Central Utah Project, Bonneville Unit: Diamond Fork Power System: Final Environmental Impact Statement

Forest Service; Western Area Power Administration; United States

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FINAL
ENVIRONMENTAL IMPACT STATEMENT

DIAMOND FORK POWER SYSTEM,
BONNEVILLE UNIT,
CENTRAL UTAH PROJECT

Prepared by:
Upper Colorado Region
Bureau of Reclamation
U.S. Department of the Interior

In cooperation with:
U.S. Department of Agriculture
Forest Service
U.S. Department of the Interior
U.S. Department of Energy
Western Area Power
Administration

This Environmental Impact Statement analyzes the environmental impacts of alternatives being considered to deliver increased amounts of water from the enlarged Strawberry Reservoir through the Diamond Fork drainage in north-central Utah for hydroelectric power generation and for agricultural and municipal and industrial purposes for both the Municipal and Industrial System and the Irrigation and Drainage System of the Bonneville Unit. Alternatives assessed include the Sixth Water Flow Through Alternative (the recommended plan); the Fifth Water Pumped Storage Alternative; the Sixth Water Pumped Storage Alternative; the 1964 Definite Plan Report Alternative; and the No Power Alternative. In the Draft Environmental Statement, the Fifth Water Pumped Storage Alternative was presented as the recommended plan; however, an assessment of non-Federal interest in developing and financing the power system conducted early in 1984 indicated inadequate support for the Fifth Water Alternative and resulted in Reclamation selecting the Sixth Water Flow Through Alternative as the recommended plan in this Final Environmental Impact Statement. The recommended plan would generate approximately 166 megawatts of hydroelectric power. The key issues raised in the scoping process and in review of the Draft Environmental Statement relate to water and electrical energy requirements, road and transmission alignments, recreation and tourism and increased opportunities for stream and flatwater fishing, construction impacts on fish and wildlife, flood damage and erosion, and payment for acquisition of property. A loss of existing wildlife habitat on project lands would occur through a combination of reservoir inundation and construction and operation of project features, primarily roads. Wildlife mitigation plans are included as a part of all alternatives to offset the loss of the wildlife values associated with this habitat.

The Environmental Impact Statement is intended to serve environmental review requirements in compliance with the Clean Water Act of 1977 (Public Law 95-217); Executive Order 11988, Floodplain Management; and Executive Order 11990, Protection of Wetlands. The statement is also intended to fulfill requirements for exemption from Section 404 of Public Law 95-217. For further information on the processing or content of this document, please contact the Regional Director, Bureau of Reclamation, 125 South State Street, P.O. Box 11568, Salt Lake City, Utah 84147, or call commercial (801) 524-5580 or FTS 588-5580.

Draft
Statement number: DES 83-46
Date made available to EPA and the public: June 17, 1983

Final
INT FES 84-30
SUMMARY

General

The Diamond Fork Power System, located in north-central Utah, would be an essential component of the interrelated systems of the Central Utah Project's Bonneville Unit. Construction of the Bonneville Unit began in 1967 and is nearly 30 percent complete, based on costs expended to date as a percent of the total estimated cost and assuming construction of the recommended Sixth Water Flow Through Alternative for the Diamond Fork Power System. The Central Utah Project is a major water development project designed to provide water for agricultural and municipal and industrial needs for 12 counties in northern and central Utah and for hydroelectric power generation. The Diamond Fork Power System would develop hydroelectric energy by means of a transbasin diversion of water which would descend about 2,600 feet from the enlarged Strawberry Reservoir in the Uinta Basin, a part of the Colorado River Basin, to the confluence of Diamond Fork and the Spanish Fork River in the Bonneville Basin through a system of tunnels, pipelines, reservoirs, and powerplants. The recommended plan would provide about 166 megawatts (MW) of hydroelectric power. The system would also facilitate the conveyance of an average of 137,400 acre-feet of Bonneville Unit water and 61,000 acre-feet of Strawberry Valley Project water annually from the Uinta Basin to the Bonneville Basin. Additionally, the project would provide recreation, fish and wildlife measures, and flood and water quality control. The developed water and energy would fulfill the project objectives of supplying immediate and projected needs for the rapidly growing population along the Wasatch Front. Some of the energy would be used for project pumping, and the rest would be marketed for commercial use throughout the Colorado River Storage Project (CRSP) marketing area. Most of the power system would be located in Utah County; however, a small portion at the upper end of the system would be located in Wasatch County. The system would be constructed in the Diamond Fork and Sixth Water drainages in the Uinta National Forest of the Wasatch Mountain range. Sixth Water is a tributary of Diamond Fork, which is a tributary of the Spanish Fork River. Elevations of project features would range from about 7,600 feet to 5,000 feet.

A number of non-Federal entities have expressed interest in participating in development of the Diamond Fork Power System. Under the concept of non-Federal participation, which the Bureau of Reclamation (Reclamation) has been directed to explore, such entities would fund most of the construction of the powerplants and associated features in return for a comparable portion of the power produced. Specific guidelines for implementing this participation have yet to be developed, with the exception that the generating units would be an integral part of water resource development projects and, therefore, would be operated to satisfy the multiple purposes of the project. Securing non-Federal financial involvement would confirm that the proposed additional hydroelectric power is needed.
SUMMARY (Continued)

Under the National Environmental Policy Act (NEPA), the average annual transbasin diversion of 137,400 acre-feet of project water is being evaluated in practical increments. This intent and format was discussed in the 1973 programmatic Final Environmental Statement (FES), which dealt with the entire Bonneville Unit, and was also stipulated in the 1974 litigation, which confirmed the adequacy of that FES. The 1973 FES provided the final NEPA compliance only for the Strawberry Aqueduct and Collection System. A 1979 FES for the Municipal and Industrial System evaluated the transbasin conveyance of up to 30,000 acre-feet of water and the use of 104,100 acre-feet of water along the Wasatch Front. The Diamond Fork Power System Final Environmental Impact Statement (FEIS) provides NEPA compliance for conveyance of the full 137,400-acre-foot diversion but does not include full evaluation of the use of the last 33,300-acre-foot increment. This last increment of water will be evaluated in the environmental statement for the Irrigation and Drainage System, scheduled for mid-1985.

This Environmental Impact Statement is intended to provide final NEPA compliance for the Diamond Fork power production facilities. Since these facilities would be constructed mostly on Forest Service lands and because Western Area Power Administration (Western) would be responsible for transmission of project power, these agencies are formal cooperators in preparation of this environmental statement. Because the extent of non-Federal participation in the project is not yet known, the distribution of project power cannot be predicted at this time. However, a task force headed by Western and including representatives of the U.S. Forest Service, Bureau of Land Management, and Bureau of Reclamation has determined that there are no insurmountable environmental impediments to routing the project power out of Diamond Fork to points of need. No significant modifications of the existing interconnected transmission system would be required with the recommended plan.

Alternatives

During project investigations, five alternatives were developed from all feasible options. In four of these alternatives, hydroelectric power would be generated and an annual average of 198,400 acre-feet of existing Strawberry Valley Project and Bonneville Unit water would be delivered through a system of tunnels, pipelines, dams and reservoirs, and powerplants. The fifth alternative would consist only of facilities to deliver the 198,400 acre-feet of water and would not include power generation. Summary Table 1 compares the features of the five alternatives.

In the Draft Environmental Statement (DES), the Fifth Water Pumped Storage Alternative was presented as the recommended plan; however, an assessment of non-Federal interest in developing and financing the power system conducted early in 1984 indicated inadequate support for the Fifth Water Alternative and resulted in Reclamation selecting the Sixth Water Flow Through Alternative as the recommended plan in this Final Environmental Impact Statement. The Sixth Water Flow Through Alternative would include three dams and reservoirs and five flow-through.
### Summary Table 1

<table>
<thead>
<tr>
<th>Feature</th>
<th>Sixth Water</th>
<th>Fifth Water</th>
<th>Sixth Water</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Through</td>
<td>Pumped</td>
<td>Storage</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Syar Tunnel</td>
<td>Capacity (cfs)</td>
<td>800</td>
<td>600</td>
</tr>
<tr>
<td></td>
<td>Diameter (feet)</td>
<td>10.5</td>
<td>10.5</td>
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<tr>
<td></td>
<td>Length (miles)</td>
<td>5.3</td>
<td>5.3</td>
</tr>
<tr>
<td>Syar Pumped</td>
<td>Capacity (cfs)</td>
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<td>500</td>
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<tr>
<td></td>
<td>Diameter (feet)</td>
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<tr>
<td></td>
<td>Length (miles)</td>
<td>4.0</td>
<td>4.0</td>
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<tr>
<td>Syar Powerplant</td>
<td>Capacity (MW)</td>
<td>12.6</td>
<td>14.5</td>
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<tr>
<td></td>
<td>Annual energy (MWh)</td>
<td>11,780</td>
<td>12,460</td>
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<tr>
<td>Fifth Water Reservoir</td>
<td>Total capacity (acre-feet)</td>
<td>4,400</td>
<td>4,400</td>
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<td></td>
<td>Surface area at normal water surface elevation (acres)</td>
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<td>19.3</td>
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<tr>
<td>Fifth Water Dam</td>
<td>Height (feet)</td>
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<td>125</td>
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<tr>
<td></td>
<td>Material volume (cubic yards)</td>
<td>130,000</td>
<td>150,000</td>
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<tr>
<td>Corona Aqueduct</td>
<td>Capacity (cfs)</td>
<td>2,500</td>
<td>2,500</td>
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<td>Diameter (feet)</td>
<td>19.75-21.5</td>
<td>19.75-21.5</td>
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<td></td>
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<tr>
<td>Dyne Aqueduct</td>
<td>Capacity (cfs)</td>
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<td>1,250</td>
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<tr>
<td></td>
<td>Diameter (feet)</td>
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<td>7.5</td>
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<tr>
<td></td>
<td>Length (miles)</td>
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<td></td>
<td>Annual energy (MWh)</td>
<td>121,800</td>
<td>131,600</td>
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<td>Monks Hollow Reservoir</td>
<td>Total capacity (acre-feet)</td>
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<td>5,100</td>
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<td></td>
<td>Surface area at normal water surface elevation (acres)</td>
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<td>19.3</td>
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<tr>
<td>Monks Hollow Dam</td>
<td>Height (feet)</td>
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<td>125</td>
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<td></td>
<td>Material volume (cubic yards)</td>
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<td>150,000</td>
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<td>Capacity (MW)</td>
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<tr>
<td></td>
<td>Annual energy (MWh)</td>
<td>33,000</td>
<td>39,200</td>
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<td>Diamond Fork Pipeline</td>
<td>Capacity (cfs)</td>
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<td>1,250</td>
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<td>Diameter (feet)</td>
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<td>8.0</td>
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<td></td>
<td>Length (miles)</td>
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<td>Diamond Fork Powerplant</td>
<td>Capacity (MW)</td>
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<td>6.8</td>
</tr>
<tr>
<td></td>
<td>Annual energy (MWh)</td>
<td>19,300</td>
<td>19,300</td>
</tr>
</tbody>
</table>

### Notes

1/ January 1983 price level; includes engineering, overhead, and service facilities.

2/ Net benefits are for the power increment only.

3/ Includes 1,400 acre-feet exclusively for flood control. Capacity at normal water surface elevation would be 31,400 acre-feet.
SUMMARY (Continued)

powerplants. The powerplants would have a combined capacity of about 166 MW. Conveyance works would consist of one tunnel, three penstocks, two aqueducts, and a pipeline. Access roads would include 32.9 miles of new roads and 12.4 miles of existing roads to be upgraded. Transmission lines would consist of 3.6 miles of 13.8-kilovolt (kV) lines; 0.5 mile of 46-kV lines; 5.0 miles of single-circuit, 138-kV lines; and 10.0 miles of double-circuit, 138-kV line. Five switchyards and two substations would be constructed. Recreation facilities would be provided, stream fisheries would be considerably enhanced, a limited reservoir fishery would be created, some flood control would be accomplished in Diamond Fork, and measures would be taken to mitigate wildlife losses. No additional transmission lines would be required within the interconnected transmission system.

The Fifth Water Pumped Storage Alternative would include two dams and reservoirs, three flow-through powerplants, and one pumped storage powerplant. The powerplants would have a combined generating capacity of about 1,182 MW. Conveyance works would consist of a tunnel, three penstocks, a discharge tunnel, and a pipeline. Additionally, an access tunnel, an access shaft, and a ventilation shaft would be constructed. Access roads would include 22.4 miles of new roads and 15.8 miles of existing roads to be upgraded. Transmission lines from the Diamond Fork Power System to the interconnected transmission system would consist of 8.5 miles of 345-kV, double-circuit line and 8.0 miles of 46-kV line. Four switchyards and one substation would be constructed. Recreation facilities would be provided, stream fisheries would be considerably enhanced, limited reservoir fisheries would be created, some flood control would be accomplished in Diamond Fork, and wildlife losses would be mitigated. Additional extra high- and high-voltage transmission lines would be required within the interconnected transmission system for this alternative.

The Sixth Water Pumped Storage Alternative would include three dams and reservoirs, three flow-through powerplants, and two pumped storage powerplants. The powerplants would have a combined capacity of about 423 MW. Conveyance works would consist of a tunnel, three penstocks, two aqueducts, and a pipeline. Access roads would include 20.2 miles of new roads and 19.1 miles of existing roads to be upgraded. Transmission lines would consist of 10.9 miles of 345-kV and 4.7 miles of 46-kV lines. Five switchyards and two substations would be constructed. As in the recommended plan, recreation facilities would be provided, stream fisheries would be considerably enhanced, a limited reservoir fishery would be created, some flood control would be provided in Diamond Fork, and wildlife losses would be mitigated. Additional extra high- and high-voltage transmission lines would be required within the interconnected transmission system for this alternative.

The 1964 Definite Plan Report (DPR) Alternative would include three dams and reservoirs and three flow-through powerplants. The powerplants would have a combined capacity of about 133 MW. Conveyance works would consist of a tunnel, three penstocks, and three aqueducts. Access roads would include 11.4 miles of new roads and 16.3 miles of existing roads.
SUMMARY (Continued)

to be upgraded. Transmission lines would consist of 10.9 miles of 138-kV and 1.4 miles of 46-kV lines. Three switchyards and two substations would be constructed. Recreation facilities and fishery mitigation would be provided, a limited reservoir fishery would be created, some flood control would be accomplished in Sixth Water Creek and Diamond Fork, and wildlife losses would be mitigated. No additional transmission lines would be required within the interconnected transmission system for this alternative.

The No Power Alternative would include a tunnel and pipeline as conveyance works. No powerplants would be provided. Road construction would consist of 4.7 miles of existing roads to be upgraded. Since project water would be conveyed entirely in the Diamond Fork Pipeline, this alternative would have a beneficial impact on the existing fishery resource in the Diamond Fork drainage. Wildlife mitigation measures would be much reduced from those of the other alternatives because of lesser impacts. Recreation facilities would also be provided by this alternative.

Recommended Plan of Development

On the basis of economic, engineering, and environmental factors, as well as information received from the public, the Sixth Water Flow Through Alternative was selected as the recommended plan of development.

The recommended plan includes Syar, Sixth Water, and Monks Hollow Dams and Reservoirs and Syar, Sixth Water, Dyne, Monks Hollow, and Diamond Fork Flow Through Powerplants. The powerplants would have a combined capacity of 166.2 MW. Conveyance works would consist of Syar Tunnel and Penstock, Corona Aqueduct and Sixth Water Penstock, Dyne Aqueduct and Penstock, and the Diamond Fork Pipeline. A switchyard would be built at each of the five powerplants, and two separate 13.8-kV transmission lines would connect the Syar Switchyard with the Rays Valley Substation and the Monks Hollow Switchyard with the Dyne Switchyard. A 138-kV line would connect the Rays Valley Substation with the Dyne Switchyard. A double-circuit, 138-kV transmission line would connect the Rays Valley Substation with the Sheep Creek Substation in Spanish Fork Canyon where the power would be tied to the existing interconnected transmission system. A separate 46-kV transmission line would connect the Diamond Fork Switchyard with the interconnected system at the mouth of Diamond Fork Canyon. About 32.9 miles of new roads would be constructed and 12.4 miles of existing roads improved to facilitate construction and operation. Recreation facilities would provide about 60,400 recreation-days annually and would include a day-use area at Monks Hollow Reservoir, a trail around the reservoir, and a full-use area and trailhead below the reservoir. In addition, two existing campgrounds would be enlarged to replace two which would be abandoned. Diamond Fork below Monks Hollow Dam would be considerably enhanced as a fishery, and a limited flatwater fishery would be created in Monks Hollow Reservoir. Mitigation for big game and other wildlife habitat
losses would consist of the acquisition, habitat improvement, and management of about 4,000 acres of private land for wildlife.

Summary of Environmental Impacts

Summary Table 2 is a comparison of net environmental impacts which would result from implementation of the five alternatives, including mitigation measures. The impacts are compared to future conditions expected without additional Federal development of the Bonneville Unit, although facilities to deliver an annual average of 198,400 acre-feet of water from the Uinta Basin to the Bonneville Basin without power generation would be the minimum required to maintain the basic integrity of the Bonneville Unit. This future without condition is used as a basis for comparison because impacts resulting from the delivery system without power generation were not previously evaluated.

Temporary and permanent impacts on topography and scenery would result from the construction of reservoirs, powerplants, transmission lines, and roads, and the upgrading of existing roads. Construction-related mitigation measures would include the contouring, topsoiling, and revegetation of these areas. Revegetation of native grasses, shrubs, and forbs would probably take about 5 to 10 years, whereas pinyon-juniper, mountain brush, and riparian communities would require about 25 years to return to conditions visually comparable to those existing. The scenic quality of the reservoirs would vary depending on water level fluctuations. During periods of low water, mudflats around the shoreline would detract from the aesthetic appeal and recreational use. Powerline corridors have been aligned to limit adverse visual impacts on scenery.

Both permanent and temporary losses of vegetation would occur primarily to reseeded grass, mountain brush, and pinyon-juniper communities. Permanent losses of vegetation, mostly from reservoir inundation, would total about 545 acres for the recommended plan, including about 46 acres of scarce riparian habitat. Temporary losses of vegetation, mostly from construction of the Diamond Fork Pipeline and development of borrow areas, would total about 280 acres, most of which is reseeded and mountain brush communities.

The construction of three reservoirs would inundate flood plains and cause the loss of 48 acres of existing stream and associated riparian vegetation. In exchange, these reservoirs would provide about 393 acres of aquatic habitat. Additionally, 28 acres of riparian vegetation would be temporarily disturbed by construction of the Diamond Fork Pipeline. Potential for flooding would be reduced because flows in the streams would be controlled. Flood control has been included in the design of Syar, Sixth Water, and Monks Hollow Reservoirs.

Both Syar and Sixth Water Reservoirs would be completely mixed systems. Water in the reservoirs and water released to Monks Hollow Reservoir would be similar in quality (temperature and nutrient) to the water
SUMMARY (Continued)

<table>
<thead>
<tr>
<th>Environmental category</th>
<th>Future without condition</th>
<th>Sixth Water Flow Through</th>
<th>Fifth Water Pumped Storage</th>
<th>Sixth Water Pumped Storage</th>
<th>1964 DPR</th>
<th>No Power</th>
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<tr>
<td>Fish (lb/year)*</td>
<td>27,186</td>
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<td>2,353</td>
<td>3,301</td>
<td>-684</td>
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<td>Streams</td>
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<td>-715</td>
<td>-7,048</td>
<td>-827</td>
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<td>Vegetation (area)</td>
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<td>-415</td>
<td>-1,031</td>
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<td>-835</td>
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<td>Temporary</td>
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<td>-297</td>
<td>-327</td>
<td>-254</td>
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<td>Wildlife indicator species (90%)*</td>
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<td>-50</td>
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<td></td>
<td>Bobcat</td>
<td>17,536</td>
<td>-150</td>
<td>-221</td>
<td>-49</td>
<td>-133</td>
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<td></td>
<td>Golden eagle</td>
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<td>-255</td>
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**SUMMARY Table 3**

Comparison of environmental impacts of Diamond Fork Power System alternatives.

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<tr>
<th>Recreation (RD)</th>
<th>Livestock use</th>
<th>Power generated (MW)</th>
<th>Vegetation (acres)</th>
<th>Net economic benefits ($1,000)</th>
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<th>Cultural</th>
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<tr>
<td>No Power</td>
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</table>

1/ Numerical ratings prepared by the Forest Service for a relative comparison of effects.
2/ Conditions expected in the future without additional Federal development of the Bonneville Unit.
3/ Estimated temperatures are given when cold water is withdrawn from the enlarged Strawberry Reservoir and when warm water is withdrawn, expected temperature ranges would be 16° to 20° C for each reservoir under each alternative (maximum in August).
4/ The values given for the Fifth Water Pumped Storage, Sixth Water Flow Through, and Sixth Water Pumped Storage Alternatives are for Diamond Fork immediately below Monks Hollow Reservoir. The values given for the 1964 DPR Alternative are for Sixth Water Creek immediately below Sixth Water Reservoir and Diamond Fork below Three Forks. For the No Power alternative, the values given are at Syar Tunnel outlet. In addition, the values given apply to both conditions of water withdrawal from the enlarged Strawberry Reservoir.

Change from average monthly temperature in August.

Average high temperature.

Average of spot measurements taken throughout the year.

A significant reduction in turbidity and sediment transport would result because project reservoirs would act as sediment traps, and existing irrigation flows would be placed in a closed system and would no longer carry a large historical sediment load.

A slight adverse impact over existing conditions would result from high surging flows in Diamond Fork between Dyne Powerplant and Syar Reservoir.

Temperature ranges given are maximum predicted to occur when cold water is withdrawn from the enlarged Strawberry Reservoir. When warm water is withdrawn, expected temperature ranges would be 16° to 20° C for each reservoir under each alternative (maximum in August).

Fifteen percent represents water fluctuation under projected initial operating conditions, whereas thirty percent represents fluctuation under maximum conditions.

20/ Based on surveys covering 90 percent of the project area.
21/ Total number of direct and indirect jobs from project construction.
22/ Population inflow during peak construction year.
23/ Animal Unit Month.
24/ Numerical ratings prepared by the Forest Service for a relative comparison of effects.
25/ Recreation through (not annual use and decrease expected in 1992).
SUMMARY (Continued)

released from Strawberry Reservoir, except that anoxic waters from Strawberry would be aerated. All three reservoirs would have relatively high nutrient loadings and would be classified as eutrophic. However, significant eutrophication problems are not expected because of water level fluctuations and short detention times, particularly in the smaller reservoirs. Monks Hollow Reservoir is expected to weakly stratify during project operation. Projected water temperatures of the reservoir water that would be released to Diamond Fork should be within 5°C to 8°C of present conditions. Even though Monks Hollow Reservoir is not expected to strongly stratify, the top several feet of water would probably become several degrees warmer than the rest of the reservoir during the warmest part of the summer. These combined conditions may result in abundant algae growth in the reservoir, particularly in more isolated or calmer bay areas. Under project operation, nutrient levels in Diamond Fork should not be significantly higher than at present. The sediment load in Diamond Fork would be reduced significantly from present conditions. The increased late summer and autumn flows from the project would improve water quality in the lower reaches of the Spanish Fork River by diluting the flows, which presently consist mostly of seepage and irrigation return flows.

Approximately 45 miles of fishery habitat in Diamond Fork, the Spanish Fork River, and Sixth Water Creeks would be affected by the project as a result of altering existing streamflow patterns. The recommended plan would result in considerable enhancement of stream fisheries, mainly because the Diamond Fork Pipeline from Monks Hollow to the Spanish Fork River would remove excess flows from Diamond Fork, thereby reducing water velocities, scouring, and bank erosion. Trout standing crop, habitat, and angler use would increase over existing conditions, especially in the lower reach of Diamond Fork. This increase would more than compensate for the loss of habitat upstream because of inundation by Monks Hollow Reservoir and removal of presently imported flows from Sixth Water Creek, which is the only stream that would be adversely affected by implementation of the plan. Reduction in trout habitat would occur because the irrigation flows from Strawberry Reservoir that now flow through the upper portion of the creek would be diverted through Syar Tunnel and into Syar and Sixth Water Reservoirs. The upper portion of the creek would revert to natural flows, which would be much less than the high flows it now carries. These lowered flows would not provide the existing level of trout habitat.

Monks Hollow Reservoir is expected to have limited fish production potential. Syar and Sixth Water Reservoirs would be too small and would undergo too rapid and extreme fluctuations to support viable fisheries.

With the recommended plan, the permanent loss and reduced quality of existing wildlife habitat (based on indicator species) would range from 98 acres (beaver and Cooper's hawk) to 2,487 acres (mule deer) through a combination of construction impacts, reservoir inundation, new and improved access roads, and operation of project features. Impacts to beaver would be mostly compensated. The loss of mule deer habitat would nearly all be compensated by habitat replacement and management.
SUMMARY (Continued)

Losses of golden eagle and bobcat habitat would be overcompensated by about 9 percent and 35 percent, respectively, whereas losses of Cooper's Hawk habitat would be undercompensated by about 70 percent.

Social, economic, and demographic impacts include both adverse and beneficial effects. The magnitude of the impacts is closely related to the level of construction activity. One of the major benefits of the project would be to create more jobs. Some additional services and facilities would be required for housing, education, and health and medical care to respond to an influx of population. With withdrawal of the construction work force, however, nonproject-related economic and population growth would quickly absorb additional capacity created by the project.

Construction of the recommended plan would result in approximately a 5 percent reduction in grazing and a 45 percent increase in expenses to permittees. Construction of Monks Hollow Reservoir and other project features would close Diamond Fork road, causing grazing management problems by blocking access to and from the upper and lower grazing areas. The Forest Service and the Bureau of Reclamation are working cooperatively to minimize these losses.

The recommended plan would provide increased recreation facilities at both dispersed recreation areas and potential recreation sites in the Diamond Fork area. Construction of the recommended plan would result in an increase of about 13 percent over projected recreation use without the project.

A survey of the market for potential hydroelectric resources in the CRSP marketing area indicates an unmet need for 200 MW of baseload power and 2,300 MW of peaking capacity from publicly and privately owned utilities by 1990 and 4,340 MW and 11,000 MW, respectively, by the year 2000. The survey area included all of Wyoming, Colorado, New Mexico, Arizona, Utah, southern Nevada, and a small portion of southeastern California. The final determination of power need will be verified by the extent of non-Federal participation in the project.

Impacts from transmission facilities in the Diamond Fork area would result from construction activities such as clearing of trees for power-line towers, installation of transmission structures, damage to stream-banks and riparian habitat, and removal of vegetation for access road construction. With the recommended plan, visual impacts would be relatively low because most of the transmission corridor alignment would not be visible from roads. A combination of helicopter and conventional construction methods would be used to build the transmission system. There would be no measurable effect on fisheries. Impacts to wildlife, recreation use, and livestock would be minor.
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CHAPTER I

INTRODUCTION

Purpose of the Environmental Impact Statement

This Final Environmental Impact Statement (FEIS) presents and analyzes site-specific environmental aspects of the Diamond Fork Power System (power system) of the Bonneville Unit of the Central Utah Project. The Central Utah Project was authorized as a participating project of the Colorado River Storage Project (CRSP) by the Act of April 11, 1956 (70 Stat. 105). This statement has been prepared in compliance with the National Environmental Policy Act (NEPA) of 1969 (Public Law 91-190) and current guidelines established by the Department of the Interior, the Bureau of Reclamation (Reclamation), and the Western Area Power Administration (Western) of the Department of Energy. The statement is also intended to serve environmental review requirements in compliance with Executive Orders 11988, Floodplain Management, and 11990, Protection of Wetlands.

The portion of the Diamond Fork Power System not required for project use will be funded by non-Federal entities. As a result, agreements with potential participants are currently being developed to provide this funding. Construction of the power system would not begin until these agreements have been negotiated and signed. Securing adequate non-Federal funding would confirm the projected need for additional hydropower and would supplement and refine marketing studies already performed by Western. An assessment of non-Federal interest in developing and financing the power system conducted in early 1984 indicated inadequate support for the Fifth Water Pumped Storage Alternative recommended in the Draft Environmental Statement (DES). As a result, Reclamation has selected the Sixth Water Flow Through Alternative as the recommended plan. This flow-through alternative was evaluated in the draft statement with the Fifth Water Pumped Storage Alternative and more adequately satisfies current energy needs.

Studies for the power system were conducted in accordance with the Federal Water Pollution Control Act amendments of October 1972 (Public Law 92-500), which mandate the development of comprehensive programs for preventing, reducing, or eliminating the pollution of waters. Public Law 92-500 was amended by the Clean Water Act of 1977, Public Law 95-217. Section 404 of Public Law 95-217 requires permits to be obtained from the Corps of Engineers if dredge and fill material is to be discharged below the normal high water level of streams or other water bodies. However, Reclamation intends to pursue an exemption from this activity through procedures described in Section 404(r) of Public Law 95-217. This statement discusses the impacts of discharging dredge and fill material into navigable waters at project construction sites and measures which would be employed to control or limit water pollution from these discharges. This information, which is presented in Attachment 1, is based on the
technical analyses contained in the body of this statement and was prepared in accordance with Section 404(b)(1) of Public Law 95-217. The Corps of Engineers and the Environmental Protection Agency have responded in letters commenting on the Draft Environmental Statement that this information is in compliance with the Section 404(b)(1) guidelines (see "Consultation and Coordination" section in the Appendix). Reclamation will submit the Final Environmental Impact Statement for the Diamond Fork Power System to Congress prior to construction funding.

A programmatic Final Environmental Statement (FES) for the entire Bonneville Unit was filed with the Council on Environmental Quality in August 1973. Reclamation has employed a technique known as tiering, which is a process of covering broad matters in a general impact statement and focusing on a specific proposal requiring a current decision in a narrower impact statement. The programmatic Bonneville Unit statement and subsequent decisions determined the basic unit plan including the Diamond Fork Power System. The basic decision to accept the resulting cumulative impacts of the unit was made 30 days after filing the final statement and need not be examined again in detail. The programmatic statement also committed Reclamation to prepare site-specific statements covering specific impacts of the major unit systems remaining to be constructed (except the Strawberry Collection System, which had already met NEPA compliance). This document is the site-specific statement for the Diamond Fork Power System.

Purpose of the Power System

The purpose of the Diamond Fork Power System is to utilize the potential developed by a planned transbasin diversion of water from the Uinta Basin of the Upper Colorado River Basin to the Bonneville Basin of the Great Basin to provide additional hydroelectric capacity and generate additional energy. The transbasin diversion would provide water for irrigation and municipal and industrial uses by the Municipal and Industrial (M&I) and Irrigation and Drainage (I&D) Systems of the Bonneville Unit. An integral part of the Bonneville Unit, this transbasin diversion involves an elevation drop of about 2,600 feet and thus provides a significant resource for hydroelectric capacity and energy generation. The power system would also provide increased recreational opportunities, flood control, and improved stream fisheries.

The 1973 programmatic Environmental Statement for the Bonneville Unit discussed four alternative routes to accomplish the transbasin diversion. These routes include (1) diversion to the Provo River through two potential Wallsburg Tunnels and a Round Valley Power System, (2) diversion to the Spanish Fork River through a Halls Fork Tunnel and a Hobble Creek Power System, (3) diversion to the Provo River through a Wallsburg Tunnel and Main Creek, and (4) diversion to the Spanish Fork River through a Syar Tunnel and the Diamond Fork drainage. The first three of these alternative routes are not discussed in this statement because they were adequately covered in the programmatic statement. The fourth has been selected as the preferred route because it maximizes
hydroelectric capacity and energy generation in the most economical and environmentally acceptable manner.

The amount of power required by consumers fluctuates daily, weekly, and seasonally. More power is used during weekdays than at night or on weekends. Also, depending on the climate of an area, more power may be required in the summer for air conditioning and/or winter for heating than in the spring and fall, when temperatures are more moderate. Figure 1 shows a typical power demand for a 1-week period. The bottom of the figure shows demand for baseload power generation, which is generation utilized 100 percent of the time. The top of the figure shows demand for peakload, or power which is needed only at periodic intervals during the day or week. Peaking power generation has a higher economic value than baseload generation. The Diamond Fork Power System would supply both baseload and peaking power.

![Figure 1: Electrical Generation and Demand](image)

**Interrelationships**

Strawberry Valley Project

The Strawberry Valley Project, completed in 1922, is a forerunner of the Central Utah Project. Principal features of the project related
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to the Diamond Fork Power System include Strawberry Dam, Reservoir, and Tunnel. The dam impounds flows of the Strawberry River, a tributary of the Duchesne River northeast of Diamond Fork in the Uinta Basin, for storage in the reservoir. The tunnel serves as an outlet for the reservoir and conveys water through the Wasatch Mountains to Sixth Water Creek for irrigation in the Bonneville Basin. With a capacity of approximately 500 cubic feet per second (cfs) and a length of 3.8 miles, the tunnel conveys an average of 61,000 acre-feet from May to September each year. From the tunnel outlet, the water flows in Sixth Water Creek, Diamond Fork, and the Spanish Fork River to points of diversion and use. The tunnel inlet was recently rehabilitated for use with the enlarged Strawberry Reservoir, a feature of the Bonneville Unit. NEPA compliance for the rehabilitation was accomplished with a Finding of No Significant Impact (FONSI).

Bonneville Unit

The Bonneville Unit, one of six independent units of the Central Utah Project, involves a transbasin diversion from the Uinta Basin to the Bonneville Basin. The remaining units—Vernal, Jensen, Upalco, Uintah, and Ute Indian—are or would be located entirely within the Uinta Basin. The Vernal Unit is essentially complete; the Bonneville, Jensen, and Upalco Units are under construction; Uintah Unit advance planning is in progress; and planning on the Ute Indian Unit was concluded in 1980 because a viable plan could not be formulated at that time. The Bonneville Unit is shown on Figure 2.

The Bonneville Unit includes facilities to collect water from streams of the Duchesne River system in the Uinta Basin, to store and regulate the collected water, and to release it as needed through a tunnel to the Bonneville Basin and deliver it to areas of use. Other water collection and storage works in the Uinta Basin would increase usable water supplies to protect the water rights of local users and to expand irrigation and other water uses in that basin. Project works in the Bonneville Basin would be provided for storage and distribution of the imported water, for further development of local water resources, and for facilitating water exchanges and water quality control that would allow the most beneficial use. An average annual water supply of 294,400 acre-feet would be provided, including 121,100 acre-feet for municipal and industrial use, 166,800 acre-feet for irrigation, and 6,500 acre-feet for stream fisheries. Of the total, an annual average of 137,400 acre-feet would be diverted from the Uinta Basin through the Diamond Fork Power System to the Bonneville Basin, including 106,800 acre-feet for irrigation use and 30,600 acre-feet for municipal and industrial use.

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1/ As discussed under Water Requirements in Chapter II, additional water will be provided for stream fisheries as part of a Bonneville Unit instream fishery flow agreement. Alternative plans are being evaluated which would provide fishery flows and still allow full development of the Bonneville Unit.
The unit is divided into six systems according to location and function: (1) the Starvation Collection System, (2) the Strawberry Collection System, (3) the Municipal and Industrial System, (4) the Irrigation and Drainage System, (5) the Ute Indian Tribal Development (formerly known as the Bureau of Indian Affairs Activity), and (6) the Diamond Fork Power System. The Starvation Collection System is complete; the Strawberry Collection System, the Municipal and Industrial System, and the Ute Indian Tribal Development are under construction; and the Irrigation and Drainage System is planned for construction after the Diamond Fork Power System. These systems are designed for interrelated operation to provide maximum efficiency. However, the Diamond Fork Power System would not depend on construction of the Irrigation and Drainage System to obtain its projected benefits because a conveyance system in Diamond Fork Canyon would still be needed to convey water for the M&I System. The Starvation Collection System, Strawberry Collection System, Municipal and Industrial System, and Diamond Fork Power System could operate together as an integrated project. The various systems are described below, with the exception of the Diamond Fork Power System, which is described in Chapter III.

**STARVATION COLLECTION SYSTEM**

The Starvation Collection System, completed in 1970, is located in the Uinta Basin and develops water primarily for local use. Regulatory storage is provided by the 167,300-acre-foot Starvation Reservoir, which is located on the Strawberry River just above its confluence with the Duchesne River, and stores surplus flows of both streams. The collection system provides irrigation water, recreation, fish and wildlife enhancement, and flood control and replaces water presently used along the Duchesne River (which will eventually be diverted to the Bonneville Basin) with storage water collected during high spring flows. As the first of the Bonneville Unit systems, the Starvation Collection System was under construction and nearing completion prior to enactment of NEPA and a final environmental statement was not written specifically for this system.

**STRAWBERRY COLLECTION SYSTEM**

The Strawberry Collection System is the major system of the unit, developing water in the Uinta Basin for in-basin use and for export to the Bonneville Basin. The 37-mile-long Strawberry Aqueduct, of which 36 miles have been constructed and 1 mile is under construction, would intercept flows of Rock Creek and eight other tributaries of the Duchesne and Strawberry Rivers and convey them to the existing Strawberry Reservoir, which has been enlarged in capacity from 270,000 acre-feet to 1,106,500 acre-feet to accommodate these diversions. The 33,123-acre-foot Upper Stillwater Reservoir, which is under construction, will provide temporary storage for high spring flows which would otherwise be lost for diversion and storage in Strawberry. The system will also provide flood control, recreation facilities, and fish and wildlife considerations. The 1973 programmatic Environmental Statement for the entire Bonneville Unit covered in specific detail the Strawberry Collection
System and certain aqueduct reaches of the M&I System that were needed initially to convey nonproject water.

The 1973 Bonneville Unit FES specifically evaluated the decision to collect an annual average of 136,600 acre-feet of water for diversion into the Bonneville Basin. A 1979 FES for the M&I System evaluated the decision to convey up to 30,000 acre-feet of water annually to the Wasatch Front through existing facilities. The 1979 FES also analyzed the impacts of using an annual average of 104,100 acre-feet of water in Utah, Salt Lake, and Wasatch Counties. This Environmental Statement on the Diamond Fork Power System evaluates the impacts of conveying 137,400 acre-feet of water but does not completely analyze the impacts of using the last 33,300-acre-foot increment of the transbasin diversion. This increment will be fully analyzed in the Environmental Statement for the I&D System scheduled for mid-1985. Thus, the decision to make the transbasin diversion of 137,400 acre-feet of water is being made in increments. This approach to NEPA compliance was presented in the 1973 programmatic FES and upheld in a subsequent 1974 court decision.

In a 1974 court action, the adequacy of the Environmental Statement was challenged by the Sierra Club, Trout Unlimited, the Natural Resources Defense Council, Inc., and the Environmental Defense Fund. The plaintiffs argued that (1) the statement was too narrow and should include the cumulative and collective impacts of the Central Utah Project, (2) the statement was incomplete because it was final only for the Strawberry Collection System and did not encompass the entire Bonneville Unit, (3) the statement did not adequately discuss alternatives for obtaining water within the Bonneville Basin for municipal and industrial purposes, and (4) the statement did not include a cost-benefit ratio. The United States District Court for the District of Utah decided in favor of the defendants, and the decision was upheld by the United States Tenth Circuit Court of Appeals. The Supreme Court refused to review the Circuit Court decision. The courts determined that the Strawberry Collection System was an independent major Federal action and that its environmental consequences had been adequately addressed in accordance with NEPA, including the discussion of alternatives and a comparison of environmental costs and benefits.

MUNICIPAL AND INDUSTRIAL SYSTEM

The M&I System would be located in the Bonneville Basin and would develop 105,100 acre-feet of water annually, including 90,000 acre-feet for municipal and industrial use in the Salt Lake City and Provo metropolitan areas and 15,100 acre-feet for supplemental irrigation along the Provo River. The system would also provide hydroelectric power generation, flood control, improved recreation opportunities, and protection of fish and wildlife resources. The Final Environmental Statement on the M&I System was filed in October 1979.

1/ This figure is slightly larger than in the 1973 FES because current water operation studies are based on a slightly wetter period.

2/ Corresponding figures of 104,100 acre-feet and 14,100 acre-feet presented in the M&I System FES were in error.
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The water supply for the M&I System would be developed by constructing Jordanelle Reservoir on the Provo River upstream from the existing Deer Creek Reservoir. Because most of the Provo River water is already appropriated for use, the water stored in Jordanelle would be exchanged through Utah Lake. Initially, this exchange would be accomplished by releasing Bonneville Unit water from Strawberry Reservoir to Utah Lake through the existing Strawberry Tunnel. With full development of the Bonneville Unit, project return flows and water saved by diking the lake as part of the I&D System would be used to accomplish the exchange. Some water would be developed from floodflows of the Provo River in high runoff years. If the I&D System is not built, the water conveyed through the Diamond Fork Power System would be permanently committed as the water supply for the M&I System. In that case, Utah Lake would not be diked as part of the Bonneville Unit.

The municipal and industrial water developed by the M&I System would be released from Jordanelle Reservoir to the Provo River and diverted downstream into the existing Olmsted Aqueduct. This aqueduct connects with two additional aqueducts presently under construction which would deliver the water to points of use. The irrigation water developed by the system would be diverted from the Provo River by existing facilities in the Heber and Francis areas.

IRRIGATION AND DRAINAGE SYSTEM

The I&D System would provide water for irrigation and for municipal and industrial use in areas south of Provo in the Bonneville Basin. A Draft Environmental Impact Statement for the I&D System is scheduled for completion in 1985.

The I&D System would develop an average annual water supply of 160,900 acre-feet, including 30,600 acre-feet for municipal and industrial uses and 130,300 acre-feet for irrigation. The water supply would be developed by diking Provo and Goshen Bays to reduce evaporation on Utah Lake and by recycling project return flow and using present spills from the lake. Some of the water developed by diking the lake would be pumped for irrigation of lands adjacent to the south portion of the lake. The major portion, however, would be exchanged to Jordanelle Reservoir for the M&I System. This exchange would make available to the I&D System most of the water initially conveyed from Strawberry Reservoir to Utah Lake for the M&I System exchange.

If the I&D System were not constructed, a conveyance system in Diamond Fork Canyon would still be needed to convey water for the M&I System. If Utah Lake were not diked, the water supply developed by the Strawberry Collection System would have to be permanently committed to accomplish the Jordanelle Reservoir-Utah Lake exchange. (Refer to "Alternative Operation" in Chapter III.)

UTE INDIAN TRIBAL DEVELOPMENT

The Ute Indian Tribal Development (formerly Bureau of Indian Affairs Activity) would be located on Indian land in the Duchesne River drainage
primarily downstream from Starvation Reservoir and would mitigate stream fishery and wildlife losses associated with the Bonneville Unit. Additional recreational opportunities on Indian land would also be provided.

To date, the 11,100-acre-foot Bottle Hollow Reservoir has been constructed as part of the Ute Indian Tribe's Bottle Hollow Resort complex. A proposed 12,460-acre-foot Lower Stillwater Reservoir on Rock Creek and development of several waterfowl ponds along the Duchesne River have been recommended by the Fish and Wildlife Service to further compensate for wildlife losses on Indian lands resulting from construction of the Bonneville Unit. The Ute Indian Tribe, the Fish and Wildlife Service, and the Bureau of Reclamation are presently reevaluating these remaining proposed features.

BONNEVILLE UNIT ADMINISTRATION

The Central Utah Water Conservancy District (CUWCD) has contracted with the United States for repayment of reimbursable project costs for irrigation and municipal and industrial water. However, no such costs would be associated with the power generation and transmission facilities of the Diamond Fork Power System.

Additional municipal and industrial repayment or water service contracts for the Bonneville Unit will be executed with the district and/or other user entities for repayment of costs allocated to municipal and industrial water with interest. The existing repayment contract was executed on December 28, 1965 (Contract No. 14-06-400-4286 as amended). Because of cost escalation associated with a prolonged construction period, the 1965 contract does not have sufficient coverage to repay the total estimated costs allocated to municipal and industrial water.

These allocated costs and interest, which are associated with the municipal and industrial water yield, have not yet increased to the point where scheduled construction expenditures will exceed the existing contractual obligation.

Water conveyance facilities, reservoirs, and powerplants would likely be operated and maintained by Reclamation. Switchyards and transmission lines would be operated by Western. Recreation facilities such as campgrounds would be operated by the Forest Service, which would also manage fishery habitat and wildlife habitat. The Utah Division of Wildlife Resources would manage fish and wildlife through its licensing authority and stocking program.

Colorado River Storage Project power

Power generated by the CRSP and its participating projects (such as the Central Utah Project) is marketed by Western in a seven-State area which includes Utah, Colorado, Wyoming, Arizona, New Mexico, southeastern Nevada, and a small portion of southeastern California. CRSP transmission and distribution needs are served by an interconnected power transmission system consisting of facilities owned by the CRSP, other Federal
projects, private and public utilities, and some jointly owned facilities. The interconnected transmission system is shown on Figure 3. The CRSP transmission facilities are operated by Western from a power operations center in Montrose, Colo. Power generated by the Diamond Fork Power System and not needed for project operation would be tied to the interconnected system for distribution within the CRSP marketing area.

Participating Agencies and Individuals

Planning for the Diamond Fork Power System was conducted by Reclamation with the aid of a planning team consisting of representatives of Federal agencies, State and local government, and private interests. Several Federal cooperating agencies have also had significant involvement in the planning process, and numerous non-Federal entities have expressed interest in joint Federal/non-Federal development of the power system.

Western Area Power Administration

Western, a cooperating agency for the Diamond Fork Power System Environmental Impact Statement (EIS), has provided energy load curves and marketing predictions which have been utilized to size and determine operation of project features. In addition, Western has identified specific transmission facilities required to connect Diamond Fork Power System powerplants to the existing interconnected transmission system. Since the power system will not be operational until the 1990's, however, specific customer demands will be determined by non-Federal participants in the project.

Forest Service

Because much of the Diamond Fork Power System would be situated on national forest land, another EIS cooperating agency, the Forest Service of the U.S. Department of Agriculture, has provided substantial input regarding features, locations, recreation facilities, grazing privileges, and other land use functions. Coordination with the Forest Service during plan formulation has insured that the recommended plan is consistent with land use requirements.

Fish and Wildlife Service

The Fish and Wildlife Service, under the authority of the Fish and Wildlife Coordination Act, has been involved in plan formulation and selection to ensure protection of fish and wildlife resources within the project area. The Service's recommendations for fish and wildlife mitigation are listed in Attachment 2. The Service has also provided significant input regarding recreation and other environmental considerations.
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Non-Federal participation

In planning the Diamond Fork Power System, Reclamation has explored the possibility of developing hydroelectric energy in cooperation with non-Federal entities. Under this concept, non-Federal entities, either individually or through a consortium, would fund most of the construction of the powerplants and associated features in return for a proportionate share of the power produced. In April and May 1982, letters explaining this concept and requesting interest in joint Federal/non-Federal development of the power system and other Reclamation power projects were sent to power developers, municipalities, CRSP preference customers, investor-owned utilities, and other potentially interested power-related entities within the CRSP marketing area. Many of the non-Federal entities contacted responded and expressed interest in a joint development. In July 1982, Reclamation held a public information meeting in Salt Lake City, Utah, to discuss ways potential non-Federal participants can share in the construction and operation of Federal power projects. The Diamond Fork Power System was one of two projects specifically addressed at this meeting, and significant interest in non-Federal participation was expressed. In April 1984, Reclamation and Western again conducted an assessment of non-Federal participants regarding the Fifth Water Pumped Storage Alternative. Of 220 contacts, about 5 percent indicated a willingness to participate. The interest of non-Federal power entities in participating with front-end construction funds in return for power from the project will be further defined in the future.

The only specific guideline developed to date for non-Federal participation in Federal power projects is that power generation facilities must be an integral part of multipurpose water resource developments and must be operated to satisfy all project purposes. As additional guidelines are established, Reclamation will provide an adequate mechanism for joint Federal/non-Federal development of the Diamond Fork Power System.

Federal funds will be used to fund only the capacity required for project use. The rest of the project will require front-end financing by non-Federal participants.

Location and Setting

The Diamond Fork Power System would be located mainly in Diamond Fork Canyon in the Bonneville Basin, but a small portion would be located in the Uinta Basin. Specifically, the power system would begin at the Strawberry Tunnel inlet at Strawberry Reservoir and would extend southwest through the rugged Wasatch Mountains to the mouth of Diamond Fork Canyon. As shown on the General Map, most of the project area is in Utah County, but the small area in the Uinta Basin is in Wasatch County. Nearly all of the area is within the Uinta National Forest.

Diamond Fork is the principal stream in the area. A tributary of the Spanish Fork River, which is a tributary of Utah Lake, Diamond Fork
CHAPTER I INTRODUCTION

originates high in the Wasatch Mountains west of Strawberry Reservoir and flows generally southwest to its confluence with the river. At Three Forks, about 10 miles above the confluence, Diamond Fork is joined by Sixth Water Creek from the northeast and by a stream in Cottonwood Canyon from the southeast. About a mile east of Three Forks, Sixth Water Creek is joined from the east by Fifth Water Creek.

Natural flows in the streams in the area are greatest in the spring when runoff from snowmelt is highest. The flows decline considerably in late summer and reach minimums in late fall or winter. From May to September, the flows in Sixth Water Creek below the Strawberry Tunnel outlet and in Diamond Fork below Three Forks are modified by operation of the tunnel. The flows of these two streams are near or much above the peak spring flows during this period.

The water quality of the streams in the area is generally good, except for periodically high turbidity and sediment levels. Sixth Water Creek and Diamond Fork have relatively high nitrate levels, probably as a result of grazing, and have high nutrient levels from midsummer to fall because of the releases of Strawberry Reservoir water through Strawberry Tunnel. Sediment and turbidity levels are high in Sixth Water below the tunnel outlet and in Diamond Fork below Three Forks during spring runoff and the irrigation season because of high flow releases from Strawberry Reservoir.

Diamond Fork and Fifth and Sixth Water Creeks are located in narrow, steep-walled canyons, although Diamond Fork Canyon becomes gradually wider beginning at Monks Hollow, about 2 miles downstream from Three Forks. A narrow, elongated area known as Rays Valley intersects Fifth Water Creek about 3 miles above its confluence with Sixth Water Creek. Elevations in the project area range from about 5,000 feet at the mouth of Diamond Fork Canyon to about 8,500 feet in the Wasatch Mountains.

The climate of the area is generally mild in the summer but cold in the winter. The nearest weather stations are located at the Spanish Fork Powerhouse along the Spanish Fork River about 10 miles downstream from the mouth of Diamond Fork and at the Strawberry Tunnel inlet on the west side of Strawberry Reservoir. The mean annual temperature at the powerhouse is about 52° F (11° C) but has ranged from -19° to 100° F (-29° to 38° C). Precipitation averages about 18.5 inches annually. Most of the precipitation is rain but also includes about 50 inches of snow. At the tunnel inlet, conditions are much more severe. Temperatures have ranged from -50° to 89° F (-46° to 32° C), and precipitation averages about 21 inches annually, most in the form of snow. Average annual snowfall at the tunnel inlet is nearly 200 inches.

Vegetation in the project area is dominated by mountain brush species such as oakbrush, snowberry, sagebrush, mountain mahogany, and rabbit brush. Utah juniper is abundant in the eastern portion of the area. Quaking aspen and firs occur in limited areas at elevations around 8,000 feet. Riparian species such as cottonwood and willow are limited to canyon bottoms along permanent streams and seeps. Some areas formerly
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dominated by juniper, sagebrush, and oakbrush have been converted to grassland for livestock grazing.

Trout fisheries occur in Fifth and Sixth Water Creeks and in Diamond Fork. Fifth Water Creek supports mainly a small cutthroat trout fishery, limited mainly by the poor quality and small size of the stream. Sixth Water Creek and Diamond Fork provide important fisheries during the non-irrigation season, when natural flows are present. Cutthroat trout are native to these streams; and brown trout, stocked in the past, are now self-sustaining. Large cutthroat trout commonly enter Sixth Water Creek through Strawberry Tunnel.

Wildlife in the project area consists of big game species, predators, furbearers, upland game birds, small birds, raptors, small mammals, amphibians, and reptiles. Mule deer are the most numerous and important big game animal in the area. Elk occur throughout the area but are not as common as the deer.

Several farms and ranches in the lower Diamond Fork area have temporary residents in the summer, but the project area has no permanent residents. Commercial activity and industry are nonexistent. Recreation is a major activity in the area because of the proximity (20 miles) of the Provo metropolitan area. Popular activities include camping, picnicking, fishing, hunting, and horseback riding.

