existing traffic data are shown in Figures 3-1, 3-2, and 3-3.

Table 3-2
Baseline Traffic Levels

Roadway	Approximate Location	AADT
Utah		
Highway 89	AZ State Line	3,130
Highway 89	E. incorporated limits Big Water	2,300
Highway 89	Johnson Canyon	2,783
Average		**2,737**
Arizona		
SR-389	Utah State line	3,289
SR-389	Cane Beds Road	2,039
SR-389	Pipe Springs National Monument Road	2,171
SR-389	Pratt Street	1,949
Average		**2,362**

Source: (UDOT 2014b), (ADOT 2014b)

AADT data was not available for most local and county roads, but observations and discussions with UDOT and ADOT officials indicated there are no significant traffic issues in the LPP Project area and that LOS and AADT levels are generally acceptable at this time.



Hurricane Cliffs Forebay/Afterbay
Water Conveyance System
Hydro System - South Alternative
Hydro System - Southeast Corner Alternative
KCWCD System
Hydro System - Existing Highway Alternative

Key Sheets
National Park/Monument
Tribal Lands
State Boundaries
Major Rivers
Lakes/Reservoirs
Cities

FERC Project Number:
12966-001
BLM Serial Numbers:
AZA-34941
UTU-85472

N

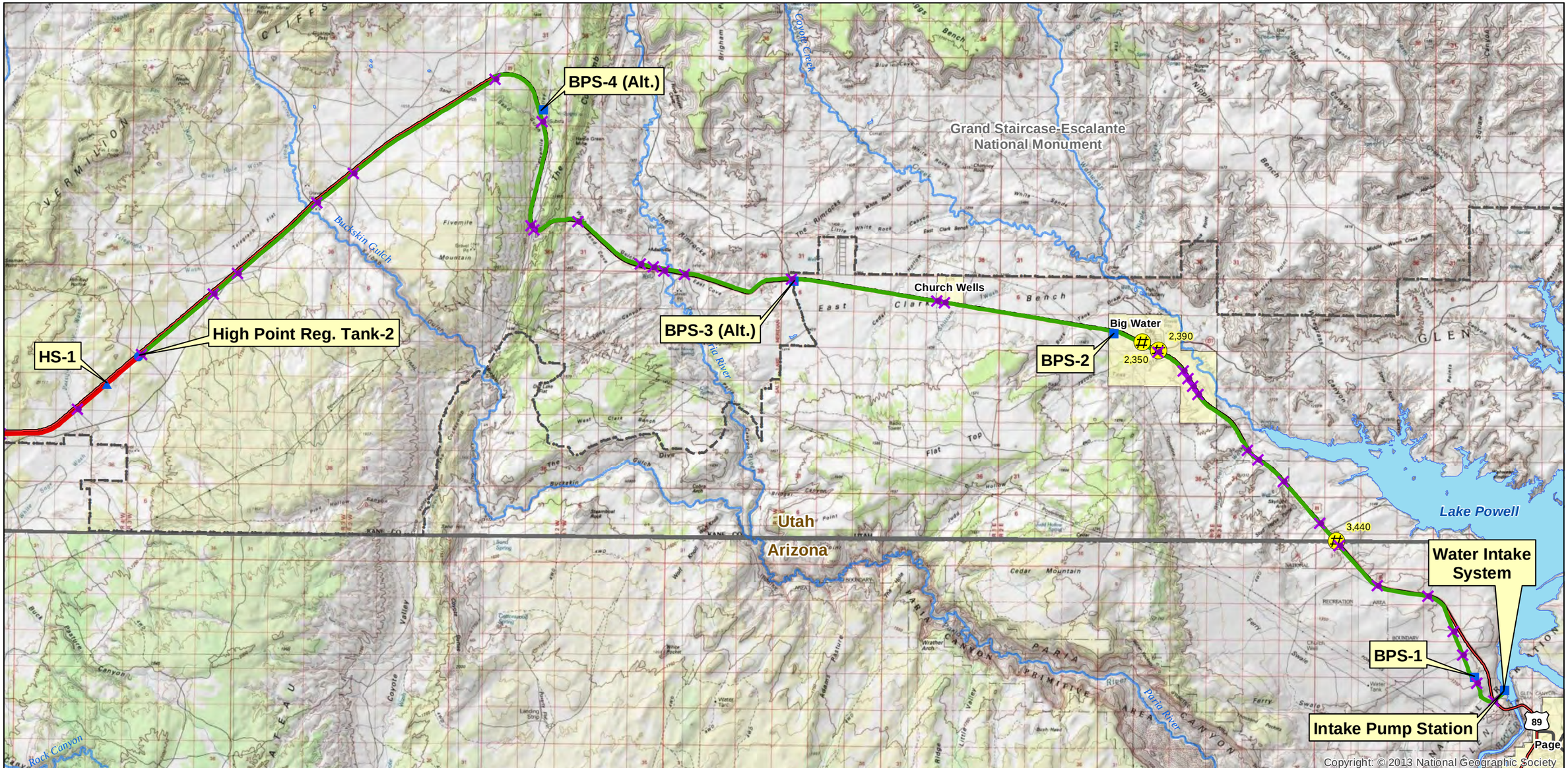
0 2.5 5 10 15 20 Miles

Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWRe **Figure 3-1** MWH

Lake Powell Pipeline
Key Map
Road Crossings & Traffic Survey



Road Crossings
Traffic Survey Locations
Water Conveyance System
Hydro System - South Alternative

Project Pump Station
Project Regulating Tank
Project Hydro Station

Interstate
US Highway
ST Highway
Hwy
Major Road

Lakes & Reservoirs
Major Rivers & Streams
National Park/Monument
State Boundaries
Cities

