Lake Powell Pipeline

Modified Draft Study Report 10
Socioeconomics and Water Resource Economics

February 2012

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Executive Summary

ES-1 Introduction

This Executive Summary succinctly reviews the economic analyses, methods, and estimated impacts on the water resource economics and socioeconomics resources affected by the Lake Powell Pipeline (LPP) action alternative. The Project conforms to the Proposed Alternative configuration(s), and its impacts are considered incrementally to the No Lake Power Pipeline Alternative and to the No Action Alternative (baseline conditions, as is without the Project).

The following material reflects technical reviews and analyses completed through December 2011, based on completed (or draft) analyses pertaining to several pre-construction engineering and preliminary cost studies. Most of the analyses/estimates presented here are draft in nature, subject to change and revision, given project design/configuration changes and different resource management and impact assumptions.

ES-1.1 NED, FERC, and RED Project Impacts

The "No Action" alternative is considered as not implementing the LPP Project and reflects baseline, empirical conditions. Consequently, no incremental economic impact analyses have been applied to the baseline conditions. Baseline conditions—and associated water resource acquisitions—continue to be reviewed. Even so, the economic analyses performed and documented in this study report take into account alternative (marginal) water resource costs for the Project that could be adopted under "baseline" conditions. Further economic analyses on the No Action Alternative (baseline condition) may be developed, given additional planning direction.

Under the No Lake Powell Water Alternative, the economic analyses performed and documented in this study report take into account alternative (marginal) water resource costs that reflect this action alternative. The marginal value of water used for the LPP Proposed Alternative is equivalent to the No Lake Powell Water Alternative, and generally reflects a conservative assessment.

The LPP Project (Proposed Alternative) impacts can be summarized from three different perspectives: 1) a direct net, national economic development (NED) or state direct net value perspective; 2) the "developmental" economic analysis approach commonly employed by the Federal Energy Regulatory Commission (Commission), and using an "avoided cost" criteria for measuring project cost-effectiveness; and 3) a regional economic development (RED) perspective, where state and local employment/income impacts are the central focus. Relying on these three perspectives, the Project economic impacts are summarized in the following sections.

ES-1.1.1 NED or State Direct Economic Impacts Perspective

- The Project is determined to be an infrastructure feature of population and economic growth in Southern Utah, but it is not the *"driver"* of growth. The Utah State population projection/forecast indicates that other population and economic growth features (natural growth rates and net in-migration) would drive upward population growth in the area. This assessment is made by the state economists. The long-term, average annual rate of population growth for the Project affected area is forecast to be about 3.1 percent.

- The Project would facilitate new population growth in a manner similar to other infrastructure requirements, such as roads and transportation, power and energy, housing, and other human services needs. All of these infrastructure requirements would accommodate population and economic growth in the area.

- The Project is part of the water resources infrastructure that is needed to accommodate, or accommodate, growth. If the Project is not developed, then other alternative cost water resource supplies would need to be acquired, along with an acceptance of potential changes in individual and community lifestyles affected by reduced water demand and use.

- The Project benefits are principally determined by comparing (or defining) the Project development (direct benefits and costs) to alternative (marginal) costs for other water resources. The marginal cost spread, for alternative water resources, is great, with some conservation features being under $250/acre-foot, some water marketing and transfer costs likely ranging from $130-260/acre-foot; and new water treatment costs likely being in a $750-$1,150/acre-foot range (or higher), depending on an ability to meet regulatory compliance and environmental requirements and the effect of real escalation rates affecting project operations (annual 2010$).

- The NED base Project costs, without power benefits included, suggest costs approaching $1,100/acre-foot ($1,100/acre-foot is based on an average water delivery over the project life, not peak operations).

- The LPP Project is reviewed with the expectation that lower cost resources are brought into development first (such as conservation and water right transfers, and other planned water development projects), and with the LPP Project development following thereafter. Also, the Project is determined to avoid, or delay, the construction of high-cost water treatment and waste disposal facilities, such as reverse osmosis (RO) and combined brine disposal projects (currently under review); and to avoid costs of restricting residential outdoor irrigation with culinary water and converting this water to only culinary use.

- Overall, the Project displays greater benefits than costs given the complex set of economic variables and assumptions under consideration. Depending on economic perspectives and assumptions, the Project direct net benefits range from about $1.8 to $2.7 billion, and the Project costs range from about $1.8 to $2.7 billion (2010$, present value).

- From a "baseline" NED principles and guidelines perspective, the Project development benefits are greater than costs of Project construction and operation, per the life-cycle cost review performed in this analysis (Benefit/Cost [B/C] ratio of about 1.20). This perspective assumes some relative escalation (2.5 percent) in monetary values between the costs of water resources development today versus other "product" costs tomorrow (and a more short-term cost-of-capital factor of 4.14 percent).

- From a sensitivity analysis perspective, where inter-generational equity affecting benefits/costs of the Project is taken more fully into consideration (social time preference rate of 3.0 percent for discount rate), and the real monetary value of water, power, and construction costs are assumed to increase over the life of the Project, the Project benefits/cost ratio is about 1.49.

- Analyses have incorporated a Project configuration that includes a pump storage hydro generation component. This is a more costly Project configuration, raising overall Project costs to about $2.6 to 3.2 billion, but with benefits potentially in the $2.9 to $4.3 billion range. These estimates are preliminary in nature. The B/C ratio is about 1.14 to 1.34 depending on analysis assumptions.

- An initial set of analyses also have taken into account relying on the natural gas generation alternative for pipeline water pumping (see Tables 5-5 to 5-8). Under the state project configuration, the Project benefits are about $1.8 billion, with costs at about $1.5 billion (4.14% discount rate); or benefits at about $2.7 billion, with costs at about $1.8 billion (3.0% discount rate). This yields B/C ratios from 1.17 to 1.48, respectively.

- For the pump storage integration Project with natural gas generation pumping, the benefits are about $2.9 billion, with cost at about $2.6 billion (4.14% discount rate); or benefits at about $4.3 billion, with costs at about $3.2 billion (3.0% discount rate). This yields B/C ratios from 1.12 to 1.33, respectively.

- For the above analyses, the primary risk, or sensitivity, components would be escalating construction, OM&R, power, and water costs. To limit this risk, power costs (values) have been established at a relative mid-to-high range, and real escalation rates are used to take into account structural shifts in the relationship to power and water values relative to other societal costs. As a general statement, the higher the initial capital costs for any project, the greater is the risk of the economic analyses being inaccurate, thus carrying over the life of the project inadequate assumptions. Related to the above analyses, the project OM&R costs are likely the most uncertain factor related to construction costs. Low range values are used here relative to a broad range of construction projects.

ES-1.1.2 Commission's Economic and Fiscal Impacts Perspective

- The Commission's project developmental perspective *differs from the NED perspective,* and it also focuses exclusively on the power production costs and benefits (hydro project) portions of the Project, *per a specified hydro project configuration*. Under this specified configuration, the hydro project power benefits are substantially less than the hydro project costs. The costs are based on all hydro *project* generation facilities *and the full portion of the inter-connected water delivery pipeline.* And a nominal, instead of real, discount rate is applied.

- Under this hydro project configuration, the power benefits are substantially less than the project costs (B/C ratios of about 0.10 to 0.41). The costs are based on all hydro project generation facilities and the complete portion of the inter-connected water system delivery pipeline. The estimated power cost would be about $160-260/MWh, whereas an estimated avoided power cost would be about $64 MWh (wholesale power values, with nominal discount rate). In terms of general power purchases, the avoided power cost (and/or other green power costs) is far more attractive than the potential hydro project costs.

- For the pump storage configuration of the Project, the B/C ratios are about 0.47 to 0.89, and the power costs are estimated to be about $80-130/MWh. This cost per MWh is higher than the avoided cost of about $65/MWh (or $85/MWh for the green power premium).

- *From a "true" marginal cost perspective,* the Project power costs should be treated as incremental costs to the water delivery pipeline—depicting a with and without "hydro project" analysis. In this analysis, the costs of the water delivery system are not included as part of the hydro project. Under the pump storage configuration, the hydro project benefits are approximately equal to or greater than the costs, with the costs estimated to be about $100/MWh. The corresponding B/C ratios would be in the 0.97 to 1.10 range (direct project benefits and costs, depending on the discount rate applied).

While this Project power cost is greater than the estimated avoided ("market") regional power costs, it is roughly equivalent to the costs of integrating renewable power sources such as wind turbine generation; and the power would likely be marketed as a "renewable resource," with an implied carbon credit.

ES-1.1.3 RED Economic Impacts Perspective

- The regional economic development (RED) perspective is more focused on economic impacts "on the ground," describing impacts resulting from regional and state direct Project employment, secondary employment and income, and the overall affect of purchases of goods and services throughout the state economy. Project construction is initially estimated to produce about 2,395 direct jobs (annual FTE) during the period of project construction, and about 5,510 jobs taking into account direct and indirect employment effects throughout the state. Annual operation and maintenance (O&M) employment is estimated to be at least 64 jobs (direct and indirect impacts).

- Total state construction labor income impacts are estimated to be about $247,578,200, with annual O&M labor income impacts estimated to be about $2,485,000.

- The estimated value of total goods and services purchases throughout the state is difficult to determine at this time, given the yet to be designated contracting and vender firms. Nevertheless, an initial range of potential impacts suggests that $902,000,000 to $2.0 billion could "pass through" the state economy, as a result of the Project (direct and secondary impacts).

- It is assumed that most of the direct employment benefits will accrue to the study area counties, primarily in Utah. For analysis purposes, the direct and secondary employment and income estimates are primarily allocated to the state of Utah.

- Additional review is forthcoming on Project construction-related public services and labor force needs. The time frame for construction and relatively low construction-related increases to local populations (and existing services) does not suggest significant impacts. Most service needs would be directed toward site-specific construction staging areas, where land, transportation services and congestion, power/water and fuel, and other public and private sector service demands would increase.

- The Project will contribute to the long-term economic stability and general development of the region. To the extent that it off-sets higher cost water resources projects or maintains an attractive lifestyle for the region, it provides more dollars to be allocated to economic sectors other than infrastructure.

ES-1.1.4 Kaibab Band of Paiute Indians and the Kaibab-Paiute Indian Reservation

- Additional analyses are forthcoming to determine Project construction, income, and potential tax opportunities for Tribal members and the Tribal government. This will depend on Project configuration and selection of the Project alignment.

- It is assumed that any Executive Order Environmental Justice issues would be reconciled, or mitigated, per consultations with the Tribe. There are several mitigation tools available to mitigate for undesired social or economic impacts caused by the Project.

ES-1.1.5 Qualitative Economic Issues and Impacts

- Additional analyses are forthcoming to better assess and describe the more qualitative (or non-quantified economic impacts at this time) surrounding project development. These items will include: 1) general concerns about regional economic growth and community lifestyle changes (should there be growth controls in the area); 2) non-Project development impacts on declining groundwater aquifer resources; 3) non-Project development impacts associated with substantial water demand reductions per capita within the study area, as a programmatic curtailment option; and 4) other economic impacts.

Chapter 1
Introduction

1.1 Introduction

This chapter presents a summary description of the alternatives studied for the Lake Powell Pipeline (LPP) project, located in north central Arizona and southwest Utah (Figure 1-1) and identifies the issues and impact topics for the Draft Air Quality Study Report. The alternatives studied and analyzed include different alignments for pipelines, penstocks, natural gas supply line and transmission lines, a no Lake Powell water alternative, and the No Action alternative. The pipelines would convey water under pressure and connect to the penstocks, which would convey the water to a series of hydroelectric power generating facilities. The action alternatives would each deliver 86,249 acre-feet of water annually for municipal and industrial (M&I) use in the three southwest Utah water conservancy district service areas. Washington County Water Conservancy District (WCWCD) would receive 69,000 acre-feet, Kane County Water Conservancy District (KCWCD) would receive 4,000 acre-feet and Central Iron County Water Conservancy District (CICWCD) could receive up to 13,249 acre-feet each year.

1.2 Summary Description of Alignment Alternatives

Three primary pipeline and penstock alignment alternatives are described in this section along with the electrical power transmission line alternatives. The pipeline and penstock alignment alternatives share common segments between the intake at Lake Powell and delivery at Sand Hollow Reservoir, and they are spatially different in the area through and around the Kaibab-Paiute Indian Reservation. The South Alternative extends south around the Kaibab-Paiute Indian Reservation. The Existing Highway Alternative follows an Arizona state highway through the Kaibab-Paiute Indian Reservation. The Southeast Corner Alternative follows the Navajo-McCullough Transmission Line corridor through the southeast corner of the Kaibab-Paiute Indian Reservation. The transmission line alignment alternatives are common to all the pipeline and penstock alignment alternatives. The natural gas line alignment alternative is common to all pipeline and penstock alignment alternatives. Figure 1-1 shows the overall proposed project and alternative features from Lake Powell near Page, Arizona to Sand Hollow and Cedar Valley, Utah.

1.2.1 South Alternative

The South Alternative consists of five systems: Intake, Water Conveyance, Hydro, Kane County Pipeline, and Cedar Valley Pipeline.

The **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 (Figure 1-2). The pump station enclosure would house vertical turbine pumps with electric motors, electrical controls, and other equipment at a ground level elevation of 3,745 feet mean sea level (MSL).

The **Water Conveyance System** would convey the Lake Powell water from the Intake System for about 51 miles through a buried 69-inch diameter pipeline parallel with U.S. 89 in Coconino County, Arizona and Kane County, Utah to a buried regulating tank (High Point Regulating Tank-2) on the south side of U.S. 89 at ground level elevation 5,695 feet MSL, which is the LPP project topographic high point

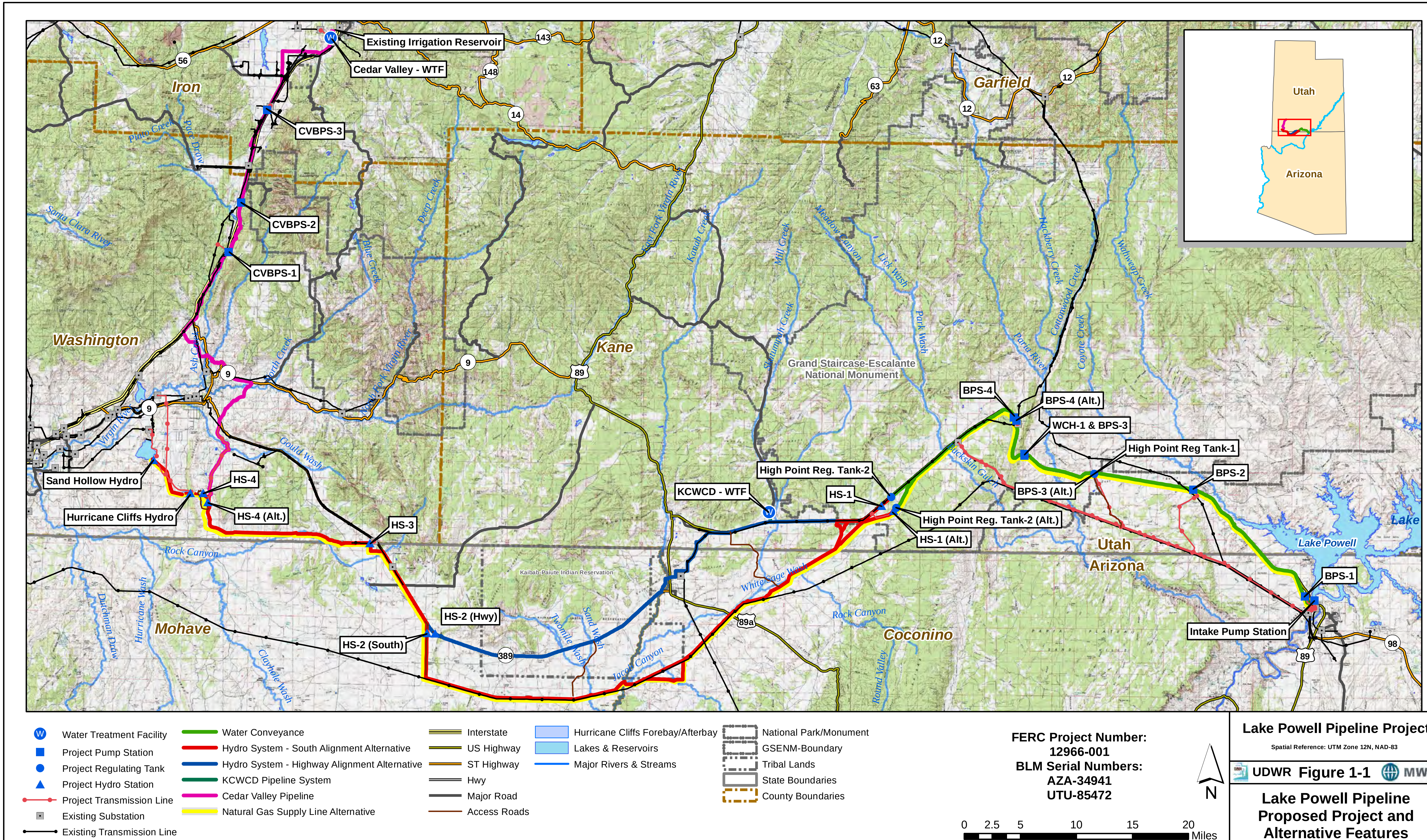
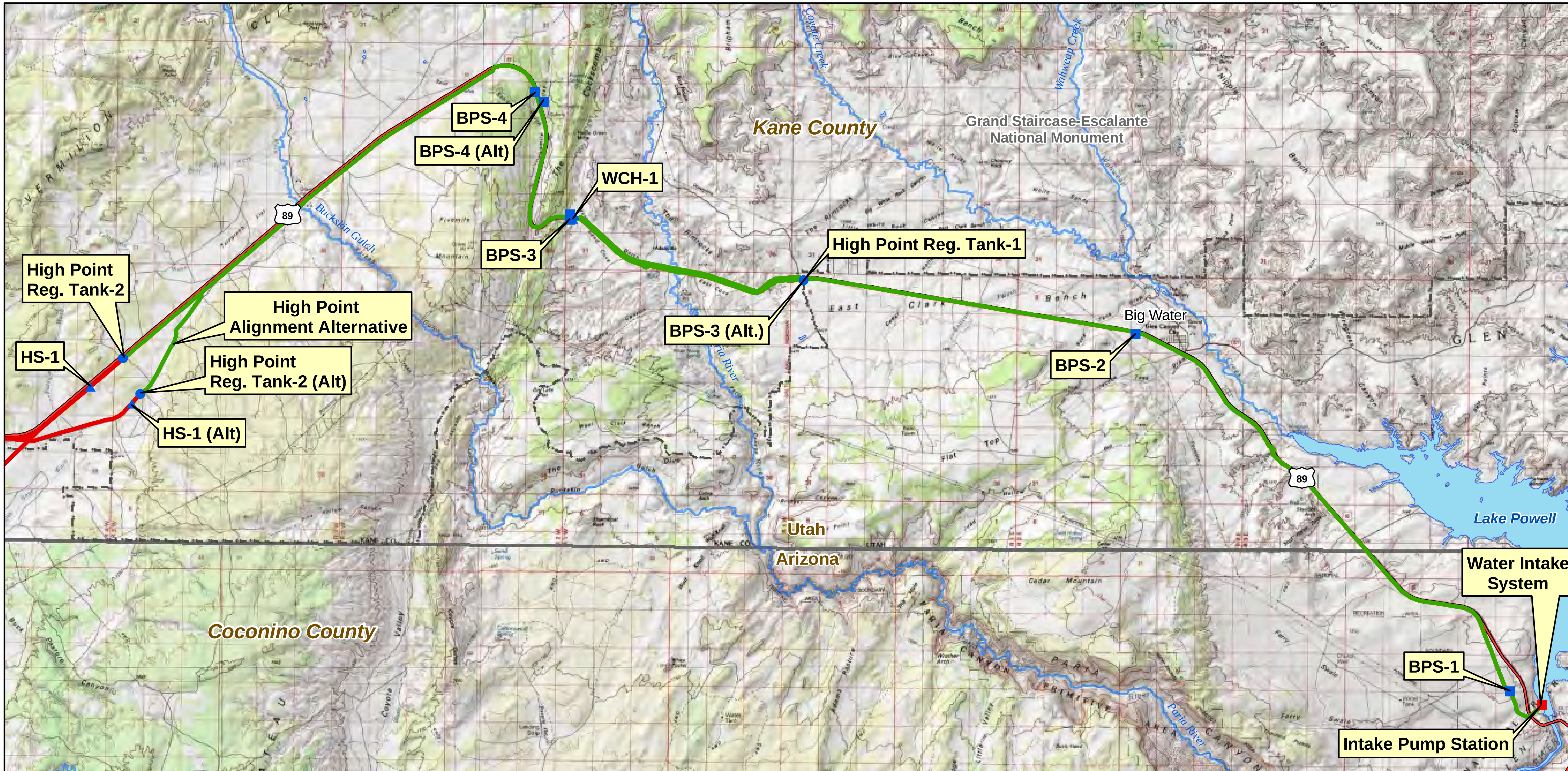


Figure 1-1
Lake Powell Pipeline Proposed Project and Alternative Features



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

NGS USA Topographic Maps

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

UDWR **Figure 1-2** MWH

Lake Powell Pipeline
Intake and
Water Conveyance Systems

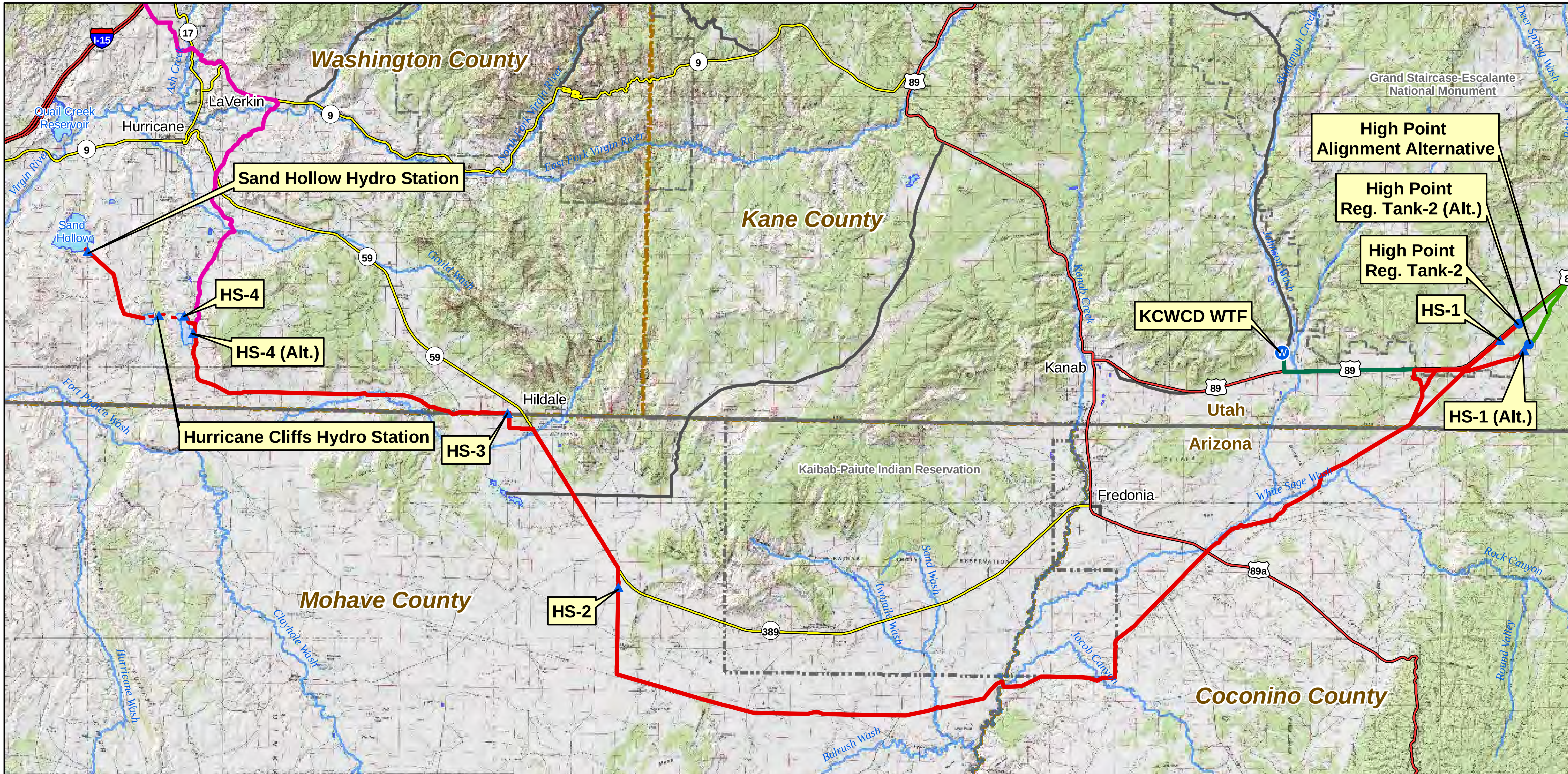
(Figure 1-2). The pipeline would be sited within a utility corridor established by Congress in 1998 which extends 500 feet south and 240 feet north of the U.S. 89 centerline on public land administered by the Bureau of Land Management (BLM) (U.S. Congress 1998). Four booster pump stations (BPS) located along the pipeline would pump the water under pressure 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 and a surface emergency overflow detention basin. BPS-1 would be sited within the Glen Canyon National Recreation Area adjacent to an existing Arizona Department of Transportation maintenance facility located west of U.S. 89. BPS-2 would be sited on land administered by the Utah School and Institutional Trust Lands Administration (SITLA) near the town of Big Water, Utah on the south side of U.S. 89. BPS-3 (Alt.) is the proposed third booster pump station and would be sited on land administered by the BLM Kanab Field Office near the east boundary of the Grand Staircase-Escalante National Monument (GSENM) on the south side of U.S. 89 within the Congressionally-designated utility corridor. BPS-4 (Alt.) would be sited on private land east of U.S. 89 and west of the Cockscomb geologic feature (Figure 1-2). The proposed pipeline alignment would diverge south from U.S. 89 parallel to the K4020 road and continue outside of the Congressionally-designated utility corridor to a buried regulating tank, High Point Regulating Tank-2 (Alt.) at ground level elevation 5,630 feet MSL, which would be the topographic high point of the LPP project along this alignment alternative (Figure 1-2).

An alternative pipeline alignment parallel to U.S. 89 and up to the high point of the GSENM would require BPS-3 and an in-line hydro station (WCH-1) to be sited at the east side of the Cockscomb geologic feature in the GSENM within the Congressionally-designated utility corridor. BPS-4 would be sited on the west side of U.S. 89 and within the Congressionally-designated utility corridor in the GSENM on the west side of the Cockscomb geologic feature. The BPS-4 site would be on land administered by the BLM in the GSENM. This High Point Highway alignment alternative would end at High Point Regulating Tank-2 at elevation 5,695 feet MSL (Figure 1-2).

A rock formation avoidance alignment option would be included immediately north of Blue Pool Wash along U.S. 89 in Utah. Under this alignment option, the pipeline would cross to the north side of U.S. 89 for about 400 feet and then return to the south side of U.S. 89. This alignment option would avoid tunneling under the rock formation or excavating the toe of the rock formation on the south side of U.S. 89 near Blue Pool Wash.

A North Pipeline Alignment option is located parallel to the north side of U.S. 89 for about 6 miles from the east boundary of the GSENM to the east side of the Cockscomb geological feature.

The **Hydro System** would convey the Lake Powell water from High Point Regulating Tank-2 (Alt.) at a high point at ground level elevation 5,630 feet MSL 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 1-3). The High Point Highway Alignment Alternative would convey the Lake Powell water from High Point Regulating Tank-2 at the high point at ground level elevation 5,695 feet MSL for about 87 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 1-3). Four in-line hydro generating stations (HS-1 (Alt.), HS-2 HS-3 and HS-4) with substations located along the penstock would generate electricity and help control water pressure in the penstock. The proposed High Point Alignment Alternative would include HS-1 (Alt.) along the K4020 road within the GSENM and continue along a portion of the K3290 road. Under the High Point Highway alignment alternative, HS-1 would be sited on the south side of U.S. 89 within the Congressionally-designated utility corridor through the GSENM.



Water Treatment Facility
Project Regulating Tank
Project Hydro Station
Hurricane Cliffs Forebay/Afterbay
Lakes & Reservoirs
Major Rivers & Streams
Hydro System - South Alignment Alternative
Water Conveyance System
Cedar Valley Pipeline
KCWCD Pipeline System
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 1.25 2.5 5 7.5 10 Miles

Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWR **Figure 1-3** MWH

Lake Powell Pipeline Hydro System South Alternative

The proposed penstock alignment and two penstock alignment options are being considered to convey the water from the west GSENM boundary south through White Sage Wash. The proposed penstock alignment would parallel the K3250 road south from U.S. 89 and follow the Pioneer Gap Road alignment around the Shinarump Cliffs. One penstock alignment option would parallel the K3285 road southwest from U.S. 89 and continue to join the Pioneer Gap Road around the Shinarump Cliffs. The other penstock alignment option would extend southwest through currently undeveloped BLM land from the K3290 road into White Sage Wash.

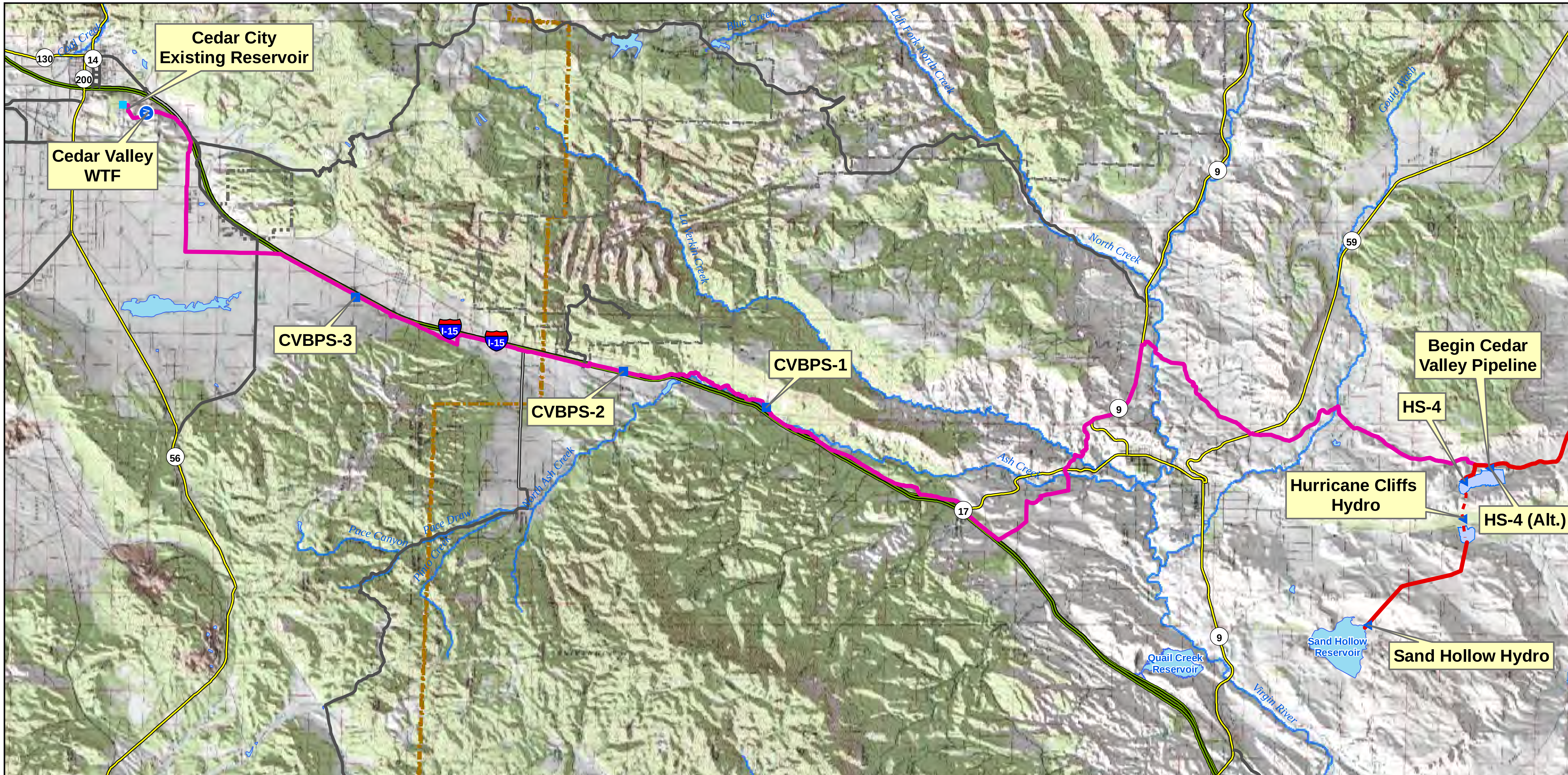
The penstock alignment would continue through White Sage Wash and then parallel to the Navajo-McCullough Transmission Line, crossing U.S. 89 Alt. and Forest Highway 22 toward the southeast corner of the Kaibab Indian Reservation. The penstock alignment would run parallel to and south of the south boundary of the Kaibab Indian Reservation, crossing Kanab Creek and Bitter Seeps Wash, across Moonshine Ridge and Cedar Ridge, and north along Yellowstone Road to Arizona State Route 389 west of the Kaibab Indian Reservation. HS-2 would be sited west of the Kaibab Indian Reservation. 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.

The penstock alignment would follow Uzona Road west through Canaan Gap and south of Little Creek Mountain and turn north to HS-4 (Alt.) above the proposed Hurricane Cliffs forebay reservoir. The forebay reservoir would be contained in a valley between a south dam and a north dam and maintain active storage of 11,255 acre-feet of water. 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 pumped storage hydro generating station. The pumped storage hydro generating station would connect to an afterbay reservoir contained by a single dam in the valley below the Hurricane Cliffs. A low pressure tunnel would convey the water northwest to a penstock continuing on to the Sand Hollow Hydro Station. The water would discharge into the existing Sand Hollow Reservoir.

The peaking hydro generating station option would involve a smaller, 200 acre-foot forebay reservoir with HS-4 discharging into the forebay reservoir, with the peaking hydro generating station discharging to a small afterbay connected to a penstock running north along the existing BLM road and west to the Sand Hollow Hydro Station. 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 peaking hydro generating station, which would discharge into a 200 acre-foot afterbay reservoir. A penstock would extend north from the afterbay reservoir along the existing BLM road and then west to the Sand Hollow Hydro Station. The water would discharge into the existing Sand Hollow Reservoir.

The **Kane County Pipeline System** would convey the Lake Powell water from the Lake Powell Pipeline at the west GSENM boundary for about 8 miles through a buried 24-inch diameter pipe in Kane County, Utah to a conventional water treatment facility located near the mouth of Johnson Canyon. The pipeline would parallel the south side of U.S. 89 across Johnson Wash and then run north to the new water treatment facility site (Figure 1-3).

The **Cedar Valley Pipeline System** would convey the Lake Powell water from the Lake Powell Pipeline just upstream of HS-4 or HS-4 (Alt.) for about 58 miles through a buried 36-inch diameter pipeline in Washington and Iron counties, Utah to a conventional water treatment facility in Cedar City, Utah (Figure 1-4). Three booster pump stations (CVBPS) located along the pipeline would pump the water under pressure to the new water treatment facility. The pipeline would follow an existing BLM road north from HS-4, cross Utah State Route 59 and continue north to Utah State Route 9, with an aerial crossing of



Water Treatment Facility
Project Pump Station
Project Hydro Station
Hydro System - South Alignment Alternative
Water Conveyance System
Hurricane Cliffs Pressure Tunnel
Cedar Valley Pipeline
Interstate
US Highway
ST Highway
Hwy
Major Road
Hurricane Cliffs Forebay/Afterbay
Lakes & Reservoirs
Major Rivers & Streams
National Park/Monument
County Boundaries
Tribal Lands

FERC Project Number:
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AZA-34941
UTU-85472

0 1 2 4 6 8 Miles

N

Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWR **Figure 1-4** MWH

Cedar Valley Pipeline System

the Virgin River at the Sheep Bridge. The pipeline would run west along the north side of Utah State Route 9 and parallel an existing pipeline through the Hurricane Cliffs at Nephi's Twist. The pipeline would continue across LaVerkin Creek, cross Utah State Route 17, and make an aerial crossing of Ash Creek. The pipeline would continue northwest to the Interstate 15 corridor and then northeast parallel to the east side of Interstate 15 highway right-of-way. CVBPS-1 would be sited adjacent to an existing gravel pit east of Interstate 15. CVBPS-2 would be sited on private property on the east side of Interstate 15 and south of the Kolob entrance to Zion National Park. CVBPS-3 would be sited on the west side of Interstate 15 in Iron County. The new water treatment facility would be sited near existing water reservoirs on a hill above Cedar City west of Interstate 15.