The principal road in the area is in Diamond Fork Canyon. This road extends from U.S. 6-89 at the mouth of the canyon northeast along Diamond Fork. The road is paved for about 15 miles and then becomes an improved dirt road. About 5 miles north of Three Forks, an unimproved road extends to the east, paralleling Sixth Water Creek for several miles and connecting with Strawberry Reservoir. A second unimproved road extends south from about the point where the first begins to parallel Sixth Water Creek to Rays Valley where it joins a newly constructed road extending from the valley to U.S. 6 in Spanish Fork Canyon at the mouth of Sheep Creek (see Chapter III, "Recommended Plan, Project Facilities and Measures, Roads"). Sheep Creek is a tributary of the Spanish Fork River and joins the river about 12 miles above the mouth of Diamond Fork. U.S. 6-89 is the only major route providing access to the project area.

In the spring of 1983, a large landslide occurred along the Spanish Fork River about 2 miles upstream from the mouth of Diamond Fork near the town of Thistle. The slide blocked U.S. Highway 6-89, the river, and a main east-west railroad line in the canyon. A temporary reservoir created by the slide destroyed the town of Thistle and caused extensive damage to roads, the railroad, and other structures in the reservoir area. Although the slide did not directly affect Diamond Fork Canyon, reconstruction of U.S. Highway 6-89 and the railroad have altered the landscape considerably at the mouth of the canyon.
CHAPTER II

NEED FOR ACTION

Problems and needs of the Diamond Fork area were identified by the planning team, aided by public involvement activities such as public meetings, tours of the project area, and newsletters. Significant concerns and needs which emerged are related to water requirements, electrical energy requirements, recreation and tourism, fish and wildlife, and flood damage and erosion.

Water Requirements

With operation of the Bonneville Unit, an annual average of about 198,400 acre-feet of water would be released from the enlarged Strawberry Reservoir through the Diamond Fork drainage to the Bonneville Basin for consumptive uses downstream. This quantity is slightly larger than the 197,600 acre-feet presented in the Draft Environmental Statement because the current studies are based on a slightly wetter period. The Strawberry Collection System is under construction and nearing completion. This system is scheduled to be completed and begin delivering an annual supply of 157,200 acre-feet of water to the enlarged Strawberry Reservoir beginning in 1987.\footnote{Includes 135,200 acre-feet delivered through the Strawberry Aqueduct and 22,000 acre-feet of tributary flow between Strawberry and Soldier Creek Dams.} Present deliveries are about 10 percent of that amount. The Diamond Fork Power System would use the energy potential of this water for hydroelectric energy generation. The 198,400 acre-feet would include 61,000 acre-feet for the Strawberry Valley Project and 137,400 acre-feet for the M&I and I&D Systems of the Bonneville Unit. Consumptive water requirements for the M&I System are discussed in the Final Environmental Statement on that system, and requirements for the I&D System will be discussed in the draft statement on that system which is scheduled for completion in 1985.

An instream fishery flow agreement was signed on February 27, 1980, by the U.S. Department of the Interior, the State of Utah, the Central Utah Water Conservancy District, the Fish and Wildlife Service, and the Forest Service. This agreement establishes a goal of providing 44,400 acre-feet of water for instream flows within the Uinta Basin tributaries from which the water for the transbasin diversion would be collected. Of this total, 6,500 acre-feet would be developed as part of the Bonneville Unit plan described in the 1973 Environmental Statement. Collectively, all of the involved agencies and parties to the agreement mentioned above are committed to providing the remaining 37,900 acre-feet of water for minimum fishery flows. These flows are to be provided
without reducing the project water supply. However, if the full 44,400 acre-feet cannot be developed, the CUWCD has agreed to reduce the trans-basin diversion by up to 15,800 acre-feet. Various alternatives are being studied which would maintain fishery flows at the level agreed on and still allow the 15,800 acre-feet to be included in the transbasin diversion. These include a plan for water recirculation by pumping and a cloud-seeding plan. If these alternatives are determined to be infeasible, the transbasin diversion could be reduced to a minimum of 121,600 acre-feet annually.

Power Market Demand

A need for additional electric capacity has been identified in the CRSP marketing area. In 1981, Western conducted a power marketing survey to determine the marketability of potential hydroelectric resources. The survey determined that both baseload and peaking resources were needed to serve future loads in addition to existing resources and those which are presently committed for construction. Requirements for baseload and peaking resources in 1990 and 2000 are shown in Table 1 for publicly owned utilities and in Table 2 for privately owned utilities. Specifically, the survey projected a need for about 11,600 megawatts (MW) of baseload power and 18,700 MW of peaking power from public and private utilities by 1990 and 17,700 MW of baseload power and 29,100 MW of peaking power by the year 2000. Needs which will not be met by projects presently planned or committed for construction are shown in Table 3. Unmet baseload needs are estimated at about 220 MW in 1990 and 4,340 MW in the year 2000. Unmet peaking needs are estimated at 2,300 MW and 11,000 MW, respectively. Non-Federal participation in the Diamond Fork Power System would verify the need for the power.

In June 1981, representatives from Western and Reclamation met to evaluate potential pumped-storage and related power projects within the CRSP marketing area. All hydroelectric peaking power projects planned by Reclamation within the marketing area were evaluated based on the following criteria: (1) cost per installed kilowatt, (2) transmission impacts, (3) environmental impacts, (4) social impacts and public acceptability, (5) marketability, and (6) date when the power could be available. As a result of this evaluation, the Diamond Fork Power System was given the number one priority for construction within the marketing area. It was also determined that the power system would be sized at approximately 1,000 MW to satisfy a significant portion of the peaking electrical energy demand projected for the year 1990 and beyond.

In April 1984, Reclamation and Western submitted the Fifth Water Pumped Storage power system proposal to private sector entities with potential interest in the power that would be produced and in financing construction of the power facilities. Approximately 220 entities were contacted by mail, including preference customers, municipal utilities, investor-owned utilities, private financial institutions, and construction companies. Of 39 responses received, 12 submitted security deposits for a total of 219.5 MW. Most responses were positive about the merits
### Table 1: Electric power resources and requirements of publicly owned utilities (1979-2000)

<table>
<thead>
<tr>
<th></th>
<th>Baseload</th>
<th>Existing resources—1979</th>
<th>Additional requirements</th>
<th>Total requirements</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>MW</td>
<td>MWh</td>
<td>MW</td>
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<tr>
<td>Arizona, et al.</td>
<td>3.039</td>
<td>26.621,640</td>
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<td>Colorado/Wyoming</td>
<td>2.640</td>
<td>23,126,400</td>
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<td>New Mexico</td>
<td>3.091</td>
<td>29,906,800</td>
<td>387</td>
<td>30,394,600</td>
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<td>Utah</td>
<td>2.782</td>
<td>21,111,289</td>
<td>218</td>
<td>21,530,400</td>
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<td><strong>Total</strong></td>
<td>11,494</td>
<td>98,056,028</td>
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<table>
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<td>Colorado/Wyoming</td>
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<tr>
<td>New Mexico</td>
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<td>0.465</td>
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<td>0.426</td>
<td>0.052</td>
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<td><strong>Total</strong></td>
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### Table 2: Electric power resources and requirements of privately owned utilities (1979-2000)

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<th>Total requirements</th>
</tr>
</thead>
<tbody>
<tr>
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<td>1.946</td>
<td>17,029,640</td>
<td>1,039</td>
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<td>Colorado</td>
<td>2.256</td>
<td>20,621,916</td>
<td>1,290</td>
<td>22,113,826</td>
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<tr>
<td>Nevada</td>
<td>2.208</td>
<td>18,932,000</td>
<td>1,062</td>
<td>20,290,000</td>
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<td>New Mexico</td>
<td>2.000</td>
<td>17,350,000</td>
<td>1,150</td>
<td>18,470,000</td>
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<td>1.870</td>
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<td><strong>Total</strong></td>
<td>8.413</td>
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<td>7,571</td>
<td>78,904,280</td>
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<table>
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<th>Additional requirements</th>
<th>Total requirements</th>
</tr>
</thead>
<tbody>
<tr>
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<td>0.701</td>
<td>0.083</td>
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<tr>
<td>Colorado</td>
<td>0.087</td>
<td>0.730</td>
<td>0.088</td>
<td>0.815</td>
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<tr>
<td>Nevada</td>
<td>0.086</td>
<td>0.718</td>
<td>0.086</td>
<td>0.804</td>
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<tr>
<td>New Mexico</td>
<td>0.086</td>
<td>0.706</td>
<td>0.085</td>
<td>0.791</td>
</tr>
<tr>
<td>Utah</td>
<td>0.086</td>
<td>0.706</td>
<td>0.085</td>
<td>0.791</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>0.347</td>
<td>2.936</td>
<td>0.347</td>
<td>3.283</td>
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Table 3

Unmet electric power needs for the CRSP marketing area in 1990 and 2000

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<th>Year/type of need</th>
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<td></td>
<td>Capacity (MW)</td>
<td>Energy (GWh)</td>
<td>Capacity (MW)</td>
</tr>
<tr>
<td>Baseload 1990</td>
<td>120</td>
<td>1,049</td>
<td>99</td>
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<tr>
<td>Peaking 1990</td>
<td>446</td>
<td>1,976</td>
<td>1,862</td>
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<tr>
<td>Reserve capacity 1990</td>
<td>1,455</td>
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<tr>
<td>Total 1990</td>
<td>2,021</td>
<td>3,025</td>
<td>5,873</td>
</tr>
<tr>
<td>Baseload 2000</td>
<td>2,141</td>
<td>18,760</td>
<td>2,199</td>
</tr>
<tr>
<td>Peaking 2000</td>
<td>4,021</td>
<td>10,858</td>
<td>7,001</td>
</tr>
<tr>
<td>Reserve capacity 2000</td>
<td>2,226</td>
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<tr>
<td>Total 2000</td>
<td>8,388</td>
<td>29,618</td>
<td>14,393</td>
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</table>

1/ Needs which will not be met by projects presently planned or committed for construction. The needs are shown in terms of megawatts (MW) of capacity and gigawatthours (GWh) of energy. A megawatt is 1,000 kilowatts of capacity. A gigawatthour is 1,000,000 kilowatthours of energy.
of the pumped storage system, the concept of non-Federal financing, and the flexible project management arrangement that was offered. However, many entities were unable to make the immediate financial commitment necessary to participate; nearly every respondent wanted to be kept informed of future development plans on the peaking power proposal.

Despite the projected demand for both baseload and peaking capacity, the results of the responses received indicate that there is inadequate non-Federal support for the Fifth Water Pumped Storage Alternative as described in the DES. Therefore, the recommended plan described in this final statement is the Sixth Water Flow Through Alternative, which more nearly accommodates the committed interests while maintaining the flexibility for adding a pumped storage component at such time as non-Federal commitments can be obtained. Appropriate NEPA compliance would be accomplished if a pumped storage component were recommended for future construction.

**Recreation and Tourism**

The Diamond Fork project area is located near Utah's Wasatch Front, a heavily populated valley area along the west side of the Wasatch Mountains which includes Salt Lake, Weber, Davis, and Utah Counties. These counties contain about 80 percent of the total State population (nearly 1.5 million persons in 1980). Wasatch Front residents can travel by road to any existing or potential recreation site in the Diamond Fork area in times ranging from minutes to about 2 hours. The population of the four Wasatch Front counties increased at a rate of 3.9 percent annually from 1978 to 1981. The Utah State Comprehensive Outdoor Recreation Plan (SCORP) projects that leisure time will increase 16 percent between 1980 and 1990. Recreation demand is expected to increase in proportion to the population increase.

The Diamond Fork project area is located in SCORP District No. 4, which consists of Utah, Wasatch, and Summit Counties. According to the SCORP, there is a need in this district for 1,570 additional camping units and 1,560 additional picnicking units and there is a shortage of available boat-launching facilities near the populated Wasatch Front. The SCORP also indicates that total outdoor recreation use in the district is increasing by 6 percent annually.

The Forest Service has developed a process for determining the capability of land areas to provide developed recreation (camping, picnicking, etc.) and dispersed recreation (hiking, pleasure driving, etc.). Using this process, the recreation capability for the Diamond Fork area is 1,380,000 recreation-days of dispersed recreation and 1,710,720 recreation-days of developed recreation (7,100 developed units).
CHAPTER II  

NEED FOR ACTION

Fish and Wildlife

The major fishery problem in the Diamond Fork drainage is a degradation of habitat which has occurred in Sixth Water Creek, Diamond Fork, and the Spanish Fork River since the Strawberry Valley Project began delivering Strawberry Reservoir water through the Strawberry Tunnel in 1915. Figure 4 shows a typical stream section along lower Diamond Fork. High summer irrigation flows up to 500 cfs have scoured and eroded the stream channels, especially Sixth Water and Diamond Fork, to the extent that fishery habitat is poor and fish production is low. As a result, fishing success has been severely limited and fisherman use on these streams has been minimal. The high flows also present a significant safety hazard to fishermen, campers, and picnickers, and make fishing very difficult on most of the system. The fishery in the Diamond Fork stream system could be enhanced greatly by reducing peak streamflows and repairing stream channels.

Figure 4.—Lower Diamond Fork.

There is a need to maintain important existing values for wildlife in the Diamond Fork area, including deer, elk, bobcats, and eagles. A draft management plan for the Uinta National Forest provides for maintenance of these values.
CHAPTER II

FLOOD DAMAGE AND EROSION

Flood damage in the form of channel erosion occurs annually in the Diamond Fork drainage system. Prior to 1983, more significant flood damage to roads, campgrounds, and agricultural lands occurred about once every 10 years. Significant damage within the canyon occurred during both the 1983 and 1984 spring runoff seasons.

The most critical flood-producing situation is a snowmelt and rain combination. The highest peaks of record on Diamond Fork have occurred in the springs of 1952 (1,610 cfs), 1983 (about 1,600 cfs), and 1984 (about 2,000 cfs). The 1984 value is estimated and cannot be verified because of a loss of the gage and record. Limited local damage may result from thunderstorm runoff. Since the operation of Strawberry Tunnel began, most of the peak flows have resulted from tunnel releases rather than snowmelt or storm runoff. The highest flow at the Strawberry Tunnel outlet was 595 cfs in 1923.

Floodflows from Diamond Fork can contribute to flood damage along the Spanish Fork River. Peak flows measured on the river near Castilla were 3,610 cfs in 1952, 2,890 cfs in 1983, and about 4,200 cfs in 1984. The 1983 peak was reduced by approximately 1,000 cfs because of the Thistle slide impoundment. The floodflows caused damage to the river channel, the highway, the railroad, and agricultural properties in Spanish Fork Canyon. In addition, the 1983 and 1984 floods threatened the Spanish Fork Diversion Dam and the Strawberry Power Canal. The diversion dam was damaged when sediment and debris plugged the floodgates and high flows overtopped the dam. The power canal was endangered and the maintenance road damaged when the riverbank was severely undercut by the high flows. Numerous acres of farmland were destroyed as the river channel shifted and cut through farm fields.

Releases from the Strawberry Tunnel have resulted in higher than normal sediment transport through Sixth Water Creek and Diamond Fork. This sediment results from natural tributary inflow and some bank sloughing during high spring runoff and during periods of large releases from the tunnel. The sediment is then transported downstream by early summer releases from the tunnel, causing high turbidity levels, particularly in the early part of the irrigation season. The sediment decreases toward the end of the irrigation season as flows decrease.
CHAPTER III

ALTERNATIVES

Five viable structural alternatives have been investigated in considerable detail for the Diamond Fork Power System. Each of these would provide for the average annual transbasin diversion of 198,400 acre-feet of water from Strawberry Reservoir to the confluence of Diamond Fork and the Spanish Fork River to supply water for the M&I and I&D Systems of the Bonneville Unit. Four of the alternatives would include flow-through facilities to generate hydroelectric power. Two of the four alternatives would also include pumped storage facilities to generate peaking power. The fifth alternative would provide only for the transbasin diversion of water from Strawberry Reservoir and would not include power generation facilities.

Of the five alternatives considered, a flow-through alternative involving facilities in the Sixth Water and Diamond Fork drainages was selected as the recommended plan. This Sixth Water Flow Through Alternative was selected because it best meets current market conditions for hydroelectric power, is economically justified, is environmentally acceptable (with mitigation), and is geologically acceptable based on investigations to date.

Recommended Plan

Plan accomplishments and concept

The recommended Sixth Water Flow Through Alternative would utilize the transbasin diversion of water from Strawberry Reservoir and the large drop in elevation from the reservoir to generate 166.2 MW of conventional hydroelectric power. The transbasin diversion would provide water for irrigation and municipal and industrial uses by the M&I and I&D Systems. Also, recreation facilities would be provided, stream fisheries would be considerably enhanced, a limited flatwater fishery would be created, some flood control would be accomplished in Diamond Fork, and wildlife losses would be mitigated. The major features of this alternative are shown on Figures 5 and 6.

From the Strawberry Tunnel inlet at Strawberry Reservoir, water would flow through the proposed Syar Tunnel and Penstock to the proposed Syar Reservoir, which would be formed by two dams on a saddle north of Rays Valley between Fifth Water and Sixth Water Creeks. From the reservoir, water would be conveyed by the proposed Corona Aqueduct and Sixth Water Penstock to the proposed Sixth Water Reservoir, which would be formed by a dam on Sixth Water Creek about due west of Syar Reservoir. Water from this reservoir would be conveyed in the proposed Dyne Aqueduct and Penstock to the proposed Monks Hollow Reservoir, which would be formed by a dam on Diamond Fork just below Monks Hollow. All Bonneville
Unit water and part of the Strawberry Valley Project water would be released from Monks Hollow Dam into the proposed Diamond Fork Pipeline and conveyed to a proposed bifurcation near the confluence of Diamond Fork and the Spanish Fork River. At the bifurcation, water planned for use in areas south of Utah County and part of the water for south Utah County would enter the Wasatch Aqueduct of the I&D System. Water planned for storage in Utah Lake and the remainder of the water for south Utah County would flow through the Diamond Fork Powerplant and into Diamond Fork and the Spanish Fork River. The Strawberry Valley Project flows not conveyed in the Diamond Fork Pipeline would enter the Diamond Fork stream channel below Monks Hollow Powerplant. Flood control would be provided by Sixth Water and Monks Hollow Reservoirs.

Power would be generated at five proposed flow-through plants—Syar at Syar Reservoir, Sixth Water at Sixth Water Reservoir, Dyne at the terminus of the Dyne Aqueduct and Penstock at Monks Hollow Reservoir, Monks Hollow at the base of Monks Hollow Dam, and Diamond Fork at the terminus of the Diamond Fork Pipeline. Surge tanks would be provided at the Syar, Sixth Water, and Dyne plants.

New roads would be constructed and some existing roads would be improved or replaced to facilitate construction and operation of the power system. Facilities for operation and maintenance of the power system would be located at the Sixth Water Powerplant. Construction facilities would also be located within project feature areas of impact.

New transmission lines and switchyards would be required to transmit the power generated at each proposed powerplant to the interconnected transmission system. A switchyard would be built at each of the five powerplants and a substation constructed between Syar and Sixth Water Powerplants. Three separate transmission lines would connect the Syar, Sixth Water, and Dyne Switchyards to the Rays Valley Substation, and a fourth line would connect Monks Hollow Switchyard to Dyne Switchyard. A double-circuit transmission line would connect the Rays Valley Substation to the Sheep Creek Substation near the confluence of Sheep Creek and Soldier Creek where the power would be tied to the interconnected transmission system. A separate transmission line would be required to connect the Diamond Fork Switchyard with the system.

Recreation facilities would include a day-use area and trail adjacent to Monks Hollow Reservoir and a full-use area just downstream from Monks Hollow Dam. In addition, two existing campgrounds along Diamond Fork downstream from the proposed Monks Hollow full-use area would be enlarged to replace two campgrounds above the reservoir which would be abandoned, and a trailhead would be provided at a site 2 miles downstream from Monks Hollow Dam.

Diamond Fork downstream from Monks Hollow Dam would be considerably enhanced as a fishery as a result of diverting historically high flows from the stream into the Diamond Fork Pipeline. A limited flatwater fishery would be created at Monks Hollow Reservoir.
FIGURE 6
SIXTH WATER FLOW THROUGH ALTERNATIVE ELEVATION PROFILE
CHAPTER III

Approximately 4,000 acres of private land would be acquired and developed to mitigate wildlife losses. Existing habitat on public land would be improved.

Project facilities and measures

SYAR DAMS AND RESERVOIR

The two Syar Dams would be constructed at an offstream site about a mile north of where the existing Rays Valley Road crosses Fifth Water Creek. The dams would be embankment structures about 88 feet high with a crest width of 30 feet. The north dam would have a crest length of about 2,030 feet and the south dam about 1,210 feet. The outlet works would be located between the two dams and would have a capacity of 1,300 cfs at a water surface elevation of 7,157 feet. The dams would have a total volume of 810,000 cubic yards of embankment material. Material source areas for project features are shown in Figure 7.

Geologic conditions at the sites for the Syar Dams are favorable for the embankment structures planned. Bedrock at the damsite is of the Green River-Colton (undifferentiated) Formation, consisting of calcareous siltstone, with some interbedded limestone and shale. Suitable rockfill materials for the dams are available in Fifth Water Canyon (Borrow Area J, Figure 7), about 2 miles from the dams.

Impervious core material is available adjacent to the damsite (Borrow Areas G and H). Granular filter material is available in the Monks Hollow Reservoir basin (Borrow Area B), a haul distance of about 12 miles. A riprap source is located in Wanrhodes Canyon, a distance of 20 miles (Figure 7).

Syar Reservoir would be the afterbay for the Syar Powerplant and the forebay for the Sixth Water Powerplant. The reservoir would have a capacity of 910 acre-feet, including 640 acre-feet of active capacity and 270 acre-feet of inactive capacity (of which 20 acre-feet is dead storage). Because the reservoir would be located offstream, only 35 acre-feet of flood control would be provided. No significant sedimentation is expected because most inflow would come directly from Strawberry Reservoir. The reservoir would have a surface area of 31 acres at an elevation of 7,184 feet and would fluctuate up to 26 feet daily and weekly. Physical data for Syar, Sixth Water, and Monks Hollow Dams and Reservoirs are summarized in Table 4.

SIXTH WATER DAM AND RESERVOIR

Sixth Water Dam would be constructed on Sixth Water Creek about 2.8 miles above the confluence with Fifth Water Creek. The dam would be an embankment structure about 135 feet high with a crest length of 500 feet and a crest width of 30 feet. The outlet works would be located on the right abutment and would have a capacity of 1,250 cfs at a water surface elevation of 6,362 feet. An uncontrolled, open channel spillway with a
### Table 4

Summary data for dams and reservoirs—Sixth Water Flow Through Alternative Syar Dam and Reservoir

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<thead>
<tr>
<th>Dams (two)</th>
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<tr>
<td>Surface area at normal water surface elevation 7,184 feet (acres)</td>
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Sixth Water Dam and Reservoir

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<td>Height (feet)</td>
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<td>Material volume (cubic yards)</td>
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<td>Reservoir capacity (acre-feet)</td>
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<td>Surface area at normal water surface elevation 6,366 feet (acres)</td>
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Monks Hollow Dam and Reservoir

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<td>Material volume (cubic yards)</td>
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<td>Reservoir capacity (acre-feet)</td>
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<td></td>
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<tr>
<td>Surface area at normal water surface elevation 5,550 feet (acres)</td>
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<td></td>
<td></td>
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</table>

1/ Reservoir capacity at normal water surface elevation. An additional capacity of 1,400 acre-feet is reserved for flood control, resulting in a total capacity of 32,800 acre-feet.
discharge capacity of 5,000 cfs would also be located on the right abutment. The dam would have a volume of 510,000 cubic yards of embankment material.

Geologic conditions at the damsite are suitable for the planned structure. Bedrock at the site consists of three formations—the North Horn, Flagstaff, and Colton Formations. These formations consist of fresh water limestone and calcareous siltstone.

Impervious core material is available from Borrow Areas F, G, and H, about 1 to 3 miles from the damsite. Granular filter material is available in the Monks Hollow Reservoir basin (Borrow Area B), a haul distance of about 9 miles. Local bedrock will be available for rockfill and riprap.

Sixth Water Reservoir would serve as the afterbay to Sixth Water Powerplant and the forebay to Dyne Powerplant. The reservoir would have a capacity of 560 acre-feet, including 40 acre-feet of active capacity and 520 acre-feet of inactive capacity (of which 70 acre-feet is dead storage). A surcharge of about 500 acre-feet would also be provided for flood control. No significant sedimentation is expected. The reservoir would have a surface area of 19 acres at an elevation of 6,366 feet and would fluctuate up to 4 feet daily and weekly.

**MONKS HOLLOW DAM AND RESERVOIR**

Monks Hollow Dam would be located on Diamond Fork about 8 miles upstream from its confluence with the Spanish Fork River and about 2.4 miles below the Dyne Powerplant. The dam would be a thin-arch concrete structure, 250 feet high, with a crest length of 925 feet and a crest width of 13 feet. The outlet works would be located at river level and would have a capacity of 875 cfs at minimum water surface elevation 5,500 feet. The outlet works would include the penstock for the Monks Hollow Powerplant, as discussed below, and a bypass to the Diamond Fork channel. An overflow spillway would be located on the left abutment. The spillway would have a design capacity of 12,373 cfs at maximum water surface elevation 5,569 feet. A total of 150,000 cubic yards of concrete would be used in the dam.

Geologic conditions at the damsite are favorable for a thin-arch concrete dam. Bedrock at the site consists of Triassic-Jurassic Age Nugget Sandstone and Jurassic Age Twin Creek Limestone. Concrete aggregate for the dam would be obtained from the reservoir basin (Borrow Area B).

Monks Hollow Reservoir would be the afterbay for Dyne Powerplant and the forebay for the Monks Hollow Powerplant. The reservoir would have a total capacity of 31,400 acre-feet, consisting of 14,500 acre-feet of active capacity and 16,900 acre-feet of inactive capacity (including 600 acre-feet of dead storage). An additional 1,400 acre-feet would be provided exclusively for flood control. The 100-year sediment accumulation is expected to be 1,200 acre-feet, which would deposit to a
CHAPTER III

alternatives

depth of 17 feet at the dam. A surcharge of 5,460 acre-feet would be provided for flood control. The surface area of the reservoir would be 343 acres at normal water surface elevation (5,550 feet). The reservoir would not fluctuate greatly on a daily basis, but would fluctuate a maximum of about 50 feet on a seasonal basis.

SYAR TUNNEL, PENSTOCK, AND POWERPLANT

The Syar Tunnel, about 6.5 miles long, would deliver water from Strawberry Reservoir to the Syar Powerplant. The tunnel would be a pressure-type tunnel, 8.25 feet in diameter, with a capacity of 600 cfs. The last 350 feet of the tunnel would have a steel lining encased in concrete. An underground surge shaft, to be constructed near the tunnel outlet, would be 37 feet in diameter and 259 feet high. A steel penstock, 8.5 feet in diameter and 0.2 mile long, would connect the tunnel with the powerplant. The tunnel would be in the Green River and Uinta Formations. Concrete aggregates in sufficient quantities for lining are located within about 12 miles of the site at Borrow Area B. The completed Syar Tunnel would include a 2,435-foot-long inlet to the existing Strawberry Tunnel, which is presently being rehabilitated before it is inundated by the enlarged Strawberry Reservoir. Physical data for the powerplants and conveyance works are shown in Table 5.

The 12.6-MW Syar Powerplant would utilize a head of about 330 feet between Strawberry and Syar Reservoirs to generate 50,700 megawatthours (MWh) of energy annually. The powerplant would include a 17,300-horsepower turbine, with a 300-foot design head and a 600-cfs discharge capacity, and a 12,600-kilowatt (kW) generator. Syar Powerplant would be remotely controlled.

CORONA AQUEDUCT, SIXTH WATER PENSTOCK, AND SIXTH WATER POWERPLANT

Water would be conveyed from Syar Reservoir to Sixth Water Powerplant through the 0.9-mile-long Corona Aqueduct and the 0.3-mile-long Sixth Water Penstock. The aqueduct would consist of 0.7 mile of 11.75-foot-diameter buried pipeline and 0.2 mile of 10.0-foot-diameter pressurized tunnel. The aqueduct would have a capacity of 1,300 cfs. The penstock would be 7.5 feet in diameter and would also have a capacity of 1,300 cfs. A surge tank 60 feet high and 52 feet in diameter would be provided near the end of the aqueduct.

The 74.1-MW Sixth Water Powerplant would utilize an elevation difference of about 810 feet between Syar and Sixth Water Reservoirs to generate 137,100 MWh of energy annually. The powerplant would include two 50,750-horsepower turbines, each with an 810-foot design head and a 650-cfs discharge capacity, and two 37,050-kW generators. The powerplant would be attended, but would be remotely controlled.

DYNE AQUEDUCT, PENSTOCK, AND POWERPLANT

Water would be conveyed from Sixth Water Reservoir along Tanner Ridge to Dyne Powerplant through the 2.6-mile-long Dyne Aqueduct and
### Table 5
Summary data for powerplants and conveyance works--Sixth Water Flow Through Alternative

<table>
<thead>
<tr>
<th>Syar Tunnel, Penstock, and Powerplant</th>
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0.5-mile-long Dyne Penstock. The aqueduct would consist of 0.9 mile of pressurized 10.75-foot-diameter tunnel and 1.7 miles of 11.5-foot-diameter pipeline with a 1,250-cfs capacity. The penstock would be 7.75 feet in diameter and would also have a capacity of 1,250 cfs. A surge tank 178 feet high and 26 feet in diameter would be installed at the upper end of the penstock.

The 67.7-MW Dyne Powerplant would use an elevation difference of about 780 feet between the Sixth Water Reservoir and Dyne Powerplant to generate 125,300 MWh of energy annually. The powerplant would include two 46,500-horsepower turbines, each with a 750-foot design head and a 625-cfs discharge capacity, and two 33,850-kW generators. Dyne Powerplant would be remotely controlled.

MONKS HOLLOW POWERPLANT

The 5.0-MW Monks Hollow Powerplant would be located at the base of Monks Hollow Dam and would generate 29,900 MWh of energy annually, using water released from Monks Hollow Reservoir to meet downstream irrigation and municipal and industrial needs in the Bonneville Basin. The plant would include a 6,900-horsepower turbine and a 5,000-kW generator. The unit would have a design head of 218 feet and a discharge capacity of 325 cfs. The plant would be remotely controlled.

A steel penstock would deliver water to the powerplant through the base of the dam. As previously discussed, the penstock is part of the outlet works from the dam. The penstock would have a diameter of 7 feet, a capacity of 875 cfs, and a length of 320 feet. Peak summer releases in excess of 325 cfs will bypass the powerplant. After passing through the Monks Hollow Powerplant, the water would discharge into a tailrace basin. The tailrace structure would serve as a diversion works which would divert part of the flow into the Diamond Fork Pipeline and release the rest into the river. The flows in the pipeline and river would vary throughout the year, depending on downstream demands.

DIAMOND FORK PIPELINE AND POWERPLANT

The Diamond Fork Pipeline would serve a dual purpose. It would convey all of the Bonneville Unit water and a portion of the existing Strawberry Valley Project flows to the mouth of Diamond Fork outside of the stream channel, thus reducing the existing level of erosion and enhancing the quality of the fishery habitat. The pipeline would also be the penstock for the Diamond Fork Powerplant. The buried pipeline would have a diameter of 9 feet and a capacity of 450 cfs. The pipeline would extend 6.9 miles along Diamond Fork from the Monks Hollow Powerplant to the Diamond Fork Powerplant.

The 6.8-MW Diamond Fork Powerplant would be located at the confluence of Diamond Fork and the Spanish Fork River and would generate 19,300 MWh of energy annually. The plant would utilize a head of 305 feet between its location and the Monks Hollow Powerplant. Like the Monks Hollow Powerplant, this plant would generate electric power using
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Water released from Monks Hollow Reservoir to meet downstream demands in the Bonneville Basin. The Diamond Fork Powerplant would include a 9,350-horsepower turbine, with a 305-foot design head and 298 cfs of discharge capacity, and a 6,800-kW generator. The plant would be remotely controlled.

Switchyards, Substations, and Transmission Lines

A switchyard would be required at each of the five powerplants, and two substations would be required. The size and characteristics of each would be a function of the powerplant size and method of interconnection with other switchyards or substations.

The Syar Switchyard would include a 13.8-kilovolt (kV) bus tie bay with circuit breakers and switches. The size of the switchyard would be approximately 100 feet by 100 feet.

Sixth Water Switchyard would consist of a 13.8/138-kV, three-phase transformer and associated circuit breakers and disconnecting switches. The size of the switchyard would be 100 feet by 100 feet.

Rays Valley Substation would be located approximately halfway between Syar and Sixth Water Switchyards. The substation would contain a 13.8/138-kV, three-phase transformer; five 138-kV line bays; and a 138-kV bus tie bay. The substation would be approximately 250 feet by 300 feet in size.

Dyne Switchyard would contain a 13.8/138-kV, three-phase transformer; two 138-kV line bays; and a 138-kV bus tie bay. Additionally, it would have a 13.8-kV bus tie bay. The switchyard would be approximately 100 feet by 200 feet in size.

Monks Hollow Switchyard would contain a 6.6/13.8-kV, three-phase transformer and a 13.8-kV bus tie bay. The size of the switchyard would be approximately 100 feet by 100 feet.

The Diamond Fork Switchyard would contain a 6.6/46-kV, three-phase transformer and a 46-kV bus tie bay. It would be approximately 100 feet by 100 feet in size.

An overhead, alternating current transmission system would be required for this alternative. An 0.8-mile, 13.8-kV line would be required to connect Syar Powerplant to Rays Valley Substation, and a 2.8 mile, 13.8-kV line would be required to connect Monks Hollow Powerplant to Dyne Powerplant. A 4.4-mile, 138-kV line would be required to connect Dyne Powerplant to Rays Valley Substation; a 0.6-mile, 138-kV line would connect Sixth Water Powerplant to Rays Valley Substation; and a 10-mile, double-circuit, 138-kV line would connect Rays Valley Substation to the interconnected transmission system at the Sheep Creek Substation. A 0.5-mile, 46-kV line would be required to connect the Diamond Fork Powerplant to the interconnected system.
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The 138-kV lines would be supported on steel or wood-pole structures. The 46-kV and 13.8-kV lines would most likely be suspended from single wood-pole structures designed to prevent raptor electrocution. Nonreflecting, steel-reinforced aluminum conductors would be used.

A combination of helicopter and conventional construction methods would be used to construct the transmission facilities.

Assuming contractual arrangements could be made, the Sheep Creek Substation would be tied with Deseret Generation and Transmission Cooperative's 345-kV Bonanza-to-Mona line and Utah Power & Light Company's two existing 138-kV lines (Carbon to Hale). This tie would result in a substation approximately 800 feet by 800 feet in size.

A temporary construction powerline would be built from Spanish Fork Canyon to the Syar Tunnel outlet portal. The 12-mile-long line would be suspended from wood-pole structures. The temporary powerline would be removed and the landscape restored at the end of the construction period. Construction power for Sixth Water and Monks Hollow Dams would be provided by constructing the permanent 13.8-kV and 138-kV lines described above (see General Map) and connecting them to the temporary construction powerline.

ROADS

About 32.9 miles of new roads would be constructed and about 12.4 miles of existing roads would be improved to facilitate construction and operation of the Sixth Water Flow Through Alternative. The new roads would either replace existing roads or provide new access to project facilities. About 0.6 mile of the new roads would be located on private land and the remaining 32.3 miles would be on Forest Service land.

A newly constructed Sheep Creek-Rays Valley Road provides access to Rays Valley from U.S. Highway 6 at the mouth of Sheep Creek in Spanish Fork Canyon. The new road extends about 15 miles in a northeasterly direction to Syar Reservoir. All of the existing Sheep Creek Road will be obliterated except for the 1.2 miles north of (above) its junction with Highway 6, which will be used to provide access to the Sheep Creek Substation. NEPA compliance for the new road was achieved through an Environmental Assessment/Finding of No Significant Impact (FONSI) process in 1983 (UC-FONSI 83-4, dated July 18, 1983).

A new road would be constructed beginning at the end of the Sheep Creek-Rays Valley road to provide access to the Syar Tunnel portal and Syar Surge Shaft. This road would extend southeasterly about 1.9 miles to the surge shaft. A 0.6-mile-long branch would extend to the tunnel portal.

The existing Diamond Fork Road would be improved from Highway 6 at the mouth of Diamond Fork Canyon to Monks Hollow Dam (7.5 miles). A portion of the road would be inundated by Monks Hollow Reservoir and would not be replaced because of adverse environmental impacts (especially to esthetics), difficulty of construction in the rugged terrain,
and high cost. Thus, access to the north and east will not be available above the dam.

A new 3.3-mile road would provide access to Monks Hollow Dam and the proposed day-use area at Monks Hollow Reservoir. The road would branch from the Diamond Fork Road 1.1 miles below the dam and extend northeast to Red Hollow where it would turn south toward the dam.

A 0.2-mile section of the existing Rays Valley Road would be inundated by Syar Reservoir and would be replaced by a new 0.6-mile-long road around the east side of the reservoir. The existing road north of the reservoir would be replaced with a new 4.7-mile-long road that would connect with the Diamond Fork Road. From the mouth of Sheep Creek to this junction, the Rays Valley Road would consist of a total of 20.3 miles of asphalt-surfaced road, constructed to Reclamation and Forest Service standards.

A new road would also be constructed from Rays Valley Road just north of Syar Reservoir to extend 1.1 miles west to the Corona Aqueduct Tunnel Portal and Surge Tank.

From its junction with the new Rays Valley Road, Diamond Fork Road would be improved for a distance of 4.3 miles to provide access to the Dyne Powerplant. At a point about 1.3 miles northeast of the powerplant, a new road would be constructed to provide access to the Dyne Tunnel Portal and to the Dyne Surge Tank. This road would be 1.7 miles long to the surge tank. A branch of this road would begin after 0.6 mile and extend northeasterly 0.8 mile to the tunnel portal.

A new road would be constructed from the Rays Valley Road just north of Sixth Water Creek to provide access to Sixth Water Dam and Powerplant. The road would be 2.6 miles long to the dam, branching off after 1.5 miles to the powerplant (another 0.6 mile).

The new access roads and nearly all of the improved Diamond Fork Road would be 20-foot-wide, mostly asphalt-surfaced roads built to Reclamation standards. At its junction with U.S. 6-89, entrance and exit lanes would be provided on Diamond Fork Road to reduce traffic congestion during construction.

OPERATING FACILITIES AND PROJECT ADMINISTRATION

Reclamation would operate and maintain project water conveyance facilities, reservoirs, and powerplants from the central control building located at Sixth Water Powerplant. All five powerplants would be remotely controlled from the CRSP Operations Center at Page, Ariz., or from another remotely located control center, as may be determined by the non-Federal participants. A communications system consisting of microwave, radio, and land lines would be provided between the various powerplants and the control center. Facilities for a small number of operation and maintenance personnel would be provided at the plant. Western would operate and maintain the power system switchyards and
transmission lines leading to the interconnected transmission system from its CRSP Power Operations Center in Montrose, Colo. A communications system consisting of microwave, radio, and land lines would be provided between the switchyards, substations, and Western’s CRSP Power Operations Center. Reclamation would maintain the roads during the construction period. After construction is complete, the roads would be administered by the Forest Service. Reclamation would be responsible for snow removal. Agreements would be made to cover road damage caused by snow removal or heavy use by Reclamation.

The Forest Service would manage the recreation facilities. Wildlife habitat would be managed by the Forest Service in coordination with the Utah Division of Wildlife Resources.

RECREATION FACILITIES

Recreation facilities for the Diamond Fork Power System were planned by the Forest Service in cooperation with Reclamation. Facilities for the recommended plan would include Monks Hollow Recreation Area, enlargement of the existing Palmyra and Diamond Campgrounds to replace the capacity lost at the abandoned Hawthorn and Three Forks Campgrounds, Monks Hollow Day-Use Area, Lower Diamond Fork Trailhead, and a trail around Monks Hollow Reservoir (Figure 8).
Monks Hollow Recreation Area would be located about a half mile below Monks Hollow Dam. It would consist of 96 camping units; a day-use area with 40 parking spaces, 25 picnic tables, and a restroom; and a fisherman access point with 6 parking spaces and a restroom. Ten camping units would be added to Diamond and Palmyra Campgrounds to replace those at Three Forks and Hawthorn Campgrounds.

Monks Hollow Day-Use Area would be located adjacent to the north side of Monks Hollow Reservoir and would be used for hand launching of nonmotorized boats. The complex would consist of an asphalt parking lot with 20 spaces, a restroom, and appropriate signs.

Lower Diamond Fork Trailhead would be constructed 2 miles below Monks Hollow Dam. The trailhead facility would include a parking lot with 20 parking spaces allowing trailer use, a restroom, a horse-unloading ramp, and hitching racks. This trailhead would serve existing trails in the area.

**FISHERY MEASURES**

Fishery measures for all project alternatives were cooperatively developed by an interagency biological team representing the Bureau of Reclamation, the Fish and Wildlife Service, the Forest Service, and the Utah Division of Wildlife Resources. Additional details concerning these measures are given in the Diamond Fork System Fish and Wildlife Coordination Act Report. Under the recommended plan, the lower 8 miles of Diamond Fork would be substantially enhanced as a fishery from Monks Hollow Dam to the Spanish Fork River with operation of the Diamond Fork Pipeline. At 450 cfs, the pipeline is sized at the maximum justifiable capacity, based on a comparison of fishery and power benefits from the Diamond Fork Powerplant and the cost of the pipe. The pipeline would divert historically high flows from the stream. In the past, these flows have considerably degraded trout habitat through scouring and erosion. In order to realize these fishery benefits, however, minimum dissolved oxygen levels of 5 milligrams per liter (mg/L) must be maintained in Diamond Fork to sustain trout. The objective is to attain this level within a quarter mile below the stilling basin. If it is apparent upon initial operation of the system that this objective is not being met, then appropriate measures, such as installation of baffles and mixers, would be implemented if this can be done at reasonable cost. If not, additional coordination would occur with involved resource agencies to develop a satisfactory resolution to the problem. In addition, it may be necessary to consider some rehabilitation of the stream-banks to insure that the projected fishery habitat improvement is achieved and maintained. Public fishing access on lower Diamond Fork would be acquired as part of the recommended plan in order to realize the fishery enhancement provided by the pipeline. Fisherman access points and parking areas would be provided to accommodate the increased angler use associated with these fishery measures.

A flow-bypass valve would be included in the connection between Syar Tunnel and the existing Strawberry Tunnel. This valve would allow
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the release of up to 50 cfs into Sixth Water Creek to support a stream fishery if flows are available. Minimum flows would be provided in the creek below Sixth Water Dam by a release through the dam equivalent to the natural flow, up to 50 cfs. Flows in the Spanish Fork River may need to be altered to satisfy needs of the June sucker.

Monks Hollow Reservoir would have some fishery potential and would be stocked under management practices developed by the Utah Division of Wildlife Resources. Under current policy, this agency provides 50 percent of the fish stocking for Federal reservoirs in the State.

WILDLIFE MEASURES

Wildlife measures were cooperatively formulated by an interagency team of biologists representing the Bureau of Reclamation, the Fish and Wildlife Service, the Forest Service, and the Utah Division of Wildlife Resources. The team developed several mitigation options for each project alternative. These options include use of private lands, national forest lands, and combinations of the two. Each land parcel obtained for mitigation would undergo habitat improvement and would be managed for wildlife. The primary objective is to provide "in-kind" (same species) and "in-place" (vicinity of project impacts) compensation for project-caused resource losses (see Chapter IV).

In selecting land parcels and developing mitigation options, improvement of mule deer winter range and riparian (streamside) habitat types were given top priority because of the high potential for improvement of these habitat types and the resulting increased benefits to all wildlife species. All land parcels evaluated exhibited different levels of wildlife habitat values as well as varying potential for improvement. Some options, therefore, required more land to compensate for project impacts than others. Parcels of land and mitigation options were selected and prioritized according to their potential for providing added wildlife habitat values under intensive management.

The interagency biological team has recommended a preferred wildlife mitigation option for the recommended Sixth Water Flow Through plan. The preferred option includes acquisition, habitat improvement, and intensive wildlife management of about 4,000 acres in 10 parcels of private lands in the Diamond Fork Canyon area. The lands are under four ownerships and include most of parcels C-2, C-3, C-5, C-6, B, D, S-1, S-2, S-3, and S-4 as shown on Figure 9. The 10 parcels combined have the highest potential for habitat improvement and management for all wildlife species and would, therefore, provide the greatest and best distribution of compensatory biological values in the Diamond Fork study area. This wildlife option would best meet the mitigation objectives stated above. The Thistle landslide and its associated impacts have been fully considered in developing this mitigation plan. Detailed management and habitat improvement plans for the preferred option would be cooperatively formulated for each land parcel and cover type by the Bureau of Reclamation, the Fish and Wildlife Service, the Forest Service, and the Utah Division of Wildlife Resources. The Forest Service would
manage wildlife mitigation lands. Management criteria would include acquiring and/or setting aside each land parcel for wildlife as the primary use, yet allowing all other compatible uses. All vegetative cover types, if practicable, would be actively manipulated where needed to maximize their wildlife habitat values. Management practices would include (1) mechanical, chemical, and/or hand thinning of mountain brush and pinyon-juniper types; (2) reseeding all cover types with desired forb and browse species; (3) planting browse seedlings; and (4) managing livestock grazing to maintain the desired browse and forb production for wildlife. These practices would result in a reduction in livestock grazing of about 67 percent on the proposed wildlife lands.

The preferred mitigation option is used as a basis for determining net impacts on terrestrial wildlife for the recommended plan. Other mitigation options considered are described later in this chapter.

Additional mitigation measures are included in the plan to minimize or otherwise reduce impacts resulting from construction and operation of the Diamond Fork Power System on terrestrial wildlife. These measures would (1) minimize disturbance to vegetation and landscape by confining construction activities to specific areas actually needed for project purposes, (2) rehabilitate temporarily disturbed landscapes to the best possible conditions to restore maximum wildlife habitat values, and (3) protect important wildlife use areas, particularly for bobcat, golden eagles, and mule deer, from unnecessary disturbances. Specific measures include reducing stress on nesting golden eagles during the breeding cycle by avoiding heavy construction activities within 0.5 mile of any active nesting territories in the area. In addition, power transmission lines and towers would be designed to prevent electrocution of eagles and would be located to minimize the exposure of perched eagles and other raptors to indiscriminate shooting by undisciplined individuals. Rocky cliff areas immediately north of Monks Hollow, which are important in providing preferred denning and hunting habitat for bobcat, would be protected from unnecessary habitat destruction or alteration during construction. Public access (especially snowmobiles) over project roads located on severe winter range for mule deer would be restricted during the winter (December through April), in accordance with the current Uinta National Forest travel plan. Excessive construction noises would be controlled in deer wintering areas whenever possible.

More detailed terrestrial wildlife measures for the recommended plan and the other project alternatives are analyzed in the Diamond Fork System Fish and Wildlife Coordination Act Report.8 (See also Attachment 2.)

Western, in addition, has agreed to use helicopter construction methods in locations not accessible by existing roads and trails. The use of helicopters would reduce wildlife impacts by shortening the duration of disturbance and by minimizing the amount of vegetative clearing required. Also, canyons would be spanned by the transmission lines wherever possible to protect vulnerable riparian habitat and species.
Private Land Parcels

Forest Service Lands (FS)

SCALE OF MILES

FIGURE 9
POTENTIAL WILDLIFE MITIGATION LANDS
OTHER MITIGATION MEASURES

Construction specifications would be written and construction activities monitored by government personnel to ensure that protection of the environment is fully considered. An environmental commitment checklist would be prepared for each construction contract to ensure that all mitigation measures and commitments are implemented during and after construction. Contractors would be required to comply with pertinent Federal, State, and local laws, orders, and regulations concerning the prevention and control of air and water pollution and noise.

Air Quality and Noise Control

During construction, measures would be carried out to reduce dust and excessive exhaust pollution. Whether on a right-of-way provided by the Federal Government or elsewhere, the contractor would furnish, in accordance with Federal regulations, all of the labor, equipment, materials, and means required to control dust. The contractor would also carry out proper and efficient measures whenever necessary to reduce dust nuisance and to prevent dust which might originate from his operations. The contractor would be held liable for any damage resulting from dust originating from his operations on a Federal right-of-way or elsewhere.

Noise levels would be kept below 85 decibels as measured outdoors at residences or other noise-sensitive areas.

Water Quality

The contractor would be required to comply with applicable Federal and State laws, orders, and regulations concerning the control and abatement of water pollution. (See "Actions Required to Implement the Plan" later in this chapter for a discussion of water quality permits to be obtained.) The contractor's construction activities would be performed by methods that would prevent entrance or accidental spillage of solid matter, contaminants, debris, and other objectionable pollutants and wastes into streams, flowing or dry watercourses, lakes, and underground water sources. Such pollutants and wastes might include, but are not restricted to, refuse, garbage, cement, concrete, oil and other petroleum products, and aggregate processing tailings. Sanitary wastes would be disposed of on land by burial at approved sites or by other approved methods. The contractor's activities would be monitored by Reclamation and Western inspectors to ensure compliance.

Construction wastewater, including ground water intercepted in tunnels, shafts, and caverns, would be treated and discharged in compliance with all Federal and State laws and regulations concerning the control and abatement of water pollution.

Water pollution control during construction would consist of a point-source and nonpoint-source program designed to eliminate or greatly reduce adverse water quality impacts. All point-source discharges would
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meet appropriate State and Federal effluent standards, and Reclamation would obtain an NPDES (402) permit for the contractor. Sewage, oil and grease, and any hazardous substances such as herbicides used during construction would be used according to best management practices as recommended by the Environmental Protection Agency.

A nonpoint-source control program would be implemented by the contractor as specified in the contract to provide for an erosion control plan, since sediment generated on a construction site can have a significant impact on the downstream aquatic ecology by destroying the macroinvertebrate community and reducing trout spawning and hatching success by covering gravel beds. The erosion control plan would provide for maintenance of State turbidity standards, although the best management practices currently available are not perfect and some violations may be unavoidable during construction-related stream diversions and stream crossings.

The erosion control plan would follow best-management practices outlined for construction and stripmining activities and would include, as a minimum, the following actions.

1. Using the fewest stream diversions possible, with early placement of the permanent diversion for the construction period.

2. Diverting runoff around disturbed areas to reduce the sediment load reaching the stream.

3. Identifying and locating temporary features such as berms, dikes, dams, sediment basins, fiber mats, netting, gravel filters, mulches, grasses, slope drains, or other control devices which are in place or would be installed to control sediment resulting from all sources of water flowing into the construction area.

4. Controlling drainage from haul roads and access roads.

5. Providing a listing of material, machinery, and manpower available at the site for erosion control.

6. Providing permanent erosion control measures such as stabilization and revegetation or terracing of steep slopes and other disturbed areas and providing any other measures necessary to assure long-term protection of water quality.

7. Maintaining a buffer zone along the stream to protect water quality. Vegetation clearing in the reservoir pool areas would be minimized to the greatest extent possible until construction of a dam has progressed to the point that runoff from disturbed areas can be controlled. The sediment control plan would indicate the
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location and extent of buffer strips and contain a schedule of clearing activities.

8. Identifying an onsite water quality control officer, who would be responsible for implementing water quality control measures.

9. Establishing a tentative schedule of implementation of temporary and permanent control measures.

10. Including a water quality monitoring program with the sediment control program. As a minimum, this program would consist of sediment and turbidity sampling and analysis to be conducted at stations established above and below the construction site and at any other location within the construction area which might be a source of pollutants to the principal drainage. Samples would be collected at least twice weekly during the construction period.

Sediment and erosion control plans would be reviewed by the Utah Division of Environmental Health prior to granting construction permits to insure protection of water quality and aquatic habitat. Inspections would be conducted by the water pollution control staff prior to and during construction to insure compliance with approved plans. Sanitary and other pollution control facilities would be inspected by State personnel prior to operation, as well as being approved before construction.

Reclamation and the contractor would establish a temporary program around the construction site to monitor water quality impacts during construction. An ongoing water quality monitoring program in Diamond Fork would assess overall changes that occur with project operation and determine if operational or facility changes are needed (refer to Chapter IV).

