**Salt Lake City Area Integrated Projects
Electric Power Marketing
Draft Environmental Impact Statement**

Volume 1: Summary

U.S. Department of Energy
Western Area Power Administration

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COVER SHEET

Title: Salt Lake City Area Integrated Projects Electric Power Marketing Draft Environmental Impact Statement

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ABSTRACT

The Salt Lake City Area Office of the Western Area Power Administration (Western) markets electricity produced at hydroelectric facilities operated by the Bureau of Reclamation. The facilities are known collectively as the Salt Lake City Area Integrated Projects (SLCA/IP) and include dams equipped for power generation on the Green, Gunnison, Rio Grande, and Colorado rivers and on Deer and Plateau creeks in the states of Wyoming, Utah, Colorado, Arizona, and New Mexico. Of these facilities, only the Glen Canyon Unit, the Flaming Gorge Unit, and the Aspinall Unit (which includes Blue Mesa, Morrow Point, and Crystal dams) are influenced by Western power scheduling and transmission decisions. The EIS alternatives, called commitment-level alternatives, reflect combinations of capacity and energy that would feasibly and reasonably fulfill Western's firm power marketing responsibilities, needs, and statutory obligations. The viability of these alternatives relates directly to the combination of generation capability of the SLCA/IP with energy purchases and interchange. The economic and natural resource assessments in this environmental impact statement (EIS) include an analysis of commitment-level alternatives. Impacts of the no-action alternative are also assessed. Supply options, which include combinations of electrical power purchases and hydropower operational scenarios reflecting different operations of the dams, are also assessed. The EIS evaluates the impacts of these scenarios relative to socioeconomics, air resources, water resources, ecological resources, cultural resources, land use, recreation, and visual resources.

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SUMMARY

S.1 BACKGROUND

The Western Area Power Administration (Western) proposes to change the level of its commitment (sales) of long-term firm electrical capacity and energy from the Salt Lake City Area Integrated Projects (SLCA/IP) hydroelectric power plants. Because this change could be a major Federal action with potentially significant impacts to the human environment, this environmental impact statement (EIS) is being prepared in compliance with the National Environment Policy Act of 1969 (NEPA) and associated implementing regulations.

S.2 WESTERN'S RESPONSIBILITIES AND MISSION

Western, a power marketing administration within the Department of Energy, was created with the passage of the Department of Energy Organization Act of 1977 (DOE Act). The DOE Act transferred the power marketing and transmission functions from the Secretary of the Interior (Bureau of Reclamation [Reclamation]) to the Secretary of Energy, acting through Western.

Western's mission is to sell and deliver electricity that is in excess of project uses (power that is required for the operation of the project) generated from power plants that were built as part of certain Federal water projects. Most of the power plants included in this EIS are located on the Upper Colorado River and its tributaries. Western's Salt Lake City Area Office (SLCAO) is responsible for marketing of power from the Colorado River Storage Project (CRSP), Collbran Project, Rio Grande Project, and Provo River Project. On October 1, 1987, the Colorado River, Collbran, and Rio Grande projects were integrated for marketing and rate-making purposes and are collectively known as the SLCA/IP.

Western's power marketing responsibility begins at the switchyard of Federal hydroelectric power facilities and includes the transmission lines to interconnected utility systems. The hydroelectric projects in Western's 15-state area are operated by Reclamation, the Army Corps of Engineers, and the International Boundary and Water Commission. These agencies manage and release water in accordance with the various acts authorizing specific projects and with other enabling legislation. Western's capacity and energy sales must be in conformance with the laws that govern its sale of electrical power. Further, Western's hydropower operations at each facility must comply with minimum and maximum flows and other constraints set by Reclamation or other operating agencies, acting in accord with law or policy.

The 1902 Reclamation Act provided for the use of revenue from the sale of Federal land to develop irrigation projects. The Reclamation Project Act of 1939 further defined the responsibility of Reclamation in irrigation development and directed that revenues from the sale of electricity generated at the Federal facilities be used to repay some of the irrigation

investment, as well as all costs incurred in developing the hydroelectric facilities. The principal purposes of these projects are irrigation, flood control, and navigation. About 90% of all revenues received from these projects are from power sales.

An important provision of the Reclamation Project Act was to give preference in the sale of Federally generated electricity to municipalities, other public corporations or agencies, cooperatives, and other nonprofit organizations financed under the Rural Electrification Act of 1936. Western also requires that a preference entity must own and control their distribution system, be willing and able to purchase and distribute electricity, and be responsible for supplying the entire electrical load to customers in its service area. Western sells firm power to nonpreference customers only if the available supply exceeds the demands of interested and eligible preference customers. Preference is an important issue because the price of Western's firm power (the long-term firm capacity and energy rate) is limited to cost recovery at a rate that currently places it below market levels.

S.3 PUBLIC INVOLVEMENT

Public comments and opinions from interested groups, Federal and state agencies, customers, and the general public are an integral part of the decision-making process. To date, Western has received comments on the scope of this EIS, on the purpose and need statement (which was developed after the scoping process), on the alternatives, and on the hydropower operational scenarios. In addition, this EIS reflects comments by cooperating and coordinating agencies. The cooperating agencies are the Bureau of Reclamation, the National Park Service, and the U.S. Fish and Wildlife Service. The coordinating agencies are the states of Utah, Wyoming, New Mexico, Colorado, and Arizona.

S.4 ALTERNATIVES

Western could market the electricity produced at the SLCA/IP in a variety of ways. To fulfill its mission and statutory responsibilities, Western markets hydroelectricity supplemented with energy purchased from and exchanged with other utilities. By purchasing and exchanging power with other utilities, Western is able to increase its level of long-term firm sales and enhance the value of the hydrogeneration resources.

Western's principal marketing program is the sale of long-term firm capacity and energy at long-term firm power rates. The amount of capacity and energy sold under long-term contract is called the level of commitment. The alternatives examined in this EIS are based upon different levels of long-term firm commitments and are called commitment-level alternatives.