1.2.2 Existing Highway Alternative

The Existing Highway Alternative consists of five systems: Intake, Water Conveyance, Hydro, Kane County Pipeline, and Cedar Valley Pipeline. The Intake, Water Conveyance and Cedar Valley Pipeline systems would be the same as described for the South Alternative.

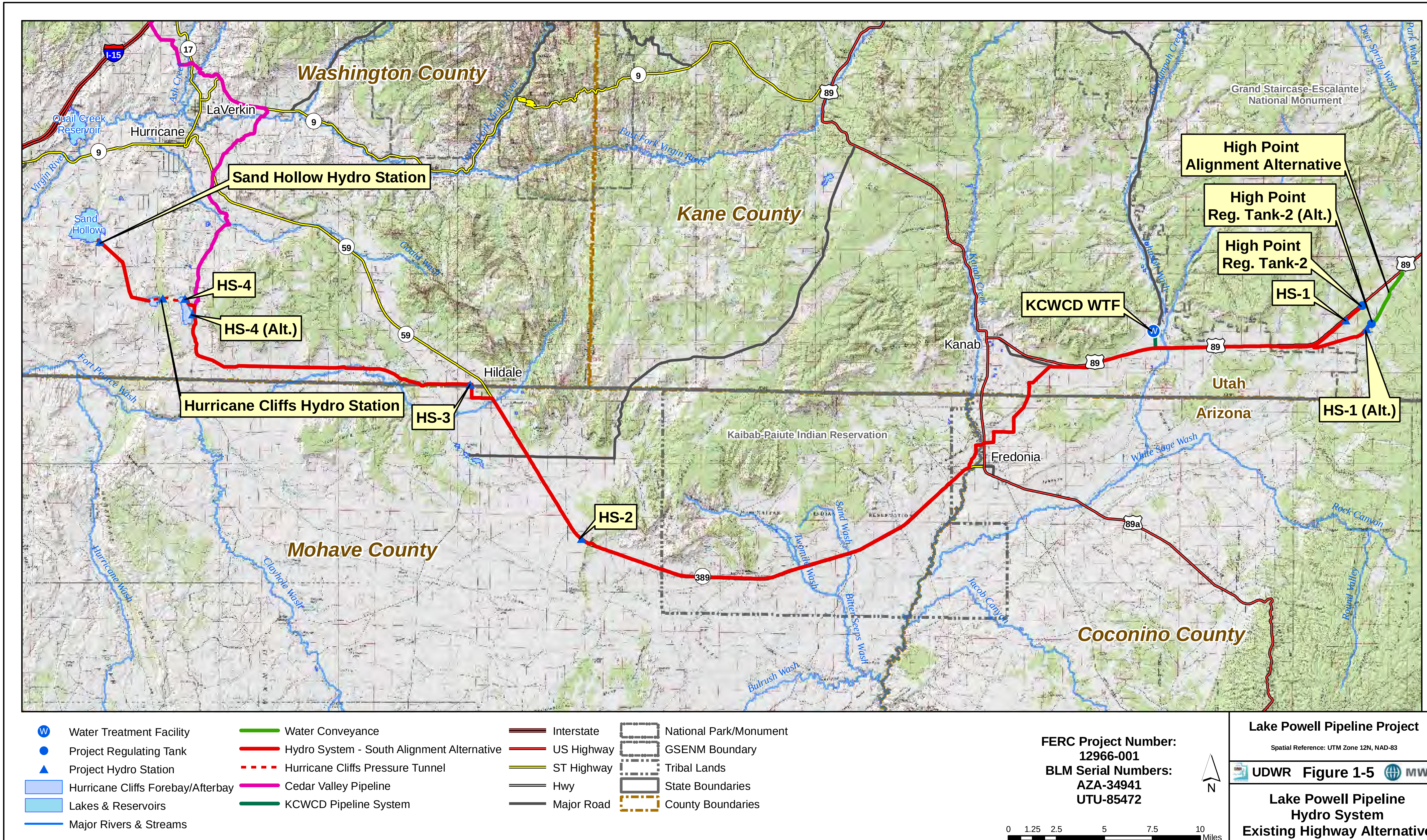
The **Hydro System** would convey the Lake Powell water from the regulating tank at the high point at ground elevation 5,630 feet MSL for about 80.5 miles through a buried 69-inch diameter penstock in Kane and Washington counties, Utah and Coconino and Mohave counties, Arizona to Sand Hollow Reservoir near St. George, Utah (Figure 1-5). The High Point Highway Alignment Alternative would convey the Lake Powell water from High Point Regulating Tank-2 at the high point at ground level elevation 5,695 feet MSL for about 80 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 1-3). The proposed alignment would rejoin U.S. 89 about 2.5 miles east of the west boundary of the GSENM. Four in-line hydro generating stations (HS-1 (Alt.), HS-2, HS-3 and HS-4 (Alt.)) located along the penstock would generate electricity and help control water pressure in the penstock. The proposed HS-1 (Alt.) would be sited along the K4020 road within the GSENM and continue along a portion of the K3290 road to its junction with the pipeline alignment along U.S. 89. The High Point Highway alignment alternative would include HS-1 sited on the south side of U.S. 89 within the Congressionally-designated utility corridor through the GSENM.

The penstock would parallel the south side of U.S. 89 west of the GSENM past Johnson Wash and follow Lost Spring Gap southwest, crossing U.S. 89 Alt. and Kanab Creek in the north end of Fredonia, Arizona. The penstock would run south paralleling Kanab Creek to Arizona State Route 389 and run west adjacent to the north side of this state highway through the 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 the Kaibab-Paiute Indian Reservation to 1.8 miles west of Cedar Ridge (intersection of Yellowstone Road with U.S. 89), from where it would follow the same alignment as the South Alternative to Sand Hollow Reservoir. HS-2 would be sited 0.5 mile west of Cedar Ridge along the north side of Arizona State Route 389.

The **Kane County Pipeline System** would convey the Lake Powell water from the Lake Powell Pipeline crossing Johnson Wash along U.S. 89 for about 1 mile north through a buried 24-inch diameter pipe in Kane County, Utah to a conventional water treatment facility located near the mouth of Johnson Canyon (Figure 1-5).

1.2.3 Southeast Corner Alternative

The Southeast Corner Alternative consists of five systems: Intake, Water Conveyance, Hydro, Kane County Pipeline, and Cedar Valley Pipeline. The Intake, Water Conveyance, Kane County Pipeline and Cedar Valley Pipeline systems would be the same as described for the South Alternative.


Washington County
Kane County
Mohave County
Coconino County
LaVerkin
Hurricane
Quail Creek Reservoir
Sand Hollow
Virgin River
Ash Creek
East Fork Virgin River
Gould Wash
Fort Pearce Wash
Hurricane Wash
Clayhole Wash
Kanab Creek
Johnson Wash
Deer Spring Wash
Park Wash
White Sage Wash
Rock Canyon
Round Valley
Jacob Canyon
Bitter Seeps Wash
Sand Wash
Twomile Wash
Bulrush Wash
Hildale
Kanab
Fredonia
Utah
Arizona
Kaibab-Paiute Indian Reservation
Grand Staircase-Escalante National Monument
I-15
17
9
59
89
89a
389
Sand Hollow Hydro Station
HS-4
HS-4 (Alt.)
Hurricane Cliffs Hydro Station
HS-3
HS-2
KCWCD WTF
High Point Alignment Alternative
High Point Reg. Tank-2 (Alt.)
High Point Reg. Tank-2
HS-1
HS-1 (Alt.)
Water Treatment Facility
Project Regulating Tank
Project Hydro Station
Hurricane Cliffs Forebay/Afterbay
Lakes & Reservoirs
Major Rivers & Streams
Water Conveyance
Hydro System - South Alignment Alternative
Hurricane Cliffs Pressure Tunnel
Cedar Valley Pipeline
KCWCD Pipeline System
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 1.25 2.5 5 7.5 10 Miles
Lake Powell Pipeline Project
Spatial Reference: UTM Zone 12N, NAD-83
UDWR
Figure 1-5
MWH
Lake Powell Pipeline
Hydro System
Existing Highway Alternative

The **Hydro System** would be the same as described for the South Alternative between High Point Regulating Tank-2 (Alt.) and the east boundary of the 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 Indian Reservation for about 3.8 miles and 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).

1.2.4 Transmission Line Alternatives

Transmission line alternatives include the Intake (3 alignments), BPS-1, Glen Canyon to Buckskin, Buckskin Substation upgrade, Paria Substation upgrade, BPS-2, BPS-2 Alternative, BPS-3 North, BPS-3 South, BPS-3 Underground, BPS-3 Alternative North, BPS-3 Alternative South, BPS-4, BPS-4 Alternative, HS-1 Alternative, HS-2 South, HS-3 Underground, HS-4, HS-4 Alternative, Hurricane Cliffs Afterbay to Sand Hollow, Hurricane Cliffs Afterbay to Hurricane West, Sand Hollow to Dixie Springs, Cedar Valley Pipeline booster pump stations, and Cedar Valley Water Treatment Facility.

The proposed new **Intake Transmission Line** would begin at Glen Canyon Substation and run parallel to U.S. 89 for about 2,500 feet to a new switch station, cross U.S. 89 at the Intake access road intersection and continue northeast to a new electrical substation on the Intake Pump Station site. The 69 kV transmission line would be about 0.9 mile long in Coconino County, Arizona (Figure 1-7). One alternative alignment would run parallel to an existing 138 kV transmission line to the west, turn north to the new switch station, cross U.S. 89 at the Intake access road intersection and continue northeast to the Intake substation. This 69 kV transmission line alternative would be about 1.2 miles long in Coconino County, Arizona (Figure 1-7). Another alternative alignment would bifurcate from an existing transmission line and run west, then northeast to the new switch station, cross U.S. 89 at the Intake access road intersection and continue northeast to the Intake substation. This 69 kV transmission line alternative would be about 1.3 miles long in Coconino County, Arizona (Figure 1-7).

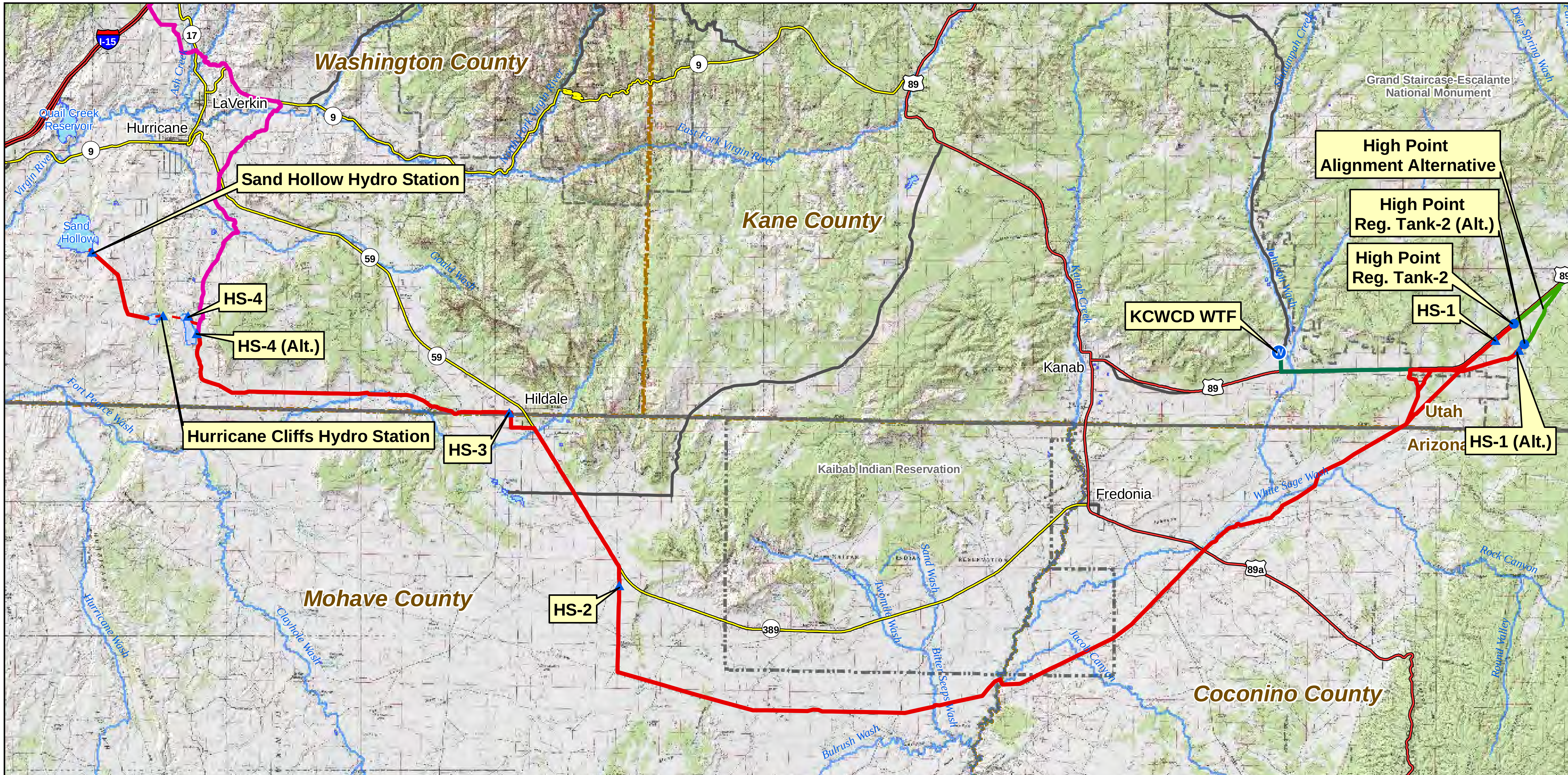
The proposed new **BPS-1 Transmission Line** would begin at the new switch station located on the south side of U.S. 89 and parallel the LPP Water Conveyance System alignment to a new electrical substation on the BPS-1 site west of U.S. 89. The 69 kV transmission line would be about 1 mile long in Coconino 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 5 acres of land within the 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 Alternative. The substation upgrade would require an additional 2 acres of privately-owned land adjacent to the existing substation in Kane County, Utah (Figure 1-7).

The proposed new **BPS-2 Transmission Line** alternative would consist of a new 3-ring switch station along the existing 138 kV Glen Canyon to Buckskin Transmission Line and 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



Water Treatment Facility
Project Regulating Tank
Project Hydro Station
Hurricane Cliffs Forebay/Afterbay
Lakes & Reservoirs
Major Rivers & Streams

Water Conveyance System
Hydro System - Southeast Corner Alternative
Kane County Pipeline System
Cedar Valley Pipeline System

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

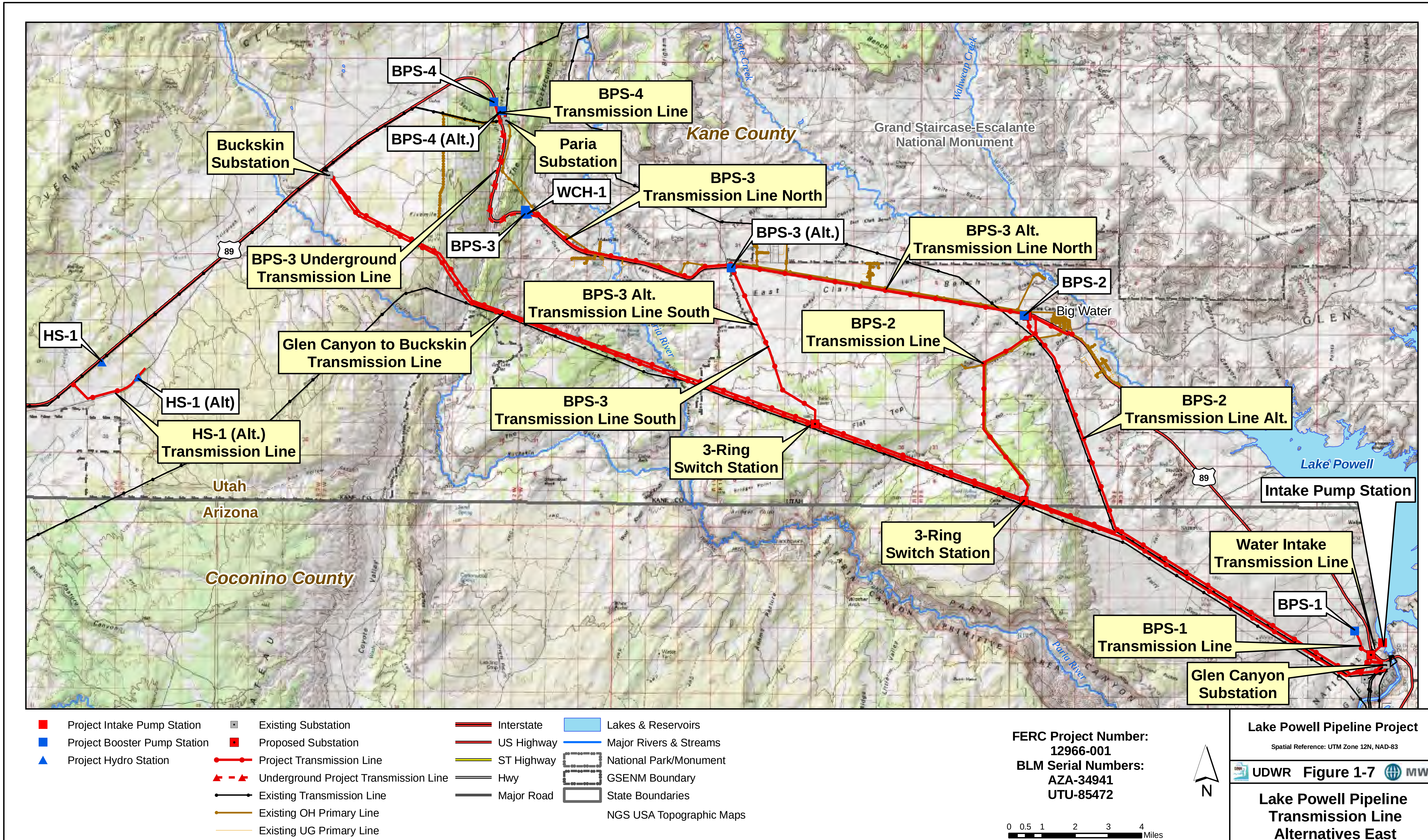
0 1.25 2.5 5 7.5 10 Miles

Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWR **Figure 1-6** MWH

Lake Powell Pipeline
Hydro System
Southeast Corner Alternative



BPS-4
BPS-4 Transmission Line
BPS-4 (Alt.)
Paria Substation
Buckskin Substation
Kane County
Grand Staircase-Escalante National Monument
WCH-1
BPS-3 Transmission Line North
BPS-3
BPS-3 (Alt.)
BPS-3 Alt. Transmission Line North
BPS-3 Underground Transmission Line
BPS-2
Big Water
BPS-3 Alt. Transmission Line South
BPS-2 Transmission Line
Glen Canyon to Buckskin Transmission Line
HS-1
HS-1 (Alt)
HS-1 (Alt.) Transmission Line
BPS-3 Transmission Line South
BPS-2 Transmission Line Alt.
3-Ring Switch Station
Lake Powell
Intake Pump Station
Utah
Arizona
89
Water Intake Transmission Line
Coconino County
BPS-1
BPS-1 Transmission Line
Glen Canyon Substation
Paria River
Project Intake Pump Station
Project Booster Pump Station
Project Hydro Station
Existing Substation
Proposed Substation
Project Transmission Line
Underground Project Transmission Line
Existing Transmission Line
Existing OH Primary Line
Existing UG Primary Line
Interstate
US Highway
ST Highway
Hwy
Major Road
Lakes & Reservoirs
Major Rivers & Streams
National Park/Monument
GSENM Boundary
State Boundaries
NGS USA Topographic Maps
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
UDWR
Figure 1-7
MWH
Lake Powell Pipeline Transmission Line Alternatives East

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 alternative would be about 7 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 new **BPS-2 Alternative Transmission Line** would consist of a new 138 kV transmission line from Glen Canyon Substation parallel to the existing Rocky Mountain Power 230 kV transmission line, connecting to a new electrical substation on the BPS-2 site west of Big Water. This new 138 kV transmission line alternative would be about 16.5 miles long in Coconino County, Arizona and Kane County, Utah crossing National Park Service-administered land, BLM-administered land and Utah SITLA-administered land (Figure 1-7).

The new **BPS-3 Transmission Line North** alternative would consist of a new 138 kV transmission line from BPS-2 paralleling the south side of U.S. 89 within the Congressionally designated utility corridor west to a new electrical substation on the BPS-3 site at the east side of the Cockscomb geological feature. This new 138 kV transmission line alternative would be about 15.7 miles long in Kane County, Utah (Figure 1-7).

The new **BPS-3 Transmission Line South** alternative would consist of a new 3-ring switch station along the existing 138 kV Glen Canyon to Buckskin Transmission Line and a new transmission line from the switch station north along an existing BLM road to U.S. 89 and then west along the south side of U.S. 89 within the Congressionally designated utility corridor to a new electrical substation on the BPS-3 site at the east side of the Cockscomb. This new 138 kV transmission line alternative would be about 12.3 miles long in Kane County, Utah (Figure 1-7).

The new **BPS-3 Underground Transmission Line** alternative would consist of a new buried 24.9 kV transmission line (2 circuits) from the upgraded Paria Substation to a new electrical substation at the BPS-3 site on the east side of the Cockscomb geological feature. This new underground transmission line would be parallel to the east and south side of U.S. 89 and would be about 4.1 miles long in Kane County, Utah (Figure 1-7).

The new **BPS-3 Alternative Transmission Line North** alternative would consist of a new 138 kV transmission line from BPS-2 paralleling the south side of U.S. 89 west to a new electrical substation on the BPS-3 Alternative site near the GSENM east boundary within the Congressionally-designated utility corridor. This new 138 kV transmission line alternative would be about 9.3 miles long in Kane County, Utah (Figure 1-7).

The proposed new **BPS-3 Alternative Transmission Line South** alternative would consist of a new 3-ring switch station along the existing 138 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 Alternative site near the GSENM east boundary and within the Congressionally-designated utility corridor. This new 138 kV transmission line alternative would be about 5.9 miles long in Kane County, Utah (Figure 1-7).

The new **BPS-4 Transmission Line** alternative would begin at the upgraded Paria Substation and run parallel to the west side of U.S. 89 north to a new electrical substation on the BPS-4 site within the Congressionally designated utility corridor. This new 138 kV transmission line would be about 0.8 mile long in Kane County, Utah (Figure 1-7).

The proposed new **BPS-4 Alternative 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 Alternative Transmission Line** would begin at the new HS-1 Alternative and run southwest parallel to the K4020 road and then northwest parallel to the K4000 road to the U.S. 89 corridor where it would tie into the existing 69 kV transmission line from the Buckskin Substation to the Johnson Substation. This 69 kV transmission line would be about 3 miles long in Kane County, Utah (Figure 1-7).

The proposed new **HS-2 South Transmission Line** alternative 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 proposed new **HS-3 Underground 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 underground circuit would be about 0.6 mile long in Washington County, Utah (Figure 1-8).

The proposed new **HS-4 Transmission Line** would consist of a new transmission line from the HS-4 hydroelectric station and substation north along an existing BLM road to an existing transmission line parallel to Utah State Route 59. The new 69 kV transmission line would be about 8.2 miles long in Washington County, Utah (Figure 1-8).

The new **HS-4 Alternative Transmission Line** alternative would connect the HS-4 Alternative 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 from the Hurricane Cliffs peaking power plant and substation, and run northwest to the Sand Hollow Hydro Station 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 from the Hurricane Cliffs pumped storage power plant and run 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 from the Sand Hollow Hydro Station 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).

The three **Cedar Valley Pipeline** booster pump stations would require new transmission lines from existing transmission lines paralleling the Interstate 15 corridor. The new CVBPS-1 transmission line would extend southeast over I-15 from the existing transmission line to the booster pump station substation for about 1.3 miles in Washington County, Utah (Figure 1-9). The new CVBPS-2 transmission line would extend east over I-15 from the existing transmission line to the booster pump station substation for about 0.2 mile in Washington County, Utah (Figure 1-9). The new CVBPS-3 transmission line would extend west over I-15 from the existing transmission line and southwest along the west side of Interstate 15 to the booster pump station substation for about 0.6 mile in Iron County, Utah (Figure 1-9).

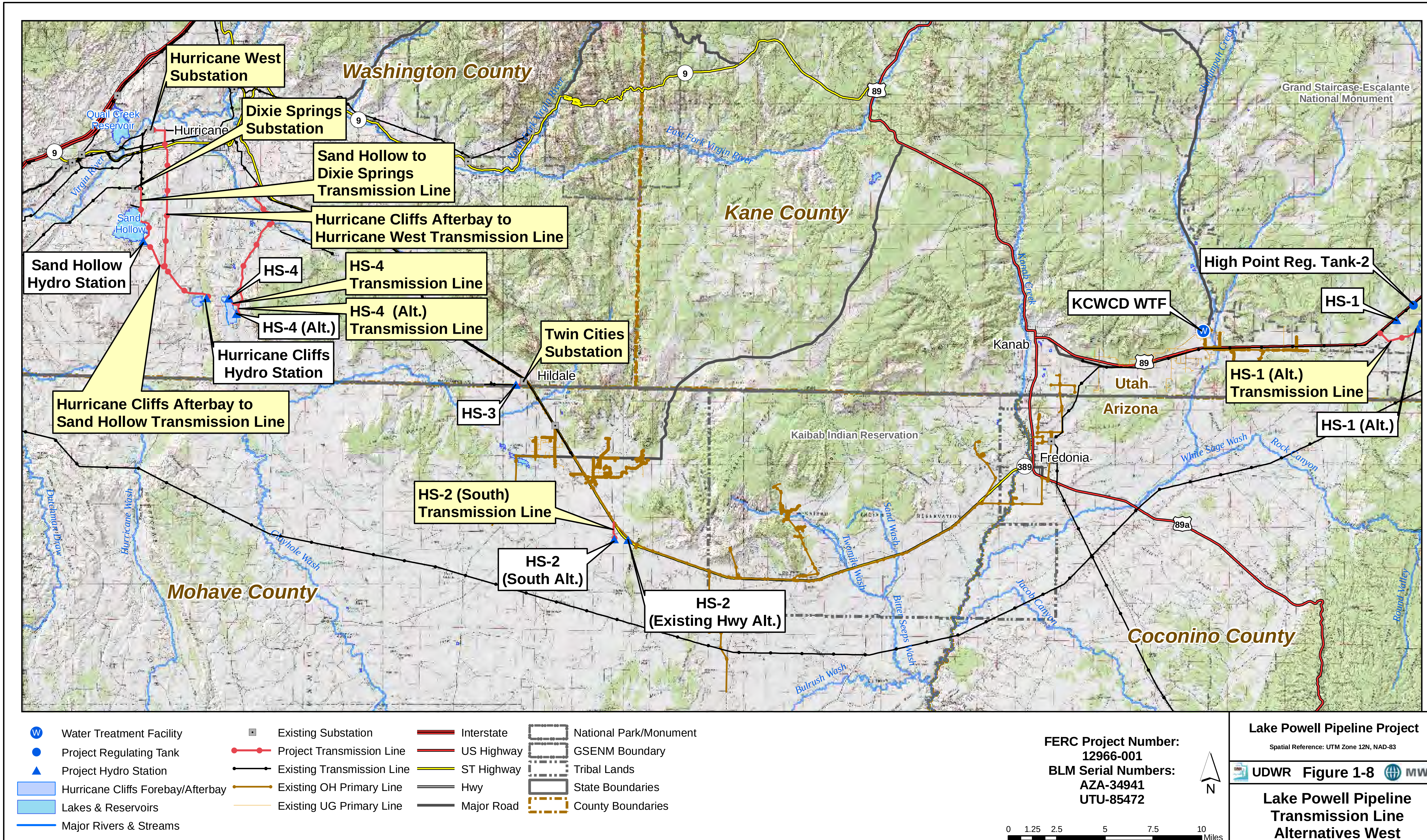
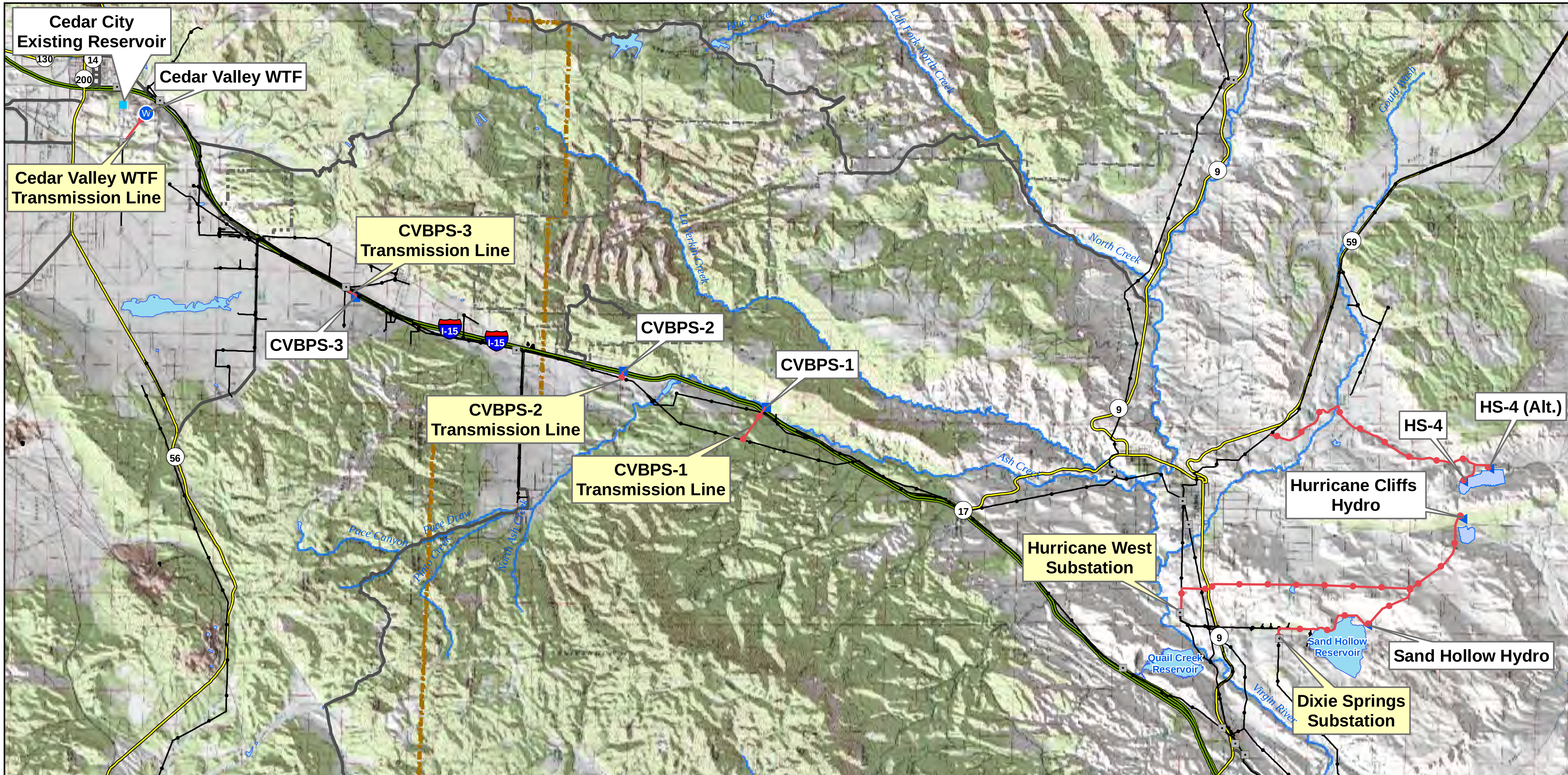


Figure 1-8

Lake Powell Pipeline Transmission Line Alternatives West



Water Treatment Facility	Existing Substation
Project Pump Station	Project Substation
Project Hydro Station	Project Transmission Line
	Existing Transmission Line
	Existing OH Primary Line
	Existing UG Primary Line

Interstate	Hurricane Cliffs Forebay/Afterbay
US Highway	Lakes & Reservoirs
ST Highway	Major Rivers & Streams
Hwy	National Park/Monument
Major Road	County Boundaries
	Tribal Lands

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

UDWR **Figure 1-9** MWH

Cedar Valley Transmission Line Alternatives

The **Cedar Valley Water Treatment Facility Transmission Line** would begin at an existing substation in Cedar City and run about 1 mile to the water treatment facility site in Iron County, Utah (Figure 1-9).

1.2.5 Natural Gas Supply Line and Generators Alternative

An alternative to powering the Lake Powell Pipeline (LPP) pump stations by electricity from transmission lines is installing natural gas engine driven generation systems to power electric pumps. Recent discussions with Questar Gas (a local natural gas supplier) have indicated that capacity is available in the Kern River natural gas pipeline, which is located west of St. George, Utah, to supply the gas for this alternative. Questar Gas has indicated they have plans to extend a high pressure gas pipeline from the Kern River line to Hurricane, Utah. The Questar Gas pipeline would be oversized 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, it has been determined that the natural gas supply line would be 12-inches in diameter to provide natural gas supply for the pump stations. The pipeline would be successively reduced in size as it delivers gas to each of the pump stations.

1.2.5.1 Natural Gas Transmission Line Connection

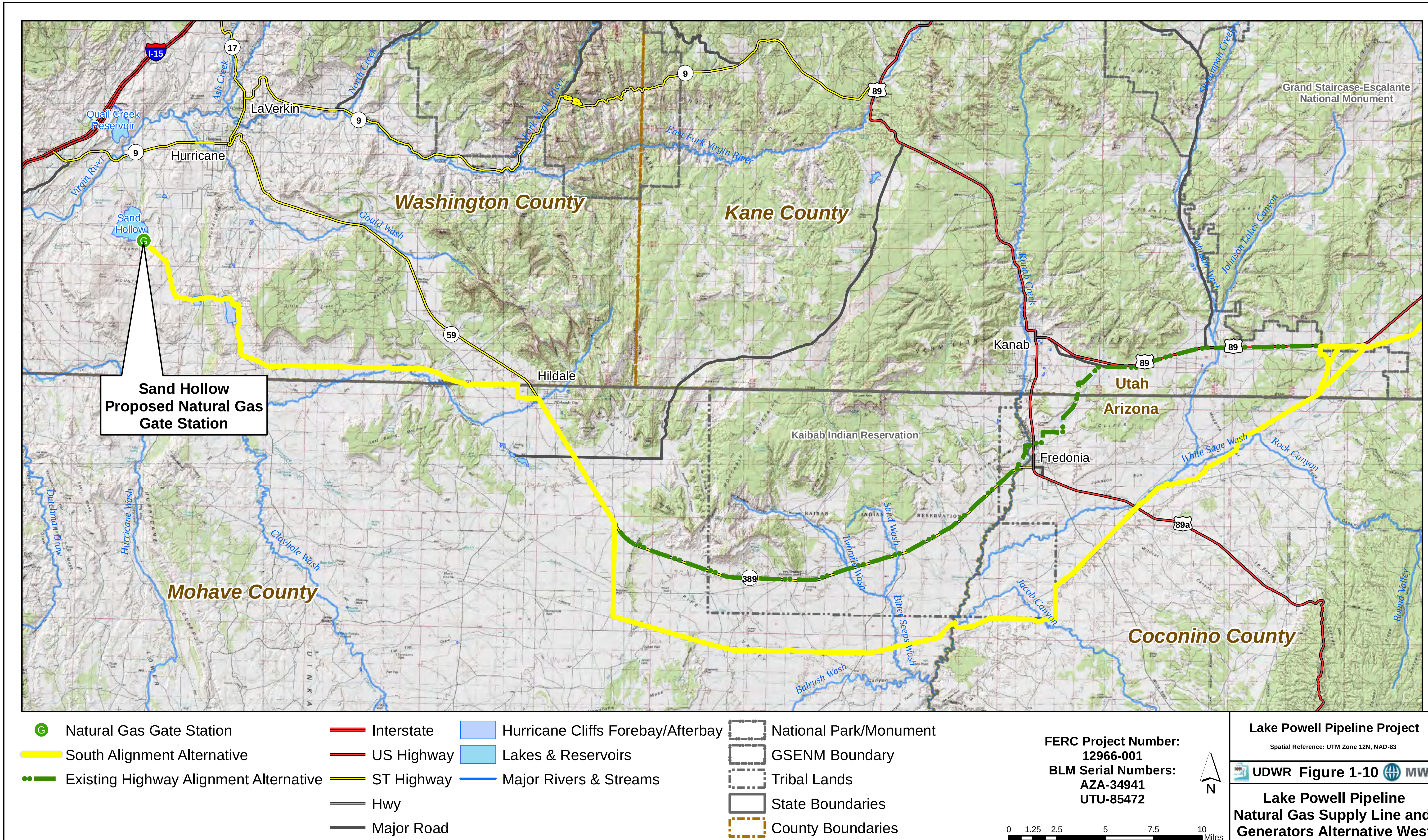
The natural gas supply line alternative would connect to the proposed Questar Gas Transmission Line from the existing Kern River line to Hurricane City. The natural gas supply line would connect to the high pressure gas transmission line at a proposed gate station southeast of Sand Hollow Reservoir at approximate station 270+00 on the LPP alignment. The proposed gate station would be located adjacent to the alignment of the future extension of the Southern Corridor highway, which would be constructed along the existing alignment of the Sand Hollow Road east of Sand Hollow Reservoir (Figure 1-10).