Landscape Preservation and Restoration

Temporary construction facilities such as camps, shops, offices, and yards would be located so as to minimize the removal of trees and vegetation. If facilities are located on national forest land, the sites would be approved by the forest supervisor. Where practical, these facilities would be within the reservoir basins. On abandonment, all materials and debris would be removed from the sites, and the construction areas outside the basins would be reshaped and revegetated with native grasses, forbs, shrubs, and trees. The movements of crews and equipment would be limited to established routes, and if temporary roads were necessary, the alignments would be restored. Borrow and riprap areas would be excavated so as not to pond water and, before being seeded, the sides would be brought to stable slopes and shaped to give a natural and pleasing appearance. Wherever feasible, materials needed for construction activities would be obtained from reservoir basins, tunnel excavation, or other disturbed sites. To mitigate the visual impact of transmission towers and conductors, (1) steel towers would be darkened by a vinyl
wash or coloring, (2) conductors would be nonreflecting, (3) towers
would be installed by helicopter if road access would cause permanent
cut-and-fill scars, and (4) low-voltage lines would be mounted on wood
poles.

All areas which are not permanent sites of proposed project surface
features and which are excavated, denuded, or otherwise disturbed by
project activities would be rehabilitated to the best possible condi-
tions. Site-specific rehabilitation plans would be prepared, including
surface restoration requirements and stabilization, stockpiling and
replacing topsoil, fertilizer applications, application of prescribed
seed mixtures, and planting of seedlings. Reclamation would consult with
the Forest Service and the Utah Division of Wildlife Resources in the
development and implementation of these site-specific restoration plans.

Western has committed to several mitigation measures to reduce
visual impacts. Where helicopters are used in the construction of
transmission lines, the amount of vegetation disturbed would be reduced.
Clearing would be limited to the specific areas actually needed for the
project, such as around structure sites or to areas where vegetation
must be removed to prevent damage to conductors or other facilities. A
feathering technique would be used to soften the edges of the clearings.
All areas where excavation or total removal of vegetation occurs would be
recontoured, fertilized, and reseeded in consultation with the Forest
Service.

Structures, switchyards, and the substation would be sited and de-
signed to minimize visual impacts. The use of nonreflecting conductors
is planned to further reduce visual impacts. Colored concrete footings
and dulled finish towers may be used if appropriate. All construction
areas would be cleaned and all debris and rubbish removed after construc-
tion is completed. All visual mitigation would be coordinated with the
Forest Service. In addition, fences and conductive structures in the
vicinity of the transmission lines would be checked and grounded properly
to prevent electrical shocks.

Preservation of Archeological, Historical,
and Paleontological Resources

Based on an intensive (Class III) survey of approximately 90 percent
of the project area, no known cultural resources would be affected by the
project. Reclamation (or Western for transmission line corridors) would
develop a discovery plan, in consultation with the Utah State Historic
Preservation Officer, for the evaluation of resources identified during
surveys of the remaining 10 percent of the project area or during con-
struction activities. The additional surveys would be in the feature
areas of (1) the pipeline for the No Power Alternative and (2) the
switchyards, transmission lines, material sources, and contractor staging
areas for all other alternatives. If significant resources are dis-
covered during construction, a plan would also be developed in consulta-
tion with the Utah State Historic Preservation Officer and the Advisory
Council on Historic Preservation to mitigate project impacts on significant resources. The contractor would be required to be alert for cultural resources uncovered during construction activities. In the event of a discovery, he would be required to halt work until the resources are evaluated by a qualified archeologist.

Other Considerations

If the use of pesticides is determined to be necessary, only those registered with the Environmental Protection Agency would be used. Drilling and blasting would be accomplished in compliance with applicable Federal, State, and local safety regulations.

Deliveries of Strawberry Valley Project water to irrigators would not be interrupted during construction.

Project reservoir and powerplant operation

Depending on downstream irrigation and municipal and industrial water demands, annual flows with the Sixth Water Flow Through Alternative would vary from about 150,000 acre-feet to about 292,000 acre-feet, with an average of 198,400 acre-feet (based on 1930-73 records). Operation of Syar, Sixth Water, Dyne, Monks Hollow, and Diamond Fork Powerplants would vary primarily as the flows vary from season-to-season and year-to-year. The surface elevations of Syar and Sixth Water Reservoirs would fluctuate 26 and 34 feet, respectively, both on a daily basis and on a weekly basis. Monks Hollow Reservoir would not fluctuate greatly on a daily basis but would fluctuate a maximum of about 50 feet on a seasonal basis.

Other planning considerations

ACTIONS REQUIRED TO IMPLEMENT THE PLAN

Several water quality permits must be obtained prior to construction of the Diamond Fork Power System. The Clean Water Act of 1977 (Public Law 95-217) requires that section 402 permits be obtained from the Environmental Protection Agency for the discharge of any wastewater or process water. These permits must be obtained for several features of the Diamond Fork Power System. In accordance with section 404 of Public Law 95-217, either (1) permits must be obtained from the Corps of Engineers to discharge dredge-and-fill material below the normal high water level of streams and other water bodies or (2) exemption must be obtained under section 404(r). As stated in Chapter I, Reclamation intends to obtain the exemption by pursuing the course of action provided by Section 404(r). An analysis of the power system in accordance with Section 404(b)(1) of Public Law 95-217 is included as Attachment 1 to this statement with the objective of obtaining the exemption. As stated previously, the Corps of Engineers and Environmental Protection Agency concurred that the analysis is in compliance with Section 404(b)(1) (see Consultation and Coordination section in the Appendix).
CHAPTER III

Approval by the Utah State Division of Health is required before the installation of any sanitary or industrial pollution control facilities including turbidity control equipment. This approval will also be obtained before dewatering, diversion, and other such facilities can be constructed. In addition, a temporary waiver of the turbidity standard would be requested from the State Division of Health during those periods of construction when it is physically impossible to provide turbidity control. A temporary waiver of temperature and total dissolved solids (TDS) standards may be necessary if it becomes impractical to completely treat all of the ground water intercepted in the various tunnels, etc., during construction. A State Engineer's permit to alter a natural stream channel would also be requested for the proposed dam structures, discharge channel, flow-through powerplants, and any other appurtenant structures necessary for the construction of the power system.

Under Executive Orders 11988 and 11990, Western is required to prepare a flood plains/wetlands assessment for any facilities which would be located in a flood plain or wetland. This assessment would be prepared, if needed, after preliminary designs for the project are completed.

Consultation with the Fish and Wildlife Service under Section 7 of the Endangered Species Act has determined that the project would not impact any threatened or endangered species of fish, wildlife, or plants. No further clearance is required. Consultation under the Fish and Wildlife Coordination Act is underway, and a report containing recommendations has been submitted to Reclamation. The recommendations and Reclamation's response are presented in Attachment 2.

The Forest Service would issue permits for the construction of access roads and transmission lines and for the removal of borrow material from forest lands outside of withdrawn lands. The Forest Service may also issue burning permits to contractors for disposal of cleared vegetation and may revise or reissue grazing permits. The latter action will require some environmental analysis by Reclamation in addition to that presented in this Environmental Impact Statement.

Archeological and historical clearance has been obtained from the Utah State Historical Preservation Officer for about 90 percent of the proposed feature sites. The remaining sites are in areas where the existing landscape would be disturbed. Clearance for these sites would be accomplished once specific locations were determined.

Other required actions would include contractors obtaining permits for oversize and overweight loads and an agreement with the Utah Department of Transportation to widen U.S. Highway 6 at the intersection with the proposed Sheep Creek-Rays Valley access road to provide for deceleration and acceleration lanes. Also, Western and Reclamation would enter into an agreement for transmitting power to and from power generation facilities.
CHAPTER III

ACQUISITION OF LAND FOR PROJECT FEATURES

About 6,760 acres of land would be required for project features, wildlife mitigation, and material source areas. The amounts of land by present ownership or administration and proposed project use are shown in Table 6.

Table 6
Lands for project features—
Sixth Water Flow Through Alternative
(Unit--acres)

<table>
<thead>
<tr>
<th>Project feature/type of acquisition</th>
<th>Ownership or administration</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Uinta National Forest Total</td>
</tr>
<tr>
<td>Syar Tunnel</td>
<td>Private</td>
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<tr>
<td>Reclamation withdrawal</td>
<td>36.2</td>
</tr>
<tr>
<td>Syar Dam, Reservoir, Powerplant,</td>
<td></td>
</tr>
<tr>
<td>Switchyard, Surge Tank, and Penstock</td>
<td></td>
</tr>
<tr>
<td>Reclamation withdrawal</td>
<td>70</td>
</tr>
<tr>
<td>Corona Aqueduct; Sixth Water Dam,</td>
<td></td>
</tr>
<tr>
<td>Reservoir, Powerplant, Switchyard,</td>
<td></td>
</tr>
<tr>
<td>Surge Tank, and Penstock</td>
<td>151</td>
</tr>
<tr>
<td>Reclamation withdrawal</td>
<td>151</td>
</tr>
<tr>
<td>Dyne Powerplant, Switchyard, Penstock, and Aqueduct</td>
<td>26.6</td>
</tr>
<tr>
<td>Reclamation withdrawal</td>
<td>26.6</td>
</tr>
<tr>
<td>Monks Hollow Dam, Reservoir, Powerplant, and Switchyard</td>
<td>1,490</td>
</tr>
<tr>
<td>Reclamation withdrawal</td>
<td>1,490</td>
</tr>
<tr>
<td>Diamond Fork Pipeline</td>
<td></td>
</tr>
<tr>
<td>Reclamation withdrawal</td>
<td>15.7</td>
</tr>
<tr>
<td>Temporary construction easement</td>
<td>87.4</td>
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<tr>
<td>Perpetual easement</td>
<td>14.7</td>
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<tr>
<td>Reserved right-of-way</td>
<td>13.3</td>
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<tr>
<td>Access roads</td>
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</tr>
<tr>
<td>Fee title</td>
<td>3.7</td>
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<tr>
<td>Forest Service land use authorization</td>
<td>382</td>
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<tr>
<td>Transmission lines</td>
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<tr>
<td>Forest Service land use authorization</td>
<td>161</td>
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<tr>
<td>Wildlife mitigation and improvement</td>
<td></td>
</tr>
<tr>
<td>Perpetual easement or fee title</td>
<td>4,000</td>
</tr>
<tr>
<td>Developed recreation sites</td>
<td>25</td>
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<tr>
<td>Material source areas</td>
<td></td>
</tr>
<tr>
<td>Reclamation withdrawal</td>
<td>270</td>
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<tr>
<td>Fee title</td>
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<tr>
<td>Total</td>
<td>4,134.1</td>
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<tr>
<td></td>
<td>2,627.5</td>
</tr>
<tr>
<td></td>
<td>6,761.6</td>
</tr>
</tbody>
</table>
Forest Service public lands would be obtained for project uses by (1) Reclamation withdrawal, (2) Forest Service right-of-way permits, (3) temporary construction easements, or (4) Forest Service special-use permits for roads. Withdrawn lands would be administered as public lands under the jurisdiction of Reclamation. Except for lands required for operation and maintenance, all Forest Service lands would revert to Forest Service administration following construction.

Private lands for project uses would be acquired from owners by (1) fee title, (2) perpetual easement, (3) reserved right-of-way, or (4) temporary construction easement. Those acquired by fee title would be purchased at the appraised value and would become Federal lands administered by Reclamation (or the Forest Service in the case of wildlife lands). Private lands with temporary construction easements would revert to the original owner following construction.

The acquisition of private lands required for wildlife mitigation would be pursued through means other than fee title, if possible. First priority would be the acquisition of perpetual easements. Any lands obtained through such easements would be clearly assignable to a third party to facilitate management by a Federal or non-Federal entity. These lands would be administered by the Forest Service under a cooperative agreement with the Bureau of Reclamation and the Utah Division of Wildlife Resources. To assure proper management of easement lands needed to mitigate wildlife losses attributed to the project, certain restrictions on the landowners' use of their lands would be needed. These restrictions would include the prohibition of such things as further construction of residential structures; commercial uses such as motels, cafes, hunting or fishing clubs, subdivisions, etc.; and the storing or use of pesticides, herbicides, or chemical agents, either directly or indirectly lethal to wildlife. In addition, these lands would be made available to the general public for hunting, fishing, or other recreational uses without permit or charge of fees by the landowners, and would be subject to grazing management and to vegetative, drainage, and contour modifications as deemed appropriate for proper fish and wildlife management. Specific measures or restrictions would be developed individually as part of the easement negotiation process with each involved landowner.

In order to realize fishery benefits used to assist in justification of the Diamond Fork Pipeline, public access to the lower 5 miles of Diamond Fork would be provided.

PUBLIC SAFETY

In accordance with Reclamation policy, the final design of Syar, Sixth Water, and Monks Hollow Dams would be based on extensive geological investigations and would include full consideration of factors such as seismic history, geology, and material composition of the dams. In addition, final design data and specifications would be reviewed by an independent professional engineering firm with appropriate expertise to ensure that the dams are safe and well designed structures, fitting the geological conditions of their sites. Criteria would be developed and
CHAPTER III

strictly followed for filling the reservoir and monitoring the dam for safety.

Marker buoys and float lines would be installed around spillway intake structures, tunnel outlet structures, and other potentially hazardous areas. Safety devices such as fences, signs, guardrails, and handrails would be installed around stilling basins, spillways, and dams. All buildings, access facilities, and mechanical or electrical facilities would have fences and warning signs. Warning signs, public notices, and restricted areas would be used to protect the public from other potential dangers.

RELOCATIONS

Ranch properties, consisting of about 4,000 acres in 10 parcels and 4 ownerships, would be acquired for wildlife mitigation and fishing access. Four single-family dwellings and other improvements are located on the land proposed for acquisition. The dwellings are not occupied during the winter, nor are they the primary residences of the owners or summer occupants. Therefore, no individuals or families would be relocated. The other improvements include barns and outbuildings. All improvements would be purchased and removed by a clearing contractor or sold back to the original owners for salvage.

All relocation assistance would be accomplished under provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (Public Law 91-646). The primary assistance provided by Reclamation would be payments for the removal of any personal property from the acquired land.

There is no provision under the act for assistance to or compensation of livestock grazing permittees. Reclamation would, however, cooperate with the Forest Service in revising its grazing management program, such as assistance in the relocation of trails, roads, fences, cattleguards, and rider camps (cabins) and assistance in measures such as noxious weed control.

Three Forks Campground would be inundated by Monk’s Hollow Reservoir, and access to Hawthorn Campground would be blocked by the reservoir. These two campgrounds would be relocated by replacing their facilities with new facilities at Palmyra and Diamond Campgrounds.

About 3.1 miles of Forest Service roads would be inundated, and some would be relocated. Syar Reservoir would inundate 0.2 mile of the existing Rays Valley Road, which would be replaced by about 0.6 mile of new road east of the reservoir. Monk’s Hollow Reservoir would inundate 2.9 miles of the existing Diamond Fork Canyon road which would not be replaced. No roads would be inundated by Sixth Water Reservoir. No power transmission or telephone lines would be relocated.
CHAPTER III

WASTE MATERIAL DISPOSAL

Waste material excavated from tunnels or any other project features would be used where needed for construction of other features. Suitable waste materials would be used as fill material for dams, dikes, or roads, or for concrete aggregate. Material not suitable or not needed for construction purposes would either be disposed of by placing it in the nearest reservoir basin, where it would not be visible after the reservoir is filled, or in some other esthetically suitable location acceptable to the Forest Service. These materials would be stabilized and revegetated where practical.

CONSTRUCTION ACTIVITIES AND SCHEDULE

Reclamation's Bonneville Basin Construction Office in Provo, Utah, would supervise construction of the Diamond Fork Power System. Construction of the roads and recreation facilities would be supervised by Reclamation in cooperation with the Forest Service.

Temporary field offices for construction would be located at each major feature site. Most of the construction workers would commute to the work sites from their homes in the south portion of Utah County (Orem to Spanish Fork).

The major facilities of the Diamond Fork Power System, including the transmission lines, would be constructed over a minimum period of about 4 years. During its two peak years, the project would provide direct employment for about 1,685 private and government employees, based on a 7-month annual construction period over the entire construction period.

Other Viable Alternatives

Fifth Water Pumped Storage Alternative

PLAN ACCOMPLISHMENTS AND CONCEPT

The Fifth Water Pumped Storage Alternative would utilize the transbasin diversion of water from Strawberry Reservoir and the large drop in elevation from the reservoir to the confluence of Diamond Fork and the Spanish Fork River to generate 42.4 MW of conventional hydroelectric power and 1,140 MW of pumped storage power. In addition, facilities would be provided to help satisfy identified recreation needs, stream fisheries would be considerably enhanced, limited flatwater fisheries would be created, and some flood control would be accomplished in Diamond Fork. Measures would be taken to mitigate losses to wildlife. The major features of the recommended plan are shown in Figures 10 and 11.

From the Strawberry Tunnel inlet at Strawberry Reservoir, water would flow through the proposed Syar Tunnel (which would replace the existing Strawberry Tunnel) and Syar Penstock to the proposed Fifth Water Reservoir, which would be formed by a dam on Fifth Water Creek just below
CHAPTER III

Alternatives

Rays Valley. From the reservoir, the water would drop almost vertically through the proposed underground Fifth Water Penstock and then flow through a discharge tunnel into the proposed Monks Hollow Reservoir, which would be formed by a dam on Diamond Fork just below Monks Hollow.

All Bonneville Unit water and part of the Strawberry Valley Project water would be released from Monks Hollow Dam into the proposed Diamond Fork Pipeline and conveyed to a proposed bifurcation near the confluence of Diamond Fork and the Spanish Fork River. Here water destined for use in areas south of Utah County and part of the water for south Utah County would enter the Wasatch Aqueduct of the I&D System. The water destined for storage in Utah Lake and the remainder of the water for south Utah County would flow through the Diamond Fork Powerplant and into Diamond Fork and the Spanish Fork River. The Strawberry Valley Project flows not conveyed in the Diamond Fork pipeline would enter the Diamond Fork stream channel below Monks Hollow Powerplant. Flood control would be provided by both Fifth Water and Monks Hollow Reservoirs.

Power would be generated at three proposed flow-through plants—the Syar Powerplant at the terminus of the Syar Tunnel and Penstock at Fifth Water Reservoir, the Monks Hollow Powerplant at the base of Monks Hollow Dam, and the Diamond Fork Powerplant at the terminus of the Diamond Fork Pipeline—and at the proposed Fifth Water Pumped Storage Powerplant to be located underground near the base of Fifth Water Dam. During periods of low power demand, water in Monks Hollow Reservoir would be pumped back about 1,600 feet almost vertically through the Fifth Water Penstock to Fifth Water Reservoir for reuse during periods of peak power demand. Surge tanks would be located underground at both Syar and Fifth Water plants.

Facilities for operation and maintenance of the power system would be located in the Fifth Water Powerplant chamber, within the area of impact surrounding Fifth Water Reservoir, and at the mouth of Sheep Creek. To facilitate construction and operation of the power system, new roads would be constructed and some existing roads would be replaced or improved. A tunnel would be constructed to provide vehicle access from one of the new roads to the underground Fifth Water Powerplant. Additionally, a vertical shaft would be constructed to provide elevator access to the Fifth Water Powerplant from above and a second, parallel shaft would be provided for ventilation.

New transmission lines and switchyards would be required to transmit the power generated at each proposed powerplant to the interconnected transmission system. A surface switchyard would be built at each of the four powerplants and two separate transmission lines would connect the Syar and Monks Hollow Switchyards with the central Fifth Water Switchyard. A third transmission line would extend from the Fifth Water Switchyard to the proposed Sheep Creek Substation near the confluence of Sheep Creek and Soldier Creek, where it would be tied to the interconnected transmission system. A separate transmission line would be required to connect the Diamond Fork Switchyard with the interconnected system at the mouth of Diamond Fork Canyon.
CHAPTER III  ALTERNATIVES

Recreation facilities would include full-use areas at Fifth Water Reservoir and just below Monks Hollow Dam and a day-use area at Monks Hollow Reservoir. In addition, two existing campgrounds along Diamond Fork below the proposed Monks Hollow full-use area would be enlarged to replace two campgrounds above the reservoir which would be abandoned, and trailheads would be provided at Fifth Water Reservoir and at a site along Diamond Fork downstream of the day-use area.

The fishery below Monks Hollow Dam would be considerably enhanced as a result of diverting historically high flows from the stream into the Diamond Fork Pipeline. Limited flatwater fisheries would be created in Fifth Water and Monks Hollow Reservoirs.

Mitigation for big game and other wildlife habitat losses would consist of the acquisition, habitat improvement, and management of 4,440 acres of land for wildlife.

PROJECT FACILITIES AND MEASURES

Dams and Reservoirs

Fifth Water Dam would be constructed just below Rays Valley, on Fifth Water Creek, about 12 miles upstream from the confluence of Diamond Fork and the Spanish Fork River. The dam would be an earth and rockfill structure about 309 feet high with a crest length of 1,300 feet and a crest width of 30 feet. An outlet-inlet structure for the powerplant penstock would be located upstream from the right abutment and would have a capacity of approximately 10,000 cfs with the reservoir at a water surface elevation of 7,100 feet. A river-level outlet works would be located in the left abutment of the dam. The outlet works would have a capacity of 370 cfs at a water surface elevation of 7,100 feet and would provide a means of emergency reservoir evacuation. Normal discharge would range from 0.5 to 20 cfs for downstream fishery releases. A dike would be constructed across the south arm of the reservoir. The dike would have a crest length of 800 feet and a maximum height of 70 feet above the original ground surface. An emergency spillway would be constructed through a saddle between Fifth Water Dam and Dike to ensure that the maximum probable flood could be safely stored and routed through the reservoir. The spillway would have a crest elevation of 7,103 feet. Fifth Water Dam would have a total volume of 5,000,000 cubic yards of embankment material, and the dike would have 185,000 cubic yards. Material source areas for project features are shown on Figure 7.

Geologic conditions at the sites for Fifth Water Dam and Dike are favorable for the earth and rockfill structures planned. Bedrock at the damsite is of the Green River-Colton (undifferentiated) Formation, consisting of calcareous siltstone, with some interbedded limestone and shale. Suitable rockfill materials for the dam and dike are available in Fifth Water Canyon (Borrow Area J, Figure 7), about 0.4 mile downstream from the dam.

54
Impervious core material is available in Rays Valley, within 2 miles of the damsite (Borrow Areas G, H, J, K, L, and M). This area would later be developed as a project recreation site. Granular filter material is available in the Monks Hollow Reservoir basin (Borrow Area B), a haul distance of about 13.5 miles. A riprap source is located in Wanrhodes Canyon, a distance of 21 miles (Figure 7).

Fifth Water Reservoir would be the afterbay for the Syar Powerplant and the forebay for the underground Fifth Water Pumped Storage Powerplant. The reservoir would have a total capacity of 49,700 acre-feet, including 17,100 acre-feet of active capacity and 32,600 acre-feet of inactive capacity (of which 100 acre-feet is dead storage). A surcharge of 2,540 acre-feet would also be provided for flood control. Sedimentation is expected to be minimal; therefore, dead storage would be limited to 100 acre-feet. The reservoir would have a surface area of 530 acres at water surface elevation 7,100 feet. A projected initial operating condition and a maximum operating condition were evaluated for the Fifth Water Pumped Storage Powerplant. Under initial conditions, Fifth Water Reservoir would fluctuate up to 10 feet on a weekly basis. Under maximum conditions, the reservoir could fluctuate as much as 16 feet daily and 32 feet weekly. Physical data for Fifth Water and Monks Hollow Dams and Reservoirs are shown in Table 7.

Table 7
Summary data for dams and reservoirs--Fifth Water Pumped Storage Alternative

<table>
<thead>
<tr>
<th>Fifth Water Dam and Reservoir</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Dam</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Height (feet)</td>
<td>309</td>
<td></td>
</tr>
<tr>
<td>Material volume (cubic yards)</td>
<td>5,000,000</td>
<td></td>
</tr>
<tr>
<td>Reservoir capacity (acre-feet)</td>
<td>49,700</td>
<td></td>
</tr>
<tr>
<td>Surface area at normal water surface elevation, 7,100 feet (acres)</td>
<td>530</td>
<td></td>
</tr>
<tr>
<td>Monks Hollow Dam and Reservoir</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dam</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Height (feet)</td>
<td>250</td>
<td></td>
</tr>
<tr>
<td>Material volume (cubic yards)</td>
<td>150,000</td>
<td></td>
</tr>
<tr>
<td>Reservoir capacity (acre-feet)</td>
<td>32,800</td>
<td></td>
</tr>
<tr>
<td>Surface area at normal water surface elevation, 5,550 feet (acres)</td>
<td>343</td>
<td></td>
</tr>
</tbody>
</table>

Monks Hollow Dam and Reservoir would be at the same location as in the recommended plan. The dam would be a thin-arch concrete structure, 250 feet high, with a crest length of 925 feet and a crest width of 13 feet. The outlet works would be located at river level and would have a capacity of 875 cfs at minimum water surface elevation 5,498 feet. The outlet works would include the penstock for the Monks Hollow Powerplant and a bypass to the Diamond Fork channel. An overflow spillway would be located on the left abutment. The spillway would have a design capacity of 12,373 cfs at maximum water surface elevation 5,569 feet. A total of 150,000 cubic yards of concrete would be used in the dam.
Monks Hollow Reservoir would be the afterbay for the underground Fifth Water Pumped Storage Powerplant and the forebay for the Monks Hollow Powerplant. The reservoir would have a total capacity of 32,800 acre-feet, consisting of 16,400 acre-feet of active capacity and 16,400 acre-feet of inactive capacity (including 600 acre-feet of dead storage). The 100-year sediment accumulation is expected to be 1,200 acre-feet, which will deposit to a depth of 17 feet at the dam. A surcharge of 5,460 acre-feet would be provided for flood control. The surface area of the reservoir would be 343 acres at normal water surface elevation (5,550 feet). The reservoir surface elevation would fluctuate up to 25 feet per day during maximum operation of the Fifth Water Pumped Storage Powerplant.

**Powerplants and Conveyance Works**

The Syar Tunnel, about 5.3 miles long, would deliver water from Strawberry Reservoir to the Syar Powerplant. The tunnel would be a pressure-type, 10.5 feet in diameter, with a capacity of 800 cfs. The last 3,000 feet of the tunnel would have a steel lining encased in concrete. A surge shaft, to be constructed at the tunnel outlet, would be 18 feet in diameter and 400 feet high. A steel penstock, 7 feet in diameter and 0.2 mile long, would connect the tunnel with the powerplant. The tunnel would be in the Green River and Uinta Formations. Concrete aggregates in sufficient quantities for lining are located within 13.5 miles of the site at Borrow Area B. Physical data for the powerplants and conveyance works are shown in Table 8.

The 26-MW Syar Powerplant would utilize a head of about 502 feet between Strawberry and Fifth Water Reservoirs. The powerplant would include a 35,600-horsepower turbine, with a 432-foot design head and an 800-cfs discharge capacity, and a 26,000-kW generator. Syar Powerplant would be remotely controlled from a master station at the Fifth Water Pumped Storage Powerplant.

The underground Fifth Water Pumped Storage Powerplant would utilize a head of about 1,550 feet between Fifth Water Reservoir and Monks Hollow Reservoir for power generation and would pump water from Monks Hollow Reservoir back into Fifth Water Reservoir for later reuse in power generation. The powerplant would be located about 1,800 feet below ground in a chamber about 525 feet long, 75 feet wide, and 170 feet high. Figure 12 shows an underground pumped storage powerplant similar to the proposed Fifth Water plant. The 1,140-MW plant would include four 402,300-horsepower pump turbines, each with a 285,000-kW (285-MW) motor-generator. Each unit would have a 1,568-foot design head and a 2,502-cfs discharge capacity.

A central control building, switchyard, service yard, warehouse, and storage yard would be located at ground level above the powerplant. These facilities would occupy an area of about four acres. The control building would allow for attended control of the Fifth Water Powerplant and for remote control of the Syar, Monks Hollow, and Diamond Fork Powerplants.
### Table 8
Summary data for powerplants and related facilities--Fifth Water Pumped Storage Alternative

<table>
<thead>
<tr>
<th>Description</th>
<th>Length (miles)</th>
<th>Diameter (feet)</th>
<th>Capacity (cfs)</th>
<th>Capacity (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Syar Tunnel, Penstock, and Powerplant</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Syar Tunnel</td>
<td>5.3</td>
<td>10.5</td>
<td>800</td>
<td></td>
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<tr>
<td>Syar Penstock</td>
<td>0.2</td>
<td>7</td>
<td>800</td>
<td></td>
</tr>
<tr>
<td>Syar Powerplant</td>
<td></td>
<td></td>
<td></td>
<td>26.0</td>
</tr>
<tr>
<td><strong>Fifth Water Pumped Storage Powerplant, Penstock, and Discharge Tunnel</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fifth Water Pumped Storage Powerplant</td>
<td></td>
<td></td>
<td></td>
<td>1,140</td>
</tr>
<tr>
<td>Fifth Water Penstock</td>
<td>0.4</td>
<td></td>
<td>28.5 to 21.5</td>
<td></td>
</tr>
<tr>
<td>Fifth Water Discharge Tunnel</td>
<td>2.9</td>
<td>28.5</td>
<td>10,008</td>
<td></td>
</tr>
<tr>
<td><strong>Monks Hollow Powerplant</strong></td>
<td></td>
<td></td>
<td></td>
<td>9.6</td>
</tr>
<tr>
<td><strong>Diamond Fork Pipeline</strong></td>
<td></td>
<td></td>
<td></td>
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</tr>
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<td>Diamond Fork Pipeline</td>
<td>6.9</td>
<td>9.0</td>
<td>450</td>
<td></td>
</tr>
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<td><strong>Diamond Fork Powerplant</strong></td>
<td></td>
<td></td>
<td></td>
<td>6.8</td>
</tr>
<tr>
<td><strong>Fifth Water Access Tunnel</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Width (feet)</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Length (miles)</td>
<td>1.3</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
Figure 12.—A typical underground pumped storage powerplant chamber under construction.
CHAPTER III  

Alternatives

Water would be conveyed from Fifth Water Reservoir to the powerplant through a 10,008-cfs, near vertical, penstock tunnel. The penstock would vary in diameter from 28.5 feet to 21.5 feet and would be 0.4 mile in length. A surge shaft, 140 feet deep and 50 feet in diameter, would be built in conjunction with the penstock. A low pressure, concrete-lined discharge tunnel would convey water between the powerplant and the afterbay, Monks Hollow Reservoir. The discharge tunnel would have a diameter of 28.5 feet and a length of 2.9 miles. Sufficient concrete aggregate for the tunnel lining are available in the Monks Hollow Reservoir basin (Borrow Area B, Figure 7), within 2 miles of the lower end of the tunnel and within 5 miles of the upper end. Two underground surge chambers would be located near the powerplant end of the discharge tunnel. In addition, the chambers would include a common 10-foot-diameter ventilation shaft to the surface. Two retention dams would be constructed at the upper end of Monks Hollow Reservoir to prevent sediment in the reservoir from entering the discharge tunnel. The structures would also serve as diversion dams during construction. The dams would be roller-compacted, concrete structures with a height of 70 feet and a combined volume of 94,000 cubic yards.

As discussed previously, two conditions of powerplant operation were evaluated. The first, a projected initial operating condition, is based on Western's projected system operation, which was based on a consumer use of 469,000 MWh annually. This use yields a plant factor of approximately 5.4 percent for the Fifth Water Pumped Storage Powerplant. When combined with the flow-through component, the resulting plant factor is 7.8 percent. Projected power requirements for the Fifth Water Pumped Storage Powerplant were provided by Western. The second operating condition analyzed was with the power system operating at maximum capability, resulting in a plant factor of about 34 percent.

The Monks Hollow and Diamond Fork Powerplants would be at the same locations as in the recommended plan. The Diamond Fork Powerplant would have the same capacity as in the recommended plan, but the Monks Hollow Powerplant would be larger, with a capacity of 9.6 MW. The latter plant would include two 6,555-horsepower turbines and a 9,600-kW generator, with one turbine located on each side of the generator. Each unit would have a design head of 218 feet and a discharge capacity of 300 cfs. The powerplants would be remotely controlled from the Fifth Water Pumped Storage Powerplant.

Switchyards and Transmission Lines

A switchyard would be required above ground at each of the four powerplants. The size and characteristics of each switchyard would be a

\[1/\] Annual plant factor is the amount of energy actually generated expressed as a percent of the amount of energy that could be generated if the plant were continuously operated at maximum capacity throughout the year.
function of the powerplant size and method of interconnection with the other switchyards.

The Fifth Water Switchyard would consist of a complete 345/46-kV unit. Because of a lack of level area for a conventional switchyard, Western is investigating the possibility of insulating certain equipment with sulfur hexafluoride gas (SF₆), which would greatly reduce the equipment and switchyard sizes. The Fifth Water Switchyard would contain the necessary 46- and 345-kV switches; station service transformers; a 345/46-kV, three-phase transformer; 345- and 46-kV line bays with circuit breakers; a 46-kV bus tie bay; and necessary standard busses and supporting structures. If SF₆ insulating equipment is used, the size of the switchyard would be approximately 200 feet by 200 feet. Although SF₆ gas is nontoxic, it would displace oxygen because of its weight and, therefore, requires special consideration for human safety. The gas would be enclosed with the bus run and would mostly be restricted to a compartment in the Fifth Water Access Tunnel which would be isolated from the powerplant. No disposal or handling problems are anticipated. The Syar, Monks Hollow, and Diamond Fork Switchyards would be the same as in the recommended plan.

Energy from the Syar and Monks Hollow Powerplants would be transmitted 2.5 and 5.0 miles, respectively, over two 46-kV lines to the Fifth Water Switchyard, where it would be transformed and integrated with the 345-kV energy from the Fifth Water Powerplant. From the Fifth Water Switchyard, the energy would be transmitted over an 8.5-mile, double-circuit, 345-kV line to the Sheep Creek Substation, where it would be tied to the interconnected transmission system. Energy from the Diamond Fork Powerplant would be tied to the interconnected transmission system independently by a 0.5-mile, 46-kV transmission line.

The 345-kV lines would be supported on steel lattice structures, as shown in Figure 13. The 46-kV lines would most likely be suspended from single wood-pole structures designed to prevent raptor electrocution. Nonreflecting steel-reinforced aluminum conductors would be used.

A combination of helicopter and conventional construction methods would be used to construct the transmission lines.

Assuming contractual arrangements could be made, the Sheep Creek Substation would be tied with Deseret Generation and Transmission Cooperative's proposed 345-kV, Bonanza-to-Mona line and Utah Power & Light Company's two existing 345-kV lines (Spanish Fork to Huntington and Camp Williams to Emery). This tie would require a substantial amount of equipment and would result in a substation approximately 900 feet by 900 feet in size.

A temporary construction powerline would be built from Spanish Fork Canyon to the surface above the underground Fifth Water Powerplant site. The line would be suspended from wood-pole structures. By closely following the Sheep Creek-Rays Valley road alignment, disturbance to the landscape would be minimized. A substation would be required near the
FIGURE 13
TYPICAL 345-KILOVOLT DOUBLE-CIRCUIT STRUCTURE
mouth of Sheep Creek to connect the temporary line to an existing 138-kV, Utah Power & Light Company line. The temporary powerline would be approximately 11 miles long, and the substation would be approximately 200 feet by 300 feet. Both the temporary transmission line and the substation would be removed and the landscape restored at the end of the construction period. Construction power for Syar Tunnel and Monks Hollow Dam would be provided by constructing the permanent 46-kV lines described above (see General Map) and connecting them to the temporary construction powerline.

Tunnels and Shafts

The 1.3-mile-long Fifth Water Access Tunnel would provide vehicle access over a paved roadway to the underground Fifth Water Pumped Storage Powerplant. The 20-foot-wide tunnel would be horseshoe shaped and would slope downhill toward the powerplant. The entrance would be located in Sixth Water Canyon at an elevation of 5,940 feet, with the terminus in the underground chamber at an elevation of 5,373 feet. For safety and convenience purposes, the tunnel would be ventilated and lighted and would probably be partially lined with shotcrete.

The Fifth Water Access Shaft would be a concrete-lined vertical shaft, 33 feet in diameter and 1,742 feet deep. The shaft would be divided into four compartments: (1) a utility compartment, (2) an electrical bus and service elevator, (3) a personnel elevator, and (4) a stairwell. The Fifth Water Ventilation Shaft would also be a concrete-lined vertical shaft, 1,742 feet in depth. This 15-foot-diameter shaft would consist of two compartments: (1) a downdraft conduit and (2) an updraft conduit.

Roads

About 22.4 miles of new roads would be constructed and about 15.8 miles of existing roads would be improved to facilitate construction and operation of the Diamond Fork Power System. The 22.4 miles of new roads would either replace existing roads or provide new access to project facilities. Except for about 0.5 mile on private land, the new roads would be located within the Uinta National Forest.

Operating Facilities and Project Administration

Reclamation would operate and maintain project water conveyance facilities, reservoirs, and powerplants from the central control building located at ground level above the Fifth Water Pumped Storage Powerplant. Facilities for operation and maintenance personnel would be provided in the underground chamber at the plant. Western would operate and maintain the power system switchyards and transmission lines leading to the interconnected transmission system. The Forest Service would manage the recreation facilities and wildlife habitat.
Recreation Facilities

Recreation facilities for the Fifth Water Pumped Storage Alternative would include Monks Hollow and Fifth Water Recreation Areas; enlargement of the existing Palmyra and Diamond Campgrounds to replace the capacity lost at the abandoned Hawthorn and Three Forks Campgrounds; Monks Hollow Day-Use Area; and Lower Diamond Fork and Fifth Water Trailheads (Figure 14). The Monks Hollow Recreation and Day-Use Areas and the Lower Diamond Fork Trailhead would be the same as in the recommended plan.

Fifth Water Recreation Area would be located adjacent to the north arm of Fifth Water Reservoir. The area would consist of 35 camping units, 27 picnic units, a boat ramp with parking, and restroom facilities. This recreation area would include areas used as project material source (borrow) areas during construction.

Fifth Water Trailhead would be located on the north side of Fifth Water Reservoir near the campground. It would consist of an asphalt parking lot with 20 spaces, a restroom, a horse-unloading ramp, hitching racks, and appropriate signs. A 15-mile-long trail would be constructed from the Fifth Water Recreation Area to Fifth Water Dam, down Fifth Water Creek to the confluence with Sixth Water Creek, then up Sixth Water and back to the Fifth Water Recreation Area. An arm of the trail would also
CHAPTER III ALTERNATIVES

extend from the confluence of Fifth Water and Sixth Water Creeks to below Monks Hollow Dam.

In determining project-induced recreation use and facilities at the Fifth Water and Monks Hollow Reservoirs, the effect of pumped storage drawdown was analyzed. The projected water surface fluctuations for these two reservoirs in an average year for the June through August period are discussed later in this chapter under "Project Reservoir and Powerplant Operations." Projected initial operation for peaking power generation would have daily fluctuations of less than 8 feet on weekdays during the summer recreation period, with less than 3-foot daily fluctuations on weekends and holidays because of decreased power demand during these times. Under maximum operation for peaking power generation, larger drawdowns (up to 16 feet) would occur during the week; however, on weekends and holidays, maximum fluctuations would be less than 11 feet.

Fishery and Wildlife Measures and Mitigation

Fishery mitigation and improvement measures would include enhancement of Diamond Fork below Monks Hollow Dam and stocking of Monks Hollow and Fifth Water Reservoirs. Public fishing access would be acquired on the lower 5 miles of Diamond Fork. Wildlife mitigation measures would be similar to those for the recommended plan but would include a different recommended mitigation option for terrestrial wildlife. The recommended wildlife mitigation for the Fifth Water Pumped Storage Alternative would include the acquisition, habitat improvement, and intensive management of 4,443 acres of private land for wildlife use. These lands include six parcels under multiple ownership (C-1 through C-6 and 352 acres in R in Figure 9). Additional mitigation measures would be implemented during project construction and operation as discussed for the recommended plan.

Other Mitigation Measures

Construction specifications would be written and construction activities monitored by government personnel to insure that protection of the environment is fully considered. Contractors would be required to comply with pertinent Federal, State, and local laws, orders, and regulations concerning the prevention and control of air and water pollution and noise. Specific measures for air quality; noise; water quality; landscape preservation and restoration; archeological, historical, and paleontological resources; visual resources; electrical effects; and other considerations are the same as for the recommended plan.

PROJECT RESERVOIR AND POWERPLANT OPERATION

Annual flows through the power system would be the same for the Fifth Water Pumped Storage Alternative as for the recommended plan. Also, operation of the powerplants would vary primarily in relation to the variation in flows from season-to-season and year-to-year.
CHAPTER III ALTERNATIVES

The Fifth Water Pumped Storage Powerplant would be operated to meet the demand for peaking power, which occurs between 8 a.m. and 10 p.m. on weekdays. During nongeneration periods (nights, weekends, and holidays), the plant would be available for pumping. Water would be pumped from Monks Hollow Reservoir back up to Fifth Water Reservoir in a way that would minimize fluctuations in the two reservoirs but fill Fifth Water each Monday morning. To minimize the reservoir fluctuations, as much pumping as possible would be done on weekday nights when low-cost pumping energy is available (between 11 p.m. and 7 a.m.). The remainder of the recirculated water required to fill Fifth Water Reservoir by Monday morning would be pumped during the weekend.

Under the projected initial operating condition for the power system, Fifth Water Reservoir would have a maximum daily fluctuation of 8 feet on weekdays and 3 feet on weekends, when peaking power is not needed. Under the same condition, Monks Hollow Reservoir would have a maximum daily fluctuation of 14 feet on weekdays and 5 feet on weekends (Figures 15 and 16).

Under the maximum operating condition, Fifth Water Reservoir would have a maximum daily fluctuation of 16 feet on weekdays and 11 feet on weekends. For the same condition, Monks Hollow Reservoir would have a maximum daily fluctuation of 25 feet on weekdays and 18 feet on weekends.

OTHER PLANNING CONSIDERATIONS

Actions Required to Implement the Plan

Federal water quality permits and State permits for installation of sanitary or industrial pollution control facilities, including turbidity control equipment, would be the same as for the recommended plan. Western may need to complete a flood plains/wetlands assessment.

Acquisition of Land for Project Features

Acquisition of lands for the Sixth Water Flow Through Alternative would be accomplished in the same manner as described for the recommended plan. About 8,740 acres of land would be required for project features and material source areas as shown in Table 9.

Public Safety

As with the recommended plan, the final design of Fifth Water and Monks Hollow Dams would be conducted in accordance with Reclamation policy for dam safety. Criteria would be developed and strictly followed for filling the reservoirs and monitoring the dams for safety. Safety procedures to protect the public around project facilities would be followed as discussed under the recommended plan.
FIGURE 15
FIFTH WATER RESERVOIR
WATER LEVEL FLUCTUATIONS JUNE-AUGUST
PROJECTED INITIAL OPERATION

FIGURE 16
MONKS HOLLOW RESERVOIR
WATER LEVEL FLUCTUATIONS JUNE-AUGUST
PROJECTED INITIAL OPERATION
**Table 9**  
Lands for project features--  
Fifth Water Pumped Storage Alternative  
(Unit--acres)

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<tr>
<th>Project feature/type of acquisition</th>
<th>Ownership or administration</th>
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<td></td>
<td>Uints</td>
<td>Private</td>
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<tr>
<td>Syar Tunnel</td>
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<td>32.7</td>
<td>32.7</td>
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<td>Reclamation withdrawal</td>
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<td>Fifth Water Dam, Reservoir, Pumped Storage Powerplant, and Switchyard; Syar Powerplant, Surge Tank, Penstock, and Switchyard</td>
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<td>1,515</td>
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<td>Reclamation withdrawal</td>
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<td>Reclamation withdrawal</td>
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<td>Fifth Water Pumped Storage Powerplant Discharge Tunnel</td>
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<td>14.5</td>
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<td>Reclamation withdrawal</td>
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<td>1,490</td>
<td>1,490</td>
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<td>Reclamation withdrawal</td>
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<td>Diamond Fork Pipeline</td>
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<td>15.7</td>
<td>15.7</td>
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<tr>
<td>Reclamation withdrawal</td>
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<td>Reserved right-of-way</td>
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<td>Access roads</td>
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<td>Wildlife mitigation and improvement</td>
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<td>Developed recreation sites</td>
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<td>4,162.4</td>
<td>8,739.5</td>
</tr>
</tbody>
</table>
CHAPTER III

ALTERNATIVES

Relocations

With the exception of some roads, relocation provisions for the Fifth Water Pumped Storage Alternative would be the same as in the recommended plan. About 22.4 miles of new access roads would be constructed and about 15.8 miles of existing roads would be upgraded. Existing power transmission lines and telephone lines would not be relocated. Provisions for livestock permittees who would lose their grazing rights would be the same as in the recommended plan. Ranch properties consisting of 4,443 acres in six separate parcels would be acquired for wildlife mitigation.

Construction Activities and Schedule

Construction activities for the Fifth Water Pumped Storage Alternative would be accomplished over a period of about 7 years and in the same manner as in the recommended plan.

Sixth Water Pumped Storage Alternative

PLAN ACCOMPLISHMENTS AND CONCEPT

The Sixth Water Pumped Storage Alternative would be basically the same as the recommended plan with the exception that the Sixth Water and the Dyne Powerplants would be pumped storage plants. The Sixth Water Pumped Storage Alternative would utilize the transbasin diversion of water from Strawberry Reservoir and the large drop in elevation from the reservoir to generate 422.6 MW of hydroelectric power. The transbasin diversion would provide water for irrigation and municipal and industrial uses by the M&I and I&D Systems. Also, recreation facilities would be provided, stream fisheries would be considerably enhanced, a limited flatwater fishery would be created, some flood control would be provided in Diamond Fork, and wildlife losses would be mitigated. The major features of the alternative are shown in Figures 17 and 18.

From its inlet at Strawberry Reservoir, water would flow through Syar Tunnel and Penstock to Syar Reservoir, which would be formed by two dams on a saddle north of Rays Valley between Fifth Water and Sixth Water Creeks. From Syar Reservoir, water would be conveyed by Corona Aqueduct and Sixth Water Penstock to Sixth Water Reservoir, which would be formed by a dam on Sixth Water Creek about due west of Syar Reservoir. From there water would be carried in Dyne Aqueduct and Dyne Penstock to Monks Hollow Reservoir, which would be formed by a dam on Diamond Fork just below Monks Hollow. Water released from Monks Hollow Reservoir would be conveyed through Diamond Fork Pipeline to the confluence of Diamond Fork and the Spanish Fork River. Some flood control would be provided by Syar, Sixth Water, and Monks Hollow Reservoirs.

Power would be generated at three proposed flow-through plants—Syar at Syar Reservoir, Monks Hollow at the base of Monks Hollow Dam, and Diamond Fork at the terminus of the Diamond Fork Pipeline. Additionally, power would be generated at two proposed pumped storage plants—the Sixth
CHAPTER III ALTERNATIVES

Water Pumped Storage Powerplant at the terminus of Sixth Water Penstock, and the Dyne Pumped Storage Powerplant at the terminus of the Dyne Penstock. When surplus energy is available, usually at night or on weekends, water from Sixth Water Reservoir would be pumped to Syar Reservoir, and water from Monks Hollow Reservoir would be pumped to Sixth Water Reservoir. This water would then be released through the respective powerplants to generate power. Surge tanks would be provided at the Syar, Sixth Water, and Dyne Powerplants.

New roads would be constructed and some existing roads would be improved or replaced to facilitate construction and operation of the power system. Facilities for operation and maintenance would be located at the Sixth Water Powerplant.

New transmission lines and switchyards would be required to transmit the power generated at each proposed powerplant to the interconnected transmission system. A switchyard would be built at each of the five powerplants and a substation constructed between Syar and Sixth Water Powerplants. Three separate transmission lines would connect the Syar, Sixth Water, and Dyne Switchyards to the substation and a fourth line would connect Monks Hollow Switchyard to Dyne Switchyard. A double-circuit transmission line would connect the substation with a second substation to be located near the confluence of Sheep Creek and Soldier Creek where the power would be tied to the interconnected transmission system. A separate line would be required to connect the Diamond Fork Switchyard with the system.

Recreation facilities would include a day-use area at Monks Hollow Reservoir, a full-use area just downstream of Monks Hollow Dam, enlargement of the two existing campgrounds downstream of the proposed Monks Hollow full-use area to accommodate the relocation of Three Forks and Hawthorn Campgrounds, a trailhead at the site downstream, and a trail around Monks Hollow Reservoir.

Fishery mitigation and improvement measures would include enhancement of Diamond Fork downstream from Monks Hollow Dam and stocking of Monks Hollow Reservoir. Public fishing access would be provided on lower Diamond Fork.

Wildlife mitigation measures would include the acquisition, habitat improvement, and management of approximately 2,455 acres of private land for wildlife purposes. Existing habitat on public land would be improved, and additional mitigation measures would be implemented during construction and operation of the project, as discussed for the recommended plan.

PROJECT FACILITIES AND MEASURES

Dams and Reservoirs

Syar, Sixth Water, and Monks Hollow Dams and Reservoirs would be constructed at the same locations as in the recommended plan. In
MAPLETON

DIAMOND FORK PIPELINE

138 KV TRANSITION LINE

Spanish Fork - Huntington
Carbon - Hale

UPBL 345KV

Diamond Fork Substation

DIAMOND FORK PIPELINE

UPBL 400KV

DIAMOND FORK POWERPLANT

Proposed & Existing Tunnels
Proposed & Existing Transmission Lines
Proposed Powerplants
Proposed & Existing Access Roads
Roads to be Upgraded
Proposed Reservoirs
Proposed Pipeline

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
BONNEVILLE UNIT -- UTAH

DIAMOND FORK POWER SYSTEM
SIXTH WATER PUMPED STORAGE ALTERNATIVE
FIGURE 17
CHAPTER III

FIGURE 18
SIXTH WATER PUMPED STORAGE ALTERNATIVE
ELEVATION PROFILE

Distance in miles

Distance in miles
addition, Monks Hollow Dam and Reservoir would be the same sizes and capacities but Syar and Sixth Water Dams and Reservoirs would be different, as shown in Table 10.

Table 10
Summary data for dams and reservoirs -- Sixth Water Pumped Storage Alternative

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<thead>
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<th>Syar Dams and Reservoir</th>
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<th>Sixth Water Dam and Reservoir</th>
</tr>
</thead>
<tbody>
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<td>Dams (two)</td>
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<tr>
<td>Height (feet)</td>
<td>138</td>
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<tr>
<td>Material volume (cubic yards)</td>
<td>4,408,000</td>
<td>Material volume (cubic yards)</td>
</tr>
<tr>
<td>Reservoir capacity (acre-feet)</td>
<td>4,400</td>
<td>Reservoir capacity (acre-feet)</td>
</tr>
<tr>
<td>Surface area at normal water surface elevation, 7,187 feet (acres)</td>
<td>70</td>
<td>Surface area at normal water surface elevation, 6,393 feet (acres)</td>
</tr>
</tbody>
</table>

| Monks Hollow Dam and Reservoir   |                          |                                        |
| Dam                              |                          |                                        |
| Height (feet)                    | 125                      |                                       |
| Material volume (cubic yards)    | 351,000                  |                                        |
| Reservoir capacity (acre-feet)   | 620                      |                                        |
| Surface area at normal water surface elevation, 6,393 feet (acres) | 20                     |                                        |
|                                  |                          |                                        |
| Syar Dams and Reservoir          |                          |                                        |
| Dam                              |                          |                                        |
| Height (feet)                    | 250                      |                                       |
| Material volume (cubic yards)    | 150,000                  |                                        |
| Reservoir capacity (acre-feet)   | 31,400                   |                                        |
| Surface area at normal water surface elevation, 5,524 feet (acres) | 343                     |                                        |

1/ At normal water surface elevation. The reservoir would also have 1,400 acre-feet of storage capacity reserved for flood control for a total capacity of 32,800 acre-feet.

Powerplants and Conveyance Works

The Sixth Water Pumped Storage Alternative would include the same powerplants and conveyance works as the recommended plan, except that the Sixth Water and Dyne Plants would be pumped storage powerplants and all of the powerplants would have different capacities. A portion of the Syar Tunnel would be pressurized and would be steel encased in concrete. Physical data for the powerplants and conveyance works are shown in Table 11.