FERC Project Number:
12966-001
BLM Serial Numbers:
AZA-34941
UTU-85472

N

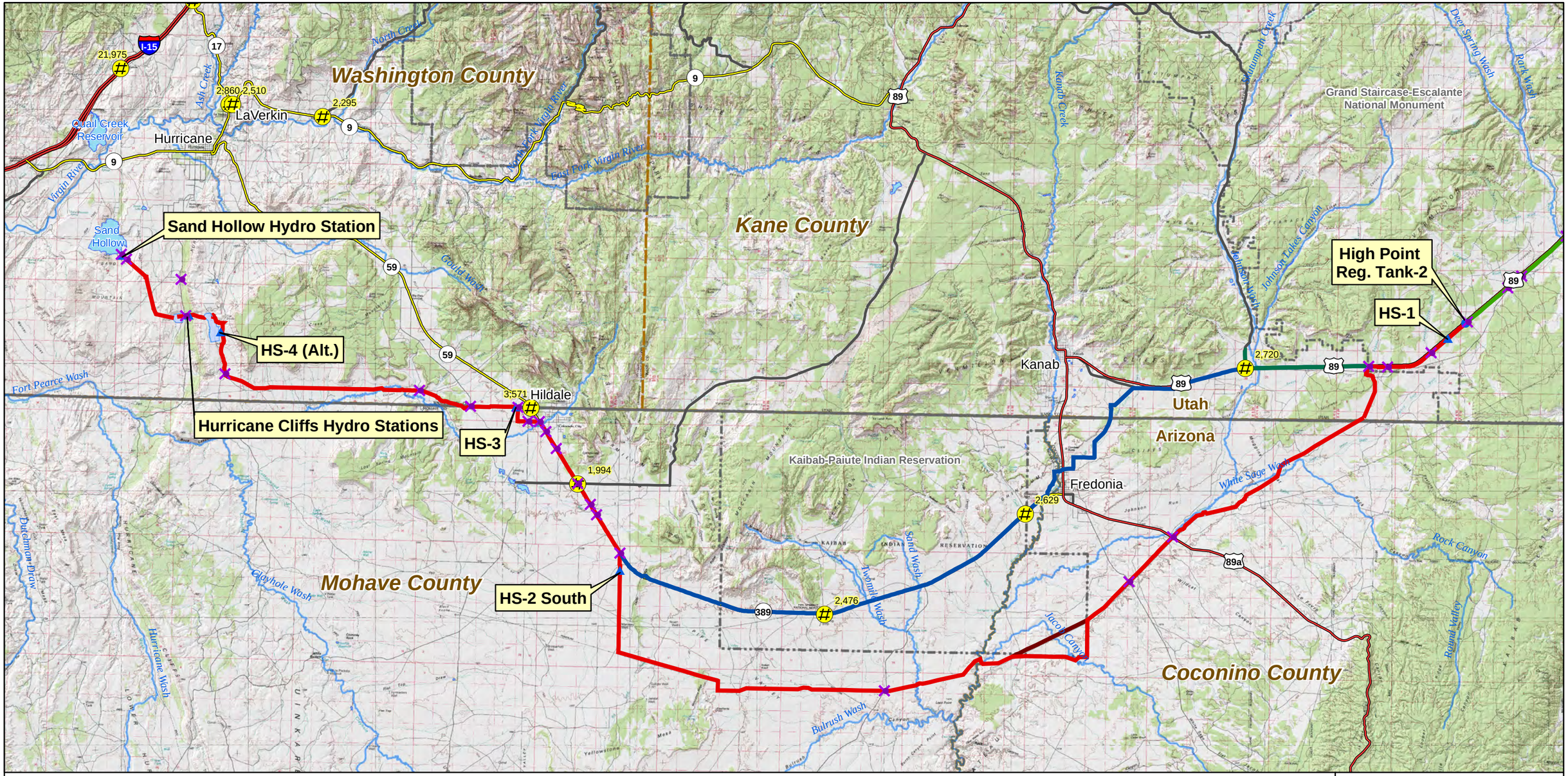
0 0.5 1 2 3 4 Miles

Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWRe **Figure 3-2** MWH

Lake Powell Pipeline
Water Conveyance System
Road Crossings & Traffic Survey



Road Crossings
Traffic Volume Locations
Project Pump Station
Project Regulating Tank
Project Hydro Station

Water Conveyance System
Hydro System - South Alternative
Hydro System - Southeast Corner Alternative
KCWCD System
Hydro System - Existing Highway Alternative

Interstate
US Highway
ST Highway
Hwy
Major Road

National Park/Monument
Tribal Lands
State Boundaries
County Boundaries

Hurricane Cliffs Forebay/Afterbay
Lakes & Reservoirs
Major Rivers & Streams

FERC Project Number: 12966-001
BLM Serial Numbers: AZA-34941 UTU-85472

0 1 2 4 6 8 Miles

N

Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWRe **Figure 3-3** MWH

Lake Powell Pipeline Hydro System Road Crossings & Traffic Survey

3.2.1.2 Transportation Rights-of-Way

Typical transportation ROWs for Federal and State roads and highways through Federal, State, county, city, tribal and private lands are presented in Table 3-3. Construction on Kaibab tribal lands must be coordinated and permitted by the Kaibab Tribe officials.

Table 3-3
ROWs for Federal and State Roadways

Roadway	Typical Approximate ROW (ft)
Highway 89	130 to 400
SR-389	100 to 200
SR-59	100
Utah State Route 9	90 to 200

State Highways (SR-59, 89, 89A, and 389). Authorization to install pipelines or other facilities in State highway ROWs is still under discussion but is assumed to be allowed on a preliminarily basis.

3.2.1.3 Levels of Service (LOS)

The transportation LOS system uses the letters A through F, with A being best and F being worst (TRB 2000). LOS A is the best condition where traffic flows at or above the posted speed limit and all motorists have complete mobility between lanes. Generally The State and local roadways in the region are at LOS A or B and are anticipated to remain at comparable volumes during and after the LPP Project. The roadways of most concern are the rural roadways that may be impacted by the project construction.

Using the AADT traffic data and comparing them to Tables 3-4, 3-5 and 3-6 confirms the highways within the project study area are all either LOS A or B.

LOS A occurs late at night in urban areas, and frequently in rural areas.

LOS B is slightly more congested, with some impingement of maneuverability where two motorists might be forced to drive side by side on multi-lane roadways, limiting lane changes. LOS B does not reduce speed from LOS A.

LOS C has more congestion than B, where ability to pass or change lanes is not always assured. LOS C is the target for urban highways in some places, and for rural highways in many places. At LOS C most experienced drivers are comfortable, roads remain safely below but efficiently close to capacity, and posted speed is maintained.

LOS D is the level of service typical of a busy shopping corridor in the middle of a weekday, or a functional urban highway during commuting hours. The motorist's ability to maneuver is severely restricted because of traffic congestion. Travel speed is reduced by the increasing volume and only minor disruptions can be absorbed without extensive queues forming and the service deteriorating.

LOS E is a marginal service state. Flow becomes irregular and speed varies substantially, but rarely reaches the posted limit. This is consistent with a highway at or approaching its designed capacity. LOS F is the lowest measurement of efficiency for a road's performance. Flow is forced where every vehicle moves in lockstep with the vehicle in front of it, with frequent slowing required. Technically, a road in a constant traffic jam would be at LOS F. This is because LOS does not describe an instantaneous state, but rather an average or typical service. For example, a highway might operate at LOS D for the AM peak hour, but have traffic consistent with LOS C some days, LOS E or F others, and come to a halt once every few weeks. However, LOS F describes a road for which the travel time cannot be predicted. Facilities operating at LOS F generally have more demand than capacity.

Tables 3-4, 3-5 and 3-6 are from the Transportation Research Board's 2000 Highway Capacity Manual (TRB 2000) and list the levels of service for various road types and conditions.

Table 3-4
Freeway Service Level Typical Ranges

	Number of Lanes	Free-Flow Speed (FFS) (mph)	Service Volumes (vehicle/hr) for LOS			
			A	B	C	D
Urban	2	63	1,230	2,030	2,930	3,840
	3	65	1,900	3,110	4,500	5,850
Rural	2	75	1,410	2,310	3,340	4,500
	3	75	2,110	3,460	5,010	6,750

Table 3-5
Urban Streets Service Level Typical Ranges

Urban Street Class	I	II	III	IV
Range of FFS (mph)	55 to 45	45 to 35	35 to 30	35 to 25
Typical FFS (mph)	50	40	35	30
LOS	Average Travel Speed (mph)			
A	>42	>35	>30	>25
B	>34-42	>28-35	>24-30	>19-25
C	>27-34	>22-28	>18-24	>13-19
D	>21-27	>17-22	>14-18	>9-13

Table 3-6 2-Lane Highway Service Level Typical Ranges				
FFS (mph)	**Terrain**	**Service Volumes (vehicles/hr)**		
		A	**B**	**C**
65	Level Rolling Mountainous	260 130 N/A	480 290 160	870 710 340
60	Level Rolling Mountainous	260 130 N/A	480 290 160	870 710 340
55	Level Rolling Mountainous	N/A N/A N/A	330 170 110	871 710 340
50	Level Rolling Mountainous	N/A N/A N/A	N/A N/A N/A	330 170 110
45	Level Rolling Mountainous	N/A N/A N/A	N/A N/A N/A	N/A N/A N/A

According to UDOT's Design Manual of Instruction, the goal for LOS is to "Provide a Level of Service C for a 20-year design in a rural area and a level of service D or higher for a 20-year design in an urban area" (UDOT 2009).