The commitment-level alternatives evaluated in this EIS are defined on the basis of a specified level of both capacity (which is equivalent to the instantaneous output of a generator, usually stated in megawatts [MW]) and energy (the amount of power generated over a period of time, usually stated in megawatt-hours [MWh] and limited by generator

capacity). The combination of capacity and energy commitment, plus other elements of the power marketing contracts, are used to define a resource that is used to meet a customer's load requirements. Normally, this allows for a higher energy use during daytime (on-peak) hours and a lower use during nighttime (off-peak) hours. Western, in coordination with Reclamation, schedules and releases water on an hourly and daily basis from the SLCA/IP and Western makes purchases and exchanges to meet its contractual commitments defined by the alternatives. Together these factors affect hydropower operations at SLCA/IP facilities.

The commitment-level alternatives considered in this EIS span the range of commitments necessary for Western to fulfill its statutory obligations. These alternatives were presented in draft to the general public for comment and were discussed with specific environmental and customer groups. Seven combinations of capacity and energy commitments are considered as representative of the entire range of commitments that could be offered by Western. Capacity commitments range from a low of 550 MW (less than 40% of the historical commitment) to a high of 1,450 MW. Energy commitments range from a low of 3,300 MWh (less than 60% of the historical commitment) to a high of 6,200 MWh.

The major characteristics of the commitment-level alternatives considered in this EIS are described in Table S.1. These alternatives were selected on the basis that, as a group, the combinations of capacity and energy incorporated into these alternatives represent the reasonable bounds of capacity and energy available to Western given currently available resources. In addition to two moderate capacity-moderate energy alternatives (3 and 6), the alternatives include high capacity and energy (alternative 1), low capacity and energy (alternative 4), high capacity and low energy (alternative 2), and low capacity and high energy (alternative 5) combinations. As of this time, Western has not selected a preferred alternative.

S.5 HYDROPOWER OPERATIONAL SCENARIOS

In addition to analyzing the commitment-level alternatives, this EIS evaluates the impacts of hydropower operations at the three SLCA/IP facilities that provide most of the hydropower marketed by Western — Glen Canyon Dam, Flaming Gorge Dam, and the Aspinall Unit. The array of potential dam operations — referred to as operational scenarios — ranges from historical high fluctuations, to no fluctuation (baseload or steady flows) at each facility. Operational scenarios considered here are presented in Tables S.2, S.3, and S.4. These hydropower operational scenarios were submitted in draft to the public and to specific interest groups for review.

This EIS addresses a set of actions that could be considered in separate NEPA documents. By considering both commitment-level alternatives and operational scenarios together, examination of a full range of operations and commitment levels and their combined impacts is possible. Actual hydropower operations within the range of scenarios examined

TABLE S.1 Electric Power Marketing EIS Commitment-Level Alternatives

Alternative	Capacity Commitment (MW)	Energy Commitment (GWh)	Load Factor (%)	Minimum Schedule Requirement (%)	Description
No action	1,291	5,700	50	35	Moderate capacity and high energy (the 1978 marketing program commitment level)
1	1,449	6,156	48.5 ^a	35	High capacity and high energy (the post-1989 commitment level)
2	1,450	3,300	26	10	High capacity and low energy
3	1,225	4,000	37	15	Moderate capacity and moderate energy
4	550	3,300	68	52	Low capacity and low energy
5	625	5,475	100	100	Low capacity and high energy
6	1,000	4,750	54	33	Moderate capacity and moderate energy

^a This load factor differs slightly from that published in the Post-1989 Marketing Criteria (50.2%) because of a difference between calculating this number annually versus seasonally.

may come about as a result of management decisions by Western or Reclamation. Reclamation determines operational constraints for hydropower facilities, and Western makes operational decisions within these constraints.

S.6 AFFECTED ENVIRONMENT

The Upper Colorado River and its tributaries provide the principal supply of surface water for western Colorado, Utah, and Arizona. More than 50 impoundments are located on the Upper Colorado and its tributaries, with a combined storage capacity equivalent to three years of flow (33 million acre-feet). These impoundments provide some or all of the requirements for flood control, irrigation and municipal water supply, recreation, and hydropower generation. The impoundments have supported agricultural, municipal, and recreational development that would otherwise not have been possible. The environment

TABLE S.2 Hydropower Operational Scenarios for Glen Canyon Dam

Parameter	Continuation of Historical Flows	Maximum Power Plant Capacity	Restricted Fluctuating Flows				Steady Flows		
			High	Moderate	Modified Low	Interim Low	Existing Monthly Volume	Seasonally Adjusted	Year-Round
Minimum releases ^a (cfs)	1,000 Labor Day-Easter 3,000 Easter-Labor Day ^b	1,000 Labor Day-Easter 3,000 Easter-Labor Day ^b	3,000, 5,000, 8,000, depending on monthly volume, firm load, and market conditions	5,000	8,000 between 7 a.m. and 7 p.m. 5,000 at night	8,000 between 7 a.m. and 7 p.m. 5,000 at night	8,000	8,000 Oct-Nov ^c 8,500 Dec 11,000 Jan-Mar 12,500 Apr 18,000 May-Jun 12,500 Jul 9,000 Aug-Sep	Yearly volume prorated ^d
Maximum releases (cfs)	31,500	33,200	31,500	31,500 ^f	20,000 ^f	20,000	Monthly volumes prorated	18,000 ^f	Yearly volume prorated ^d
Allowable daily change in flow (cfs/24 hours)	30,500 Labor Day-Easter 28,500 Easter-Labor Day	32,200 Labor Day-Easter 30,200 Easter-Labor Day	15,000 to 22,000	±45% of mean flow for the month not to exceed ±6,000	5,000, ^g 6,000, or 8,000	5,000, ^g 6,000, or 8,000	±1,000 ^h	±1,000 ^h	±1,000 ^h
Allowable scheduled ramping (cfs/h)	Unrestricted	Unrestricted	Unrestricted up 5,000 or 4,000 down	4,000 up 2,500 down	2,500 up 1,500 down	2,500 up 1,500 down	2,000 cfs/d between months	2,000 cfs/d between months	2,000 cfs/d between months
Elements common to restricted fluctuating and steady flow alternatives	None	None	Adaptive management including long-term monitoring and research, monitoring and protection of cultural resources, flood frequency reduction measures, beach/habitat-building flows, new population of humpback chub, further study of selective withdrawal, emergency exception criteria						

^a In high volume release months, the allowable daily change would require higher minimum flows.