Switchyards, Substations, and Transmission Lines

Switchyards and transmission facilities for the Sixth Water Pumped Storage Alternative would have the same approximate configuration and be at the same locations as in the recommended plan.

An overhead alternating current transmission system would be used for the Sixth Water Pumped Storage Alternative, as in the recommended plan. Since the generating capacity of the system would be 422.6 MW,
<table>
<thead>
<tr>
<th>Syar Tunnel, Penstock, and Powerplant</th>
<th></th>
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<tbody>
<tr>
<td>Syar Tunnel</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Length (miles)</td>
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<tr>
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<td>Capacity (cfs)</td>
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<td>Syar Penstock</td>
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<td>Length (miles)</td>
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<table>
<thead>
<tr>
<th>Corona Aqueduct, Sixth Water Penstock, and Sixth Water Powerplant</th>
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<tr>
<td>Corona Aqueduct</td>
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<tr>
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<td>17.0</td>
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<td>Diameter (feet)</td>
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<tr>
<td>Capacity (cfs)</td>
<td></td>
<td>3,460</td>
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<tr>
<td>Sixth Water Penstock</td>
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<td>Length (miles)</td>
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<td>Diameter (feet)</td>
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<tr>
<td>Capacity (cfs)</td>
<td></td>
<td>3,460</td>
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<tr>
<td>Sixth Water Powerplant</td>
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<tr>
<td>Capacity (MW)</td>
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<table>
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<td>Diameter (feet)</td>
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<tr>
<td>Capacity (cfs)</td>
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<td>3,460</td>
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<td>Dyne Penstock</td>
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<tr>
<td>Capacity (cfs)</td>
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<td>3,460</td>
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<tr>
<td>Dyne Powerplant</td>
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<tr>
<td>Capacity (MW)</td>
<td>195.1</td>
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</table>

| Monks Hollow Powerplant                                          |       |       |
| Capacity (MW)                                                    | 9.6   |       |

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<thead>
<tr>
<th>Diamond Fork Pipeline and Powerplant</th>
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<td>Diamond Fork Pipeline</td>
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<tr>
<td>Length (miles)</td>
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<td>9.0</td>
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<tr>
<td>Diameter (feet)</td>
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<td></td>
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<tr>
<td>Capacity (cfs)</td>
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<td>Diamond Fork Powerplant</td>
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<td>Capacity (MW)</td>
<td>6.8</td>
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</tbody>
</table>
CHAPTER III ALTERNATIVES

A larger capacity transmission system would be needed. A 0.75-mile, 13.8-kV line would be required to connect the Syar Powerplant to the Rays Valley Substation, and a 2.8-mile, 13.8-kV line would be required to connect Monks Hollow Powerplant to Dyne Powerplant. A 4.4-mile, 345-kV line would be required to connect Dyne Powerplant to the substation, a 0.6-mile, 345-kV line would connect Sixth Water Powerplant to the substation, and a 10-mile, 345-kV line would connect the substation to the Sheep Creek Substation. A 0.5-mile, 46-kV line would connect the Diamond Fork plant with the interconnected system.

Structures and construction methods would be similar to the recommended plan.

Rocks

About 20.2 miles of new roads would be constructed and about 19.1 miles of existing roads would be improved to facilitate construction and operation of the power system. The new roads would either replace existing roads or provide new access to project facilities. About 19.5 miles of the new roads would be located within the Uinta National Forest.

Operating Facilities and Project Administration

Reclamation would operate and maintain project water conveyance facilities, reservoirs, and powerplants from headquarters located at the Sixth Water Pumped Storage Powerplant. Facilities for a small number of operation and maintenance personnel would probably be provided at the plant. Western would operate and maintain the switchyards and transmission lines. The Forest Service would manage the recreation facilities and wildlife habitat.

Recreation Facilities

Recreation facilities for the Sixth Water Pumped Storage Alternative would include Monks Hollow Day-Use Area, Monks Hollow Recreation Area, enlargement of the existing Diamond and Palmyra Campgrounds, Lower Diamond Fork Trailhead, and a trail around Monks Hollow Reservoir (Figure 8). These facilities would be the same as in the recommended plan.

Fishery and Wildlife Measures and Mitigation

Fishery mitigation and improvement measures would include enhancement of Diamond Fork downstream of Monks Hollow Dam and stocking of Monks Hollow Reservoir. Wildlife mitigation measures would be identical to the recommended plan, including the acquisition, habitat improvement, and management of 2,455 acres of private land for wildlife purposes. Additional measures would be implemented during construction and operation of the project, as discussed for the recommended plan.

Other Mitigation Measures

Construction specifications would be written and construction activities monitored by government personnel to insure that protection of the
environment is fully considered. Contractors would be required to comply with pertinent Federal, State, and local laws, orders, and regulations concerning the prevention and control of air and water pollution and noise. Specific measures for air quality; noise; water quality; land preservation and restoration; archeological, historical, and paleontological resources; visual resources; electrical effects; and other considerations are the same as for the recommended plan.

PROJECT RESERVOIR AND POWERPLANT OPERATION

Annual flows through the power system would be the same for the Sixth Water Pumped Storage Alternative as for the recommended plan. Operation of the powerplants would vary primarily in relation to the variation in flows from season-to-season and year-to-year. During an average year and under maximum operating conditions, the surface elevation of Monks Hollow Reservoir would fluctuate up to 6 feet daily, 16 feet weekly, and 38 feet seasonally. Syar Reservoir would fluctuate up to 38 feet daily and 85 feet weekly. Sixth Water Reservoir would be the afterbay for the Sixth Water Pumped Storage Powerplant and the forebay for the Dyne Pumped Storage Powerplant. Because these two plants would be operated synchronously, however, water would merely be transferred through Sixth Water Reservoir, with minimal fluctuation.

OTHER PLANNING CONSIDERATIONS

Actions Required to Implement the Plan

Water quality permits and permits for installation of sanitary or industrial pollution control facilities, including turbidity control equipment, would be the same as for the recommended plan, as would requirements for Western to complete a flood plains/wetlands assessment.

Acquisition of Land for Project Features

About 5,200 acres of land would be required for project features and material source areas, as shown in Table 12. Acquisition of these lands would be the same as for the recommended plan.

Public Safety

As with the recommended plan, the final design of Syar, Sixth Water, and Monks Hollow Dams would be conducted in accordance with Reclamation policy for dam safety. Criteria would be developed and strictly followed for filling the reservoirs and monitoring the dams for safety. Safety procedures to protect the public around project facilities would be followed as discussed under the recommended plan.

Relocations

Ranch properties consisting of 2,455 acres in two separate parcels would be acquired for wildlife mitigation. Relocation procedures would be the same as for the recommended plan.
## Table 12
Lands for project features—
Sixth Water Pumped Storage Alternative
(Unit—acres)

<table>
<thead>
<tr>
<th>Project feature/type of acquisition</th>
<th>Ownership or administration</th>
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<tbody>
<tr>
<td></td>
<td>Uinta National</td>
<td>Total</td>
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<tr>
<td>Syar Tunnel</td>
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<tr>
<td>Reclamation withdrawal</td>
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<td>36.2</td>
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<tr>
<td>Syar Dam, Reservoir, Powerplant,</td>
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<td></td>
</tr>
<tr>
<td>Surge Tank, and Penstock</td>
<td></td>
<td></td>
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<tr>
<td>Reclamation withdrawal</td>
<td>70</td>
<td>70</td>
</tr>
<tr>
<td>Corona Aqueduct, Sixth Water Dam,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reservoir, Powerplant, Surge Tank,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>and Penstock</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reclamation withdrawal</td>
<td>151</td>
<td>151</td>
</tr>
<tr>
<td>Dyne Powerplant, Surge Tank, Penstock, and Aqueduct</td>
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<td></td>
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<tr>
<td>Reclamation withdrawal</td>
<td>26.6</td>
<td>26.6</td>
</tr>
<tr>
<td>Monks Hollow Dam, Reservoir, and</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Powerplant</td>
<td></td>
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<tr>
<td>Reclamation withdrawal</td>
<td>1,490</td>
<td>1,490</td>
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<tr>
<td>Diamond Fork Pipeline</td>
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<td>Reclamation withdrawal</td>
<td>15.7</td>
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<tr>
<td>Temporary construction easement</td>
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<td>Reserved right-of-way</td>
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<td>Access roads</td>
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<tr>
<td>Fee title</td>
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<td>3.7</td>
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<tr>
<td>Forest Service land use authorization</td>
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<td>382</td>
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<td>Transmission lines</td>
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<td></td>
<td>161</td>
<td>161</td>
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<tr>
<td>Wildlife mitigation and improvement</td>
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<td>2,455</td>
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<td>Material source areas</td>
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<td></td>
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<tr>
<td>Reclamation withdrawal</td>
<td>270</td>
<td>270</td>
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<tr>
<td>Fee title</td>
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<td>15</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>2,589.1</td>
<td>2,627.5</td>
</tr>
</tbody>
</table>
CHAPTER III

ALTERNATIVES

About 4.3 miles of Forest Service roads would be inundated, and some would be relocated. Syar Reservoir would inundate about a half mile of the existing Rays Valley Road, which would be replaced by about 0.7 mile of new road around the reservoir. Monks Hollow Reservoir would inundate 2.9 miles of the existing Diamond Fork Canyon Road. This road would not be replaced. No relocation of roads would be necessary at Sixth Water Reservoir. No power transmission or telephone lines would be relocated. Provisions for livestock permittees would be followed as described under the recommended plan.

Construction Activities and Schedule

Construction activities for the Sixth Water Pumped Storage Alternative would be conducted in the same manner as in the recommended plan. As with the recommended plan, the construction period would be about 6 years.

1964 DPR Alternative

PLAN ACCOMPLISHMENTS AND CONCEPTS

The 1964 Definite Plan Report (DPR) Alternative would utilize the transbasin diversion of water from Strawberry Reservoir and the large drop in elevation from the reservoir to generate 133.5 MW of conventional hydroelectric power. The transbasin diversion would provide water for irrigation and municipal and industrial uses by the M&I and I&D Systems. Recreation facilities and fishery mitigation would be provided, a limited flatwater fishery would be created, some flood control would be accomplished in Sixth Water and Diamond Fork Creeks, and wildlife losses would be mitigated. The major features of this alternative are shown in Figures 19 and 20.

From the Strawberry Tunnel inlet at Strawberry Reservoir, water would flow through the proposed Syar Tunnel and Penstock to the proposed Syar Reservoir, which would be formed by a dam on a saddle north of Rays Valley between Fifth Water and Sixth Water Creeks. From the reservoir, water would be conveyed by the proposed Corona Aqueduct and Sixth Water Penstock to the proposed Sixth Water Reservoir, which would be formed by a dam on Sixth Water Creek about due west of Syar Reservoir. Water from the reservoir would be conveyed through the proposed Dyne Aqueduct and Penstock to the Dyne Powerplant, which would be located near Three Forks. At this point, the flow would be divided. A portion of the water would be conveyed in the proposed Wasatch Aqueduct down Diamond Fork to the Spanish Fork River. The remainder would be released into Diamond Fork and would flow into Hayes Reservoir, to be located about a half mile upstream from the confluence of Diamond Fork and the Spanish Fork River, and then into the Spanish Fork River. Some flood control would be provided in Sixth Water and Hayes Reservoirs.

Power would be generated at three proposed flow-through plants--Syar at Syar Reservoir, Sixth Water at Sixth Water Reservoir, and Dyne at the terminus of the Dyne Penstock. Surge tanks would be provided at the Syar, Sixth Water, and Dyne Plants.
CHAPTER III  ALTERNATIVES

New roads would be constructed and some existing roads would be improved or replaced to facilitate construction and operation of the power system. Facilities for operation and maintenance would be located at the Sixth Water Powerplant.

New transmission lines and switchyards would be required to transmit the power generated at each proposed powerplant to the interconnected transmission system. A switchyard would be built at each of the three powerplants, and a substation would be constructed between Syar and Sixth Water Powerplants. Separate transmission lines would connect the Syar, Sixth Water, and Dyne Switchyards with the substation. A double-circuit transmission line would connect the substation with a second substation which would be located near the confluence of Sheep Creek and Soldier Creek. Another line would connect the latter switchyard with the interconnected transmission system.

Recreation facilities would consist of a recreation area at the northwest end of Hayes Reservoir. The existing Palmyra and Diamond Campgrounds would be closed as a result of fluctuating flows induced by the project in Diamond Fork.

A limited flatwater fishery would be created at Hayes Reservoir. Approximately 3,748 acres of private land would be acquired and developed to mitigate wildlife losses.

PROJECT FACILITIES AND MEASURES

Dams and Reservoirs

Syar and Sixth Water Dams and Reservoirs would be similar to the recommended plan but with some differences. The outlet works for Syar Dams would be located on the north dam and a morning glory emergency spillway would be located between the two dams.

Hayes Reservoir would be located on Diamond Fork approximately a half mile upstream from the confluence of Diamond Fork and the Spanish Fork River. The reservoir would be formed by a rolled earthfill dam. An outlet to Diamond Fork would be located on the right abutment and an uncontrolled morning glory spillway would be located on the left abutment. Because of the recent relocation of U.S. Highway 6 at the mouth of Diamond Fork, the Hayes Dam axis may need to be moved upstream slightly from the originally proposed axis. Also, additional flood storage capacity might be required in the reservoir to insure that the maximum probable flood could safely pass through the new highway and railroad embankments. Physical data for Syar, Sixth Water, and Hayes Reservoirs are summarized in Table 13.

Powerplants and Conveyance Works

The Syar Tunnel and Penstock would deliver water from Strawberry Reservoir to the Syar Powerplant. The tunnel would be pressurized and would have a capacity of 400 cfs, a diameter of 8 feet, and a length of 6
FIGURE 20
1964 DPR ALTERNATIVE ELEVATION PROFILE

- WASATCH AQUEDUCT
- SYAR TUNNEL
- SYAR PENSTOCK
- STAR POWERPLANT
- CORONA AQUEDUCT
- SIXTH WATER PENSTOCK
- SIXTH WATER POWERPLANT
- DYNE PENSTOCK
- DYNE POWERPLANT
- SIXTH WATER RESERVOIR
- DYNE AQUEDUCT
- STRAWBERRY RESERVOIR
- HAYES RESERVOIR
- THREE FORKS
- BASKIN DIVIDE
### Table 13
Summary data for dams and reservoirs--
1964 DPR Alternative

<table>
<thead>
<tr>
<th>Location</th>
<th>Dam(s) (two)</th>
<th>Height (feet)</th>
<th>Material volume (cubic yards)</th>
<th>Reservoir capacity (acre-feet)</th>
<th>Surface area at normal water surface elevation, x feet (acres)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Syar Dam and Reservoir</td>
<td>Dams</td>
<td>88</td>
<td>810,000</td>
<td>930</td>
<td>32</td>
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<tr>
<td></td>
<td>Material volume (cubic yards)</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td>Reservoir capacity (acre-feet)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Surface area at normal water surface elevation</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>elevation, 7,185 feet (acres)</td>
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<td></td>
</tr>
<tr>
<td>Sixth Water Dam and</td>
<td>Dam</td>
<td>150</td>
<td>510,000</td>
<td>1,020</td>
<td>35</td>
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<tr>
<td>Reservoir</td>
<td>Material volume (cubic yards)</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Reservoir capacity (acre-feet)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Surface area at normal water surface elevation</td>
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<td></td>
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<tr>
<td></td>
<td>elevation, 6,385 feet (acres)</td>
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<td>200</td>
<td>5,963,000</td>
<td>51,500</td>
<td>680</td>
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<td></td>
<td>Material volume (cubic yards)</td>
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<tr>
<td></td>
<td>Reservoir capacity (acre-feet)</td>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td>Surface area at normal water surface elevation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>elevation, 5,150 feet (acres)</td>
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<td></td>
<td></td>
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</tr>
</tbody>
</table>
miles. A surge tank would be installed at the beginning of the penstock. The penstock would have a diameter of 6.75 feet and a length of 0.2 mile.

The 10.5-MW Syar Powerplant would utilize a head of about 403 feet between Strawberry and Syar Reservoirs. Syar Powerplant would be remotely controlled from the Sixth Water Powerplant.

Water would be conveyed from Syar Reservoir to Sixth Water Powerplant through the Corona Aqueduct and Sixth Water Penstock. The aqueduct would be a pressurized concrete tunnel with a length of 0.9 mile, a diameter of 12.5 feet, and a capacity of 1,600 cfs. A surge tank would be provided near the end of the aqueduct. The penstock would have a length of 0.3 mile and a diameter of 10 feet.

The 90-MW Sixth Water Powerplant would utilize a head of 800 feet between Syar and Sixth Water Reservoirs. Sixth Water Powerplant would be attended and operated manually.

Water would be conveyed from Sixth Water Reservoir to Dyne Powerplant through the Dyne Aqueduct and Penstock. The aqueduct would be a pressurized concrete tunnel with a capacity of 600 cfs, a diameter of 8.5 feet, and a length of 2.6 miles. The penstock would have a length of 0.5 mile and a diameter of 7 feet. A surge tank would be installed at the upper end of the penstock.

The 33-MW Dyne Powerplant would utilize a head of 800 feet between Sixth Water Reservoir and the Dyne Powerplant. Dyne Powerplant would be remotely controlled from the Sixth Water Powerplant. Physical data for the powerplants and conveyance works are summarized in Table 14.

The Wasatch Aqueduct would convey part of the project water about 10.2 miles from Dyne Powerplant to the Spanish Fork River outside the Diamond Fork channel, preventing erosion and enhancing the quality of the fishery habitat. The buried, reinforced, concrete pipeline would vary from 5 to 4.5 feet in diameter and would have a capacity of 200 cfs.

Switchyards, Substations, and Transmission Lines

Syar, Sixth Water, and Dyne Powerplants and the Rays Valley and Sheep Creek Substations would be the same as in the recommended plan. Transmission facilities would also be the same.

Roads

About 11.4 miles of new roads would be constructed and about 16.3 miles of existing roads would be improved to facilitate construction and operation of the power system. The 11.4 miles of new roads would either replace existing roads or provide new access to project facilities. About 24.5 miles of the roads would be located within the Uinta National Forest, and 3.2 miles of the roads would be on private lands.
### Table 14
Summary data for powerplants and conveyance works—
1964 DPR Alternative

<table>
<thead>
<tr>
<th>Project Details</th>
<th>Length (miles)</th>
<th>Diameter (feet)</th>
<th>Capacity (cfs)</th>
<th>Capacity (MW)</th>
</tr>
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<tbody>
<tr>
<td><strong>Syar Tunnel, Penstock, and Powerplant</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Syar Tunnel</td>
<td>6.0</td>
<td>8.0</td>
<td>400</td>
<td></td>
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<tr>
<td>Syar Penstock</td>
<td>0.2</td>
<td>6.75</td>
<td>400</td>
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</tr>
<tr>
<td>Syar Powerplant</td>
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<td>10.5</td>
</tr>
<tr>
<td><strong>Corona Aqueduct, Sixth Water Penstock, and Sixth Water Powerplant</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corona Aqueduct</td>
<td>0.9</td>
<td>12.5</td>
<td>1,600</td>
<td></td>
</tr>
<tr>
<td>Sixth Water Penstock</td>
<td>0.3</td>
<td>10.0</td>
<td>1,600</td>
<td></td>
</tr>
<tr>
<td>Sixth Water Powerplant</td>
<td></td>
<td></td>
<td></td>
<td>90.0</td>
</tr>
<tr>
<td><strong>Dyne Aqueduct, Penstock, and Powerplant</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dyne Aqueduct</td>
<td>2.6</td>
<td>8.5</td>
<td>600</td>
<td></td>
</tr>
<tr>
<td>Dyne Penstock</td>
<td>0.5</td>
<td>7.0</td>
<td>600</td>
<td></td>
</tr>
<tr>
<td>Dyne Powerplant</td>
<td></td>
<td></td>
<td></td>
<td>33.0</td>
</tr>
<tr>
<td><strong>Wasatch Aqueduct</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wasatch Aqueduct</td>
<td>10.2</td>
<td>5.0-4.5</td>
<td>200</td>
<td></td>
</tr>
</tbody>
</table>
CHAPTER III

Operating Facilities and Project Administration

Reclamation would operate and maintain project water conveyance facilities, reservoirs, and powerplants from a headquarters located at the Sixth Water Powerplant. Reclamation would also manage the recreation facilities at Hayes Reservoir, since they would be located on Reclamation withdrawn lands. Western would operate and maintain the switchyards and transmission lines using personnel from its Power Operations Center in Montrose, Colo.

Recreation Facilities

Recreation facilities for the 1964 DPR Alternative would be constructed at Hayes Reservoir (Figure 21). The reservoir would create an attractive impoundment in close proximity to heavily traveled highways and urban population centers. The recreation potential of the reservoir would, however, be limited by an unfavorable shoreline terrain and by the reservoir operation plan. To fully accommodate expected recreation use in the area, some facilities would probably be needed on nearby national forest lands. The existing Palmyra and Diamond Campgrounds would be closed with construction of Hayes Reservoir because increased flows down Diamond Fork would erode campgrounds and endanger recreation visitors.
In view of the above-mentioned space limitation and expected heavy use, only day-use facilities would be provided on the Hayes Reservoir shoreline. These facilities would include necessary roads, parking areas, barriers and signs, a boat launching ramp, a picnic area, and water and sanitary facilities. A small storage building would be constructed for administrative purposes. Camping would best be accommodated on nearby national forest lands.

Fishery and Wildlife Measures and Mitigation

The 1964 DPR Alternative would have an adverse effect on the fishery resource as a result of inundation by Hayes Reservoir and daily surging flows on Diamond Fork from Dyne Powerplant. Compensation for those losses could be accomplished by any one or a combination of several methods, as discussed in Chapter IV. Refinements in the mitigation analysis for this alternative would have to be accomplished before a definitive plan could be formulated. Such refinements would be made if this alternative is ultimately selected.

Recommended mitigation for big game and other wildlife habitat losses for the 1964 DPR Alternative would include the acquisition, habitat improvement, and intensive management of 3,748 acres of private land for wildlife purposes. Six parcels of land would be acquired including five separate ownerships. Parcels to be included are D, K, P, R, S-3, and S-4 (Figure 9). Detailed management and habitat improvement plans would be cooperatively formulated for each land parcel and cover type by the Bureau of Reclamation, the Fish and Wildlife Service, the Forest Service, and the Utah Division of Wildlife Resources. Wildlife habitat improvement and management would be the primary management objective, with all other uses being subordinate to and compatible with this objective. Additional mitigation measures would be implemented during construction and operation of the power system, as discussed for the recommended plan.

Other Mitigation Measures

Construction specifications would be written and construction activities monitored by government personnel to ensure that protection of the environment is fully considered. Contractors would be required to comply with pertinent Federal, State, and local laws, orders, and regulations concerning the prevention and control of air and water pollution and noise. Specific measures for air quality; noise; water quality; land preservation and restoration; archeological, historical, and paleontological resources; visual resources; electrical effects; and other considerations are the same as for the recommended plan.

PROJECT RESERVOIR AND POWERPLANT OPERATION

Annual flows through the power system would be the same for the 1964 DPR Alternative as for the recommended plan. Operation of the powerplants would vary primarily in relation to the variation in flows from season-to-season and year-to-year. The surface elevation of Syar
CHAPTER III ALTERNATIVES

Reservoir would fluctuate a maximum of about 27 feet on a daily basis. Sixth Water Reservoir would fluctuate a maximum of about 23 feet on a daily basis. Hayes Reservoir would be used mainly to store water for use during the irrigation season. It would fluctuate only minimally on a daily basis and a maximum of about 100 feet on a seasonal basis.

OTHER PLANNING CONSIDERATIONS

Actions Required to Implement the Plan

Federal water quality permits and State permits for installation of sanitary or industrial pollution control facilities, including turbidity control equipment, would be the same as for the recommended plan, as would requirements for Western to complete a flood plains/wetlands assessment.

Acquisition of Land for Project Features

Acquisition of lands for the 1964 DPR Alternative would be accomplished in the same manner as for the recommended plan. About 6,400 acres would be required for project features and material source areas, as shown in Table 15.

Public Safety

As with the recommended plan, the final design of Syar, Sixth Water, and Hayes Dams would be conducted in accordance with Reclamation policy for dam safety. Criteria would be developed and strictly followed for filling the reservoirs and monitoring the dams for safety. Safety procedures to protect the public around project facilities would be followed as discussed under the recommended plan.

Relocations

A total of 1,515 acres of private agricultural land in two ownerships would be acquired for Hayes Reservoir. One of the properties includes a home and farm structures near the mouth of Diamond Fork Canyon. Relocation procedures would be the same as for the recommended plan.

About 3.7 miles of roads would be inundated and would be relocated. Syar Reservoir would inundate 0.3 mile of an existing Forest Service road, which would be replaced by about 0.6 mile of new road. Hayes Reservoir would inundate 3.4 miles of paved county road, which would be replaced by about 4.8 miles of new road. No power transmission or telephone lines would be relocated. Provisions for livestock permittees who would lose their grazing privileges would be the same as for the recommended plan.

Construction Activities and Schedule

Construction activities for the 1964 DPR Alternative would be conducted over a period of about 4 years and in the same manner as for the recommended plan.
Table 15
Lands for project features--
1964 DPR Alternative
(Unit--acres)

<table>
<thead>
<tr>
<th>Project feature/type of acquisition</th>
<th>Ownership or administration</th>
<th>Uinta</th>
<th>National</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Private</td>
<td>Forest</td>
<td></td>
</tr>
<tr>
<td>Syar Tunnel</td>
<td></td>
<td>36.2</td>
<td>36.2</td>
<td>72.4</td>
</tr>
<tr>
<td>Syar Dam, Reservoir, Powerplant, Surge Tank, and Penstock</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>70</td>
<td>70</td>
<td>140</td>
</tr>
<tr>
<td>Corona Aqueduct; Sixth Water Dam, Reservoir, Powerplant, Surge Tank, and Penstock</td>
<td></td>
<td>151</td>
<td>151</td>
<td>302</td>
</tr>
<tr>
<td></td>
<td></td>
<td>26.6</td>
<td>26.6</td>
<td>53.2</td>
</tr>
<tr>
<td>Dyne Powerplant, Penstock, and Aqueduct</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>88</td>
<td>88</td>
<td>176</td>
</tr>
<tr>
<td>Hayes Dam and Reservoir</td>
<td></td>
<td>18</td>
<td>18</td>
<td>36</td>
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<td></td>
<td>Fee title</td>
<td>1,515</td>
<td>1,515</td>
<td>3,030</td>
</tr>
<tr>
<td>Access roads</td>
<td></td>
<td>38.8</td>
<td>38.8</td>
<td>77.6</td>
</tr>
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<td>297</td>
<td>297</td>
<td>594</td>
</tr>
<tr>
<td>Transmission lines</td>
<td></td>
<td>141</td>
<td>141</td>
<td>282</td>
</tr>
<tr>
<td></td>
<td>Forest Service land use authorization</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3,748</td>
<td>3,748</td>
<td>7,496</td>
</tr>
<tr>
<td>Wildlife mitigation and improvement</td>
<td>Perpetual easement or fee title</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>10</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>Developed recreation sites</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Material source areas</td>
<td>Reclamation withdrawal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>270</td>
<td>270</td>
<td>540</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>5,311.8</td>
<td>1,107.8</td>
<td>6,419.6</td>
</tr>
</tbody>
</table>
No Power Alternative

PLAN ACCOMPLISHMENTS AND CONCEPT

The No Power Alternative (Figure 22) would consist of a new tunnel and pipeline to accomplish the transbasin diversion of water from Strawberry Reservoir without power generation. The transbasin diversion would provide water for irrigation and municipal and industrial uses by the M&I and I&D Systems. In addition, recreation facilities would be provided, stream fisheries would be enhanced, and wildlife losses would be mitigated.

![Diagram of No Power Alternative]

At the Strawberry Tunnel inlet at Strawberry Reservoir, water would enter the proposed Syar Tunnel and be conveyed to the tunnel outlet in Sixth Water Canyon. From the outlet, part of the water would enter Sixth Water Creek, Diamond Fork, and the Spanish Fork River. Because of high flow levels, the remainder would be conveyed to the river in the Diamond Fork Pipeline.

Some existing roads would be improved to facilitate construction and operation. Facilities for operation and maintenance would not be required.
Recreation facilities would consist of a recreation area along Diamond Fork just below the Monks Hollow Dam site and a trailhead downstream. Approximately 612 acres of private land would be acquired and developed to mitigate wildlife losses.

**PROJECT FACILITIES AND MEASURES**

Under the No Power Alternative, water would be conveyed through the new 4.2-mile-long Syar Tunnel, beginning near the existing Strawberry Tunnel inlet and ending in Sixth Water Canyon about a mile below the outlet portal of the existing tunnel. Because of high flow levels, the 400-cfs capacity Diamond Fork Pipeline would be constructed to carry a portion of the flows about 18.3 miles from the discharge point of the new tunnel to the Spanish Fork River. The remainder of the water would flow through the Diamond Fork channel. The buried concrete pipeline would be located along the north side of Sixth Water and Diamond Fork Canyons to near the site of Monks Hollow Dam in the recommended plan. From that point it would follow the proposed alignment of the Diamond Fork Pipeline in the recommended plan (along the south side of the canyon) to the mouth of Diamond Fork. A number of pressure regulating stations would be used along the pipeline to control the flows. Recreation developments would consist of Monks Hollow Recreation Area and Lower Diamond Fork Trailhead (Figure 22) at the same locations and with the same facilities as in the recommended plan. No flood control would be provided under this alternative. Table 16 summarizes physical data for the features of the No Power Alternative.

**Table 16**

<table>
<thead>
<tr>
<th>Feature</th>
<th>No Power Alternative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Syar Tunnel</td>
<td></td>
</tr>
<tr>
<td>Length (miles)</td>
<td>4.2</td>
</tr>
<tr>
<td>Diameter (feet)</td>
<td>10.0</td>
</tr>
<tr>
<td>Capacity (cfs)</td>
<td>875</td>
</tr>
<tr>
<td>Pipeline</td>
<td></td>
</tr>
<tr>
<td>Length (miles)</td>
<td>18.3</td>
</tr>
<tr>
<td>Diameter (feet)</td>
<td>7.25</td>
</tr>
<tr>
<td>Capacity (cfs)</td>
<td>400</td>
</tr>
</tbody>
</table>

The existing fisheries in Diamond Fork and Sixth Water Creek would undergo considerable enhancement as a result of the construction and operation of the Diamond Fork Pipeline, which would function to remove some of the existing high irrigation flows, as well as all Bonneville Unit water, from the stream channels through the operational flexibility of the system. Wildlife mitigation measures would be at a much reduced scale from the other alternatives because of lesser impact. The recommended mitigation option would include 612 acres of private land, involving four parcels and three ownerships. The parcels are labeled C-4, P, S-3, and S-4 on Figure 9. Wildlife mitigation and improvement measures would include the acquisition, habitat improvement, and intensive management of these private lands as well as other measures discussed under the recommended plan.
CHAPTER III

About 4.7 miles of existing roads would be improved to facilitate construction and operation of the tunnel and pipeline. All of these roads are located within the Uinta National Forest.

The Central Utah Water Conservancy District would operate and maintain the project facilities of the No Power Alternative. All construction specifications would be written, and construction activities would be monitored by government personnel to insure that protection of the environment is fully considered. Contractors would be required to comply with all relevant laws, orders, and regulations, as discussed under the recommended plan, in order to protect the environment.

OPERATION OF PROJECT FEATURES

Under the No Power Alternative, water would be released through the Strawberry Tunnel to meet demands in the Bonneville Basin. The project would be operated in a manner to ensure that flows in Sixth Water Creek and Diamond Fork did not exceed historical flows with operation of the existing Strawberry Valley Project.

OTHER PLANNING CONSIDERATIONS

Actions Required to Implement the Plan

Federal water quality permits and State permits for installation of sanitary or industrial pollution control facilities, including turbidity control equipment, would be the same as for the recommended plan.

Acquisition of Land for Project Features

Acquisition of lands for the No Power Alternative would be accomplished in the same manner as for the recommended plan. About 900 acres would be required for project features and material source areas, as shown in Table 17.

Other

Safety procedures to protect the public around project facilities would be followed as discussed under the recommended plan. No relocations would be required with this alternative. Construction activities for the No Power Alternative would be conducted over a period of about 5 years and in the same manner as for the recommended plan.

Alternative Operation

The operation of each alternative for the Diamond Fork Power System and its associated impacts as discussed in this document is based on release patterns that would be required with the entire Bonneville Unit in place, particularly the I&O System. This operation would be consistent with the programmatic Final Environmental Statement for the Bonneville Unit. As stated previously, a Draft Environmental Impact Statement
<table>
<thead>
<tr>
<th>Project feature/type of acquisition</th>
<th>Ownership or administration</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Uinta National Forest Total</td>
<td></td>
</tr>
<tr>
<td>Syar Tunnel</td>
<td>Private</td>
<td>Total</td>
</tr>
<tr>
<td>Reclamation withdrawal</td>
<td></td>
<td>25.3</td>
</tr>
<tr>
<td>Pipeline</td>
<td></td>
<td>96.4</td>
</tr>
<tr>
<td>Reclamation withdrawal</td>
<td></td>
<td>96.4</td>
</tr>
<tr>
<td>Temporary construction easement</td>
<td>87.4</td>
<td>87.4</td>
</tr>
<tr>
<td>Perpetual easement</td>
<td>14.7</td>
<td>14.7</td>
</tr>
<tr>
<td>Reserved right-of-way</td>
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<td>13.3</td>
</tr>
<tr>
<td>Access roads</td>
<td></td>
<td></td>
</tr>
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<td>57</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Perpetual easement or fee title</td>
<td>612</td>
<td>612</td>
</tr>
<tr>
<td>Total</td>
<td>727.4</td>
<td>178.7</td>
</tr>
</tbody>
</table>
CHAPTER III

Alternatives

covering the site-specific impacts of the I&D System—the final major segment of the Bonneville Unit—is scheduled for 1985. However, if a decision is made to not construct the I&D System, an alternative operation of the Diamond Fork Power System would be required and additional NEPA compliance would be necessary.

The alternative operation would consist of project releases to Utah Lake to accomplish an exchange from the lake to Jordanelle Reservoir for the M&I System and to develop full service agricultural lands in the Mosida area on the southwest side of Utah Lake. The water supply for south Utah County would be released from Strawberry Reservoir and delivered through existing conveyance facilities for supplemental service irrigation and municipal and industrial use.

The pattern of water releases to Utah Lake would be very flexible. Minimal releases could be made during periods of high runoff to help control flooding. A pattern similar to the existing Strawberry Valley Project releases could be followed during the summer irrigation season, and delivery of the remaining portion of the transbasin diversion could be spread out over the rest of the year to minimize adverse impacts to the Spanish Fork River. One possible release pattern would include releases of 550 cfs from mid-June through the end of August (this flow would include Strawberry Valley Project water). The remainder of the water could be released during the remaining months at an average rate of approximately 200 cfs.

Wildlife Mitigation Options Considered

Several wildlife mitigation options for each project alternative were developed by the interagency biological team. The recommended option for each alternative was discussed earlier in this chapter. The recommended option and alternatives are presented in Table 18 in order of priority of consideration. Land parcels are shown in order of the priority they were considered (left to right) for each option. Various combinations of private lands (single ownership and multiple ownership), Forest Service lands, and a combination of forest and private lands were considered.

Land parcels and mitigation options were evaluated prior to the Thistle landslide. Subsequent reevaluation shows that the landslide, Thistle Lake, and the resulting highway and road relocations would render parcels C-4 and K substantially less valuable as potential mitigation lands and would slightly affect parcels S-4, FS-3, C-5, and C-6. Considering all factors, the impacts on these land parcels would not reduce the value of the total mitigation options sufficiently to cause a significant change in the mitigation plans for the project alternatives. However, the reduced values referred to were taken into account for the recommended Sixth Water Flow Through Alternative mitigation options given in Table 18.
The options not recommended for each alternative would provide a more uneven distribution of wildlife mitigation values than the recommended options, because they are slanted more toward compensation for individual species. If one of these options were selected, the acquisition, habitat improvement, and management criteria would be implemented as discussed for the recommended options. The result, however, would be a lesser degree of mitigation than recommended for each alternative.

In most cases, the private land options provide the best potential for habitat improvement and the resulting increase in wildlife population. This is the result of a more diverse cover-type selection and the present single-use (primarily livestock grazing) management, while Forest Service lands are less diverse in cover types and are managed under a multiple-use concept, with wildlife already receiving some management consideration.

The Forest Service does not favor the use of forest lands specifically for wildlife mitigation because of its legislative mandate for multiple-use management. Also, changing management emphasis to the single purpose of wildlife benefits would result in added and significant social and economic impacts to both current and future forest users beyond direct impacts of the Diamond Fork Power System features. For example, livestock grazing would have to be reduced about 50 percent on any forest lands set aside for wildlife in order to meet the specified mitigation objectives. Additionally, this type of management change would create substantial administrative and financial difficulties for the Forest Service in adjusting present and proposed management plans and would require a reformulation of the draft management plan for the Uinta National Forest, which has received considerable public review and input.

Acquisition of the recommended or alternative wildlife lands in the Diamond Fork area may not be attainable under perpetual easement, fee title, or other methods because of incompatibility with current or future administrative policies. If this situation exists, then lands outside of the project area may be considered for wildlife mitigation. This may include acquisition of lands in the Spanish Fork Canyon area which have been identified as having potential mitigation value by the Utah Division of Wildlife Resources. Another possibility would be to attribute wildlife mitigation values for the Diamond Fork Power System to excess lands which have already been acquired for wildlife purposes in the Currant Creek and Strawberry River drainages. If any of these alternatives are considered, Reclamation would fully coordinate the details and evaluations with all cooperating agencies. Additional NEPA compliance and public involvement would be accomplished as needed.

Comparative Analysis of Recommended Plan and Alternatives

Basis for impact analysis

To provide a meaningful evaluation of the five power system alternatives, impacts expected to result from each have been compared to
### Table 18

<table>
<thead>
<tr>
<th>Recommended mitigation options and alternatives</th>
<th>Private</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>C-5</td>
</tr>
<tr>
<td>Sixth Water Flow Through</td>
<td></td>
</tr>
<tr>
<td>1. All private lands</td>
<td>X</td>
</tr>
<tr>
<td>2. All private lands</td>
<td>X</td>
</tr>
<tr>
<td>3. Forest and private</td>
<td>X</td>
</tr>
<tr>
<td>4. All private lands</td>
<td>X</td>
</tr>
<tr>
<td>5. All forest lands</td>
<td>X</td>
</tr>
<tr>
<td>Fifth Water Pumped Storage</td>
<td></td>
</tr>
<tr>
<td>1. All private lands</td>
<td>X</td>
</tr>
<tr>
<td>2. All private lands</td>
<td>X</td>
</tr>
<tr>
<td>3. Forest and private</td>
<td>X</td>
</tr>
<tr>
<td>4. All private lands</td>
<td>X</td>
</tr>
<tr>
<td>5. All forest lands</td>
<td>X</td>
</tr>
<tr>
<td>Sixth Water Pumped Storage</td>
<td></td>
</tr>
<tr>
<td>1. All private lands</td>
<td>X</td>
</tr>
<tr>
<td>2. All private lands</td>
<td>X</td>
</tr>
<tr>
<td>3. Forest and private</td>
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</tr>
<tr>
<td>4. All forest lands</td>
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<tr>
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<td></td>
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<tr>
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<tr>
<td>2. All private lands (single owner)</td>
<td>X</td>
</tr>
<tr>
<td>3. Forest and private</td>
<td>X</td>
</tr>
<tr>
<td>4. All private lands</td>
<td>X</td>
</tr>
<tr>
<td>5. All forest lands</td>
<td>X</td>
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<tr>
<td>No Power</td>
<td></td>
</tr>
<tr>
<td>1. All private lands</td>
<td>X</td>
</tr>
<tr>
<td>2. All forest lands</td>
<td>X</td>
</tr>
<tr>
<td>3. All private lands</td>
<td>X</td>
</tr>
<tr>
<td>4. All private lands</td>
<td>X</td>
</tr>
<tr>
<td>5. All private lands</td>
<td>X</td>
</tr>
</tbody>
</table>

1/ Shown in Figure 9.
2/ Parcel C-6, for these alternatives, includes 352 acres of Parcel R.
3/ The mitigation requirement is only 4,000 acres of the total 4,763 acres contained in these land parcels.
4/ Private, 1,971 acres; Forest Service, 1,160 acres.
5/ Private, 2,555 acres; Forest Service, 1,160 acres.
6/ Private, 1,409 acres; Forest Service, 1,160 acres.
conditions expected in the future without additional Federal development of the Bonneville Unit. This future without condition was developed by inventorying existing conditions and projecting expected changes into the future. This condition is partially described in the Final Environmental Statement for the M&I System. In addition, this condition is based on the assumption that recreation and electrical energy uses and population will continue to increase in the area affected by the power system and that the draft management plan for the Uinta National Forest will be implemented. The draft management plan assumes development of the Diamond Fork Power System and includes some common features. Impacts associated with the common features and appropriate mitigation measures are included in this statement for each alternative because the power system is expected to be completed prior to implementation of all measures included in the management plan.

The M&I System Final Environmental Statement included an alternative which provided for an average annual transbasin diversion of 197,600 acre-feet of water through Diamond Fork Canyon without power development. Facilities associated with this No Power Alternative would be the minimum required to maintain the basic integrity of the Bonneville Unit. Because of changing conditions and a lack of data in some areas, impacts associated with this alternative were not adequately discussed in that statement. If it had been possible to more thoroughly evaluate these impacts, the No Power Alternative would have been the basis for comparison with the power alternatives described in this statement on the Diamond Fork Power System. To comply with NEPA, the No Power Alternative has been included in this statement and compared with the future without condition along with the power alternatives. In this manner, impacts not previously evaluated are considered.

If the No Power Alternative were selected for implementation, additional planning and NEPA compliance may be required. This compliance could be accomplished through a supplement to the M&I System Final Environmental Statement or the future statement on the I&D System.

Comparative analysis of features

The major features of each alternative plan are compared in Table 19. Construction costs and net benefits for each alternative are also compared in the table. The feature sizes and costs are based on appraisal-level designs and estimates and January 1983 prices. As the designs for the recommended plan are refined, the sizes and capacities of the features may change somewhat, but the basic configurations and locations should remain the same.

Comparative analysis of impacts

Each of the alternatives considered for the power system would result in varying impacts on the future without condition. A summary comparison of these impacts is presented in Table 20 and more detail is given in Chapter IV. The table presents net impacts resulting from implementation of all recommended mitigation and/or enhancement measures.
### Chapter III

#### Alternatives

<table>
<thead>
<tr>
<th>Feature</th>
<th>Sixth Water Flow Pumped Storage</th>
<th>Fifth Water Flow Pumped Storage</th>
<th>Sixth Water Flow Pumped Storage</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Syar Dam</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Capacity (cfs)</td>
<td>85</td>
<td>116</td>
<td>46</td>
</tr>
<tr>
<td>Diameter (feet)</td>
<td>1,300</td>
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<td>1,600</td>
</tr>
<tr>
<td>Length (miles)</td>
<td>38.0</td>
<td>41.0</td>
<td>44.0</td>
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<tr>
<td>Material volume (cubic yards)</td>
<td>1,200</td>
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<tr>
<td><strong>Diamond Fork Pipeline</strong></td>
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<tr>
<td>Capacity (cfs)</td>
<td>35</td>
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<tr>
<td>Diameter (feet)</td>
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<td>10.7-11.5</td>
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<td>Length (miles)</td>
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<td>Material volume (cubic yards)</td>
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<td><strong>Diamond Fork Powerplant</strong></td>
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<tr>
<td>Capacity (MW)</td>
<td>0.3</td>
<td>0.3</td>
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<tr>
<td>Annual energy (MWh)</td>
<td>15.0</td>
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<tr>
<td><strong>Syar Reservoir</strong></td>
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<td>Total capacity (acre-feet)</td>
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<tr>
<td><strong>Hayes Reservoir</strong></td>
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<td>Total capacity (acre-feet)</td>
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<td>Height (feet)</td>
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<td>Material volume (cubic yards)</td>
<td>150,000</td>
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<tr>
<td><strong>Monk's Hollow Dam</strong></td>
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<td>Annual energy (MWh)</td>
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<td>Material volume (cubic yards)</td>
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<tr>
<td><strong>Hayes Dam</strong></td>
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<td>Total capacity (acre-feet)</td>
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<td><strong>Muddy Creek Pipeline</strong></td>
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<td>Material volume (cubic yards)</td>
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<td><strong>Fifth Water Reservoir</strong></td>
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<td>Total capacity (acre-feet)</td>
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<tr>
<td><strong>Syar Dam</strong></td>
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<td></td>
</tr>
<tr>
<td>Height (feet)</td>
<td>85</td>
<td>116</td>
<td>46</td>
</tr>
<tr>
<td>Material volume (cubic yards)</td>
<td>1,200</td>
<td>1,300</td>
<td>1,400</td>
</tr>
<tr>
<td><strong>Diamond Fork Pipeline</strong></td>
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<td></td>
</tr>
<tr>
<td>Capacity (cfs)</td>
<td>35</td>
<td>35</td>
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<tr>
<td>Diameter (feet)</td>
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<tr>
<td>Material volume (cubic yards)</td>
<td>550</td>
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<tr>
<td><strong>Diamond Fork Powerplant</strong></td>
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</tr>
<tr>
<td>Capacity (MW)</td>
<td>0.3</td>
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<tr>
<td>Annual energy (MWh)</td>
<td>15.0</td>
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<td>15.0</td>
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<tr>
<td><strong>Wenatche Dam</strong></td>
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<td></td>
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</tr>
<tr>
<td>Height (feet)</td>
<td>61.8</td>
<td>61.8</td>
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<tr>
<td>Material volume (cubic yards)</td>
<td>150,000</td>
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#### Table 19: Comparison of Alternatives

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<tr>
<th>Feature</th>
<th>Sixth Water Flow Pumped Storage</th>
<th>Fifth Water Flow Pumped Storage</th>
<th>Sixth Water Flow Pumped Storage</th>
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<tbody>
<tr>
<td><strong>Syar Dam</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Capacity (cfs)</td>
<td>85</td>
<td>116</td>
<td>46</td>
</tr>
<tr>
<td>Diameter (feet)</td>
<td>1,300</td>
<td>1,400</td>
<td>1,600</td>
</tr>
<tr>
<td>Length (miles)</td>
<td>38.0</td>
<td>41.0</td>
<td>44.0</td>
</tr>
<tr>
<td>Material volume (cubic yards)</td>
<td>1,200</td>
<td>1,300</td>
<td>1,400</td>
</tr>
<tr>
<td><strong>Diamond Fork Pipeline</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Capacity (cfs)</td>
<td>35</td>
<td>35</td>
<td>35</td>
</tr>
<tr>
<td>Diameter (feet)</td>
<td>10.7-11.5</td>
<td>10.7-11.5</td>
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<td>Length (miles)</td>
<td>8.4-9.5</td>
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<tr>
<td>Material volume (cubic yards)</td>
<td>550</td>
<td>550</td>
<td>550</td>
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<tr>
<td><strong>Diamond Fork Powerplant</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Capacity (MW)</td>
<td>0.3</td>
<td>0.3</td>
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<tr>
<td>Annual energy (MWh)</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
</tr>
<tr>
<td><strong>Wenatche Dam</strong></td>
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<td></td>
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</tr>
<tr>
<td>Height (feet)</td>
<td>61.8</td>
<td>61.8</td>
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<td>Material volume (cubic yards)</td>
<td>150,000</td>
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**Table 20**

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<tr>
<th>Environmental category</th>
<th>Future without condition</th>
<th>Fifth Water Pumped Storage</th>
<th>Sixth Water Pumped Storage</th>
<th>1964 DPR</th>
<th>Power generation (MWh)</th>
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<tr>
<td>Fish (lb/year)</td>
<td>17/814</td>
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<td>1,321</td>
<td>587</td>
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<td>Streams</td>
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<td>93,500</td>
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<td>75,955</td>
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<td>1,443</td>
<td>1,443</td>
<td>1,443</td>
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<td>0</td>
<td>0</td>
<td>0</td>
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<td>Reservoir fluctuation (feet)</td>
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<td>0</td>
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<tr>
<td>Recreation</td>
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<td>0</td>
<td>0</td>
<td>0</td>
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<td>Population</td>
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<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Livestock use</td>
<td>32,113</td>
<td>32,113</td>
<td>32,113</td>
<td>32,113</td>
<td>32,113</td>
</tr>
</tbody>
</table>

**Notes:**
- Impacts represent changes from the future without condition. Where this condition is not quantified, impacts shown are absolute values.
- Conditions expected in the future without additional Federal development of the Bonneville Unit.
- Recommended plans.
- Biomass values are applicable to wild trout only.
- Existing conditions.
- A zero indicates no change.
- All temporarily disturbed landscape would be rehabilitated to the current practical.
- Habitat units in a combined measure of quantity and quality of habitat.
- Not affected by any project alternative.
- The values given for the Fifth Water Pumped Storage, Sixth Water Pump Through, and Sixth Water Pumped Storage Alternatives are for Diamond Fork Reservoir and Diamond Fork Reservoir below Strawberry Reservoir. The values given for the 1964 DPR Alternative are for Sixth Water Creek immediately below Sixth Water Reservoir and 11 miles below the confluence of Diamond Fork and Sixth Water Creek.
- Change from average monthly temperature in August.
- Average August temperature.
- Average of spot measurements taken throughout the year.
- A significant reduction in turbidity and sediment transport would result because project reservoirs would act as sediment traps, and existing conditions would be rehabilitated to the extent possible.
- A slight adverse impact over existing conditions would result from high spring flows in Diamond Fork Reservoir.
- Temperature ranges given are maximum predicted to occur when cold water is withdrawn from the enlarged Strawberry Reservoir.
- Water temperatures in the reservoir would be 16°F to 20°F for each reservoir under each alternative.
- Number of direct and indirect jobs from project construction.
- Population influx during peak construction year.
- Animal Unit Hours.
- Numerical ratings prepared by the Forest Service for a relative comparison of effects.
- Water quality.
- Monitoring stations.
- Conditions expected in the future without additional Federal development of the Bonneville Unit.
- Recommended plans.
- Biomass values are applicable to wild trout only.
- Change from average monthly temperature in August.
- Average August temperature.
- Average of spot measurements taken throughout the year.
- A significant reduction in turbidity and sediment transport would result because project reservoirs would act as sediment traps, and existing conditions would be rehabilitated to the extent possible.
- A slight adverse impact over existing conditions would result from high spring flows in Diamond Fork Reservoir.
- Temperature ranges given are maximum predicted to occur when cold water is withdrawn from the enlarged Strawberry Reservoir.
- Water temperatures in the reservoir would be 16°F to 20°F for each reservoir under each alternative.
- Number of direct and indirect jobs from project construction.
- Population influx during peak construction year.
- Animal Unit Hours.
- Numerical ratings prepared by the Forest Service for a relative comparison of effects.
As shown in Table 20, only the 1964 DPR Alternative would have an adverse effect on stream fisheries. The other alternatives would result in enhancement of the fisheries. This enhancement would result from the Diamond Fork Pipeline removing damaging excess flows from Diamond Fork and thereby offsetting all adverse impacts from project construction and operation. Except for the 1964 DPR Alternative, the power alternatives would essentially be equal in pounds of fish per year (without mitigation). The No Power Alternative would be about the same as the future without condition. The 1964 DPR Alternative would cause a loss of about 683 pounds annually. This alternative would provide the largest reservoir fishery, mainly because of the size of Hayes Reservoir. Standing crop of fish under the Fifth Water Pumped Storage Alternative would be relatively high because of the size and habitat quality of Fifth Water Reservoir.