1.2.5.2 Natural Gas Supply Line

The proposed natural gas line would be an intermediate high pressure line and would operate between approximately 250 to 300 psi pressure at the gate station connection. With pressure losses in the pipeline it is anticipated 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 4 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, installed a minimum of 10 feet from the edge of the proposed water pipeline in a separately excavated trench within the LPP ROW. Figure 1-10 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 1-11 shows the east alignment of the natural gas supply line as proposed from the west GSENM boundary to the intake pump station.

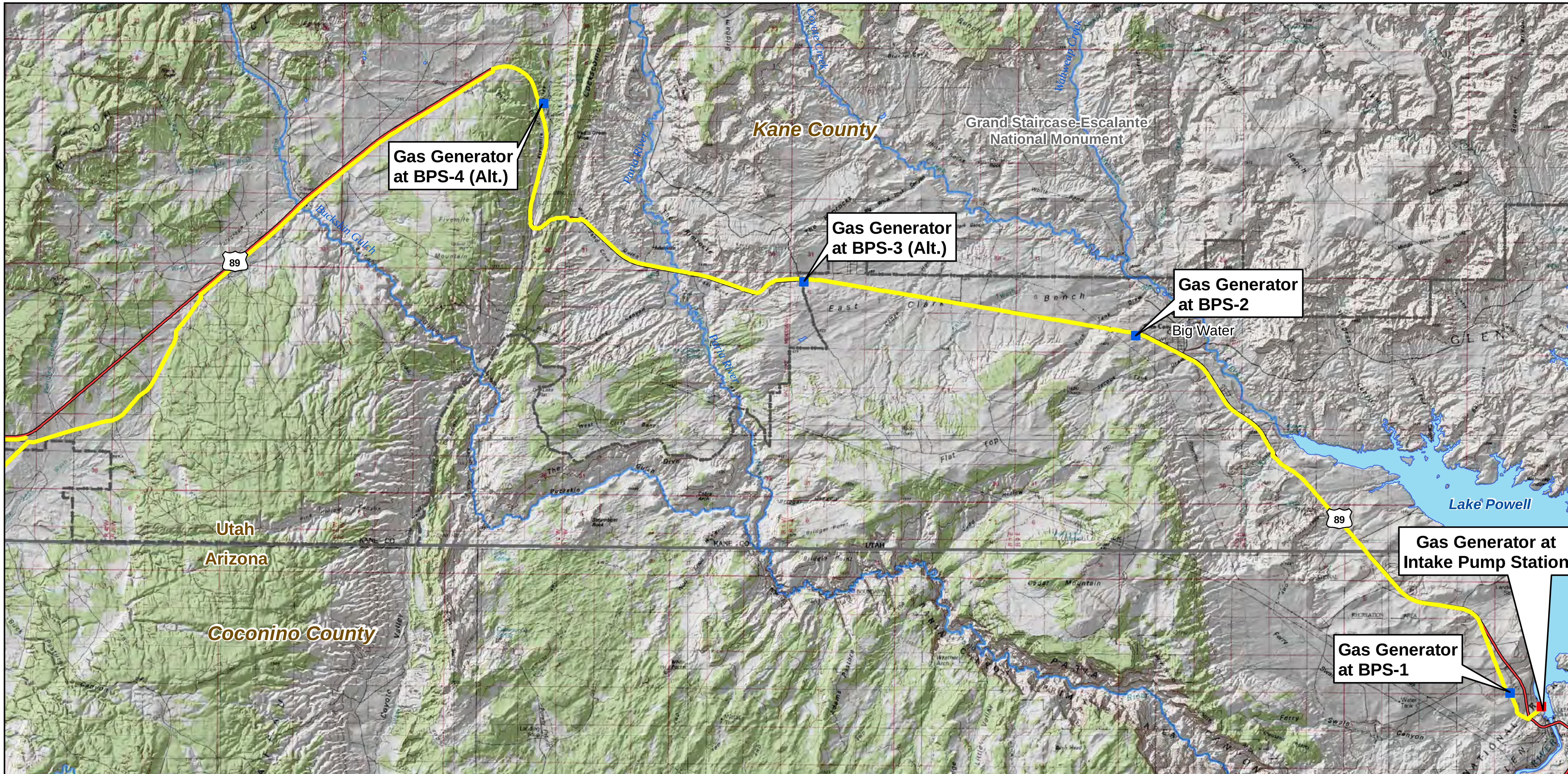


Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWR **Figure 1-10** MWH

Lake Powell Pipeline Natural Gas Supply Line and Generators Alternative West



Project Intake Pump Station
Gas Generator 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:
AZA-34941
UTU-85472

0 0.5 1 2 3 4 Miles

N

Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWR **Figure 1-11** MWH

Lake Powell Pipeline Natural Gas Supply Line and Generators Alternative East

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 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, connected to the buried natural gas supply line. Additionally, pig launching or receiving equipment would be installed within the sectionalizing valve 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. Launchers and receivers are facilities connected to the natural gas supply line that enable pigs to be inserted into or removed from the pipeline.

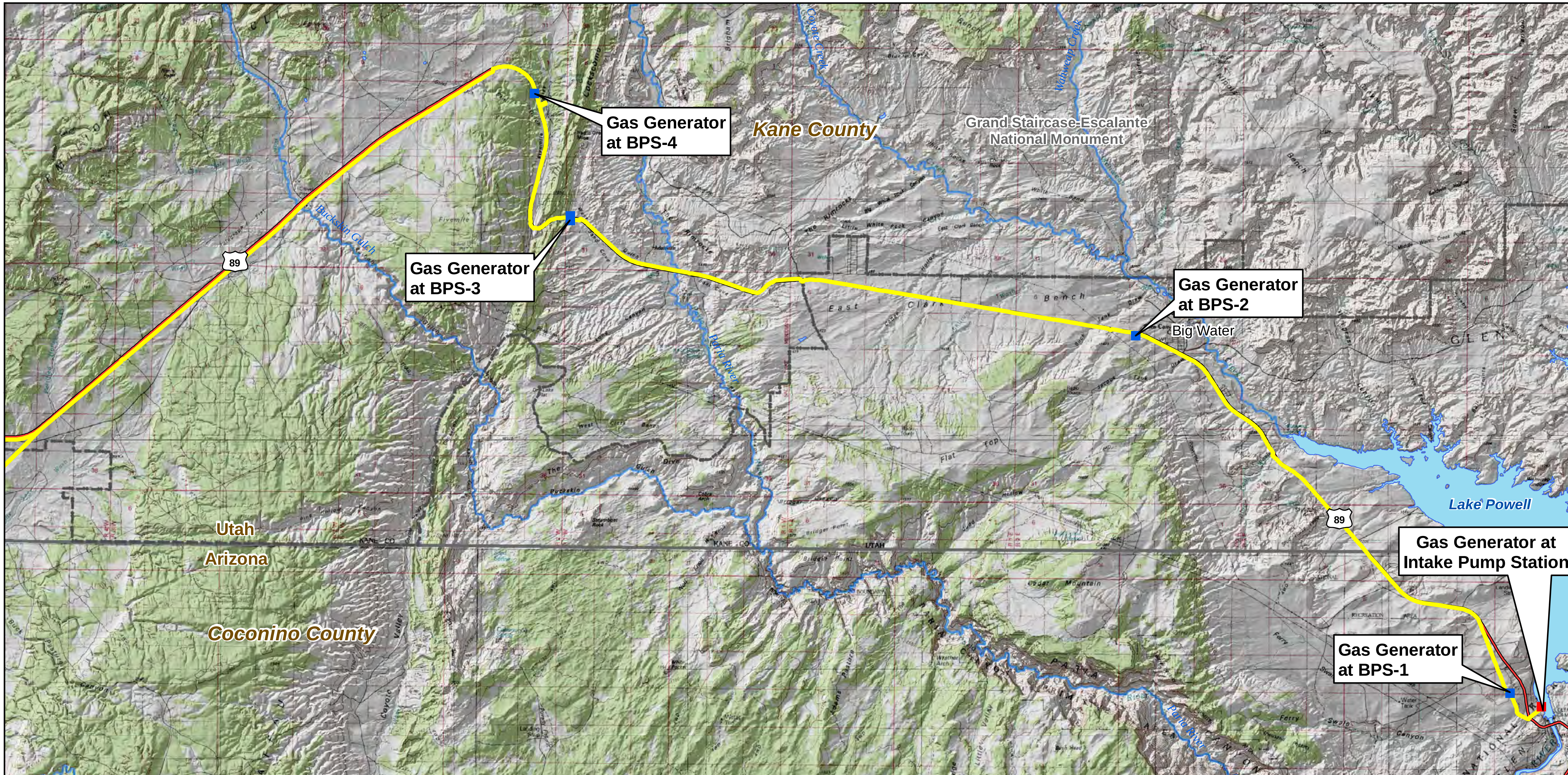
1.2.5.3 Natural Gas Generators

Natural gas generators would be used to supply power to operate the pumps at the LPP pump stations. The configuration of the electric pumps is approximately 18 feet center to center. The overall pump station building size would be increased 14 feet in width and 18 feet in length compared to pump stations powered by electricity from transmission lines.

The natural gas generators would be approximately 35 feet long by 8 feet wide by 9 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, adjacent to the pump station electrical room within the 5-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 25 feet above the top of the building to a total height of 75 feet above the ground surface. 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.

An alternative configuration of the booster pump stations and pipeline alignment involving BPS-3 and BPS-4 combined with the intake pump station, BPS-1 and BPS-2 would be similar to the proposed project, except the LPP water would be pumped to the High Point Regulating Tank 2 at elevation 5,695 feet MSL within the Congressionally-designated utility corridor along U.S. 89 (Figure 1-12). Additional pumping requirements at BPS-3 also would require one additional natural gas generator and emission control systems to meet air quality standards. BPS-4 would require emission control systems. The stacks at BPS-3 and BPS-4 would extend 61 feet above the top of the buildings to a total height of 100 feet above the ground surface.

The proposed natural gas generators 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 1-2 shows the annual natural gas consumption (2,976,900 MMBtu) at the intake pump station and alternative booster pump station configuration.



Project Intake Pump Station
Gas Generator 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:
AZA-34941
UTU-85472

0 0.5 1 2 3 4 Miles

N

Lake Powell Pipeline Project

Spatial Reference: UTM Zone 12N, NAD-83

UDWR **Figure 1-12** MWH

Natural Gas Supply Line and Generators High Point Highway Alternative East

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	**20**		**43,830**		**18+5**		**53,069**	**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 hp, 8400 hrs/year operation with generators loaded at 87 percent on the average.

Table 1-2
Water Conveyance System Alternative 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	4,522	5	3000	11,190	JGS 620 F09	5+1	Yes	14,565	729,000
BPS-4	5,140	5	3000	11,190	JGS 620 F09	5+1	Yes	14,430	729,000
	Total	**20**		**45,695**		**19+5**		**55,982**	**2,976,900**

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 hp, 8400 hrs/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 treatment of existing low quality water supplies, and reducing residential outdoor water use in the WCWCD and CICWCD service areas. This alternative could provide a total of 86,249 acre-feet of water annually to WCWCD, CICWCD and KCWCD for M&I use without diverting Utah's water from Lake Powell.

1.3.1 WCWCD No Lake Powell Water Alternative

The WCWCD would implement other future water development projects currently planned by the District, develop additional water reuse/reclamation, and convert additional agricultural water use to M&I use as a result of urban development in agricultural areas through 2020. Remaining planned and future water supply projects through 2020 include the Ash Creek Pipeline (5,000 acre-feet per year), Crystal Creek Pipeline (2,000 acre-feet per year), and Quail Creek Reservoir Agricultural Transfer (4,000 acre-feet per year). Beginning in 2020, WCWCD would convert agricultural water to secondary use and work with St. George City to maximize existing wastewater reuse, bringing the total to 96,258 acre-feet of water supply per year versus demand of 98,427 acre-feet per year, incorporating currently mandated conservation goals. The WCWCD water supply shortage in 2037 would be 70,000 acre-feet per year, 1,000 acre-feet more than the WCWCD maximum share of the LPP water. Therefore, the WCWCD No Lake Powell Water Alternative needs to develop 69,000 acre-feet of water per year to meet comparable supply and demand requirements as the other action alternatives.

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 40,000 acre-feet per year of Virgin River water with high total dissolved solids (TDS) concentration and other contaminants. The RO advanced water treatment facility would produce up to 36,279 acre-feet per year of water suitable for M&I use. The WCWCD would develop the planned Warner Valley Reservoir to store the diverted Virgin River water, which would be delivered to the RO advanced water treatment facility. The remaining 3,721 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 remaining needed water supply of 32,721 acre-feet per year to meet WCWCD 2037 demands would be obtained by reducing and restricting outdoor residential water use in the WCWCD service area. The Utah Division of Water Resources (UDWR) estimated 2005 culinary water use for residential outdoor watering in the communities served by WCWCD was 102 gallons per capita per day (gpcd) (UDWR 2008a). This culinary water use rate is reduced by 30.5 gpcd to account for water conservation attained from 2005 through 2020, yielding 71.5 gpcd residential outdoor water use available for conversion to other M&I uses. The equivalent water use rate reduction to generate 32,721 acre-feet per year of conservation is 56.6 gpcd for the 2037 population within the WCWCD service area. Therefore, beginning in 2020, the existing rate of residential outdoor water use would be gradually reduced and restricted to 14.9 gpcd, or an 85.4 percent reduction in residential outdoor water use.

The combined 36,279 acre-feet per year of RO product water and 32,721 acre-feet per year of reduced residential outdoor water use would equal 69,000 acre-feet per year of M&I water to help meet WCWCD demands through 2037.

1.3.2 CICWCD No Lake Powell Water Alternative

The CICWCD would implement other future groundwater development projects currently planned by the District, purchase agricultural water from willing sellers for conversion to M&I uses, and convert additional agricultural water use to M&I use as a result of urban development in agricultural areas through 2020. Remaining planned and future water supply projects through 2020 include additional groundwater development projects (3,488 acre-feet per year), agricultural conversion resulting from M&I development (3,834 acre-feet per year), and purchase agricultural water from willing sellers (295 acre-feet per year). Beginning in 2020, CICWCD would have a total 19,772 acre-feet of water supply per year versus demand of 19,477 acre-feet per year, incorporating required progressive conservation goals. The

CICWCD water supply shortage in 2060 would be 11,470 acre-feet per year. Therefore, the CICWCD No Lake Powell Water Alternative needs to develop 11,470 acre-feet of water per year to meet comparable supply and demand limits as the other action alternatives.

The remaining needed water supply of 11,470 acre-feet per year to meet CICWCD 2060 demands would be obtained by reducing and restricting outdoor residential water use in the CICWCD service area. The UDWR estimated 2005 culinary water use for residential outdoor watering in the communities served by CICWCD was 84.5 gpcd (UDWR 2007). A portion of this residential outdoor water would be converted to other M&I uses. The equivalent water use rate to obtain 11,470 acre-feet per year is 67.8 gpcd for the 2060 population within the CICWCD service area. Therefore, the existing rate of residential outdoor water use would be gradually reduced and restricted to 16.7 gpcd beginning in 2023, an 80 percent reduction in the residential outdoor water use rate between 2023 and 2060. The 11,470 acre-feet per year of reduced residential outdoor water use would be used to help meet the CICWCD demands through 2060.

1.3.3 KCWCD No Lake Powell Water Alternative

The KCWCD would use existing water supplies and implement future water development projects including new groundwater production, converting agricultural water rights to M&I water rights as a result of urban development in agricultural areas, and developing water reuse/reclamation. Existing water supplies (4,039 acre-feet per year) and 1,994 acre-feet per year of new ground water under the No Lake Powell Water Alternative would meet projected M&I water demand of 6,033 acre-feet per year within the KCWCD service area through 2060. The total potential water supply for KCWCD is about 12,140 acre-feet per year (4,039 acre-feet per year existing culinary plus secondary supply, and 8,101 acre-feet per year potential for additional ground water development up to the assumed sustainable ground water yield) without agricultural conversion to M&I supply. Short-term ground water overdrafts and new storage projects (e.g., Jackson Flat Reservoir) would provide reserve water supply to meet demands during drought periods and other water emergencies.

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. 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 or released according to the operating guidelines. Future population growth as projected by the Utah Governor's Office of Planning and Budget (GOPB) would continue to occur in southwest Utah until water and other potential limiting resources such as developable land, electric power, and fuel begin to curtail economic activity and population in-migration.

1.4.1 WCWCD No Action Alternative

The WCWCD would implement other future water development projects currently planned by the District, develop additional water reuse/reclamation, convert additional agricultural water use to M&I use as a result of urban development in agricultural areas, and implement advanced treatment of Virgin River water. The WCWCD could also limit water demand by mandating water conservation measures such as outdoor watering restrictions. Existing and future water supplies under the No Action Alternative would meet projected M&I water demand within the WCWCD service area through approximately 2020. The 2020 total water supply of about 96,528 acre-feet per year would include existing supplies, planned

WCWCD water supply projects, wastewater reuse, transfer of Quail Creek Reservoir supplies, and future agricultural water conversion resulting from urban development of currently irrigated lands. Each future supply source would be phased in as needed to meet the M&I 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). Maximum reuse of treated wastewater effluent for secondary supplies would be required to meet the projected M&I water demand starting in 2020. The No Action Alternative would not provide adequate water supply to meet projected water demands from 2020 through 2060. There would be a potential water shortage of approximately 139,875 acre-feet per year in 2060 under the No Action Alternative (UDWR 2008b).

1.4.2 CICWCD No Action Alternative

The CICWCD would implement future water development projects including converting agricultural water rights to M&I water rights as a result of urban development in agricultural areas, purchasing “buy and dry” agricultural water rights to meet M&I demands, and developing water reuse/reclamation. The Utah State Engineer would act to limit existing and future ground water pumping from the Cedar Valley aquifer in an amount not exceeding the assumed sustainable yield of 37,600 ac-ft per year. Existing and future water supplies under the No Action Alternative meet projected M&I water demand within the CICWCD service area during the planning period through agricultural conversion of water rights to M&I use, wastewater reuse, and implementing “buy and dry” practices on irrigated agricultural land. Each future water supply source would be phased in as needed to meet the M&I demand associated with the forecasted population. The CICWCD No Action Alternative includes buying and drying of agricultural water rights covering approximately 8,000 acres between 2005 and 2060 and/or potential future development of West Desert water because no other potential water supplies have been identified to meet unmet demand. The No Action Alternative would not provide CICWCD with any reserve water supply (e.g., water to meet annual shortages because of drought, emergencies, and other losses) after 2010 (i.e., after existing supplies would be maximized).

1.4.3 KCWCD No Action Alternative

The KCWCD would use existing water supplies and implement future water development projects including new ground water production, converting agricultural water rights to M&I water rights as a result of urban development in agricultural areas, and developing water reuse/reclamation. Existing water supplies (4,039 acre-feet per year) and 1,994 acre-feet per year of new ground water under the No Action Alternative would meet projected M&I water demand of 6,033 acre-feet per year within the KCWCD service area through 2060. The total potential water supply for KCWCD is about 12,140 acre-feet per year (4,039 acre-feet per year existing culinary plus secondary supply, and 8,101 acre-feet per year potential for additional ground water development up to the assumed sustainable ground water yield) without agricultural conversion to M&I supply. Short-term ground water overdrafts and new storage projects (e.g., Jackson Flat Reservoir) would provide reserve water supply to meet demands during drought periods and other water emergencies.

1.5 Identified Issues and Impacts

The review approach performed as part of this study report generally adopts conventional federal-state agency guidelines for water resources management, and requirements to prepare project water resource economics and socioeconomics impact analyses. Some modifications have been made to take into account unique project features, and changing economic resource values directly, and indirectly, affecting project costs and benefits.

These analyses review Project impacts for direct net economic benefits and costs, cost-effectiveness, national economic development accounting (NED), regional economic development accounting (RED), and other social effects. The analyses determine national, regional, and local impacts during Project construction, operation and maintenance and identify measures to mitigate these impacts, where necessary. The impacts of the No Action Alternative (i.e., future without the Project) are considered in this study report.

The other social effects, related to the NED and RED analyses, include: 1) changes in regional population growth and periodic rates of growth; 2) population growth and its relationship to economic activity for the project area; 3) information on economic development perspectives for the local area (what types of development or economic activity are being encouraged to locate in the area); and 4) available information on general growth perspectives for the local area (such as information from the Vision Dixie process.

The following are primary water resources agency management objectives addressed by the analyses.

1.5.1 Water Resource Economics

- Ensure water resources agency compliance with: 1) the Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies, and agency modifications thereof; and 2) state practices for direct benefit/cost analyses.

    - ✓ Ensure that NED analyses for water and power impacts are appropriately applied and integrated; and that appropriate state economic analysis methodologies are recognized.

    - ✓ Ensure that RED analyses for water and/or power impacts are appropriately applied and integrated.

- Provide a clear picture of Project economic benefits and costs, including: 1) a comparison to Project alternatives; and 2) reviewing the economics of conservation measures and available water right changes/transfers from irrigated agriculture or other water supply sources, as designated by the water supply study.

- Review the cost-effectiveness of the Project, and compare the relative costs of new water supplies for the alternative configurations; describe the costs and cost-effectiveness of the baseline condition.

- Determine Project (and alternatives) marginal costs and cost allocations to the Water Conservancy Districts. In terms of new supply options and marginal costs, consider the general economic impacts on the Districts and to the state; clarify the likely fiscal impacts.

- Identify the net economic impacts associated with the loss of power generation at Glen Canyon Dam; including any fiscal impacts on the regional power system (CRSP power rates).

    - ✓ Impact estimates cover any power losses at the power plant from energy/peaking power losses and the costs of replacement power.

    - ✓ Impact estimates are determined for water system pumping and distribution.

1.5.2 Socioeconomics: Population, Regional Economic and Fiscal Impacts

- Define and explain the relationship of the Project to regional water demand needs (compare and interpret population and economic demand forecasts relative to new supplies); make the relationship transparent between growth and with/without Project development.

- Identify specific potential population and economic growth impacts, with/without the Project, including baseline growth conditions.

- Clarify the regional economic impacts associated with Project construction and development; identify services impacts.

- Describe any economic impacts or mitigation needs related to resource management on the Kaibab Indian Reservation relative to the Existing Highway Alternative and Southeast Corner Alternative; with specific attention to the agency guidelines outlined under Executive Order 12898 for Environmental Justice compliance.

Chapter 2
Study Approach

2.1 Project Need and Relationship to Water Resources Planning

The Project was reviewed per the water resources development needs of the state and local water conservancy districts (MWH 2008-09). It is being considered as well within larger water resources needs for the West, per the Colorado River system. The area is anticipated to receive additional population/economic growth, with or without the LPP project. The question becomes one of efficient allocation (economic dispatch) of existing water resources for southwest Utah and the West.

The Project is one of several projects and water resources management actions under review to provide future water supplies for southwest Utah, as continued population growth in these areas is anticipated. The Project is determined to be an infrastructure feature of population and economic growth in southwest Utah, but it is not the *"driver"* of growth. The State of Utah Governor's Office of Planning and Budget forecast indicates that other population and economic growth features (birth rates and net in-migration) would drive upward population growth in the area.

The Project would accommodate new population growth in a manner similar to other infrastructure requirements, such as roads and transportation, power and energy, housing, and other human services needs. All of these infrastructure requirements would accommodate population and economic growth in the area.

2.2 Water Resource Economics and Financial Assumptions

2.2.1 Water Resource Economics

The fundamental approaches used in the analyses are primarily based on the methodologies outlined in the U.S. Water Resources Council's (1983) "Principles and Guidelines" for water and land related economic evaluations, Utah DNR-Water Resources guidelines and other state guidelines (such as the California Water Resources Dept. 2008), conventional methodologies relied on by water resource planners, and some methods specific to the project and water resources development that currently exist in the Western U.S. (per consultation with several resource economists).

The following economic and financial assumptions are adopted within the analysis based on multi-agency review and discussions and several agency economic reports, and they reflect current modeling activity, key assumptions, and analyses (see Tables 2-1 and 2-2).

Table 2-1
Basic NED Accounting Benefit-Cost Analysis Structure

NED Benefit-Cost Methodology for Lake Powell Pipeline Project
Sensitivity Analysis--Baseline NED Assumptions and Escalation Rates

Benefits

09-2010	2020	2030	2040	2050	2060

PV At 2010$ Start of Engineering-Construction Period, 4.14% Discount/Interest Rate

Municipal Water Supply:

Marginal Value-Alternative Cost of Municipal Water from LPP--Based Primarily on Water Reuse-RO ($1,000/acre-ft., annual)

Water Delivery Start in 2021

Annual Escalation after 2010 at 2.5% (in real value terms)

Power Production-Pipeline Operations and Peaking Unit:

Marginal Value of Power--Based on NPPC Subregional Model/Other Model Estimates $85/MWh (with Green Power Premium)

Power Production in 2021

Annual Escalation after 2010 at 2.5% (in real value terms)

Costs

09-2010	2020	2030	2040	2050	2060

PV At 2010$ Start of Engineering-Construction Period, 4.14% Discount/Interest Rate

Construction:

* Field Costs (with 15% Contingency)

* Non-Construction Contract Costs: Environmental Analyses, Engineering, Administration., Adm. (18% of Field Costs During Construction)

* Interest During Construction (Not Included as Separate Cost)

Construction Period 2016-2019

Annual Escalation after 2010 at 2.5% (in real value terms)

Construction, Operation & Maintenance, Replacement:

O&MR Start in 2021

Annual Escalation after 2010 at 2.5% (in real value terms)

Power-Reservoir System Lost Power Production:

Marginal Value of Power--Based on NPPC Subregional Model/Other Estimates ($64/MWh)

Reservoir Water Diversions Start in 2021

Annual Escalation after 2010 at 2.5% (in real value terms)

Power-Pipeline Water Pumping

Marginal Value of Power--Based on NPPC Subregional Model/Other Estimates ($42/MWh)

Pipeline Water Pumping Start in 2021

Annual Escalation after 2010 at 2.5% (in real value terms)

Table 2-2
Basic NED Accounting Benefit-Cost Analysis Structure

NED Benefit-Cost Methodology for Lake Powell Pipeline Project
Sensitivity Analysis--NED with Social Time Preference Discount Rate/Real Escalation

Benefits

09-2010 **2020** **2030** **2040** **2050** **2060**

PV At 2010$ Start of Engineering-Construction Period, 3.0% Discount/Interest Rate

Municipal Water Supply:

Marginal Value-Alternative Cost of Municipal Water from LPP--Based Primarily on Water Reuse-RO ($1,000/acre-ft., annual)

Water Delivery Start in 2021

Annual Escalation after 2010 at 2.5% (in real value terms)

Power Production-Pipeline Operations and Peaking Unit:
Marginal Value of Power--Based on NPPC Subregional Model/Other Estimates $85/MWh (with Green Power Premium)

Power Production in 2021

Annual Escalation after 2010 at 2.5% (in real value terms)

Costs

09-2010 **2020** **2030** **2040** **2050** **2060**

PV At 2010$ Start of Engineering-Construction Period, 3.0% Discount/Interest Rate

Construction:

* Field Costs (with 15% Contingency)

* Non-Construction Contract Costs: Environmental Analyses, Engineering, Administration., Adm. (18% of Field Costs During Construction)

* Interest During Construction (Not Included as Separate Cost)

Construction Period 2016-2019

Annual Escalation after 2010 at 2.5% (in real value terms)

Construction, Operation & Maintenance, Replacement:

O&MR Start in 2021

Annual Escalation after 2010 at 2.5% (in real value terms)

Power-Reservoir System Lost Power Production:

Marginal Value of Power--Based on NPPC Subregional Model/Other Estimates ($64/MWh)

Reservoir Water Diversions Start in 2021

Annual Escalation after 2010 at 2.5% (in real value terms)

Power-Pipeline Water Pumping:

Marginal Value of Power--Based on NPPC Subregional Model/Other Estimates ($42/MWh)

Pipeline Water Pumping Start in 2021

Annual Escalation after 2010 at 2.5% (in real value terms)

At present, the analysis and report presentation format include sensitivity analyses, for different perspectives toward Project development (for the Proposed Alternative). The principal perspectives and key assumptions shown in Tables 2-1 and 2-2 are discussed and outlined in the following sections.

2.2.1.1 NED Analyses Assumptions

- The Project present value (PV) period starts in 2010; all values used between 2008 and 2010 are escalated annually at 3 percent (includes inflation).

- The Project PV period covers 2010 through 2060, with Project operations commencing in 2020 (project life-cycle/operations approach); project power operations are considered at maximum operation in 2042.

- The Project PV period benefits and costs are expressed in real (constant) 2010$.

- The Project construction period is 2016-2019, with Project operations commencing in 2020. No interest during construction is included, to be consistent with the State of Utah's perspective on economic and financial analyses. The State of Utah does not consider deferred revenues during the construction period as affecting their interest payments on general obligation bond requirements.

- NED account Project benefits are:

  <u>Water values:</u> Alternative project costs are based on reverse osmosis (RO) reuse values, which are the most likely alternative supply to the Project, where the LPP Project defers the need to develop an RO plant and annual operations (affects the bulk of future water supply needs). The Project also would avoid transferring existing residential outdoor use of culinary water, with residence retrofits required to implement xeriscape conditions. This latter economic cost varies (alternative water value), but it likely approaches a cost range depicted by RO plant operations (also other non-market social costs would be involved).

  Marginal costs for water are taken into consideration under the demand-supply curves, where lower cost conservation and water market resources (and other planned resources) developed ahead of the more expensive RO or LPP Project costs.

  <u>System pipeline and peaking unit-Sand Hollow power production; and pump storage:</u> The Project includes in-line power generating facilities, and peaking unit with the Sand Hollow reservoir. Given a review of the regional/national power costs, the project power values here reflect block power purchases (all load hours), currently estimated to be about $85 MWh. This is deemed to be a renewable resource power value, green power premium (2010$). Also, a pump storage configuration is reviewed that could be integrated into project configuration.

- NED account Project costs are:

  <u>Construction costs:</u> This includes all field and non-contract costs, with contingencies, as provided by MWH in a preliminary Opinion of Probable Capital Costs (MWH 2009).

  <u>Project annual OM&R costs:</u> This includes the annual operation, maintenance, and replacement costs currently estimated by MWH engineers and economists. The opinion of probable annual operation, maintenance and replacement costs are preliminary in nature.

Project system power pumping costs: The direct water pumping system costs for the Project are estimated to be about $42/MWh. This takes into account some ability to pump during off-peak power demand periods. This ability varies over the life of the Project.

Project foregone power cost impacts to Lake Powell: The water withdrawals from Lake Powell affect power production, although the impact is not a linear relationship affecting water pumping withdrawals. The power impact costs are estimated to be about $64/MWh, reflecting some ability to “re-shape” the water releases within the reservoir, for peaking power production. A green power premium is not applied to this rate, as the premium is commonly reserved for new or recently built hydro projects.

- The NED analyses are summarized in present value (PV) and annualized PV terms, for the 50-year PV period.

2.2.1.2 Sensitivity Analysis-NED with Real Discount Rate and Real Escalation Rates

A modified NED analysis is reviewed representing the State of Utah’s real (inflation-removed) cost of capital over time, and with consideration for real dollar increases to water, power, and construction changes:

- The PV period discount rate is 4.14 percent (Utah’s calculated real discount rate).

- The Project benefits are expressed in real (2010$) terms with real escalation rates (2.5 percent), depicting assumptions about higher marginal costs for water/power supply in the West. There is consensus among economists that water (energy) costs will escalate in real terms at or above 2.0%.

- The Project costs are expressed in real (2010$) terms with real escalation rates (2.5 percent), depicting assumptions about higher marginal costs for water/power supply in the West. There is consensus among economists that water (energy) costs will escalate in real terms at or above 2.0 percent.

2.2.1.3 Sensitivity Analysis-NED with Social Time Preference and Real Escalation Rates

A modified NED analysis is provided reflecting the long-term nature of the project operations and intergenerational equity considerations, with consideration for real marginal benefit and cost changes during the most substantive period of discounting:

- The PV period discount rate is 3.0 percent (real social time preference rate); this rate “mirrors” the real, long-term federal bonding rate (with inflation removed), but it is not tied per se to a direct empirical financial instrument.

- The Project benefits are expressed in real (2010$) terms with real escalation rates (2.5 percent), depicting assumptions about higher marginal costs for water/power supply in the West.

- The Project capital construction costs are expressed in real (2010$) terms with real escalation rates (2.5 percent), depicting assumptions about real construction cost increases (2016-2020).

- The Project power costs are expressed in real (2010$) terms with real escalation (2.5 percent), reflecting higher marginal costs for water/power supply in the West.

Chapter 3
Existing Environment

3.1 Overview Background Description

Southwest Utah has increasingly become a destination for suburban and urban people to reside and retire (UDWR 2007). Tourism, retirement facilities, information technology, and other entrepreneurial and innovation-based businesses have become common. The many recreational opportunities, pleasant climate, scenic vistas, and growth opportunities in the area have attracted many newer residents to the area.

The Cedar Valley area, located in Iron County, is one of the fastest growing regions in the country and is near St. George, Utah, which is the fastest growing metropolitan area in the country. St. George is located in Washington County, and this county's population has nearly doubled in the last three decades (UDWR 2007), largely around the greater St. George area, which is locally referred to as "Dixie." Given the mild winters in the Dixie area and throughout southwest Utah and northern Arizona, the area has become a popular destination for "snow birds" or retirees who live in the area for part of the year to avoid harsh winters elsewhere. Hence, many retiree "residents" in southwest Utah are part-time residents who own homes that they use only during winter months. A portion of the southwest Utah part-time resident population is comprised of university students who live on or near campuses throughout the school year (UDWR 2007).

Today, tourism is a major industry in southwest Utah and northern Arizona with many national parks and other recreational and scenic attractions supporting the industry. Secondary tourism attractions and facilities, such as urban attractions and resort and retiree-based facilities, are becoming more common to make the region more robust and attractive to visitors. Research and service based industries are emerging components of southwest Utah's and northern Arizona's economies. Together, the transitions in the southwest Utah economy and population have changed ways of life for many and have spawned more urban-based development (NRCS 2007).

Recent trends indicate that the population within Iron County is increasing, particularly along the Interstate 15 corridor. New landowners in this area typically maintain non-agricultural and non-resourced based ways of life, seeing natural resources in the vicinity as recreational opportunities, not as a direct means for making a living (NRCS 2007). An ability to maintain more traditional ways of life associated with farming and other resource-based livelihoods is diminishing and has created great concerns from resource-based sectors of the population. Areas previously utilized for farming around the greater Cedar City area have begun to be converted to housing and business developments.

The use and distribution of water is changing and becoming more challenging to manage because of the increase in urban populations (UDWR 2007). For example, water use can be correlated with population and urbanization in southwest Utah. Demands are anticipated to continue with projected population increases and the increased development moving into the sub-basins of the Escalante Valley Basin and the St. George metropolitan area. Water use for agriculture in southwest Utah remains a primary use of basin water and is critical to the economic fabric of the rural communities surrounding the urban developments (NRCS 2007).

3.2 Study Area

The study area, including the Project alignment alternatives, is shown in Figure 3-1. It includes the following components.

- The St. George to Cedar City corridor, in southwest Utah. This would include Washington, Iron, and Kane counties and the areas served by their respective Water Conservancy Districts.

- Any area or community directly affected by Project construction or operations in Utah and Arizona.

- The Kaibab-Paiute Indian Reservation.