^b Releases each weekday during recreation season (Easter to Labor Day) would average not less than 8,000 cfs for the period from 8 a.m. to midnight.

^c Based on an 8.23 million acre-feet year; in higher release years, additional water would be added equally to each month, subject to an 18,000 cfs maximum.

^d For an 8.23-million acre-feet year, steady flow would be about 11,400 cfs.

^e Maximums represent normal or routine limits and may necessarily be exceeded during high water years.

^f May be exceeded during habitat-maintenance flows.

^g Daily fluctuation limit of 5,000 cfs for monthly release volumes less than 600,000 acre-feet; 6,000 cfs for monthly release volumes of 600,000 to 800,000 acre-feet and 8,000-cfs for monthly volumes over 800,000 acre-feet.

^h Adjustments would allow for small power system load changes.

Source: Adapted from Reclamation (1993).

TABLE S.3 Hydropower Operational Scenarios for Flaming Gorge Dam^a

Parameter	Year-Round High Fluctuating Flows	Seasonally Adjusted Flows		
		High Fluctuating	Moderate Fluctuating	Steady
Minimum releases (cfs)	800	800 Oct-Jan 2,380 Feb-Mar 800 Apr-May 4,700 Jun 1-21 800 Jun 22-Jul 9 890 Jul 10-31 990 Aug 1,070 Sep	800 Oct 2,220 Nov-Jan 2,380 Feb-Mar 2,440 Apr 2,740 May 4,700 Jun 1-21 2,770 Jun 22-30 1,860 Jul 1-Jul 9 976 Jul 10-31 1,080 Aug 1,160 Sep	800 Oct 2,380 Nov-Mar 2,600 Apr 3,390 May 4,700 Jun 1-21 3,740 Jun 22-30 2,020 Jul 1-9 1,060 Jul 10-31 1,160 Aug 1,240 Sep
Maximum releases (cfs)	4,700	800 Oct 4,700 Nov-Jan 2,380 Feb-Mar 4,700 Apr-Jul 9 2,900 Jul 10-31 3,000 Aug 3,100 Sep	800 Oct 4,170 Nov-Jan 2,380 Feb-Mar 4,390 Apr 4,700 May-Jun 3,810 Jul 1-9 1,980 Jul 10-31 2,080 Aug 2,160 Sep	Same as minimum releases
Allowable daily change in flow (cfs/24 hours)	3,900	0 Oct 3,900 Nov-Jan 0 Feb-Mar 3,900 Apr-May 0 Jun 1-21 3,900 Jun 22-Jul 9 2,010 Jul 10-Aug 2,030 Sep	0 Oct 1,950 Nov-Jan 0 Feb-Mar 1,950 Apr-May 0 Jun 1-21 1,950 Jun 22-Jul 9 1,000 Jul 10-Sep	0
Allowable scheduled ramping (cfs/h)	3,900	3,900	1,950	0

^a For a moderate hydrological year.

TABLE S.4 Hydropower Operational Scenarios for the Aspinall Unit^a

Parameter	Seasonally Adjusted High Fluctuating Flows			Seasonally Adjusted Steady Flows		
	Blue Mesa	Morrow Point	Crystal	Blue Mesa	Morrow Point	Crystal
Minimum release (cfs)	1,750 Jun 0 Others	0 Oct-Mar 557 Apr 1,830 May 2,440 Jun 1,070 Jul 0 Aug-Sep	1,920 Oct 1,430 Nov 1,280 Dec 680 Jan-Mar 2,250 Apr 3,580 May 3,830 Jun 2,640 Jul 1,920 Aug-Sep	1,570 Oct 1,200 Nov 1,050 Dec 500 Jan-Mar 1,600 Apr 2,370 May 3,050 Jun 2,350 Jul 1,750 Aug-Sep	1,700 Oct 1,280 Nov 1,100 Dec 570 Jan-Mar 1,970 Apr 2,890 May 3,320 Jun 2,480 Jul 1,770 Aug 1,820 Sep	1,920 Oct 1,430 Nov 1,280 Dec 680 Jan-Mar 2,250 Apr 3,580 May 3,830 Jun 2,640 Jul 1,920 Aug-Sep
Maximum release (cfs)	3,700	5,300 Oct-Mar 2,680 Apr 3,420 May 3,770 Jun 3,190 Jul 5,300 Aug-Sep	Same as minimum releases	Same as minimum releases	Same as minimum releases	Same as minimum releases
Allowable daily change in flow (cfs/24 hours)	3,700 Oct-May 1,950 Jun 3,700 Jul-Sep	5,300 Oct-Mar 2,120 Apr 1,590 May 1,330 Jun 2,120 Jul 5,300 Aug-Sep	0	0	0	0
Allowable scheduled ramping (cfs/h)	3,700	5,300	0	0	0	0

^a For a moderate hydrological year

potentially affected by the commitment-level alternatives and the hydropower operational scenarios varies among resources (Figures S.1 and S.2). Socioeconomics are treated first in this EIS because commitment-level alternatives vary considerably in their impact on socioeconomics but differ little in their effects on the natural environment.

