Chapter 5
Environmental Analysis

5.3.1 Geology and Soil Resources

5.3.1.1 Affected Environment

5.3.1.1.3 Fault Movement.
Pg. 5-30, 5th paragraph
The fault crossings evaluated for the LPP pipelines and penstocks are summarized in Table 5-3. The fault crossings evaluated to be of potentially high relevance for the LPP pipelines and penstocks are the Sevier fault, the Hurricane fault, and the West Grass Valley fault. The Sevier fault crosses the South, Existing Highway, Southeast Corner, and South Variant alternatives. The Sevier fault hazard was designated as potentially high relevance based on evidence of Quaternary displacement and the presence of a 3- to 4-foot scarp just south of the Existing Highway Alternative alignment and the displacement of 5 to 6 feet of alluvium near the South Alternative alignment. The Hurricane Fault is crossed by the LPP Hydro alignment common to all alternatives. It is designated as potentially high relevance because of its potential for generating high-magnitude earthquakes, recent movement and relatively high recurrence intervals. The West Grass Valley fault hazard was designated as potentially high relevance based on displacement of the approximately 1 million-year-old Grass Valley Basalt and the potential for reactivation of the fault because of its proximity to the main trace of the Hurricane fault. These fault crossings are not located near populated areas, decreasing the potential risk of effects associated with a pipeline rupture.

5.3.1.1.6 Subsidence, Expansion and Collapsible Soils.
Pg. 5-40, 3rd paragraph
Soils along the LPP alignments are typically composed of alluvial, eolian and fluvial deposits and terraces. Some soils are weathered-in-place residual soils over shallow sedimentary bedrock. Soils east of the Cockscomb are typically eolian sand derived from the Navajo, Entrada and Page Sandstone formations. Soils over the Carmel Formation are typically weathered shale, limestone and sandstone and the shale typically contains gypsum. Soils along the South, Existing Highway, Southeast Corner, and South Variant alternatives typically consist of clay, silty loam, silty clay loam, or sandy loam. The soils are mostly weathered from the Moenkopi Formation and are shale, sandstone, or limestone derived. Soils in the Shinarump Member of the Chinle Formation consist of coarse sand and gravel weathered from the sandstone and well-rounded gravel conglomerate. Soils in the Petrified Forest Member of the Chinle Formation are primarily plastic clays, or occasionally, fine sands. The soil near Sand Hollow Reservoir consists of variable depths of windblown sand derived from weathering of Navajo Sandstone outcrops.

5.3.1.1.9 Borrow and Spoil.
Pg. 5-61, 2nd paragraph
A preliminary comparison between the excavated volumes and the volumes of materials needed for construction of all alternatives indicates a surplus of soil for all alternatives. Rock for bedding material would be sufficient for the total required volume for the South, Southeast Corner, and South Variant alternatives. The amount of soil that would need to be used for bedding is

estimated at 0 percent for the South Alternative, 48.5 percent for the Existing Highway Alternative, 0 percent for the Southeast Corner Alternative, and 0 percent for the South Variant Alternative. The surplus soil would be spread across the ROW along the pipeline and penstock alignments. The total estimated area of the ROW for the pipeline portions of the alternatives is 2,624 acres for the South Alternative, 2,316 acres for the Existing Highway Alternative, 2,589 acres for the Southeast Corner Alternative, and 2,581 acres for the South Variant Alternative. The preliminary analysis indicates the spread and compacted spoils would be up to approximate 6 inches thick for the South Alternative, 4 inches thick for the Existing Highway Alternative, 7 inches thick for the Southeast Corner Alternative, and 5 inches thick for the South Variant Alternative. The spoils would be spread in a manner to blend with original topography and drainages with periodic swales or rolling dips to promote natural drainage patterns.