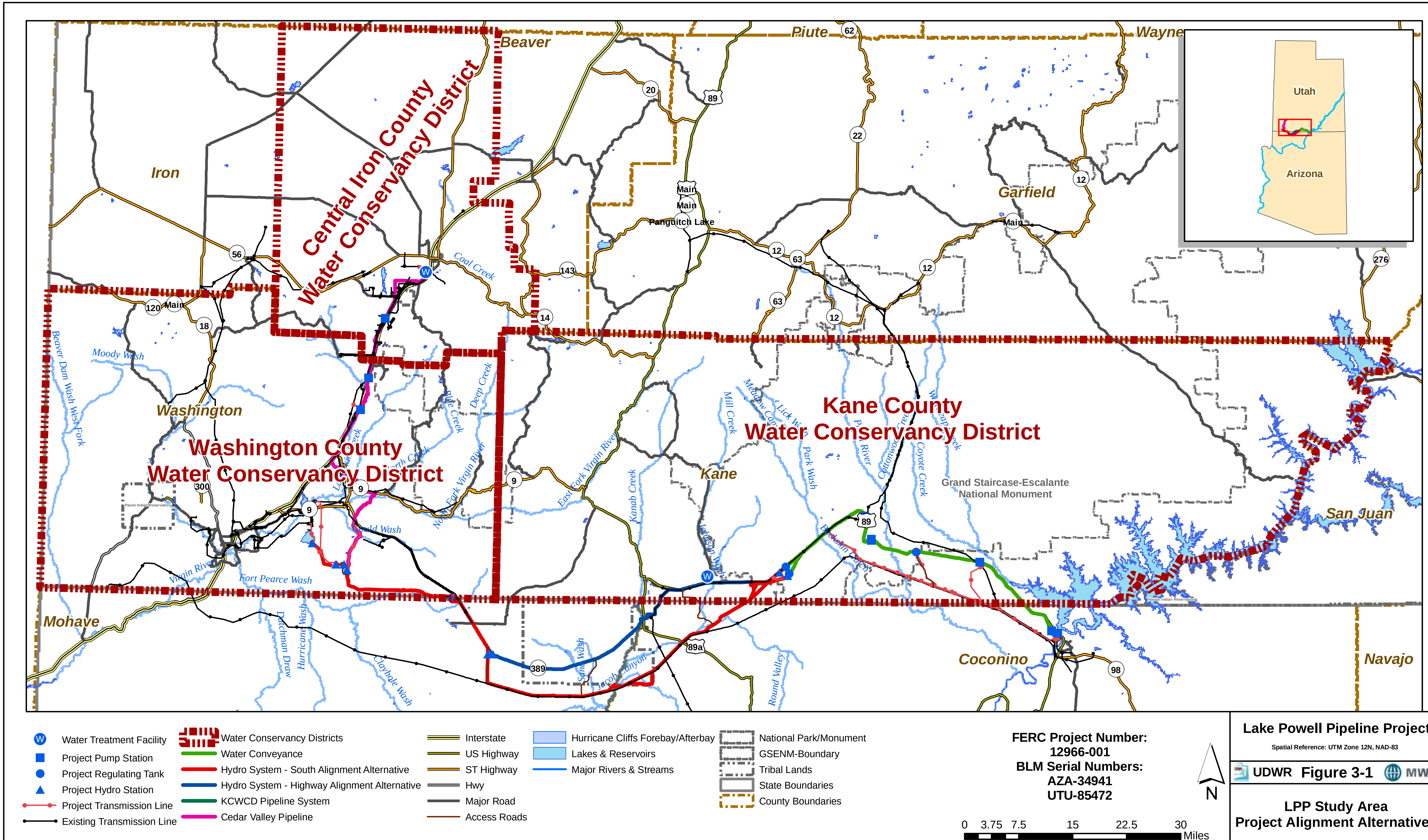
In assessing socioeconomic impacts, the impact area is generally similar for each of the Project alternatives (and baseline conditions), and relates to economic impact issues for new water supplies for the primary project area, as described below.

- The Project area for construction impacts includes: all communities, towns, and cities along the pipeline corridors from Lake Powell to St. George and Cedar City; the Kaibab-Paiute Indian Reservation; and communities in northern Coconino and Mohave counties in Arizona (Fredonia and Colorado City) along the pipeline corridor. Relevant statewide impacts are considered as well.

- Construction Project impacts would be related primarily to workforce needs and local population impacts, services needs for construction, and regional economic impacts associated with the direct construction phase (local income and employment impacts—RED type analyses).

- The Project area for operation impacts includes: the St. George to Cedar City corridor, and the service areas of the Washington County, Central Iron County, and Kane County water conservancy districts), and the Kaibab-Paiute Indian Reservation.

- Operational changes include any direct population, labor force, or services/utilities/energy needs associated with project operations.



Central Iron County Water Conservancy District
Washington County Water Conservancy District
Kane County Water Conservancy District
Iron
Beaver
Piute
Wayne
Garfield
Washington
Kane
San Juan
Mohave
Coconino
Navajo
Grand Staircase-Escalante National Monument
Panguitch Lake
Utah
Arizona
Water Treatment Facility
Project Pump Station
Project Regulating Tank
Project Hydro Station
Project Transmission Line
Existing Transmission Line
Water Conservancy Districts
Water Conveyance
Hydro System - South Alignment Alternative
Hydro System - Highway Alignment Alternative
KCWCD Pipeline System
Cedar Valley Pipeline
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
0 3.75 7.5 15 22.5 30
Miles
N
Lake Powell Pipeline Project
Spatial Reference: UTM Zone 12N, NAD-83
UDWR
Figure 3-1
MWH
LPP Study Area
Project Alignment Alternatives

Chapter 4
Water Resource Marginal Costs and Alternative Project Costs

The LPP Project is part of the water resources infrastructure that is needed to facilitate, or accommodate growth. If the LPP Project is not developed, then other higher cost water resource supplies would need to be acquired, along with potential changes in individual and community lifestyles affected by water demand and use. This chapter reviews the population forecasts, water needs forecasts,

4.1 Population and Water Needs Forecasts

4.1.1 Population Forecasts

Any water resources demand and water supply estimates, and marginal costs, are inherently driven by population forecasts. The population forecast that underlies new water resources development is developed by the State of Utah, Governor's Office of Planning and Budget (GOPB 2008) (see Table 4-1). By state policy, the GOPB forecast is to be used by all state agencies for planning purposes. The local association of governments allocates the projected population among the communities within its boundaries.

Other regional-federal population forecasts were reviewed in this study as well. The regional forecasts appear to be either dated or modified versions of the GOPB forecast. The U.S. Census Bureau forecast is a statewide forecast through 2030 that does not allocate forecasted population by county. The GOPB Utah forecast for 2030 is about 4,388,000, and the Census forecast is about 3,485,000. The Census forecast has been consistently lower than the state forecast over time.

The GOPB forecast suggests that the population within Washington, Iron, and Kane counties will increase by about 842,000 residents between 2008 and 2060, reaching collectively about 1,012,000 residents. This would constitute about a 3.1 percent average annual rate of growth for the region (over 52 years).

In discussions with the GOPB economists, it was conveyed that work on new forecasts would be initiated in 2010 and would include some changes regarding near-term economic and population growth, affected by the U.S. and state recessionary trends during the 2008-2010 period. However, the long-term population growth rate trend for the future was expected to remain largely the same.

Table 4-1
Population Forecasts/Projections for Study Area Counties

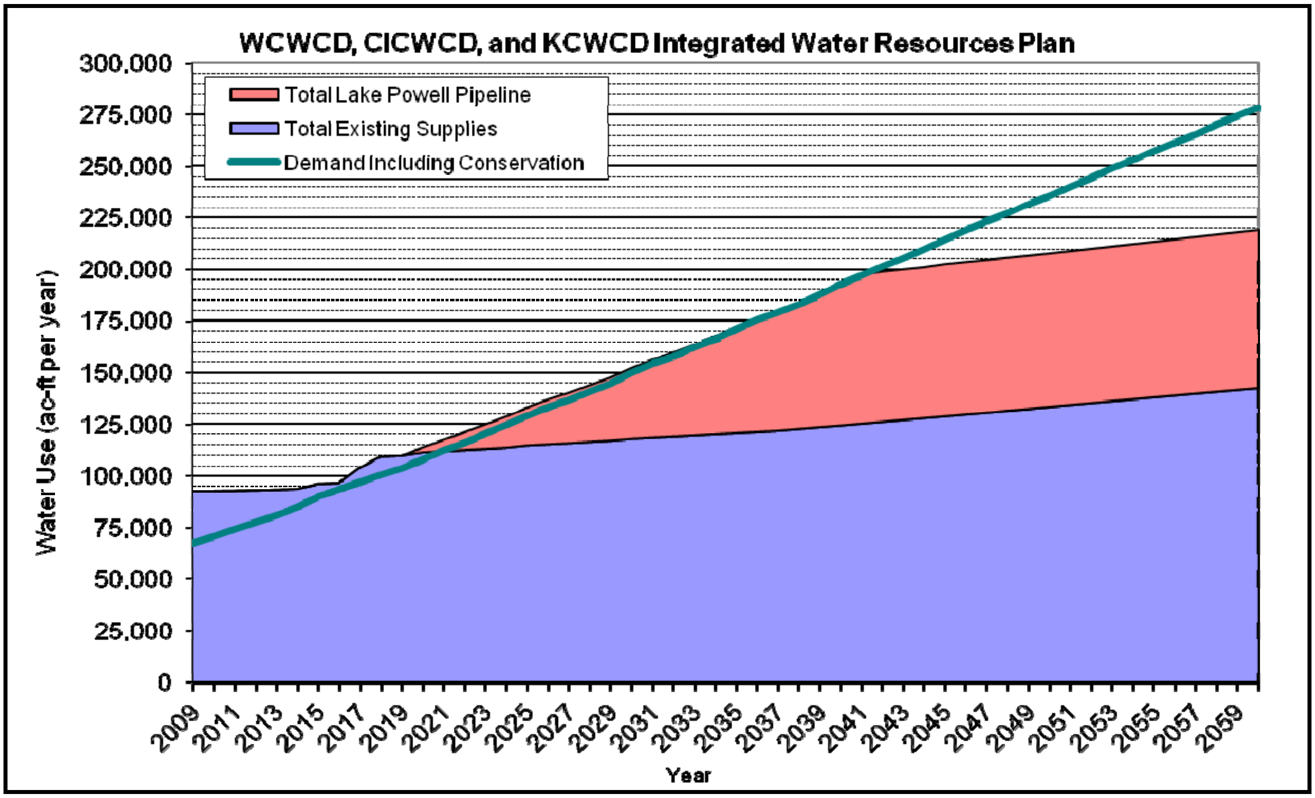
Year	Washington County			Iron County			Kane County		
	Population	Natural Increase[1,2]	Net Migration[2]	Population	Natural Increase[1,2]	Net Migration[2]	Population	Natural Increase[1,2]	Net Migration[2]
2008	150,079			46,992			6,582		
2010	168,078	4,262	13,737	50,601	1,416	2,193	6,893	26	285
2015	219,324	13,270	37,976	59,212	3,806	4,805	7,839	135	811
2020	279,864	16,758	43,782	68,315	4,095	5,008	8,746	199	708
2025	346,408	20,482	46,062	77,721	4,506	4,900	9,592	213	633
2030	415,510	24,629	44,473	87,644	5,098	4,825	10,394	204	598
2035	486,315	29,010	41,795	98,473	5,763	5,066	11,174	216	564
2040	559,670	33,255	40,100	110,257	6,351	5,433	12,034	254	606
2045	634,437	36,907	37,860	123,206	6,844	6,105	13,050	306	710
2050	709,674	39,861	35,376	137,240	7,359	6,675	14,267	357	860
2055	784,798	42,388	32,736	152,263	7,889	7,134	15,677	414	996
2060	860,378	44,671	30,909	168,383	8,391	7,729	17,276	483	1,116
Change 2008-2060	**710,299**	305,493	404,806	**121,391**	61,518	59,873	**10,694**	2,807	7,887

Notes:

[1] Natural increase is the difference between births and deaths.
[2] The numbers represents the projected cumulative changes.
Source: Governor's Office of Planning and Budget, 2008 Baseline Projections.

4.1.2 Water Needs Forecasts

Figure 4-1 matches the future water demand rates with planned water resources development including additional conservation measures, and with the LPP Project in place. The specific water resource development projects are described in the draft Water Needs Assessment study report (MWH 2009). The demand curve includes conservation goals approved by the state, reducing current per capita demands by 25 percent between 2000 and 2050.



Source: Draft Water Needs Assessment Study Report (UDWR 2011)

Figure 4-1
Water Supply and Demand Curves

4.2 Water Resources Marginal Costs

The Project economic benefits are significantly determined by comparing the Project development (direct benefits and costs) to alternative (marginal) costs for other water resources. The Project costs are reviewed within the NED analyses, and the marginal costs for other supply options are estimated in Tables 4-2 and 4-3. The NED analysis assumptions suggest that the base Project costs—with power benefits/cost excluded—are approximately $1,100/acre-foot (2010$ annualized present value costs over the project life). This cost reflects the specific cost and operation assumptions used in the BC analyses—such as the average annual water delivery over the life of the project, as opposed to the Project's peak delivery capacity in future years.

The marginal cost spread (for alternative water resources costs) is large, with some conservation features being under $250/acre-ft. (2010$, annualized present value). These are programmatic measures that would be implemented by the Water Conservancy Districts in the near term, ahead of Project Alternative needs. Other conservation measures would more accurately reflect curtailment measures, where secondary irrigation would be eliminated. The economic costs (or life-style changes) associated with this type of action have not been estimated in detail.

The estimated costs of water market transactions and water treatment facilities are displayed in Tables 4-2 and 4-3. The analysis assumptions are placed in comparable terms to the NED analyses and other more general review approaches. Some water marketing and transfer costs likely range from about $130-260/acre-foot, representing relatively low marginal costs. The amount of water available from market transactions is very limited in the study area. These are water resources that would be acquired before Project development, to the extent markets allow.

Based on current MWH review and engineering cost estimates (in-progress), new water treatment facility costs are projected to be in the $750-$1,150/acre-foot range depending on an ability to meet regulatory and environmental compliance requirements (2010$ annualized present value costs). Some estimates suggest higher costs for the reverse osmosis and brine disposal configurations, likely to be more than $1,150/acre-foot to develop and operate, and taking into account real escalation costs for annual plant operations. Current evaluations suggest that the most likely plant configuration for the Project area would be in the higher cost range.

The LPP Project is reviewed in this study report with the expectation that lower cost resources are brought into development first (such as conservation and water right transfers, and other planned water development projects), and with the LPP Project development following thereafter. The Project is assumed to avoid, or delay, the construction of high-cost water treatment and waste byproduct disposal facilities, such as reverse osmosis (RO) and brine disposal projects—the most likely plant and operations configuration.

Thus the overall alternative cost is expected to be about $1,150/acre-foot (or higher), and the fixed alternative cost used in the NED analyses is $1,150/acre-foot, given that the RO water treatment technology involved meets current engineering, and regulatory and permitting standards.

Table 4-2
Marginal Water Values (Alternative Costs)
(in 2009-10$)

Alternative Water Supply Costs for LPP, Based on Water Markets

Component/Feature	**Water Markets (Lower Cost-Range Features)**	**Water Markets (Higher Cost-Range Features)**
Annual Capacity (@36 mgpd):	325,850	325,850
Annual Capacity-Acre-ft.:	1	1
Estimated Capital Cost 2010$:	$2,500	$5,000
(Does Not Include Non-Contract $)		
Estimated Annual OM&R Costs	$0	$0
(2010$)		
Estimated Total Capital and		
PV of OM&R in 2010$		
PV @ 4.14%, 30 years:	$2,500	$5,000
PV @ 3.0%: 30 years:	$2,500	$5,000
PV @ 4.14%, 40 years:	$2,500	$5,000
PV @ 3.0%: 40 years:	$2,500	$5,000
Estimated Annualized $/Acre-Ft.:	$147	$294
30 years	$128	$255
Estimated Annualized $/Acre-Ft.:	$129	$258
40 years	$129	$258
Alternative Cost Range for Project Analyses	**$135**	**$260**

Table 4-3
Marginal Water Values (Alternative Costs)
(In 2009-10$)

Component/Feature	Water Treatment-RO and By-Product Disposal (Lower Cost-Range Features)	Water Treatment-RO and By-Product Disposal (Higher Cost-Range Features)
Annual Capacity (@36 mgpd):	13,140,000,000 Approx.	13,140,000,000 Approx.
Annual Capacity-Acre-ft. (@92%):	36,800	36,800
Estimated Capital Cost 2010$:	$176,900,000	$341,200,000
(Does Not Include Non-Contract $)		
Estimated Annual OM&R Costs (2010$)	$15,575,000	$20,700,000
Estimated Annualized 2010$ (Capital and OM&R)		
@ 4.14% 30 years:	$25,980,000	$40,768,000
@ 3.0%: 30 years:	$24,600,000	$38,107,000
@ 4.14% 40 years	$24,700,000	$38,299,000
@ 3.0%: 40 years:	$27,694,000	$42,280,000
Estimated Annualized $/Acre-Ft.:	$700	$1,108
30 years	$663	$1,036
Estimated Annualized $/Acre-Ft.:	$666	$1,041
40 years	$746	$1,149
Alternative Cost Range for Project Analyses	**$750**	**$1,150**

NOTE: Low cost scenario does not appear to be feasible based on capacity needs, site-specific engineering, and regulatory issues. Also, high-cost scenario is considered conservative for the technology used.

The OM&R values presented here have not been escalated in real dollars, offering a conservative cost perspective; higher total costs would emerge if escalated in real terms.

Chapter 5
Water Resource Economic Benefits and Costs NED Analyses

The key economic analysis assumptions and analysis variable have been reviewed in Chapter 4. The base construction cost estimates are derived from multiple technical reports and spreadsheets included in the Lake Powell Pipeline Preliminary Engineering and Environmental Studies-Cost and Deliver Schedules (2009-2010). Some cost estimates are provided from a review of other large-scale water development projects, and project data and information related to other MWH projects. Power cost data are based on recent USBR technical reviews (TSC Denver), a review of market forecast information developed by the Northwest Power and Conservation Planning Council (2009), and communications with industry analysts and MWH technical staff. The fundamental analysis findings are described below.

The benefit and cost values are displayed in the tables below and compose the following items:

Benefits:

- The alternative costs (value) of the next available water supply resource.
- The power benefits from either in-line, peaking, or pump storage generators.

Costs:

- Construction costs including pipelines, power (or natural gas) generators/pumps, power transmission facilities, and all other construction costs.
- Operation, maintenance, and replacement costs over time (OM&R).
- Power for primary reservoir and inline water system pumping.
- Foregone power from the primary reservoir, reflecting reduced power from water diverted by the Project.

Depending on variable economic perspectives and assumptions, the Project direct net benefits range from about $1.8 to 2.7 billion, and the Project costs range from about $1.5 to $1.8 billion (2010$, present value, rounded) (see Tables 5-1 and 5-2). Overall, the Project is displaying greater benefits than costs given the complex set of economic variables under consideration.

From an NED "principles and guidelines" or state direct value perspective, the Project development benefits are greater than the costs of Project construction and operation, given the life-cycle cost review conducted here (B/C ratio of about 1.20). This perspective assumes some relative escalation (2.5 percent) in monetary values between the costs of water resources development today versus other "product" costs tomorrow, and a more short-term cost-of-capital factor of 4.14 percent. It also reflects relatively high marginal costs for long-term water supply resources.

From a sensitivity analysis perspective (Table 5-2), where the inter-generational benefits and costs of the Project are taken more fully into consideration (social time preference discount rate of 3.0 percent) and the real monetary value of water, power, and construction costs are assumed to increase over the life of the Project, the Project benefits exceed the costs. The B/C ratio is about 1.49. Stated differently, the value of future benefits to future residents is given more emphasis, than just consideration of the "up-front" costs of Project construction, and the value of water and power is assumed to escalate in real terms.

Analyses also have incorporated a Project configuration that includes a pump storage component (Tables 5-3 and 5-4). This is a more costly Project configuration, raising overall Project costs to about $2.6 to 3.2

billion, and with benefits in the $2.9 to $4.3 billion range. These estimates are preliminary in nature, subject to continued construction review and further power cost information. The B/C ratio is about 1.14 to 1.34 depending on analysis assumptions. In the case of the pump storage configuration, more (higher) capital costs are incorporated in the near-term years of life-cycle cost analysis, as compared to the project power value benefits that are discounted at a greater rate in the future.

An initial set of analyses also have taken into account relying on the natural gas generation alternative (data from WCWCB, 2011) for pipeline water pumping (see Tables 5-5 to 5-8). Under the state project configuration, the Project benefits are about $1.8 billion, with costs at about $1.5 billion (4.14% discount rate); or benefits at about $2.7 billion, with costs at about $1.8 billion (3.0% discount rate). This yields B/C ratios from 1.17 to 1.48, respectively.

For the pump storage integration Project with natural gas generation pumping, the benefits are about $2.9 billion, with cost at about $2.6 billion (4.14% discount rate); or benefits at about $4.3 billion, with costs at about $3.2 billion (3.0% discount rate). This yields B/C ratios from 1.12 to 1.33, respectively.

For the above analyses, the primary risk, or sensitivity, components would be escalating construction, OM&R, power, and water costs. To limit this risk, power costs (values) have been established at a relative mid-to-high range, and real escalation rates are used to take into account structural shifts in the relationship to power and water values relative to other societal costs. As a general statement, the higher the initial capital costs for any project, the greater is the risk of the economic analyses being inaccurate, thus carrying over the life of the project inadequate assumptions. Related to the above analyses, the project OM&R costs are likely the most uncertain factor related to construction costs. Low range values are used here relative to a broad range of construction projects.

Table 5-1
LPP NED Analyses
Baseline NED Assumptions and Escalation Rates

			Real Discount Rate and Escalation Rate		
Benefits:	PV (2010$)	Annual. PV	Discount Rate	Escalation Rate	Water $/Acre-ft.
M&I Water	$1,677,491,000	$79,961,000	4.14%	2.5%	$1,150
Power-Inline	$45,167,000	$2,153,000	4.14%	2.5%	
Power-PK	$127,587,000	$6,082,000	4.14%	2.5%	
Total Benefits	$1,850,000,000	$88,197,000			
Costs:	PV	Annual. PV			
Capital Constr.	$1,124,717,000	$53,617,000	4.14%	2.5%	
OM&R	$72,908,000	$3,476,000	4.14%	2.5%	
Power Opers.	$284,353,000	$13,556,000	4.14%	2.5%	
Foregone Power	$58,401,000	$2,784,000	4.14%	2.5%	
Total Costs:	$1,540,000,000	$73,432,000			
NED B/C:	1.20	1.20			

NOTE:

Estimated Cost Per Delivered M&I Water in $/Acre-Ft.:	$1,114
Expressed in Constant Annualized $/Acre-Ft.*	
Expressed in $/1,000 gal.:	$3.42
* For Average Annual Acre-Ft. Delivery 2021-2060:	65,898

Table 5-2
LPP NED Analyses
Social Time Preference Discount Rate

			Real Discount Rate and Escalation Rate		
Benefits:	PV (2010$)	Annual. PV	Discount Rate	Escalation Rate	Water $/Acre-ft.
M&I Water	$2,489,937,000	$96,773,000	3.0%	2.5%	$1,150
Power-Inline	$69,561,000	$2,703,000	3.0%	2.5%	
Power-PK	$197,255,000	$7,666,000	3.0%	2.5%	
Total Benefits	$2,757,000,000	$107,143,000			
Costs:	PV	Annual. PV			
Capital Constr.	$1,227,349,000	$44,590,000	3.0%	2.5%	
OM&R	$95,113,000	$3,456,000	3.0%	2.5%	
Power Opers.	$435,664,000	$16,932,000	3.0%	2.5%	
Foregone Power	$88,843,000	$3,453,000	3.0%	2.5%	
Total Costs:	$1,847,000,000	$71,783,000			
NED B/C:	1.49	1.49			

NOTE:	
Estimated Cost Per Delivered M&I Water in $/Acre-Ft.:	$1,089
Expressed in Constant Annualized $/Acre-Ft.*	
Expressed in $/1,000 gal.:	$3.34
* For Average Annual Acre-Ft. Delivery 2021-2060:	65,898

Table 5-3
LPP NED Analyses—Pump Storage Configuration
Baseline NED Assumptions and Escalation Rates

			Real Discount Rate and Escalation Rate		
Benefits:	PV (2010$)	Annual. PV	Discount Rate	Escalation Rate	Water $/Acre-ft.
M&I Water	$1,677,349,000	$79,962,000	4.14%	2.5%	$1,150
Power-Inline	$45,167,000	$2,153,000	4.14%	2.5%	
Power-PS	$1,261,042,000	$60,116,000	4.14%	2.5%	
Total Benefits	$2,984,000,000	$142,231,000			
Costs:	PV	Annual. PV			
Capital Contr.	$1,482,378,000	$70,667,000	4.14%	2.5%	
OM&R	$96,015,000	$4,577,000	4.14%	2.5%	
Power Opers.	$284,353,000	$13,556,000	4.14%	2.5%	
Power PS Opers.	$700,345,000	$33,387,000	4.14%	2.5%	
Foregone Power	$58,401,000	$2,784,000	4.14%	2.5%	
Total Costs:	$2,621,492,000	$124,970,000			
NED B/C:	1.14	1.14			

NOTE:	
Estimated Cost Per Delivered M&I Water in $/Acre-Ft.:	NA
Expressed in Constant Annualized $/Acre-Ft.*	
Expressed in $/1,000 gal.:	NA
* For Average Annual Acre-Ft. Delivery 2021-2060:	65,898

NOTE: NA, not applicable to the pump storage configuration.

Table 5-4
LPP NED Analyses—Pump Storage Configuration
Social Time Preference Discount Rate

			Real Discount Rate and Escalation Rate			
Benefits:	PV (2010$)	Annual. PV		Discount Rate	Escalation Rate	Water $/Acre-ft.
M&I Water	$2,489,937,000	$94,773,000		3.0%	2.5%	$1,150
Power-Inline	$69,561,000	$2,704,000		3.0%	2.5%	
Power-PS	$1,785,425,000	$69,391,000		3.0%	2.5%	
Total Benefits	$4,345,000,000	$168,868,000				
Costs:	PV	Annual. PV				
Capital Contr.	$1,617,637,000	$62,799,000		3.0%	2.5%	
OM&R	$125,256,000	$4,868,000		3.0%	2.5%	
Power Opers.	$435,664,000	$16,932,000		3.0%	2.5%	
Power PS Opers.	$971,635,000	$37,763,000		3.0%	2.5%	
Foregone Power	$88,843,000	$3,453,000		3.0%	2.5%	
Total Costs:	$3,239,000,000	$125,887,000				
NED B/C:	1.34	1.34				

NOTE:	
Estimated Cost Per Delivered M&I Water in $/Acre-Ft.:	NA
Expressed in Constant Annualized $/Acre-Ft.*	
Expressed in $/1,000 gal.:	NA
* For Average Annual Acre-Ft. Delivery 2021-2060:	65,898

NOTE: NA, not applicable to the pump storage configuration.

Initial investigation using natural gas generators for pipeline pumping is reviewed in Tables 5-5 and 5-6.

Table 5-5
LPP NED Analyses—Natural Gas Pumping
Baseline NED Assumptions and Escalation Rates

			Real Discount Rate and Escalation Rate		
Benefits:	PV (2010$)	Annual. PV	Discount Rate	Escalation Rate	Water $/Acre-ft.
M&I Water	$1,677,491,000	$79,961,000	4.14%	2.5%	$1,150
Power-Inline	$45,167,000	$2,153,000	4.14%	2.5%	
Power-PK	$127,587,000	$6,082,000	4.14%	2.5%	
Total Benefits	$1,850,000,000	$88,197,000			
Costs:	PV	Annual. PV			
Capital Constr.	$1,208,904,000	$57,630,000	4.14%	2.5%	
OM&R	$78,367,000	$3,736,000	4.14%	2.5%	
Pumping Opers.	$231,854,000	$11,053,000	4.14%	2.5%	
Foregone Power	$58,401,000	$2,784,000	4.14%	2.5%	
Total Costs:	$1,577,626,000	$75,203,000			
NED B/C:	1.17	1.17			

NOTE:	
Estimated Cost Per Delivered M&I Water in $/Acre-Ft.:	$1,141
Expressed in Constant Annualized $/Acre-Ft.*	
Expressed in $/1,000 gal.:	$3.52
* For Average Annual Acre-Ft. Delivery 2021-2060:	65,898

Table 5-6
LPP NED Analyses—Natural Gas Pumping
Social Time Preference Discount Rate

			Real Discount Rate and Escalation Rate		
Benefits:	PV (2010$)	Annual. PV	Discount Rate	Escalation Rate	Water $/Acre-ft.
M&I Water	$2,489,937,000	$96,773,000	3.0%	2.5%	$1,150
Power-Inline	$69,561,000	$2,703,000	3.0%	2.5%	
Power-PK	$197,255,000	$7,666,000	3.0%	2.5%	
Total Benefits	$2,757,000,000	$107,143,000			
Costs:	PV	Annual. PV			
Capital Constr.	$1,319,219,000	$51,272,000	3.0%	2.5%	
OM&R	$102,234,000	$3,973,000	3.0%	2.5%	
Pumping Opers.	$355,228,000	$13,806,000	3.0%	2.5%	
Foregone Power	$88,843,000	$3,453,000	3.0%	2.5%	
Total Costs:	$1,865,000,000	$72,504,000			
NED B/C:	1.48	1.48			

NOTE:	
Estimated Cost Per Delivered M&I Water in $/Acre-Ft.:	$1,100
Expressed in Constant Annualized $/Acre-Ft.*	
Expressed in $/1,000 gal.:	$3.38
* For Average Annual Acre-Ft. Delivery 2021-2060:	65,898

The natural gas generators alternative for pipeline pumping can also be applied to

Table 5-7
LPP NED Analyses—Pump Storage Configuration, Natural Gas Pumping
Baseline NED Assumptions and Escalation Rates

			Real Discount Rate and Escalation Rate		
Benefits:	PV (2010$)	Annual. PV	Discount Rate	Escalation Rate	Water $/Acre-ft.
M&I Water	$1,677,349,000	$79,962,000	4.14%	2.5%	$1,150
Power-Inline	$45,167,000	$2,153,000	4.14%	2.5%	
Power-PS	$1,261,042,000	$60,116,000	4.14%	2.5%	
Total Benefits	$2,984,000,000	$142,231,000			
Costs:	PV	Annual. PV			
Capital Contr.	$1,566,603,000	$74,683,000	4.14%	2.5%	
OM&R	$101,473,000	$4,837,000	4.14%	2.5%	
Pumping Opers.	$231,853,000	$11,053,000	4.14%	2.5%	
Power PS Opers.	$700,345,000	$33,387,000	4.14%	2.5%	
Foregone Power	$58,401,000	$2,784,000	4.14%	2.5%	
Total Costs:	$2,658,677,000	$126,743,000			
NED B/C:	1.12	1.12			

NOTE:	
Estimated Cost Per Delivered M&I Water in $/Acre-Ft.:	NA
Expressed in Constant Annualized $/Acre-Ft.*	
Expressed in $/1,000 gal.:	NA
* For Average Annual Acre-Ft. Delivery 2021-2060:	65,898

NOTE: NA, not applicable to the pump storage configuration.

Table 5-8
LPP NED Analyses—Pump Storage Configuration, Natural Gas Pumping
Social Time Preference Discount Rate

			Real Discount Rate and Escalation Rate		
Benefits:	PV (2010$)	Annual. PV	Discount Rate	Escalation Rate	Water $/Acre-ft.
M&I Water	$2,489,937,000	$94,773,000	3.0%	2.5%	$1,150
Power-Inline	$69,561,000	$2,704,000	3.0%	2.5%	
Power-PS	$1,785,425,000	$69,391,000	3.0%	2.5%	
Total Benefits	$4,345,000,000	$168,868,000			
Costs:	PV	Annual. PV			
Capital Contr.	$1,617,637,000	$62,799,000	3.0%	2.5%	
OM&R	$125,256,000	$4,868,000	3.0%	2.5%	
Pumping Opers.	$435,664,000	$16,932,000	3.0%	2.5%	
Power PS Opers.	$971,635,000	$37,763,000	3.0%	2.5%	
Foregone Power	$88,843,000	$3,453,000	3.0%	2.5%	
Total Costs:	$3,239,000,000	$125,887,000			
NED B/C:	1.33	1.33			

NOTE:	
Estimated Cost Per Delivered M&I Water in $/Acre-Ft.:	NA
Expressed in Constant Annualized $/Acre-Ft.*	
Expressed in $/1,000 gal.:	NA
* For Average Annual Acre-Ft. Delivery 2021-2060:	65,898

NOTE: NA, not applicable to the pump storage configuration.

Chapter 6
Commission Economic Analysis

6.1 Introduction

The Federal Energy Regulatory Commission (Commission) relies on economic assessment methods and perspectives that differ from the NED project approach to derive net social benefits and costs. The Commission approach emphasizes nominal value discount rates, and comparing the project power costs to the most likely avoided power costs from other sources. It focuses more exclusively on the Project power production costs and benefits (hydro project)--portions of the Project, *per a specified hydro project configuration.* This project hydro configuration approach does not reflect a true marginal value perspective, relative to Project development.

6.2 Hydro Project Benefits

Tables 6-1, 6-2, 6-3, and 6-4 summarize the Project's hydro benefits and costs. The annual power value benefits and costs are based on estimated power values for peak and off-peak periods, as developed from multiple power planning sources and discussed in Chapter 1 (NPPC 2009, USBR 2009, and FERC 2009). An "overall" annual avoided power cost value is estimated in this study to be about $64/MWh (weighted price value taking into account peak and off-peak wholesale power prices).

For Project generation operations, all power benefits are estimated to be about $85/MWh (green power premium for block power); and for Lake Powell foregone power within the other NED analyses, about $64/MWh. Power operations costs are estimated to be about $42/MWh, reflecting some ability to shape power pumping operations, and an ability to receive low-cost, long-term power contracts. These power costs are estimated from Northwest Power Planning Council, USBR, and MWH-Argonne National Laboratory sources, as well as a review of current power market trends.

The hydro project costs include all capital construction for power generation and transmission and penstock (pipeline) construction, and associated O&MR costs. They do not include water pumping or Water Conveyance System pipeline and pump station construction costs to the hydro project portion of the larger LPP Project.

Under this hydro project configuration, the power benefits are substantially less than the project costs (B/C ratios of about 0.10 to 0.41). The costs are based on all hydro project generation facilities and the complete portion of the inter-connected water system delivery pipeline. The estimated power cost would be about $160-260/MWh, whereas an estimated avoided power cost would be about $64 MWh (wholesale power values, with nominal discount rate). In terms of general power purchases, the avoided power cost (and/or other green power costs) is far more attractive than the potential hydro project costs.

For the pump storage configuration of the Project, the B/C ratios are about 0.47 to 0.89, and the power costs are estimated to be about $80-130/MWh. This cost per MWh is higher than the avoided cost of about $65/MWh (or $85/MWh for the green power premium).