Vegetative communities provide stabilizing soil cover and are an integral part of habitat for wildlife. Permanent losses would result from construction of main roads, powerplants, dams, and reservoirs. Temporary losses would be caused by installation of buried pipelines, excavation of borrow sites, and high intensity use of construction camps. The temporarily disturbed landscape would be contoured and the topsoil restored and reseeded shortly after construction work is finished. Ground cover suitable to stabilize soils is expected within several years, but about 25 years would be required for conditions to approximate existing species diversity and age distribution. The Fifth Water Pumped Storage Alternative would cause the greatest impact on vegetation, largely because of Fifth Water and Monks Hollow Reservoirs. The 1964 DPR Alternative would have the next most significant effect, mostly because of inundation by Hayes Reservoir. The recommended plan and the Sixth Water Pumped Storage Alternative would have similar impacts, which would be much less than either the Fifth Water Pumped Storage or the 1964 DPR Alternatives because the reservoirs would be smaller under these plans. The No Power Alternative would have minimal effects on vegetation.

The Fifth Water Pumped Storage Alternative would require the most land for wildlife mitigation of all the alternatives, although, if the preferred mitigation plan is fully implemented, impacts would compare very favorably with the other alternatives. The No Power Alternative, consisting of a pipeline only, would be least harmful to wildlife. In general, mule deer, bobcat, and golden eagles would benefit slightly, while other species would experience losses.

No significant impacts on any threatened or endangered species would occur with any of the alternatives.

Comparisons for water quality impacts include temperature, dissolved oxygen, and turbidity for streams and temperature, dissolved oxygen, and nutrients for reservoirs. For stream temperatures, the recommended plan would produce conditions that deviate from present conditions more than the Fifth Water Pumped Storage Alternative, but less than most of the
other alternatives. In terms of dissolved oxygen, all of the alternatives are basically equal in impact, except the No Power Alternative which would have greater impacts at times. As explained in footnotes 14 and 15 of Table 20, surging flows in Diamond Fork under the 1964 DPR Alternative would cause a slight increase in relative background turbidity, and the other power alternatives would significantly decrease existing turbidity because reservoirs function as traps for suspended sediment and excess flows are placed in pipe.

Reservoir water temperatures would largely be a function of the depth from which water is drawn from the enlarged Strawberry Reservoir. As explained in Chapter IV, during the June through September period when temperatures in Strawberry Reservoir would vary with depth, water would come from warmer water layers about 5 to 15 percent of the years. During 60 to 80 percent of the years, water would come from deeper, colder layers, and during the remainder of the years from somewhere in between. To compare alternatives, estimated temperatures for the most prevalent expected conditions are given in Table 20. The recommended plan would provide the greatest temperature variation from present conditions as explained above. Conditions in Sixth Water and Syar Reservoirs would be similar in all alternatives. Hayes Reservoir would be similar to Monks Hollow Reservoir under the recommended plan and Sixth Water Pumped Storage Alternative. All reservoirs would be classified as eutrophic because of high nutrient loadings. However, significant eutrophication problems are not expected because of water level fluctuations and short detention times, particularly in the smaller reservoirs.

The operation of Strawberry Reservoir would not vary significantly with any of the five alternatives. The maximum difference in reservoir surface elevation would be about 8 feet between alternatives.

All of the power alternatives would have limitations on reservoir value for recreation. The extent of daily and seasonal changes in reservoir water levels largely determines the value of the impoundment for recreation use. The greater the fluctuation, the lower the value for recreation. A key factor in relating reservoir fluctuation to recreation value is whether the daily water level changes occur on weekdays or on weekends, when recreation use would be heaviest. For the Diamond Fork Power system, a meaningful comparison of alternatives is limited because the plans have different features. The downstream reservoir for the flow-through alternatives would be operated as a regulating reservoir, serving a demand which is predominantly for irrigation. For this reason, the reservoir would be drawn down considerably during the irrigation period and recharged by the transbasin diversion during the non-irrigation period in the winter. The forebay and afterbay reservoirs for the pumped-storage alternatives would fluctuate daily and weekly as the result of the daily movement of relatively large volumes of water between them. This movement of water, however, would also eliminate the seasonal drawdown effect on the downstream reservoir. Under the Fifth Water Pumped Storage Alternative, weekend fluctuations of both reservoirs would be substantially less than what would occur on weekdays. With the
CHAPTER III

Fifth Water Pumped Storage Alternative, no seasonal reservoir fluctuations would occur. Under the recommended plan and the Sixth Water Pumped Storage Alternative, Monks Hollow would be stable daily but would be drawn down 50 feet and 38 feet, respectively, over the recreation season, severely limiting its recreation value. Hayes Reservoir, under the 1964 DPR Alternative, would experience a seasonal drawdown of 100 feet. Syar Reservoir would have little recreational value under any of the plans because of its large daily fluctuation. Sixth Water Reservoir would be stable under the Sixth Water Pumped Storage plan but would fluctuate greatly under the recommended plan and the 1964 DPR Alternative.

Based on surveys of 90 percent of the project feature sites, no cultural resources would be affected by any of the alternatives.

All significant social impacts would occur during construction. No significant adverse postconstruction impacts would occur as a result of any of the alternatives.

During construction, all of the alternatives would result in a population immigration to Utah County. For the peak years of construction (the second and third years for all except the Fifth and Sixth Water Pumped Storage Alternatives, which would peak in the fifth and fourth years, respectively), population impacts would vary considerably among alternatives (Table 20). Population impacts are important because they are a measure of the magnitude of a number of social impacts. As Table 20 indicates, the two pumped storage alternatives are roughly equal in impact, the recommended plan and the 1964 DPR Alternative are roughly equal to each other and approximately half as great as the pumped storage alternatives, and the No Power Alternative is only a fourth as great.

A number of primarily beneficial economic impacts are expected in Utah County, as shown in Table 20. The Fifth Water Pumped Storage Alternative would result in the most benefits, with Sixth Water Pumped Storage second. The addition of a number of jobs should be considered a major social benefit.

Five sets of infrastructure and values impacts have been identified: (1) housing, (2) education, (3) health and medical care, (4) transportation, and (5) other.

Impacts on livestock production are compared using two important indicators: animal-unit-months (AUM's) and cost of grazing management to the permittees currently using forest lands. The Fifth Water Pumped Storage Alternative would result in the greatest amount of grazing loss because of the relatively large surface area of Fifth Water Reservoir. The recommended plan and the Sixth Water Pumped Storage Alternative would have much lower decreases in grazing use. Inundation of land by Hayes Reservoir would raise the loss of AUM's under the 1964 DPR Alternative to a relatively high level. The No Power Alternative would result in the smallest loss. The absolute reduction in AUM's would be
CHAPTER III

small, ranging from 5 to 10 percent. In terms of expense to the permittees, the impacts would be much more significant. The reservoirs, particularly Monks Hollow, would block existing access routes to key areas, forcing the permittees to truck or trail their animals over much longer distances. The Fifth Water Pumped Storage Alternative would increase expenses by approximately 50 percent. The other power alternatives would result in expense increases ranging from 27 to 47 percent. The 1964 DPR Alternative would have a lesser impact than the other power alternatives, because there would be no Monks Hollow Reservoir. The No Power Alternative would have no effect on expenses.

Esthetic impacts were evaluated using a Forest Service method based on visual changes that can be observed from travel routes on national forest land. Thus, the more project features are visible, the more significant the impact. Table 20 presents an overall relative comparison of alternatives. Based on the Forest Service analysis, each of the alternatives would cause significant scenic modifications. The 1964 DPR Alternative would result in the greatest decrease in scenic value, while the No Power Alternative would have the least impact. Reservoirs are viewed as positive, but limited, elements because of water level fluctuation. The transmission line would be the most visible feature.

Recreation use has been utilized to evaluate the impacts of each alternative on existing recreation in the project area. Mostly because of Fifth Water Reservoir, the Fifth Water Pumped Storage Alternative would provide the greatest increase in recreation use. The recommended plan and the Sixth Water Pumped Storage Alternative and the No Power Alternative would increase the use potential by only 60 percent of that of the Fifth Water Pumped Storage Alternative. Under the 1964 DPR Alternative, large fluctuations in the flows of Diamond Fork below Dyne Powerplant and the draining of Hayes Reservoir during the summer for irrigation would cause an unquantified loss of recreation use. The fluctuating and high streamflows would force the closure of two existing Forest Service campgrounds, and Hayes Reservoir would have little recreation potential.

Available geological and seismic data indicate that, using current Reclamation design and construction practices, the features of all the alternatives under consideration could be safely built and operated. The Fifth Water Reservoir impoundment might raise underground fluid pressures, which could increase the possibility of subsurface activity.

Net economic benefits indicate the value of the project benefits in dollars, less total annual costs. This parameter gives an overall indication of the economic status of each alternative. The Fifth Water Pumped Storage Alternative, because it would provide the most peaking power, would have by far the greatest net benefits. The Sixth Water Pumped Storage Alternative would produce only about 40 percent of the net benefits provided by the Fifth Water Pumped Storage Alternative. Net benefits from the recommended plan and the 1964 DPR Alternative would be about 15 percent of those for the Fifth Water Pumped Storage plan.
A comparison of power production among the alternatives parallels that for net benefits. The greater the amount of total and peaking power production, the greater the net benefits.

Table 20 indicates that the No Power Alternative would cause the least adverse environmental impact. It would, therefore, be the most environmentally acceptable plan. The No Power Alternative, however, is not recommended because it would not provide hydroelectric power—the major objective of the Diamond Fork Power System.

Benefit-Cost Analysis--Bonneville Unit

The Diamond Fork Power System is an integral part of the Bonneville Unit, and its costs are part of the project costs of the entire unit. Also, benefits from power generation, along with those from municipal and industrial water, irrigation, flood control, and fish and wildlife enhancement, contribute to the benefit-cost analysis of the entire unit.

A preliminary cost-benefit evaluation of the Bonneville Unit, including the Sixth Water Flow Through power system, has a benefit-cost ratio of 1.88, based on the authorized Bonneville Unit interest rate.

Other Alternatives Studied

Other alternatives studied for the Diamond Fork Power System include (1) the Fifth Water Flow Through Alternative, (2) the Sixth Water Flow Through Alternative with Strawberry Tunnel Rehabilitation, (3) an alternative proposed by a local utility company that is similar to the recommended plan, (4) a Strawberry Tunnel enlargement with four flow-through powerplants, and (5) a Tie Fork Alternative. The first three alternatives are considered variations of the recommended plan. These five alternatives and the reasons for their elimination from further consideration are discussed briefly below.

Under the Fifth Water Flow Through plan, water would flow from Strawberry Reservoir through the proposed Syar Tunnel into Fifth Water Penstock and Powerplant and then into Fifth Water Reservoir. The tunnel would follow the same alignment and Fifth Water Dam would be located at the same site as in the Fifth Water Pumped Storage Alternative. From Fifth Water Reservoir, water would be released through the Fifth Water Tunnel into Sixth Water Penstock and Powerplant and then into Sixth Water Reservoir (at a site slightly downstream from its site in the recommended plan). From Sixth Water Reservoir, the water would flow through the Dyne Aqueduct and Dyne Penstock and Powerplant into Monks Hollow Reservoir (at the same site as in the recommended plan). From this reservoir, the water would pass through Monks Hollow Penstock and Powerplant and then be conveyed through the Diamond Fork Pipeline to the Diamond Fork Powerplant. This alternative was eliminated because preliminary analysis indicated that it had lower net benefits than the recommended plan.
CHAPTER IV

AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

Topography and Scenery

Existing conditions

The Diamond Fork Power System would be located in the Diamond Fork drainage within the Uinta National Forest of the rugged and scenic Wasatch Mountain Range. Elevations of project feature sites range from about 7,600 feet down to about 5,000 feet. Features of the various alternatives would be located primarily in Diamond Fork, Sixth Water, and Fifth Water Canyons, all of which are narrow, steep-walled canyons containing perennial streams as well as popular hot springs and hiking trails. Diamond Fork is a tributary of the Spanish Fork River, which is tributary to Utah Lake. Before terminating in Utah Lake, the Spanish Fork River flows past the community of Spanish Fork in south Utah Valley.

Environmental impacts

RECOMMENDED PLAN

Temporary and permanent landscape disturbance would be apparent from the placement of permanent project features such as roads, dams, powerplants, and transmission lines and from loss of native vegetation and natural landscape resulting from construction of these features.

Changes in topography and the natural shape of the landscape, impacts on vegetation, and visual impacts on the esthetic quality of the mountainous terrain from above-ground project features would be mitigated to the extent practical through the mitigation measures discussed in Chapter III. These measures would include revegetation of denuded areas and placement of features such as transmission towers and lines in inconspicuous areas where feasible.

During project construction, increased human activity, heavy machinery, material processing, powerline installation, and surface excavations would temporarily detract from the scenery. Such detractions, however, would be visible only in localized areas where construction was occurring. The reservoir basins would be unattractive until filled. Excavations for tunnels, aqueducts, roads, powerlines, and other facilities would create sections of cleared land until vegetation could be reestablished. Successful restoration of visual appeal by revegetation of these areas would probably take 5 to 10 years and up to 25 years to reach full maturity or preproject conditions.

Project impacts on the scenery were evaluated using the U.S. Department of Agriculture's National Forest Landscape Management, Volume 2.
CHAPTER IV

AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

Its system of landscape evaluation establishes ratings for various types of landscapes that are visible from travel routes on national forest land. The Forest Service has applied the system to the lands in the Diamond Fork area.

The following types of features or landscape modifications located in visually sensitive areas would have significant adverse impacts under the rating system used by the Forest Service: (1) transmission lines, towers, and substations; (2) powerplant structures and visible pen-stocks; (3) double-lane roads; (4) aqueducts, both buried and above ground; (5) dam structures; (6) exposed reservoir shorelines; (7) material source areas; and (8) recreation developments (i.e., major compounds). After assessing the Diamond Fork drainage in terms of its vegetative regeneration capability, steepness of slopes, viewing distance between the project features or modifications and the observer, and other factors, each type of feature or modification listed above was analyzed for the recommended plan and alternatives to determine the net increase or decrease in visual rating from existing conditions. The tabulation below ranks the alternatives according to their impacts on the visual resource. Ranking No. 1 represents the least adverse visual impact, while ranking No. 5 represents the greatest.

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Adverse rating</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Power</td>
<td>19,525</td>
<td>1</td>
</tr>
<tr>
<td>Fifth Water Pumped Storage</td>
<td>22,135</td>
<td>2</td>
</tr>
<tr>
<td>Sixth Water Pumped Storage</td>
<td>25,411</td>
<td>3 and 4</td>
</tr>
<tr>
<td>Sixth Water Flow Through</td>
<td>25,411</td>
<td>3 and 4</td>
</tr>
<tr>
<td>(recommended plan)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1964 DPR</td>
<td>29,240</td>
<td>5</td>
</tr>
</tbody>
</table>

Some of the measures which would mitigate the visual impacts of the various alternatives are discussed in Chapter III. The procedure for implementing these and other measures would be to coordinate them with the development of project designs and specifications.

The major impact on scenery and topography would result from construction of the reservoirs and the pipeline down Diamond Fork Canyon. The next most significant impact would result from the construction and upgrading of roads along Diamond Fork and Sheep Creek. Although such areas would be contoured to match the existing landscape as much as possible and revegetated with native grasses, shrubs, and forbs, it would probably take 20 to 50 years for the pinyon-juniper, mountain brush, and riparian ecosystem communities to return to conditions similar to those which now exist.

Where helicopters are used in the construction of transmission lines, the amount of vegetation disturbed would be reduced. Clearing would be limited to the specific areas actually needed for the project, such as around structure sites, or to areas where vegetation must be
removed to prevent damage to conductors or other facilities. A feathering technique would be used to soften the edges of the clearings. All areas where excavation or total removal of vegetation occurs would be recontoured, fertilized, and reseeded in consultation with the Forest Service.

Structures, switchyards, and substations would be sited and designed to minimize visual impacts. The use of nonreflecting conductors is planned to further reduce visual impacts. Colored concrete footings and dulled finish towers may be used if appropriate. All construction areas would be cleaned and all debris and rubbish removed after construction is completed. All visual mitigation would be coordinated with the Forest Service.

OTHER ALTERNATIVES

Since all power alternatives would consist of essentially the same kinds of project features (i.e., roads, dams, powerlines, etc.), their impact on topography would be similar to that of the recommended plan. Mitigation measures to compensate for such impacts would also be similar.

The impact on scenery for the alternatives would differ somewhat from the recommended plan. The Fifth Water Pumped Storage Alternative would have the same impacts, except that Fifth Water Reservoir would be constructed in place of Sixth Water Reservoir. Fifth Water Reservoir would be larger than Sixth Water Reservoir and, because it would be located on a major travel route, would be seen by more people. The result would be greater enhancement of the landscape from this alternative. Since Fifth Water Reservoir would be larger, the visual impacts would be greater. The impacts to scenery for the Sixth Water Pumped Storage Alternative would be the same as for the recommended plan. Hayes Reservoir of the 1964 DPR Alternative would not have the impacts on scenery of Monks Hollow Reservoir. Hayes Reservoir would be seen by more individuals and the reservoir would be larger. The larger body of water seen by more users would be more valuable in the scenery. A major drawback to the impact on the scenery under this alternative would be to the stream. Under this alternative, peak flows would increase. Extensive erosion would occur. The recreation areas would be closed because of the hazardous waters. The water in the river would enhance the appearance; however, the erosion and damage caused by the erosion would affect several miles of river and the adjacent landscape. The result would be that more landscape would be degraded than improved. The No Power Alternative would be similar to the recommended plan and the Sixth Water Pumped Storage Alternative with respect to impacts on scenery; however, there would be no powerlines or dams to detract from the landscape under this alternative.
CHAPTER IV

AFFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

Vegetation

Existing conditions

Vegetation communities within the project area are divided into seven groups (Figure 23). These communities and their respective acreages and percentages of the total study area (93,500 acres) are listed in the tabulation below.

<table>
<thead>
<tr>
<th>Vegetation type</th>
<th>Acreage</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>500</td>
<td>0.5</td>
</tr>
<tr>
<td>Aspen-conifer</td>
<td>3,800</td>
<td>4</td>
</tr>
<tr>
<td>Mountain brush</td>
<td>51,500</td>
<td>55</td>
</tr>
<tr>
<td>Pinyon-juniper</td>
<td>19,700</td>
<td>21</td>
</tr>
<tr>
<td>Reseeded</td>
<td>8,900</td>
<td>10</td>
</tr>
<tr>
<td>Sagebrush</td>
<td>8,600</td>
<td>9</td>
</tr>
<tr>
<td>Riparian woodland</td>
<td>1/500</td>
<td>0.5</td>
</tr>
<tr>
<td>Total</td>
<td>93,500</td>
<td>100</td>
</tr>
</tbody>
</table>

1/ Not shown on Figure 23 because this type occurs only in narrow corridors along permanent streams and seeps.

Mountain brush is by far the most prevalent vegetation type. It occurs at almost all elevations of the project area and represents prime habitat for upland game birds, nesting nongame birds, and big game, particularly in winter. This habitat type is also a very important food source for small birds, small mammals, several species of grouse, and big game. It is primarily a shrub community dominated by oakbrush and snowberry. Other important species are big sagebrush, true mountain mahogany, and rabbit brush.

Pinyon-juniper is the second most prevalent vegetation type. Ground cover is sparse in this community but still provides some food for birds and small mammals. It is valuable as a source of cover and emergency food for big game, especially during the winter. This cover type is also primarily a shrub community dominated by shrubs and Utah juniper (a small conifer), which is the most conspicuous because of its density and height. Other important species include oakbrush, sagebrush, rabbit brush, birchleaf and curl-leaf mountain mahogany, and bitterbrush. Pinyon pine is present in low numbers.

Reseeded land is the third most common vegetation type. Most of the land cover in this category was formerly dominated by pinyon-juniper, sagebrush, or oakbrush. It has been converted to grassland for livestock grazing by removing the natural vegetation and replacing it with adapted grass species. In addition to its livestock value, it provides an important food source for many birds and small mammals. It also provides very good spring range for big game. This community is dominated by crested wheatgrass, intermediate wheatgrass, and smooth brome. Scattered browse species include sagebrush, rabbit brush, and
CHAPTER IV AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

snowberry. This vegetation type is generally located in areas of gentle slope at various elevations within the Diamond Fork area.

Sagebrush land represents the fourth most prevalent vegetation community. This cover type provides habitat and is an important source of food for birds, small mammals, and big game. It is a shrub-dominated community, consisting primarily of big sagebrush with grass and forb understories. Other browse species occurring here are rabbit brush, snowberry, and bitterbrush. This community occurs throughout the study area but is most prevalent at lower elevations.

The aspen-conifer community is very limited. It occurs primarily at the higher elevations, around 8,000 feet. It is important, however, in providing habitat for two species of forest grouse and big game, as well as for a variety of birds. This cover type is dominated by single and mixed stands of quaking aspen and several species of fir.

The riparian woodland community, which is the vegetative type providing most wetland values, occurs infrequently and is associated with canyon bottoms in conjunction with permanent streams and seeps. These areas provide a diversity of habitat for birds, furbearers, other small mammals, and big game. It is particularly significant to species requiring moist habitats, such as amphibians, reptiles, some birds, furbearers, and other small mammals. The most conspicuous woodland plant species is the narrowleaf cottonwood, because of its large size and dense growth patterns. Willow is the dominant browse species, but big sagebrush and rabbit brush also occur. The understory community is dominated by bluestem wheatgrass and Kentucky bluegrass.

The agricultural land is located in lower Diamond Fork Canyon. This land consists primarily of pasture, alfalfa, and fallow fields and serves as livestock pasture during the course of the year. Originally, this land was mostly wet meadows, riparian woodland, and shrub-grass communities. This land provides bird and small mammal habitat but has limited value for big game species.

Environmental impacts

RECOMMENDED PLAN

Permanent losses of vegetation caused by the recommended Sixth Water Flow Through Alternative would total 545 acres (Table 21), including 46 acres (9 percent) of riparian habitat. Most of this would occur in the reseeded grass, mountain brush, and pinyon-juniper communities and would be attributable to inundation by Monks Hollow Reservoir and construction of new access roads. Temporary losses of 280 acres would primarily be the result of construction of the Diamond Fork Pipeline and power transmission lines and the development of material source areas, and would mainly affect the reseeded grass and mountain brush communities. In addition, agriculture and riparian woodland communities would be temporarily impacted by construction of the pipeline.
FIGURE 23
VEGETATION TYPE AND MULE DEER WINTER RANGE
### Table 21

Acres of vegetation temporarily\(^1\)/ or permanently\(^2\)/ lost under each alternative

| Vegetation type/duration of loss | Alternative | Sixth Water Flow Through | Fifth Water Pumped Storage | Sixth Water Pumped Storage | 1964 DPR | No Power
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Sagebrush</td>
<td>Temporary</td>
<td>18</td>
<td>18</td>
<td>18</td>
<td>17</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Permanent</td>
<td>62</td>
<td>58</td>
<td>57</td>
<td>283</td>
<td>1</td>
</tr>
<tr>
<td>Reseeded</td>
<td>Temporary</td>
<td>75</td>
<td>148</td>
<td>83</td>
<td>105</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>Permanent</td>
<td>108</td>
<td>451</td>
<td>107</td>
<td>32</td>
<td>1</td>
</tr>
<tr>
<td>Mountain brush</td>
<td>Temporary</td>
<td>98</td>
<td>154</td>
<td>107</td>
<td>153</td>
<td>33</td>
</tr>
<tr>
<td></td>
<td>Permanent</td>
<td>199</td>
<td>229</td>
<td>210</td>
<td>141</td>
<td>8</td>
</tr>
<tr>
<td>Pinyon-juniper</td>
<td>Temporary</td>
<td>26</td>
<td>30</td>
<td>26</td>
<td>39</td>
<td>59</td>
</tr>
<tr>
<td></td>
<td>Permanent</td>
<td>125</td>
<td>231</td>
<td>119</td>
<td>34</td>
<td>7</td>
</tr>
<tr>
<td>Agriculture</td>
<td>Temporary</td>
<td>33</td>
<td>33</td>
<td>33</td>
<td>0</td>
<td>33</td>
</tr>
<tr>
<td></td>
<td>Permanent</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>332</td>
<td>0</td>
</tr>
<tr>
<td>Riparian</td>
<td>Temporary</td>
<td>28</td>
<td>28</td>
<td>28</td>
<td>5</td>
<td>44</td>
</tr>
<tr>
<td></td>
<td>Permanent</td>
<td>46</td>
<td>47</td>
<td>48</td>
<td>33</td>
<td>1</td>
</tr>
<tr>
<td>Aspen-conifer</td>
<td>Temporary</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>8</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Permanent</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>Temporary</td>
<td>280</td>
<td>411</td>
<td>297</td>
<td>327</td>
<td>204</td>
</tr>
<tr>
<td></td>
<td>Permanent</td>
<td>545</td>
<td>1,021</td>
<td>546</td>
<td>855</td>
<td>19</td>
</tr>
</tbody>
</table>

\(^1\)/ Temporary losses include those vegetated areas where surface disturbance would occur during project construction, after which the land surface would be rehabilitated and revegetated to the extent possible. It is assumed that with proper rehabilitation these areas would regain at least 75 percent of their former wildlife habitat value.

\(^2\)/ Permanent losses include those vegetated areas where permanent project surface features would be placed.
CHAPTER IV AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

OTHER ALTERNATIVES

The Fifth Water Pumped Storage Alternative would result in the permanent loss of 1,021 acres of vegetation, mostly in the reseeded grass, mountain brush, and pinyon-juniper communities (Table 21). Most of the loss would be the result of inundation by Monks Hollow and Fifth Water Reservoirs. Temporary losses of 411 acres would also occur with this alternative, primarily as a result of construction of the Diamond Fork Pipeline and development of material source areas. The temporary losses would mainly affect the reseeded grass and mountain brush communities.

The 1964 DPR Alternative would result in the permanent loss of 855 acres, primarily agricultural and sagebrush, through inundation by Hayes Reservoir. Temporary losses of 327 acres would also be associated with this alternative. The greatest temporary impact would occur to the mountain brush community and reseeded areas as a result of the construction of buried aqueducts and the development of material source areas.

The Sixth Water Pumped Storage Alternative would have slightly greater effects on vegetation than the recommended plan.

The No Power Alternative would result in the permanent loss of only 19 acres of vegetative cover, consisting mostly of mountain brush and pinyon-juniper with 1 acre of riparian. This loss would result primarily from the construction of roads. Temporary impacts caused by pipeline excavation would amount to 204 acres, with all vegetative types being affected, including 44 acres of riparian.

Flood Plains and Wetlands

Existing conditions

Flood plains are not extensive within the project area. Most of the project-affected streams are located in narrow, constricted canyons with high gradient streambeds. Flood waters flowing under these conditions are physically confined and unable to spread out.

Insofar as wetlands may include "those areas that are frequently inundated by surface or ground water and normally support a prevalence of vegetative or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction," all intermittent and perennial streams within the area of the proposed project may be classified as such. The perennial streams contain a wide variety of aquatic macroinvertebrates as well as a valuable stream fishery resource. The riparian woodland community, which is the only vegetation type having wetland value, occurs infrequently (0.5 percent of total project area) and is associated with canyon bottoms in conjunction with permanent streams and seeps. These areas provide a diversity of habitat for birds, furbearers, other small mammals, and big game.
CHAPTER IV

RECOMMENDED PLAN

Environmental impacts

The construction of Monks Hollow, Syar, and Sixth Water Reservoirs would inundate flood plains and cause the complete loss of 46 acres of existing stream and associated riparian vegetation through inundation. These reservoirs would provide 393 acres of aquatic habitat in exchange. In addition, 28 acres of riparian vegetation would be temporarily disturbed as a result of construction of the Diamond Fork Pipeline from Monks Hollow Dam to the Spanish Fork River.

Executive Orders 11988 (flood plains) and 11990 (wetlands) were written with the intent of minimizing flood damages and preserving the natural values of wetlands. The minimization of flood damage in the Diamond Fork system is not an issue in this case, because these facilities would be built for no other purpose than water conveyance and power production. Under these conditions, flows in the streams would for the most part be controlled, and the potential for flooding would be reduced. A certain amount of flood control has been included in the design capacity of Monks Hollow Reservoir.

The natural values of wetlands within the project area would be diminished by project construction and operation. The beaver is the best representative of the wetland value associated with the riparian woodland vegetative community. The net change in habitat values would be -8 habitat units for this alternative; but this loss would be partially or totally negated, depending on which mitigation option was chosen. The slight loss in value associated with some options is not considered to be significant to the wetland value of the riparian woodland habitat. The loss of wetted streambed and associated macroinvertebrate communities (benthos) would be relatively small (10 acres). This loss would be traded for a macroinvertebrate community associated with the reservoirs, which would certainly be different in its species composition but would also have its own unique value; however, direct compensation/enhancement for the loss of the stream benthic communities, as well as fisheries, would occur on the lower Diamond Fork as described in Chapter III.

The temporary disturbance to wetland habitat values in Diamond Fork Canyon from construction of the Diamond Fork Pipeline would be minor. When the pipeline is buried, however, at least 75 percent of the existing wetland values inherent in the riparian zone of the stream would be restored through mechanical revegetation and time.

The transmission lines and switchyards may have some impacts on flood plains and wetlands, depending on designs. Flood plains and wetlands would be avoided wherever possible by spanning narrow canyons. If project transmission facilities are designed to be constructed in a flood plain or wetland, Western would prepare a flood plains/wetlands assessment which would recommend appropriate mitigation measures.
CHAPTER IV

Although the proposed project would impact the flood plains and wetlands as described above, the nature of the project as one of water conveyance and power production dictates that facilities be located in these areas.

OTHER ALTERNATIVES

Comparative values indicating the permanent impact for all project alternatives on flood plain and wetland values are given in Table 22.

Table 22
Permanent impacts on flood plains and wetlands

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Riparian woodland habitat change</th>
<th>Beaver1/</th>
<th>Stream lost (acres)</th>
<th>Reservoir habitat gained (acres)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sixth Water Flow Through</td>
<td>-46</td>
<td>-2</td>
<td>10</td>
<td>393</td>
</tr>
<tr>
<td>Fifth Water Pumped Storage</td>
<td>-47</td>
<td>-1</td>
<td>16</td>
<td>873</td>
</tr>
<tr>
<td>Sixth Water Pumped Storage</td>
<td>-48</td>
<td>-1</td>
<td>11</td>
<td>433</td>
</tr>
<tr>
<td>1964 DPR</td>
<td>-33</td>
<td>+14</td>
<td>29</td>
<td>747</td>
</tr>
<tr>
<td>No Power</td>
<td>-1</td>
<td>-3</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

1/ Net change with implementation of recommended mitigation measures.
2/ "Habitat unit" is a combined measure of quantity and quality of habitat.

Although there are slight differences in values as given in the table, the overall effect of any one of the above alternatives on flood plains and wetlands would be insignificant, especially with implementation of the compensation measures which were discussed under the recommended plan and which apply to the other alternatives as well. Although the riparian woodland habitat is not high quality compared to similar habitat types in other areas, it is unique in this area because it is limited by natural climatic conditions as well as by prior degradation and loss from excessively high summer irrigation flows. Every effort would, therefore, be made through the wildlife mitigation plan to manage and protect this habitat type in order to preserve and even enhance its unique value for wildlife species.

Water Resources

Water supply

EXISTING CONDITIONS

Diamond Fork, a major tributary of the Spanish Fork River, is the principal stream in the area of the proposed features of the power system. Its major tributaries are Sixth Water Creek and the stream in
Cottonwood Canyon. First and Second Water Creeks are tributaries to Cottonwood Canyon. Third, Fourth, and Fifth Water Creeks are tributaries to Sixth Water Creek. These streams originate in the Bonneville Basin, high on the western slopes of the Wasatch Mountains, just west of the divide between the Colorado River Basin and the Great Basin.

An estimated 90,000 acre-feet of water annually enters the Spanish Fork River from Diamond Fork. This includes about 61,000 acre-feet released from Strawberry Reservoir through the Strawberry Tunnel to Sixth Water Creek. Thus, about two-thirds of the existing Diamond Fork flow results from a transbasin diversion of water from the Colorado River Basin. This diversion has occurred since 1915, when the Bureau of Reclamation's Strawberry Valley Project began delivering water through the tunnel. Strawberry Reservoir, which began storing water in 1912, receives its supply primarily from the Strawberry River and from feeder canals from Indian Creek, Horse Creek, Trail Hollow Creek, and Currant Creek. In addition, the Strawberry Aqueduct, another feature of the Bonneville Unit now under construction, has been delivering water to the reservoir in small but increasing amounts since 1971. When completed, this aqueduct will intercept the flows of nine streams along the south slope of the Uinta Mountains, beginning at Rock Creek and extending about 37 miles to Strawberry Reservoir.

The Diamond Fork stream system flows from its headwaters just west of Strawberry Reservoir for about 18 miles to its confluence with the Spanish Fork River.

Natural flows of First, Second, Third, Fourth, and Fifth Water Creeks and upper Diamond Fork above the Three Forks confluence are greatest in the spring, when snowmelt runoff is peaking. Peak flows during May and June are estimated to range from 40 to 50 cfs in upper Diamond Fork and 10 to 20 cfs in the remaining tributaries of the Diamond Fork drainage. The natural flows decline considerably in late summer and reach minimums in late fall or winter. Late-season flows are estimated to be 0 to 5 cfs for all tributaries.

Sixth Water and Diamond Fork from the Strawberry Tunnel Outlet Portal to the Spanish Fork River Confluence

Sixth Water Creek, one of the largest tributaries, enters Diamond Fork about 8 miles above its confluence with the Spanish Fork River and receives much of its water during the summer months from Strawberry Reservoir through the 3.8-mile-long Strawberry Tunnel. Increased flows of 480 to 500 cfs have been added to the streams since about 1920 for Strawberry Valley Project irrigation during peak summer demand periods. There are no major irrigation diversions above the confluence with the Spanish Fork River.

Spanish Fork River from the Diamond Fork Confluence to Utah Lake

From its confluence with Diamond Fork, the Spanish Fork River flows northwest about 21 miles to Utah Lake. There are no major tributaries
to this section of the Spanish Fork River, but numerous large diversions are made for irrigation along the lower portion from April through mid-October.

As shown in Table 23, the average annual flow of the Spanish Fork River above the major irrigation diversions is 147,100 acre-feet. Irrigation diversions reduce this flow by about 95,500 acre-feet, or 65 percent, even after return flows and natural accretion have augmented the river just above Utah Lake. Stretches of the Spanish Fork River above Utah Lake are often dewatered because of irrigation diversions.

<table>
<thead>
<tr>
<th>Station Description</th>
<th>Drainage Area (square miles)</th>
<th>Annual Runoff (acre-feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diamond Fork, 7.25 miles above its mouth</td>
<td>110</td>
<td>76,100  98,100  30,000</td>
</tr>
<tr>
<td>Spanish Fork River, 3 miles below the</td>
<td>670</td>
<td>147,100  310,600  62,300</td>
</tr>
<tr>
<td>Diamond Fork confluence</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spanish Fork River, 1 mile above Utah</td>
<td>700</td>
<td>51,600  208,500  16,600</td>
</tr>
<tr>
<td>Lake</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1/ Data based on 1930-73 historical recorded flows.

ENVIRONMENTAL IMPACTS

In analyzing project-induced changes in water supply, existing and expected conditions are compared for each alternative. It is anticipated that the Strawberry Valley Project would continue to operate as it does now. Under the M&I System plan, Reclamation has stipulated that Bonneville Unit water conveyed through the Diamond Fork drainage would be limited to 30,000 acre-feet annually until the Diamond Fork Power System is in place. This limited delivery would take place during the off-peak and nonirrigation seasons and flows would be limited so as to not degrade the stream channels.

The pattern of water release from Strawberry Reservoir into the Diamond Fork Power System would vary somewhat, depending on the alternative selected. The historical flow regimes of First, Second, Third, and Fourth Water Creeks and upper Diamond Fork would remain unchanged under project operating conditions for all alternatives considered. However, streamflows in Sixth Water Creek, Diamond Fork, and the Spanish Fork River would be affected by operation of any of the alternatives. To determine the streamflow patterns that would occur as a result of reservoir operation under the different alternatives, a computerized, historical flow data model was created. From the model, simulated long-term average streamflows and reservoir releases were projected for the period of study (1930 through 1973).
CHAPTER IV

Recommended Plan

Operation of the Diamond Fork Power System under the recommended plan would affect streamflows in Sixth Water Creek, Diamond Fork, and the Spanish Fork River. The other tributaries in the Diamond Fork drainage would not be affected.

Under this alternative, the 198,400 acre-feet of water diverted annually from Strawberry Reservoir would be conveyed to the Bonneville Basin through the proposed Syar Tunnel and in succession through Syar, Sixth Water, Dyne, Monks Hollow, and Diamond Fork Powerplants. Flows through the powerplants would be regulated by Syar, Sixth Water, and Monks Hollow Reservoirs. Syar Reservoir would be an off-stream reservoir, having little effect on adjacent drainages, since all operational releases would be through the Corona Aqueduct to Sixth Water Reservoir.

Sixth Water Creek.—Diversions from Strawberry Reservoir through the existing Strawberry Tunnel would no longer exist. An estimated 4 to 5 cfs of seepage would continue to flow from the existing tunnel. Sixth Water Dam and Reservoir would be constructed on Sixth Water Creek approximately 2.8 miles above its confluence with Diamond Fork. The reservoir would have a total storage capacity of 560 acre-feet at a normal water surface elevation of 6,366 feet. No operational releases would be made from Sixth Water Reservoir to Sixth Water Creek. However, the natural flow (including tunnel seepage) up to 50 cfs would be released through Sixth Water Dam and maintained below the dam. Up to 1,250 cfs of project releases would be conveyed by the Dyne Aqueduct and Penstock to the Dyne Powerplant near the confluence of Sixth Water Creek and Diamond Fork.

Diamond Fork from Sixth Water confluence to the Spanish Fork River confluence.—Project water conveyed through Dyne Aqueduct and Dyne Powerplant would be released to Monks Hollow Reservoir. Since the powerplant would be located at the upper reach of the reservoir, there would be no fluctuating powerplant discharges to existing stream courses. Monks Hollow Dam and Reservoir would be located on Diamond Fork, approximately 8 miles northeast of its confluence with the Spanish Fork River. Monks Hollow Reservoir would provide long-term storage through the winter months. At a normal water surface elevation of 5,550 feet, the total reservoir storage capacity would be 32,800 acre-feet. The minimum water surface elevation would be 5,500 feet.

Operational releases from Monks Hollow Reservoir to Diamond Fork would be conveyed through the Monks Hollow Powerplant. Expected peak daily releases under project conditions for irrigation, municipal, and industrial use would be 875 cfs. Minimum releases would be no less than historic natural flows.

The Diamond Fork Pipeline would reduce flows below the powerplant tailrace by conveying up to 450 cfs of the total releases to the confluence with the Spanish Fork River. As a result, the average monthly flow...
in a 7.5-mile reach of Diamond Fork below Monks Hollow Powerplant is estimated to be in the 80- to 250-cfs range. Under the existing Strawberry irrigation system, flows in this reach usually range up to 537 cfs for long periods during the irrigation season. The maximum recorded flow in Diamond Fork near the confluence with the Spanish Fork River was 1,610 cfs on May 4, 1952. In the spring of 1984, flood flows washed out the gaging station and road. Estimates of these flows are not available but could have exceeded the historic record.

Spanish Fork River from Diamond Fork confluence to Utah Lake.—A bifurcation structure near the confluence would divert excess Diamond Fork Pipeline flows to the Diamond Fork Powerplant and the remainder to the Wasatch Aqueduct of the I&D System. Up to 450 cfs of the pipeline flow could be diverted to the powerplant and discharged to Diamond Fork just above its confluence with the Spanish Fork River. The bifurcation from the pipeline would be necessary to provide irrigation and municipal and industrial water to users along the Spanish Fork River. The normal discharge through the powerplant would be 250 cfs. Below the powerplant tailrace structure, the maximum daily flow would range from 550 to 675 cfs in the short reach of Diamond Fork above the Spanish Fork River confluence, depending on the final capacity of the Wasatch Aqueduct.

In the Spanish Fork River, the effects of the project would be buffered as a result of the river's larger natural flow. A summary of project and preproject flows in Diamond Fork and Spanish Fork River for average, maximum, and minimum years is given in Tables 24 and 25. Table 24 gives the streamflows with a 325-cfs Wasatch Aqueduct, while Table 25 gives streamflows with a 200-cfs aqueduct. Both flow conditions are given because the final capacity of the aqueduct has not yet been determined but is expected to be in the range of 200 to 325 cfs.

Fifth Water Pumped Storage Alternative

Sixth Water Creek.—Diversions from Strawberry Reservoir through the existing Strawberry Tunnel would no longer be made if the Fifth Water Pumped Storage Alternative were constructed. An estimated 4 to 5 cfs of tunnel seepage, however, would continue to discharge into Sixth Water Creek.

Fifth Water Creek.—Fifth Water Creek would be impacted by the construction of Fifth Water Dam and Reservoir. The dam and reservoir would be located approximately 3 miles northeast of the confluence of Fifth and Sixth Water Creeks. At the normal water surface elevation of 7,100 feet, the total reservoir capacity would be 49,720 acre-feet, which is considerably greater than the 17,130 acre-feet of active storage capacity required to provide for a 10-hour generation period. The reservoir would be approximately 2 miles in length.

Water from Strawberry Reservoir, averaging 198,400 acre-feet annually, would be delivered through the Syar Tunnel and Powerplant to Fifth Water Reservoir. From Fifth Water Reservoir, water would flow through
<table>
<thead>
<tr>
<th>Month</th>
<th>Preproject monthly flows</th>
<th>Project monthly flows</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Average</td>
<td>Maximum</td>
</tr>
<tr>
<td>Diamond Fork below Monks Hollow</td>
<td></td>
<td></td>
</tr>
<tr>
<td>October</td>
<td>38</td>
<td>141</td>
</tr>
<tr>
<td>November</td>
<td>16</td>
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<td>April</td>
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<td>July</td>
<td>291</td>
<td>421</td>
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<tr>
<td>August</td>
<td>203</td>
<td>342</td>
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<tr>
<td>September</td>
<td>118</td>
<td>227</td>
</tr>
<tr>
<td>Diamond Fork near Thistle</td>
<td></td>
<td></td>
</tr>
<tr>
<td>October</td>
<td>41</td>
<td>151</td>
</tr>
<tr>
<td>November</td>
<td>16</td>
<td>72</td>
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<td>430</td>
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<tr>
<td>July</td>
<td>298</td>
<td>434</td>
</tr>
<tr>
<td>August</td>
<td>209</td>
<td>350</td>
</tr>
<tr>
<td>September</td>
<td>119</td>
<td>232</td>
</tr>
<tr>
<td>Spanish Fork River at Castilla</td>
<td></td>
<td></td>
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<tr>
<td>October</td>
<td>93</td>
<td>96</td>
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<td>November</td>
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<tr>
<td>May</td>
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<td>617</td>
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<tr>
<td>July</td>
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<tr>
<td>August</td>
<td>282</td>
<td>335</td>
</tr>
<tr>
<td>September</td>
<td>178</td>
<td>313</td>
</tr>
<tr>
<td>Spanish Fork River near Lake Shore</td>
<td></td>
<td></td>
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<tr>
<td>October</td>
<td>30</td>
<td>46</td>
</tr>
<tr>
<td>November</td>
<td>67</td>
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</tr>
<tr>
<td>September</td>
<td>8</td>
<td>40</td>
</tr>
</tbody>
</table>

1/ T&D System.
2/ During the maximum year, the flow for a particular month would sometimes be less than the average flow for that month because the average is based on the 1930-73 period rather than a particular year.
### Table 25
Diamond Fork and Spanish Fork River preproject and project streamflows—recommended plan with 200-cfs, Wasatch Aqueduct1/ (Unit—cfs)

<table>
<thead>
<tr>
<th>Month</th>
<th>Preproject monthly flows</th>
<th>Project monthly flows</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Average year</td>
<td>Maximum year</td>
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<td>Diamond Fork below Monks Hollow</td>
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<tr>
<td>October</td>
<td>38</td>
<td>141</td>
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<td>November</td>
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<tr>
<td>September</td>
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<td>227</td>
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<tr>
<td>Diamond Fork near Thistle</td>
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<tr>
<td>October</td>
<td>41</td>
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<tr>
<td>Spanish Fork River at Castilla</td>
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<td>Spanish Fork River near Lake Shore</td>
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<td>0</td>
</tr>
<tr>
<td>September</td>
<td>8</td>
<td>40</td>
</tr>
</tbody>
</table>

1/ I&D System.  
2/ During the maximum year, the flow for a particular month would sometimes be less than the average flow for that month because the average is based on the 1930-73 period rather than a particular year.
the underground Fifth Water Powerplant and a 3-mile-long discharge tunnel into Monks Hollow Reservoir. There would be no operational releases from Fifth Water Reservoir to any adjacent drainage channels. A continuous release of 0.5 to 20 cfs to Fifth Water Creek would be maintained. A peak release of 20 cfs would be sustained for a 10-day period during late spring and/or early summer. Average streamflow releases during the summer would range from 5 to 10 cfs. Late summer, fall, and winter flows would range from 0.5 to 2 cfs.

Diamond Fork from Three Forks to the confluence with the Spanish Fork River. Monks Hollow Dam and Reservoir would be located on Diamond Fork about 8 miles northeast of its confluence with the Spanish Fork River. The total reservoir storage capacity would be 32,800 acre-feet at a normal water surface elevation of 5,550 feet. Water would be released through the underground powerplant from Fifth Water Reservoir into Monks Hollow Reservoir. The powerplant discharge would be made through tunnel outlet-inlet structures located within the Monks Hollow Reservoir basin area, entirely below the minimum water surface.

The reservoir release patterns and the effects on streamflow below Monks Hollow Dam resulting from those releases would be the same as for the recommended plan.

Spanish Fork River from Diamond Fork confluence to Utah Lake. Expected streamflow patterns of the Spanish Fork River resulting from operation of this alternative are the same as for the recommended plan (Tables 24 and 25).

Sixth Water Pumped Storage Alternative

This alternative plan would also facilitate the average annual transbasin diversion of 198,400 acre-feet of water from the Colorado River Basin. The features necessary for maintaining the diversion are the same as the recommended plan but vary only in size and purpose.

The operational releases from storage reservoirs to existing stream courses in the Diamond Fork drainage and the Spanish Fork River are the same as in the recommended plan.

1964 DPR Alternative

This alternative would also maintain the 198,400-acre-foot average annual transbasin diversion of water to the Bonneville Basin from Strawberry Reservoir. Flows would be regulated by Syar, Sixth Water, and Hayes Reservoirs. Hydroelectric power would be generated as the water is conveyed in succession through Syar, Sixth Water, and Dyne Powerplants. The streamflow patterns of First, Second, Third, Fourth, and Fifth Water Creeks and upper Diamond Fork above Three Forks would remain unchanged under project operating conditions.
CHAPTER IV

AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

Sixth Water Creek.—The features to be constructed on Sixth Water Creek in this plan and the effects which would be incurred to the streamflow are the same as in the recommended plan.

Diamond Fork from Three Forks to the confluence of Spanish Fork River.—Part of the power system water would be conveyed by the Wasatch Aqueduct from Dyne Powerplant. The remaining flows would be released to Diamond Fork.

Daily flows through Dyne Powerplant would be in the 200- to 600-cfs range. Up to 325 cfs of this flow would be diverted into the Wasatch Aqueduct. As a result, the remaining flows in the 5-mile reach of Diamond Fork above Hayes Reservoir would have an average daily flow between 80 and 400 cfs.

Hayes Dam and Reservoir would be constructed approximately 0.5 mile above the Spanish Fork River confluence. At the normal water surface elevation of 5,150 feet, the total reservoir storage capacity is estimated to be 51,500 acre-feet.

Spanish Fork River from the Diamond Fork confluence to Utah Lake.—Releases from Hayes Reservoir during the summer months would follow irrigation demands and would not be drastically different from flows which have occurred historically. Average monthly flows in the Spanish Fork River under project conditions are estimated to be the same as those given for the recommended plan (Tables 24 and 25).

No Power Alternative

To facilitate the average annual transbasin diversion of 198,400 acre-feet of water to the Bonneville Basin, including 137,400 acre-feet of project water and 61,000 acre-feet of existing Strawberry Valley Project water, a new tunnel and pipeline would be constructed from Strawberry Reservoir to the confluence of Diamond Fork and the Spanish Fork River.

Sixth Water Creek and Diamond Fork above the confluence of the Spanish Fork River.—Operation of the system under this alternative would affect streamflows in Sixth Water Creek, Diamond Fork, and the Spanish Fork River. The tunnel would have a maximum discharge capacity of 875 cfs to deliver peak irrigation, municipal, and industrial water supplies. Daily flows through the tunnel would be in the 200- to 600-cfs range. Up to 400 cfs of project water would be diverted into a pipeline located at the tunnel outlet portal in Sixth Water Canyon. An estimated 4 to 5 cfs of seepage would continue to flow from the existing Strawberry Tunnel to Sixth Water Creek above the proposed tunnel outlet portal. Below the outlet portal, Sixth Water Creek and Diamond Fork would continue to carry existing irrigation flows during the summer months, while the project water would be conveyed through the pipeline to the mouth of Diamond Fork.
Spanish Fork River from the Diamond Fork confluence to Utah Lake.—

Under the I&D System, the 400-cfs pipeline conveying project water from Strawberry Reservoir would be reduced in size near the confluence and would deliver up to 325 cfs. The remaining flow would be diverted into the Spanish Fork River. The flow regimes that would exist in the river would be the same as for the recommended plan (Tables 24 and 25).

**Water quality**

**EXISTING CONDITIONS**

A significant amount of data on water quality, hydrology, and climate have been collected in Diamond Fork, Spanish Fork, Strawberry Valley, and along the Strawberry Aqueduct to enable Reclamation to determine baseline or present conditions and to project future conditions and project impacts. The following discussion is a summary of these water quality studies. Some water quality values (figures) have been updated from the DES due to the analysis of additional data collected. Supporting data including methodology are available at Reclamation's Utah Projects Office in Provo, Utah.

**Diamond Fork-Spanish Fork River System**

The Spanish Fork River and Diamond Fork, from the mouth of Spanish Fork Canyon to their headwaters, are classified by the Utah State Division of Health as Class 3A (protected for instream use by beneficial cold water species of aquatic wildlife) and Class 4 (protected for agricultural uses including irrigation of crops and stockwatering). Some stream segments may need to be upgraded to Class 1C (protected for domestic use by State-approved complete treatment processes) if the water is to be treated for domestic use in the future. Water quality in these stream sections is generally good, but sediment and turbidity levels are elevated during periods of spring runoff and irrigation releases.

The Spanish Fork River from Utah Lake to the mouth of Spanish Fork Canyon is classified by the State as 3B (protected for instream use by warm water game fish and other warm water aquatic life), 3D (protected for waterfowl, shorebirds, and other water-oriented wildlife), and Class 4.

Historical releases of imported Strawberry Reservoir water into the Diamond Fork system have resulted in a higher than normal transport of sediment through Diamond Fork. Concerns have been expressed by the Forest Service that the present high turbidity levels are causing significant impacts to the water resource. The high sediment load results from natural erosion as well as some bank sloughing during the spring runoff period and during high releases from the Strawberry Tunnel. Natural erosion in side channels and on steeper hillsides occurs during periods of snowmelt and thunderstorms. As a result of these conditions, sediment concentrations are low from September through February and considerably higher from March through August, but decreasing toward the end of the irrigation season.
Table 26 is a summary of selected water quality parameters from recent stream and reservoir monitoring activities.