ADOT does not specify mandatory LOS levels for the region however, state and local officials indicate that most if not all roadways in the region are likely LOS level A or B. It was indicated that LOS A or B are acceptable.

3.3 Overview of LPP Project Conditions

3.3.1 Construction of Pipelines and Facilities

Arizona and Utah State ROWs would be used for pipeline installation and generally the construction would occur with enough clearance from roadways to have minimal impacts on traffic. Crossings of State routes would be open cut or bored as authorized by Utah and Arizona. Open cut construction could be of greater impact to traffic because of road closures and traffic controls required during this work. The main county and BLM roads that would be affected are shown in Table 3-1 and crossing of those would generally be open cut with pipelines paralleling these roads outside of the roadway clear zones.

Vehicles added to local traffic from pipeline and facility construction would not exceed 40 vehicles per day as calculated from estimated construction spreads for the various efforts. These calculations included 6 worker vehicles, 16 delivery and hauling vehicles, and 6 visitors to and from the site per day.

The following sequence would likely be used to construct pipelines:

- Clear and grade pipeline alignments

- Excavate trench or microtunnel or bore/jack for pipe installation
- Haul pipe to construction sites
- Place pipe along trenches
- Place pipe in trenches and connect pipe
- Backfill trenches and grade surface
- Clean up and restore areas disturbed by construction

3.3.2 Construction of Transmission Lines

Utility easements or ROWs would be required for transmission lines. The construction would occur with enough clearance to have minimal impact on traffic in terms of traffic controls. Crossings of State routes would be coordinated with the State agencies for road closures and traffic control plan approvals.

The following sequence would likely be used to construct each overhead transmission line.

- Locate and stake line (survey)
- Clear right-of-way and access roads
- Install pole footings
- Erect transmission poles
- String and sag line conductors
- Clip in conductors and shield wires
- Restore site

The installation of the poles and towers would likely involve helicopters to install transmission towers and pole parts hauled in by truck. Traffic added to the highway system is expected to be a maximum of 8 vehicles per day based on required rate of truck transports of tower components. Transmission line construction that would affect some local and county roads would need to be coordinated during final design for exact impacts and permitting.

3.3.3 Construction of Reservoirs (Afterbay and Forebay)

Reservoir construction would include surveys, clearing, earthwork, and other heavy construction. The construction of reservoirs would have a similar effect on traffic compared to the construction of pipelines and other facilities with a calculated potential additional 40 vehicles added to local roadways and highways per day per construction site.

3.3.4 Road Construction Calculations

A review of the estimated road lengths to be constructed or improved under the project was performed. Generally new roads would be constructed near the new facilities and along the transmission lines and new pipeline installations that require maintenance. During the study, it was assumed that roads to various pump station facilities, new maintenance roads and improved access roads would be constructed with a gravel surface.

3.3.4.1 Estimated Length of Road Construction or Improvements

The information used to determine the estimated length of roadways that would be constructed under the LPP Project included the following:

- Where an existing main road parallels the new pipeline or transmission line, new spur roads would be constructed at various intervals from the existing roads to access the pipeline. These access roads are assumed to be between 200 and 500 feet long.
- Where existing roads do not parallel the new pipeline or transmission line, new roads would be constructed for access.
- Where the new pipeline or transmission lines parallel existing gravel roads that are in poor condition, the gravel roads would be improved as necessary for access.
- Access roads would be constructed to access each facility (pump station, hydro station, etc.). Generally these facilities are near major roadways and the required lengths were determined on a case-by-case basis.

Lengths of these new roads are presented in Table 3-7.

Table 3-7
Road Construction and Improvement Lengths

Page 1 of 2

Location/Description	Road Construction (Miles)	Road Improvement (Miles)
IPS-1 (Intake) to Access Road	0.3	
BPS-1 to Access Road	0.7	
BPS-2 to Highway 89	0.2	
Cottonwood Canyon Road (Transmission Line to Highway 89)		5.9
BPS-4 (Alt.) to Highway 89	0.1	
High Point Reg Tank-2	0.1	
HS-1 to Highway 89	0.1	
LPP to Highway 89 (8 mile Gap Road)		8.7
LPP to SR-389 (Mt. Trumbull Road)		5.8
Hydro-HS-2 South Alternative	0.1	
Hydro-HS-2 Existing Highway Alternative	0.1	
Hydro-HS-3	0.1	
Hydro-HS-4	0.1	
Hurricane Cliffs Discharge Hydro	0.1	
Sand Hollow Hydro Station		0.5
Along transmission line from Intake to Highway 89 (NE of High Point Regulating Tank-2)		36.0
BPS-2 transmission line		7.0
Spurs to Pipeline along Highway 89 (10 @ 500 ft each)	0.9	

Table 3-7
Road Construction and Improvement Lengths

Page 2 of 2

Location/Description	Road Construction (Miles)	Road Improvement (Miles)
Along penstock from Highway-89 SW to Navajo-McCullough transmission line (near White Sage Wash)	11.3	
Spurs to penstock from Highway-89A to Hwy 239 (5 @ 200 ft each)	0.2	
Along penstock from Highway 89 SW to near Fredonia		4.8
Along penstock W of HS-3	9.5	
Spurs from Hurricane Cliffs Hydro to Sand Hollow Hydro	0.2	
Along transmission lines E of Sand Hollow Reservoir	13.2	
Total	**37.3**	**68.7**

Notes:

1. Road Construction – Work includes installing new access roadways to facilities, pipelines and transmission lines. The work would include clearing, grubbing, grading and installing gravel to allow convenient access by trucks, cars and maintenance equipment.
2. Road Improvements – Work includes minor clearing and grading and possible installation of gravel to existing unimproved roads and trails as needed to allow access to the new facilities, pipelines and transmission lines.

3.3.5 Change in Cumulative Traffic Levels from Construction

Table 3-8 shows the estimated cumulative change in traffic levels to highway segments from the construction of pipelines, facilities, and transmission lines under the LPP Project. It is expected that a cumulative maximum of 120 vehicles per day would be added to the region from all construction activities associated with the LPP Project.

Table 3-8 AADT from Cumulative Construction			
Roadway	**Section**	**Cumulative AADT***	**% Change from Current AADT**
Utah			
Highway 89	AZ State Line	3,170	1.3
Highway 89	E. incorporated limits Big Water	2,340	1.7
Highway 89	Johnson Canyon	2,823	1.4
Average		**2,778**	**1.5**
Arizona			
SR-389	Utah State line	3,329	1.2
SR-389	Cane Beds Road	2,079	2.0
SR-389	Pipe Springs National Monument Road	2,211	1.8
SR-389	Pratt Street	1,989	2.0
Average		**2,402**	**1.7**

* The cumulative increase in traffic for the entire project during construction is expected to be approximately 120 vehicles per day; however, the contribution to each highway segment is expected to be 40 vehicles per day on average.