Table 6-1
Commission Economic-Financial Analyses With 5.4% Nominal Discount Rate

Hydro System (Penstock and Power Stations)

			Discount Rate and Escalation Rate	
Benefits:	PV (2010$)	Annual. PV	Nominal Discount Rate	Escalation Rate
Power-Inline	$12,158,000	$708,000	5.4%	0%
Power-PK	$33,789,000	$1,966,000	5.4%	0%
Total Benefits	$45,950,000	$2,674,000		
Costs:	PV	Annual. PV		
Capital Constr.	$419,184,000	$24,395,000	5.4%	0%
OM&R	$21,360,000	$1,243,000	5.4%	0%
Total Costs:	$440,545,000	$25,638,000		
NED B/C:	0.10	0.10		

Notes:

Estimated MWhs (2020-2060 average annual MWhs):	97,388
Estimated MWhs (2042 average annual MWhs):	157,970
Estimated Cost Per MWh (2020-2060 average annual MWhs):	$263
Estimated Annual Avoided Cost (Wholesale Power Est.):	$64
Est. Avoided Cost/Project Cost:	0.20
Estimated Cost Per MWh (2042 average annual MWhs):	$162
Estimated Annual Avoided Cost (Wholesale Power Est.):	$64
Est. Avoided Cost/Project Cost:	0.33

Table 6-2
Commission Economic-Financial Analyses With 3% State Real Discount Rate

Hydro System (Penstock and Power Stations)

			Discount Rate and Escalation Rate	
Benefits:	PV (2010$)	Annual. PV	Real Discount Rate	Escalation Rate
Power-Inline	$69,651,000	$2,704,000	3.0%	2.5%
Power-PK	$197,255,000	$7,666,000	3.0%	2.5%
Total Benefits	$266,817,000	$10,370,000		
Costs:	PV	Annual. PV		
Capital Constr.	$604,269,000	$23,485,000	3.0%	2.5%
OM&R	$54,314,000	$2,111,000	3.0%	2.5%
Total Costs:	$658,583,000	$25,596,000		
NED B/C:	0.41	0.41		

Notes:

Estimated MWhs (2020-2060 average annual MWhs):	97,388
Estimated MWhs (2042 average annual MWhs):	157,970
Estimated Cost Per MWh (2021-2060 average annual MWhs):	$263
Estimated Annual Avoided Cost (Wholesale Power Est.):	$64
Est. Avoided Cost/Project Cost:	0.24
Estimated Cost Per MWh (2042 average annual MWhs):	$162
Estimated Annual Avoided Cost (Wholesale Power Est.):	$64
Est. Avoided Cost/Project Cost:	0.39

Table 6-3
Commission Economic-Financial Analyses With 5.4% Nominal Discount Rate
Pump Storage Configuration

Hydro System (Penstock and Power Stations)

			Discount Rate and Escalation Rate	
Benefits:	PV (2010$)	Annual. PV	Nominal Discount Rate	Escalation Rate
Power-Inline	$12,158,000	$708,000	5.4%	0%
Power-PS	$468,379,000	$27,258,000	5.4%	0%
Total Benefits	$480,537,000	$27,965,000		
Costs:	PV	Annual. PV		
Capital Constr.	$703,137,000	$40,920,000	5.4%	0%
OM&R	$35,662,000	$2,075,000	5.4%	0%
Power PS Oper.	$277,379,000	$16,142,000		
Total Costs:	$1,016,000,000	$59,138,000		
NED B/C:	0.47	0.47		

Notes:

Est. MWhs (2020-2060 average annual MWhs):	636,931
Est. MWhs (2042 average annual MWhs):	703,670
Estimated Cost Per MWh (2021-2060 average annual MWhs):	$93
Estimated Annual Avoided Cost (Wholesale Power Est.):	$64
Est. Avoided Cost/Project Cost:	0.50
Estimated Cost Per MWh (2042 average annual MWhs):	$84
Estimated Annual Avoided Cost (Wholesale Power Est.):	$64
Est. Avoided Cost/Project Cost:	0.55

Table 6-4
Commission Economic-Financial Analyses With 3% Real Discount Rate
Pump Storage Configuration

Hydro System (Penstock and Power Stations)

			Discount Rate and Escalation Rate	
Benefits:	PV (2010$)	Annual. PV	Real Discount Rate	Escalation Rate
Power-Inline	$69,561,000	$2,704,000	3.0%	2.5%
Power-PS	$1,785,425,000	$69,391,000	3.0%	2.5%
Total Benefits	$1,854,986,000	$72,095,000		
Costs:	PV	Annual. PV		
Capital Constr.	$1,013,409,000	$39,387,000	3.0%	2.5%
OM&R	$90,680,000	$3,524,000	3.0%	2.5%
Power PS Oper.	$971,635,000	$37,763,000	3.0%	2.5%
Total Costs:	$2,075,724,000	$80,674,000		
NED B/C:	0.89	0.89		

Notes:

Est. MWhs (2020-2060 average annual MWhs):	636,931
Est. MWhs (2042 average annual MWhs):	703,670
Estimated Cost Per MWh (2021-2060 average annual MWhs):	$127
Estimated Annual Avoided Cost (Wholesale Power Est.):	$64
Est. Avoided Cost/Project Cost:	0.51
Estimated Cost Per MWh (2042 average annual MWhs):	$115
Estimated Annual Avoided Cost (Wholesale Power Est.):	$64
Est. Avoided Cost/Project Cost:	0.56

6.3 Hydro Generation Project Costs

There is justification to compare these hydro project costs within a different hydro project configuration. From a marginal cost perspective, the hydro project power costs should be treated as incremental costs to the water system delivery pipeline—using a with and without "hydro project" analysis. Under this analysis, the costs of the water delivery system are not included as part of the hydro project per se (see Tables 6-5 and 6-6).

Under this configuration, only the "marginal" costs of hydro project are considered, and using the state's real and social time preference discount rates, and a real escalation rate for power values. For example, under the pump storage configuration, the hydro project benefits are about equal to or slightly above costs (B/C ratios of 0.97 to 1.10), with the costs estimated to be about $100/MWh. While this cost is still greater than the estimated avoided ("market") regional power costs, it is comparable to the costs of integrating renewable power sources such as wind turbine generation ($80-85/MWh base costs with green power premium; or about $130-150/MWh based on existing Pacific Northwest wind integration costs). Consequently, the power from the hydro project may be designated as a renewable resource, and the power values may be competitive with other forms of renewable resources in the future.

Table 6-5
Commission Economic-Financial Analyses With 4.14% Real Discount Rate
Pump Storage Configuration With Hydro Power Station Costs

Hydro System (Power Stations) Marginal Costs

			Discount Rate and Escalation Rate	
Benefits:	PV (2010$)	Annual. PV	State Real Discount Rate	Escalation Rate
Power-Inline	$45,167,000	$2,153,000	4.14%	2.5%
Power-PS	$1,261,196,000	$60,116,000	4.14%	2.5%
Total Benefits:	$1,306, 000,000	$62,269,000		
Costs:	PV	Annual. PV		
Capital Contr.	$595,000,000	$28,368,000	4.14%	2.5%
OM&R	$44,540,000	$2,123,000	4.14%	2.5%
Power PS Opers.	$700,345,000	$33,387,000	4.14%	2.5%
Total Costs:	$1,340,000,000	$63,878,000		
NED B/C:	0.97	0.97		

Notes:

Est. MWhs (2020-2060 average annual MWhs):	636,931
Est. MWhs (2042 average annual MWhs):	703,670
Estimated Cost Per MWh (per 2020-2060 average annual MWhs):	$100
Estimated Annual Avoided Cost (Wholesale Power Est.):	$64
Est. Avoided Cost/Project Cost:	0.64
Estimated Cost Per MWh (per 2042 average annual MWhs):	$91
Estimated Annual Avoided Cost (Wholesale Power Est.):	$64
Est. Avoided Cost/Project Cost:	0.71

Table 6-6
FERC Economic-Financial Analyses With 3.0% Real Discount Rate
Pump Storage Configuration With Hydro Power Station Costs

Hydro System (Power Stations) Marginal Costs

Discount Rate and Escalation Rate

Benefits:	PV (2010$)	Annual. PV	Nominal Discount Rate	Escalation Rate
Power-Inline	$69,561,000	$2,704,000	3.0%	2.5%
Power-PS	$1,785,425,000	$69,391,000	3.0%	2.5%
Total Benefits:	$1,855,000,000	$72,095,000		
Costs:	PV	Annual. PV		
Capital Contr.	$649,371,000	$25,238,000	3.0%	2.5%
OM&R	$58,106,000	$2,258,000	3.0%	2.5%
Power PS Opers.	$971,635,000	$37,763,000		
Total Costs:	$1,679,000,000	$65,256,000		
NED B/C:	1.10	1.10		

Notes:

Est. MWhs (2020-2060 average annual MWhs):	636,931
Est. MWhs (2042 average annual MWhs):	703,670
Estimated Cost Per MWh (per 2020-2060 average annual MWhs):	$102
Estimated Annual Avoided Cost (Wholesale Power Est.):	$64
Est. Avoided Cost/Project Cost:	0.62
Estimated Cost Per MWh (per 2042 average annual MWhs):	$93
Estimated Annual Avoided Cost (Wholesale Power Est.):	$64
Est. Avoided Cost/Project Cost:	$.69

Chapter 7
Regional Economic Development Analyses and Impacts

7.1 Introduction

The regional economic development (RED) perspective is more focused on economic impacts “on the ground,” describing impacts resulting from regional and state direct project employment, secondary employment and income, and the overall gross affect of purchases of goods and services throughout the state economy. This represents how the state’s investment in any project affects the local economy, and impacts will vary given different types of projects or programs.

The employment, income, and value of output (production) impacts are using two input-output models: 1) an IMPLAN model frequently used in U.S. regional economic impact estimates (calibrated to the state of Utah); and 2) the state’s 2001 input-output model developed for the GOPB. While the IMPLAN model retains more recent data, the state model may better represent the economic sector linkages within the state.

7.2 Analysis and Impacts

Project construction is initially estimated to produce about 2,395 direct jobs (annual FTEs during the construction period), and about 5,510 jobs taking into account direct and indirect employment affects throughout the region and state (see Table 7-1). Annual operation and maintenance (O&M) employment is estimated to be at least 64 jobs (direct and indirect impacts).

Total state, construction labor income impacts are estimated to be about $247,578,200, with annual O&M labor income impacts estimated to be about $2,485,000.

The estimated value of total goods’ and services’ purchases throughout the state is difficult to determine at this time, given the yet to be designated contracting and vender firms. Nevertheless, an initial range of potential impacts suggests that $902,000,000 to $2.0 billion could “pass through” the state economy, as a result of the Project (direct and secondary socioeconomic impacts).

Project staging locations have been identified and it is assumed that most of the direct employment benefits would accrue to the regional study area counties, primarily in Utah, with much less in the Arizona counties (because of population, services, and commerce centers’ distribution). For analysis purposes in this study, the direct and secondary employment and income estimates are primarily allocated within Utah.

Additional review is forthcoming of Project construction-related public services and labor force needs. The time frame for construction, construction locations, and relatively minor increases in local population centers (and existing services) do not suggest significant impacts.

Most service needs would be directed toward multiple, site-specific construction staging areas, where land, transportation services, congestion, power and fuel, and other public and private sector service demands would substantially increase.

Table 7-1
RED Economic Analyses

Regional Economic Impacts From LPP Construction and OM&R

	CONSTRUCTION:			OM&R:		
		Statewide	Statewide	RED Direct	Statewide	Statewide
	RED Direct	Employment	Direct & Indirect	Direct	Employment	Direct & Indirect
Economic Sector	Employment	Multiplier	Employment	Employment	Multiplier	Employment
Construction	2,125	1.9	4,038	25	1.6	40
		2.3	4888		2.1	53
Professional/Tech Serv.	270	2.0	540	5	2.2	11
		2.3	621			
Total	2,395	------	4,578	30	------	51
			5,510			64

	CONSTRUCTION:			OM&R:		
		Statewide	Statewide		Statewide	Statewide
	Direct	Income	Direct & Indirect	Direct	Employment	Direct & Indirect
Economic Sector	Labor Income	Multiplier	Income	Labor Income	Income	Income
Construction	$104,015,500	2.0	$208,031,000	$1,218,000	1.6	$1,948,800
Professional/Tech Serv.	$17,976,000	2.2	$39,547,200	$243,600	2.2	$535,900
Total	$121,991,500	------	$247,578,200	$1,461,600	------	$2,484,700

	CONSTRUCTION:		OM&R:	
	Est. Statewide	Est. Statewide	Est. Statewide	Est. Statewide
Economic Impact	Direct 2010$	Total Output$	Direct 2010$	Total Output$
Total Direct @40%	$487,680,000	$1,170,432,000	$1,600,000.00	$2,960,000.00
		$902,208,000		$3,840,000.00
Total Direct @65%	$792,480,000	$1,981,200,000	$2,600,000.00	$4,810,000.00
		$1,466,088,000		$6,240,000.00

Sources: MWH-PNP direct construction workforce estimates; Utah I/O Model Fiscal Impacts, Working Paper 2001-1; IMPLAN Model Estimates for the State of Utah, 2007 data and model structure and run estimates.

Chapter 8
Socioeconomics Baseline (Action and No Action Alternatives)

8.1 Population Trends for Washington, Iron, and Kane Counties, Utah

Given the premise that "people follow jobs," population changes provide insight into how the economy is currently performing, and how it has performed over time.

The population trends for Washington, Iron, and Kane counties and the State of Utah are presented in Table 8-1, and Figures 8-1, 8-2, and 8-3. Figure 8-1 compares the population trends in Washington, Iron, and Kane counties and the State of Utah using 1990 as a base year (assuming their respective populations in 1990 are equal to 100). Figure 8-2 traces Washington, Iron, and Kane Counties' shares of state of Utah's total population from 1990 to 2007. Figure 8-3 shows annual percentage changes in population of Washington, Iron, and Kane counties and State of Utah from 1990 to 2007. In summary:

- The 2007 population estimates for Washington, Iron, and Kane counties totaled 133,447, 43,453, and 6,506 persons, respectively. The 2007 population counts ranked Washington, Iron, and Kane counties 5th, 9th, and 23rd among Utah's 29 counties, respectively.

- From 1990 to 2007, the populations of Washington, Iron, and Kane counties have increased by 71 percent (or 84,264 persons), 108 percent (or 22,526 persons), and 26 percent (or 1,340 persons), respectively. Within the same period, the State of Utah and the nation's populations have risen by 54 percent and 21 percent, respectively.

- During 1990-2007, Washington, Iron, and Kane counties and Utah experienced annual population growth rates of 6.0 percent, 4.4 percent, 1.4 percent and 2.6 percent, respectively.

- During 1990-2007, the population in Washington and Iron counties grew much faster than the state average, while Kane County's population grew slower than the state average:

    - Washington County's share of state's population increased from 2.8 percent in 1990 to 5.0 percent in 2007.

    - Iron County's share of state's population increased from 1.2 percent in 1990 to 1.6 percent in 2007.

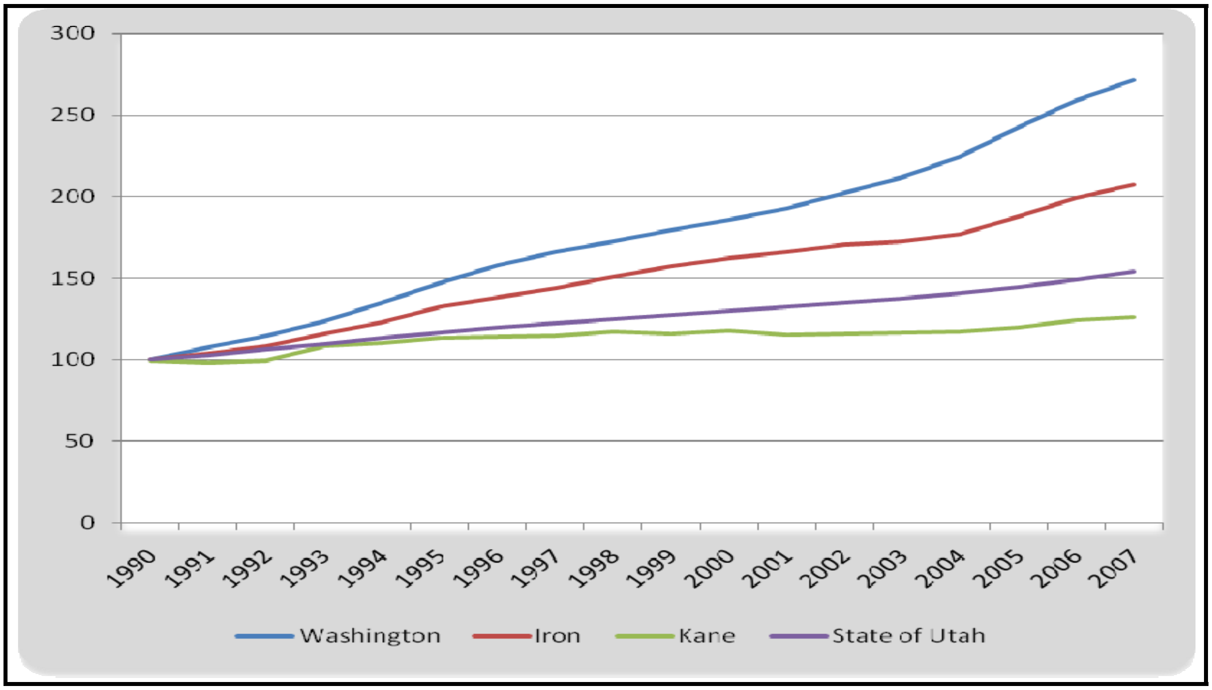
    - Kane County's share of state's total population declined from 0.30 percent in 1990 to 0.24 percent in 2007.

- In recent years, Southwestern Utah Counties, mainly Washington and Iron counties became the most popular places for permanent retirees and seasonal retirees from other counties in the state and from the state of California. From 2000 to 2007, net-migrations accounted for about 83 percent, 64 percent, and 36 percent of Washington, Iron, and Kane counties' total population increases. During the same period, the number of individuals age 65 and over in Washington, Iron, Kane counties increased by 52 percent, 42 percent, and 12 percent, respectively, which is higher than 24 percent for the State of Utah.

Table 8-1
Population Trends in Washington, Iron, and Kane Counties, 1990-2007

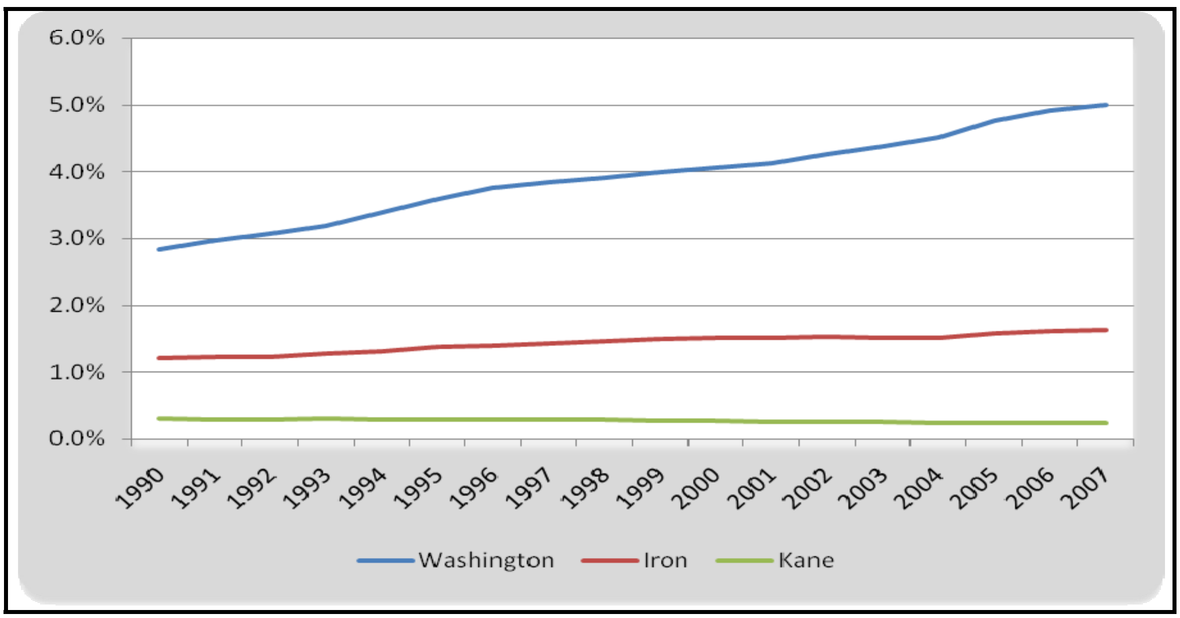
Population Indicator Description	Washington	Iron	Kane	State of Utah
Population, 2007	**133,447**	**43,453**	**6,506**	**2,668,925**
Change in Population, 1990-2007	**84,264**	**22,526**	**1,340**	**937,702**
Change in Population, 1990-2000	42,071	13,065	913	512,987
Change in Population, 2000-2007	42,193	9,461	427	424,715
Percent Change in Population, 1990-2007	**71%**	**108%**	**26%**	**54%**
Percent Change in Population, 1990-2000	86%	62%	18%	30%
Percent Change in Population, 2000-2007	46%	28%	7%	19%
Annual Population Growth, 1990-2007	**6.0%**	**4.4%**	**1.4%**	**2.6%**
Annual Population Growth, 1990-2000	6.4%	5.0%	1.6%	2.6%
Annual Population Growth, 2000-2007	5.6%	3.6%	1.0%	2.5%
As Percent of State Population				
in 1990	2.8%	1.2%	0.30%	
in 2000	4.1%	1.5%	0.27%	
in 2007	5.0%	1.6%	0.24%	

Source: U.S. Bureau of Economic Analysis, Regional Economic Information Services (REIS)



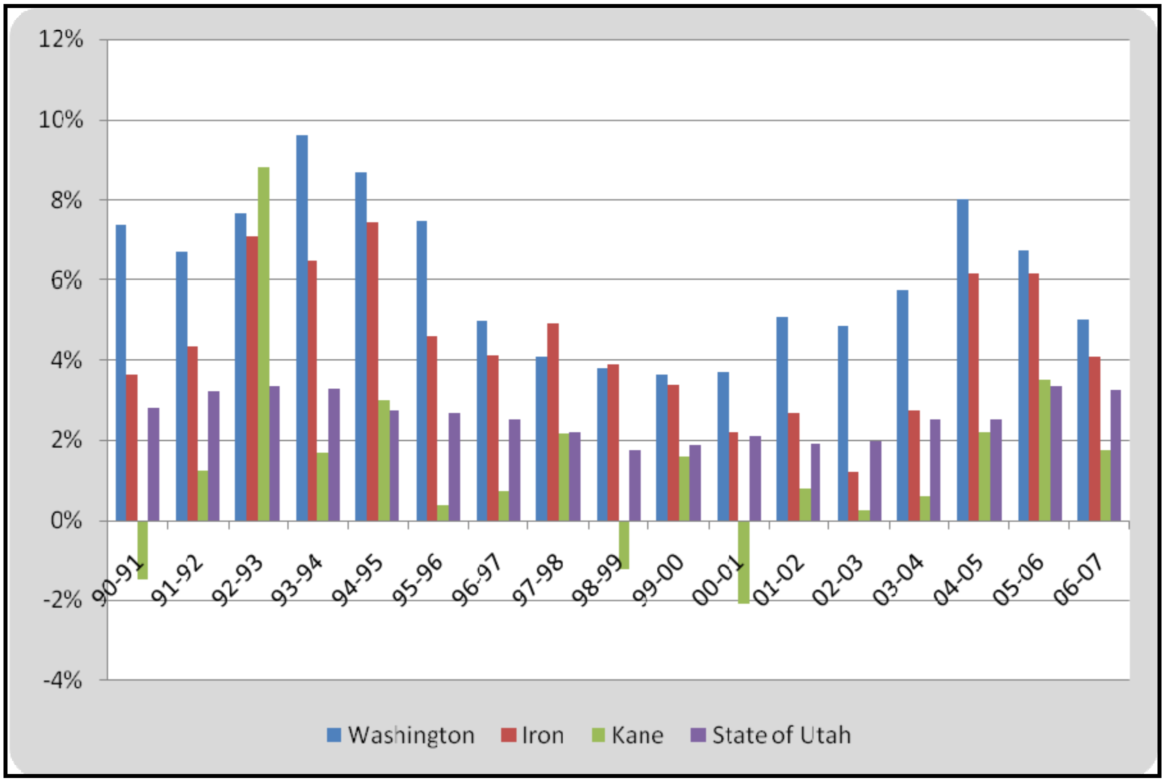
Source: U.S. Bureau of Economic Analysis, Regional Economic Information Services (REIS)

Figure 8-1
Population Trends in Washington, Iron, and Kane Counties, and in the State of Utah, 1990-2007



Source: U.S. Bureau of Economic Analysis, Regional Economic Information Services (REIS)

Figure 8-2
Washington, Iron, and Kane Counties' Share of Utah's Population, 1990-2007



Source: U.S. Bureau of Economic Analysis, Regional Economic Information Services (REIS)

Figure 8-3
Annual Percentage Changes in Population of Washington, Iron and Kane Counties, and State of Utah, 1990-2007

8.2 Population Projections for Washington, Iron, and Kane Counties[1/]

Table 8-2 provides the projected population levels, the projected natural increases, and projected net-migrations for selected years for Washington, Iron and Kane counties from 2010 to 2060. The population projections, provided by the Utah Governor's Office of Planning and Budget (GOPB), are based on 2008 population estimates. Figure 8-4 shows the population projection growth rates for Washington, Iron and Kane counties from 2008 through 2060.

[1/] The U.S. Bureau of Census is the main source of population estimates for the United States. The decennial census, as conducted by the Bureau, provides an actual enumeration of the population every ten years. The Bureau also generates annual estimates of the population at the state, county and sub-county levels, but on an irregular basis. Additionally, the Bureau establishes long-term population projections at the state level only. Long-term population projections at state and county-level for Utah and Arizona states are established by the Utah Governor’s Office of Planning and Budget (GOPB) and the Arizona Department of Commerce, respectively. The Bureau of the Census’s latest long-term population projections for the Utah and Arizona States are based on 2000 census data and span until 2030. The latest Utah GOBP population projections for the state and the counties is based on 2008 estimates and span until 2060, while Arizona Department of Commerce’s population projections is based on 2005 and span until 2055. The Utah GOBP and Arizona Department of Commerce population projections are used in this report.

8.2.1 Washington County Population

The county's population is projected to grow at an annual rate of 3.4 percent, while the state's population is expected to grow at an annual rate of 1.7 percent during the next 50 years. The county's population, estimated at 150,079 in 2008 is projected to reach 860,378 in 2060 (an increase of 473 percent). About 56 percent of population increase between 2008 and 2060 would be from an increase in net migration projection (about 404,806 persons). Among 29 counties in the state, Washington County is projected to have the third largest population increase during the projections period.

Based on GOPB population projections, the county will increase its share of the state's total population from 5.7 percent in 2008 to 10 percent by 2060, which implies that the county is projected to grow significantly faster than the state average. The City of St. George, which is the largest city in Washington County, is projected to increase from 72,711 in 2008 to 431,239 by 2060.[2/]

8.2.2 Iron County Population

The county's population is projected to increase at an annual rate of 2.5 percent over the next 50 years. The county's population, which is estimated at 46,992 in 2008, is projected to reach 168,383 by 2060 (an increase of 258 percent). About 51 percent of the projected population increase between 2008 and 2060 is attributed to an increase in net migration (about 61,518 persons).

Based on GOPB population projections, the county will increase its shares of the state's total population from 1.7 percent in 2008 to 4.4 percent by 2060, which implies that Iron County's population is projected to grow significantly faster rate than the state average.

8.2.3 Kane County Population

It is projected that the county's population will grow at an annual rate of 1.9 percent over the next 50 years. The county's population, which is estimated at 6,582 in 2008, is projected to reach 17,276 by 2060 (an increase of 162 percent). About 26 percent of the projected population increase between 2008 and 2060 is attributed to an increase in net migration (about 2,817 persons).

Based on GOPB population projections, the county's share of the state's total population will decline from 0.24 percent in 2008 to 0.16 percent by 2060, which implies that the county is projected to grow at lower rate than the state average.

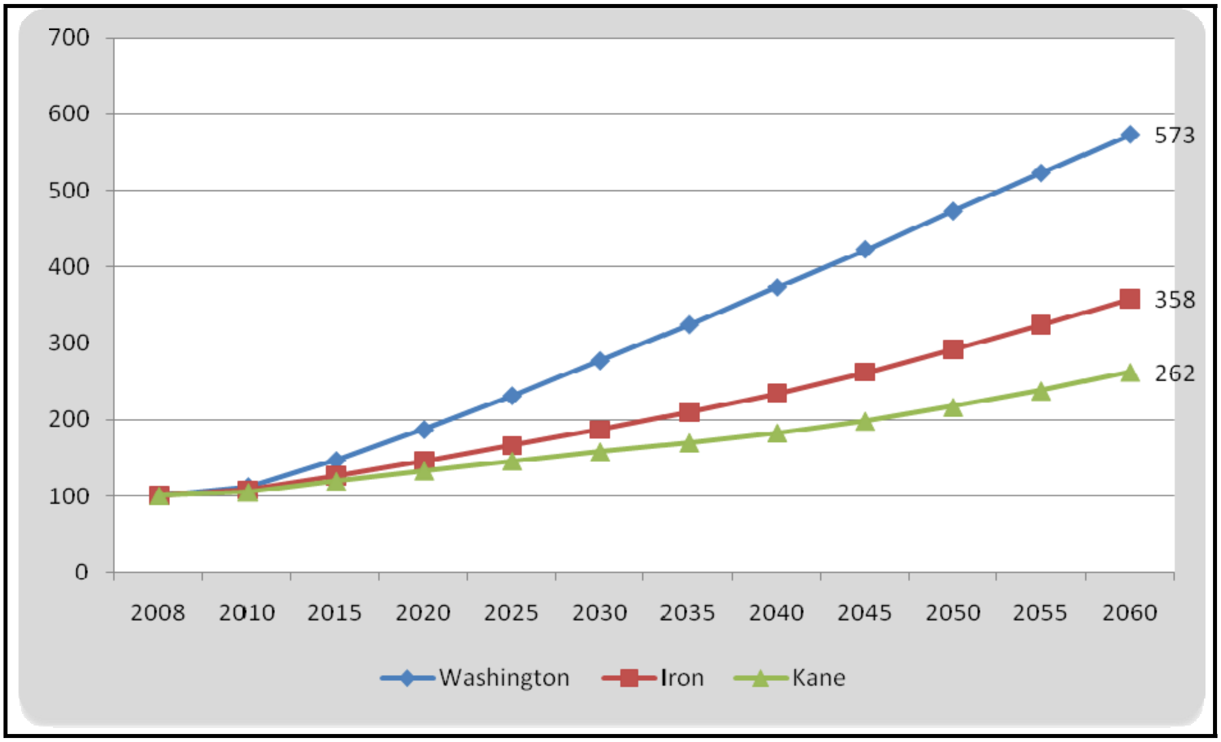
Appendix A provides the household size and employment projections for Washington, Iron and Kane counties over the next 50 years. It also provides the population projections for major cities in Washington, Iron and Kane counties over the next 50 years.

[2/] Appendix A provides population projection from 2010 to 2060 for major cities in Washington, Iron and Kane counties.

Table 8-2
Population Projections for Washington, Iron, and Kane Counties, 2008-2060

Year	Washington County			Iron County			Kane County		
	Population	Natural Increase[1,2]	Net Migration[2]	Population	Natural Increase[1,2]	Net Migration[2]	Population	Natural Increase[1,2]	Net Migration[2]
2008	150,079			46,992			6,582		
2010	168,078	4,262	13,737	50,601	1,416	2,193	6,893	26	285
2015	219,324	13,270	37,976	59,212	3,806	4,805	7,839	135	811
2020	279,864	16,758	43,782	68,315	4,095	5,008	8,746	199	708
2025	346,408	20,482	46,062	77,721	4,506	4,900	9,592	213	633
2030	415,510	24,629	44,473	87,644	5,098	4,825	10,394	204	598
2035	486,315	29,010	41,795	98,473	5,763	5,066	11,174	216	564
2040	559,670	33,255	40,100	110,257	6,351	5,433	12,034	254	606
2045	634,437	36,907	37,860	123,206	6,844	6,105	13,050	306	710
2050	709,674	39,861	35,376	137,240	7,359	6,675	14,267	357	860
2055	784,798	42,388	32,736	152,263	7,889	7,134	15,677	414	996
2060	860,378	44,671	30,909	168,383	8,391	7,729	17,276	483	1,116
Change 2008-2060	**710,299**	305,493	404,806	**121,391**	61,518	59,873	**10,694**	2,807	7,887

Notes:
[1] Natural increase is the difference between births and deaths.
[2] The numbers represents the projected cumulative changes.
Source: Governor's Office of Planning and Budget, 2008 Baseline Projections



Source: Governor's Office of Planning and Budget, 2008 Baseline Projections

Figure 8-4
Population Projection Growth Rates for Washington, Iron, and Kane Counties, 2008-2060 (*Index set at 100)*

8.3 Economic Trends

Economic changes and population changes are closely linked to each other. A full understanding of the population changes requires knowledge of the changes in economic conditions in terms of income and employment.

8.3.1 Personal Income Trends

Personal income is generally seen as a key indicator of a region's economic vitality and the economic well being of its residents. Total personal income can come from two sources: (1) labor or earned income, consisting of wages and salaries, other labor income and proprietors' income; and (2) non-labor income, which includes transfer payments (e.g., Social Security, Medicare, food stamps, unemployment insurance) and investment (or interest) income (consisting of dividends, interest, and rent).

Tables 8-3and 8-4 show Per Capita Personal Income (PCPI) and PCPI trends for Washington, Iron, and Kane counties and the state of Utah from 1990 to 2007. The PCPI trends in current dollars and in real dollars (after adjusted for inflation) for Washington, Iron, and Kane counties and the State of Utah are presented in Figures 8-5 and 8-6, respectively.

- During 1990-2007, PCPI for Washington, Iron, and Kane counties increased by 92 percent, 76 percent and 126 percent, respectively, while PCPI for State of Utah increased by 100 percent.

- In 1990s and 2000s, Washington and Iron counties' PCPI lagged behind the state while Kane County's PCPI outpaced the state. For the duration of 1990-2007, Washington, Iron, and Kane Counties' PCPI grew at an annual rate of 3.9 percent, 3.4 percent and 4.9 percent, respectively (Table 8-3); whereas, the State's PCPI grew at an annual rate of 4.2 percent.

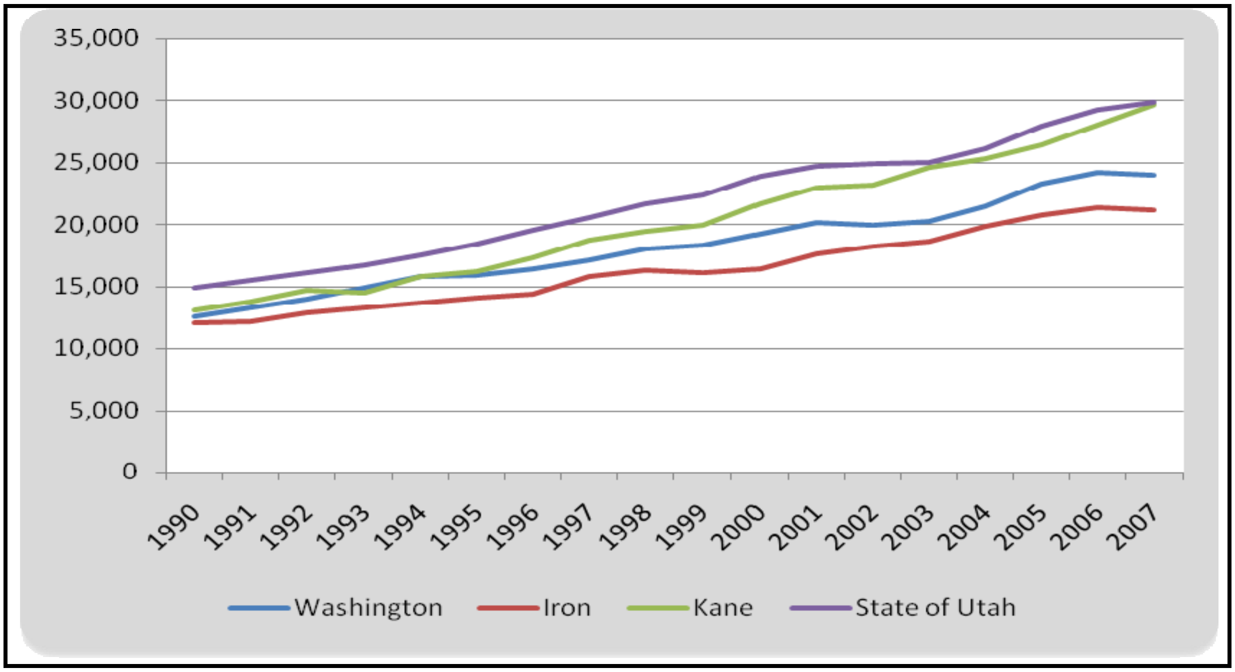
- Washington, Iron, and Kane counties' 2007 medium household income of $47,097, $40,250, $42,268, respectively, were significantly below the statewide average of $55,220 (U.S. Census Bureau).

- From 1990 to 2007, the real PCPIs (after adjusting for inflation) in Washington, Iron, and Kane counties and the State of Utah changed by 31 percent, 20 percent, 55 percent, and 27 percent, respectively.