S.6.1 Socioeconomics

Western's SLCAO serves about 183 customers, including utilities, Federal installations, state universities, irrigation districts, and others. In turn, Western's utility customers serve end-users in 192 counties in 12 states. Part of the socioeconomic analysis of the commitment-level alternatives assessed the impacts that a change in Western's long-term firm commitments could have on its utility customers. Specific attention was focused on the financial viability of these customers and the retail rates charged to their end-users. For analytical purposes, utilities were classified according to whether they are municipally or cooperatively owned and the degree to which they rely on Western for the power they sell. Utilities that receive less than 25% of their total energy from Western were classified as low reliance; 55% of Western's customers fall into this category. The remaining 45% of Western's customers were classified as high reliance. On this basis, high-reliance municipals are most dependent on Western — an average of 47% of the load served by utilities in this category

FIGURE S.1 Affected Environment for Socioeconomics

FIGURE S.2 Affected Environment for Natural and Cultural Resources

is provided by Western. At the other extreme, an average of 6% of the load served by low-reliance municipals is provided by Western.

In addition, the impact of commitment-level alternatives on conservation and renewable energy programs was evaluated by examining the impacts on consumption efficiency and load management activities by long-term firm sale utility customers.

To facilitate the analysis of regional economic impacts, the combined service territory of these utilities was subdivided into six metropolitan subregions and three rural subregions. Within the metropolitan subregions, economic activity, as measured by employment, is concentrated in the wholesale, retail, business, and public service sectors. In the three rural subregions, economic activity is more dispersed, with no one sector accounting for more than 25% of the total employment in each subregion. Population, employment, and output are most heavily concentrated in the metropolitan subregions.

The impacts on agricultural production were analyzed on a state-by-state basis. The six-state region that includes Arizona, Colorado, New Mexico, Nevada, Wyoming, and Utah produces a variety of crops, such as alfalfa, cotton, and wheat. About 24% of the total acreage in this region that is used in agriculture is irrigated with use of electric pumps.

S.6.2 Air Resources

The affected environment for air resources was defined as the area encompassing the states of Arizona, Colorado, Nevada, New Mexico, Utah, and Wyoming. This region is semiarid to arid and encompasses many major population centers, including Phoenix and Tucson, Arizona; Denver and Colorado Springs, Colorado; Albuquerque, New Mexico; Las Vegas, Nevada; and Salt Lake City, Utah. These population centers and some of their suburbs are designated as *nonattainment areas*¹ with respect to one or more of the National Ambient Air Quality Standards. The electric utility industry is a major contributor to the overall air pollutant emissions within the region, particularly with regard to sulfur dioxide, nitrogen oxides, and carbon dioxide. Despite this situation, ambient air quality in the region as a whole is generally considered good, and visibility is currently the best in the contiguous United States.

S.6.3 Water Resources

The affected environment for water resources and other natural resources evaluated in this EIS was defined as the areas associated with the hydroelectric facilities that are influenced on an hourly and daily basis by Western to produce power (Glen Canyon Dam, Flaming Gorge Dam, and the Aspinall Unit). Other facilities where operations are dictated by irrigation demands, municipal and industrial uses, flood control, or other nonpower

¹ This designation means that the air in the area exceeds the concentration limits established for the specified pollutant.

purposes were not considered because, although Western markets power produced at these facilities, Western does not affect power production at them.

The area affected by hydropower operations at Glen Canyon Dam included the area along the Colorado River between the dam and Lake Mead. This area includes the Grand Canyon National Park. The affected area for Flaming Gorge Dam was the area along the Green River between the dam and Jensen, Utah; and the affected area for the Aspinall Unit was the reservoirs of the unit (Blue Mesa, Morrow Point, and Crystal reservoirs).

Existing conditions in the affected environment of these three facilities have been shaped by hydropower operations occurring since the facilities were built in the early 1960s. Compared with pre-dam conditions, the Colorado River below Glen Canyon Dam and the Green River below Flaming Gorge Dam generally exhibit larger daily fluctuations in flow and less seasonal fluctuations in flow, are much clearer (carry less sediment), are more erosive of existing sediment deposits, and are colder. Flow, stage, water temperature, and sediment transport are considered the most important characteristics of water resources downstream of these facilities.

The affected environment of the Aspinall Unit was limited to the reservoirs themselves because the lowermost dam of the unit (Crystal Dam) is a reregulation dam and would eliminate hydropower-induced fluctuations in flow in the Gunnison River below the unit. The water resources of the affected environment of the Aspinall Unit are characteristic of western reservoirs (cold, clear, minimal flow). Sediment is not an important resource of the Aspinall Unit because the shores of the reservoirs are mostly bare rock. The largest of the reservoirs, Blue Mesa, experiences relatively minor hydropower-induced daily fluctuations, while the elevations of Morrow Point and Crystal reservoirs can exhibit larger fluctuations within a day because of steep canyon walls and limited storage volume.

S.6.4 Ecological Resources

The current conditions of ecological resources in and along the Colorado and Green rivers below Glen Canyon Dam and Flaming Gorge Dam, respectively, and the reservoirs of the Aspinall Unit reflect the effects of approximately 30 years of dam operations.

Certain ecological resources below Glen Canyon and Flaming Gorge dams are similar. Both rivers support high-quality trout fisheries in the areas immediately below the dams where waters are clearest and coldest. Farther downstream, native fish that rely on warm water are more common, and each river supports several fish species that are Federally listed as endangered. The humpback chub and the razorback sucker occur in the Colorado River between Glen Canyon Dam and Lake Mead. No reproduction of the razorback sucker is known to occur in the area, while the humpback chub population is maintained almost exclusively by reproduction in the Little Colorado River. This population is the largest known remaining population of humpback chub in the Colorado River system. The Green River below Flaming Gorge Dam supports populations of razorback sucker, humpback chub, and Colorado squawfish. Little or no successful reproduction by the razorback sucker has

been observed in the Green River, and this population is declining. The Colorado squawfish and humpback chub successfully reproduce in the Green River, and populations may be stable. The bonytail chub may be extirpated from the Green River above Jensen, Utah. No verified specimens of this species have been collected from this portion of the Green River Basin since 1979.