3.3.6 Operations Transportation Calculations

Each LPP Project facility was reviewed for its potential traffic impacts during operations and maintenance (O&M) activities. The review consisted of determining whether the facility would be continuously manned, how often maintenance personnel would occupy the site, and the nature and extent of the operations and maintenance site visits. It was determined that facilities would be typically monitored via remote supervisory control and data acquisition (SCADA) systems and would not be continuously manned. Maintenance personnel are expected to visit the facilities as follows:

- Intake – 4 maintenance personnel visits per week
- Pump/In-Line Hydro Stations – 1 maintenance personnel visit per week
- Discharge – 2 maintenance personnel visits per year
- Transmission Line – 2 maintenance visit per week

Table 3-9 indicates the frequency to which each facility is expected to be inspected or have maintenance personnel on-site.

Table 3-9
Operations and Maintenance Traffic Impacts

Facility	Maintenance/Inspection Frequency (Visits/Week)
Water Conveyance Systems	
Lake Powell Water Intake/Pump Station	7
BPS-1, BPS-2, BPS-3 (Alt.), BPS-4 (Alt.)	2 (each)
High Point Reg. Tank 1 and 2	2 (each)
Total	**19**
Hydro System Alternatives (South or Existing Highway)	
HS-1, HS-2 (South or Highway), HS-3, HS-4 (Alt.)	2 (each)
Sand Hollow Hydro Station	2
Hurricane Cliffs Hydro Station	7
Total	**17**

Inspection and maintenance of the transmission lines is assumed to be infrequent with less than three AADT during LPP operations.

It is expected that a maximum of 19 vehicles per week (less than 3 AADT or less than 1%) would be added to any highway during operations of the LPP Project.

Chapter 4
Consequences (Impacts)

4.1 Significance Criteria

The significance criteria for the project include traffic control, Level of Service, resource management goals, ROW conformance, and conformance with FLPMA, Highway Beautification Act, National Scenic Byway Program and RS 2477. The significance criteria are described in the following sections.

4.1.1 Traffic Control

Nearly all traffic controls have some impact on nearby traffic. UDOT and ADOT personnel define 15 minutes as the maximum allowable traffic closures under state requirements. Therefore, this is the level at which it was assumed that a project could impact the local traffic significantly. The impact on local roads is not considered to be a significant impact if the construction and closures are coordinated and approved by the appropriate officials.

4.1.2 Level of Service

It was determined that a degradation of the LOS below a Level B would be a significant impact on the local traffic.

4.1.3 Resource Management Goals

Performing projects in conflict with Federal, State, tribal and local resource management goals would be a significant impact.

4.1.4 ROW Conformance

Non-conformance with Federal and State ROW requirements would be a significant impact.

4.1.5 FLPMA, Highway Beautification Act, National Scenic Byway Program, and RS 2477

Non-compliance with the FLPMA, the Highway Beautification Act, the National Scenic Byway Program, or RS 2477 would be considered a significant impact.

4.2 Potential Impacts Eliminated From Further Analysis

Several potential impacts were eliminated from further analysis. These potential impacts are described below along with the reasons for eliminating them from further analysis.

- Impacts on non-automotive transportation (pedestrians, all-terrain vehicle (ATV) users, hikers, and bicyclists) are not considered to be significant because of the temporary nature of project construction, relatively few conflicts with this type of transportation, and the minor inconveniences the project would pose to these users.

- It is expected that most pipeline construction that would take place within State ROWs would occur outside of the roadway. However, some of the roadways may require temporary traffic controls because of LPP construction. Permitting and approvals would be obtained as required prior to any construction. Several highway stretches have potential to cause traffic controls or road/lane closures during parallel construction including but not limited to SR-89 at the Cockscomb and SR-389. State highway pipeline crossings would either be open cut or use trenchless technologies. However, while the controls may be inconvenient to traffic, the closures would be less than 15 minutes and would not result in significant transportation impacts. If, however, longer delays were experienced because of cumulative impacts resulting from other projects, mitigating measures could be undertaken to reduce those delays. These measures could include temporary bypasses, signage warning of delays, or alternate construction time schedules or sequences.
- Lane closures, road closures and traffic controls may be required on numerous local and county roads. It is expected that the LPP would be installed across or along these roadways via open cut with temporary traffic controls implemented. Federal, county and local agencies would be contacted prior to construction to obtain necessary approvals. It is not expected that the local and county roads would be significantly impacted although there would be some temporary effect on traffic.

4.3 Impacts

The impacts of the various alternative alignments were evaluated based on the design, construction and operational considerations described in Section 4.2. The remaining impacts are listed below.

4.3.1 Water Conveyance System

The Water Conveyance System would have no significant impacts on transportation. The LOS would not change with construction or operation of the LPP Project. Minor traffic delays could occur during pipeline construction of highway crossings and on highways where the construction activity is near the roadway surface.

4.3.2 Hydro System Existing Highway Alternative

The Hydro System Existing Highway Alternative would have no significant impacts on transportation. The LOS would not change with construction or operation of the LPP Project. Traffic delays could occur during pipeline construction of highway crossings and on highways where the construction activity is near the roadway surface. Traffic on some local roads could be delayed during specific pipeline construction activities and traffic controls would be required.

4.3.3 Hydro System South Alternative

The Hydro System South Alternative would have no significant impacts on transportation. The LOS would not change with construction or operation of the LPP Project. Traffic delays could occur during pipeline construction of highway crossings and on highways where the construction activity is near the roadway surface. Traffic on some local roads could be delayed during specific pipeline construction activities and traffic controls would be required.

4.3.4 Hydro System Southeast Corner Alternative

The Hydro System South Alternative would have no measurable impacts and no significant impacts on transportation. The LOS would not change with construction or operation of the LPP Project. There are no highways or roads with measurable traffic that would be affected by this alternative.

4.3.5 Kane County Pipeline System

The Kane County Pipeline System would have no measurable impacts and no significant impacts on transportation. The LOS would not change with construction or operation of the LPP Project. Traffic delays could occur during pipeline construction of highway crossings and on highways where the construction activity is near the roadway surface. Traffic on some local roads could be delayed during specific pipeline or penstock construction activities and traffic controls would be required.

4.3.6 Transmission Line Alignments

The transmission line alignments construction would have no measurable impacts and no significant impacts on transportation. The LOS would not change with construction or operation of the LPP Project. Traffic delays could occur during transmission line construction of along highways where the construction activity is near the roadway surface. Traffic on some local roads could be delayed during specific transmission line construction activities and traffic controls would be required.

4.3.7 Natural Gas Pipeline and Generators Alternative

The Natural Gas Pipeline and Generators Alternative would have no measurable impacts and no significant impacts on transportation. The LOS would not change with construction or operation of the LPP Project. Minor traffic delays could occur during pipeline construction of highway crossings and on highways where the construction activity is near the roadway surface. Traffic on some local roads could be delayed during specific pipeline construction activities and traffic controls would be required.

4.3.8 No Lake Powell Water Alternative

The No Lake Powell Water Alternative would have no significant impacts on transportation. The LOS would not change with construction or operation of the No Lake Powell Water Alternative. Minor traffic delays could occur during pipeline construction of highway crossings and on highways where the construction activity is near the roadway surface. Traffic on some local roads could be delayed during specific pipeline or other construction activities, and traffic controls would be required.

4.3.9 No Action Alternative

The No Action Alternative would have no impacts on transportation.