Table 8-3
Summary of Per Capita Personal Income (PCPI) Trends for Washington, Iron, and Kane Counties, and State of Utah, 1990-2007

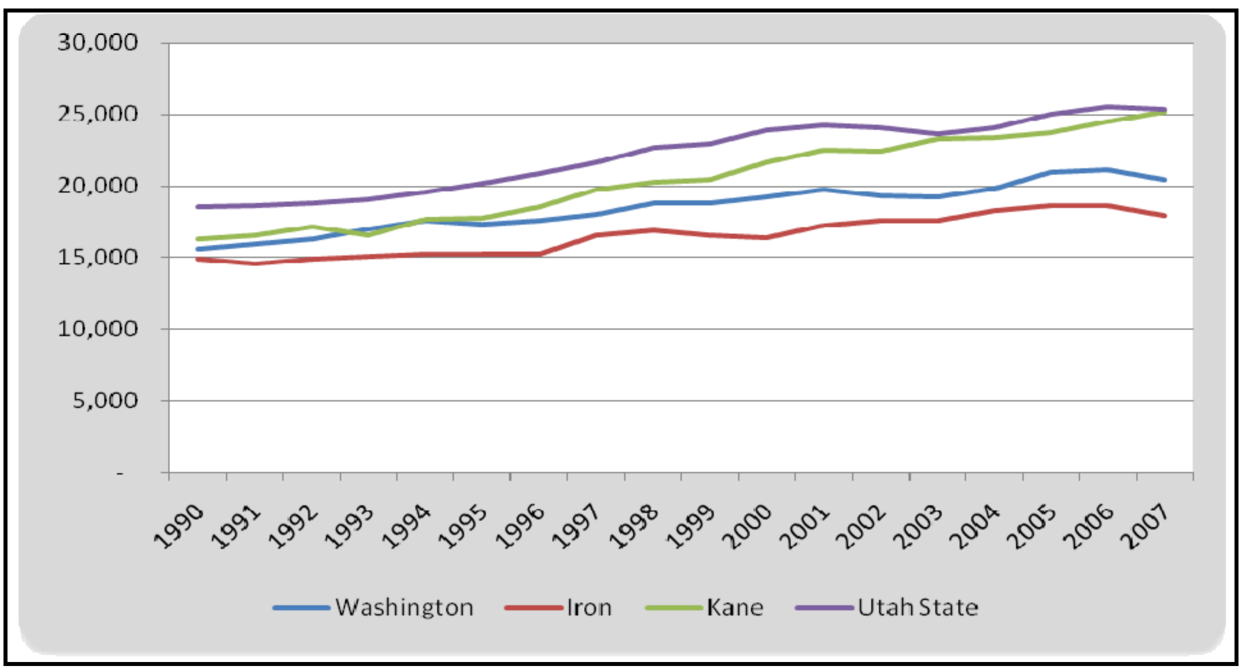
Personal Income Indicator	Washington County	Iron County	Kane County	State of Utah
PCPI, $				
in 1990	$ 12,532	$12,000	$ 13,104	$ 14,913
in 2000	$ 19,199	$16,377	$ 21,641	$ 23,866
in 2007	$ 24,014	$21,103	$ 29,663	$ 29,831
PCPI as % of State				
in 1990	84%	80%	88%	
in 2000	80%	69%	91%	
in 2007	81%	71%	99%	
% Change in PCPI,				
from 1990 to 2007	92%	76%	126%	100%
from 1990 to 2000	53%	36%	65%	60%
from 2000 to 2007	25%	29%	37%	25%
Compounded Annual Growth Rate,				
from 1990 to 2007	3.9%	3.4%	4.9%	4.2%
from 2000 to 2007	3.2%	3.7%	4.6%	3.2%

Source: U.S. Bureau of Economic Analysis, Regional Economic Information Services (REIS)



Source: U.S. Bureau of Economic Analysis, Regional Economic Information Services (REIS)

Figure 8-5
Per Capita Personal Income (PCPI) Trends in Washington, Iron, and Kane Counties, and State of Utah, 1990-2007 (in current $)



Source: U.S. Bureau of Economic Analysis, Regional Economic Information Services (REIS)

Figure 8-6
Real PCPI Trends in Washington, Iron, and Kane Counties and State of Utah, 1990-2007, (in 2000$)

Table 8-4 presents total personal income (TPI), per capita personal income (PCPI), labor income, transfer payments and investment income in 1990, 1995, 2000 and 2007 for Washington, Iron, and Kane counties and the State of Utah. Figure 8-7 shows the source of 2007 total personal income for Washington, Iron and Kane counties, and for the State of Utah.

- From 1990 to 2007, the TPIs for Washington, Iron and Kane Counties increased by 420 percent, 265 percent, and 185 percent, respectively, while the TPI for the state of Utah increased by 208 percent.
- In 2007, 62 percent of Washington County's TPI, 68 percent of Iron County's TPI, and 65 percent Kane County's TPI came from labor income, while 74 percent of state of Utah's TPI came from labor income.
- The large difference in sources of income between Washington, Iron and Kane Counties and the state is mainly due to the transfer income's share of TPI. For example, in 2007, transfer income accounted for 18 percent, 19 percent and 19 percent of Washington, Iron, and Kane Counties' TPI, respectively, versus 11 percent for the state's TPI.
- In the last 17 years, a large number of retirees have migrated into Washington, Iron and Kane counties, residents in these counties have been dependent more on non-labor income (investment income and transfer income) for their income sources.

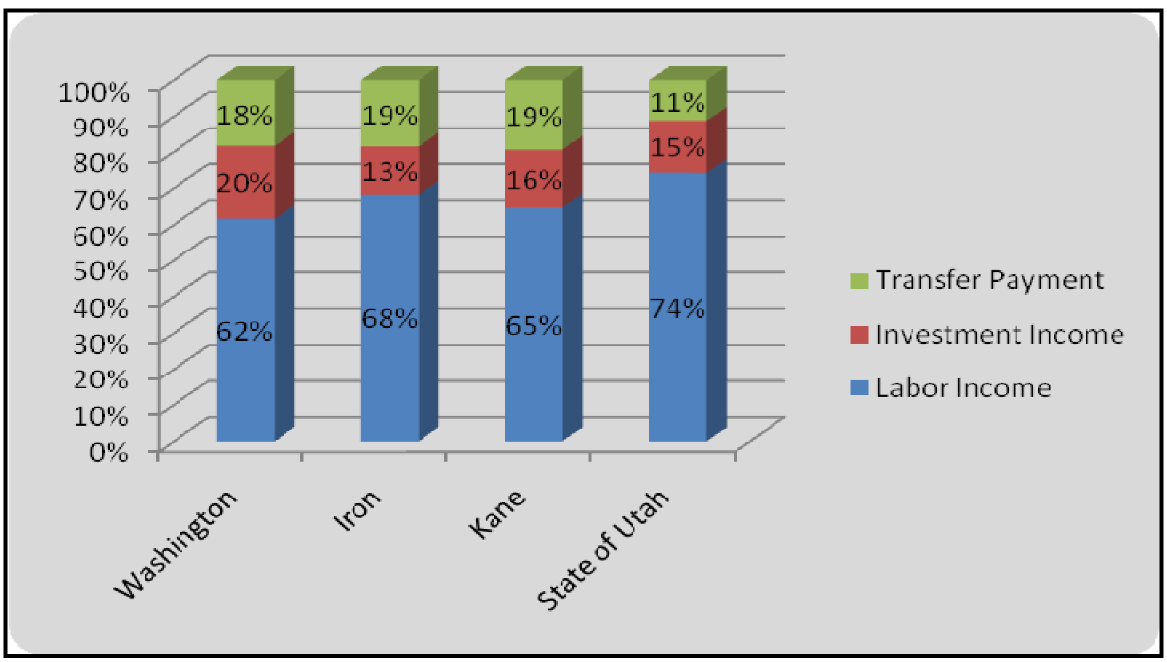
Table 8-4
Total Personal Income, Per Capita Personal Income, and Sources of Income for Washington, Iron, and Kane Counties, and State of Utah, in Various Years

Government Division	Total Personal Income ($ millions)	Per Capita Personal Income (PCPI)	PCPI as a Percent of State PCPI	Labor Income as a Percent of Personal Income	Investment Income as a Percent of Personal Income	Transfer Payment as a Percent of Personal Income
Washington						
in 1990	$ 616	$ 12,532	84%	56%	27%	17%
in 1995	$ 1,147	$ 15,873	86%	58%	24%	18%
in 2000	$ 1,752	$ 19,199	80%	56%	26%	18%
in 2007	$ 3,205	$ 24,014	81%	62%	20%	18%
Iron						
in 1990	$ 251	$ 12,000	80%	66%	18%	16%
in 1995	$ 388	$ 13,993	76%	67%	17%	16%
in 2000	$ 557	$ 16,377	69%	65%	18%	17%
in 2007	$ 917	$ 21,103	71%	68%	13%	19%

Table 8-4
Total Personal Income, Per Capita Personal Income, and Sources of Income for Washington, Iron, and Kane Counties, and State of Utah, in Various Years

Government Division	Total Personal Income ($ millions)	Per Capita Personal Income (PCPI)	PCPI as a Percent of State PCPI	Labor Income as a Percent of Personal Income	Investment Income as a Percent of Personal Income	Transfer Payment as a Percent of Personal Income
Kane						
in 1990	$ 68	$ 13,104	88%	62%	23%	15%
in 1995	$ 96	$ 16,283	88%	60%	22%	18%
in 2000	$ 132	$ 21,641	91%	59%	23%	18%
in 2007	$ 193	$ 29,663	99%	65%	16%	19%
State of Utah						
in 1990	$ 25,817	$ 14,913		70%	19%	11%
in 1995	$ 37,218	$ 18,478		72%	17%	11%
in 2000	$ 53,561	$ 23,866		73%	17%	10%
in 2007	$ 79,618	$ 29,831		74%	15%	11%

Source: U.S. Bureau of Economic Analysis, Regional Economic Information Services (REIS)



Source: U.S. Bureau of Economic Analysis, Regional Economic Information Services (REIS)

Figure 8-7
Source of 2007 Total Personal Income in Washington, Iron, and Kane Counties, and the State of Utah

8.3.2 Employment Trends

Employment is one of the most important economic variables in determining the health of an economy. Wages earned by employees are engines of economic growth.

In 2007, total employment (consists of wage and salary employees and proprietors) for Washington, Iron, and Kane counties, and the State of Utah were 75,086, 24,324, 4,609 and 1,673,907, respectively (Table 8-5).[3/] During 1990-2007, the total employment in Washington, Iron, and Kane counties increased by 250 percent, 137 percent, and 93 percent, respectively, while statewide the total employment increased by 77 percent (Table 8-5 and Figure 8-8). This translates to annual employment growth rates of 7.7 percent, 5.2 percent, and 3.9 percent for Washington, Iron, and Kane counties, respectively. During the same periods, the State's employment grew at an annual rate of only 3.4 percent. Thus, during 1990-2007, Washington, Iron, and Kane counties' employment grew significantly faster than the state's.

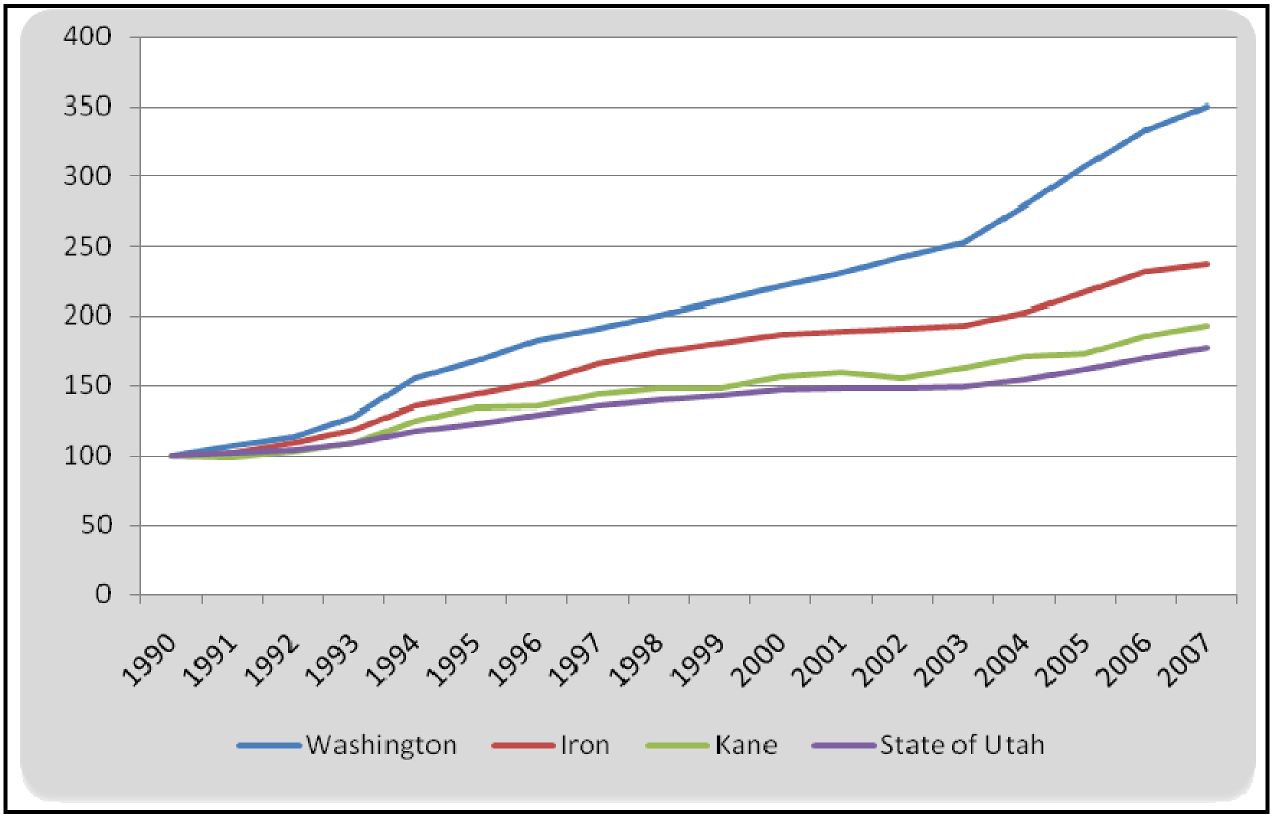
Tables 8-6, 8-7, and 8-8 provide the distribution of employment among selected sectors in Washington, Iron, and Kane counties in 2001 and 2007, respectively.

Table 8-5
Summary of Employment Trends in Washington, Iron and Kane Counties, and State of Utah, 1990-2007

Employment Indicator	Washington	Iron	Kane	State of Utah
Total Employment,				
in 1990	21,432	10,263	2,388	944,329
in 2000	47,552	19,149	3,744	1,387,847
in 2007	75,086	24,324	4,609	1,673,907
Percent Change in Employment,				
from 1990 to 2007	250%	137%	93%	77%
From 1990 to 2000	122%	87%	57%	47%
From 2000 to 2007	58%	27%	23%	21%
Annual Rate of Growth,				
from 1990 to 2007	7.7%	5.2%	3.9%	3.4%
from 1990 to 2000	8.3%	6.4%	4.6%	3.9%
from 2000 to 2007	6.7%	3.5%	3.0%	2.7%

Source: U.S. Bureau of Economic Analysis, Regional Economic Information Services (REIS)

[3/] Employment data presented in this section are from Bureau of Economic Analysis (BEA). BEA employment is by place-of-work, rather than by place-of-residence. Therefore, the jobs held by residents of neighboring counties who commute to work in these counties are included in total employment count for the county.



Source: U.S. Bureau of Economic Analysis, Regional Economic Information Services (REIS)

Figure 8-8
Employment Trends in Washington, Iron, Kane Counties and State of Utah, 1990-2007

8.3.2.1 Washington County Employment

Between 2001 and 2007, the employment in the county increased from 49,445 to 75,086, a 52 percent increase (or 25,641 jobs), whereas within the same period, the total employment at the State and national levels increased by 20 percent and 8 percent, respectively (Table 8-6). Most of the county's economic sectors experienced employment growth between 2001 and 2007. Fastest growing employment sectors in terms of numerical value, between 2001 and 2007, were Construction (added 5,508 new jobs), Healthcare and Social Services (added 3,106 new jobs), Retail Trade (added 2,081 new jobs), Government (added 1,721 new jobs), and Accommodation and Food Services (added 1,648 new jobs). Between 2001 and 2007, major employment losses among various economic sectors occurred in Farming and Natural Resources sectors. Construction, Retail Trade, Healthcare and Social Services, Government, and Accommodation and Food Services were the major employers and accounted for 15 percent, 13 percent, 11 percent, 9 percent, and 9 percent of Washington County's 2007 total employment, respectively.

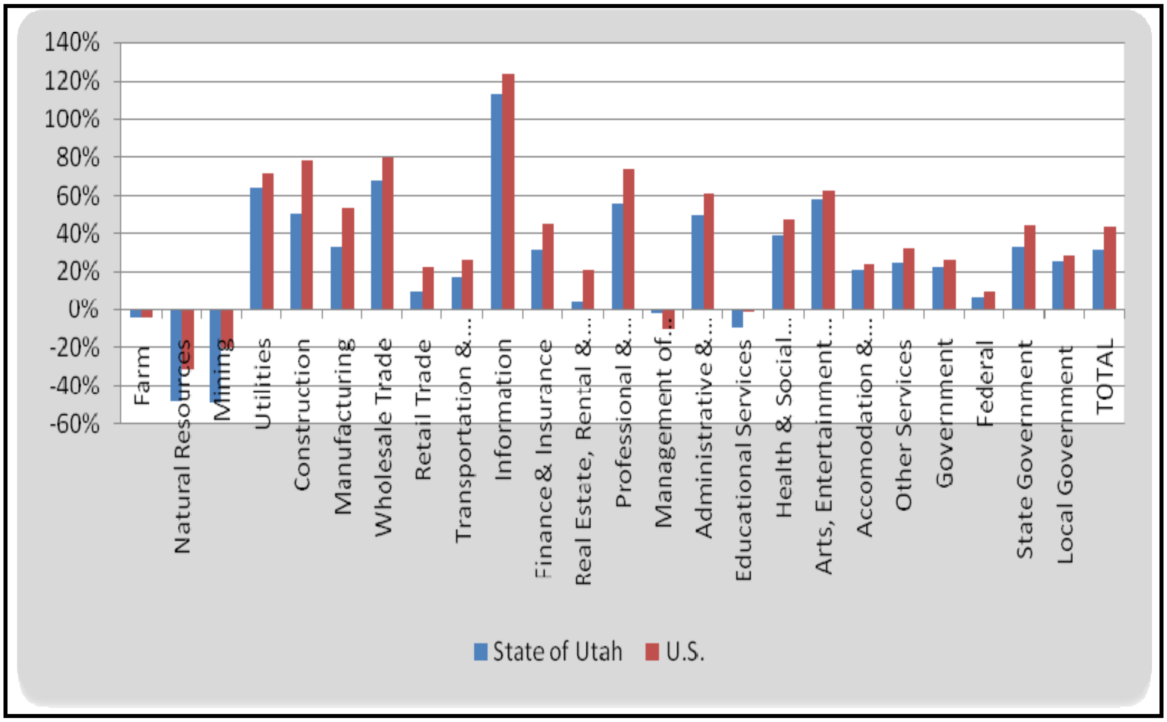
Table 8-6
Employment Changes by Sector in 2001 and 2007, Washington County

Employment Sector	Employment				Changes in Employment	
	2001		2007		%	# of jobs
Farm	541	1%	479	1%	-11%	(62)
Natural Resources	212	0%	144	0%	-32%	(68)
Mining	403	1%	409	1%	1%	6
Utilities	65	0%	107	0%	65%	42
Construction	5,712	12%	11,220	15%	96%	5,508
Manufacturing	2,452	5%	3,408	5%	39%	956
Wholesale Trade	838	2%	1,559	2%	86%	721
Retail Trade	7,744	16%	9,825	13%	27%	2,081
Transportation & Warehousing	2,552	5%	3,410	5%	34%	858
Information	541	1%	1,139	2%	111%	598
Finance & Insurance	2,258	5%	3,432	5%	52%	1,174
Real Estate, Rental & Leasing	2,668	5%	4,482	6%	68%	1,814
Professional & Technical Services	2,100	4%	3,907	5%	86%	1,807
Management of Companies	282	1%	362	0%	0%	80
Administrative & Waste Services	2,032	4%	3,609	5%	78%	1,577
Educational Services	465	1%	576	1%	24%	111
Health & Social Services	4,901	10%	8,007	11%	63%	3,106
Arts, Entertainment & Recreation	926	2%	1,644	2%	78%	718
Accommodation & Food Services	4,662	9%	6,383	9%	37%	1,721
Other Services	2,801	6%	4,046	5%	44%	1,245
Government	5,290	11%	6,938	9%	31%	1,648
Federal	967	2%	1,080	1%	12%	113
State Government	772	2%	1,089	1%	41%	317
Local Government	3,551	7%	4,769	6%	34%	1,218
TOTAL	**49,445**	**100%**	**75,086**	**100%**	**52%**	**25,641**

Source: U.S. Bureau of Economic Analysis, Regional Economic Information Services (REIS)

Most of the sectors in the county experienced an employment growth between 2001 and 2007. To better understand how well these sectors have performed, however, it is necessary to compare their employment growths to their counterparts at the state or national levels. The differences between the employment growths in Washington County versus the State and the nation for major economic sectors are presented in Figure 8-9.

Between 2001 and 2007, the County's total employment gained 30 percent and 44 percent above the state and the nation, respectively. Among major economic sectors, the employment gains in Construction, Manufacturing, Wholesale Trade, and Healthcare and Social Services sectors of the county were significantly higher than the employment gains at the state and the national levels. Among major economic sectors, the employment in Farm, Natural Resources, and Mining sectors declined much faster than at the State and the national levels.



Source: Calculated from data provided by U.S. Bureau of Economic Analysis, REIS

Figure 8-9
Percentage Difference in Employment Changes by Sector between 2001 and 2007
Washington County versus the State of Utah and the Nation

8.3.2.2 Iron County Employment

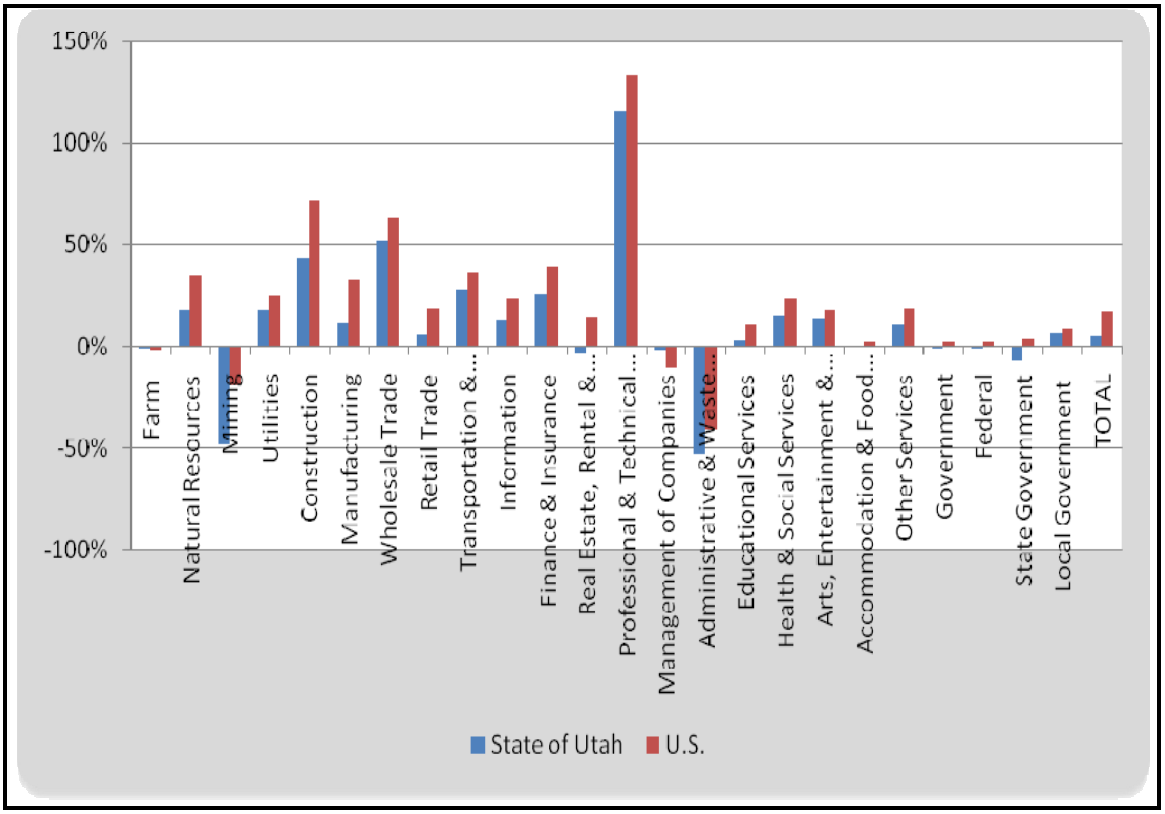
Between 2001 and 2007, the Iron County's total employment grew from 19,387 to 24,324, a 25 percent increase (or 4,937 jobs), whereas the state and nation changes were 20 percent and 8 percent, respectively. Fastest growing employment sectors in terms of numerical value, between 2001 and 2007, were Construction (added 1,253 new jobs), Professional and Technical Services (added 622 new jobs), Retail Trade (added 545 new jobs), and Wholesale Trade (added 517 new jobs). During the same periods, major employment losses among various economic sectors occurred in Farming, Management of Companies, and Administrative and Waste Services sectors. As shown in Table 8-7, Government, Retail Trade, Construction, Manufacturing, and Healthcare and Social Services sectors were the major employers in 2007 and accounted for 17 percent, 12 percent, 11 percent, 8 percent and 7 percent of Iron County's 2007 total employment, respectively.

Table 8-7
Employment Change by Sector in 2001 and 2007, Iron County

Employment Sector	Employment				Change in Employment	
	2001		2007		in %	# of jobs
Farm	598	3%	546	2%	-9%	(52)
Ag. Services & Forestry	162	1%	217	1%	34%	55
Mining	45	0%	46	0%	2%	1
Utilities	75	0%	89	0%	19%	14
Construction	1,394	7%	2,647	11%	90%	1,253
Manufacturing	1,588	8%	1,872	8%	18%	284
Wholesale Trade	305	2%	517	2%	70%	212
Retail Trade	2,388	12%	2,933	12%	23%	545
Transportation & Warehousing	350	2%	504	2%	44%	154
Information	185	1%	204	1%	10%	19
Finance & Insurance	722	4%	1,057	4%	46%	335
Real Estate, Rental & Leasing	845	4%	1,362	6%	61%	517
Professional & Technical Services	427	2%	1,049	4%	146%	622
Management of Companies	255	1%	95	0%	0%	(160)
Administrative & Waste Services	1,672	9%	1,260	5%	-25%	(412)
Educational Services	170	1%	232	1%	36%	62
Health & Social Services	1,302	7%	1,819	7%	40%	517
Arts, Entertainment & Recreation	362	2%	483	2%	33%	121
Accommodation & Food Services	1,556	8%	1,804	7%	16%	248
Other Services	1,021	5%	1,336	5%	31%	315
Government	3,965	20%	4,252	17%	7%	287
Federal	490	3%	513	2%	5%	23
State Government	1,818	9%	1,839	8%	1%	21
Local Government	1,657	9%	1,900	8%	15%	243
TOTAL	**19,387**	**100%**	**24,324**	**100%**	**25%**	**4,937**

Source: Calculated from data provided by U.S. Bureau of Economic Analysis, REIS

As shown in Figure 8-10, between 2001 and 2007, the county's total employment gained 3 percent and 17 percent above the State and the nation, respectively. Among major economic sectors, the employment gain in Professional-Scientific-Technical Services, Construction, Wholesale Trade, and Manufacturing significantly outpaced the employment gains at the State and the national levels. Among major economic sectors, the employment in Farming, Mining and Administration and Waster Services sectors declined much faster than at the State and the national levels.



Source: Calculated from data provided by U.S. Bureau of Economic Analysis, REIS

Figure 8-10
Percentage Difference in Employment Changes by Sector between 2001 and 2007
Iron County versus the State of Utah and the Nation

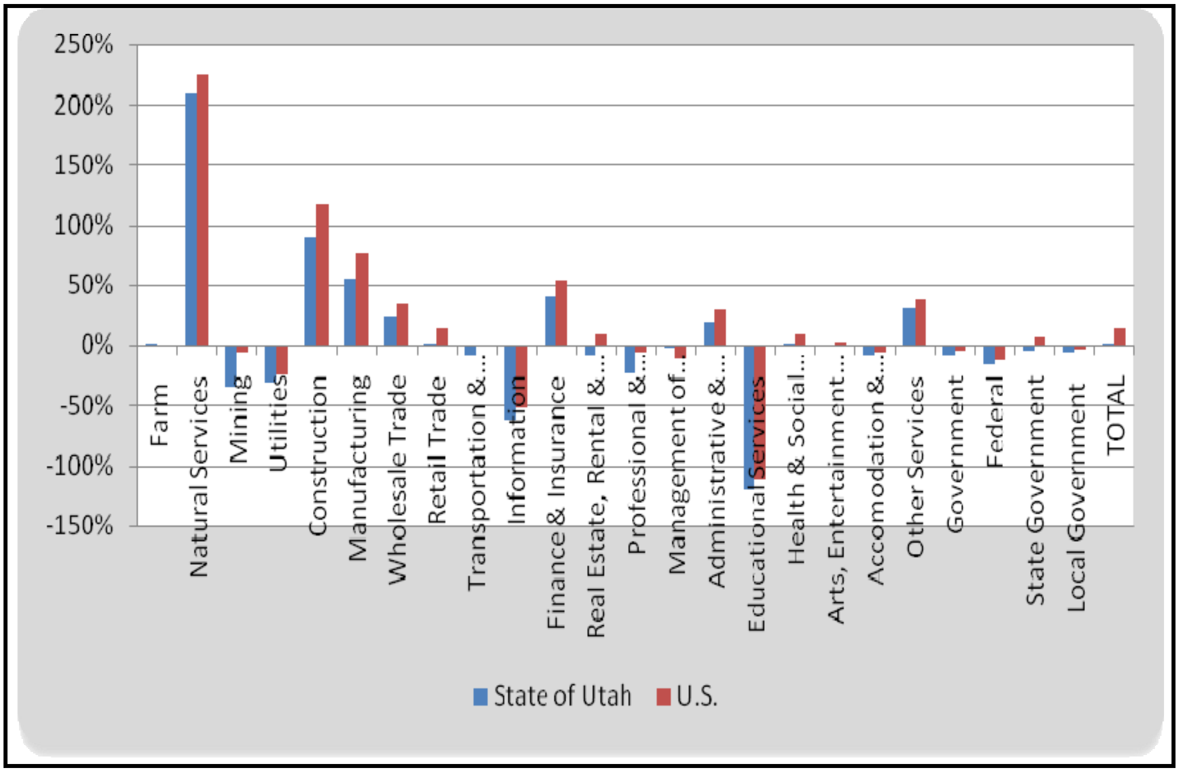
8.3.2.3 Kane County Employment

Between 2001 and 2007, the county's total employment increased from 3,800 to 4,627, a 22 percent increase (or 827 jobs), whereas the state and the nation's employment increased by 20 percent and 8 percent, respectively (Table 8-8). Between 2001 and 2007, Construction (added 218 new jobs), Other Services (added 213 new jobs), Retail Trade (added 79 new jobs), Real Estate (added 77 new jobs), and Manufacturing (added 72 new jobs) were the fastest growing employment sectors in the County. Major employment losses among various economic sectors, between 2001 and 2007, occurred in Information, Utilities and Education Services. As shown in Table 8-8, Government (mainly its Local Government subsector), Accommodation and Food Services, Other Services, Retail Trades, and Arts and Entertainment sectors were the major employers in 2007 and accounted for 16 percent, 15 percent, 14 percent, 11 percent and 10 percent of Kane County's 2007 total employment, respectively.

Table 8-8 Employment Changes by Sector in 2001 and 2007, Kane County						
	Employment				Changes in Employment	
Employment Sector	2001		2007		in %	# of jobs
Farm	174	5%	163	4%	-6%	(11)
Natural Services	11	0%	36	1%	225%	25
Mining	11	0%	13	0%	16%	2
Utilities	54	1%	37	1%	-31%	(17)
Construction	161	4%	379	8%	135%	218
Manufacturing	117	3%	189	4%	61%	72
Wholesale Trade	36	1%	51	1%	42%	15
Retail Trade	430	11%	509	11%	18%	79
Transportation & Warehousing	60	2%	65	1%	8%	5
Information	86	2%	30	1%	-65%	(56)
Finance & Insurance	82	2%	132	3%	61%	50
Real Estate, Rental & Leasing	139	4%	216	5%	55%	77
Professional & Technical Services	97	3%	103	2%	6%	6
Management of Companies	0	0%	0	0%	0%	-
Administrative & Waste Services	64	2%	94	2%	47%	30
Educational Services	20	1%	3	0%	-86%	(17)
Health & Social Services	82	2%	103	2%	26%	21
Arts, Entertainment & Recreation	372	10%	440	10%	18%	68
Accommodation & Food Services	644	17%	689	15%	7%	45
Other Services	414	11%	627	14%	51%	213
Government	746	20%	748	16%	0%	2
Federal	144	4%	129	3%	-10%	(15)
State Government	60	2%	62	1%	3%	2
Local Government	542	14%	557	12%	3%	15
TOTAL	**3,800**	**100%**	**4,627**	**100%**	**22%**	**827**
Source: Calculated from data provided by U.S. Bureau of Economic Analysis, REIS						

The differences between the employment growths in Kane County vs. the state and the nation for major economic sectors are presented in Figure 8-11. Between 2001 and 2007, the County's total employment gained 2 percent and 14 percent above the State and the nation, respectively. Among major economic sectors, the employment gain in Construction, Manufacturing, and Finance and Insurance outpaced the employment gains at the State and the national levels. Among major economic sectors, the employment in

Mining, Utilities, Information, and Educational Services sectors declined much faster than the State and the national levels.



Source: Calculated from data provided by U.S. Bureau of Economic Analysis, REIS

Figure 8-11
Percentage Difference in Employment Changes by Sector between 2001 and 2007
Kane County versus the State of Utah and the Nation

8.3.3 Economic Base of Washington, Iron, and Kane Counties

In the Section 8.3.2, an overview of some of the employment changes in Washington, Iron, and Kane counties from 1990 to 2007 were presented and the major employers in those counties were identified. In this section, a location quotient technique (LQ) is used to identify the counties' leading economic sectors that constitute economic base of these counties (i.e., sectors that bring in money to the county through export activities).

Several methods have been used to identify the basic and non-basic sectors of an economy. However, the location quotient (LQ) approach is the most popular and frequently used technique in economic base analyses.

The location quotients identify the basic and non-basic sectors of a local economy by comparing the economic structure of the local economy with a reference economy (usually state and/or nation). This comparison can be performed using various measures of economic activity, such as employment, income, or retail sales. However, the standard unit of measurement used in LQ is employment for which the data are readily available.

LQ compares the share of total employment in a particular sector in a local economy to its share at the national or state level. The quotient is calculated by dividing the local share of employment in a particular economic sector by the reference economy's share of employment in the same sector. If the quotient exceeds one, then the sector can be considered as a basic sector (suggests some of goods or services produced by an industry are exported to non-local areas). Sectors with quotients less than or equal to one are assumed to be industries serving local markets only (they are considered as non-basic sectors). The greater the LQ value above (below) 1.0, the stronger the suggestion of exporting (importing) becomes. A local economy with a large number of sectors having quotients greater than 1.0 may also indicate a reasonable level of economic diversity.

Table 8-9 shows the 2007 location quotients for Washington, Iron, and Kane counties' economic sectors at North American Industrial Classification System (NAICS) one-digit level. The location quotients are calculated compared to the State of Utah and the nation's economies. Table 8-9 also shows LQs for the Utah State. Except for Farming and Natural Resources sectors, most of LQs for Utah are near 1.0, which indicates that its employment patterns among sectors is very similar to the U.S employment pattern. Low LQs for Farming and Natural Resources for the State reflects absence of a strong resource-based economy.

8.3.3.1 Washington County Economic Base

Table 8-9 shows the LQs for Washington County compared to the State and the nation's economies.[4/]

- The following sectors constitute the economic base of Washington County in 2007 (sectors with LQs greater than 1.25):[5/]
    - Construction (2.0, 2.3, **5,677** jobs)
    - Health and Social Services (1.6, 1.1, **2,946** jobs)
    - Accommodation and Food Services (1.6, 1.3, **2,383** jobs)
    - Retail Trade (1.3, 1.2, **2,337** jobs)
    - Transportation and Warehousing (1.5, 1.4, **1,213** jobs)
    - Real Estate, Rental & Leasing (1.3, 1.3, **1,071** jobs)[6/]

- The large quotients for Construction, Health and Social Services Accommodation, Food Services, and Retail Trade sectors can be credited to the presence of large retiree net in-

[4/] Due to potential errors with LQ analysis, it is difficult to draw broad conclusions with respect to a sector with LQ between .75 and 1.25 without a more detailed study.

[5/] The first two numbers in the parentheses show the quotients compared to the State and the nation, respectively. The bolded numbers in the parentheses are potential excess employment above the state average. The excess employment is assumed to be due to export activities.

[6/] Many of these sectors usually provide goods and services only to the local economy and are considered as non-basic sectors in many small economies (e.g., counties). However, where they serve in-migrating retirees, tourists, state and federal employees, State University students, and shoppers from non-local areas, these sectors could bring in money to the local economy and should be considered basic sectors. It should be noted that, in many small counties, agriculture, mining and manufacturing sectors produce for export, and thus are considered basic sectors. The LQs less than 1 for these sectors imply that relative to the reference economy, these sectors are not as specialized as the reference economy.

migration, seasonal retirees (non-permanent population)[7/], student population (mainly Dixie State College of Utah and Utah State University)[8/].