Riparian vegetation and some wildlife species have increased substantially along the rivers in response to regulated flows. The endangered peregrine falcon commonly breeds along both the Colorado and Green rivers below the dams, and the endangered bald eagle winters in the downstream corridors. Other Federally listed terrestrial species that are either known to occur or could occur in the affected environment of these two facilities include Ute ladies-tresses (Flaming Gorge), Mexican spotted owl (Glen Canyon and Flaming Gorge), and the whooping crane (Flaming Gorge).

The ecological resources of the Aspinall Unit reservoirs are very different from those below Glen Canyon and Flaming Gorge dams. The cold, nutrient-poor waters of the reservoirs support few aquatic resources with the exception of an important introduced kokanee salmon population. Little riparian vegetation occurs in the vicinity of any of the reservoirs, and most shoreline areas consist of bare rock. Federally listed endangered species that could occur in the vicinity of the reservoirs include the peregrine falcon, bald eagle, and the whooping crane. Only the bald eagle is relatively common in the area.

S.6.5 Cultural Resources

The affected environment for cultural resources, including archaeological, historical, and Native American resources, includes the area along the Colorado River below Glen Canyon Dam, the Green River below Flaming Gorge Dam, and the area around the Aspinall Unit reservoirs. The regional prehistory and ethnohistory for the three sites is relatively similar. Numerous archaeological sites, but fewer historical structures, are present in the river corridors below Glen Canyon and Flaming Gorge dams. The paucity of historical remains reflects the relatively minor degree of Euro-American settlement and activity that has occurred in the area. Most sites in the area of the Aspinall Unit are located along Blue Mesa Reservoir and consist of archaeological sites, although some historic sites also occur. Native American tribes that have identified or may identify cultural resources in the areas include the Havasupai, Hopi, Hualapai, Navajo, Southern Paiute, and Zuni for the Glen Canyon Dam area; and the San Juan Southern Paiute, Southern Ute Tribe, Ute Mountain Tribe, and Ute Indian Tribe for the Flaming Gorge Dam and the Aspinall Unit areas.

S.6.6 Land Use

Most of the land in areas along the Colorado River below Glen Canyon Dam, along the Green River below Flaming Gorge Dam, and in the vicinity of the Aspinall Unit reservoirs is publicly owned and consists primarily of national parks, monuments, forests,

and reservation lands. Recreation is a key component in the management of the region's public lands.

S.6.7 Recreation

The affected areas of the Glen Canyon, Flaming Gorge, and Aspinall Unit facilities support important water-based recreational activities. These activities include white-water boating, angling, and riverside camping downstream of both the Glen Canyon and Flaming Gorge dams and boating and angling in the Aspinall Unit reservoirs.

S.6.8 Visual Resources

Visual resources in the affected areas are of high quality and are dominated by the prominent geological features characteristic of each area. Dam operations in these areas, through their effects on stream flow and shoreline vegetation, have relatively minor influence on visual resources.

S.7 ENVIRONMENTAL CONSEQUENCES OF COMMITMENT-LEVEL ALTERNATIVES

Commitment-level alternatives were analyzed for their potential impacts on the financial viability of Western's utility customers, the retail rates charged to the end-users of electricity marketed by Western, regional economic variables (including population, employment, disposable income, and gross regional product), agricultural production, and the use value of recreational activities. In addition, the analysis considered the potential effects that a change in Western's commitment levels could have on the mix of generation options used to supply electricity to the affected region and the resulting impacts on local and regional air quality. Impacts on natural and cultural resources were assessed in the context of changes in operational scenarios at each of the affected sites. With this approach, it was possible to identify the range of impacts that could result from implementation of any one of the commitment-level alternatives.

Hydropower operational scenarios could also affect socioeconomics and air resources through their effects on purchases and exchanges and the resultant cost of electricity. Thus, it was necessary to specify both an operational scenario and a commitment-level alternative to assess socioeconomic and air resource impacts. Commitment-level alternatives were paired with specific supply options, which consisted of combinations of operational scenarios at each of the three facilities considered in this EIS, combined with power purchases. These supply options were defined as follows:

- *Supply Option A:* Continuation of historical operations at Glen Canyon, year-round high fluctuations at Flaming Gorge, and seasonally adjusted high fluctuations at the Aspinall Unit, combined with all necessary power purchases;

- *Supply Option B:* Low fluctuations at Glen Canyon, year-round high fluctuations at Flaming Gorge, and seasonally adjusted high fluctuations at the Aspinall Unit, combined with all necessary power purchases;
- *Supply Option C:* Seasonally adjusted steady flows at Glen Canyon, Flaming Gorge, and the Aspinall Unit, combined with all necessary power purchases.

The supply options are obtainable through actions by both Western and Reclamation.

The socioeconomic impacts determined for these supply options capture the full range of impacts that could occur given any possible combination of operational scenarios. Combinations of operational scenarios whose impacts approximate those of supply option A include any combination that incorporates a continuation of historical operations, maximum power plant capacity, or restricted high fluctuations at Glen Canyon Dam; any of the four operational scenarios at Flaming Gorge Dam; and either of the operational scenarios at the Aspinall Unit. Combinations whose impacts approximate those of supply option B include any combination that incorporates moderate fluctuations or low fluctuations at Glen Canyon Dam; any of the four operational scenarios at Flaming Gorge Dam; and either of the operational scenarios at the Aspinall Unit. Finally, combinations whose impacts approximate those of supply option C include any combination consisting of seasonally adjusted steady flows, existing monthly steady flows, or year-round steady flows at Glen Canyon Dam; any of the four operational scenarios at Flaming Gorge; and either of the operational scenarios at the Aspinall Unit.

The predicted impacts attributable to the combinations of commitment-level alternatives and supply options considered in this EIS are summarized in Table S.5. The analyses indicated that none of the combinations of commitment-level alternatives and supply options would have a statistically significant effect on any of the four socioeconomic variables mentioned above (i.e., the estimated impacts are not statistically different from zero), and only slight impacts are likely on conservation and renewable energy programs as measured in terms of consumption efficiency and load management. This result is partly a reflection of the fact that the power marketed by Western accounts for only about 10% of the total electricity consumed in the affected region. In addition, much of the affected region has an excess supply of generating capacity. This excess capacity would serve to offset the adverse price effects of a reduction in the amount of Western's long-term firm commitment of capacity and energy and thus blunt the regional economic impacts of any increase in electricity prices.