Chapter 5
Mitigation and Monitoring

5.1 LPP Project Alternatives (Water Conveyance System, Hydro System, Kane County Pipeline System, Transmission Line Alignments and Natural Gas Pipeline and Generators Alternative)

5.1.1 Mitigation

No mitigation would be required if Best Management Practices (BMPs) are implemented during construction and operations. BMPs would include coordination with appropriate Federal, State and local agencies to acquire required permits for traffic controls and closures, development of traffic control plans, and scheduling construction during off-peak traffic hours as necessary. The Project would be designed in conformance with the National Scenic Byway Program, FLPMA, Highway Beautification Act, and RS 2477 to avoid any significant impacts.

5.1.1.1 Traffic Controls and Lane Closures

Coordination would be done with appropriate federal, state and local agencies to acquire required permits for traffic controls and lane closures during construction activities.

5.1.1.2 Traffic Control Plans

Traffic control plans would be developed for each construction activity along each roadway and highway segment in coordination with federal, state and local agencies. Traffic control plans would address flagging, communications, signage, lane closures, blasting safety procedures and containment, pilot vehicle operations, clear zone restrictions, speed limit reductions, traffic condition monitoring, and other construction safety procedures as necessary.

5.1.1.3 Construction Schedule

Construction of pipeline and penstock crossings of highways and roads would be scheduled during off-peak traffic hours as necessary to minimize impacts on traffic and provide for safer construction sites near transportation infrastructure.

5.1.2 Monitoring

No specific monitoring would be required if BMPs are implemented during construction and operations; however, construction monitoring of traffic conditions near construction sites would be performed as part of approved traffic control plans to avoid traffic congestion, delays and triggering implementation of additional BMPs.

5.2 No Lake Powell Water Alternative

No mitigation or monitoring for transportation impacts is expected for the No Lake Powell Water Alternative.

5.3 No Action Alternative

No mitigation or monitoring for transportation impacts would occur under the No Action Alternative.

Chapter 6
Unavoidable Adverse Impacts

6.1 South Alternative

The South Alternative would cause short-term traffic delays on highways and roads during construction activities. These short-term delays on traffic would be unavoidable adverse impacts. Permanent access roads constructed for the South Alignment Alternative would total 37.2 miles long and disturb a total of 135 acres. These permanent access roads would have minor unavoidable adverse impacts as transportation infrastructure.

6.2 Existing Highway Alternative

The Existing Highway Alternative would cause short-term traffic delays on highways and roads during construction activities. These short-term delays on traffic would be unavoidable adverse impacts. Permanent access roads constructed for the Existing Highway Alternative would total 16.5 miles long and disturb a total of 60 acres. These permanent access roads would have minor unavoidable adverse impacts on transportation infrastructure since they are lightly traveled, side roads for facility access only.

6.3 Southeast Corner Alternative.

The Southeast Corner Alternative would have the same unavoidable adverse impacts involving transportation infrastructure and service as described for the South Alignment Alternative in Section 6.1.1.

6.4 Transmission Line Alignments

The Transmission Line Alignments would have the same unavoidable adverse impacts involving transportation infrastructure and service as described for the South Alignment Alternative in Section 6.1.1.

6.5 Natural Gas Pipeline and Generators Alternative

The Natural Gas Pipeline and Generators Alternative would have the same unavoidable adverse impacts involving transportation infrastructure and service as described for the South Alignment Alternative in Section 6.1.1.

6.6 No Lake Powell Water Alternative

The No Lake Powell Water Alternative would cause short-term traffic delays on the Southern Corridor Highway and local roads during construction activities. These short-term delays on traffic would be minor unavoidable adverse impacts.

6.7 No Action Alternative

No unavoidable adverse impacts would occur under the No Action Alternative.

Chapter 7
Cumulative Impacts

This chapter analyzes cumulative impacts that may occur from construction and operation of the proposed LPP project when combined with the impacts of other past, present, and reasonably foreseeable future actions and projects after all proposed mitigation measures have been implemented. Only those resources with the potential to cause cumulative impacts are analyzed in this chapter.

7.1 South Alternative

The South Alignment Alternative could have short-term cumulative impacts on transportation infrastructure when combined with the construction impacts of the Kern River-Hurricane Natural Gas Pipeline. These short-term cumulative impacts could occur at the intersection of the South Alignment Alternative penstock with the Kern River-Hurricane Natural Gas Pipeline alignments adjacent to the Southern Corridor Highway near Sand Hollow Reservoir. The short-term cumulative impacts on highway traffic may involve lane closures and reduced speed zones throughout the duration of construction activities at this site.

7.2 Existing Highway Alternative

The Existing Highway Alternative would have the same cumulative impacts on transportation infrastructure and service as described for the South Alternative in Section 7.1.

7.3 Southeast Corner Alternative

The Southeast Corner Alternative would have the same cumulative impacts on transportation infrastructure and service as described for the South Alternative in Section 7.1.

7.4 Transmission Line Alternatives

The Transmission Line Alignments would have the same cumulative impacts on transportation infrastructure and service as described for the South Alternative in Section 7.1.

7.5 Natural Gas Pipeline and Generators Alternative

The Natural Gas Pipeline and Generators Alternative would have the same cumulative impacts on transportation infrastructure and service as described for the South Alternative in Section 7.1.

7.6 No Lake Powell Water Alternative

The No Lake Powell Water Alternative could have short-term minimal cumulative impacts on transportation infrastructure and service where the Washington Fields Diversion pipeline, pump station and Warner Valley Reservoir embankment are sited adjacent to the Southern Corridor Highway. These

short-term cumulative impacts on highway traffic could involve lane closures and reduced speed zones throughout the duration of construction activities at this site. Construction traffic using the Southern Corridor Highway could cause short-term congestion in the area near the Washington Fields Diversion.

7.7 No Action Alternative

The No Action Alternative would have no cumulative impacts.

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Glossary

Open-cut Pipe Installation. A method of installing pipe whereby the earth is excavated to the grade of the pipe and the pipe is then placed in the prepared trench. Also known as trenching.

Trenchless Pipe Installation. A method of installing pipe whereby the pipe is installed without excavating the entire pipeline alignment. Also known as boring, jacking & boring, or microtunneling.

Penstock: A high-pressure conduit extending from the first upstream water surface or source to the turbine.

Pipeline: A line of connected pipes used for carrying water over a long distance.

Reverse Osmosis. The movement of freshwater through a semi permeable membrane when pressure is applied to a solution (as seawater) on one side of it.

Substation. A subsidiary station in which electric current is transformed.

Traffic Control Plan. This plan is submitted to the appropriate agency to detail the expected traffic controls needed during construction.