<table>
<thead>
<tr>
<th>Sampling site</th>
<th>Total dissolved solids (mg/L)</th>
<th>Total alkalinity (mg/L)</th>
<th>Summer maximum temperature (°C)</th>
<th>Dissolved oxygen (mg/L)</th>
<th>Total phosphorus (mg/L)</th>
<th>Total Kjeldahl nitrogen (mg/L)</th>
<th>Inorganic nitrogen (mg/L)</th>
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<tbody>
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<td>Diamond Fork</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Above Three Forks</td>
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<td>181</td>
<td>9</td>
<td>0.085</td>
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<tr>
<td>At Monks Hollow</td>
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<td>167</td>
<td>21</td>
<td>.101</td>
<td>.50</td>
<td>.122</td>
<td></td>
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<tr>
<td>At mouth</td>
<td>262</td>
<td>191</td>
<td>22</td>
<td>.124</td>
<td>.46</td>
<td>.102</td>
<td></td>
</tr>
<tr>
<td>Sixth Water</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>At Three Forks</td>
<td>215</td>
<td>175</td>
<td>21</td>
<td>0.090</td>
<td>.48</td>
<td>.073</td>
<td></td>
</tr>
<tr>
<td>Spanish Fork River</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>At Castilla</td>
<td>290</td>
<td>200</td>
<td>21.4</td>
<td>.150</td>
<td>.62</td>
<td>.143</td>
<td></td>
</tr>
<tr>
<td>At mouth</td>
<td>655</td>
<td>273</td>
<td>28</td>
<td>.141</td>
<td>.20</td>
<td>.50</td>
<td></td>
</tr>
<tr>
<td>Strawberry Reservoir</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Above thermocline</td>
<td>170</td>
<td>130</td>
<td>19</td>
<td>.032</td>
<td>0.05-.40</td>
<td>0.2</td>
<td>0.05-.86</td>
</tr>
<tr>
<td>Below thermocline</td>
<td>8</td>
<td>0-3</td>
<td>6-10</td>
<td>.144</td>
<td>0.23</td>
<td>0.13</td>
<td>0.26</td>
</tr>
<tr>
<td>Strawberry tributaries</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strawberry River</td>
<td>146</td>
<td>109</td>
<td>26</td>
<td>.129</td>
<td>.53</td>
<td>.223</td>
<td></td>
</tr>
<tr>
<td>Indian Creek Canal</td>
<td>285</td>
<td>235</td>
<td>20</td>
<td>.044</td>
<td>.26</td>
<td>.171</td>
<td></td>
</tr>
<tr>
<td>Rock Creek</td>
<td>31</td>
<td>12</td>
<td>17</td>
<td>.013</td>
<td>.47</td>
<td>.104</td>
<td></td>
</tr>
<tr>
<td>West Fork Duchesne River</td>
<td>197</td>
<td>155</td>
<td>18</td>
<td>.036</td>
<td>.33</td>
<td>.121</td>
<td></td>
</tr>
<tr>
<td>Current Creek</td>
<td>212</td>
<td>163</td>
<td>18</td>
<td>.084</td>
<td>.49</td>
<td>.112</td>
<td></td>
</tr>
</tbody>
</table>

1/ Flow-weighted averages, unless noted otherwise.
2/ Arithmetic average.

Sixth Water Creek from Strawberry Tunnel Outlet Portal to the Diamond Fork confluence.—Because large flows are released from Strawberry Reservoir through the Strawberry Tunnel to Sixth Water Creek during the irrigation season (May through October), the water quality of the Strawberry releases dominates the water quality of the stream. The water released from Strawberry Reservoir has better water quality than existing water in Diamond Fork, except for nutrients and dissolved oxygen. High nutrient concentrations occur periodically from midsummer to fall overturn due to releases from the lower portion (below the thermocline) of Strawberry Reservoir. These waters are frequently anoxic and seasonally contain high nutrient concentrations.

This stream segment is presently under severe environmental stress from the extreme flow fluctuations. These extreme flow levels have altered the natural flow regime and have resulted in bank and riverbed erosion and removal of most of the silt-sand-gravel substrates required by many species of aquatic organisms. In the upper 3 miles of the segment, the channel is characterized by a well armored bottom and reaches of unstable banks with considerable sloughing. Below this reach, the streambed material gradually becomes finer.

A significant sediment load originates within the Sixth Water Creek drainage. One source of fine sediments is a landslide area upstream from Rays Valley which has been accelerated by undercutting of the toe of the slide area by releases from the tunnel.

Fifth Water Creek, a tributary to Sixth Water Creek, has relatively high levels of total dissolved solids (TDS) and chemical oxygen demand (COD) from a series of hot sulfur springs that enter the stream beginning...
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about 2 1/4 miles above the mouth. The major spring area is located about 1 1/4 miles above the mouth. The turbulent character of the stream precludes any serious dissolved oxygen deficiency. The biotic communities below the springs have adapted to tolerate the hot sulfur spring waters and are unique to that habitat.

Diamond Fork to Spanish Fork River confluence.—Diamond Fork above Three Forks also has numerous small thermal sulfur (mineral) springs; however, they do not appear to dominate the quality of the stream. The stream is in relatively good condition, partly as a result of Forest Service grazing control programs over the past 10 to 15 years. This upper section of Diamond Fork functions as a tributary to Sixth Water because of the dominant flows released from Strawberry Reservoir through Sixth Water Creek.

The remainder of the discussion in this section refers to Diamond Fork between Three Forks and its confluence with the Spanish Fork River. This stream segment has relatively high levels of TDS, biochemical oxygen demand (BOD), and nitrates and is also subject to extreme flow fluctuations as a result of Strawberry Tunnel releases. Because of rapid aeration in the stream, the high BOD level does not cause a problem. Channel banks become more stable here than in Sixth Water Creek, but erosion does occur wherever the bankside vegetation is insufficient, such as areas adjacent to the campground above the national forest boundary and downstream agricultural lands. Throughout this stream segment, the streambed material becomes progressively finer, with more sand and gravel near the mouth.

The present sediment load passing the proposed Monks Hollow Dam site as well as the mouth of Diamond Fork are given in the tabulation below. These loads are the result of both natural runoff and imported flows from Strawberry Reservoir under the Strawberry Valley Project. From the tabulation it can be seen that about 10,900 tons of sediment per year originate in this lower stream segment between Monks Hollow and the mouth.

<table>
<thead>
<tr>
<th>Location</th>
<th>Present sediment load (tons/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monks Hollow Dam site</td>
<td>22,500</td>
</tr>
<tr>
<td>Diamond Fork at mouth</td>
<td>33,400</td>
</tr>
</tbody>
</table>

Spanish Fork River from Diamond Fork confluence to Utah Lake.—Water quality in the Spanish Fork River to the canyon mouth downstream is fair to good and normally meets State standards. The segment is marked by high nitrate levels and prolonged high turbidity, which are in large part attributable to the releases from Strawberry Reservoir. Some of the turbidity, however, must be attributed to the natural geologic conditions in the Spanish Fork drainage itself. Grazing and livestock feed yards may contribute to the problems to some degree. TDS levels occasionally exceed 500 mg/L, but neither BOD nor coliform levels are excessive.
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The water quality in the river from the canyon mouth to Utah Lake fluctuates widely from season-to-season and deteriorates considerably in the lower reaches during certain times of the year. It experiences high TDS and nutrient levels with periodic increases in BOD and coliforms. During the summer, the water is largely diverted for irrigation; therefore, most flows in the lower reaches result from seepage, irrigation return flows, and septic tanks. Livestock and urban runoff also contribute to the pollutant load in this lower stream section. Summertime water temperatures occasionally exceed 20° C, particularly in the lower reaches.

Present Strawberry Reservoir

Strawberry Reservoir, the source of the water supply for the Diamond Fork Power System, has good water quality seasonally with the exception of high nutrient concentrations and resultant eutrophication. All other constituents (TDS, cations, anions, metals, pesticides, etc.) are low.

Because of the large volumes of water that would be released from Strawberry Reservoir into the Diamond Fork Power System, the quality of the released waters would largely determine the water quality in the Diamond Fork-Spanish Fork River System, just as it does at the present time. In turn, the quality of water released from Strawberry Reservoir will be determined by future conditions in the reservoir, the season of the year, and the location of the thermocline in relation to the Syar Tunnel inlet. A description of the dynamics and conditions in both the present and future enlarged Strawberry Reservoir will aid in understanding the potential conditions and impacts in the Diamond Fork System.

Strawberry Reservoir is a eutrophic system due to the relatively high nutrient loading, which occurs mainly from the extensive cattle grazing and erosion, and recreation activities in the watershed. The reservoir stratifies in both summer and winter and experiences frequent algae blooms in the bay areas. The composition of the bloom varies from diatoms to blue-greens, depending on the season and nutrient levels, and temperature. The excess of nutrients fertilizes the surface waters at both fall and spring overturn. As a result of these eutrophic conditions and the resulting low dissolved oxygen levels, the reservoir experiences periodic localized fish kills in late summer and kills are likely to occur during periods of extensive winter ice cover.

Strawberry Reservoir is experiencing increasing eutrophication problems from increasing use within the watershed. Reclamation has completed a watershed management study and is currently developing a land use management plan which should help control these eutrophication problems.

Strawberry Reservoir normally freezes over during December and remains frozen through the first part of May. The reservoir normally starts to stratify the first part of June. By the latter part of June, a definite thermocline has developed at about 7 to 8 meters. The oxygen below the thermocline in the reservoir has been depleted by the middle
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to latter part of July. Fall overturn normally occurs between September 1 and 20.

During summer stratification, the average water temperatures of the upper portion (above thermocline) of the reservoir vary from about 6° to 10° C in May to a maximum of about 18° to 19° C in late July-early August. Water temperatures in the lower portion (below the thermocline) of the reservoir vary from about 5° C in May to about 7° to 10° C in late August. Dissolved oxygen and phosphorus (total) levels during this same period are shown below.

<table>
<thead>
<tr>
<th>Location</th>
<th>Dissolved oxygen (mg/L)</th>
<th>Total phosphorus (mg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Above thermocline</td>
<td>6-10</td>
<td>0.030</td>
</tr>
<tr>
<td>Below thermocline</td>
<td>0-3</td>
<td>.157</td>
</tr>
<tr>
<td>Entire reservoir (if mixed)</td>
<td></td>
<td>.045</td>
</tr>
</tbody>
</table>

The present estimated phosphorus load to Strawberry Reservoir is 8,933 kilograms per year (Table 27). This represents an average inflow concentration of 0.096 mg/L (total phosphorus) and an average nutrient loading of 0.354 gram per square meter of surface area per year. Water quality studies of Strawberry Reservoir indicate the reservoir is even more eutrophic than the phosphorus loading models show. This may be due to the high efficiency of internal phosphorus recycling, heavy recreational use, bank instability, erosion, silt loading, and septic tank leaching; however, these sources are not entirely measured in the stream monitoring program.

As part of the watershed management study for Strawberry Reservoir referred to previously, it has been determined that reductions in biologically available phosphorus inflows from septic tanks, livestock grazing, and areas of excessive erosion may be feasible. Phosphorus release rates from sediments in the reservoir have been determined recently at the Utah Water Research Laboratory, Messer et al. (in preparation). These studies indicate that phosphorus release rates are low compared to other Utah reservoirs. In addition, the Strawberry Reservoir sediments are poor phosphorus binders. Any phosphorus released from decaying phytoplankton (algae) is probably rapidly reutilized biologically. Very little bioavailable phosphorus is stored in the sediments, and little will be released in response to a reduction of external sources; consequently, internal phosphorus loading from reservoir sediments is not likely to delay the trophic response of Strawberry, as it has in many lake restoration projects.

Algal assays conducted on Strawberry River and Indian Creek Canal during spring runoff indicate that phosphorus is the limiting nutrient. Reservoir samples indicated that, at times (November and February), nitrogen is the limiting nutrient and, at other times (at spring and fall turnover), both nitrogen and phosphorus seemed jointly limiting. Low nitrogen levels probably encourage the selective growth of the noxious
### Table 27

Mean inflow and phosphorus loading to Strawberry Reservoir 1/

<table>
<thead>
<tr>
<th>Tributaries</th>
<th>Mean inflow (acre-feet per year)</th>
<th>Total phosphorus</th>
<th>Ortho phosphate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rock Creek</td>
<td>79,900</td>
<td>0.013</td>
<td>1,235</td>
</tr>
<tr>
<td>Hades Creek</td>
<td>4,800</td>
<td>0.18</td>
<td>109</td>
</tr>
<tr>
<td>Wolf Creek</td>
<td>4,800</td>
<td>0.065</td>
<td>385</td>
</tr>
<tr>
<td>West Fork Duchessee River</td>
<td>22,900</td>
<td>0.036</td>
<td>1,010</td>
</tr>
<tr>
<td>Current Creek</td>
<td>15,800</td>
<td>0.084</td>
<td>1,645</td>
</tr>
<tr>
<td>Layout Creek</td>
<td>1,300</td>
<td>0.20</td>
<td>33</td>
</tr>
<tr>
<td>Water Hollow Creek</td>
<td>2,900</td>
<td>0.32</td>
<td>114</td>
</tr>
<tr>
<td>Strawberry River (new) 2/</td>
<td>19,500</td>
<td>(.070)2/</td>
<td>(1,680)</td>
</tr>
<tr>
<td>Strawberry River</td>
<td>19,810</td>
<td>.129</td>
<td>3,154</td>
</tr>
<tr>
<td>Co-op Creek</td>
<td>14,500</td>
<td>.174</td>
<td>3,113</td>
</tr>
<tr>
<td>Clyde Creek</td>
<td>2,420</td>
<td>.052</td>
<td>156</td>
</tr>
<tr>
<td>Mud Creek</td>
<td>3,090</td>
<td>.095</td>
<td>360</td>
</tr>
<tr>
<td>Bryant's Fork</td>
<td>2,155</td>
<td>.036</td>
<td>95</td>
</tr>
<tr>
<td>Indian Creek Canal</td>
<td>14,620</td>
<td>.044</td>
<td>787</td>
</tr>
<tr>
<td>Sage Creek</td>
<td>1,000</td>
<td>.097</td>
<td>120</td>
</tr>
<tr>
<td>Coal Creek</td>
<td>1,125</td>
<td>.082</td>
<td>114</td>
</tr>
<tr>
<td>Cow Hollow Creek</td>
<td>1,830</td>
<td>.069</td>
<td>155</td>
</tr>
<tr>
<td>Trout Creek</td>
<td>2,060</td>
<td>.028</td>
<td>72</td>
</tr>
<tr>
<td>Chicken Creek</td>
<td>1,160</td>
<td>.044</td>
<td>62</td>
</tr>
<tr>
<td>Surface runoff</td>
<td>1,930</td>
<td>(.070)2/</td>
<td>(170)</td>
</tr>
<tr>
<td>Precipitation</td>
<td>10,100</td>
<td>.010</td>
<td>125</td>
</tr>
<tr>
<td>Other 4/</td>
<td>450(+190)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>75,800</td>
<td>(.096)2/</td>
<td>8,933</td>
</tr>
<tr>
<td>Present Strawberry</td>
<td>227,700</td>
<td>(.055)3/</td>
<td>15,334</td>
</tr>
</tbody>
</table>

1/ Based on an arithmetic monthly average phosphorus concentration, flow weighted by month.

2/ This is the water originating between the old Strawberry Dam and the new Soldier Creek Dam and presently flowing into the new portion of the reservoir.

3/ Concentration is an estimate from the Mountainland Association of Governments 208 study.

4/ Includes estimates for recreation, fishing, etc.

5/ Weighted mean.
blue-green algae, which are nitrogen fixers, during late summer. Any restoration programs for Strawberry Reservoir would, therefore, have to be based on phosphorus reduction rather than nitrogen.

Future Enlarged Strawberry Reservoir

Under completed Bonneville Unit conditions, the increased inflows to the enlarged Strawberry Reservoir and the modified reservoir operation will affect water quality conditions within the reservoir as well as downstream. Increasing the inflow to Strawberry Reservoir from approximately 75,000 acre-feet/year at present with an additional 150,000 acre-feet/year, most of it high quality water from the Uinta Mountains, will dilute the high nutrient concentrations and should improve the present eutrophication problems to some extent. The long-term increase in water surface fluctuation would also affect the dissolved oxygen levels, water temperature, location of the thermocline, and length of stratification.

After analyzing the existing data on Strawberry Reservoir, the predicted impact of the enlarged reservoir, and the modeling efforts, the following approach was used to project temperature of water released into the Diamond Fork system.

1. The average expected temperature of water above and below the thermocline in the enlarged reservoir was plotted for the May to October period (Figure 24).

2. On a monthly basis, the depth from the water surface to the top and bottom of the thermocline was estimated.

3. Based on the 1921-73 monthly operation study of the enlarged Strawberry Reservoir, the location of the thermocline relative to Syar Tunnel inlet was projected on a monthly basis. It is estimated that water released from Strawberry Reservoir during the summer stratification period of June-September would come from above the thermocline about 5 to 15 percent of the time, from below the thermocline about 60 to 80 percent of the time, and from somewhere in between the remainder of the time. The enlarged Strawberry Reservoir would be a long-term carryover reservoir, and the surface elevation fluctuation in any 1-year period would be relatively small. As a result, during most summer stratification periods water would come from either above or below the thermocline all season but not from both. During about 10 to 20 percent of the years (or 5 to 11 years out of 53 years), waters could be released from below the thermocline the first part of the summer. As the thermocline deepened and the surface elevation dropped, waters could potentially be released from within and above the thermocline during the latter part of the summer.
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ENLARGED STRAWBERRY RESERVOIR PROJECTED WATER TEMPERATURES

Above Thermocline

Below Thermocline

FIGURE 2A
4. Two extreme (worst case) temperature scenarios used to evaluate impacts on the Diamond Fork system were (1) when waters released from Strawberry Reservoir would come from above the thermocline during the entire summer stratification period and (2) when waters released would come from below the thermocline during the entire summer stratification period.

Waters withdrawn from the enlarged Strawberry Reservoir above the thermocline (warmer upper layer) during summer stratification are projected to vary in temperature from about 5° to 10° C in May up to a maximum of about 18° to 19° C in late July-early August (Figure 24). Dissolved oxygen levels of this water would range between about 6 to 10 mg/L. Nutrient concentrations would be relatively low compared to levels which would occur below the thermocline.

In contrast, waters withdrawn from below the thermocline (colder bottom layer) during the same period are projected to vary in temperature from about 5° to 6° C in May to about 7° to 10° C in late August. Dissolved oxygen levels would probably range between about 0 and 3 mg/L. Nutrient concentrations could approach 3 to 10 times the level in the upper layer of the reservoir.

To project nutrient loading into the Diamond Fork system it was first necessary to project future phosphorus concentrations in the enlarged Strawberry Reservoir. The average tributary inflow concentration of total phosphorus into the enlarged reservoir is projected to be about 0.055 mg/L (Table 27). This should reduce present concentrations approximately 35 percent. Projected phosphorus concentrations are shown below.

<table>
<thead>
<tr>
<th>Location</th>
<th>Total phosphorus (mg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Above thermocline</td>
<td>0.021</td>
</tr>
<tr>
<td>Below thermocline</td>
<td>0.095</td>
</tr>
<tr>
<td>Entire reservoir (if mixed)</td>
<td>0.030</td>
</tr>
</tbody>
</table>

The enlarged reservoir would also be classified as eutrophic, according to the loading models, but would be less productive than the existing reservoir. The main portion of the reservoir, particularly the shallow bays, would probably remain eutrophic. The lower portion, between the old and new dams, would probably be of better quality and would tend to be a mesotrophic system. The effects of a range of nutrient loadings, including these projected concentrations, were evaluated in the Diamond Fork system.

The Strawberry Valley Project Land Use Management Plan will recommend measures to reduce phosphorus loading by about 4,000 kilograms per
year. If this program is effectively implemented in the future, nutrient loadings into the Diamond Fork system would be lowered and eutrophy conditions would be better than described below under "Environmental Impacts."

Present and projected levels of TDS in the Diamond Fork system are not high enough to be of major concern in either Strawberry Reservoir or the Diamond Fork system. The addition of high quality water from the Strawberry Aqueduct would reduce the present average TDS levels by approximately 20 to 25 percent.

ENVIRONMENTAL IMPACTS

The water quality parameters of significant concern in the Diamond Fork-Spanish Fork River System which may be impacted by the project are water temperatures, dissolved oxygen, nutrients, and suspended solids. These are of concern in the streams as well as in the proposed reservoirs. Other water quality elements are suitable for the intended uses of the water and would not be significantly impacted by the project.

Before construction was initiated on the Strawberry Tunnel inlet rehabilitation (the inlet to the proposed Syar Tunnel), the need for a selective withdrawal inlet tower in Strawberry Reservoir was evaluated. A multilevel outlet would add flexibility in controlling water quality in the Diamond Fork Power System. Strawberry Reservoir, however, would benefit from withdrawing the deeper waters. An effort to improve water quality in the Diamond Fork System might result in water quality tradeoffs in the Strawberry Reservoir. If water quality problems occur, they could be dealt with better in the Diamond Fork system than in Strawberry Reservoir. For example, if low dissolved oxygen levels should occur below project reservoirs, baffles or mixers could be installed to aerate the stream more rapidly. Based on these factors, a multilevel outlet in Strawberry Reservoir is not included in the plan for the Diamond Fork Power System.

The release pattern of water from Strawberry Reservoir into the Diamond Fork Power System varies depending on the alternative selected. The water temperature, dissolved oxygen, and nutrient concentrations of the released water would vary seasonally but can be estimated based on water surface elevation, length of stratification, and location of the thermocline relative to the Syar Tunnel inlet.

Studies by Reclamation indicate that none of the reservoirs are expected to strongly stratify. Hayes Reservoir, under the 1964 DPR Alternative, would have the greatest tendency to stratify. Monks Hollow Reservoir, under the various alternatives, would weakly stratify. In addition, the reservoirs should not experience significant density currents, except for Hayes and Monks Hollow Reservoirs which would have mild stratification.
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Temperature computer models were applied to the Fifth Water Pumped Storage Alternative for the DES. The results of that modeling, water quality data from nearby reservoirs, and professional judgment were used to extrapolate for the other alternatives. For the FEIS, additional hand calculations were performed on proposed reservoirs, and experience and professional judgment were also used to project future temperatures. Because of the inherent problems (assumptions and long-term data required, etc.) of applying the temperature models and because of the complexity of the system (the future Strawberry Aqueduct and the enlarged Strawberry Reservoir as input to three proposed Diamond Fork Reservoirs in series), Reclamation is confident that the temperature projections for the recommended Sixth Water Flow Through Alternative, as well as for the other alternatives, are as fully supportable and as accurate as the computer temperature models. Although time and manpower restraints precluded the direct application of these models to the recommended plan, Reclamation does not believe that the possible small adjustments to temperature projections would justify the delay and expense of using the models. The temperature ranges projected for all of the alternatives would not cause significant impacts, nor have they been a major issue, and they would not affect the selection of an alternative or the design of the power system.

For each of the proposed reservoirs, empirical phosphorus models were used to project the trophic state classification and the probability of eutrophication. Methods of predicting algal dominance were also applied to each reservoir. Because the present inorganic nitrogen levels in Strawberry Reservoir are normally low, each proposed reservoir would be expected to have a summer/fall probability of dominance by blue-green algae of about 90 percent. Blue-green algae is presently dominant seasonally in Strawberry and Soldier Creek Reservoirs, which agrees with this analysis. The high hydraulic flushing rates that would occur in the proposed small (less than 5,000 acre-feet) reservoirs may induce mixing and light conditions that would preclude blue-green dominance.

The projected water quality conditions for the different reservoirs and the effects of the alternative plans on water quality in the lower Diamond Fork-Spanish Fork River are summarized in Tables 28, 29, and 30, and are discussed below.

Recommended Plan

Both Syar and Sixth Water Reservoirs would be very small, with detention times of 1 to 2 days (0.005 year), and both would be completely mixed systems. Because of the short detention times, the water in those reservoirs and the water released to Monks Hollow Reservoir is expected to be similar in quality (temperature, dissolved oxygen, and nutrients) to the water released from Strawberry Reservoir. However, anoxic waters from Strawberry Reservoir would be aerated in these mixed reservoirs as discussed below.
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Nutrient loading into Syar, Sixth Water, and Monks Hollow Reservoirs from Strawberry Reservoir would be relatively high, especially during years that waters are released from below the thermocline. All three reservoirs would be classed as eutrophic. The probability of eutrophy would be about 46 to 99 percent for both Syar and Sixth Water Reservoirs (71 percent average), and 50 to 96 percent for Monks Hollow Reservoir (66 percent average). Nutrient levels in water released from Monks Hollow Reservoir should be lower than the presently high levels in releases from Strawberry Reservoir.

Considerable effort was made to project dissolved oxygen conditions in the various reservoirs and downstream for the different alternatives, but conclusive projections were not possible. The state-of-the-art in this area is not to the point that there is adequate methodology available to reliably project dissolved oxygen conditions within each reservoir. The projections are based upon professional judgment and knowledge of conditions in other existing reservoir systems in addition to the results of the models used.

Monks Hollow Reservoir is expected to weakly stratify during project operation. Projected temperatures of water within the reservoir that would be released to Diamond Fork are tabulated on a monthly basis in Table 31. This table also gives inflow temperatures from Strawberry and Sixth Water Reservoirs.

During years that releases are from below the thermocline in Strawberry Reservoir, Syar and Sixth Water Reservoirs should warm to about 9° to 10° C and 9° to 11° C, respectively, in August-early September. Monks Hollow Reservoir should warm to about 9° to 15° C. Water released to Diamond Fork from Monks Hollow Reservoir would probably reach a maximum of 9° to 15° C. Normally, dissolved oxygen levels in Monks Hollow Reservoir should be sufficient to maintain a fishery; however, during some periods, such as when anoxic waters are released from Strawberry Reservoir or when algae blooms or calm weather periods occur, there may be locations in the reservoir where dissolved oxygen is below 5 mg/L. In these areas the worst case condition is projected in the 4 to 5 mg/L dissolved oxygen range.

During years in which warm waters are released from above the thermocline in Strawberry Reservoir, Syar Reservoir should warm up to a maximum temperature of about 17° to 20° C in August. Sixth Water Reservoir should warm up to a maximum temperature of 17° to 20° C in August. Waters released from Monks Hollow Reservoir down Diamond Fork should range from 5° to 6° C in early May to about 17° to 20° C in August. These maximum water temperatures are very similar to the present range of maximum water temperatures (17° to 21° C) in Diamond Fork at Monks Hollow. Dissolved oxygen levels should range from about 6 to 10 mg/L.

Because of the expected temperature and dissolved oxygen conditions and the large water-level fluctuations which would occur in Strawberry and Monks Hollow Reservoirs, multilevel outlets are not recommended for
## CHAPTER IV

### AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

Table 28

<table>
<thead>
<tr>
<th>Reservoir size</th>
<th>Reservoir operating condition</th>
<th>Stream condition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Maximum capacity (acre-feet)</td>
<td>Maximum reservoir temperature (°C)</td>
</tr>
<tr>
<td></td>
<td>surface area (acres)</td>
<td>surface area (feet)</td>
</tr>
<tr>
<td>Present conditions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sixth Water Flow Through</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sixth Water Reservoir</td>
<td>910</td>
<td>31</td>
</tr>
<tr>
<td>Sixth Water Reservoir</td>
<td>560</td>
<td>19</td>
</tr>
<tr>
<td>Sixth Water Reservoir</td>
<td>31,400</td>
<td>343</td>
</tr>
<tr>
<td>Fifth Water Pumped Storage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fifth Water Reservoir</td>
<td>49,700</td>
<td>330</td>
</tr>
<tr>
<td>Fifth Water Reservoir</td>
<td>31,400</td>
<td>343</td>
</tr>
<tr>
<td>Fifth Water Pumped Storage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sixth Water Reservoir</td>
<td>4,400</td>
<td>70</td>
</tr>
<tr>
<td>Sixth Water Reservoir</td>
<td>620</td>
<td>20</td>
</tr>
<tr>
<td>Sixth Water Reservoir</td>
<td>31,400</td>
<td>343</td>
</tr>
<tr>
<td>1964 DPR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Syar Reservoir</td>
<td>930</td>
<td>30</td>
</tr>
<tr>
<td>Sixth Water Reservoir</td>
<td>1,020</td>
<td>28</td>
</tr>
<tr>
<td>Hayes Reservoir</td>
<td>51,500</td>
<td>680</td>
</tr>
</tbody>
</table>

1/ Condition A is for those years when water is released from below the thermocline in Strawberry Reservoir.
2/ Condition B is for those years when water is released from above the thermocline in Strawberry Reservoir.
3/ Presently the dissolved oxygen levels in Strawberry Reservoir range from 0 to 3 mg/L below the thermocline and from 6 to 10 mg/L above the thermocline. The low range values shown in this table are expected only locally in association with the low values of the inflows from Strawberry Reservoir. The potential 2 to 5 mg/L values will not occur over the entire water column and are not expected to impact the fisheries. The dissolved oxygen levels in Fifth Water and Monks Hollow Reservoirs are not expected to be any lower than those currently found in Strawberry Reservoir.
4/ Below Sixth Water Reservoir.
CHAPTER IV

AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

Table 29
Reservoir sediment load summary

<table>
<thead>
<tr>
<th>Alternative/reservoir</th>
<th>Drainage area (square miles)</th>
<th>Annual sediment inflow (acre-feet/ year)</th>
<th>Sediment retention (percent)</th>
<th>100-year sediment deposition (acre-feet)</th>
<th>Percent of reservoir capacity (%)</th>
<th>Annual sediment release (acre-feet/ year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sixth Water Flow Through Syar</td>
<td>1/</td>
<td>17 2.3</td>
<td>15</td>
<td>30</td>
<td>5</td>
<td>2.0</td>
</tr>
<tr>
<td>Sixth Water</td>
<td>89 13.9</td>
<td>89</td>
<td>91</td>
<td>1,300</td>
<td>4</td>
<td>1.3</td>
</tr>
<tr>
<td>Monks Hollow</td>
<td>96 13.0</td>
<td>96</td>
<td>91</td>
<td>1,200</td>
<td>4</td>
<td>1.2</td>
</tr>
<tr>
<td>Fifth Water Pumped Storage Syar</td>
<td>10 1.3</td>
<td>89</td>
<td>91</td>
<td>1,300</td>
<td>4</td>
<td>1.3</td>
</tr>
<tr>
<td>Fifth Water</td>
<td>96 13.0</td>
<td>96</td>
<td>91</td>
<td>1,200</td>
<td>4</td>
<td>1.2</td>
</tr>
<tr>
<td>Monks Hollow</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sixth Water Pumped Storage Syar</td>
<td>17 2.3</td>
<td>17</td>
<td>28</td>
<td>60</td>
<td>6</td>
<td>1.7</td>
</tr>
<tr>
<td>Sixth Water</td>
<td>89 13.9</td>
<td>89</td>
<td>93</td>
<td>1,900</td>
<td>4</td>
<td>1.4</td>
</tr>
<tr>
<td>Monks Hollow</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1964 DPR</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Syar</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sixth Water</td>
<td>17 2.3</td>
<td>17</td>
<td>28</td>
<td>60</td>
<td>6</td>
<td>1.7</td>
</tr>
<tr>
<td>Hayes</td>
<td>140 20.4</td>
<td>140</td>
<td>93</td>
<td>1,900</td>
<td>4</td>
<td>1.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
1/ Insignificant.

Table 30
Stream sediment load summary

<table>
<thead>
<tr>
<th>Alternative/reservoir</th>
<th>Present sediment load (Tons)</th>
<th>Present sediment flow (Tons/year)</th>
<th>Pumped storage (Tons)</th>
<th>Pumped storage (Tons/year)</th>
<th>1964 DPR (Tons)</th>
<th>Power (Tons/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fifth Water below damsite</td>
<td>2,070 2,070</td>
<td>160 2,070</td>
<td>2,070 2,070</td>
<td>2,070</td>
<td>2,070</td>
<td>2,070</td>
</tr>
<tr>
<td>Sixth Water below damsite</td>
<td>3,660 3,180</td>
<td>3,660 3,180</td>
<td>3,660 3,180</td>
<td>2,700</td>
<td>2,700</td>
<td>2,700</td>
</tr>
<tr>
<td>Diamond Fork</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>At Monks Hollow</td>
<td>22,500 22,100</td>
<td>22,700 22,100</td>
<td>22,100 22,100</td>
<td>22,100</td>
<td>22,100</td>
<td>22,100</td>
</tr>
<tr>
<td>Below Monks Hollow Dam</td>
<td>22,500 2,070</td>
<td>1,860 2,070</td>
<td>2,070 2,070</td>
<td>22,500</td>
<td>22,500</td>
<td>22,500</td>
</tr>
<tr>
<td>At mouth</td>
<td>33,400 12,970</td>
<td>12,760 12,970</td>
<td>12,970 12,970</td>
<td>2,230</td>
<td>2,230</td>
<td>2,230</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reduction at mouth of Diamond Fork</td>
<td>61 62 93 93</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| 1/ Some increase in channel and bank erosion is expected; however, total sediment load should not increase significantly.
CHAPTER IV

AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

Table 31
Projected water temperatures for the recommended plan1/
(Unit—°C)

<table>
<thead>
<tr>
<th>Scenario/date</th>
<th>Strawberry Reservoir releases to Syar Reservoir</th>
<th>Sixth Water Reservoir releases to Monks Hollow Reservoir</th>
<th>Monks Hollow Reservoir releases to Diamond Fork</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cold scenario2/</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>May</td>
<td>5- 6</td>
<td>5- 7</td>
<td>5- 8</td>
</tr>
<tr>
<td>June</td>
<td>5- 7</td>
<td>5- 8</td>
<td>6-12</td>
</tr>
<tr>
<td>July</td>
<td>6- 8</td>
<td>7- 9</td>
<td>7- 14</td>
</tr>
<tr>
<td>August</td>
<td>7-10</td>
<td>8-11</td>
<td>9- 15</td>
</tr>
<tr>
<td>September</td>
<td>7-11</td>
<td>8-12</td>
<td>9- 15</td>
</tr>
<tr>
<td>Warm scenario3/</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>May</td>
<td>5-13</td>
<td>5-14</td>
<td>5-14</td>
</tr>
<tr>
<td>June</td>
<td>10-17</td>
<td>10-18</td>
<td>10-18</td>
</tr>
<tr>
<td>July</td>
<td>15-19</td>
<td>15-19</td>
<td>15-19</td>
</tr>
<tr>
<td>August</td>
<td>16-19</td>
<td>16-19</td>
<td>17-20</td>
</tr>
<tr>
<td>September</td>
<td>13-18</td>
<td>13-18</td>
<td>13-19</td>
</tr>
</tbody>
</table>

1/ Projections are based on temperature profiles of Strawberry, Soldier Creek, Deer Creek, and Flaming Gorge Reservoirs, with a comparative analysis of depth of withdrawal and hydraulic detention time. In addition, temperature models were run on the Fifth Water Pumped Storage Alternative. Projected temperatures of releases are based on this information and on professional engineering judgment.

2/ Temperature range expected during those years that cold waters are released from below the thermocline from Strawberry Reservoir.

3/ Temperature range expected during those years that warm waters are released from above the thermocline from Strawberry Reservoir.
CHAPTER IV AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

Syar, Sixth Water, or Monks Hollow Reservoirs. If problems should occur with temperatures or low dissolved oxygen levels in waters released down Diamond Fork once the power system is constructed and in operation, baffles or mixers could then be constructed to aerate the generally small flows. The stream should aerate rapidly within a short distance downstream (from a quarter to a half mile). If the water content of Monks Hollow Reservoir should fluctuate more than presently planned and temperature problems occur, an upper outlet or multi-level outlet could be attached to the concrete face of the dam. A monitoring program would be established to ensure satisfactory water quality.

As a result of projected low inorganic nitrogen concentrations and relatively high phosphorus concentrations expected in Syar, Sixth Water, and Monks Hollow Reservoirs, there is a 90 percent probability that nitrogen fixing blue-green algae will outcompete other forms of algae and become the dominant form in these reservoirs. However, the probability of blue-green algae being dominant seasonally in the proposed reservoirs is not an issue requiring specific control plans or mitigation measures. Blue-green algae is presently dominant seasonally in Strawberry Reservoir as indicated earlier, as well as in Deer Creek and other reservoirs in the Utah area. Algae blooms in these reservoirs, as well as any projected in the proposed reservoirs, are normally of the varieties that do not cause the water to become toxic to animals that drink it. The more hazardous algae species have been identified in nearby reservoirs, but they do not become dominant and have not created significant toxic problems. These species are not expected to cause major problems in the proposed reservoirs. The proposed water quality monitoring program would also monitor dominant algae species.

Some of the more significant factors that control algae growth and species dominance are temperature, nutrients such as phosphorus and nitrogen, and the availability of light. Phosphorus and nitrogen are not as likely to limit total algae production as light, since the lighted (euphotic) zone in the proposed reservoirs is expected to be relatively small compared to the mixed volume of water in which the algae will reside. Algae, being photosynthetic, will be limited by this reduced availability of light.

The temperature of a reservoir also affects the growth rates and physiology of the algal species. Nutrient uptake and cell growth would vary with changes in the seasonal water temperatures. Syar and Sixth Water Reservoirs are not expected to remove much phosphorus or have much algal growth because of their short detention time and complete mixing characteristics.

Even though Monks Hollow Reservoir is only expected to weakly stratify, the top several feet of water would probably warm up several degrees warmer than the rest of the reservoir on a daily basis during the warmest part of the summer. These combined conditions may result in abundant algae growth in the reservoir, particularly in the more isolated or calmer bay areas.
Monks Hollow Reservoir would probably not be any more eutrophic than the existing Strawberry Reservoir, Deer Creek Reservoir, or other similar reservoirs in the State. The relatively short detention time, along with temperature, light limitation, and drawdown characteristics would limit eutrophic problems.

Under project operation, turbidity and suspended solids levels would be significantly reduced in Diamond Fork from present conditions, particularly below Monks Hollow Reservoir. About 91 percent of the sediment inflow would be retained in that reservoir (Table 29). The total sediment load at the mouth of Diamond Fork would be reduced about 61 percent from present conditions (Table 30).

Flows in the Spanish Fork River would vary somewhat from present conditions depending on the size of the Wasatch Aqueduct of the Irrigation and Drainage System. With a 200-cfs Wasatch Aqueduct, flows in the Spanish Fork River would be periodically higher than at present from June to October. The higher flows would result in a slight increase in bank erosion in this stream reach. The total sediment load would be reduced almost the same amount as the reduction at the mouth of Diamond Fork. With a 325-cfs Wasatch Aqueduct, flows would vary from slightly above to slightly below present conditions. There would be no significant additional bank erosion.

With the alternative operation described in Chapter III (without the Wasatch Aqueduct), a more flexible release pattern would be followed. Flows in the Spanish Fork River would be higher during the summer, which would result in slightly higher bank erosion and turbidity in the upper reaches (between Diamond Fork and the canyon mouth) than for the recommended plan. The total sediment load would be increased slightly from the recommended plan but would still be a very significant reduction from present conditions. These higher summer flows would not significantly impact the lower reaches of the river.

Increased late summer and winter flows from the project would not significantly impact the water quality in the upper reaches of the Spanish Fork River. However, these increased flows would improve water quality in the lower reaches, even more than with the recommended plan, by further diluting the low flows which presently consist mostly of seepage and return flows. These water quality impacts would be essentially the same for each alternative.

Other Alternatives

Fifth Water Pumped Storage Alternative.—Both projected initial and maximum conditions of powerplant operation, as defined in Chapter III, were evaluated for this alternative. Actual operation could vary between these two conditions.

Under the initial operating condition, both Fifth Water and Monks Hollow Reservoirs may start to weakly stratify in May and June. With the
larger pumpback flows during July and August; however, both reservoirs should mix continuously during the remainder of the summer period. Under the maximum operating condition, neither reservoir should stratify. Hence, project operation under either scenario should result in similar water quality conditions in both reservoirs, as well as in the lower Diamond Fork-Spanish Fork area.

The WQRRS (U.S. Army Corps of Engineers) model was applied to each reservoir under both of the above operating conditions to predict in-reservoir and downstream water temperatures. Projected water temperatures are tabulated on a monthly basis for Monks Hollow Reservoir in Table 32. Waters released from Monks Hollow Reservoir to Diamond Fork would have these same temperatures. Water temperatures in Fifth Water Reservoir would normally be similar to those of Monks Hollow Reservoir; however, when cold waters are released from Strawberry Reservoir, temperatures may be up to 0.5° to 1.0° C colder in Fifth Water Reservoir.

Table 32
Projected water temperatures in Monks Hollow Reservoir\(^1\) (Unit=°C)

<table>
<thead>
<tr>
<th>Date</th>
<th>Initial operation temperature</th>
<th>Maximum operation temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High(^2)</td>
<td>Low(^3)</td>
</tr>
<tr>
<td>May 1</td>
<td>5-6</td>
<td>5-6</td>
</tr>
<tr>
<td>June 1</td>
<td>8-10</td>
<td>8-10</td>
</tr>
<tr>
<td>July 1</td>
<td>13-15</td>
<td>11-13</td>
</tr>
<tr>
<td>August 1</td>
<td>16-18</td>
<td>15-17</td>
</tr>
<tr>
<td>September 1</td>
<td>16-19</td>
<td>15-17</td>
</tr>
<tr>
<td>October 1</td>
<td>15-18</td>
<td>14-16</td>
</tr>
</tbody>
</table>

1/ Based on WQRRS modeling.
2/ Temperature range expected during those years that warm waters are released from above the thermocline from Strawberry Reservoir.
3/ Temperature range expected during those years that cold waters are released from below the thermocline from Strawberry Reservoir.

During years that warm waters are released from above the thermocline from Strawberry Reservoir, both reservoirs should warm up to a maximum temperature of about 17° to 19° C in August. Waters released down Diamond Fork from Monks Hollow Reservoir should range from about 5° to 6° C in early May to 17° to 19° C in August. Dissolved oxygen levels should range from about 6 to 10 mg/L.

During the years that releases are from below the thermocline in Strawberry Reservoir, Fifth Water Reservoir should warm up to about 12° to 16° C in August-early September. Monks Hollow Reservoir would be about 1° warmer. Water released down Diamond Fork would probably reach a maximum of 13° to 17° C. Dissolved oxygen levels in waters released may occasionally be low, possibly reaching 4 to 5 mg/L at times. Again, multi-level outlets are not recommended because they would have little effect and Diamond Fork would aerate rapidly.
CHAPTER IV

In both the Fifth Water and Sixth Water pumpback alternatives, the hydraulic mixing is expected to minimize temperature stabilization in the proposed peaking reservoirs. Surface warming, however, would occur similar to the recommended plan. These waters would reaerate the low dissolved oxygen inflow from Strawberry, but some local deficiencies may infrequently exist from the Strawberry inflows.

If the Fifth Water Pumped Storage Powerplant were constructed, unknown quantities of warm ground water (up to 35°C) could be intercepted. This water may contain relatively high levels (500-1,000 mg/L) of total dissolved solids and possibly hydrogen sulfide and may cause temporary warming of the stream and an increase in TDS and hydrogen sulfide. A National Pollution Discharge Elimination System (Section 402) permit would be obtained to cover each discharge of ground water, and State and Federal standards would be met as far as practical.

Methods developed to project water quality conditions such as temperatures and trophic state do not adequately address many characteristics of a large pumped storage system. Examples of significant unaddressed aspects include momentum of large flows, morphometric features, and other physical restrictions. Each of these factors would tend to reduce the growth of aquatic vegetation.

Nutrient loading into Fifth Water and Monks Hollow Reservoirs from Strawberry Reservoir would be relatively high, especially during years that waters are released from below the thermocline. Both reservoirs would be classified as eutrophic. The probability of eutrophy would average about 60 percent but could range between 40 and 90 percent in both Fifth Water and Monks Hollow Reservoirs. Algae growth and limiting factors for the reservoirs would be similar to the recommended plan.

Under project operation, turbidity and suspended solids levels would be significantly reduced in Diamond Fork from present conditions, particularly below Monks Hollow Reservoir. About 91 percent of the sediment inflow would be retained in that reservoir (Table 29). The total sediment load at the mouth of Diamond Fork would be reduced about 62 percent from present conditions (Table 30).

Sixth Water Pumped Storage Alternative.—Syar Reservoir would be about 5 times as large as under the recommended plan. Detention time would be correspondingly longer (about 2 to 7 days). Sixth Water Reservoir would be slightly larger, with a detention time of about a day. Water in both reservoirs would be completely mixed and would have eutrophic nutrient loadings (probability of eutrophy of 66 to 97 percent for Syar and 74 to 98 percent for Sixth Water). Water in both Syar and Sixth Water Reservoirs and that released to Monks Hollow Reservoir would be almost the same quality (temperatures, dissolved oxygen, and nutrient levels) as that released from Strawberry Reservoir. However, some aeration would occur. Algae growth probably would not be excessive in either reservoir because of high flushing rates and colder water temperatures at times.
Monks Hollow Reservoir would probably also mix continuously. The probability of eutrophy would be about 65 to 95 percent. Its capacity, detention time, dissolved oxygen, and water temperatures would be the same as in the recommended plan. Algae growth would be about the same as in the recommended plan.

Monks Hollow Reservoir would retain about 91 percent of the sediment inflow (Table 29), a significant reduction from present levels. The sediment load at the mouth of Diamond Fork would be reduced about 61 percent.

1964 DPR Alternative.—Both Syar and Sixth Water Reservoirs would have conditions almost identical to those of the recommended plan. Both would mix thoroughly, have high nutrient loadings, high flushing rates, and periodically colder waters from Strawberry Reservoir.

Diamond Fork between Three Forks and Hayes Reservoir would experience large daily fluctuations in flows. Total annual flows would be increased over present conditions. Some increase in channel and bank erosion is expected; however, total sediment load and turbidity levels should not increase significantly.

Water released to Diamond Fork at Three Forks would be very similar in quality to water released from Strawberry Reservoir. During years that water would be released from below the thermocline in Strawberry, these temperatures would be relatively cold, reaching a maximum of 9° to 11° C in late summer.

The combination of wide streamflow fluctuations, increased sediment/turbidity problems, and colder water temperatures would result in significant adverse impacts on this stream section.

Hayes Reservoir would probably mildly stratify and would probably be a eutrophic system. The probability of eutrophy would be about 60 to 90 percent. The reservoir would experience algae blooms, but they would not be as extensive as those of Strawberry Reservoir because of potential light limitation resulting from turbidity and mixing, water-level fluctuations, and reduced reservoir stability. Water released downstream would be cool, reaching about 9° to 15° C by late summer, and could have low oxygen levels, unless multi-level outlets were installed.

Sediment inflow to Hayes Reservoir would be a result of project flows released from Dyne Powerplant into Diamond Fork and natural flows. Hayes Reservoir would retain about 93 percent of the sediment inflow (Table 29) which would reduce the sediment load to the Spanish Fork River by about 93 percent (Table 30). This reduction would improve turbidity and suspended solids conditions in the Spanish Fork River more than the other alternatives. Diamond Fork, however, would benefit much more than the Spanish Fork River for any given reduction in sediment load.
CHAPTER IV AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

No Power Alternative.—During the irrigation season, flows in Sixth Water Creek and Diamond Fork would be reduced from present conditions whenever excess pipeline capacity is available for Strawberry Project water. During these periods, turbidity and suspended solids levels would be reduced somewhat. Other water quality parameters would not change significantly except for temperatures and, occasionally, dissolved oxygen. During the years that cold waters are released from below the thermocline in the enlarged Strawberry Reservoir, waters released to Sixth Water Creek would only warm up to about 7° to 10° C and oxygen levels may be low. The present Strawberry Tunnel releases warm up to 17° to 19° C normally. No aeration would occur in the pressurized Syar Tunnel, so the 0- to 3-mg/L dissolved oxygen waters released from Strawberry would also be released into Sixth Water Creek. Because of the turbulent nature of the stream, however, Sixth Water Creek should aerate rapidly.

Water quality conditions in the Spanish Fork River under this alternative, as well as the other alternatives, would be essentially the same as those described for the recommended plan.

Fish and Wildlife

EXISTING CONDITIONS

Fish

General

High water velocities resulting from high irrigation flows (up to 500 cfs) for the Strawberry Valley Project have greatly altered the characteristics of Sixth Water Creek and Diamond Fork from stable, narrow, meandering channels with good fish habitat to unstable, wide, and straightened channels with degraded fish habitat. The Spanish Fork River is the largest river in the system. Its fishery habitat is adversely affected by several major diversions along its course to Utah Lake. This stream is naturally turbid for much of the year, but this condition has been compounded by large amounts of sediment from Sixth Water and Diamond Fork.

Despite the limitation of available habitat, Sixth Water Creek and Diamond Fork provide a valuable trout fishery during the nonirrigation season, when only natural flows are present. The Utah Division of Wildlife Resources (UDWR) annually stocks the system with rainbow trout. Brown trout have been stocked in the past and self-sustaining populations have developed. Large cutthroat and rainbow trout commonly enter the system through Strawberry Tunnel. Cutthroat trout are native to the system but rely mainly on side tributaries and Diamond Fork above Three Forks for spawning and rearing habitat. Along with the cutthroat trout from Strawberry Reservoir, they probably exist as migrants in Diamond Fork and Sixth Water Creek. The Spanish Fork River supports a limited trout fishery.
Fifth Water Creek supports a native cutthroat trout fishery, limited mainly by the stream's small size and poor water quality. Individuals in the population are pure-strain Bonneville cutthroat, the only native trout in the Bonneville Basin, once believed extinct. Recent genetic evaluations have shown that the Fifth Water population does not qualify as a pure population; however, some individuals collected were pure-strain specimens.

The Diamond Fork stream system was studied by the UDWR in 1975 and 1976. Each stream was divided into specific reaches according to physical characteristics of the stream channel as caused by different flow levels, gradient, and geology, among others. The entire stream system and associated reaches are depicted in Figure 25.

Spanish Fork River

From its confluence with Diamond Fork, the Spanish Fork River flows approximately 20 miles into Utah Lake. (Data on trout sampling, trout population estimates, and angler use are presented in Tables 33 and 34.) Habitat units were developed using the Binns and Eiserman method.11 The reach immediately above the lake is deep and slow moving. Sand and silt comprise the stream bottom, and much of the bank is unstable. This instability, plus upstream erosion, renders the section constantly turbid. During the irrigation season, severe dewatering occurs, resulting in stagnation in many areas. Many lake fish species use this portion of the river. The primary sport fishery consists of black bullhead, white bass, and channel catfish. During early spring, walleye move up the river to spawn. The degree of spawning success is unknown.

The remainder of the river consists of a variety of habitats affected by high flows, erosion, and diversions. Habitat quality generally declines below Spanish Fork Canyon. Sand and silt are abundant substrates. Some of the available gravel areas become covered with silt. Low gradient and stream meanders result in reduced current velocities favoring development of many pools with poor to fair quality for use by fish.

The predominance of limited quality trout habitat restricts production of large numbers of these fish. Cutthroat trout are present in low numbers but are in good condition. Macroinvertebrate food organisms are abundant enough for good fish growth and consist of a significant proportion of silt-tolerant forms. The UDWR has classified this portion of river as Class VI for the lower 14 miles and Class III for the 6-mile segment immediately below the confluence with Diamond Fork.1/
### Table 33
Trout sampled from the Spanish Fork River (1975)

<table>
<thead>
<tr>
<th>Stream reach</th>
<th>Length of stream sampled (feet)</th>
<th>Brown trout</th>
<th>Cutthroat trout</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. From Utah Lake upstream to the end of Utah Lake backwater</td>
<td>No sample</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. From backwater of Utah Lake upstream to powerhouse return flow point (11.7 miles)</td>
<td>1,320</td>
<td>25</td>
<td>83</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10.6</td>
<td>92</td>
</tr>
<tr>
<td>3. From powerhouse return flow point upstream to the East Bench Canal diversion (2.8 miles)</td>
<td>1,320</td>
<td>162</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td></td>
<td>12.8</td>
<td>100</td>
</tr>
<tr>
<td>4. From the East Bench Canal diversion upstream to the Spanish Fork Diversion Dam (1.6 miles)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. From the Mapleton-Highline Canal diversion upstream to the Diamond Fork confluence (4.2 miles)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1/ No viable fishery because of low winter flows.