5.3.1.2 Environmental Effects

5.3.1.2.2 Effects of South Alternative Construction.

Section 5.3.1.2.2.7 Borrow and Spoil
Pg. 5-69, 3rd paragraph
The South Alternative would have no measurable effects on borrow material development for pipeline and penstock bedding or spoil material disposal. Rock excavated along the alignment suitable for crushing would meet the pipeline and penstock bedding requirements and no bedding material would need to be imported from commercial gravel pits. The South Alternative would not require expanding or developing additional gravel resources to meet construction demands for the LPP pipeline and penstock alignments. All rock would be used for bedding, backfill, or maintenance road construction. Soil would be used for backfill. Excess soil not used as backfill or for dam construction would be spread and compacted on the pipeline and penstock ROW, an area of approximately 2,624 acres, and compacted to a thickness of up to approximately 6 inches. No additional spoil disposal areas would be required and spoil disposal along the pipeline and penstock alignments would be within the excavated trenches, covered with previously segregated topsoil, and revegetated at approximate original contours. Rolling dips would be contoured in to the spoils as needed to accommodate natural drainage patterns. The South Alternative would have no significant effects resulting from borrow material development and spoil material disposal.

5.3.1.2.4 Existing Highway Alternative Construction Effects.

Section 5.3.1.2.4.7 Borrow and Spoil
Pg. 5-73, 5th paragraph
Excess soil not used as backfill or for dam construction would be spread and compacted on the pipeline and penstock ROW, an area of approximately 2,316 acres, and compacted to a thickness of up to approximately 4 inches if sufficient suitable soil can be obtained from the excavated material to make up for the deficit in pipe bedding. If not, the estimated compacted thickness of soil would be approximately five inches. No additional spoil disposal areas would be required and spoil disposal along the pipeline and penstock alignments would be within the excavated trenches, covered with previously segregated topsoil, and revegetated at approximate original contours. Rolling dips would be contoured into the spoils as needed to accommodate natural

drainage patterns. The Existing Highway Alternative would have no significant effects resulting from spoil material disposal.

5.3.1.2.6 Southeast Corner Alternative Construction Effects.

Section 5.3.1.2.6.1 Borrow and Spoil
Pg. 5-75, 5th paragraph
All rock would be used for bedding, backfill, or maintenance road construction. Soil would be used for backfill. Excess soil not used as backfill or for dam construction would be spread and compacted on the pipeline and penstock ROW, an area of approximately 2,589 acres, and compacted to a thickness of up to approximately 7 inches. No additional spoil disposal areas would be required and spoil disposal along the pipeline and penstock alignments would be within the excavated trenches, covered with previously segregated topsoil, and revegetated at approximate original contours. Rolling dips would be contoured in to the spoils as needed to accommodate natural drainage patterns. The Southeast Corner Alternative would have no significant effects resulting from spoil material disposal.

This is a new Section 5.3.1.2.8 and Section 5.3.1.2.9. Section heading numbers of the remaining sections in Section 5.3.1.2 are increased accordingly.

5.3.1.2.8 South Variant Alternative Construction Effects.
Construction effects associated with fault movement, seismic activity, rockfall and steep slopes, expandable, collapsible, or subsiding soils or rocks, geologic hazards on human health and safety, important structures and mineral resources, Intake Pump Station, and Hurricane Cliffs forebay and afterbay reservoir areas would be the same as described for the South Alternative in Section 5.3.1.2.2.

5.3.1.2.8.1 Borrow and Spoil.
The South Variant Alternative would have measurable effects on borrow material development for pipeline and penstock bedding. Rock excavated along the alignment suitable for crushing would meet all the pipeline and penstock bedding requirements. The South Variant Alternative would not require expanding additional gravel resources to meet construction demands for the LPP pipeline and penstock alignments.

The material generated as part of the pipeline and penstock construction consists of the following categories:

- Blastable (hard rock such as hard limestone and well-cemented sandstone)
- Rippable (soft rock such as shale, mudstone, soft limestone, and poorly-cemented sandstone)
- Mixed Soil over Blastable (soil - assumed 5’ thick - over blastable material as described above)
- Mixed Soil over Rippable (soil - assumed 5’ thick – over rippable material as described above)
- Excavatable (soil and highly decomposed rock)

The volumes of material generated (neat lines excluding expansion) in cubic yards are summarized below:

- Blastable 1,645,800
- Rippable 1,119,000
- Mixed Soil over Blastable 806,600 (489,600 soil – 317,000 rock)
- Mixed Soil over Rippable 381,300 (239,500 soil – 141,800 rock)
- Excavatable 2,108,000