Abbreviations and Acronyms

Abbreviation/Acronym	Meaning/Description
AADT	Average Annual Daily Traffic
ADOT	Arizona Department of Transportation
AMSL	Above Mean Sea Level
ATV	All-Terrain Vehicle
BLM	U.S. Bureau of Land Management
BPS	Booster Pump Station
CICWCD	Central Iron County Water Conservancy District
CL	Centerline
FERC	Federal Energy Regulatory Commission
FLPMA	Federal Land Policy Management Act
GSENM	Grand Staircase-Escalante National Monument
HS	Hydro System
KCWCD	Kane County Water Conservancy District
kV	kilo-Volt
LOS	Level of Service
LPP	Lake Powell Pipeline
M&I	Municipal and Industrial
O&M	Operations and Maintenance
RO	Reverse Osmosis
ROW	Right-of-Way
SCADA	Supervisory Control and Data Acquisition
SITLA	School and Institutional Trust Lands Administration
SR	State Route
UDOT	Utah Department of Transportation
UDWRe	Utah Division of Water Resources
WCWCD	Washington County Water Conservancy District

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Lake Powell Pipeline Project

Appendix A -
Transportation Management Plan

April 2016

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Attachment A: Access Roads

List of Abbreviations and Acronyms

AADT	Average Annual Daily Traffic
ADOT	Arizona Department of Transportation
BLM	Bureau of Land Management
FERC	Federal Energy Regulatory Commission
Hwy	Highway
I	Interstate
NPS	National Park Service
Project	Lake Powell Pipeline Project
ROW	Right-of-Way
SR	State Route
TMP	Traffic Management Plan
UBWR	Utah Board of Water Resources
UDOT	Utah Department of Transportation
UDWR	Utah Division of Wildlife Resources
UDWRe	Utah Division of Water Resources

Chapter 1
Transportation Management Plan

1.1 Introduction

The Lake Powell Pipeline Project (LPP Project), is a water conveyance and energy recovery project in southwest Utah and north-central and northwest Arizona proposed by the Utah Division of Water Resources (UDWRe) on behalf of the Utah Board of Water Resources (UBWR). The LPP Project is comprised of approximately 140 miles of 69-inch diameter steel pipeline to divert water from Lake Powell. The pipeline starts at the Water Intake Pump Station at Lake Powell and terminates at Sand Hollow Reservoir in Washington County, Utah. The LPP Project includes hydro stations, booster pump stations, storage reservoirs and a regulating tank. Power transmission lines and associated substations and switch stations would be constructed as part of the project. The right-of-way (ROW) would cross parts of Utah and Arizona (Figure 1-1).

The purpose of this Transportation Management Plan (TMP) is to:

- Describe how the roads are intended to be used, improved, and maintained during LPP Project construction; and

- Evaluate potential impacts of construction traffic ingress and egress.

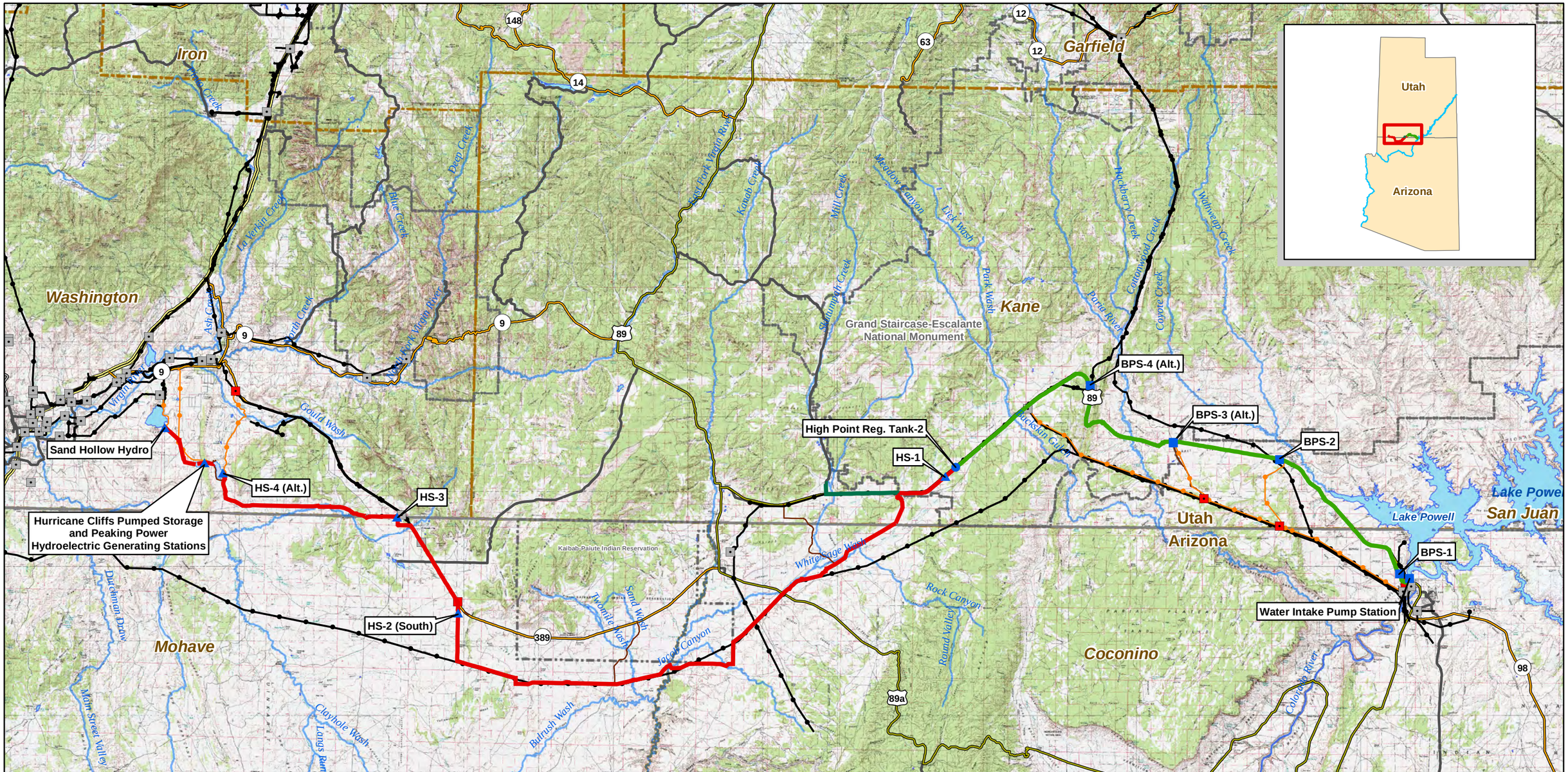
The TMP describes equipment access to and from the ROW, drainage improvements, dust control and maintenance measures, and, if required, reclamation and abandonment of roads.

1.2 Traffic Impacts

The road network within Utah and Arizona in the vicinity of the LPP Project area is generally rural in nature, typically characterized by paved two-lane Utah Department of Transportation (UDOT) or Arizona Department of Transportation (ADOT) roads and by paved and unpaved roads managed by Bureau of Land Management (BLM), National Park Service (NPS) and the Bureau of Reclamation (Reclamation). County and private roads are also in the area. In addition to general rural traffic patterns, many of these roads are travelled by tourists for recreation and sight-seeing activities in Grand Staircase-Escalante National Monument and Glen Canyon National Recreation Area.

There are not expected to be significant impacts on state or federal highways, roads administered by Federal land management agencies (BLM, NPS, and Reclamation), state agencies, counties, or private entities. Pipeline crossings for major roads or other identified critical roads that would require more than a 15-minute traffic control will most likely be installed using methods required by the regulating agency to minimize road closures or delays. Any impacts would be within the bounds of approval by federal agencies, local permits, and guidelines, and as permitted by local landowners. Permit requirements will be further defined upon final design of the pipeline and obtained prior to any construction.

At completion of the LPP Project, all roads would be restored back to their original status, unless directed otherwise in writing by the landowner or land management agency.