- Low LQs for Farm, Natural Resources and Mining sectors indicate the County's economy does not depend on resource-based sectors.

- The quotients for Utilities (0.6, 0.4), Manufacturing (0.6, 0.4) and Management of Companies (0.4, 0.4), and Educational Services (0.4, 0.3) are all sufficiently low, which may indicate the county relies on import to meet the demands for goods and services provided by these sectors.

8.3.3.2 Iron County Economic Base

- Five of the county's economic sectors had location quotients greater than 1.25, indicating these sectors constitute the economic base of the county. The sectors and their respective LQs and the sectors' potential excess employments due to export activities are presented below:

  - Government (1.5, 1.2, **1,374** jobs)
  - Construction (1.5, 1.7, **851** jobs)
  - Accommodation and Food Services (1.4, 2.2, **508** jobs)
  - Farm (2.3, 1.4, **304** jobs)
  - Natural Resources (4.9, 1.6, **172** jobs)

- High LQs for Construction and Accommodation and Food Services are due to retiree net in-migration, seasonal retirees and student population (mainly Southern Utah University).

- Resource-based economy in the county appears to be relatively strong. This signifies a significance difference between the county's economy and the State's economy.

- The low quotients for Information (0.4, 0.4), Management of Companies (0.3, 0.4), Educational Services (0.4, 0.5) and Health and Services indicate that the County's relies on import for goods and services provided by these sectors.

8.3.3.3 Kane County Economic Base

- Five of the county's economic sectors had location quotients greater than 1.0, indicating these sectors constitute the economic base of the county. The sectors and their respective LQs and the sectors' potential excess employments due to export activities are presented below:

  - Accommodation and Food Services (2.8, 2.2, **443 jobs**)
  - Arts, Entertainment and Recreation (5.4, 4.6, **358** jobs)
  - Farming (3.5, 2.2, **117** jobs)

[7/] Southwestern Utah Counties have significant retiree and seasonal residents. In 2007, retirees (using 65 years and older as a proxy) accounted for 16% of total population in Southwestern Utah Counties, while they accounted for 4% of the State's total population. The average seasonal residence for Washington, Iron and Kane Counties, as a percent of total population, are estimated to be around 27%, 20%, and 59%, respectively (MWH 2008).

[8/] Average annual student population for Washington and Iron Counties are estimated around 10,100 and 9,700, respectively (MWH 2008).

- Construction (1.1, 1.3, **37** jobs)
- Natural Resources (4.2, 1.4, **27** jobs)

- Tourism, recreation, and seasonal residents contributed to high LQs for Arts, Entertainment and Recreation, and Accommodation and Food Services sectors. (see footnote 5)

- Contrary to the State, resource-based economy in the county appears to be relatively strong.

- The low quotients for Information (0.4, 0.4), Management of Companies (0.3, 0.4), Educational Services (0.4, 0.5) and Health and Services indicate that the county relies on imports for goods and services provided by these sectors.

Table 8-9
Location Quotients for Washington, Iron, and Kane Counties
Compared to the State of Utah and the United States, 2007

Page 1 of 2

Economic Sector	Compared to Utah State			Compared to U.S.			
	Washington	Iron	Kane	Washington	Iron	Kane	State of Utah
Farm	0.6	2.3	3.5	0.4	1.4	2.2	0.6
Natural Resources	1.0	4.9	4.2	0.3	1.6	1.4	0.3
Mining	0.8	0.3	0.4	1.0	0.3	0.5	1.3
Utilities	0.6	1.6	3.5	0.4	1.1	2.5	0.7
Construction	2.0	1.5	1.1	2.3	1.7	1.3	1.1
Manufacturing	0.6	1.1	0.6	0.6	1.0	0.5	0.9
Wholesale Trade	0.7	0.7	0.4	0.6	0.6	0.3	0.8
Retail Trade	1.3	1.2	1.1	1.2	1.1	1.0	0.9
Transportation & Warehousing	1.6	0.7	0.5	1.4	0.6	0.4	0.9
Information	0.8	0.4	0.3	0.8	0.4	0.3	1.0
Finance & Insurance	0.9	0.9	0.6	1.0	0.9	0.6	1.1
Real Estate, Rental & Leasing	1.3	1.2	1.0	1.3	1.2	1.0	1.0
Professional & Technical Services	0.9	0.8	0.4	0.8	0.7	0.3	0.8
Management of Companies	0.4	0.3	0.0	0.4	0.4	0.0	1.1
Administrative & Waste Services	0.9	1.0	0.4	0.8	0.8	0.3	0.9
Educational Services	0.3	0.4	0.0	0.4	0.5	0.0	1.0
Health & Social Services	1.6	1.1	0.3	1.1	0.7	0.2	0.7
Arts, Entertainment & Recreation	1.2	1.1	5.4	1.1	1.0	4.6	0.9
Accommodation & Food Services	1.6	1.4	2.8	1.3	1.1	2.2	0.8
Other Services	1.2	1.2	3.0	1.0	1.0	2.4	0.8

Table 8-9
Location Quotients for Washington, Iron, and Kane Counties
Compared to the State of Utah and the United States, 2007

	Compared to Utah State			Compared to U.S.			
Economic Sector	**Washington**	**Iron**	**Kane**	**Washington**	**Iron**	**Kane**	**State of Utah**
Government	0.8	1.5	1.4	0.7	1.3	1.2	0.9
Federal	0.5	0.8	1.0	0.5	0.8	1.0	1.0
State Government	0.4	2.2	0.4	0.5	2.6	0.5	1.2
Local Government	1.1	1.4	2.1	0.8	1.0	1.5	0.7

Source: Calculated from data provided by U.S. Bureau of Economic Analysis, REIS

8.4 Population Trends for Coconino and Mohave Counties, Arizona

The population trends for Coconino and Mohave Counties and Arizona State are presented in Table 8-10, and Figures 8-12 and 8-13.

- The 2007 population estimates for Coconino and Mohave counties totaled 127,350 and 195,873 persons, respectively. The 2007 population counts ranked Coconino and Mohave counties 8th and 5th among Arizona's 15 counties, respectively.

- From 1990 to 2007, the population of Coconino and Mohave counties increased by 31 percent (or 30,244 persons) and 105 percent (or 100,382 persons), respectively. Within the same period, the population of state of Arizona has risen by 72 percent (or 2,669,324 persons).

- During 1990-2007, the population of Coconino and Mohave counties grew at annual rates of 1.6 percent and 4.3 percent, respectively, whereas the state's population grew at an annual rate of 3.3 percent.

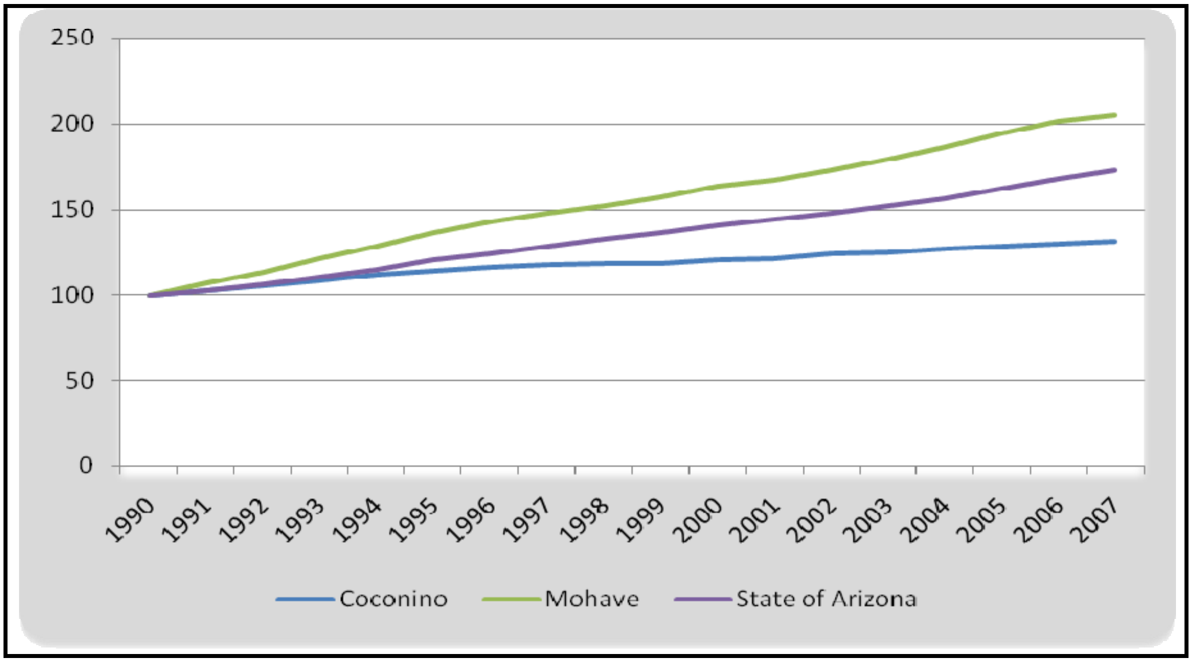
- Coconino County's share of the state's population declined from 2.6 percent in 1990 to 2.0 percent in 2007 (which implies the County's population growth lagged behind the state), while Mohave County's share of the state's population increased from 2.6 percent in 1990 to 3.1 percent in 2007.

- From 2000 to 2007, the number of individuals age 65 and over in Coconino and Mohave counties and in the state of Arizona increased by 24 percent, 30 percent and 24 percent, respectively.

Table 8-10
Population Trends in Coconino and Mohave Counties, 1990-2007

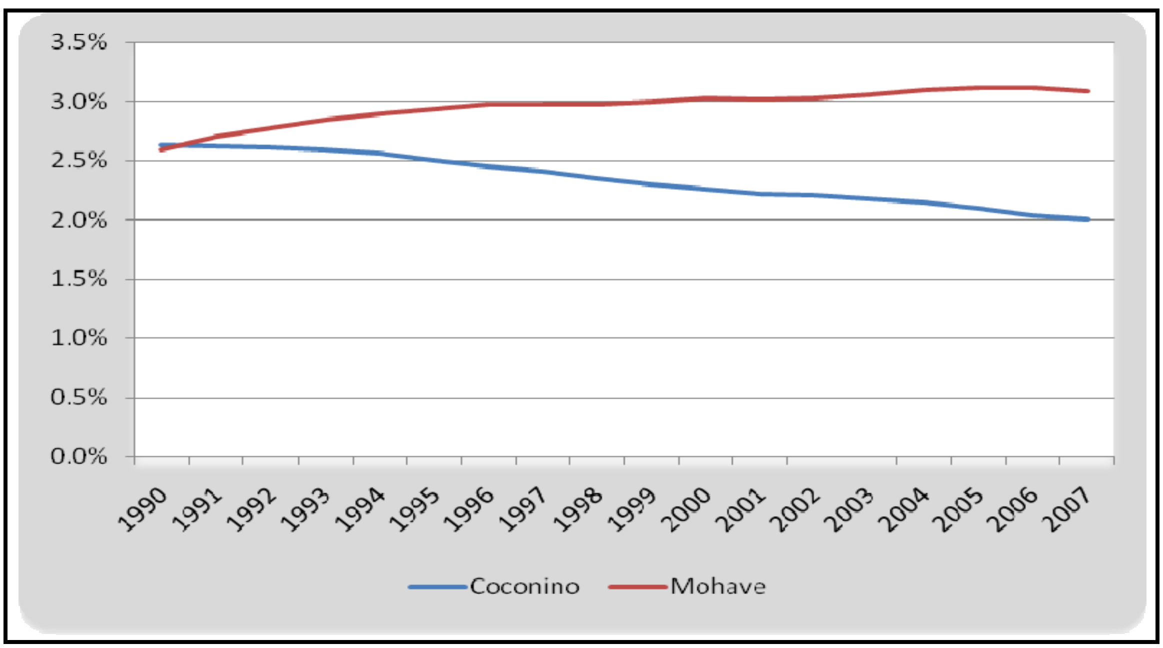
Population Indicator Description	Coconino	Mohave	State of Arizona
Population, 2007	**127,350**	**195,873**	**6,353,421**
Change in Population, 1990-2007	**30,244**	**100,382**	**2,669,324**
Change in Population, 1990-2000	19,597	60,689	1,482,713
Change in Population, 2000-2007	10,647	39,693	1,186,611
Percent Change in Population, 1990-2007	**31%**	**105%**	**72%**
Percent Change in Population, 1990-2000	20%	64%	40%
Percent Change in Population, 2000-2007	9%	25%	23%
Annual Population Growth, 1990-2007	**1.6%**	**4.3%**	**3.3%**
Annual Population Growth, 1990-2000	1.9%	5.0%	3.4%
Annual Population Growth, 2000-2007	1.3%	3.3%	3.0%
As Percent of State Population in 1990	2.6%	2.6%	
in 2000	2.3%	3.0%	
in 2007	2.0%	3.1%	

Source: U.S. Bureau of Economic Analysis, Regional Economic Information Services (REIS)



Source: U.S. Bureau of Economic Analysis, Regional Economic Information Services (REIS)

Figure 8-12
Population Trends in Coconino and Mohave Counties and State of Arizona, 1990-2007



Source: U.S. Bureau of Economic Analysis, Regional Economic Information Services (REIS)

Figure 8-13
Coconino and Mohave Counties' Share of the State of Arizona's Total Population, 1990-2007

8.5 Population Projections for Coconino and Mohave Counties

Table 8-11 provides the projected population levels, the projected natural increases, and projected net-migrations and projected population increases for selected years for Coconino and Mohave counties from 2010 to 2060. Population projections for Coconino and Mohave counties are provided by the Arizona Department of Commerce. The population projections are based on 2005 population estimates and span until 2055.

8.5.1 Coconino County Population

Coconino County's population has been projected to grow at an annual rate of 0.83 percent, while the state's population is projected to grow at an annual rate of 1.56 percent over the next 50 years. The County's population, which was 132,826 persons in 2006, is projected to reach 207,101 persons in 2060. This translates to an increase in population of 74,275 persons (or 56 percent) between 2006 and 2060. Natural increase (birth minus death) is projected to account for 99 percent of the County's total projected population increase between 2006 and 2060.

Based on the State of Arizona population projections, the County's share of the state population will decline from 2.13 percent in 2006 to 1.52 percent in 2060, which implies that the County is projected to grow at lower rate than the state average.

8.5.2 Mohave County Population

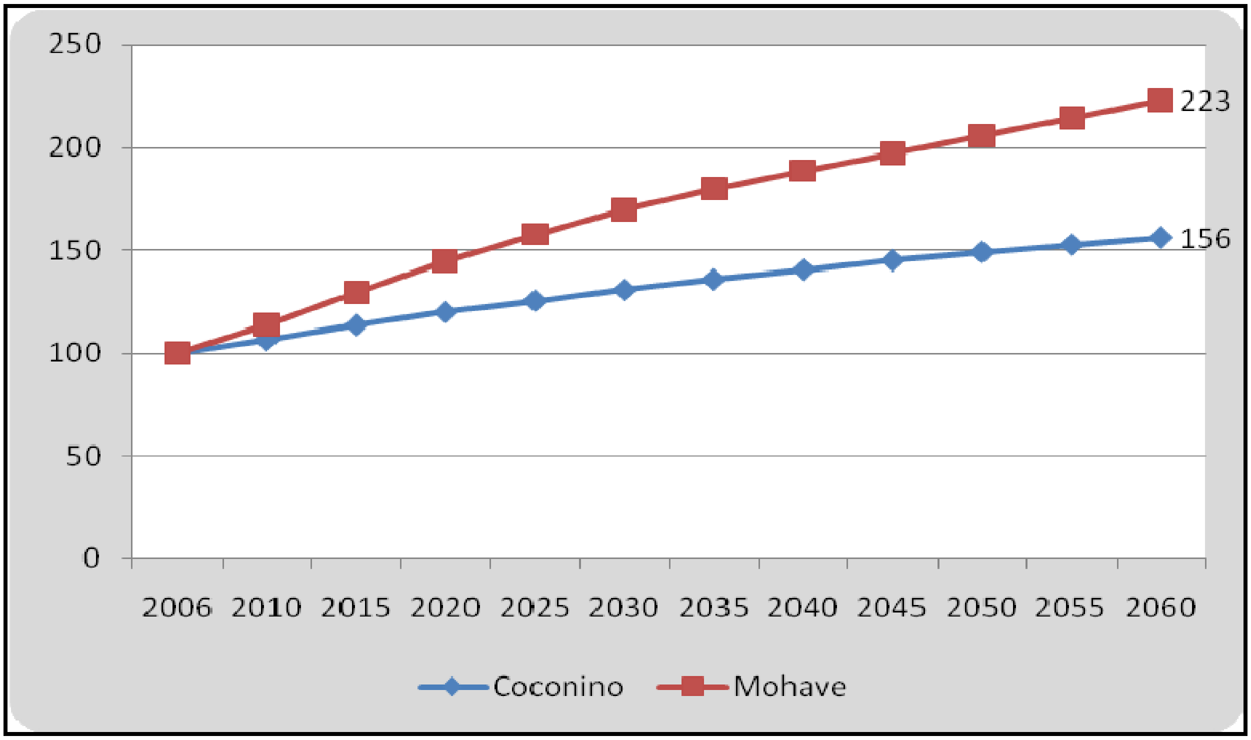
Mohave County's population has been projected to increase at an annual rate of 1.50 percent over the next 50 years. The County's population, which is estimated at 194,920 persons in 2006, is projected to reach 434,696 persons by 2060. This translates to an increase in population of 239,696 persons (or 123 percent) between 2006 and 2060. The 239,695 persons projected population increase in the County would result from a projected decline of 83,833 persons resulted from natural increases and a projected increase of 323,528 persons in net-migration.

Based on the State of Arizona population projections, the County's share of the state population will increase from 3.12 percent in 2006 to 3.26 percent by 2060, which implies that the County is projected to grow at higher rate than the state average.

Table 8-11
Population Projections for Coconino County and Mohave Counties, 2008-2060

Year	Coconino County				Mohave County			
	Population	Natural Increase [1,2]	Net Migration[2]	Projected Change[2]	Population	Natural Increase[1,2]	Net Migration[2]	Projected Change[2]
2006	132,826				194,920			
2010	141,451	5,818	2,807	8,625	221,443	(594)	27,117	26,523
2015	151,145	7,096	2,592	9,688	252,706	(1,732)	32,995	31,263
2020	159,336	6,659	1,527	8,186	281,668	(3,385)	32,347	28,962
2025	166,730	6,239	1,146	7,385	307,703	(5,378)	31,413	26,035
2030	173,825	6,150	945	7,190	330,581	(7,287)	30,165	22,878
2035	180,511	6,217	465	6,682	350,412	(8,962)	28,793	19,831
2040	186,856	6,462	(128)	6,334	367,952	(10,418)	27,958	17,540
2045	192,749	6,787	(909)	5,878	384,331	(11,372)	27,751	16,379
2050	198,134	7,204	(1,834)	5,370	400,695	(11,671)	28,035	16,364
2055	202,957	7,541	(2,733)	4,808	417,498	(11,535)	28,338	16,803
2060*	207,101	7,803	(3,674)	4,129	434,615	(11,499)	28,616	17,117
Change 2006-2060	74,275	73,976	204	74,275	239,695	(83,833)	323,528	239,695

Notes:
[1] Natural increase is the difference between births and deaths.
[2] The numbers represents the projected cumulative changes from preceding year.
Source: Arizona Department of Commerce



Source: Arizona Department of Commerce

Figure 8-14
Population Projection Growth Rates for Coconino and Mohave, 2006-2060

8.6 Economic Trends

This section summarizes the economic trends for Coconino and Mohave counties in Arizona.

8.6.1 Personal Income Trends

Table 8-12 shows Per Capita Personal Income (PCPI) and PCPI trends for Coconino and Mohave counties, and the State of Arizona from 1990 to 2007. The PCPI trends in current dollar and in real dollar (after adjusted for inflation) for Coconino and Mohave counties, and for the state of Arizona are presented in Figures 8-15 and 8-16, respectively. The personal income data for Coconino and Mohave counties is primarily influenced by communities south of the Grand Canyon (e.g. Flagstaff and Kingman) and are not representative of communities north of the Grand Canyon that would be affected by the LPP project (e.g. Fredonia and Colorado City).

- On a per capita basis, Coconino and Mohave counties' 2007 PCPI of $31,855 and $23,908 were below the statewide average of $32,833. Coconino and Mohave counties' 2007 PCPIs represent 97 percent and 73 percent of Arizona's PCPI, and 82 percent and 62 percent of the national PCPI, respectively (In 2007, Arizona's PCPI accounted for 85 percent of the national PCPI, which ranked Arizona 42nd in the nation).

- During 1990-2007, PCPI for Coconino and Mohave counties increased by 130 percent and 73 percent, respectively, while the state's PCPI increased by 93 percent.
- Coconino County's PCPI as a percentage of the state's PCPI increased from 81 percent in 1990 to 97 percent in 2007.

- Mohave County's PCPI as a percentage of state's PCPI decreased from 87 percent in 1990 to 73 percent in 2007.

- For the duration of 1990-2007, Coconino and Mohave counties and Arizona's PCPI grew at annual rates of 5.0 percent, 2.8 percent and 3.9 percent, respectively.

- From 1990 to 2007, the real PCPIs in Coconino and Mohave counties and Arizona changed by 57 percent, 10 percent, and 32 percent, respectively.

- From 1990 to 2007, the state increased its per capita purchasing power by $6,780; while Coconino and Mohave counties' per capita purchasing power increased by $9,872 and $1,860, respectively.

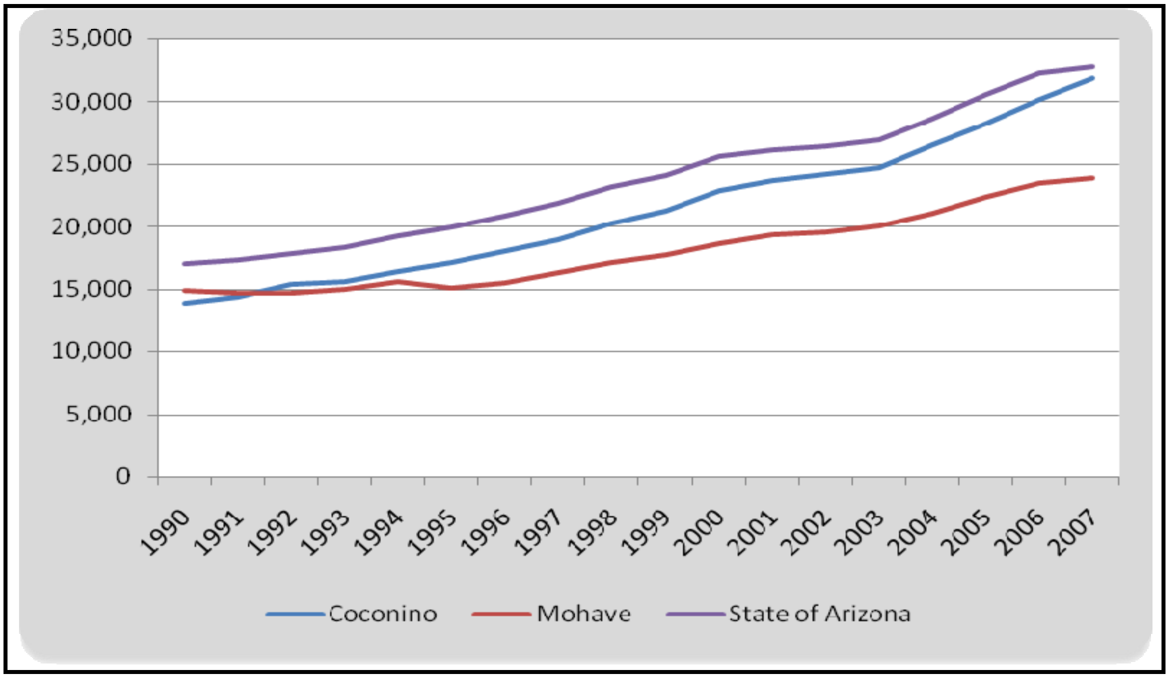
- Approximately, 16 percent and 14 percent of Coconino and Mohave counties populations had incomes below poverty level in 2007, respectively. Statewide about 14 percent of the population, in 2007, had incomes below the poverty line, which was comparable with 13 percent at the national level (U.S. Census Bureau).

- Coconino County's 2007 medium household income of $48,549 was comparable with the statewide average of $49,923, and Mohave County's 2007 medium household income was significantly below the statewide average (U.S. Census Bureau).

Table 8-12
Summary of Per Capita Personal Income (PCPI) Trends for
Coconino and Mohave Counties and Arizona State, 1990-2007

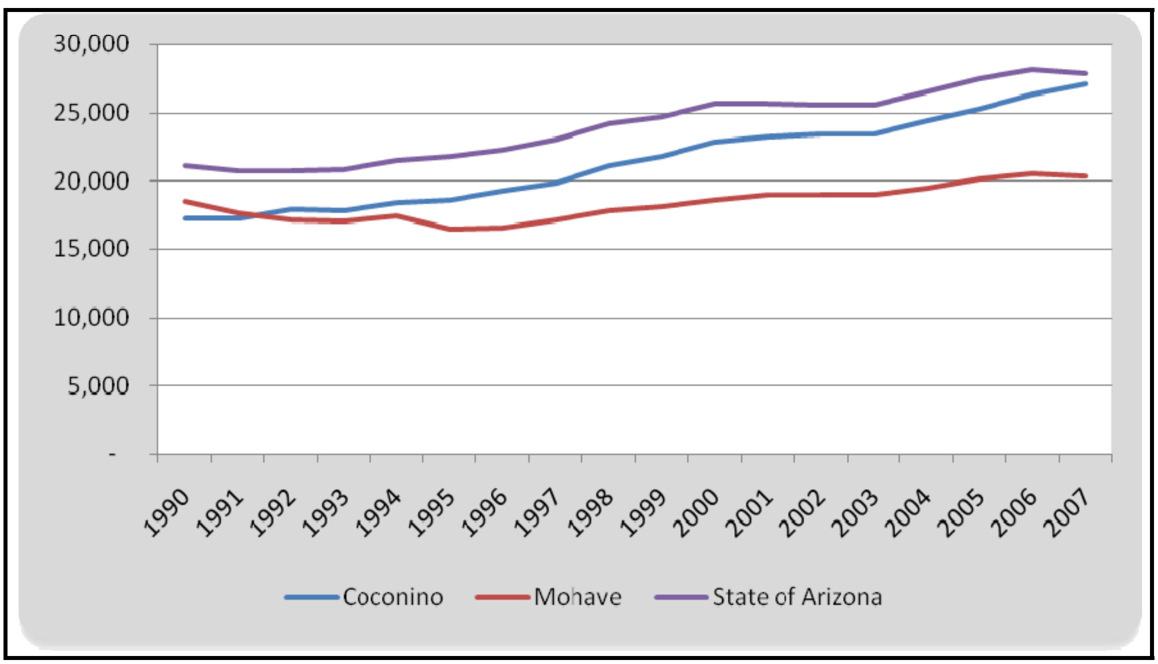
Personal Income Indicator	Coconino	Mohave	State of Arizona
PCPI, $			
in 1990	$ 13,847	$ 14,859	$ 17,005
in 2000	$ 22,808	$ 18,621	$ 25,656
in 2007	$ 31,855	$ 23,908	$ 32,833
PCPI as Percent of State			
in 1990	81%	87%	
in 2000	89%	73%	
in 2007	97%	73%	
Percent Change in PCPI,			
from 1990 to 2007	130%	61%	93%
from 1990 to 2000	65%	25%	51%
from 2000 to 2007	40%	28%	28%
Compounded Annual Growth Rate,			
from 1990 to 2007	5.0%	2.8%	3.9%
from 2000 to 2007	4.9%	3.6%	3.6%

Source: U.S. Bureau of Economic Analysis, Regional Economic Information Services (REIS)



Source: U.S. Bureau of Economic Analysis, Regional Economic Information Services (REIS)

Figure 8-15
Per Capita Personal Income (PCPI) Trends in Coconino and Mohave Counties and State of Arizona, 1990-2007 (in current $)



Source: U.S. Bureau of Economic Analysis, Regional Economic Information Services (REIS)

Figure 8-16
Real PCPI Trends in Coconino and Mohave Counties, and State of Arizona, 1990-2007, (in 2000$)

Table 8-13 presents total personal income (TPI), per capita personal income (PCPI), labor income, transfer payments and investment income in 1990, 1995, 2000 and 2007 for Coconino and Mohave counties and the State of Arizona.

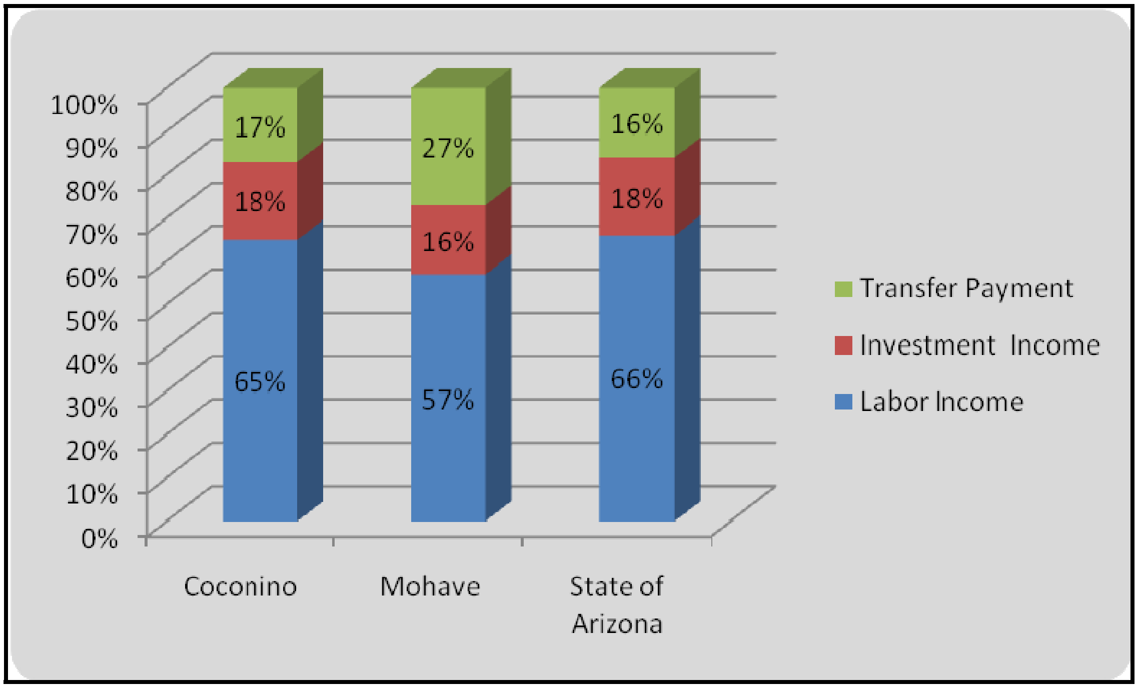
- From 1990 to 2007, TPIs for Coconino and Mohave Counties and the state increased by 202 percent and 230 percent, and 233 percent, respectively.

- From 1990 to 2007, while Mohave County had a higher percentage increase in TPI than the state average, the County's PCPI, as percentage of state's PCPI, declined from 87 percent in 1990 to 73 percent in 2007.

Table 8-13
Total Personal Income, Per Capita Personal Income, and Sources of Income for Coconino and Mohave Counties, and State of Arizona, Selected Years

Government Division	Total Personal Income ($ millions)	Per Capita Personal Income (PCPI)	PCPI as a Percent of State PCPI	Labor Income as a Percent of Personal Income	Investment Income as a Percent of Personal Income	Transfer Payment as a Percent of Personal Income
Coconino						
in 1990	$ 1,345	$ 13,847	81%	65%	22%	14%
in 1995	$ 1,890	$ 17,034	85%	64%	22%	14%
in 2000	$ 2,662	$ 22,808	89%	64%	23%	13%
in 2007	$ 4,057	$ 31,855	97%	65%	18%	17%
Mohave						
in 1990	$ 1,419	$ 14,859	87%	56%	24%	20%
in 1995	$ 1,967	$ 15,101	76%	54%	21%	24%
in 2000	$ 2,908	$ 18,621	73%	56%	21%	23%
in 2007	$ 4,683	$ 23,908	73%	57%	16%	27%
State of Arizona						
in 1990	$ 62,649	$ 17,005		64%	23%	13%
in 1995	$ 88,333	$ 19,929		65%	20%	15%
in 2000	$ 132,558	$ 25,656		68%	19%	13%
in 2007	$ 208,603	$ 32,833		66%	18%	16%

Source: U.S. Bureau of Economic Analysis, Regional Economic Information Services (REIS)



Source: U.S. Bureau of Economic Analysis, Regional Economic Information Services (REIS)

Figure 8-17
Source of 2007 Total Personal Income, Coconino and Mohave Counties and State of Arizona

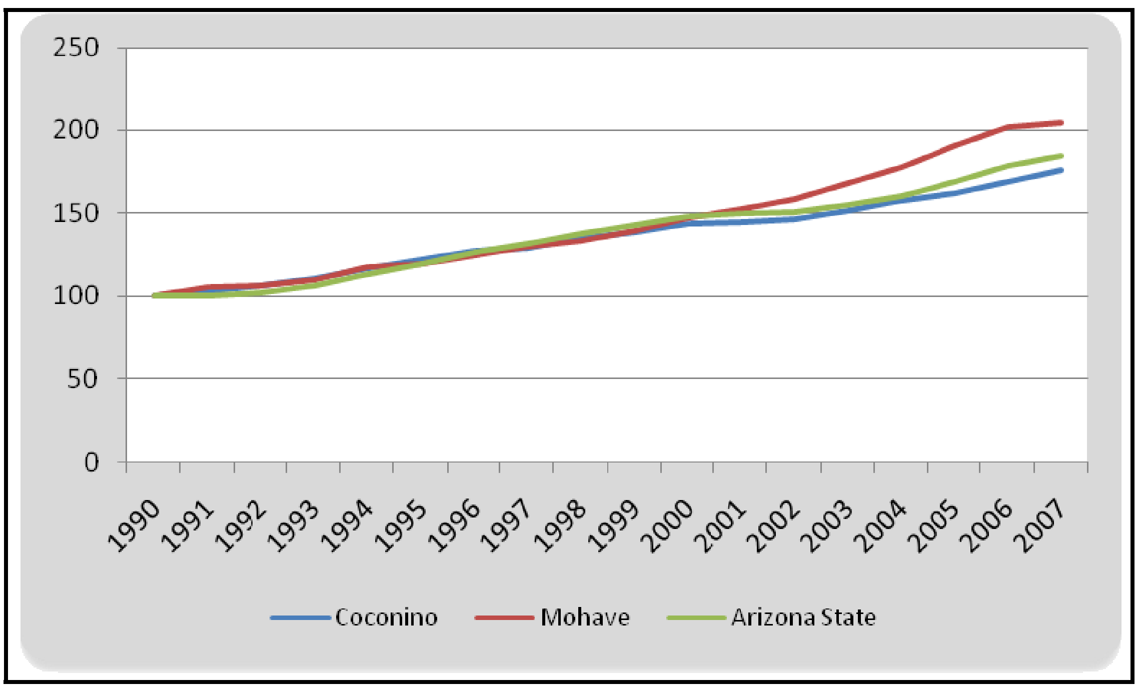
8.6.2 Employment Trends

In 2007, total employment for Coconino and Mohave counties were at 85,848 jobs, and 75,929 jobs, respectively (Table 8-13). Over 1990-2007, total employment in Coconino and Mohave counties and in the State of Arizona increased by 75 percent, 104 percent, and 84 percent, respectively. This translates to annual employment growth rates of 3.4 percent, 4.3 percent, and 3.7 percent for Coconino and Mohave counties and the State of Arizona, respectively (Table 8-14). The employment trends in Coconino County during the period 1990-2007 follow the employment trends in the State of Arizona as shown in Table 8-14 and Figure 8-18. However, in the 2000s, employment in Mohave County significantly outpaced the employment in the state (an annual employment growth rate of 4.8 percent compared to 3.2 percent annual growth rate for the state). The employment trend data for Coconino and Mohave counties is primarily influenced by communities south of the Grand Canyon (e.g. Flagstaff and Kingman) and are not representative of communities north of the Grand Canyon that would be affected by the LPP project (e.g. Fredonia and Colorado City).