### Table 34
Trout fisheries data estimated for the Spanish Fork River below its confluence with Diamond Fork (1981)

<table>
<thead>
<tr>
<th>Stream reach</th>
<th>Wild trout</th>
<th>Stocked trout</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Standing crop (lb/reach)</td>
<td>Habitat units</td>
</tr>
<tr>
<td>1. From Utah Lake upstream to the end of Utah Lake backwater</td>
<td>No sample</td>
<td>No sample</td>
</tr>
<tr>
<td>2. From backwater of Utah Lake upstream to the powerhouse return flow point</td>
<td>25</td>
<td>50</td>
</tr>
<tr>
<td>3. From powerhouse return flow point upstream to the East Bench Canal diversion</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>4. From the East Bench Canal Diversion upstream to the Spanish Fork Diversion Dam</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>5. From the Spanish Fork Diversion Dam upstream to the Diamond Fork confluence</td>
<td>215</td>
<td>215</td>
</tr>
</tbody>
</table>

Total 252 277 183 0 0

1/ All wild trout values for reaches 2 to 4 have been revised to reflect comments received on the Draft Environmental Statement and refinements in the analysis.
CHAPTER IV

DIAMOND FORK

The reach of Diamond Fork from the confluence with Sixth Water to the Spanish Fork River is approximately 10 miles long. The lower half of this section is bordered by private agricultural lands, and bank cover for fish is limited. The upper half is national forest and is characterized by a fairly high gradient, narrow channel, closely bordered by steep mountains and canyon walls. Nearly all of the banks in both areas are unstable, and considerable channel scouring has degraded fish habitat. Because this reach has a lower gradient and wider channel than Sixth Water Creek, water velocities during the irrigation season are lower than in Sixth Water, thereby creating more favorable fish habitat and, therefore, greater fish production. During periods of reduced flow, however, water often splits into braided channels with lower fishery value. Most of the bottom substrate is rubble and gravel, with the lower Diamond Fork containing some of the best brown trout spawning habitat in the entire drainage. Fish sampling data, standing crop, and habitat quality, as well as angler use under existing conditions are presented in Tables 35 and 36.

Despite channel deterioration and extreme flows, this reach of Diamond Fork supports a good population of trout, with brown trout comprising about 75 percent by numbers. Cutthroat and rainbow trout make up the remainder. Density of brown trout tends to increase toward the lower reaches. Age and growth analyses indicate a healthy population with good growth. Macroinvertebrate populations are stressed but recover rapidly following flow reduction. Sufficient production occurs to support adequate fish growth. The existence of a relatively large number of young brown trout suggests that Diamond Fork is a source of recruitment for the Spanish Fork River, as well as the entire system. Sculpin, mountain sucker, dace, and leatherside chub are nongame fish also inhabiting the stream. The UDWR classifies Diamond Fork as a Class III fishery.

Diamond Fork above the confluence with Sixth Water Creek at Three Forks is characterized by a natural, high quality stream totally unaffected by the transport of irrigation water carried in Diamond Fork below Three Forks. The canyon is narrow in this reach, bordered on each side by vertical rock cliffs. Streamside vegetation is abundant, forming a dense canopy over the stream. The gradient in this reach is steeper than downstream reaches. As a result, riffles are more numerous than pools, although the pools provide important fish habitat (Tables 35 and 36).

This reach of Diamond Fork contains a productive trout population, with cutthroat and rainbow trout comprising 44 and 37 percent of the population, respectively. The results of age and growth analyses indicate a healthy population with good growth. Although no critical spawning areas have been identified in this reach, it is believed that some trout spawning occurs in the limited areas of gravel and small rubble located throughout the reach. Macroinvertebrate populations are in good condition, exhibiting sufficient production to provide a food base for trout. Nongame fish in this reach of Diamond Fork include mountain
sucker, sculpin, dace, and leatherside chub. This reach is classified as a Class III fishery by the UDWR.

Sixth Water Creek

This stream, classified by the UDWR as a Class III fishery, is about 10 miles in length, extending from Strawberry Tunnel to its confluence with Diamond Fork. The lower part of this stream is located in a narrow, steep-walled canyon containing large boulders and logs in the streambed. The upper part is generally wider, with a flat bottom filled with rubble substrate and a noticeable lack of quality pools. Fish sampling data by specific stream reach and estimates of trout standing crop, habitat quality, and angler use are presented in Tables 37 and 38.

Aquatic productivity is limited by the habitat degradation caused by undesirably high amounts of imported irrigation water during the summer season and low winter flows averaging less than 10 cfs. About 80 percent of the banks are unstable, and turbid water from continual erosion is a serious problem. Most of the bottom substrate consists of rubble and boulders, and much of the gravel suitable for spawning has been scoured away. Most existing pools are formed behind large boulders and where the stream spills over bedrock outcrop. These pools provide only limited habitat during the late fall and winter season when flows are too low to adequately fill the enlarged channel.

Brown and cutthroat trout appear to be in reasonably good condition, suggesting that the food supply is adequate. Studies by the Brigham Young University Aquatic Ecology Laboratory (1982), however, indicate that macroinvertebrate communities are in a stressed state because of the high summer flows. It appears that the organically enriched water from Strawberry Reservoir contributes to the support of the fish food supply.

Fifth Water Creek

Fifth Water Creek is characteristic of a small, high mountain stream through most of its 5.2-mile length. It originates at high elevations and flows along a steep gradient through narrow, deep canyons to its junction with Sixth Water Creek. It averages about 10 feet in width during most of the year. Estimated flows range from 0.5 to 3 cfs in the upper reaches to 2 to 10 cfs at its mouth. A series of hot sulfur springs, which alter its characteristics considerably, begin entering the stream about 2.25 miles above its mouth. The largest spring is located about 1.25 miles above the mouth. Sulfate-salt precipitate cements the bottom and causes moderate growth of blue-green algae below the springs. Fish sampling data by stream reach and estimates of trout standing crop, habitat quality, and angler use are shown in Tables 39 and 40.

Streambank stability is relatively good, except under conditions of heavy rainfall or snowmelt, when substantial sediment loads are carried downstream. A number of high quality pools are located primarily below
### Table 35
Trout sampled from Diamond Fork (1975)

<table>
<thead>
<tr>
<th>Stream reach</th>
<th>Brown</th>
<th>Cutthroat</th>
<th>Rainbow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length of stream sampled (feet)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight total number (lb)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight total weight</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. From the confluence with the Spanish Fork River upstream to the high water line of the proposed Hayes Reservoir (5.0 miles)</td>
<td>3,960</td>
<td>339 81.5 126.2 86</td>
<td>70 17 17 11.6</td>
</tr>
<tr>
<td>2. From the high water line of the proposed Hayes Reservoir to the proposed Monks Hollow Dam (3.0 miles)</td>
<td>1,320</td>
<td>87 63 21.0 42.5</td>
<td>23 16.7 10.5 20.5</td>
</tr>
<tr>
<td>3. From the proposed Monks Hollow Dam upstream to the confluence with Sixth Water Creek (2.4 miles)</td>
<td>1,320</td>
<td>4 4.7 1.2 5.3</td>
<td>44 51.8 7.2 32.5</td>
</tr>
<tr>
<td>4. From the confluence with Sixth Water Creek upstream to the high water line of the proposed Monks Hollow Reservoir (0.2 mile)</td>
<td>1,320</td>
<td>4 4.7 1.2 5.3</td>
<td>44 51.8 7.2 32.5</td>
</tr>
</tbody>
</table>

1/ Fish were not sampled in this section; however, the sampling station in section 3 was located immediately upstream from section 2. Trout population estimates and species distribution in section 2 are, therefore, assumed to be similar to data given for section 3.
CHAPTER IV

Chapter IV: Trout fisheries

Stream reach
1. From the confluence with the Spanish Fork River upstream to the high water line of the proposed Hayes Reservoir (5.0 miles)
2. From the high water line of the proposed Hayes Reservoir upstream to the proposed Monks Hollow Dam (3.0 miles)
3. From the proposed Monks Hollow Dam upstream to the confluence with Sixth Water Creek (2.4 miles)
4. From the confluence with Sixth Water Creek upstream to the high water line of the proposed Monks Hollow Reservoir (0.2 mile)

Total

<table>
<thead>
<tr>
<th>Stream reach</th>
<th>Wild trout</th>
<th>Stocked trout</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Standing crop (lb/reach)</td>
<td>Habitat units (dals/lear)</td>
</tr>
<tr>
<td>1. From the confluence with the Spanish Fork River upstream to the high water line of the proposed Hayes Reservoir (5.0 miles)</td>
<td>437</td>
<td>495</td>
</tr>
<tr>
<td>2. From the high water line of the proposed Hayes Reservoir upstream to the proposed Monks Hollow Dam (3.0 miles)</td>
<td>352</td>
<td>384</td>
</tr>
<tr>
<td>3. From the proposed Monks Hollow Dam upstream to the confluence with Sixth Water Creek (2.4 miles)</td>
<td>207</td>
<td>225</td>
</tr>
<tr>
<td>4. From the confluence with Sixth Water Creek upstream to the high water line of the proposed Monks Hollow Reservoir (0.2 mile)</td>
<td>48</td>
<td>52</td>
</tr>
<tr>
<td>Total</td>
<td>1,044</td>
<td>1,156</td>
</tr>
</tbody>
</table>

Table 36: Trout fisheries data estimated for Diamond Fork (1981)
### Table 37
Trout sampled from Sixth Water Creek (1975)

<table>
<thead>
<tr>
<th>Stream reach</th>
<th>Brown</th>
<th>Cutthroat</th>
<th>Rainbow</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Length of stream sampled (feet)</td>
<td>Number</td>
<td>Percent of total number</td>
</tr>
<tr>
<td>1. From the confluence with Diamond Fork upstream to the confluence with Fifth Water Creek (1.1 miles)</td>
<td>1,320</td>
<td>14</td>
<td>37.8</td>
</tr>
<tr>
<td>2. From the Fifth Water Creek confluence upstream to the high water line of the proposed Sixth Water Reservoir (3.3 miles)</td>
<td>1,320</td>
<td>47</td>
<td>66</td>
</tr>
<tr>
<td>3. From the high water line of the proposed Sixth Water Reservoir upstream to the Strawberry Tunnel west portal (5.4 miles)</td>
<td>1,320</td>
<td>211</td>
<td>82.4</td>
</tr>
</tbody>
</table>

1/ One brook trout was collected along stream section 3.
Table 38
Trout fisheries data estimated for Sixth Water Creek (1981)

<table>
<thead>
<tr>
<th>Stream reach</th>
<th>Wild trout</th>
<th>Stocked trout</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Standing</td>
<td>Angler</td>
</tr>
<tr>
<td></td>
<td>crop (lb/</td>
<td>use (days/</td>
</tr>
<tr>
<td></td>
<td>reach)</td>
<td>year)</td>
</tr>
<tr>
<td>1. From the confluence with Diamond Fork upstream to the confluence with</td>
<td>79</td>
<td>51</td>
</tr>
<tr>
<td>Fifth Water Creek (1.1 miles)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. From the Fifth Water Creek confluence upstream to the high water line</td>
<td>184</td>
<td>118</td>
</tr>
<tr>
<td>of the proposed Sixth Water Reservoir (3.3 miles)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. From the high water line of the proposed Sixth Water Reservoir upstream</td>
<td>508</td>
<td>326</td>
</tr>
<tr>
<td>to the Strawberry Tunnel west portal (5.4 miles)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>771</td>
<td>495</td>
</tr>
</tbody>
</table>

Table 39
Trout sampled from Fifth Water Creek (1975)

| Stream reach                                                                 | Brown | Cutthroat |
|                                                                             | Length |          |
|                                                                             | stream | trunk    |
|                                                                             | sampled | species |
|                                                                             | (feet) |          |          |
| 1. From the confluence with Sixth Water Creek upstream to hot sulfur spring  | 1,320  | 3        | 1.3     |
|    (1.3 miles)                                                             |        | 3        | 43.3    |
| 2. From hot sulfur spring upstream to the proposed Fifth Water Dam (1.7    | 1      | 3.7      | 5.5     |
|    miles)                                                                  |        | 3        | 44.4    |
| 3. From the proposed Fifth Water Dam upstream to the high water line of    | 1,320  | 2        | 3.7     |
|    Fifth Water Reservoir (2.6 miles)                                        |        | 3        | 44.4    |

1/ Fish were not sampled in this section; however, trout population estimates and species distribution in section 2 are assumed to be similar to data given for section 1 rather than section 3. A natural fish barrier between sections 2 and 3 effectively blocks migration and isolates the trout population in the uppermost section.

Table 40
Trout fisheries estimated for Fifth Water Creek (1981)

| Stream reach                                                                 | Wild trout | Stocked trout |
|                                                                             | Standing   | Angler       | Standing | Angler       |
|                                                                             | crop (lb)  | use (days/   | crop (lb) | use (days/   |
|                                                                             |             | year)        |           | year)        |
| 1. From the confluence with Sixth Water Creek upstream to hot sulfur spring | 32         | 21           | 0        | 0            |
|                                                                             | 34         |              |          |              |
| 2. From hot sulfur spring upstream to the proposed Fifth Water Dam         | 57         | 37           | 0        | 0            |
|                                                                             | 61         |              |          |              |
| 3. From the proposed Fifth Water Dam upstream to the high water line of    | 27         | 17           | 0        | 0            |
|    Fifth Water Reservoir                                                   | 29         |              |          |              |
| Total                                                                       | 116        | 75           | 0        | 0            |
steep riffles or small waterfalls in Fifth Water Creek. Overall habitat analysis indicates relatively good habitat conditions for this stream. The presence of more tolerant macroinvertebrate communities below the hot sulfur springs indicates a stressed system, primarily as a result of lower water quality, while the presence of less tolerant species and high species diversity above the springs indicates the presence of a high quality macroinvertebrate community.

Although nongame fish comprised most of the biomass in samples collected, small cutthroat were also present and represented the dominant game fish in the stream. Growth rates varied between sample stations but were generally considered good. Much higher numbers of trout occurred above the hot springs than below, which is an indicator of the stress imposed on the population by the high water temperature and low water quality. This stream is classified as a Class III fishery by the UDWR.

ENVIRONMENTAL IMPACTS

Stream Fisheries

General.—This evaluation was prepared cooperatively by biologists of the Bureau of Reclamation, the Forest Service, the Utah Division of Wildlife Resources, and the Fish and Wildlife Service. Details of this evaluation are available in the Fish and Wildlife Service Coordination Act Report for the Diamond Fork Power System at the Utah Projects Office in Provo, Utah.

The purpose of this evaluation is to (1) analyze the effects on fisheries of five alternatives under consideration for the Diamond Fork Power System and (2) discuss measures that could be incorporated into plans to mitigate or enhance the affected fisheries.

Approximately 45 miles of fisheries habitat in the Spanish Fork River, Diamond Fork, and Sixth Water Creeks would be affected by the project. Supporting data for this impact and mitigation analysis are available to the public at the Utah Projects Office in Provo, Utah.

Information on late summer streamflows, annual streamflow variation, water velocity, trout cover, stream width, eroding streambanks, stream substrate, nitrate nitrogen concentration, and maximum summer stream temperatures were used in a mathematical formula developed by Binns and Eiserman (1979). This equation yields stream trout habitat quantity/quality indices and predictions of wild trout standing crop. Stocked trout were included in the analysis wherever habitat conditions under project operations would be sufficient to support both wild and hatchery trout.

It was assumed for purposes of the analysis that wild trout populations would stabilize 5 years after the project becomes operational. Standing crop and habitat units would attain their maximum values at that
CHAPTER IV AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

point and remain constant throughout the life of the project. Angler use, however, would continue to increase at an annual rate of 5 percent based on trends in UDWR angler license sales, until angler-use carrying capacity is reached. Beyond this point, the catch rate would fall below that level of success for which anglers would return to the stream. Angler-use carrying capacity is generally considered to be reached in 20 years for most project alternatives. Twenty years after implementation of the recommended plan, an angler-use carrying capacity of 69,400 angler days would be reached and maintained at that level throughout the remaining life of the project.

Hatchery trout used in conjunction with the wild population would be stocked at an annual rate of 14,000 pounds, or 42,400 fish, only in Diamond Fork below Monks Hollow Reservoir. The remaining streams in the system would not be stocked. Five years after project implementation, a stocking program of this magnitude would annually produce 31,650 angler-days of use for the recommended plan and the Sixth Water Pumped Storage and Fifth Water Pumped Storage Alternatives. The 1964 DPR Alternative does not include stocking because of severe adverse impacts to the fishery associated with its operation.

Recommended plan.--The recommended plan would result in considerable overall enhancement of stream fisheries as indicated in Table 4.1. Wild trout standing crop (total weight), habitat units (quality indicator), and angler use would increase over existing conditions by 106 percent, 110 percent, and 25 percent, respectively. The major part of this enhancement would be attributable to the Diamond Fork Pipeline, from Monks Hollow Dam to the Spanish Fork River. The pipeline would remove project flows as well as a portion of the existing irrigation flows from Diamond Fork, thereby reducing channel scouring and bank erosion and enhancing trout habitat.

Trout standing crop, habitat units, and angler use would increase by 383 percent, 387 percent, and 225 percent, respectively, in the lower two reaches of Diamond Fork (Table 42). This significant gain more than compensates for the complete loss of habitat in reaches 3 and 4 of Diamond Fork because of the inundation by Monks Hollow Reservoir.

Reaches 2 and 3 of the Spanish Fork River would be enhanced by increased flows in reaches of stream historically dewatered for irrigation. For example, reach 2 is completely dewatered during the summer months and would benefit from increased flows provided by the project. Standing crop, habitat units, and angler use would increase in this reach of the Spanish Fork River by 1,964 percent, 1,050 percent, and 2,235 percent, respectively (Table 42). Under project operation, increased flows in reaches 4 and 5 would degrade fish habitat, primarily because of excessive water velocities. Standing crop, habitat units, and angler use would decrease by 36, 23, and 62 percent, respectively. These categories for all reaches of the Spanish Fork River combined would increase by 287 percent, 239 percent, and 104 percent, respectively, under this alternative.

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### CHAPTER IV

**AFFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES**

#### Table 41

Predicted effects of alternatives on stream trout fisheries 5 years after operation begins

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Wild trout</th>
<th>Stocked trout</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Standing crop (lbs)</td>
<td>Standing use (days/year)</td>
</tr>
<tr>
<td>Existing conditions</td>
<td>2,184</td>
<td>3,000</td>
</tr>
<tr>
<td>Sixth Water Flow Through</td>
<td>4,505</td>
<td>14,000</td>
</tr>
<tr>
<td>Fifth Water Pumped Storage</td>
<td>4,537</td>
<td>14,000</td>
</tr>
<tr>
<td>Six Water Pumped Storage</td>
<td>4,505</td>
<td>14,000</td>
</tr>
<tr>
<td>1964 DPR</td>
<td>1,501</td>
<td>0</td>
</tr>
<tr>
<td>No power</td>
<td>4,250</td>
<td>3,000</td>
</tr>
</tbody>
</table>

1/ All wild trout values have been revised to reflect refinements in the analysis.

2/ Values represent an average of a range of possible impacts reflected by the range of feature sizes and operation of the I&D System currently being considered. Differences in impacts between the high and low end of the range are generally below 5 percent.

3/ Fish habitat and populations would stabilize in the first year of project operation under this alternative.

#### Table 42

Trout fishery evaluation for the fifth year of operation with the Sixth Water Flow Through Alternative

<table>
<thead>
<tr>
<th>Stream</th>
<th>Reach</th>
<th>Standing crop (lb)</th>
<th>Habitat units</th>
<th>Angler use (angler days/year)</th>
<th>Stocked crop (lb)</th>
<th>Angler use (angler days/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spanish Fork River</td>
<td>2</td>
<td>516</td>
<td>575</td>
<td>397</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>174</td>
<td>195</td>
<td>134</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>138</td>
<td>165</td>
<td>106</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Diamond Fork Creek</td>
<td>1</td>
<td>1,852</td>
<td>2,082</td>
<td>1,187</td>
<td>9,333</td>
<td>21,104</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>1,175</td>
<td>1,316</td>
<td>695</td>
<td>4,667</td>
<td>10,550</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Sixth Water Creek</td>
<td>1</td>
<td>59</td>
<td>64</td>
<td>38</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>188</td>
<td>202</td>
<td>121</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>283</td>
<td>306</td>
<td>181</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Fifth Water Creek</td>
<td>1a</td>
<td>32</td>
<td>34</td>
<td>36</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>1b</td>
<td>57</td>
<td>61</td>
<td>64</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>1c</td>
<td>27</td>
<td>29</td>
<td>29</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Total                   | 4,505 | 5,033             | 2,991         | 14,000                        | 31,654            |

1/ All wild trout values for Spanish Fork River reaches 2 to 5 have been revised to reflect comments received on the Draft Environmental Statement and refinements in the analysis.
Sixth Water Creek is the only stream within the project area that would be adversely affected by implementing the recommended plan. Reductions in trout habitat would occur because the historically high irrigation flows from Strawberry Reservoir, which flow through the Sixth Water Creek channel, would be diverted through Syar Tunnel into Syar and Sixth Water Reservoirs. The Sixth Water Creek channel would revert back to carrying natural flows throughout the year, which would be much less than the high flows it has been carrying and to which the channel has become adapted through the hydrologic process of scouring and bank erosion. The much lower natural flows would be unable to provide the existing level of trout habitat because of the unnaturally widened and deepened channel. Reach 3 of Sixth Water Creek would exhibit the greatest impact, with reductions in standing crop, habitat units, and angler use of 44 percent, 45 percent, and 68 percent, respectively, over existing conditions.

The interagency biological team evaluated channel rehabilitation and other measures for improving the fishery potential of Sixth Water Creek. This evaluation is discussed under impacts associated with the 1964 DPR Alternative. Additional mitigation for the recommended plan is not required because of the overall enhancement created on lower Diamond Fork and the Spanish Fork River. As long as the Diamond Fork Pipeline at its present capacity is an integral part of the recommended plan, funding of any measures to improve the fishery potential of Sixth Water Creek would not be justified and would have to come from other sources. Reclamation, however, recognizes the desirability of maintaining a fishery in Sixth Water Creek and is committed to working with the Forest Service and other resource agencies to achieve a satisfactory solution to the problem. To provide a potential solution to the problem, a flow-bypass valve would be included in the connection between Syar Tunnel and the existing Strawberry Tunnel. This valve would allow the release of up to 50 cfs into Sixth Water Creek to support the stream fishery if flows are available.

Construction and operation of Monks Hollow Dam and Reservoir would effectively block upstream movement of trout from lower Diamond Fork and the Spanish Fork River. Potentially, this could affect historical trout-spawning success in these two streams, especially since recruitment from Strawberry Reservoir through the Strawberry Tunnel would be discontinued and streamflows in Sixth Water Creek would be much reduced under project operation.

The existence and significance of trout-spawning migrations into the upper reaches of these two streams is presently unknown. Based on a fish habitat inventory study conducted by UDWR in 1975 and 1976, it is believed that trout reproduction on Sixth Water Creek occurs throughout reach 3 and in Dip Vat Creek, which is a tributary to Sixth Water Creek, thereby providing the necessary recruitment to sustain existing populations. Brown trout, the dominant game fish in reaches 2 and 3, have historically sustained their numbers through natural reproduction, without recruitment from Strawberry Reservoir or lower Diamond Fork.
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upper Diamond Fork (reach 4), spawning habitat is dispersed but extensively used by resident brown and cutthroat trout. These species have maintained their population through natural reproduction (UDWR, 1976).13

Existing information as discussed above indicates that the unrestricted ability of trout to move up or down the system may not be significant to the maintenance of natural populations in these two streams. In addition, any loss of trout reproduction and subsequent standing crop attributed to stream blockage by project features would likely be more than offset by fishery benefits associated with the Diamond Fork Pipeline. Reclamation, however, is committed to working with the other resource agencies in order to provide habitat improvement measures as needed on Sixth Water Creek to maintain existing populations under project operation. Periodic selective fish stocking may be required.

The effects of the project on temperature and oxygen levels of water released below Monks Hollow Dam is a primary concern because of the potential adverse effects on the enhanced fishery downstream. Existing temperature levels in Diamond Fork below Monks Hollow and those anticipated with the recommended plan are given in Table 43.

Table 43

Existing and predicted temperature levels in Diamond Fork below Monks Hollow with operation of the recommended plan (Unit: °C)

<table>
<thead>
<tr>
<th>Month</th>
<th>Existing</th>
<th>Predicted</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Maximum</td>
<td>Minimum</td>
</tr>
<tr>
<td>June</td>
<td>16 -16.5</td>
<td>10 -12</td>
</tr>
<tr>
<td>July</td>
<td>19</td>
<td>13.5-15</td>
</tr>
<tr>
<td>August</td>
<td>17 -21</td>
<td>14.5-16</td>
</tr>
<tr>
<td>September</td>
<td>16.5-17.5</td>
<td>12.5-13</td>
</tr>
</tbody>
</table>

1/ Temperature ranges are taken from data collected over two field seasons.
2/ Temperature range expected during those years that warm waters are released from above the thermocline in Strawberry Reservoir.
3/ Temperature range expected during those years that cold waters are released from below the thermocline in Strawberry Reservoir.

As indicated on Table 43 for low water withdrawal from Strawberry Reservoir, water temperatures in Diamond Fork below Monks Hollow in June would range from 6° to 12° C. Water would be withdrawn from below the thermocline in Strawberry Reservoir about 60 to 80 percent of the time throughout the life of the project. The temperature range for June is only slightly lower than under existing conditions and generally is slightly lower or within the preferred temperature range for brown, rainbow, and cutthroat trout growth. The predicted temperature ranges of 7° to 14° C and 9° to 15° C for July and August, respectively, are generally within the preferred range for growth and are also well within the overall tolerance limits for trout. These temperatures are slightly below average water temperatures present under existing conditions, but

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they are also closer to the preferred level of 12.5°C. The predicted temperature range of 9°C to 15°C in September would average slightly lower than the existing average of 14.5°C. This would still be within the preferred and overall tolerance range for trout. Therefore, the project would have no significant impact on water temperatures as they affect the trout species considered.

Temperatures predicted under high water withdrawal from Strawberry Reservoir (Table 43) would generally be higher than those just discussed. Water temperatures as high as 20°C in August below Monks Hollow may be apparent in years when water is pulled into the power system from above the thermocline in Strawberry Reservoir. This would occur about 5 to 15 percent of the time. Temperatures of this magnitude have reached the upper limit of the trout tolerance range (20°C), beyond which the growth rate of cold water species such as trout decreases because of the increased metabolic rate associated with higher temperatures. Existing water temperatures, however, reach a maximum level of 19.5°C in August and average levels of 16°C to 17.5°C during July and August, respectively (Table 43). Trout populations have become acclimated to these high temperatures during the summer months; therefore, the project would cause little additional stress to trout populations under this operating condition.

During about 10 to 20 percent of the time throughout the project life, water could be withdrawn from below the thermocline during the first part of the summer and from within and above the thermocline during the latter part as the thermocline deepens and the surface elevation drops. Whenever this condition exists, water temperatures in Diamond Fork below Monks Hollow Reservoir would vary between those described above for low and high water withdrawal from Strawberry Reservoir. Because there would be no significant adverse impacts on trout populations from water temperatures associated with these two extremes, the same conclusion can be made for this in-between condition.

Trout spawning and egg hatching success would not be affected by temperature changes in Diamond Fork below Monks Hollow. Rainbow and cutthroat trout have limited success under existing conditions because of the high irrigation flows during the spawning period. Lower project flows may improve success. Brown trout spawn during the fall and, therefore, would not be subjected to artificial changes in flow or temperature during their spawning cycle.

Dissolved oxygen levels in water released from Monks Hollow Reservoir would range between 4 to 8 mg/L during periods of low water withdrawal from Strawberry Reservoir. This would generally be adequate to support trout. Normally, however, dissolved oxygen levels would be between 6 and 10 mg/L and would be totally adequate for trout. The stream is expected to aerate rapidly within a quarter to half a mile of the Monks Hollow Dam stilling basin. If levels below 5 mg/L are apparent for any significant distance greater than a quarter mile in Diamond Fork below the stilling basin, appropriate corrective measures such as baffles
or weirs would be implemented in order to realize predicted fishery benefits on lower Diamond Fork.

Nutrient levels in Diamond Fork below Monks Hollow would be high. Nutrient levels under existing conditions are high, however, because of nutrient-rich water released from Strawberry Reservoir. Current levels are not causing any major problems to stream biota, and nutrient levels would essentially be no higher under project operation.

Turbidity levels in Diamond Fork below Monks Hollow would experience a significant reduction from present conditions, because Monks Hollow Reservoir would function as a sediment trap, effectively retaining 87 percent of the sediment inflow. This reduction in turbidity and sediment deposition in the stream channel would result in significant habitat improvement for aquatic macroinvertebrate communities. Decreased silt deposition on the presently extensive spawning areas in the lower Diamond Fork would also enhance brown trout egg incubation and hatching success, unless dissolved oxygen is a problem, as discussed previously.

Other alternatives.—The 1964 DPR Alternative would have an overall adverse impact on stream fisheries (Table 41). The major effect would be on Diamond Fork, where almost 100 percent of the existing trout standing crop, habitat units, and angler use would be lost through a combination of inundation by Hayes Reservoir and 80- to 400-cfs surging flows released into the stream from Dyne Powerplant at Three Forks (Table 44). These losses in the fishery resource would be partially offset by fishery enhancement on the Spanish Fork River equal to that described under the recommended plan. Standing crop, habitat unit, and angler-use reductions of 44 percent, 45 percent, and 68 percent, respectively, in reach 3 of Sixth Water Creek from return of the enlarged stream to a natural flow would, however, combine with the adverse impact on Diamond Fork described above to produce a net adverse impact to stream fisheries.

Mitigation for this impact could be accomplished by any one or a combination of the items listed below as analyzed by the interagency biological team. The analysis would, however, require additional refinements if this alternative were selected in order to develop a complete mitigation plan for project impacts on fisheries.

1. The size of the Wasatch Aqueduct could be enlarged from 200 to 500 cfs to accommodate the flow surges into Diamond Fork from Dyne Powerplant. This would leave 80 to 100 cfs in the stream channel for trout habitat.

2. Flows could be provided through the existing Strawberry Tunnel in Sixth Water Creek that would maintain the same level of trout standing crop and habitat quality as presently exists. Analyses indicate that a summer flow of 49 cfs and winter flow of 5 cfs would provide the same level of trout habitat. A winter flow of 32 cfs would optimize conditions for trout.
### Table 44
Wild trout fishery evaluation for the first year of operation with the 1964 DPR Alternative

<table>
<thead>
<tr>
<th>Stream</th>
<th>Reach</th>
<th>Standing crop (lb)</th>
<th>Habitat units</th>
<th>Angler use (angler days/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spanish Fork River 1/</td>
<td>2</td>
<td>517</td>
<td>574</td>
<td>398</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>174</td>
<td>195</td>
<td>134</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>138</td>
<td>165</td>
<td>106</td>
</tr>
<tr>
<td>Diamond Fork Creek  2/</td>
<td>1</td>
<td>9</td>
<td>9</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>3/</td>
<td>3/</td>
<td>3/</td>
</tr>
<tr>
<td>Sixth Water Creek</td>
<td>1</td>
<td>72</td>
<td>78</td>
<td>46</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>188</td>
<td>202</td>
<td>121</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>283</td>
<td>306</td>
<td>181</td>
</tr>
<tr>
<td>Fifth Water Creek</td>
<td>1a</td>
<td>32</td>
<td>34</td>
<td>36</td>
</tr>
<tr>
<td></td>
<td>1b</td>
<td>57</td>
<td>61</td>
<td>64</td>
</tr>
<tr>
<td></td>
<td>1c</td>
<td>27</td>
<td>29</td>
<td>29</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>1,501</td>
<td>1,657</td>
<td>1,124</td>
</tr>
</tbody>
</table>

1/ Because of severe adverse impacts on reaches 1-3 of Diamond Fork, trout would not be stocked with this alternative.

2/ All wild trout values for Spanish Fork River reaches 2-5 have been revised to reflect comments received on the Draft Environmental Statement and refinements in the analysis.

3/ Not applicable under this alternative.
3. The Sixth Water Creek channel could be rehabilitated with appropriate structures such as gabions, check dams, and scour pools to provide comparable habitat as currently exists. Placement of such structures, along with some streambank revegetation, would make trout habitat more available at natural flows.

Although improvement of trout potential in Sixth Water Creek, through either the provision of additional flow through the Strawberry Tunnel or rehabilitation of the channel itself, represents an excellent opportunity for stream fisheries enhancement on a stream that flows entirely through public land, it is only justified as mitigation if the 1964 DPR Alternative were selected for construction. If any other project alternative were selected, sources of funding for improvements to the Sixth Water Creek fishery would have to be explored through means other than as part of the Diamond Fork Power System. One potential avenue of justifying the retention of some flow through the Strawberry Tunnel into Sixth Water Creek is the possibility of building a small flow-through powerplant at the outlet of Strawberry Tunnel to produce power from the released fishery water.

Overall, the Fifth Water and Sixth Water Pumped Storage Alternatives would cause considerable enhancement to the fishery resource within the project area (Tables 41 and 45). As with the recommended plan, the fishery enhancement associated with these two alternatives would primarily be the result of the inclusion of the Diamond Fork Pipeline in the plan. Increases in trout standing crop, habitat units, and angler use on the lower Diamond Fork and the Spanish Fork River would be the same as in the recommended plan (Table 42) for the Sixth Water Pumped Storage Alternative and slightly greater for the Fifth Water Pumped Storage Alternative (Table 45). Impacts to reach 3 of Sixth Water Creek under these alternatives would be similar to those associated with the 1964 DPR Alternative and would include a reduction in trout standing crop, habitat units, and angler use of 44 percent, 45 percent, and 68 percent, respectively, over existing conditions (Tables 42 and 45). Impacts to the fishery resource from these two project alternatives would be essentially equal.

A minimum flow equivalent to natural flow would be provided in Fifth Water Creek below Fifth Water Reservoir as part of the Fifth Water Pumped Storage Alternative. This alternative would, therefore, have no impact on Fifth Water Creek below the reservoir, and compensation for the loss of stream associated with inundation would be attained through enhancement associated with the Diamond Fork Pipeline on lower Diamond Fork.

The No Power Alternative would include slightly less fishery enhancement than the recommended plan (Table 41). This enhancement would be realized on lower Diamond Fork, as with the other alternatives, from the removal of a portion of the existing high irrigation flows from
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Table 45
Trout fishery evaluation for the fifth year of operation with the Fifth Water Pumped Storage Alternative

<table>
<thead>
<tr>
<th>Stream</th>
<th>Reach</th>
<th>Wild/1</th>
<th>Stocked</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Standing crop (lb)</td>
<td>Habitat units</td>
</tr>
<tr>
<td>Spanish Fork River</td>
<td>2</td>
<td>516</td>
<td>575</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>174</td>
<td>195</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>137</td>
<td>165</td>
</tr>
<tr>
<td>Diamond Fork Creek</td>
<td>1</td>
<td>1,852</td>
<td>2,082</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>1,175</td>
<td>1,316</td>
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<tr>
<td></td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Sixth Water Creek</td>
<td>1</td>
<td>59</td>
<td>64</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>244</td>
<td>288</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>283</td>
<td>306</td>
</tr>
<tr>
<td>Fifth Water Creek</td>
<td>1a</td>
<td>32</td>
<td>34</td>
</tr>
<tr>
<td></td>
<td>1b</td>
<td>57</td>
<td>61</td>
</tr>
<tr>
<td></td>
<td>1c</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>4,537</td>
<td>5,070</td>
</tr>
</tbody>
</table>

1/ All wild trout values for Spanish Fork River reaches 2 to 5 have been revised to reflect comments received on the Draft Environmental Statement and refinements in the analysis.
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the channel by the Diamond Fork Pipeline. In addition, fishery improve-
ment may be attainable on Sixth Water Creek and Diamond Fork between
Three Forks and Monks Hollow because the pipeline would extend from
upper Sixth Water Creek to the mouth of Diamond Fork. Flows for fish-
eries purposes could be improved on these stream reaches by either car-
rying excess streamflows in the pipeline whenever excess pipeline capac-
ity was available or adding flow to the stream from the pipeline during
periods of natural low flow in the channel. Either of these possibili-
ties would be subject to the flexibility provided within the operational
constraints of the conveyance system. This additional potential enhance-
ment has not been quantified at this time. Additional analysis to ac-
complish this would be required if this alternative were selected for
construction at some future time.

Although predicted water temperatures by month are not available
for project alternatives other than the recommended plan, a more general
comparison of temperatures in Diamond Fork below Monks Hollow associated
with each alternative is presented in Table 28. Maximum stream tempera-
tures are shown for operational options representing years when water in
Strawberry Reservoir is released from both above and below the thermo-
cline. Releases from above the thermocline would have predicted maximum
water temperatures of 17° to 19° C for the Fifth Water Pumped Storage
Alternative, 16° to 19° C for the 1964 DPR Alternative, and 17° to 20° C
for the Sixth Water Pumped Storage Alternative. These temperatures are
similar to existing maximum temperature levels in Diamond Fork. Trout
populations, therefore, would not be appreciably affected over present
conditions. Maximum water temperatures predicted with releases below
the thermocline in Strawberry Reservoir would vary with each alternative
but would generally be at least within the tolerance range for trout if
not within the preferred, or optimum, range. Predicted temperatures
under the 1964 DPR Alternative, however, would be approaching the lower
end of the trout tolerance range, which could adversely affect trout
growth.

Impacts of other project alternatives on oxygen and nutrient levels
as they affect the fishery resource in Diamond Fork below Monks Hollow
would be similar to those discussed for the recommended plan, although
dissolved oxygen levels could be slightly lower with the Fifth Water
Pumped Storage Alternative. The reduction in turbidity and sediment
deposition in Diamond Fork as discussed for the recommended plan would
be similar for the Fifth Water Pumped Storage and Sixth Water Pumped
Storage Alternatives, in that significant habitat improvement for aquatic
macroinvertebrates and brown trout spawning would occur. Under the 1964
DPR Alternative, however, total streamflow, sediment load, and turbidity
would increase. These factors, along with the colder water temperatures
predicted with operation of this alternative, would combine to cause
significant adverse impacts to biological communities in Diamond Fork
between Three Forks and Hayes Reservoir.
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Reservoir Fisheries

Recommended plan.--A mathematical model developed by Youngs and Heimlich (1982)14 was used to determine the intrinsic productive capacity of Monks Hollow Reservoir under the recommended plan as well as Monks Hollow and Fifth Water Reservoirs under initial operating conditions for the Fifth Water Pumped Storage Alternative and Hayes Reservoir under the 1964 DPR Alternative. Trout standing crop (lb/acre/year), as shown in Table 46, was predicted for each reservoir at maximum and minimum water levels resulting from either gradual irrigation drawdown or rapid weekly fluctuation. The former condition would apply to Monks Hollow and Hayes Reservoirs under the recommended plan and the 1964 DPR Alternative, respectively, while the latter would apply to Fifth Water and Monks Hollow Reservoirs under the pumped storage alternatives. Although standing crop values presented in Table 46 do not precisely describe predicted biological conditions in these reservoirs because of the unquantifiable effect of rapid and extreme water level fluctuation and/or drawdown, the data do represent the range in values anticipated. Furthermore, the values are relative but provide an adequate basis of comparison among all major reservoirs under the various project alternatives.

The analysis of predicted angler use, also shown in Table 46, was based on several assumptions. Since the reservoir fisheries would consist entirely of stocked trout, the assumption includes specified trout stocking rate, growth rate, carryover, creel return, average catch rate, and angler-day length.

Monks Hollow Reservoir would exhibit low trout productivity (693 to 857 pounds). Predicted angler use would range from 2,554 to 3,650 days per year with the reservoir at maximum water level (Table 46).

Sixth Water and Syar Reservoirs would be too small and would undergo too rapid and extreme fluctuations to support viable fisheries.

Strawberry Reservoir currently provides one of the best flatwater fisheries in the State. The reservoir is a Class I fishery as classified by the Utah Division of Wildlife Resources and currently provides about 250,000 fisherman-days use each year. Large cutthroat and rainbow trout, which are abundant in Strawberry Reservoir, are known to enter the Diamond Fork drainage through the Strawberry Tunnel and Sixth Water Creek. The number of trout entering the system in this manner is unquantified. Under present conditions, trout enter Sixth Water Creek relatively unharmed. Under project operation, however, trout entering Syar Tunnel from Strawberry Reservoir would likely not enter Syar Reservoir unharmed because they would first have to pass through Syar Powerplant. In compliance with a commitment associated with the Environmental Assessment for the Strawberry Tunnel inlet rehabilitation, a study will be conducted to quantify fish movement from Strawberry Reservoir into Syar Tunnel for mitigation consideration. Such a study would be accomplished with input from and cooperation with State and Federal resource agencies.
### Table 46

Predicted trout productivity and angler use for major project reservoirs under the various project alternatives

<table>
<thead>
<tr>
<th>Project alternative</th>
<th>Reservoir</th>
<th>Water level</th>
<th>Area (acres)</th>
<th>Standing crop (lb/year)¹</th>
<th>Angler use (days/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sixth Water Flow Through</td>
<td>Monks Hollow</td>
<td>Maximum</td>
<td>27343</td>
<td>857</td>
<td>3,650</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Minimum</td>
<td>240</td>
<td>693</td>
<td>2,554</td>
</tr>
<tr>
<td>Fifth Water Pumped Storage</td>
<td>Fifth Water</td>
<td>Maximum</td>
<td>27530</td>
<td>1,272</td>
<td>5,916</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Minimum</td>
<td>481</td>
<td>1,154</td>
<td>4,437</td>
</tr>
<tr>
<td>Fifth Water and</td>
<td>Monks Hollow</td>
<td>Maximum</td>
<td>27343</td>
<td>857</td>
<td>3,650</td>
</tr>
<tr>
<td>Sixth Water Pumped Storage</td>
<td></td>
<td>Minimum</td>
<td>300</td>
<td>810</td>
<td>2,511</td>
</tr>
<tr>
<td>1964 DPR</td>
<td>Hayes</td>
<td>Maximum</td>
<td>27684</td>
<td>1,915</td>
<td>7,278</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Minimum</td>
<td>200</td>
<td>760</td>
<td>2,128</td>
</tr>
</tbody>
</table>

¹/ Values for standing crop indicate the pounds of trout which a reservoir containing a specific relationship among surface area, mean depth, and total dissolved solids could produce in a given year. Since the reservoir fisheries would consist entirely of stocked trout, at an annual stocking rate of 100 5-inch trout (5 lb) per acre, the standing crop values are indicative of the growth potential of these small trout.

2/ Maximum and minimum water levels are based on a full reservoir in the spring and a low reservoir in late summer from gradual irrigation drawdown.

3/ Maximum and minimum water levels are based on weekly reservoir fluctuation under the initial project operating condition described previously.
Other alternatives.—The analysis of potential reservoir fisheries with implementation of the Fifth Water Pumped Storage and Sixth Water Pumped Storage Alternatives is complicated by the fact that there are two operating conditions for these alternatives. Reservoir fluctuation under the projected initial operating condition would not only be less in magnitude than under the maximum condition but would also occur for only a few months of the year. As a result, Fifth Water and Monks Hollow Reservoirs under initial operating conditions are expected to have some fish production potential, as indicated in Table 46, but subject to possible limitations imposed by occasionally low levels of dissolved oxygen, as discussed earlier in this chapter under Water Quality. Production under maximum operating conditions would be severely limited or nonexistent because of extreme water level fluctuations. The increase in trout standing crop in Monks Hollow Reservoir for these alternatives would range from 810 to 857 pounds. The reservoir surface area and both maximum and minimum water levels would be the same for these alternatives. Fifth Water Reservoir under the Fifth Water Pumped Storage Alternative would also be characterized by rapidly fluctuating water levels but would have higher productivity than Monks Hollow Reservoir. The increase in predicted standing crop would range from 1,154 to 1,272 pounds as a result of this drawdown. Angler use would range from 4,437 to 5,916 days per year. Sixth Water and Syar Reservoirs of the Sixth Water Pumped Storage Alternative would not support viable fisheries.

Hayes Reservoir under the 1964 DPR Alternative would function under very similar conditions as Monks Hollow Reservoir in the recommended plan. Drawdown over the summer would be gradual. The increase in predicted trout standing crop would range from 1,915 pounds at the maximum water level to 760 pounds at the minimum water level. Angler use would range from 7,278 to 2,128 days per year. Sixth Water and Syar Reservoirs would not support viable fisheries.

Wildlife

EXISTING CONDITIONS

The Diamond Fork area supports a large variety of wildlife which varies in density and diversity according to altitude, season, and habitat type. Biological inventories have been made throughout the project area, including all project feature sites. These inventories revealed about 45 species of mammals, 125 species of birds, and 8 species of amphibians and reptiles inhabiting the project area. An additional 39 species of mammals, 28 species of birds, and 11 species of amphibians and reptiles were listed as possibly occurring because of overlapping ranges but were not observed during the inventories (Utah Division of Wildlife Resources, 1977).15

Mule deer are the most numerous and important big game animals in the Diamond Fork area. Most are migratory and spend late spring, summer, and early fall at the higher mountain elevations (nonwinter range above 7,000 feet) in the mountain shrub, aspen-conifer, and mountain-meadow
communities. In late fall, the deer migrate to shrub communities at the lower elevations (below 7,000 feet), especially areas with south and west facing slopes. These areas make up the deer winter range, comprising about 52,000 acres (56 percent) of land in the study area. The deer concentrate in these areas because they are able to find the essential browse species (woody shrubs) which they need for winter survival. In normal winters, deer utilize areas between 6,000 and 7,000 feet elevation. This normal winter range consists of about 38,000 acres (73 percent of the total winter range). In severe winters, deer are forced to the lowest elevations by deeper snows. This area constitutes the 14,000 acres of severe winter range (or 27 percent of the total winter range) in the study area. Boundaries of normal and severe deer winter range are shown in Figure 23. The size and quality of the winter range, especially the severe winter range, is the most important factor affecting the mule deer herd in the study area and is, therefore, critical to deer survival. The project study area makes up only 62 percent of the Diamond Fork deer herd unit. The total unit (149,800 acres) provided 17,417 deer-hunter days during the 1981 season. This hunting pressure is not evenly distributed over the unit.

Elk occur throughout the study area but in lower numbers than mule deer. Elk summer in the conifer and aspen at higher elevations (8,000 feet) and winter in areas similar to deer but generally at higher elevations. Elk can tolerate deeper snow than deer and, unlike deer, elk will use grass in addition to browse species for winter forage. The project study area makes up only 18 percent of the Diamond Fork-Strawberry elk herd unit. The unit (515,840 acres) provided 3,809 elk-hunter days in 1981. This hunting pressure is not evenly distributed over the unit.

Large predators in the project area include cougars, bobcats, coyotes, and black bears. Cougars are infrequent summer inhabitants of the aspen and conifer vegetative communities at the higher elevations and move to lower communities during winter periods as they follow the deer, the major prey species, to lower elevations. Bobcats prefer rocky canyon areas located primarily at the lower elevations. The hunting of cougar, bobcat, and bear is regulated by Utah State law.

The most prevalent furbearers in the study area are beaver and mink. Both are closely associated with riparian habitats. The beaver is a common resident, while the mink occurs occasionally.

The Diamond Fork area supports seven species of upland game birds, including mourning dove, band-tailed pigeon, blue grouse, ruffed grouse, sage grouse, ring-necked pheasant, and chukar partridge. Small numbers of waterfowl use the area. A total of 65 species of small birds was observed in the study area, with the greatest density occurring in the stream bottom riparian zone. These include snipes, sandpipers, killdeer, flycatchers, swallows, chickadees, American robins, warblers, blackbirds, and several species of sparrow.
Eleven species of raptors inhabit the project area. These are the turkey vulture, sharp-shinned hawk, Cooper's hawk, red-tailed hawk, Swainson's hawk, golden eagle, bald eagle, marsh hawk, American kestrel, great-horned owl, and long-eared owl. These birds use a wide variety of habitats, but the larger species prefer open shrub communities and meadows for hunting. A few species, such as the Cooper's hawk, prefer riparian woodlands for this purpose as well as nesting. Four active golden eagle eyries located within the study area may be affected by the project. Bald eagles, although not permanent residents, inhabit the area over the winter.

Numerous species of small mammals inhabit the project area. These include badgers, porcupines, raccoons, jackrabbits, cottontails, skunks, tree squirrels, ground squirrels, chipmunks, bats, pocket gophers, mice, muskrats, voles, and shrews. These species have a wide range of habitat preference but occur in all habitat types in the Diamond Fork area. Many serve as an excellent food base for the predatory species.

During the biological inventory, three species of amphibians and five species of reptiles occurred in low densities throughout the study area. Amphibians are restricted to moist habitats provided by streams, wet meadows, and ponds, etc. Lizards prefer the dry slopes within the area. Snake species generally inhabit canyon areas near water.

The Fish and Wildlife Service Habitat Evaluation Procedure (HEP) was used to assess expected future conditions for terrestrial wildlife species, without additional development of the Bonneville Unit. Under this method, the habitat value for selected species of wildlife is described by a habitat suitability index (HSI). HSI values range from 0.0 to 1.0 (0.0 = no value and 1.0 = value at optimum level) and are multiplied by available habitat area to obtain habitat units (HU).

Indicator species form the basis of an HEP analysis. They are used to quantify habitat suitability and to determine changes in the number of HU's available. Five species were chosen as indicators for the analysis. These species represent all habitat types and wildlife populations within the project area. The selection was based on those species for which the most information was available, as well as those indicating the most importance relative to public interest, economic, and ecological value. The indicator species used were the mule deer, bobcat, golden eagle, Cooper's hawk, and beaver.

HSI models were developed for each of the indicator species used in the HEP. Mean HSI's and available habitat units were determined for each cover type important to a specific species. For baseline conditions, this information is summarized in Table 47, which gives total area of usable habitat, overall mean HSI, and total habitat units for each species considering all usable vegetation communities. The table also gives average annual habitat units (AAHU) for the 110-year evaluation period.
Table 47
Baseline wildlife habitat data for 110-year evaluation period

<table>
<thead>
<tr>
<th>Species name/ type of habitat</th>
<th>Area (acres)</th>
<th>Base-Rela-</th>
<th>Relative</th>
<th>Base-Rela-</th>
<th>HU</th>
<th>AARU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mule deer (range types)</td>
<td></td>
<td>line HSI HSI</td>
<td>HSI HU</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nonwinter</td>
<td>41,500</td>
<td>0.6</td>
<td>1.00</td>
<td>0.6</td>
<td>24,900</td>
<td>27,390</td>
</tr>
<tr>
<td>Normal winter</td>
<td>38,000</td>
<td>0.6</td>
<td>1.17</td>
<td>0.7</td>
<td>26,600</td>
<td>29,260</td>
</tr>
<tr>
<td>Severe winter</td>
<td>14,000</td>
<td>0.6</td>
<td>1.67</td>
<td>1.0</td>
<td>14,000</td>
<td>15,400</td>
</tr>
<tr>
<td>Total</td>
<td>93,500</td>
<td>.6</td>
<td>.7</td>
<td>3/65,450</td>
<td>3/71,995</td>
<td></td>
</tr>
<tr>
<td>Bobcat</td>
<td>79,800</td>
<td>.2</td>
<td></td>
<td>15,960</td>
<td>17,556</td>
<td></td>
</tr>
<tr>
<td>Golden eagle</td>
<td>93,500</td>
<td>.5</td>
<td></td>
<td>46,750</td>
<td>51,425</td>
<td></td>
</tr>
<tr>
<td>Cooper's hawk</td>
<td>4,300</td>
<td>.5</td>
<td></td>
<td>2,150</td>
<td>2,365</td>
<td></td>
</tr>
<tr>
<td>Beaver</td>
<td>500</td>
<td>.2</td>
<td></td>
<td>100</td>
<td>110</td>
<td></td>
</tr>
</tbody>
</table>

1/ RVI = relative value index. This index establishes the relative value of an HSI or HU for one mule deer range type versus another.
2/ AARU = HU x evaluation period (110 years) / life of proposed project (100 years).
3/ Totals for HU and AARU are slightly different than the additive values because of rounding total values.

The data in Table 47 show that mule deer utilize all range types in the study area (93,500 acres). The mean relative HSI for deer is 0.70. Of the total amount utilized, severe winter range is the most important (HSI = 1.0) as compared to the other range types. The bobcat utilizes about 85 percent of the area, but, overall, the project area exhibits low value (HSI = 0.2) for the bobcat. The golden eagle also utilizes all of the project area which provides medium range value (HSI = 0.5) for the eagle. The Cooper's hawk utilizes mainly the riparian and aspen-conifer habitat types which constitute less than 5 percent of the study area. The overall value to the hawk is in the medium range (HSI = 0.50). The beaver is restricted to the riparian habitat which is about 0.5 percent of the study area. The riparian habitat is low quality (HSI = 0.20) for the beaver.

ENVIRONMENTAL IMPACTS

HEP was also used to describe project impacts and develop mitigation options for terrestrial wildlife species. This analysis was based on the habitat acres lost or gained for all alternatives as enumerated in Table 48.