The analysis also indicates that a change in Western's long-term firm commitments would have, at most, a very small effect on agricultural production, as measured by net income to the agricultural sector at the state level. At the state level, most of the impacts would consist of shifts from irrigated to dryland farming methods for individual crops and some substitution among crops. However, the largest impact indicated by the analysis was a decrease in net agricultural income by about 1.2% in Utah in the final year of the forecast

TABLE S.5 Relative Impacts of the Commitment-Level Alternatives

Commitment-Level Alternative	Financial Viability and Retail Rates	Regional Economic Activity	Agricultural Production	Air Resources	Water, Ecological, Cultural, Recreation, Land Use, and Visual Resources
No action (1978 Marketing Criteria)	Slight impacts on financial viability of Western's customers and the retail rates charged to end-users.	No impacts on the levels of population, employment, income or output.	No impacts on agricultural production.	No impacts on local or regional air quality or noise.	Impacts dependent on dam operations (see Tables S.6, S.7, and S.8).
Commitment-level alternative 1	No impact on financial viability; slight impact on retail rates.	Estimated impacts on population, employment, income, and output are not statistically different from zero.	Slight impact on agricultural production.	Same as above.	Same as above.
Commitment-level alternative 2	Slight impact on financial viability; moderate impact on retail rates.	Same as above.	Same as above.	Same as above.	Same as above.
Commitment-level alternative 3	Slight impact on financial viability; moderate impact on retail rates.	Same as above.	Same as above.	Same as above.	Same as above.
Commitment-level alternative 4	No impact on financial viability; moderate or large impacts on retail rates.	Same as above.	Same as above.	Same as above.	Same as above.
Commitment-level alternative 5	Slight impact on financial viability; moderate to large impact on retail rates.	Same as above.	Same as above.	Same as above.	Same as above.
Commitment-level alternative 6	Slight impact on financial viability; moderate impact on retail rates.	Same as above.	Same as above.	Same as above.	Same as above.

period. Furthermore, this impact would occur under the commitment-level alternative representing the lowest long-term firm commitment of capacity and energy and, therefore, the lowest supply risk.

Results of the analysis suggest that the different combinations of commitment-level alternatives and supply options could affect the financial viability of Western's utility customers and the retail rates charged to end-users. The combination of commitment-level alternative 2 and unrestricted dam operations at the three affected sites — Glen Canyon Dam, Flaming Gorge Dam, and the Aspinall Unit — would leave the financial viability of affected utilities unchanged. In addition, many of Western's utility customers would experience a decline in their retail rates. However, the remaining combinations of commitment-level alternatives and operational scenarios could result in adverse impacts. Maximum adverse impacts to financial viability would result from the combination of commitment-level alternative 4 and steady flows at each of the hydropower facilities. However, this impact is considered moderate. Less than 12% of the utilities included in the financial analysis would experience a decrease in financial viability under this combination of commitment-level alternative and supply option. All of the other alternatives and operational scenarios would result in smaller impacts on financial viability.

With the exception of alternative 2, retail rates would generally increase as a result of a change in Western's commitment levels. Changes in rates would vary by alternative, state, and the characteristics of the affected utilities. Commitment-level alternatives 4 and 5 combined with steady flows at each dam would result in the largest weighted average increase in rates (15%) across affected utilities. The combination of alternative 4 and steady flows would also result in the largest rate increase, as measured for state and utility categories. Under these conditions, it is estimated that the retail rates charged by municipal utilities in Utah that rely on Western for more than 25% of their supply (high reliance) would increase by 41%.

Overall, high-reliance utilities — primarily municipals — in Utah and New Mexico would experience the largest retail rate impacts under each of the commitment-level alternatives. In contrast, utility customers in Wyoming would be largely unaffected. Utility customers in Arizona, Colorado, and Nevada would experience slight to moderate effects under most alternatives.

Even with lack of any statistically significant regional economic impacts, the fact that retail rates would increase under most combinations of commitment-level alternatives and supply options suggests that there are likely to be localized impacts to employment and income. However, the areas in which such impacts are likely to occur are small relative to the subregions that were constructed to conduct the regional analysis. Consequently, any impacts that might occur at the local level could be undetected when impacts were measured at the regional level.

The analysis of impacts to air resources led to the conclusion that local and regional air quality and noise levels would not be affected by any of the commitment level alternatives.

The impacts of commitment-level alternatives on water resources, ecological resources, cultural resources, and recreation would depend on the operational scenarios implemented at the hydropower facilities under consideration. In addition to the direct impacts of hydropower operations, indirect impacts could result from fulfilling the need for additional generating capacity under each commitment-level alternative. This need for additional capacity could be met by building new power plants, by expanding or retrofitting existing ones, or by purchases and exchanges. Construction and operation of power plants to meet additional capacity needs could result in additional impacts to natural and cultural resources in the vicinities of any new or expanded facilities. A detailed assessment of specific impacts is not presented here because the significance and nature of any such impacts would depend on the specific plans and locations for the new expanded facilities — information that is not available at this time.

S.8 ENVIRONMENTAL CONSEQUENCES OF HYDROPOWER OPERATIONAL SCENARIOS

Hydropower operations are only weakly linked to commitment levels. To assess the potential impacts associated with hydropower operations, ranges of operational scenarios were specified for each of the three affected sites. Nine operational scenarios were considered at Glen Canyon Dam; four scenarios were considered at Flaming Gorge Dam, and two scenarios were considered for the Aspinall Unit. Impacts are described below by facility and are summarized in Tables S.6, S.7 and S.8.