Table 8-14
Summary of Employment Trends in Coconino and Mohave Counties and State of Arizona, 1980-2007

Employment Indicator	Coconino County	Mohave County	State of Arizona
Total Employment,			
in 1990	48,977	37,255	1,909,879
in 2000	70,286	54,637	2,819,302
in 2007	85,848	75,929	3,520,657
Percent Change in Employment,			
from 1990 to 2007	75%	104%	84%
from 1990 to 2000	36%	58%	40%
from 2000 to 2007	22%	39%	25%
Annual Rate of Growth,			
from 1990 to 2007	3.4%	4.3%	3.7%
from 1990 to 2000	3.7%	3.9%	4.0%
from 2000 to 2007	2.9%	4.8%	3.2%

Source: U.S. Bureau of Economic Analysis, Regional Economic Information Services (REIS)



Source: U.S. Bureau of Economic Analysis, Regional Economic Information Services (REIS) (Index set at 100)

Figure 8-18
Employment Trends in Coconino and Mohave Counties and State of Arizona, 1980-2007

Tables 8-15 and 8-16 provide the distribution of employment among selected sectors in Coconino and Mohave Counties in 2001 and 2007, respectively.

8.6.2.1 Coconino County Employment

Government, Accommodation and Food Services, Retail Trade, Healthcare and Social Services, and Real Estate and Rental Leasing sectors were the major employers in 2007 and they accounted for 19 percent, 15 percent, 11 percent, 10 percent and 8 percent of Coconino County's 2007 total employment, respectively. Coconino County employment grew from 70,636 to 85,848 between 2001 and 2007, a 22 percent increase (or 15,212 new jobs), whereas the State's and the nation's employment grew by 23 percent and 8 percent, respectively. As shown in Table 8-15, between 2001 and 2007, most of the sectors in Coconino County added jobs. The fastest growing employment sectors in terms of numerical values were Real Estate and Rental Leasing (added 3.447 new jobs), Healthcare and Social Services (added 3,106 new jobs), Accommodation and Food Services (added 2,239 new jobs), Retail Trade (added 2,081 new jobs), Construction (added 1,409 new jobs), and Manufacturing (added 1,159 new jobs).

Table 8-15
Percent of Employment by Industry in 2001 and 2007, Coconino County

Page 1 of 2

Employment Sector	**Employment**				Change in Employment	
	2001		2007		in %	# of jobs
Farm	327	0.5%	336	0.4%	3%	9
Ag. Services & Forestry	**(D)**	NA	233	0.3%	NA	NA
Mining	**(D)**	NA	241	0.3%	NA	NA
Utilities	199	0%	106	0.1%	-47%	(93)
Construction	4,018	6%	5,427	6%	35%	1,409
Manufacturing	3,071	4%	4,222	5%	37%	1,151
Wholesale Trade	904	1%	1,435	2%	59%	531
Retail Trade	8,620	12%	9,605	11%	11%	985
Transportation & Warehousing	2,111	3%	2,263	3%	7%	152
Information	768	1%	796	1%	4%	28
Finance & Insurance	1,640	2%	2,021	2%	23%	381
Real Estate, Rental & Leasing	3,053	4%	6,500	8%	113%	3,447
Professional & Technical Services	3,059	4%	3,859	4%	26%	800
Management of Companies	180	0%	124	0%	-31%	(56)
Administrative & Waste Services	2,263	3%	3,144	4%	39%	881
Educational Services	694	1%	1,085	1%	56%	391
Health & Social Services	7,117	10%	8,348	10%	17%	1,231
Arts, Entertainment & Recreation	2,633	4%	3,161	4%	20%	528
Accommodation & Food Services	10,254	15%	12,493	15%	22%	2,239
Other Services	3,436	5%	4,024	5%	17%	588

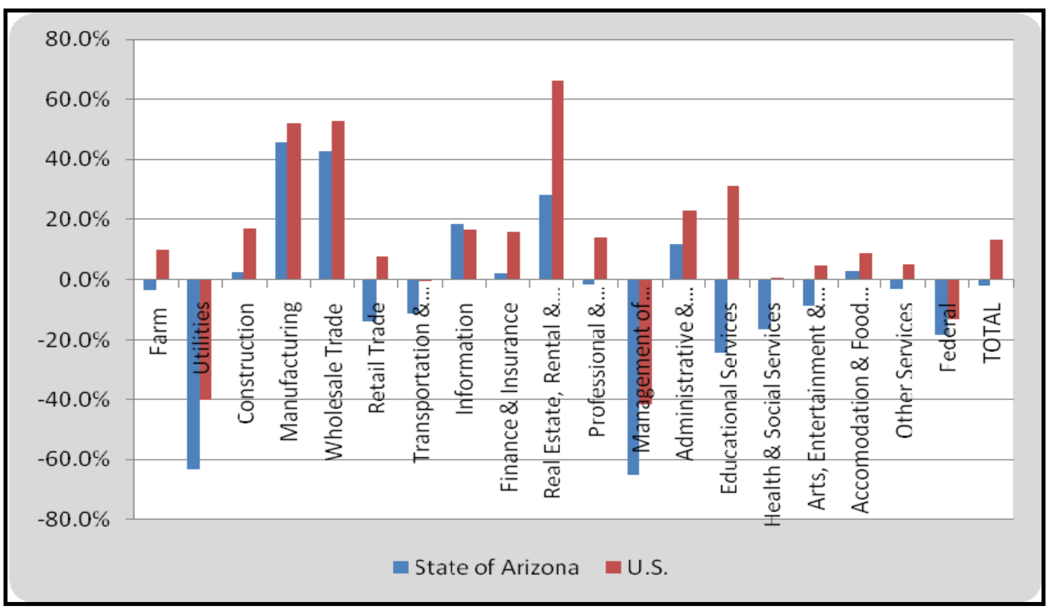
Table 8-15
Percent of Employment by Industry in 2001 and 2007, Coconino County

Page 2 of 2

Employment Sector	**Employment** 2001		2007		**Change in Employment** in %	# of jobs
Government	NA	NA	16,425	19%	NA	NA
Federal	3,557	5%	3,157	4%	-11%	(400)
State	**(D)**	NA	5,687	7%	NA	NA
Local	**(D)**	NA	7,581	9%	NA	NA
TOTAL	**70,636**	**99%**	**85,848**	**100%**	**22%**	**15,212**

Notes:
(D) implies information not disclosed.
Source: U.S. Bureau of Economic Analysis, Regional Economic Information Services (REIS)

Figure 8-19 shows how well various sectors of Coconino County's economy performed with respect to their counterparts at the State of Arizona and national levels. Overall, the employment growth in major economic sectors outpaced the employment growth at the state and national levels between 2002 and 2007. Among major economic sectors, the Manufacturing, Wholesale Trade, and Real Estate sectors significantly outpaced their counterparts at the state and national levels. The gains in employment in Retail, Transportation and Warehousing, Art and Entertainment, and Management of Companies sectors, however, were significantly slower than the state's.



Source: U.S. Bureau of Economic Analysis, Regional Economic Information Services (REIS)

Figure 8-19
The Percentage Difference in Employment Changes by Sector
Between 2001 and 2007, Coconino County vs. the State and the Nation

8.6.2.2 Mohave County Employment

Table 8-16 shows that, in 2007, Retail Trade, Government[9/], Construction, Healthcare and Social Services, Real Estate, Rental and Leasing and Accommodation and Food Services sectors were major employers in Mohave County, and accounted for 16 percent, 12 percent, 11 percent, 10 percent, 9 percent and 9 percent of the County's 2007 total employment, respectively. Between 2001 and 2007, Mohave County's employment grew from 56,501 to 75,929, a 34 percent increase (or 19,428 new jobs), whereas the employment at the state and national levels increased by 23 percent and 8 percent, respectively. Largest increases in employment between 2001 and 2007 occurred in Real Estate, Rental and Leasing (added 4,334 new jobs), Retail Trade (added 2,447 new jobs), Healthcare and Social Services (added 2,148 new jobs), Construction (added 1,735 new jobs), and Accommodation and Food Services (added 1,347 new jobs).

Table 8-16
Percent of Employment by Industry in 2001 and 2007, Mohave County
Page 1 of 2

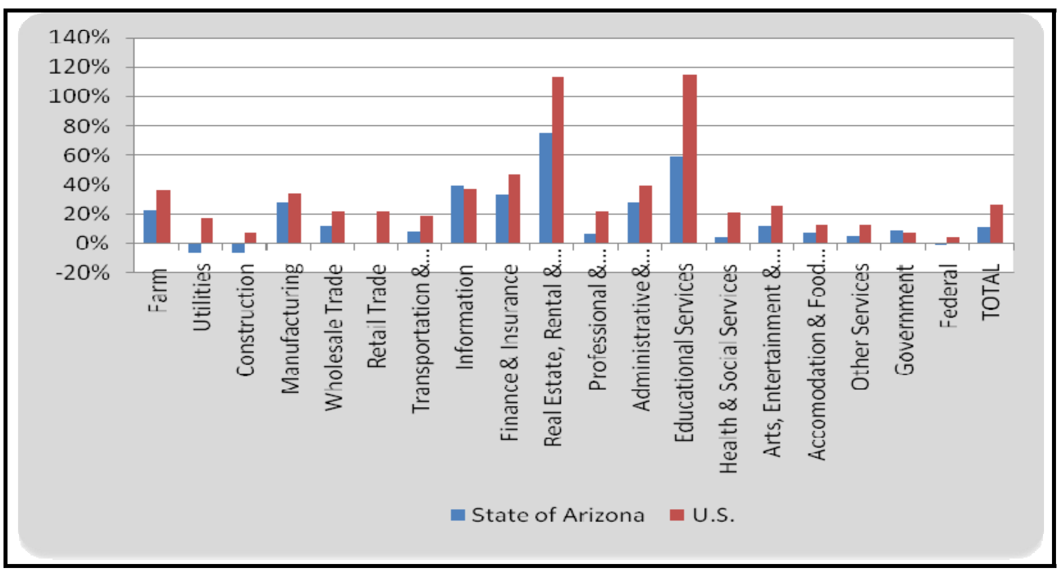
	Employment				**Changes in Employment**	
Employment Sector	2001		2007		%	# of jobs
Farm	430	0.8%	554	0.7%	29%	124
Ag. Services & Forestry	**(D)**	NA	**(D)**	NA	NA	NA
Mining	**(D)**	NA	274	0.4%	NA	NA
Utilities	299	1%	329	0.4%	10%	30
Construction	6,739	12%	8,474	11%	26%	1,735
Manufacturing	3,353	6%	4,014	5%	20%	661
Wholesale Trade	1,131	2%	1,446	2%	28%	315
Retail Trade	9,493	17%	11,940	16%	26%	2,447
Transportation & Warehousing	1,450	3%	1,841	2%	27%	391
Information	949	2%	1,178	2%	24%	229
Finance & Insurance	1,519	3%	2,342	3%	54%	823
Real Estate, Rental & Leasing	2,711	5%	7,045	9%	160%	4,334
Professional & Technical Services	1,892	3%	2,541	3%	34%	649
Management of Companies	180	0%	**(D)**	NA	NA	NA
Administrative & Waste Services	2,594	5%	4,023	5%	55%	1,429
Educational Services	322	1%	771	1%	139%	449
Health & Social Services	5,656	10%	7,804	10%	38%	2,148
Arts, Entertainment & Recreation	920	2%	1,293	2%	41%	373
Accommodation & Food Services	5,178	9%	6,525	9%	26%	1,347
Other Services	3,648	6%	4,563	6%	25%	915

[9/] The local government accounted for 83% of 2007 government jobs in Mohave County.

Table 8-16 **Percent of Employment by Industry in 2001 and 2007, Mohave County** **Page 2 of 2**						
	Employment				**Changes in Employment**	
Employment Sector	2001		2007		%	# of jobs
Government	7,774	14%	8,735	12%	12%	961
Federal	863	2%	919	1%	6%	56
State Government	**(D)**	NA	541	1%	NA	NA
Local Government	**(D)**	NA	7,275	10%	NA	NA
TOTAL	**56,501**	**100%**	**75,929**	**100%**	**34%**	**19,428**

Notes:
(D) implies information not disclosed.
Source: U.S. Bureau of Economic Analysis, Regional Economic Information Services (REIS)

Figure 8-20 shows how well various economic sectors of Mohave County's economy performed with respect to their counterparts at the state and national levels between 2001 and 2007. Overall, nearly all economic sectors in Mohave County added more jobs than their respective sectors at the state and national levels. The employment gains in Utilities and Construction sectors, however, were slightly below the State's. Among major economic sectors, Manufacturing, Information, Financing and Insurance, and Real Estate sectors added significantly more jobs than the state.



Source: U.S. Bureau of Economic Analysis, Regional Economic Information Services (REIS)

Figure 8-20
Percentage Difference in Employment Changes by Sector Between 2001 and 2007
Mohave County vs. the State and the Nation

8.6.3 Economic Base of Coconino and Mohave Counties

Table 8-17 shows the 2007 location quotients for Coconino and Mohave counties' economic sectors at North American Industrial Classification System (NAICS) one-digit level. LQ index identifies the economic activities that are significantly larger in those counties than in State of Arizona and the nation. The location quotients are calculated compared to State of Arizona's and the nation's economies. The economic base data for Coconino and Mohave counties is primarily influenced by communities south of the Grand Canyon (e.g. Flagstaff and Kingman) and are not representative of communities north of the Grand Canyon that would be affected by the LPP project (e.g. Fredonia and Colorado City).

8.6.3.1 Coconino County Economic Base

- A few sectors in Coconino County are clustered at the 1.0 quotient, indicating similar employment patterns as the state and the nation.

- Based on LQ index, as presented in Table 8-17, excess employment due to export activities are indicated in the following sectors: [10/]

    - Accommodation and Food Services (2.0, 2.1, **6,296** jobs)
    - State Government (2.7, 2.3, **3,579** jobs)
    - Arts, Entertainment & Recreation (1.8, 1.8, **1,439** jobs)
    - Federal (1.5, 1.4, **1,056** jobs)
    - Real Estate and Rental & Leasing (1.1, 1.7, **450** jobs)
    - These data imply that these sectors constitute the economic base of the County

- The retiree residents, seasonal retirees, student population in Northern Arizona University, and Flagstaff's role as a multi-counties trade center, are the reasons for excess employment in these sectors.

- The low quotients in Utilities (0.3, 0.4), Wholesale Trade (0.5, 0.5), Information (0.6, 0.5), Finance and Insurance (0.5, 0.5) Management of Companies (0.2, 0.1), and Administrative and Waste Services (0.4, 0.6) sectors, indicate that the County depends on import for a large portion of the goods and services provided by these sectors.

- Low LQs for Farm (0.6, 0.2) and Natural Resources (0.5, 0.5) sectors indicate the County's economy does not depend on resource-based sectors.

8.6.3.2 Mohave County Economic Base

As discussed in Section 8.6.2, Mohave County's per capita employment (the employment-population ratio) is considerably lower than the state and the nation averages (the 2007 per capita employment for Coconino and Mohave counties, and the state were estimated at 67 percent, 39 percent, and 55 percent, respectively). Researchers argue that the low per capita employment could lead to misleading results, if LQs are calculated based on employment. For this reason, LQs for Mohave County presented in Table 8-17 are based on employment and per capita employment.

[10/] See footnote 3 for definition of values in parentheses.

- As Table 8-17 shows, there are significant differences between LQs based on employment and per capita.

- The economic activities in Construction (1.0, 1.1), Retail Trade (0.9, 1.0), and Real Estate, Rental and Leasing (0.9, 1.3) are important driving forces in the County's economy. The in-migrating retiree, Federal government and tourism are important contributors to the economy (see footnote 6 for definition of values in parentheses).

- Majority of economic sectors in the County have LQs significantly below 1.0 indicating that the County depends on import for a large portion of the goods and services provided by these sectors.

- Low LQ for Farming sector (0.7, 0.3) indicates low farming activities in the County.

Table 8-17
Location Quotients, Coconino and Mohave Counties
Compared to Arizona State and the United States, 2007

Page 1 of 2

Employment Sector	Compared to Arizona			Compared to U.S.			
	Coconino County	Mohave County		Coconino County	Mohave County		State of Arizona
		Employment	Per Capita		Employment	Per Capita	
Farm	0.6	1.1	0.7	0.2	0.2	0.3	0.4
Ag. Services & Forestry	0.5	NA	NA	0.5	0.5	NA	1.0
Mining	0.6	0.8	0.6	0.5	0.5	0.4	0.8
Utilities	0.3	1.2	0.8	0.4	0.4	0.9	1.2
Construction	0.8	1.4	1.0	1.0	1.0	1.1	1.3
Manufacturing	0.9	1.0	0.7	0.6	0.6	0.4	0.7
Wholesale Trade	0.5	0.5	0.4	0.5	0.5	0.3	0.9
Retail Trade	1.0	1.3	0.9	1.0	1.0	1.0	1.1
Transportation & Warehousing	1.0	0.9	0.6	0.8	0.8	0.5	0.8
Information	0.6	1.0	0.7	0.5	0.5	0.5	0.8
Finance & Insurance	0.5	0.6	0.4	0.5	0.5	0.4	1.1
Real Estate, Rental & Leasing	1.1	1.3	0.9	1.7	1.7	1.3	1.6
Professional & Technical Serv.	0.7	0.5	0.4	0.7	0.7	0.3	0.9

Table 8-17
Location Quotients, Coconino and Mohave Counties
Compared to Arizona State and the United States, 2007

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Employment Sector	Compared to Arizona			Compared to U.S.			
	Coconino County	Mohave County		Coconino County	Mohave County		State of Arizona
		Employment	Per Capita		Employment	Per Capita	
Management of Companies	0.2	NA	NA	0.1	0.1	NA	0.8
Administrative & Waste Serv.	0.4	0.6	0.4	0.6	0.6	0.6	1.4
Educational Services	0.8	0.6	0.4	0.6	0.6	0.3	0.8
Health & Social Services	1.1	1.2	0.8	1.0	1.0	0.7	0.9
Arts, Entertainment & Recreation	1.8	0.8	0.6	1.8	1.8	0.5	1.0
Accommodation &Food Serv.	2.0	1.2	0.8	2.1	2.1	0.8	1.1
Other Services	1.0	1.3	0.9	0.8	0.8	0.7	0.9
Government	1.5	0.9	0.6	1.4	1.4	0.6	1.0
Federal	1.5	0.5	0.3	1.4	1.4	0.3	0.9
State Government	2.7	0.3	0.2	2.3	2.3	0.2	0.9
Local Government	1.1	1.2	0.9	1.1	1.1	0.8	1.0

Source: Calculated from data provided by U.S. Bureau of Economic Analysis, REIS

Chapter 9
Kaibab-Paiute Indian Reservation Baseline and Impacts

The Kaibab-Paiute Indian Reservation is located in northeastern Mohave County and northwestern Coconino County spanning both Counties adjacent to the southern Utah border (Figure 9-1). It is the homeland of a branch of the Southern Paiute tribe of Native Americans. It covers a land area of 189 square miles (or 120,413 acres) of plateau and desert grassland. A vast majority of the reservation land is undeveloped. Elevations range from 4400 feet to over 7000 feet above mean sea level, spanning semi-arid to alpine environments. Surface waters on the reservation are produced by spring run-off and to a limited degree, Kanab Creek.

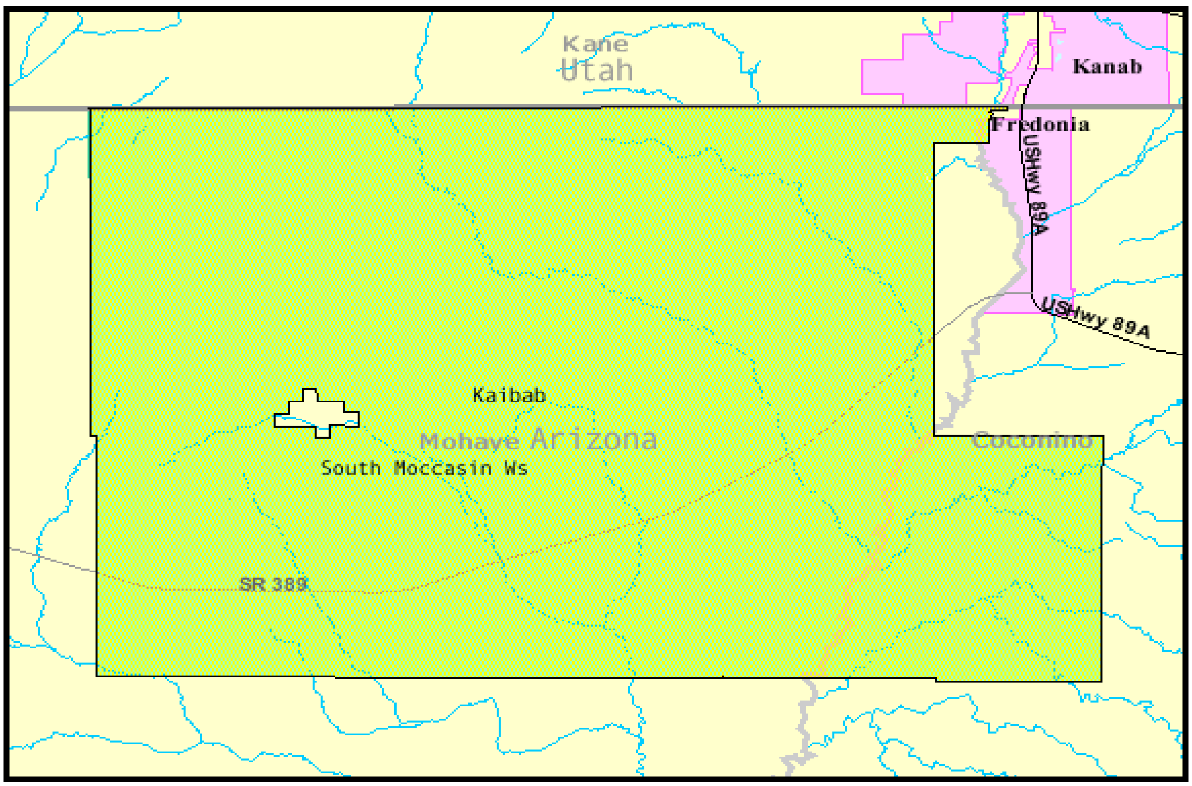

Figure 9-1
Kaibab-Paiute Indian Reservation

According to the 2000 Census, there were 196 people and 65 households residing on the reservation. The median age at the reservation was 21.6 years, with 44 percent of the population under the age of 18. The population density was 0.4/km² (1/mi²). The average household size was 3.02 and the average family size was 3.49. The median income for a household on the reservation was $20,000, and the median income for a family was $21,250. The per capita income for the reservation was $7,951. About 29.69 percent of families and 31.65 percent of the population were below the poverty line.

The Kaibab-Paiute Indian Reservation economy relies heavily on the tourism and the livestock industry. Regional attractions such as Pipe Spring National Monument, with a tourism complex containing the Zion

Natural History Association bookstore, and the old Mormon Fort at Pipe Springs also attract visitors. Numerous land and road-use leases also provide revenue.

Most of the businesses on the Kaibab-Paiute Indian Reservation are owned and operated by the Kaibab Band of Paiute Indians, and include a visitor's center at Pipe Spring National Monument (operated jointly with the National Park Service) and a convenience store/gas station which the tribe operates along with an RV park and campground. The tribe also is involved in agriculture, and owns a 1,300-tree fruit orchard.

Additional analyses are forthcoming to determine Project construction, income, and potential tax opportunities for Tribal members and the Tribal government. The Project economic impacts on the Kaibab Band of Paiute Indians will be influenced by the Project configuration and proximity of construction staging areas to the Kaibab-Paiute Indian Reservation.

It is assumed that any Executive Order Environmental Justice issues would be reconciled, or mitigated, per consultations with the Kaibab Band of Paiute Indians.

Chapter 10
Qualitative Economic Issues and Impacts

Additional analyses are forthcoming to better assess and describe the more qualitative (or non-quantified economic impacts at this time) surrounding LPP project development.

These items will include: 1) general concerns about regional economic growth and community lifestyle changes (should there be growth controls in the area); 2) non-Project development impacts on declining groundwater aquifer resources; 3) non-Project development impacts associated with substantial water demand reductions per capita within the study area, as a programmatic curtailment option; and 4) other employment, income and other economic impacts.

The Project will contribute to the long-term economic stability and general development of the region. To the extent that it off-sets higher cost water resources projects or maintains an attractive lifestyle for the region, it provides more dollars to be allocated to economic sectors other than infrastructure.

References and Citations

The literature reviewed in this study report includes information from established agency sources such as the State of Utah, State of Arizona, Bureau of Reclamation, Water Conservation Districts, U.S. Census Bureau, Tribal data, the Sonoran Institute (web site reviewed for pertinent data); previous and ongoing investigation work performed by engineering and scientific consultants and organizations; and forecasts and planning information provided from state and local sources (Vision Dixie population forecast (housing) was reviewed). The following represents the key references and sources used in compiling this draft report.

Arizona Department of Commerce, 2008. Population Statistics Unit, 2006-2055 Commerce Population Projections. Available online at *http://www.commerce.state.az.us/EconInfo/Demographics/Population+Projections.htm*

Bonneville Power Administration/CEATI, 2009. BPA Rate Case Data and CEATI Non-Energy (and Power Benefits) of Hydro Power Generation, Portland, Oregon and Montreal, Canada (Data for Wing Turbine Integration within the Pacific Northwest Power System).

Bureau of Economic Analysis, U.S. Dept. of Commerce. 2003a. Regional accounts data, local area personal income, Washington, D.C. Website: http://www.bea.gov/regional/reis.

__________. 2003b. Regional accounts, regional economic multipliers. Washington, D.C. website: http://www.bea.gov/regional/reis.

__________, University of Utah. 2003a. Economic indicators for Utah counties, 1997-2001. Salt Lake City, Utah. Website: http://www.business.utah.edu/bebr/utah.htm.

__________. 2003b. Single-family home building in Utah highest in 25 years. Press release, May 9, 2003. Salt Lake City, Utah. Website: http://www.business.utah.edu/bebr/utah.htm.

California Department of Water Resources, 2008. Economic Analysis Guidebook for Water Resources Development, Sacramento, California (and on web site).

Federal Energy Regulatory Commission, 2009. Electric Power Market (Value) Data, Historical and Current for Peak and Off-Peak Regional Power Sales, Washington, D.C., (main web site data and information).

Governor's Office of Planning and Budget State of Utah, 2001, 2008, 2009. Demographic and Economic Analysis Division, State of Utah Accuracy Analysis: Demographic and Economic Projections, and State Input-Output Model Data, 2001, March 2008-09.

Kane County Water Conservancy District (KCWCD). 1997. Water Resource Management Plan.

MWH Americas, Inc. (MWH). 2008-09 "Lake Powell Pipeline Study: Water Needs Assessment", Phase I Report, Final Draft, August 2008-June 2009 and Follow-Up.

___________. 2009-2010. Preliminary Engineering and Environmental Studies (Construction) Cost Estimates for the Lake Power Pipeline Project (with Hydro Power Configuration); and multiple communications with engineering staff. Technical studies include marginal power costs review for the Palo Verde power system hub (report prepared by ANL for MWH).

Minnesota IMPLAN Group, Inc. 2007. The IMPLAN Input-Output Model and Model Data Sets, 2007.

Northwest Power and Conservation Planning Council. 2009. 6th Northwest Power Plan and Technical Appendices, Portland Oregon, and Personal Communications with Economics Staff.

U.S. Dept. of Commerce, Bureau of Economic Analysis, Washington DC, Regional Economic Information Services (REIS), Data Sets, 1990-2007; and Bureau of Labor Statistics Data Sets, 2000-2007. http://www.bls.gov/data#employment.

U.S. Dept. of Commerce, Federal Energy Management Program. 2008. Energy Price Indices and Discount Factors for Life-Cycle Cost Analysis-April 2008. NISTIR 85-3273-23.

United States Census Bureau 2000 and 2007. Available online at www.census.gov

U.S. Bureau of Reclamation (Reclamation), Technical Services Center. 2010. Hydropower Economics, Lake Power Pipeline Study. USBR-TSC, Denver, Colorado.

U.S. Bureau of Reclamation (Reclamation). 2008. Annual Operating Plan for Colorado River Reservoirs. http://www.usbr.gov/lc/region/g4000/aop05_final.pdf; also USBR Developed Power System Data for Marginal Costs.

__________ . 2008. Economics Technical Report for the Yakima River Basin and Yakima River Basin Water Storage Feasibility Study, Washington. Technical Series No. TS-YSS-23. USBR Pacific Northwest Region and TSC Denver, Colorado. January 2008. Recent USBR and WA State Dept. of Ecology report on the Odessa Subarea Special Study, Columbia Basin Project, Washington, October 2010, was reviewed as well (TSC Denver).

__________.1995. Operation of the Glen Canyon Dam Colorado River Storage Project, Arizona. Final Environmental Impact Statement. March 1995.

United States Census Bureau 2000 and 2006. Population Data Finder and Area Profile Data Finder. Website: http://www.census.gov/

U.S. Congress. 1998. Public Law 105-355. Title II – Grand Staircase-Escalante National Monument. Section 202, Utility Corridor Designation, U.S. Route 89, Kane County, Utah. November 6, 1998.

Utah Division of Water Resources (UDWR). 2007. *Draft municipal and industrial water supply and uses in the Cedar/Beaver Basin (Data collected for the year 2005)*. November 2007.

__________. 2009. *Municipal and industrial water supply and uses in the Kanab Creek/Virgin River Basin (data collected for the year 2005)*. January 2009.

__________. 2011. *Water Needs Assessment, Draft, Lake Powell Pipeline.* Prepared by MWH, Inc. March 2011.

Utah Governor's Office of Planning and Budget (GOPB). 2007. Population Estimates for the State of Utah and Utah Counties 1940 to 2007. Available online at http://www.governor.utah.gov/dea/popestimates.html.

Utah Governors' Office of Planning and Budget (GOPB), 2008. Detailed Demographic and Economic Projections. Available online at http://www.governor.utah.gov/dea/popprojections.html

Utah Governors' Office of Planning and Budget (GOPB), 2008. Detailed Demographic and Economic Projections. Personal Communications with Staff. http://www.governor.utah.gov/dea/popprojections.html

__________. 2008. Detailed Demographic and Economic Projections. Available online at http://www.governor.utah.gov/dea/projections.html.

Washington County Water Conservancy District (WCWCD). 2011. Electricity vs. Natural Gas, An Evaluation of Available Options to Power the Lake Powell Pipeline Pump Stations. Available from the WCWCB, St. George, Utah, office (December 19, 2011).

Washington County Water Conservancy District (WCWCD). 2005b. *Water Line Water for Today and Tomorrow* Website: http://wcwcd.state.ut.us/District%20Info/Waterlines

__________.2006. *Water Line Water for Today and Tomorrow* Website: http://wcwcd.state.ut.us/District%20Info/Waterlines

__________.2007. *Water Line Water for Today and Tomorrow* Website: http://wcwcd.state.ut.us/District%20Info/Waterlines

Water Resources Council. 1983. Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies, and agency modifications thereof. Washington, D.C.: USGPO.

(http://library.nau.edu/speccoll/exhibits/indigenous_voices/kaibab_paiute/overview.html).

Personal Communications (multiple) with staff from BPA, FERC, MWH, State of Utah DWR, USBR, Governor's Office of Planning and Budget staffs, 2009-2010.

Abbreviations and Acronyms

Abbreviation/Acronym	Meaning/Description
Alt.	Alternative
BEA	Bureau of Economic Analysis
BLM	U.S. Bureau of Land Management
BPS	Booster Pump Station
CBPS	Cedar Booster Pump Station
CICWCD	Central Iron County Water Conservancy District
Commission	Federal Energy Regulatory Commission
FERC	Federal Energy Regulatory Commission
FTE	Full Time Equivalent
GOPB	Utah Governor's Office of Planning and Budget
gpcd	gallons per capita per day
GSENM	Grand Staircase-Escalante National Monument
HS	Hydro System
KCWCD	Kane County Water Conservancy District
LPP	Lake Powell Pipeline
LQ	Location Quotient
M&I	Municipal and Industrial
MSL	Mean Sea Level
MWh	Megawatts per hour
MWH	MWH Americas, Inc.
NAICS	North American Industrial Classification System
NED	Natural Economic Development
NPPC	Northwest Power Planning Council
NPS	National Park Service
NRCS	Natural Resources Conservation Service
O&M	Operation and Maintenance
OM&R	Operation Maintenance & Replacement
PAD	Preliminary Application Document
PCPI	Per Capita Personal Income
PV	Present Value
RED	Regional Economic Development
REIS	Regional Economic Information Services
RO	Reverse Osmosis
SITLA	School and Institutional Trust Lands Administration
TDS	Total Dissolved Solids
TPI	Total Personal Income
UDWR	Utah Division of Water Resources
WCH	Water Conveyance Hydro
WCWCD	Washington County Water Conservancy District

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Appendix A

Table A-1 Household Number and Household Size Projections for Washington, Iron, and Kane Counties, 2008-2060						
	Washington		**Iron**		**Kane**	
Year	**Household Number**	**Household Size**	**Household Number**	**Household Size**	**Household Number**	**Household Size**
2008	52,855	2.84	14,904	3.15	2,527	2.60
2010	59,396	2.83	16,135	3.14	2,639	2.61
2015	76,960	2.85	19,172	3.09	2,960	2.65
2020	96,788	2.89	22,367	3.05	3,246	2.69
2025	118,904	2.91	26,095	2.98	3,525	2.72
2030	142,916	2.91	30,131	2.91	3,825	2.72
2035	168,334	2.89	34,368	2.87	4,150	2.69
2040	195,188	2.87	38,944	2.83	4,509	2.67
2045	222,738	2.85	43,796	2.81	4,930	2.65
2050	250,904	2.83	49,250	2.79	5,395	2.64
2055	279,723	2.81	55,126	2.76	5,926	2.65
2060	309,273	2.78	61,530	2.74	6,527	2.65
Change 2008-2060	**256,418**	**-5.8%**	**46,626**	**-42%**	**4,000**	**4.2%**
Source: Governor's Office of Planning and Budget, 2008 Baseline Projections						

Table A-1 shows household number and household size projections for Washington, Iron, and Kane counties, from 2008 to 2060. The GOPB projects total household number in Washington, Iron, and Kane counties to grow 485 percent (an annual growth rate of 3.9 percent), 313 percent (an annual growth rate of 2.8 percent), and 158 percent (an annual growth rate of 1.8 percent) from 2008 to 2060, with 256,428, 46,626, and 4,000 additional households projected to be added by 2060, respectively.

Table A-2 Employment Projections for Washington, Iron, and Kane Counties, 2008-2060			
Year	**Washington**	**Iron**	**Kane**
2008	81,040	25,117	4,732
2010	91,146	27,470	5,011
2015	121,795	32,993	5,590
2020	154,566	37,391	6,028
2025	187,975	41,892	6,470
2030	220,700	46,920	6,986
2035	251,731	52,263	7,534
2040	280,387	58,035	8,133
2045	306,288	63,970	8,733
2050	329,210	70,096	9,343
2055	348,971	76,250	9,954
2060	365,981	82,610	10,580
Change 2008-2060	**284,941**	**57,493**	**5,848**
Source: Governor's Office of Planning and Budget, 2008 Baseline Projections			

The GOPB projects total employment in Washington, Iron, and Kane Counties to grow 352 percent (an annual growth rate of 2.9 percent), 229 percent (an annual growth rate of 2.3 percent), and 124 percent (an annual growth rate of 1.6 percent) from 2008 to 2060, with 284,941, 57,493, and 5,848 new jobs are projected to be added by 2060, respectively.

Table A-3
Population Projections for Major Cities in Washington, Iron and Kane Counties, 2010-2060

Local Government Division	2010	2020	2030	2040	2050	2060
Washington County	**168,078**	**279,864**	**415,510**	**559,670**	**709,674**	**860,378**
St. George City	84,245	140,268	208,254	280,507	355,703	431,239
Washington City	22,858	38,285	57,050	77,011	97,793	118,818
Hurricane City	16,381	27,287	40,512	54,568	69,193	83,887
Remaining Cities	44,594	74,024	109,695	147,585	186,985	226,434
Iron County	**50,601**	**68,315**	**87,644**	**110,257**	**137,240**	**168,383**
Cedar City	29,907	40,376	51,799	65,165	81,113	99,516
Enoch City	5,302	7,157	9,181	11,551	14,379	17,642
Remaining Cities	15,392	20,782	26,664	33,541	41,748	51,225
Kane County	**6,893**	**8,746**	**10,394**	**12,034**	**14,267**	**17,276**
Kanab City	4,111	5,216	6,198	7,177	8,509	10,304

Source: Governor's Office of Planning and Budget, 2008 Baseline Projections

Table A-3 shows population projections for major cities in Washington, Iron, and Kane counties between 2010 and 2060. St. George City, which is currently the largest city in the southwest Utah counties, is projected to become the largest city in Utah by 2040. The City's population is projected to increase from 72,718 persons in 2008 to 431,239 persons in 2060 (an increase of 358,521 persons or an increase of 493 percent).