A discussion of material excavated (blasted) from tunnels and shafts, common to all alternatives, is included in Section 5.3.1.1.9. All blasted rock would be used for bedding, backfill, or maintenance road construction as suitable (analysis assumes 75 percent of blasted and rippable rock would be usable). Soil would be used for trench backfill. Excess soil not used as backfill or for dam construction would be spread and compacted on the pipeline and penstock ROW, an area of approximately 2,581 acres, and compacted to a thickness of up to approximately 5 inches. No additional spoil disposal areas would be required and spoil disposal along the pipeline and penstock alignments would be within the excavated trenches, covered with previously segregated topsoil, and revegetated at approximate original contours. Rolling dips would be contoured in to the spoils as needed to accommodate natural drainage patterns. The South Variant Alternative would have no significant effects resulting from spoil material disposal.

5.3.1.2.9 South Variant Alternative Operation and Maintenance Effects.
Operation and maintenance effects associated with fault movement, seismic activity, rockfall and steep slopes, expandable, collapsible, or subsiding soils or rocks, geologic hazards on human health and safety, important structures and mineral resources, borrow and spoil, Intake Pump Station, and Hurricane Cliffs forebay and afterbay reservoir areas would be the same as described for the South Alternative in Section 5.3.1.2.3.

5.3.1.4 Cumulative Effects

This is a new Section 5.3.1.4.4. Section heading numbers of the remaining sections in Section 5.3.1.4 are increased accordingly.

5.3.1.4.4 South Variant Alternative.
The cumulative effects would be the same as described for the South Alternative in Section 5.3.1.4.1.

5.3.1.5 Unavoidable Adverse Effects
Pg. 5-80, 6th paragraph
The South Alternative, Existing Highway Alternative, Southeast Corner Alternative, and South Variant Alternative each could have a short-term unavoidable adverse effect on the Navajo sandstone at the Intake Pump Station site resulting from groundwater drawdown during underground construction below the corresponding Lake Powell level. This short-term adverse effect could have an unmeasurable short-term cumulative effect with past, present and future actions involving Glen Canyon Dam operations and Lake Powell levels. Following construction completion, the groundwater drawdown caused by pumping the underground work areas would

cease and the groundwater level would return to approximately the same elevation as Lake Powell.

5.3.2 Water Supply

5.3.2.2 Environmental Effects

5.3.2.2.3 Proposed Lake Powell Pipeline Water Supply.
Pg. 5-91, 6th paragraph
The South Alternative, Existing Highway Alternative, Southeast Corner Alternative, and South Variant Alternative would each have the same environmental effects on water supply. These are referred to in this environmental effects section as the LPP alternatives. The water supply for the LPP alternatives, diverted from Lake Powell using the State of Utah's unused Colorado River water from Green River water rights, would total 86,249 ac-ft per year. The LPP water would be used to meet water supply deficits in the WCWCD and KCWCD service areas.

5.3.2.4 Cumulative Effects
Pg. 5-92, 6th paragraph
The South Alternative, Existing Highway Alternative, Southeast Corner Alternative, and South Variant Alternative would each have the same cumulative effects on water supply. These are referred to in this cumulative effects section as the LPP alternatives. The No Lake Powell Water Alternative would have a separate set of cumulative effects on water supply. There would be no cumulative effects from the No Action Alternative.

5.3.2.5 Unavoidable Adverse Effects
Pg. 5-93, 6th paragraph
The South Alternative, Existing Highway Alternative, Southeast Corner Alternative, and South Variant Alternative each could have an unavoidable adverse, long-term cumulative indirect effect on water supply in combination with the potential effects of future management activities by the BLM St. George Field Office proposed RMP and amendments. These potential future management activities could require the use of Virgin River water currently used for M&I water supply to be used for habitat restoration, species conservation and resource protection to meet desired future conditions under the proposed RMP and amendments.

5.3.3 Surface Water Resources

5.3.3.4 Cumulative Effects

This is a new Section 5.3.3.4.4. Section heading numbers of the remaining sections in Section 5.3.3.4 are increased accordingly.

5.3.3.4.4 South Variant Alternative.
The cumulative effects of the South Variant Alternative would be the same as described for the South Alternative in Section 5.3.3.4.1.

5.3.3.5 Unavoidable Adverse Effects