S.8.1 Glen Canyon Dam

Continuation of historical operations and maximum power plant capacity operational scenarios would have impacts on most resources similar to those that have occurred since the dam was completed in 1963. Past operations have determined existing conditions for water resources, ecological resources, and recreational activities. Impacts identified for these scenarios included impacts to existing cultural resources, riparian vegetation, humpback chub, and recreation.

Restricted high fluctuations would result in moderate reductions in erosion rates and slight benefits to most ecological resources and recreation. For this scenario, slight adverse impacts were identified for the humpback chub. Adverse impacts could also occur to cultural resources because of erosion.

Moderate and low fluctuating flow operational scenarios would produce benefits for water resources (substantially reduced erosion rates), terrestrial ecology (moderate increases in woody riparian vegetation), cultural resources, and white-water boating. These operational scenarios could result in slight or moderate benefits to trout, native fish, peregrine falcon, bald eagle, southwestern willow flycatcher, and angling. Slight adverse impacts could occur to the humpback chub. Marsh vegetation could decrease under these scenarios.

TABLE S.6 Summary of Potential Impacts of Hydropower Operational Scenarios on Natural and Cultural Resources below Glen Canyon Dam^a

Operational Scenario	Water Resources	Ecological Resources	Cultural Resources	Recreation
Continuation of historical flows	No change from current conditions.	Slight adverse impact to humpback chub; no change from current conditions for other resources.	Adverse impact because of high erosion rate.	No impact.
Maximum power plant capacity	Same as above.	Slight adverse impact to humpback chub and southwestern willow flycatcher; no impact to other resources.	Same as above.	Slight adverse impact to angling and white-water boating.
Restricted high fluctuating flows	Moderate benefit; decreased sediment load and erosion rate.	Slight adverse impact to humpback chub; slight benefit to aquatic resources; no impact to terrestrial resources.	Same as above.	Slight benefit to angling and white-water boating.
Moderate fluctuating flows	Large benefit; decreased sediment load and erosion rate.	Slight adverse impact to humpback chub; slight benefit to bald eagle, peregrine falcon, and southwestern willow flycatcher; slight benefit to aquatic resources; moderate benefit to terrestrial resources.	Benefit because of reduced erosion rates.	Same as above.
Modified low fluctuating flows	Same as above.	Slight benefit to humpback chub, bald eagle, peregrine falcon, and southwestern willow flycatcher; slight to moderate benefit to aquatic resources; moderate benefit to terrestrial resources.	Same as above.	Moderate benefit to white-water boating; slight benefit to angling.
Interim low fluctuating flows	Same as above.	Same as above.	Same as above.	Same as above.
Existing monthly steady flows	Same as above.	Slight benefit to humpback chub, bald eagle, peregrine falcon, and southwestern willow flycatcher; moderate benefit to aquatic resources; large benefit to terrestrial resources.	Same as above.	Large benefit to angling and white-water boating.

TABLE S.6 (Cont.)

Operational Scenario	Water Resources	Ecological Resources	Cultural Resources	Recreation
Seasonally adjusted steady flows	Same as above.	Slight to moderate benefit to humpback chub; slight benefit to bald eagle, peregrine falcon, and southwestern willow flycatcher; moderate benefit to aquatic resources; large benefit to terrestrial resources.	Same as above.	Large benefit to white-water boating; moderate benefit to angling.
Year-round steady flows	Same as above.	Slight benefit to humpback chub, bald eagle, and peregrine falcon; moderate benefit to southwestern willow flycatcher; moderate benefit to aquatic resources; large benefit to terrestrial resources.	Same as above.	Large benefit to angling and white-water boating.

^a The impacts presented are relative to a baseline of existing conditions that have formed over 30 years of operations. No impacts to air resources, land use, or visual resources were identified.

TABLE S.7 Summary of Potential Impacts of Hydropower Operational Scenarios on Natural and Cultural Resources below Flaming Gorge Dam^a

Operational Scenario	Water Resources	Ecological Resources	Cultural Resources	Recreation
Year-round high fluctuating flows	Slight impact; increase in erosion rate.	Slight to moderate adverse impacts to aquatic resources; slight adverse impacts to terrestrial resources.	Adverse impact because of high erosion rate.	Slight adverse impact to angling; no impact on white-water boating.
Seasonally adjusted high fluctuating flows	Same as above.	Slight to moderate benefits to native fish and endangered fish; slight to moderate adverse impacts to trout; slight adverse impact to terrestrial resources; moderate adverse impact to bald eagle.	Adverse impact because of high erosion rate.	Large adverse impact to angling in spring and early summer; large benefit to angling from mid-summer to fall; moderate benefit to white-water boating in spring and early summer.
Seasonally adjusted moderate fluctuating flows	Slight benefit; decrease in erosion rate.	Slight to moderate benefit to native fish and endangered fish; moderate adverse impact to bald eagle; slight adverse impact to Ute ladies-tresses; slight adverse impact to terrestrial resources.	Moderate benefit because of reduced erosion rate.	Moderate to large adverse impact to angling in spring and early summer; moderate benefit to angling from mid-summer to fall; moderate benefit to white-water boating in spring and early summer.
Seasonally adjusted steady flows	Same as above.	Moderate to large benefit to native fish and endangered fish; slight benefit to trout; slight benefit to terrestrial resources; moderate adverse impact to bald eagle and Ute ladies-tresses; slight benefit to peregrine falcon.	Same as above.	Same as above.

^a The impacts presented are relative to a baseline of existing conditions that have formed over 30 years of operations. No impacts to air resources, land use, or visual resources were identified.