Project Pump Station
Project Regulating Tank
Project Hydro Station
Substation
Proposed Substation

Water Conveyance System
Hydro System - Proposed Action (Penstock Segment)
KCWCD System
Project Transmission Lines
Existing Transmission Lines

Interstate
US Highway
ST Highway
Hwy
Major Road
Access Roads

Hurricane Cliffs Forebay/Afterbay
Lakes & Reservoirs
Major Rivers & Streams

National Park/Monument
Tribal Lands
State Boundaries
County Boundaries

FERC Project Number:
12966-001
BLM Serial Numbers:
AZA-34941
UTU-85472

N

0 2.5 5 10 15 20 Miles

Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWRe **Figure 1-1** MWH

Lake Powell Pipeline Proposed Action

1.2.1 Pipeline Road Crossings

Construction of the pipeline would require crossing paved and unpaved roads with varying levels of traffic. Smaller unpaved roads would be crossed by open-cut trenching and then restored back to their original status. Provisions would be made for detours or other measures to permit traffic flow during construction. If no reasonable detour exists, then at least one lane of traffic would be kept open while pipeline is installed underneath the other half. In the interest of public safety, any road closures would be coordinated with federal, state, and local emergency responders (law enforcement, fire, and medical). Construction of pipelines across major paved highways, railroads, paved roads, and unpaved roads where traffic cannot be interrupted would be accomplished by methods required by the permitting agency. The pipeline would be buried to the depth required by applicable road crossing permits and approvals would be designed to withstand anticipated external loadings. The number of various types of road crossings is provided in Table 1-1. There are no railroad crossings identified within the project.

Table 1-1
Summary of Road Crossings

County/State	U.S. or State Highway Crossings	County or Private Road Crossings
Coconino, AZ	2	5
Kane, UT	3	10
Mohave, AZ	2	8
Washington, UT		5

1.3 Construction Traffic

The LPP Project would temporarily increase traffic on local road networks due to construction employees commuting to and from work and trucks transporting equipment. Construction employees would likely be located within a 100-mile radius of the LPP Project route and commute to and from the central contractor yard location for each project work segment. It is expected that during the construction phase, approximately 40 vehicles per day would be mobilized to support construction of the pipeline. These vehicles would be used to transport equipment, materials, operators, laborers, foremen, inspectors and miscellaneous workers for each construction site. Some of these vehicles may report to a staging yard before proceeding to the construction site ROW. However, many of them may depart directly from the location of their temporary lodgings. In addition, there would be bus or van availability to transport multiple personnel as necessary.

It is unknown how many vehicles workers will travel directly from their places of lodging to the work site. However, many of these vehicles are special use vehicles and may be owned by the construction worker(s) companies. In some cases, these workers may be at the construction site in the morning prior to the main workforce arriving or may stay late after the main workforce has departed.

Vehicle movements would generally occur during the daylight hours, with primary movements occurring between 5:00 and 7:00 am and at 6:00 pm in the evening. Typically, the work week is six days, sometimes extending to seven days as required by the workload and construction schedule. During potential underground work and hydrostatic testing, work would be conducted on extended hours, even up to a 24-

hour basis until the work and/or testing is complete. Vehicles would also be entering and leaving the contractor yards and/or construction staging areas throughout the day. This would include construction management personnel, supply trucks, and vendors.

Pump stations, hydro stations and other facilities under construction would have some additional traffic associated with them. During construction, these facilities would be expected to have an additional 40 employee vehicles commuting to them. Busses or vans would be utilized as feasible to minimize additional traffic. Staging yards or muster points would be identified during final design and traffic permitting to help coordinate traffic as is feasible.

Some access roads would need to be graded, bladed, or widened to allow for use by large trucks. In cases where a road is widened, its new width would not exceed 30 feet. Landowner or land management agency permission would be obtained prior to any rerouting or realigning of the road. All road grading activities would be designed to minimize loss of any existing rock, minimize sediment runoff, and avoid the spread of noxious weeds.

Watering for dust control may be necessary during grading and hauling operations. On federal lands, all road improvements must be in accordance with agency handbooks and manuals, such as the BLM 9113 Roads Manual. At a minimum, roads would be constructed using the crown-and-ditch method. At completion of Project construction, roads would be repaired and returned to their original status unless directed otherwise by the landowner or land management agency.

Depending on the quality of the road surface and amount of construction-related traffic, wear and tear impacts could occur to unpaved roads during Project construction. The access roads actively being used by construction crews would be inspected frequently. If inclement weather conditions, such as heavy rains, affect an area, the roads would also be reviewed after the weather event. Vehicular use of unpaved roads would be temporarily halted in the case of excessively wet soil conditions with appropriate repairs made to the roads during construction as needed.

Wear and tear impacts on paved surfaces would be minimal, and the roads would be kept in an acceptable condition throughout the construction process. To limit wear and tear on the roads the state and county vehicle weight limit regulations would be adhered to unless special circumstances are requested. Some states and counties have a general vehicle weight limit, while others have weight restrictions based on the particular road or bridge. Any restoration activities would be coordinated with the managing entity and inspected for future periods as agreed upon.

All vehicles associated with the LPP Project would be parked within the pipeline ROW or within the boundaries of the staging area or facilities being constructed. Project personnel would not park their vehicles outside of designated areas without first obtaining permission from the landowner or land management agency. LPP Project personnel would not park vehicles and/or equipment overnight near (within 100 ft) a wetland or waterbody boundary due to the potential for leakage. Project vehicles and/or equipment would not be refueled near a wetland or waterbody as required by owner or agency requirements.

In all LPP Project work or construction areas, signs would be placed at appropriate locations to direct traffic around construction areas and to warn drivers of heavy truck traffic. All signs on BLM, NPS, or Reclamation lands would have to be approved by the BLM, NPS, or Reclamation office having responsibility for the area.

Use of roads can be a conduit for introducing invasive plant species to an area. Seeds or other propagules can be inadvertently transported by vehicles using the road, and the edge habitat at the side of the road provides a point of entry for the exotic invasive species (USGS 2007a). Once introduced, invasive species can spread away from the road, having an even greater impact on the surrounding habitat. Methods for minimizing the spread of noxious and invasive weeds will be determined and followed.

1.3.1 Dust Control

Fugitive dust can be generated from vehicles and motorized equipment movement on access roads. To minimize the generation of fugitive dust during LPP Project construction activities, a fugitive dust plan would be developed and followed. This plan would include the following specific measures as needed for controlling dust from vehicular use of access roads:

- Apply water one or more times per day to all affected unpaved access roads(when in use);
- Reduce vehicle speeds on all unpaved roads, and unpaved haul and access roads. Construction speed limits may be set on unpaved roads, where public speed limits have not already been established; and
- Clean up track-out and/or carry-out areas at paved road access points at a minimum of once every 48 hours.

1.3.2 Cultural Resources

Cultural resource inventory surveys have been conducted of proposed access roads and have identified any known cultural resource sites that could potentially be impacted. All measures to mitigate impacts would be required for these sites, and the plans would be subject to review and approval by the appropriate cultural resource regulatory agencies as well as the landowner or land management agency holding the land with the cultural resource (UBWR 2016b).

1.4 Traffic Analysis

An analysis of the existing road network in the vicinity of the LPP Project area shows that all state-maintained roads are well under capacity. Even with the addition of the proposed construction traffic, the increase in traffic is expected to be less than 3 percent in all locations (Table 1-2) (UBWR 2016a).