TABLE S.8 Summary of Potential Impacts of Hydropower Operational Scenarios on Natural and Cultural Resources Associated with the Aspinall Unit^a

Operational Scenario	Water Resources	Ecological Resources	Cultural Resources	Recreation
Seasonally adjusted high fluctuating flows				
Blue Mesa Reservoir	Slight impact; daily fluctuations same as historical but monthly release volumes change.	No impact to any resources.	No impact.	No impact.
Morrow Point Reservoir	Same as above.	Same as above.	Same as above.	Same as above.
Crystal Dam Reservoir	Same as above.	No impacts to aquatic resources; slight benefit to terrestrial resources.	Same as above.	Same as above.
Seasonally adjusted steady flow				
Blue Mesa Reservoir	Large impact; daily fluctuations eliminated and monthly release volumes change.	No impact to aquatic or terrestrial resources; slight adverse impact to bald eagle.	No impact.	No impact.
Morrow Point Reservoir	Same as above.	Same as above.	Same as above.	Same as above.
Crystal Reservoir	Same as above.	No impact to aquatic resources; slight benefit to terrestrial resources; slight adverse impact to bald eagle.	Same as above.	Same as above.

^a The impacts presented are relative to a baseline of existing conditions that have formed over 28 years of operation. No impacts to air resources, land use, or visual resources were identified.

Although steady flow scenarios could result in benefits to a number of resources, some benefits would require the proposed occasional high flows to build beaches and maintain fish habitats. Benefits could occur for water resources (reduced erosion rates), aquatic ecology (trout and native fish), terrestrial ecology (increase in woody riparian vegetation), cultural resources, and recreation (angling and white-water boating). Benefits would be expected for the humpback chub, bald eagle, peregrine falcon, and southwestern willow flycatcher. Marsh vegetation could decrease.

S.8.2 Flaming Gorge Dam

The year-round high fluctuating flow operational scenario for Flaming Gorge Dam features higher maximum releases and greater daily flow fluctuations than occurred under historical operations. These higher flows and daily fluctuations could result in adverse impacts to some ecological resources, including trout, native fish, endangered fish, and woody riparian vegetation. Since this scenario has a higher erosion rate than steady flows, adverse impacts to cultural resources would be expected.

The remaining three operational scenarios at Flaming Gorge Dam are seasonally adjusted; that is, they feature shifts in monthly volumes to meet requirements of the U.S. Fish and Wildlife Service Biological Opinion issued for the facility. These scenarios exhibit a high sustained flow in May or June, reduced fluctuations and lower flows in summer and autumn, and steady flows when ice cover is present on the river (February and March). These flows are intended to be protective of endangered fish in the system and could result in benefits to these species, as well as to other resources. Some adverse impacts could result from seasonal adjustment, however. The spring peak in flows would result in large adverse impacts to anglers. The bald eagle and over-wintering waterfowl could be adversely affected by steady flows in February and March. With steady flows, less open ice-free water would be available for these species.

Seasonally adjusted high fluctuations would have moderate effects on flow and stage, but would have erosion rates similar to those of year-round high fluctuations. Slight to moderate benefits are expected to native fish (including the endangered humpback chub, bonytail chub, Colorado squawfish and razorback sucker) because of improved nursery habitat conditions and increased overwinter survival. This scenario would result in large benefits to angling in mid-summer through autumn (when lower flows are maintained) and moderate benefits to white-water boating during the spring peak in flows. Slight adverse impacts are expected to terrestrial ecology because of the inundation of some woody riparian vegetation. Slight adverse impacts are also expected to trout as under year-round high fluctuations. Because erosion rates would be higher than under steady flows, cultural resources would be adversely affected by this operational scenario.

Seasonally adjusted moderate and steady flows are relatively similar in their impacts to most resources. Both scenarios would have moderately reduced erosion rates and, thus, would benefit water resources and cultural resources. Slight benefits to trout and moderate to large benefits to native and endangered fish, angling, and white-water boating are also

expected under these scenarios because of reduced daily fluctuations. Slight to moderate adverse impacts to the threatened plant Ute ladies-tresses could occur if these scenarios resulted in lower soil moisture levels in the alluvial meadows where the species occurs.

Seasonally adjusted moderate fluctuations are expected to have slight adverse impacts on terrestrial resources because some existing woody riparian vegetation would be inundated and lost. The steady flow scenario would result in slight benefits to terrestrial resources by allowing an increase in woody riparian vegetation.

S.8.3 Aspinall Unit

Because Crystal Dam reregulates flows from the Aspinall Unit, flows in the Gunnison River below the Unit and the resources that depend on those flows would not be affected by hydropower operations. Slight to moderate impacts to flow and stage in Blue Mesa and Morrow Point reservoirs would occur because of seasonal adjustments in releases and daily fluctuations. Despite these changes in flow and stage, neither operational scenario is expected to result in impacts to sediment, most ecological resources (aquatic ecology, threatened and endangered species), cultural resources, recreation, land use, or visual resources. Both scenarios would result in slight benefits to terrestrial resources in the headwaters of Crystal Reservoir in the form of an increase in woody riparian vegetation. Slight adverse impacts to the bald eagle are expected under the seasonally adjusted steady flow scenario because the reservoirs would freeze earlier in the winter with reduced fluctuations.

S.9 CUMULATIVE ENVIRONMENTAL CONSEQUENCES

Past actions relevant to the cumulative impacts of commitment-level alternatives and hydropower operational scenarios include the construction and operation of existing hydropower facilities and thermal power plants, as well as other development activities. These past impacts and the impacts of ongoing activities were incorporated into the baseline conditions described under *Affected Environment* and, consequently, are considered in the assessment of impacts discussed under *Environmental Consequences*. Similarly, reasonably foreseeable future actions have been considered in the impact assessment wherever possible. Included are actions that might be implemented in association with findings or recommendations of the EIS for continued operation of Glen Canyon Dam, the Biological Opinion for operation of Flaming Gorge Dam, and the EIS for operations of the Aspinall Unit. These actions were incorporated into the impact assessment in the formulation of the hydropower operational scenarios considered.

The location of Glen Canyon Dam, Flaming Gorge Dam, and the Aspinall Unit within the Colorado River Basin together with other hydroelectric facilities within the basin increases the potential for cumulative impacts on the hydrology of the basin. However, because of the distance between facilities and the number of intervening tributaries that

ameliorate the impacts of individual facilities on flow, sediment load, and water temperature, no cumulative impacts to resources are expected that have not already been considered in the individual assessments for each facility.

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