Table 1-2 Existing Traffic and Change from Construction AADT from Cumulative Construction			
Roadway	**Section**	**Cumulative AADT**	**% Change from Current AADT**
Utah			
Highway 89	AZ State Line	3,170	1.3
Highway 89	E. incorporated limits Big Water	2,340	1.7
Highway 89	Johnson Canyon	2,823	1.4
Average		**2,778**	**1.5**
Arizona			
SR-389	Utah State line	3,329	1.2
SR-389	Cane Beds Road	2,079	2.0
SR-389	Pipe Springs National Monument Rd.	2,211	1.8
SR-389	Pratt Street	1,989	2.0
Average		**2,402**	**1.7**

With this level of additional traffic, it is not expected that the levels of service (LOS) provided by the roads in the area would be changed from their current LOS of A or B and that there would be minor traffic inconveniences only (UBWR 2016a).

1.5 Access Roads

Various facilities and pipeline installation locations would have access or temporary construction roads constructed. The preliminary list of access roads is included in Attachment A. A typical construction section for the access roads in relation to the various roads, ROWs and pipeline construction is shown in Figure 1-2. It is not expected that the construction or improvement of the access roads would create traffic issues in the area.

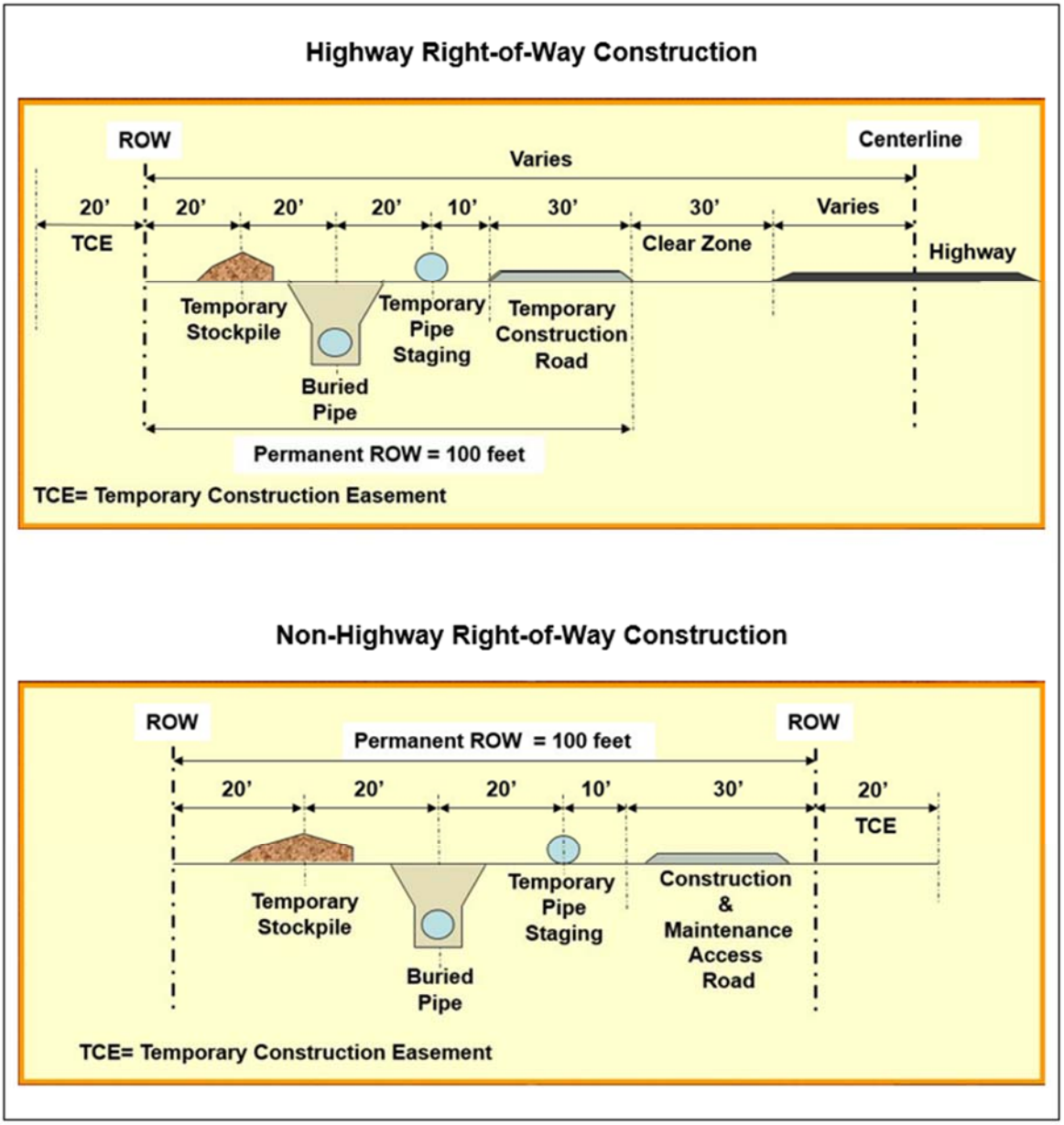


Figure 2-2
Highway Right-of-Way Layout

1.6 Traffic Control

Traffic control systems would be used on roads in the area during construction. This traffic control would include applicable measures such as caution signs to full lane or road closures with pilot cars and coordinated flagging. Traffic control plans would be developed in further detail for any specific areas of potential traffic conflict or congestion prior to construction. These control plans would be reviewed by the appropriate federal, state and local agencies to authorize the traffic management and control plans.

References

Utah Board of Water Resources (UBWR). 2016a. Lake Powell Pipeline, Final Study Report 14 – Transportation, Utah Division of Water Resources. Salt Lake City, Utah.

Utah Board of Water Resources (UBWR). 2016b. Lake Powell Pipeline, Final Study Report 3 – Archeological and Historic-era Resources, Utah Division of Water Resources. Salt Lake City, Utah.

Attachment A: Access Roads

Table A-1
Access Roads and Improvement Lengths for the Project

Location/Description	Road Construction (Miles)	Road Improvement (Miles)
IPS-1 (Intake) to Access Road	0.3	
BPS-1 to Access Road	0.7	
BPS-2 to Highway 89	0.2	
BPS-3 (Alt.) to Hwy 89	0.1	
Cottonwood Canyon Road (Transmission Line to Highway 89)		5.9
BPS-4 (Alt.) to Highway 89	0.1	
High Point Reg Tank-2	0.1	
HS-1 to Highway 89	0.1	
LPP to Highway 89 (8 mile Gap Road)		8.7
LPP to SR-389 (Mt. Trumbull Road)		5.8
Hydro-HS-2	0.1	
Hydro-HS-3	0.1	
Hydro-HS-4	0.1	
Hurricane Cliffs Discharge Hydro	0.1	
Sand Hollow Hydro Station		0.5
Along transmission line from Intake to Highway 89 (NE of High Point Regulating Tank-2)		36.0
BPS-2 transmission line		7.0
Spurs to Pipeline along Highway 89 (10 @ 500 ft each)	0.9	
Along penstock from Highway-89 SW to Navajo-McCullough transmission line (near White Sage Wash)	11.3	
Spurs to penstock from Highway-89A to Hwy 239 (5 @ 200 ft each)	0.2	
Along penstock from Highway 89 SW to near Fredonia		4.8
Along penstock W of HS-3	9.5	
Spurs from Hurricane Cliffs Hydro to Sand Hollow Hydro	0.2	
Along transmission lines E of Sand Hollow Reservoir	13.2	
Total	**37.3**	**73.3**