Project impacts on wildlife may be either temporary or permanent. Temporary impacts are those habitat losses caused by the removal of vegetation associated with the construction of project features such as power transmission lines and buried pipelines and the use of borrow areas. In these types of activities, vegetation would be removed during construction but would be restored afterwards. Another type of temporary impact is one in which there would be a 50 percent loss of available habitat value for a species within a quarter mile of a concentrated construction
### Table 48

**Impacts on wildlife habitat caused by each project alternative**

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Species</th>
<th>Habitat acres lost</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Permanent</td>
<td>Temporary</td>
<td></td>
</tr>
<tr>
<td>Sixth Water Flow Through</td>
<td>Mule deer range¹/</td>
<td>1,339</td>
<td>360</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Nonwinter</td>
<td>446</td>
<td>303</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Normal winter</td>
<td>702</td>
<td>352</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Severe winter</td>
<td>426</td>
<td>1,151</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Golden eagle</td>
<td>643</td>
<td>1,284</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cooper's hawk</td>
<td>98</td>
<td>23</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Beaver²/</td>
<td>+9</td>
<td>28</td>
<td></td>
</tr>
<tr>
<td>Fifth Water Pumped Storage</td>
<td>Mule deer range¹/</td>
<td>2,066</td>
<td>791</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Nonwinter</td>
<td>610</td>
<td>275</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Normal winter</td>
<td>494</td>
<td>340</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Severe winter</td>
<td>353</td>
<td>1,491</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Golden eagle</td>
<td>1,150</td>
<td>1,696</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cooper's hawk</td>
<td>101</td>
<td>21</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Beaver²/</td>
<td>+9</td>
<td>28</td>
<td></td>
</tr>
<tr>
<td>Sixth Water Pumped Storage</td>
<td>Mule deer range¹/</td>
<td>1,697</td>
<td>374</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Nonwinter</td>
<td>398</td>
<td>306</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Normal winter</td>
<td>267</td>
<td>352</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Severe winter</td>
<td>425</td>
<td>1,160</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Golden eagle</td>
<td>644</td>
<td>1,301</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cooper's hawk</td>
<td>100</td>
<td>23</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Beaver²/</td>
<td>+7</td>
<td>28</td>
<td></td>
</tr>
<tr>
<td>1964 DPR</td>
<td>Mule deer range¹/</td>
<td>1,507</td>
<td>277</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Nonwinter</td>
<td>569</td>
<td>612</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Normal winter</td>
<td>32</td>
<td>66</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Severe winter</td>
<td>469</td>
<td>1,431</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Golden eagle</td>
<td>863</td>
<td>1,503</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cooper's hawk</td>
<td>18</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Beaver²/</td>
<td>+74</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>No Power</td>
<td>Mule deer range¹/</td>
<td>414</td>
<td>57</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Nonwinter</td>
<td>0</td>
<td>55</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Normal winter</td>
<td>5</td>
<td>59</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Severe winter</td>
<td>16</td>
<td>109</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bobcat</td>
<td>19</td>
<td>204</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Golden eagle</td>
<td>10</td>
<td>204</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cooper's hawk</td>
<td>2</td>
<td>37</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Beaver</td>
<td>1</td>
<td>44</td>
<td></td>
</tr>
</tbody>
</table>

¹/ These figures include loss of habitat value and use by mule deer caused by construction disturbance and use of primary access roads.

²/ There is a net gain in usable habitat for beaver because of the elimination of high irrigation flows in Sixth Water Creek.
activity, primarily involving dam and reservoir sites. This impact would end when the construction activity is finished.

Permanent impacts would be caused by the removal of vegetative habitat through the construction of new access roads and inundation of vegetative cover by reservoirs. A permanent impact would also occur to a specific corridor on either side of a new road where there would be a long-term disturbance factor to mule deer caused by increased public use and vehicle traffic, increased vehicle-deer collisions, and increased hunting pressure. This would amount to a loss of 50 percent of the habitat value within a quarter mile of each side of the road.

A comparison of habitat unit losses among the five alternatives analyzed, including average annual habitat units (AAHU) without the project and projected changes in AAHU with and without the recommended mitigation options, is presented in Table 48 for each indicator species. For mule deer, the primary losses for the four power alternatives occur in nonwinter range (54 to 72 percent), with lesser amounts on normal winter (17 to 27 percent) and severe winter range (1.5 to 28 percent). Mitigation values are obtained primarily on winter ranges because these range types provide the best potential for habitat improvement and wildlife management for the smallest acreage.

As indicated in Table 49, the percentage changes in AAHU's predicted to occur for each indicator species under each project alternative is relatively small. These losses are considered significant on a local basis, however, and would require implementation of the recommended mitigation option or a suitable alternative.

Recommended Plan

Table 49 shows that the impact of the recommended plan on beaver would be a reduction in habitat of 8 AAHU, or 7.3 percent. However, all but two AAHU would be compensated for by the recommended mitigation option. Mule deer would lose 1,917 AAHU, or 2.7 percent, but nearly all of this loss would be compensated by habitat improvements and management of winter ranges. Impacts on golden eagles would be next in magnitude, with 643 AAHU lost (1.3 percent); however, mitigation measures would compensate for all of the losses. Losses of bobcat habitat would be overcompensated while those of Cooper's hawk would be undercompensated. Because of the 50-foot seasonal fluctuation and steep slopes of Monks Hollow Reservoir, the shoreline would be mostly barren of vegetation within the zone of fluctuation and thus would offer limited values for wildlife. There would be limited use by water-oriented species, primarily waterfowl, shore birds, and fur bearers.

Other Alternatives

The Fifth Water Pumped Storage Alternative would cause the greatest impact of all the project alternatives and thus would require the greatest amount of mitigation to compensate for identified habitat losses.
### Table 49

Projected project changes in average annual habitat units (AAHU) for each alternative and net changes with the recommended wildlife mitigation options.

<table>
<thead>
<tr>
<th>Indicator species</th>
<th>AAHU without project</th>
<th>Sixth Water Flow Through</th>
<th>Fifth Water Pumped Storage</th>
<th>Sixth Water Pumped Storage</th>
<th>1964 DPR</th>
<th>No Power</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Project changes</td>
<td>Net changes with mitigation</td>
<td>Project changes</td>
<td>Net changes with mitigation</td>
<td>Project changes</td>
<td>Net changes with mitigation</td>
</tr>
<tr>
<td>Mule deer range</td>
<td>71,895</td>
<td>-1,917</td>
<td>-45</td>
<td>-2,463</td>
<td>+50</td>
<td>-1,829</td>
</tr>
<tr>
<td>Nonwinter</td>
<td>27,390</td>
<td>-842</td>
<td>-779</td>
<td>-1,422</td>
<td>-1,264</td>
<td>-1,164</td>
</tr>
<tr>
<td>Normal winter</td>
<td>29,260</td>
<td>-350</td>
<td>+495</td>
<td>-491</td>
<td>+682</td>
<td>-349</td>
</tr>
<tr>
<td>Severe winter</td>
<td>15,400</td>
<td>-725</td>
<td>+239</td>
<td>-550</td>
<td>+632</td>
<td>-316</td>
</tr>
<tr>
<td>Bobcat</td>
<td>17,356</td>
<td>-111</td>
<td>+150</td>
<td>-103</td>
<td>+221</td>
<td>-112</td>
</tr>
<tr>
<td>Cooper's hawk</td>
<td>2,365</td>
<td>-20</td>
<td>-14</td>
<td>-21</td>
<td>-14</td>
<td>-21</td>
</tr>
<tr>
<td>Beaver</td>
<td>110</td>
<td>-8</td>
<td>-2</td>
<td>-8</td>
<td>-1</td>
<td>-8</td>
</tr>
</tbody>
</table>
CHAPTER IV

AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

Adverse impacts from this alternative would be primarily to beaver, with a loss of 8 AAHU (7.3 percent), followed by mule deer and the golden eagle, with AAHU losses of 2,463 (3.4 percent) and 1,036 (2.0 percent), respectively. Losses of mule deer would be more than compensated, while losses of golden eagles would be compensated for at the 80 percent level.

Impacts with the Sixth Water Pumped Storage Alternative would be essentially the same as with the recommended plan.

Adverse impacts with the 1964 DPR Alternative would occur primarily to mule deer and the golden eagle, with losses of 1,657 AAHU (2.3 percent) and 840 AAHU (1.6 percent), respectively (Table 49). The recommended mitigation option provides full compensation for mule deer but only 65 percent compensation for habitat losses to golden eagles.

Adverse impacts to wildlife with the No Power Alternative would be primarily to beaver, with losses in AAHU's of three, or 2.7 percent. Impacts to mule deer would consist of an AAHU loss of 330 (0.5 percent). Mitigation measures would not provide any compensation for beaver but would adequately compensate for mule deer habitat losses. Impacts to other species would be more than compensated.

Because of the fluctuating nature of Fifth Water and Monks Hollow Reservoirs in the Fifth Water Pumped Storage Alternative, the shoreline would be essentially barren of vegetation within the zone of fluctuation and thus would have little value for wildlife. Rapidly fluctuating water levels in the major reservoirs of the Fifth Water Pumped Storage Alternative would also apply to Monks Hollow Reservoir under the Sixth Water Pumped Storage Alternative, with similar ecological impacts. Monks Hollow and Hayes Reservoirs under the 1964 DPR Alternative would gradually be drawn down throughout the summer and, consequently, would offer more available habitat to water-oriented species.

Endangered Species

A biological assessment of potential impacts of the Diamond Fork Power System on listed species was completed in March 1981 (see Attachment 3). This assessment represents full compliance with Section 7 of the Endangered Species Act of 1973 and amendments of 1978. The Fish and Wildlife Service indicated that the bald eagle and American peregrine falcon occur within the project area (memorandum dated September 17, 1980) and addressed potential project impacts on these species. There are no additional State-listed species that may be affected. There are no threatened or endangered plant species in the project area. The assessment concluded that major long-term impacts would not be anticipated, and the project would have no significant effect on either species. Some short-term local effects may become apparent on wintering bald eagles but would not be significant. The peregrine falcon is only a rare transient in the area, with no recorded nesting activity. This is confirmed by the lack of recent falcon sightings. Concordance with
Reclamation on the foregoing assessment and conclusions was obtained by memorandum from the Fish and Wildlife Service on April 21, 1981. No further action related to endangered species is required unless a significant change in project plans or additional biological information is acquired.

The June sucker (Chasmistes liorus mictus), which inhabits Utah Lake and is believed to use the lower Spanish Fork River for limited spawning and larval rearing, has been proposed for listing and could be listed prior to initiation of project construction. Existing information indicates that the Diamond Fork Power System would either have no impact or would enhance conditions for this species in the lower Spanish Fork River. If the June sucker is listed on the Endangered Species List, a more detailed analysis will be accomplished and all conditions of the Endangered Species Act of 1973 and amendments of 1982 would be met. Reclamation is presently working with the Fish and Wildlife Service and the Utah Division of Wildlife Resources to collect the data necessary to develop a management plan that would maintain and enhance the species.

The Fish and Wildlife Service is currently investigating the threatened and endangered status of the Bonneville cutthroat trout. Individuals of this species are known to inhabit Fifth Water Creek. However, isolated pure populations have recently been identified in a number of other streams in the Intermountain Region, indicating that they are perhaps not as rare as once believed. In addition, the recommended plan would not affect Fifth Water Creek where this species occurs. Project effects on this species will receive no additional consideration unless the recommended plan changes and/or additional information on its status becomes available from the Fish and Wildlife Service.

Vectors

Existing conditions

Common mosquito species likely occurring in the project area include Aedes dorsalis, Aedes vexans, Aedes increpitus, Aedes fitchii, Anopheles freeborni, Culex tarsalis, Culiseta Incidens, and Culiseta Inornata. Fairly large populations develop in lower Diamond Fork Canyon in areas affected by irrigation and stock-watering practices. In addition, significant populations are generally evident in Rays Valley around ground water seeps where there is standing water associated with grasses and other emergent vegetation. Presently, there is no active mosquito abatement program in these areas.

Anopheles freeborni is the principal vector of malaria in the Western United States and is widely distributed in Utah throughout the spring and summer months at elevations below 7,000 feet. Although this species has the potential to transmit disease, it is primarily a source of annoyance, as the occurrence of malaria in this area is extremely rare. Culex tarsalis is the chief vector for western equine
encephalitis, a brain disease found in horses and humans. It is likely the most prevalent vector-borne disease in the area, but it occurs rarely and then only in lower elevation areas such as at the mouth of Diamond Fork. Because of the abundance of this species statewide and its disease significance, it is the most important species in the State.

Most of the Aedes species are significant pests to humans. Some are severe biters and can cause health problems for children, primarily through secondary infections and allergic reactions. A severe pest problem sometimes exists around mountain reservoirs because of the gradual, extensive drawdown associated with the reservoirs.

Often, mosquitoes occurring in the canyon areas are single-brood species, where only one major hatch occurs each year, usually between early May and late June. As a result, only a few adults remain by late July and August. The eggs are laid in moist soil during the spring but cannot hatch without resubmergence, which does not occur until the following year.

Environmental impacts

Project operation with any of the alternatives would not increase vector-related diseases such as encephalitis and malaria over existing conditions. Irrigation and stock-watering practices in lower Diamond Fork Canyon would be discontinued with the probable acquisition of land for project purposes.

With the recommended plan and the 1964 DPR Alternative, project reservoirs would undergo gradual drawdown through the summer, creating some potential for mosquito production. The steep reservoir sides and excessive depths, however, would not create a large area for mosquito production and thus would probably not be significant in creating higher mosquito populations than exist currently.

The project would create relatively steep-sided and deep reservoirs. Rapid daily and weekly fluctuation in the reservoirs associated with the Fifth Water Pumped Storage and Sixth Water Pumped Storage Alternatives would preclude any significant mosquito production along the shoreline. Overall, mosquito habitat should be decreased with both alternatives.

Air Quality

Existing conditions

The Diamond Fork area is located in fairly remote and rugged mountainous terrain. The air quality associated with this area is generally excellent. A limited problem with air quality parameters such as total suspended particulates (TSP), carbon monoxide (CO), and ozone probably occurs because of drift from Salt Lake and Utah Counties.
Primary sources of existing air pollutants in the project area include exhaust emissions from vehicles using the area for recreation and campfires in several national forest campgrounds in the area.

Environmental impacts

RECOMMENDED PLAN

Long-term impacts on air quality would include some increased vehicle emissions and campfires because of increased use in the area. Road access would be much improved, and recreation facilities on forest land would be increased. This, along with the increased use associated with project operations and maintenance, would contribute to some increased level of air pollutants. This impact would not be significant, however, in its effect on the excellent overall air quality of the Diamond Fork area.

There would be some temporary adverse impact on air quality associated with the construction of project features. Mitigation measures designed to alleviate this impact are discussed in Chapter III.

OTHER ALTERNATIVES

The impacts of the project on air quality, including both the construction phase and the operation and maintenance phase, would be essentially the same as those described for the recommended plan. Slight variations could occur because of the variation in size of the project under each of the alternatives.

Geology and Seismicity

General

Surface deposits and formations in the project area range in age from Pennsylvanian (about 310 million years old) to Quaternary (about 10,000 years old). Figure 26 is a general geologic map of the area. Rock exposed at feature locations is sedimentary in nature and consists of conglomerate, sandstone, limestone, shale, and siltstone. A general geologic section is shown in Figure 27.

Tectonically, the Diamond Fork Power System lies near the overthrust front of the Sevier Orogenic Belt of Cretaceous Age (65 million years ago). This tectonic activity, when combined with other Tertiary Age mountain building, accounts for the complex north-south trending folds, with intersecting east-west and north-south trending faults present in the project area. (The Tertiary Age is a geologic time period extending from 1.8 million years ago to 65 million years ago.)

The Diamond Fork Power System is situated within the Intermountain Seismic Belt, a zone of seismicity that extends from the Arizona-Nevada
Landslide Deposits (Qls), Valley Fill (Qal)
Wanrhodes Volcanics
Uinta Formation
Green River Formation
Flagstaff Limestone
North Horn Formation
Morrison Formation
Curtis Formation
Entrada Sandstone

Jtc Twin Creek Limestone
Jn Nugget Sandstone
Ja Anker Limestone
Thaynes Formation
Woodside Shale
Park City Formation
Diamond Creek Sandstone
Kirkman Limestone
Oquirrh Formation

SCALE OF MILES
1 0 1 2

Fault - bar and ball on downthrown side
Contact

CHAPTER IV

GENERALIZED GEOLOGIC FORMATIONS

NOT EXPOSED

MORRISON

CURTIS

ENTRADA

EXPOSED IN FOUNDATIONS

UINTA

GREEN RIVER

COLTON-GREEN RIVER

FLAGSTAFF

NORTH HORN

Morrison

CURTIS

ENTRADA

TWIN CREEK

NUGGET

SYSTEM FEATURES

SYAR TUNNEL

SYAR DAM

CORONA AQUEDUCT

SIXTH WATER DAM

DYNE AQUEDUCT

MONKS HOLLOW RESERVOIR

MONKS HOLLOW DAM

FIGURE 27
DIAMOND FORK POWER SYSTEM GENERALIZED GEOLOGIC SECTION

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border through Utah, Idaho, Wyoming, and into Montana. The Intermountain Seismic Belt is 60 to 120 miles wide in northern and central Utah, with the center being roughly the Wasatch Fault. The Intermountain Seismic Belt is considered to have one of the highest levels of earthquake risk in the contiguous United States, outside of California and Nevada. Figure 28 shows locations of major Utah earthquakes of magnitude 4.0 (Intensity V) or greater from 1850 to 1978.

A seismotectonic study for Soldier Creek Dam, located approximately 9 miles east of the easternmost feature of the Diamond Fork Power System, assigned maximum credible earthquakes (MCE) of 6.5 for the Stinking Springs Fault and 7.0 for the Strawberry Fault. These faults are located approximately 9 miles and 4.5 miles, respectively, east of the inlet portal of Syar Tunnel. Monks Hollow Dam site, located approximately 9.6 miles east of the Wasatch Fault was assigned an MCE of 7.5 in a feasibility seismic hazard evaluation.

Existing geology of feature sites

SYAR TUNNEL

Syar Tunnel would begin at the west bank of Strawberry Reservoir near the East Portal of the existing Strawberry Tunnel. The tunnel alignment lies in sedimentary rocks of the Uinta and Green River Shale Formations. These sedimentary rocks were deposited in a fresh water lake environment and consist of interbedded layers of sandy, calcareous shale, limestone, and sandstone alternating with layers of sandy mudstone and siltstone. These rocks are tilted upstream from 10° to 15°.

Existing geologic investigations of Syar Tunnel are limited to surface examination of the alignment; however, 24 core holes have been completed in the vicinity of the tunnel. Core from these drill holes has been logged noting rock type, fracture orientation, core recovery and rock quality designation (RQD). Additional core holes are planned along the alignment and at the portals to complete investigations of geologic conditions and provide design data.

SYAR DAM AND RESERVOIR

Syar Dam and Reservoir would lie entirely in rock of the Tertiary Age Green River Formation. The Green River Formation consists predominantly of shale with interbedded sandstone and limestone. These rocks dip from 2° to 5° northeast. The shale is soft and weathers readily to form steep rounded slopes, while the sandstone and limestone are resistant to weathering and form ledges. A thin soil layer (0 to 3 feet) overlies the dam and reservoir site. The soil is highly plastic and very slowly permeable.

Five exploratory drill holes have been completed in the area. Core obtained from these holes shows that the bedrock is moderately to intensely weathered to a depth of 10 feet but is fresh and in excellent
Epicenter map of the largest historical earthquakes in the Utah region, 1850-1978. For coincident epicenters, only the largest event is shown. Earthquakes of magnitude 5 1/2 or greater are dated by year.

Source: University of Utah Department of Geology and Geophysics.
CHAPTER IV

Environment and Environmental Consequences

Condition below. Permeability tests performed in the 5 drill holes show the rock to have a very low permeability.

Faulting has been identified in the area of Syar Dam and Reservoir. These faults are not considered active and they do not pass through the dam or reservoir site.

Additional exploratory drilling is planned to complete geologic investigations and provide design data.

SIXTH WATER DAM AND RESERVOIR

Sixth Water Dam and Reservoir would lie in the bedrock of the North Horn, Flagstaff, and Colton Formations. These formations consist of limestone and siltstone with minor amounts of shale. They are tilted upstream at about 6.5° and strike nearly parallel to the axis of the dam. At the axis, bedrock is exposed in the stream channel and intermittently up both abutments to above crest elevation. Surficial deposits are deepest near the bottom of the right abutment where slopewash has accumulated to a depth of 20 feet. The upper abutments are partially covered by soil.

Three exploratory drill holes have been completed along the axis of Sixth Water Dam. Core obtained from these holes shows that the rock is massive and free from open joints. Permeability tests performed in the three holes show the rock to have very low permeability.

Faulting has been identified in the Sixth Water area. These faults are not considered active. No faulting has been identified passing through the dam and reservoir site.

Additional exploratory drilling is planned along the axis to complete geologic investigations and provide design data.

MONKS HOLLOW DAM AND RESERVOIR

Monks Hollow Dam would be founded on the Twin Creek Limestone and Nugget Sandstone Formations. The Twin Creek Limestone near the damsite is thin bedded and hard. The Nugget Sandstone is massive, crossbedded, and hard. The bedding dips about 22° upstream.

Surficial deposits mantle parts of the bedrock at the site. They consist of stream alluvium, alluvial fan, terrace, talus, and slopewash deposits. These deposits range from clay, silt, and sand to gravels, cobbles, and boulders. These unconsolidated materials are about 75 feet thick near the stream and less than 24 feet thick on the abutments.

Thirteen exploratory drill holes were completed near the proposed axis during the most recent investigations of Monks Hollow Dam. Table 50 summarizes some of the information obtained.
CHAPTER IV

AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

Table 50
Geologic drilling at the Monks Hollow Dam site

<table>
<thead>
<tr>
<th>Drill hole number</th>
<th>General location</th>
<th>Depth to rock (feet)</th>
<th>Fractures per foot</th>
<th>Permeability</th>
</tr>
</thead>
<tbody>
<tr>
<td>DH-101</td>
<td>Left abutment</td>
<td>306</td>
<td>5</td>
<td>0.9</td>
</tr>
<tr>
<td>DH-102</td>
<td>Left abutment</td>
<td>202</td>
<td>0</td>
<td>0.7</td>
</tr>
<tr>
<td>DH-103</td>
<td>Right abutment</td>
<td>284</td>
<td>71.5</td>
<td>0.5</td>
</tr>
<tr>
<td>DH-104</td>
<td>Center</td>
<td>256</td>
<td>73.4</td>
<td>0.8</td>
</tr>
<tr>
<td>DH-105</td>
<td>Right abutment</td>
<td>314</td>
<td>13.6</td>
<td>0.7</td>
</tr>
<tr>
<td>DH-106</td>
<td>Right abutment</td>
<td>205</td>
<td>14.3</td>
<td>1.6</td>
</tr>
<tr>
<td>DH-107</td>
<td>Right abutment</td>
<td>300</td>
<td>25.7</td>
<td>1.1</td>
</tr>
<tr>
<td>DH-108</td>
<td>Downstream</td>
<td>156</td>
<td>76</td>
<td>1.5</td>
</tr>
<tr>
<td>DH-109</td>
<td>Downstream</td>
<td>203</td>
<td>0</td>
<td>1.1</td>
</tr>
<tr>
<td>DH-110</td>
<td>Downstream</td>
<td>205</td>
<td>0</td>
<td>1.9</td>
</tr>
<tr>
<td>DH-111</td>
<td>Right abutment</td>
<td>300</td>
<td>9</td>
<td>0.8</td>
</tr>
<tr>
<td>DH-201</td>
<td>Right abutment</td>
<td>251</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>DH-202</td>
<td>Center</td>
<td>201</td>
<td>70</td>
<td>1.1</td>
</tr>
</tbody>
</table>

Bedrock in the Monks Hollow Reservoir site is covered with from 0 to 100 feet of surficial deposits. These deposits range from silt, sand, and clay to gravel, cobbles, and boulders. Bedrock in the reservoir area consists of Twin Creek Limestone, Entrada Sandstone, and North Horn Formation. Bedding dips upstream between 10° and 40°. This bedding orientation is favorable and would aid in preventing seepage from the reservoir along bedding planes.

Faulting has been identified in the area of Monks Hollow Dam site. These faults are not considered active. Poor recovery, high water losses, and intense fracturing were noted in drill holes that encountered fault zones. Additional exploration is planned, including short adits into the abutments to further quantify rock conditions.

Environmental impacts

Landslides and seismicity in the Diamond Fork Power System project area and seepage from the proposed reservoirs are the primary concerns associated with the geology of the project features.

LANDSLIDES

Thistle landslide is located near the project area, about 7.5 miles southwest of the proposed Monks Hollow Dam. Thistle slide has attracted considerable attention because it is by far the most costly geologic event in Utah's history.

Thistle landslide is part of an ancient landslide mass consisting of material derived from the North Horn Formation and Flagstaff Limestone. Larger fragments within the slide are limestone. The matrix material is mostly clay derived from mudstone and claystone. Intermit-tent movement of the slide mass has been noted during historical time,
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but it is believed to have been confined to very small areas of the slide, mostly near the head and toe. Cumulative moisture during the 1981-82 and 1982-83 water years is believed to have created unusually high ground water pressure at the sole of the landslide mass, causing it to move.

Three large ancient landslides have been identified in the project area, along with many smaller slides. Two of the slides are located in lower Diamond Fork Canyon, about 2 and 5 miles below the proposed Monks Hollow Damsite. The third slide is near the head of Sheep Creek about 6.6 miles south of the proposed Syar Damsite. These slides would have no effect on the major features of the project. No large landslide capable of producing a significant loss in reservoir capacity, turbidity, or seiche generation is expected in the proposed reservoirs.

SEISMICITY

Faulting in the project area is considered inactive; however, as previously stated, the project area is located in a zone of seismicity that is considered to have one of the highest levels of earthquake risk in the contiguous United States. Feasibility seismic hazard evaluations have been conducted at Monks Hollow Damsite and a maximum credible earthquake (MCE) of 7.5 has been determined. (A maximum credible earthquake is a hypothetical earthquake from a given source that could produce the most severe ground motion at the site.) Detailed seismotectonic studies would be conducted during final design. The proposed Syar, Sixth Water, and Monks Hollow Dams would be designed to insure that they could withstand a maximum credible earthquake.

SEEPAGE

The general location of Syar Reservoir suggests that seepage may be a concern. However, permeability tests in five exploratory drill holes show the rock to be impervious. If during additional exploration a seepage problem is found, the small reservoir could be lined with materials from near the site.

Sedimentary rocks at Sixth Water Damsite have been drilled and water tested. Testing shows the rock to have a very low permeability.

Sedimentary rock at the Monks Hollow Damsite has been drilled and tested. High water losses were noted in drill holes that encountered fault zones. Adequate control of seepage around or under the dam or along faults can be accomplished by excavating a cutoff trench into the rock and grouting. Additional exploration, including exploratory adits into the abutments, is planned to further quantify rock conditions at the site.

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Cultural Resources

Existing conditions

Intensive (Class III) cultural resource surveys covering approximately 90 percent of the project area for all alternatives identified 4 prehistoric and 19 historic sites. The Bureau of Reclamation and the Utah State Historic Preservation Officer have determined that none of these cultural resources is significant. The remaining 10 percent of the project area to be surveyed would be in the feature areas of (1) the pipeline for the No Power Alternative and (2) the switchyards, transmission lines, material sources, and contractor staging areas for all other alternatives. Reclamation (or Western for transmission line corridors) would develop a discovery plan, in consultation with the State Historic Preservation Officer, for the evaluation of resources identified during construction activities. If significant resources are discovered during construction, a plan would be developed in consultation with the State Historic Preservation Officer and the Advisory Council on Historic Preservation to mitigate project impacts on significant resources.

Environmental impacts

Based on surveys of 90 percent of the project feature sites, the Bureau of Reclamation has made a "determination of no effect" to known cultural resources for all alternatives of the proposed project. The Utah State Historic Preservation Officer has concurred with this determination21 (see also Attachment 4).

Social and Economic Considerations

In 1977, a major social and economic assessment of the Diamond Fork area was concluded.22 A two-volume report on that assessment is quite comprehensive in detail. This analysis does not duplicate that study; rather, it focuses on those aspects that seem particularly important or represent significant change since the 1977 study. Perhaps most important, rapid population growth in the 1970's followed by economic stagnation in the early 1980's may have produced problems in providing public services and facilities. Generally, this analysis focuses on demographic, economic, and social conditions as well as projections where they differ from the 1977 study. Also, this analysis compares project-induced impacts with future conditions expected to occur at the time the project would be implemented.

Population and demographics

EXISTING CONDITIONS

In the 1980 census, Utah County, where most of the Diamond Fork Power System features and associated personnel would be located, had a population of 218,106 persons. Over half of that population resided in
the county's two largest cities—Provo and Orem. In 1980, a total of 14 communities had a population of 2,000 or more. These communities contain about 92 percent of the county's population.

In the 70-year period between 1900 and 1970, Utah County averaged an annual rate of growth of 2.1 percent. During the first 20 years of the period (i.e., 1900-20), the rate of population growth in Utah County was slower than for the rest of the Wasatch Front (Davis, Salt Lake, and Weber Counties). In fact, it was not until after 1930 that the cumulative growth rate for Utah County exceeded that of the non-Wasatch Front portion of the State and not until almost 1950 that the cumulative rate for Utah County was greater than the State average.

The 70-year pattern of slowly accelerating urbanization in Utah County was speeded up during the 1970's. Population growth jumped to an annual rate of 4.7 percent in the period between 1970 and 1980, the highest level of growth for Utah County during any decade in this century. Over the same time period, the rate of growth for the rest of the Wasatch Front was 2.9 percent, only slightly greater than the historical growth rate of 2.6 percent for these three counties.

Several conclusions can be drawn from these data. First, compared to the rest of the Wasatch Front, urbanization came more slowly to Utah County, at least over the first 70 years of this century. Second, since 1970, the pace of urbanization in Utah County has quickened. Within the Wasatch Front, this county alone experienced rapid population growth during the 1970's. Yet there is still considerable room for future population growth. While the population density of Utah County in 1980 was only 109 persons per square mile, the comparable figure for the rest of the Wasatch Front was 576 persons per square mile.

Reclamation has projected that Utah County will undergo an average annual growth in population of about 2.3 percent through the year 2000 (Table 51). This projection and all others for this analysis were made by the Bureau of Reclamation Economic Assessment Model (BREAM). The projection is based on the assumption that the economic structure of the county will not undergo major disruption (e.g., within the manufacturing sector) over the projection period. At this growth rate, the county's population would reach about 341,400 persons by the year 2000, a net increase of about 123,000 persons between 1980 and 2000. Even so, the population density of the county would increase to only 172 persons per square mile, still well below the rest of the Wasatch Front's current density of 576 persons per square mile.

Two characteristics are important in analyzing the age structure of Utah County. First, it is younger than average; 43.6 percent of the population in the county is 19 years old or less. The national average is 32 percent; while the State average is 41.1 percent. Second, there is a preponderant proportion of females in Utah County within the age categories 15 to 19 and 20 to 24. The same pattern exists for the State of Utah overall, but it is considerably less apparent. The cause for
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#### Table 51

**Historic and projected population and growth rates for Utah County and major communities**

<table>
<thead>
<tr>
<th></th>
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<th></th>
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</thead>
<tbody>
<tr>
<td><strong>Population</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Census</td>
<td>1,047</td>
<td>2,649</td>
<td>3,200</td>
<td>3,800</td>
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<tr>
<td>Alpine</td>
<td>7,717</td>
<td>12,417</td>
<td>15,200</td>
<td>18,300</td>
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<tr>
<td>American Fork</td>
<td>6,659</td>
<td>12,417</td>
<td>18,300</td>
<td>24,000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lehi</td>
<td>4,644</td>
<td>9,796</td>
<td>13,200</td>
<td>18,300</td>
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<tr>
<td>Lindon</td>
<td>2,726</td>
<td>4,600</td>
<td>6,800</td>
<td>9,200</td>
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<tr>
<td>Mapleton</td>
<td>1,980</td>
<td>3,400</td>
<td>5,200</td>
<td>7,200</td>
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<tr>
<td>Orem</td>
<td>12,729</td>
<td>25,729</td>
<td>33,600</td>
<td>43,100</td>
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<tr>
<td>Payson</td>
<td>4,501</td>
<td>8,246</td>
<td>10,000</td>
<td>12,800</td>
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<tr>
<td>Pleasant Grove</td>
<td>3,277</td>
<td>6,469</td>
<td>8,400</td>
<td>10,300</td>
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<td>Provo</td>
<td>53,111</td>
<td>106,900</td>
<td>121,300</td>
<td>141,300</td>
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<td>Salem</td>
<td>1,011</td>
<td>2,333</td>
<td>3,000</td>
<td>3,700</td>
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<tr>
<td>Spanish Fork</td>
<td>7,284</td>
<td>15,300</td>
<td>19,500</td>
<td>24,000</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Springville</td>
<td>8,370</td>
<td>12,101</td>
<td>15,500</td>
<td>18,300</td>
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<td></td>
<td></td>
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<tr>
<td>Other</td>
<td>13,654</td>
<td>22,375</td>
<td>29,500</td>
<td>37,300</td>
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<tr>
<td><strong>Total</strong></td>
<td>137,780</td>
<td>218,106</td>
<td>257,100</td>
<td>308,300</td>
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<tr>
<td><strong>Average</strong></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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</tr>
</tbody>
</table>

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This seeming anomaly is that within this age group, young members of The Church of Jesus Christ of Latter-day Saints (LDS) leave the area, the State, and sometimes the Nation on religious missions. Since most of these persons are male, a disproportionate number of females remain within the county, affecting the distribution of this age group.

A primary reason for the youthful character of Utah County's population is a large student population associated with Brigham Young University and Utah Technical College, both of which are located within the county. A second reason is the rate of live births, 39.9 per 1,000 persons in Utah County. That is the highest rate for any county in Utah and well above the State average of 29.5. The national rate is 15.9 births per 1,000 persons.

ENVIRONMENTAL IMPACTS

Recommended Plan

The greatest population impact of the recommended plan is projected for years 1987 and 1988 when an additional 1,900 persons would be added to Utah County's population base (Table 52). The population impact would, however, constitute less than 1 percent of the total population.

Table 52

Construction-related population impacts beyond the baseline by community
Sixth Water Flow Through Alternative, 1986-89

<table>
<thead>
<tr>
<th></th>
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<td>Provo</td>
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<td>290</td>
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<td>Orem</td>
<td>260</td>
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<td>Springville</td>
<td>90</td>
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<td>135</td>
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<td>American Fork</td>
<td>75</td>
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<td>75</td>
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<tr>
<td>Spanish Fork</td>
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<td>140</td>
<td>140</td>
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<td>Pleasant Grove</td>
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<td>Lehi</td>
<td>45</td>
<td>70</td>
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<td>Payson</td>
<td>70</td>
<td>105</td>
<td>105</td>
<td>70</td>
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<td>Mapleton</td>
<td>45</td>
<td>65</td>
<td>65</td>
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<tr>
<td>Lindon</td>
<td>30</td>
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<td>Santaquin</td>
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<tr>
<td>Salem</td>
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<td>55</td>
<td>35</td>
</tr>
<tr>
<td>Alpine</td>
<td>30</td>
<td>40</td>
<td>40</td>
<td>30</td>
</tr>
<tr>
<td>Others</td>
<td>110</td>
<td>165</td>
<td>165</td>
<td>110</td>
</tr>
<tr>
<td>Utah County total</td>
<td>1,275</td>
<td>1,905</td>
<td>1,905</td>
<td>1,275</td>
</tr>
</tbody>
</table>

There are generally two types of impacts: those that occur during project construction and those that may occur following construction. With large projects, infrastructure and services created before or during construction for the purpose of accommodating work force needs can become
a burden to the local community and taxpayers after the project is completed. With the recommended plan, there would be virtually no post-construction infrastructure/services impacts. Any additional infrastructure or services created to meet the needs of the construction work force would be utilized by a growing population base. Although additional services and infrastructure would have to be provided earlier in order to meet the needs of the construction work force, there would be virtually no remaining excess capacity following withdrawal of the work force.

Population impacts associated with project construction would not be evenly distributed throughout the region (Table 52). In 1987 and 1988, the peak year of construction, some 435 persons would be added to the city of Provo's population, for example. Nearly half of all incoming population associated with construction of the project would settle in the Provo-Orem area.

Other Alternatives

Population impacts associated with the No Power and 1964 DPR Alternatives would be less than the recommended plan in the peak year of construction (Table 53). Impacts associated with the Fifth Water Pumped Storage and Sixth Water Pumped Storage Alternatives, however, would be nearly double that of the recommended plan. In addition, the length of construction would also be greater for these alternatives. Population impacts for the other alternatives are presented in Table 53 for the entire county.

Table 53
Population impacts in Utah County for remaining alternatives, 1986-92

<table>
<thead>
<tr>
<th>Year</th>
<th>Fifth Water Pumped Storage</th>
<th>Sixth Water Pumped Storage</th>
<th>1964 DPR</th>
<th>No Power</th>
</tr>
</thead>
<tbody>
<tr>
<td>1986</td>
<td>1,465</td>
<td>1,100</td>
<td>1,165</td>
<td>575</td>
</tr>
<tr>
<td>1987</td>
<td>2,385</td>
<td>1,960</td>
<td>1,750</td>
<td>865</td>
</tr>
<tr>
<td>1988</td>
<td>2,695</td>
<td>2,570</td>
<td>1,750</td>
<td>865</td>
</tr>
<tr>
<td>1989</td>
<td>3,375</td>
<td>3,430</td>
<td>1,165</td>
<td>575</td>
</tr>
<tr>
<td>1990</td>
<td>3,850</td>
<td>2,330</td>
<td></td>
<td></td>
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<tr>
<td>1991</td>
<td>2,895</td>
<td>855</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1992</td>
<td>1,465</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1/ Does not include population impacts associated with indirect employment caused by project construction.

Economy

EXISTING CONDITIONS

The economy of Utah County centers on four key sectors, which are services, manufacturing, trade, and government. These sectors provide
almost 9 out of 10 nonagricultural jobs in the county, with services providing about 30 percent, manufacturing 21 percent, trade nearly 20 percent, and government about 18 percent. Services and manufacturing rank high, primarily because of the presence of the county's two largest employers—Brigham Young University and United States Steel's Geneva Plant. The remaining economic sectors (i.e., mining; construction; transportation; communications and public utilities; other; and finance, insurance, and real estate) provide less than 12 percent of the nonagricultural jobs in the area. Construction has generally been a vital industry in Utah County, reflective of continued urban and suburban development. This sector has been highly susceptible to the current economic recession, however, dropping from employing 6.9 percent of all nonagricultural jobs in 1978 to only 3.5 percent in 1982.

Reclamation projects nonagricultural employment would increase at an annual rate of 2.75 percent between 1980 and 2000. This figure is higher than the average annual population increase rate (2.3 percent), reflecting changes in Utah County's age structure, potential labor supply, and other factors.

All of the nonagricultural sectors show increases in employment (Table 54). The greatest number of jobs (about 12,410) would be added by the manufacturing sector between 1980 and 2000. The four primary sectors (i.e., services, manufacturing, trade, and government) taken together would add around 37,260 new jobs to Utah County's economy. The total increase for all sectors between 1980 and 2000 is projected to be 48,500 jobs.

The sector projected to experience the greatest growth would be "other," followed by manufacturing and trade. By the year 2000, manufacturing is projected to replace services as the dominant employment sector in Utah County. All of the sectors except construction, however, are projected to grow in employment at rates in excess of 2 percent per year.
Although agriculture provides less than 2 percent of all full-time jobs in the area, Utah County continues to rank at or near the top of every major Statewide indicator of farming activity. About 11.7 percent of the 13,700 farms in the State in 1978 were located in Utah County. A disproportionate number of these farms have a market value of agricultural products sold annually below $10,000, suggesting that despite national trends toward large-scale commercial farming, agriculture in Utah County is increasingly characterized by small-scale, part-time farms. Reclamation has projected that agricultural employment (both proprietors and labor) will drop from 1,040 in 1982 to 755 in 2000, an average annual decline of 1.68 percent.

As was the case nationwide, unemployment rose in Utah County in the early 1980's. It increased almost on a monthly basis, and at a rate greater than that for the State and the Nation. In November 1981, unemployment in Utah County was a relatively modest 5.6 percent, well below the State level of 6.1 percent and the national level of 8.3 percent. By November 1982, a year later, unemployment in Utah County had risen to 9.6 percent, about midway between the State's unemployment level of 8.8 percent and the national average of 10.8 percent. Reclamation has projected that unemployment in Utah County will remain above the 10 percent level through the projection period (1980-2000).

In 1970, personal per capita income in Utah County was $2,571 or 71 percent of the State average and 64 percent of the national average. During the 1970's, personal per capita income in Utah County increased at a rate of 9.9 percent, so that by 1980 it was $5,866. Although it increased at a high enough rate so that personal per capita income in Utah County had reached 77 percent of the State average, it was not rapid enough to gain against the national average. In fact, by 1980, the county's per capita personal income had fallen to less than 62 percent of the national average.

ENVIRONMENTAL IMPACTS

Recommended Plan

The recommended plan would create some 5,620 jobs (3,525 person-years of employment) in direct project employment, approximately 5,900 jobs (person-years) in indirect employment, and another 2,850 jobs (person-years) on the basis of the purchase of materials, equipment, etc. During the 4-year construction period, Reclamation estimates a total of 14,370 jobs would be created in Utah County from construction of the recommended plan. Assuming construction were to start in 1986, employment opportunities created by the project would be greatest in 1987 and 1988 (Table 55).

About 90 percent of the direct construction workers would be non-government contractor employees who would occupy a variety of positions
CHAPTER IV

Table 55
Estimated direct, indirect, and other employment\(^1\)/\(^2\)/\(^3\)/\(^4\)/ for recommended plan

<table>
<thead>
<tr>
<th>Employment</th>
<th>Construction year</th>
<th></th>
<th></th>
<th></th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Direct</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contractor</td>
<td>1,010</td>
<td>1,515</td>
<td>1,515</td>
<td>1,010</td>
<td>5,050</td>
</tr>
<tr>
<td>Government</td>
<td>115</td>
<td>170</td>
<td>170</td>
<td>115</td>
<td>570</td>
</tr>
<tr>
<td>Subtotal</td>
<td>1,125</td>
<td>1,685</td>
<td>1,685</td>
<td>1,125</td>
<td>5,620</td>
</tr>
<tr>
<td>Indirect</td>
<td>1,180</td>
<td>1,770</td>
<td>1,770</td>
<td>1,180</td>
<td>5,900</td>
</tr>
<tr>
<td>Other</td>
<td>570</td>
<td>855</td>
<td>855</td>
<td>570</td>
<td>2,850</td>
</tr>
<tr>
<td>Total</td>
<td>2,875</td>
<td>4,310</td>
<td>4,310</td>
<td>2,875</td>
<td>14,370</td>
</tr>
</tbody>
</table>

1/ Contractor's on-site labor is estimated at 9.1 person-years per $1,000,000 appropriations in July 1980 dollars (see Construction Impact for Each $1,000,000 of Appropriations, Engineering and Research Center, Bureau of Reclamation, Denver, Colo., July 1980).

2/ The estimate for indirect employment stemming from project construction is generated by the Bureau of Reclamation Economic Assessment Model (BREAM) and falls within the range of the multiplier for new construction in Utah County which ranges between 2.0 and 2.5 (see I. E. Bradley and Boyd Fjeldated, University of Utah, Bureau of Economic and Business Research, 1975).

3/ "Other" is the estimate of 30 percent of the value of all materials, equipment, etc. sold in Utah County, induced and stemming from project construction, divided by the 1980 annual average wage in Utah County.

4/ Jobs are based on a 7-month construction period with 1.71 jobs equaling one person-year of employment.
during the 7-month construction season. Most government employees in
the remaining jobs would be full-time inspectors and engineers.

When all employment—direct, indirect, and other—is taken together,
it would constitute about 3 percent of all employment in Utah County in
the year 1986, the first year of construction, more than 4 percent in the
years 1987 and 1988, and nearly 3 percent in 1989. When direct, in­
direct, and other employment are taken into consideration, the total
number of employment opportunities would constitute 3.6 percent of all
employment in Utah County, on the average, over the life of the project.

Approximately $372.7 million would be spent on construction mate­
terials, equipment, and labor during the 4-year construction schedule.
Based on spending patterns for past Reclamation projects, about 30 per­
cent, or $111.8 million, would be realized in construction worker wages.
Wages would total about $22.4 million in the first year, rise to $33.5
million in years two and three, and decline to $22.4 million in the
final year.

Most of the money from the construction workers' paychecks for the
Diamond Fork Power System would be spent in Utah County, particularly in
the cities of Provo and Orem. The economic stimulus would be substantial
but, for the most part, would last only through the duration of the
4-year construction period. The recommended plan would help reduce local
unemployment since 530 of the direct jobs in the first and fourth years
and 800 direct jobs in the second and third years would be filled by
local workers. In addition, nearly all of the indirect and other jobs
would be filled locally. As a consequence, the number of young persons
and others leaving the area for employment would be reduced.

Other Alternatives

Of the other alternatives, the pumped storage alternative would
produce the greatest number of jobs while the other alternatives produce
less (Table 56). The Fifth Water Pumped Storage Alternative would create
16,235 direct jobs (10,155 person-years), 17,050 indirect jobs (person­
years), and 5,885 other jobs (person-years) for a total of 39,170 jobs
(33,090 person-years) over a 7-year construction period. The Sixth
Water Pumped Storage Alternative would create 10,845 direct jobs (6,790
person-years), 11,385 indirect jobs (person-years), and 3,935 other jobs
(person-years) for a total of 26,165 jobs (22,005 person-years) over a
6-year construction period.

The two remaining alternatives would produce fewer jobs than the
recommended plan. The 1964 DPR Alternative would produce 5,160 direct
jobs (3,230 person-years), 5,420 indirect jobs (person-years), and
2,620 other jobs (person-years) for a total of 13,200 jobs (10,970
person-years) over a 4-year construction period. The No Power Alterna­
tive would produce the fewest employment opportunities; 2,550 direct
jobs (1,600 person-years), 2,680 indirect jobs (person-years), and 1,080
### Chapter IV

AFFECTED ENVIRONMENT AND
ENVIRONMENTAL CONSEQUENCES

#### Table 56
Estimated direct, indirect, and other employment
for the alternative plans

<table>
<thead>
<tr>
<th>Alternative plans</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fifth Water Pumped Storage</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Direct</td>
<td>1,300</td>
<td>2,110</td>
<td>2,565</td>
<td>2,985</td>
<td>3,410</td>
<td>2,565</td>
<td>1,300</td>
<td>16,235</td>
</tr>
<tr>
<td>Indirect</td>
<td>1,365</td>
<td>2,215</td>
<td>2,695</td>
<td>3,135</td>
<td>3,580</td>
<td>2,695</td>
<td>1,365</td>
<td>17,050</td>
</tr>
<tr>
<td>Other</td>
<td>470</td>
<td>765</td>
<td>930</td>
<td>1,085</td>
<td>1,235</td>
<td>930</td>
<td>470</td>
<td>5,085</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>3,135</td>
<td>5,090</td>
<td>6,190</td>
<td>7,205</td>
<td>8,225</td>
<td>6,190</td>
<td>3,135</td>
<td>39,170</td>
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<tr>
<td><strong>Sixth Water Pumped Storage</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employment</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Direct</td>
<td>975</td>
<td>1,725</td>
<td>2,275</td>
<td>3,040</td>
<td>2,060</td>
<td>760</td>
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<td>10,845</td>
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<tr>
<td>Indirect</td>
<td>1,025</td>
<td>1,820</td>
<td>2,390</td>
<td>3,190</td>
<td>2,160</td>
<td>800</td>
<td></td>
<td>11,385</td>
</tr>
<tr>
<td>Other</td>
<td>355</td>
<td>630</td>
<td>825</td>
<td>1,100</td>
<td>750</td>
<td>275</td>
<td></td>
<td>3,935</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>2,355</td>
<td>4,185</td>
<td>5,490</td>
<td>7,330</td>
<td>4,970</td>
<td>1,835</td>
<td></td>
<td>26,165</td>
</tr>
<tr>
<td><strong>1964 DPR</strong></td>
<td></td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Employment</td>
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<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Direct</td>
<td>1,030</td>
<td>1,550</td>
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<td>1,030</td>
<td></td>
<td></td>
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<td>5,160</td>
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<tr>
<td>Indirect</td>
<td>1,080</td>
<td>1,630</td>
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<td>1,080</td>
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<td></td>
<td></td>
<td>5,420</td>
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<tr>
<td>Other</td>
<td>525</td>
<td>785</td>
<td>785</td>
<td>525</td>
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<td></td>
<td></td>
<td>2,620</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>2,635</td>
<td>3,965</td>
<td>3,965</td>
<td>2,635</td>
<td></td>
<td></td>
<td></td>
<td>13,200</td>
</tr>
<tr>
<td><strong>No Power</strong></td>
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<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Employment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Direct</td>
<td>510</td>
<td>765</td>
<td>765</td>
<td>510</td>
<td></td>
<td></td>
<td></td>
<td>2,550</td>
</tr>
<tr>
<td>Indirect</td>
<td>535</td>
<td>805</td>
<td>805</td>
<td>535</td>
<td></td>
<td></td>
<td></td>
<td>2,680</td>
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<tr>
<td>Other</td>
<td>260</td>
<td>280</td>
<td>280</td>
<td>260</td>
<td></td>
<td></td>
<td></td>
<td>1,080</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>1,305</td>
<td>1,850</td>
<td>1,850</td>
<td>1,305</td>
<td></td>
<td></td>
<td></td>
<td>6,310</td>
</tr>
</tbody>
</table>
other jobs (person-years) for a total of 6,310 jobs (5,360 person-years) over a 4-year construction period.

Under the various alternatives, about 80 to 90 percent of the direct construction workers would be nongovernment employees. When direct, indirect, and other employment are taken together, the total number of job opportunities for the Fifth Water Pumped Storage Alternative would constitute 5.3 percent of all employment in Utah County, on the average, over the life of the project. The comparable proportions for the other alternatives are Sixth Water Pumped Storage, 4.2 percent; 1964 DPR, 3.2 percent; and No Power, 1.6 percent.

The allocation of jobs by economic sector would be roughly equivalent for all alternatives. Almost half of all the jobs (i.e., about 43 percent) would occur within construction. The other sectors that would be impacted significantly through the creation of jobs during project construction are government (21 percent) and trade (11 percent).

The breakdown of money spent on materials, equipment, and labor during construction would vary considerably by alternative: $327 million for Fifth Water Pumped Storage; $219 million for Sixth Water Pumped Storage; $104 million for the 1964 DPR Alternative; and $51 million for the No Power Alternative.

Infrastructure and values

Existing conditions

Housing

In 1980, there were over 62,200 housing units in Utah County. Of this number, 3,750 on the average were vacant. This represents a vacancy rate of 6.0 percent, which is somewhat lower than the Statewide average of 6.7 percent and the national average of 6.8 percent. Of particular importance to a construction work force is the vacancy rate for rental units. In 1980, Utah County averaged 1,340 rental vacancies, a rate of 2.2 percent. This figure is again slightly lower compared to the State average (2.4 percent). Of the 24,900 mobile homes and trailers in the State, 2,165 were located in Utah County in 1980. Of this number, only about 70 were unoccupied. This represents a vacancy rate of about 3 percent. An additional 13 units in Utah County were vacant on a seasonal or migratory basis. Based on these data, a large project-related construction work force might find housing somewhat more difficult to locate.

Utah County is somewhat different from most other parts of the country, partly because of the presence of a large number of students from Brigham Young University and Utah Technical College, who depend on available off-campus housing from September through April of every year. A sufficiently large number of construction workers entering the local
housing market could provide some problems for local college students competing for limited space.

Furthermore, the housing picture is not expected to change much in the near future. Over the past decade, residential construction in Utah County, while exceeding population growth, has lagged behind construction rates statewide. Furthermore, Utah County has a low ratio of housing units to population—285 units per 1,000 persons. The State average was 329 units per 1,000, while the national average was 383 units. A good proportion of this differential, however, is explained by the larger size of families in Utah County. The Provo-Orem Standard Metropolitan Statistical Area (SMSA), which ranked 163 in population size nationally in the 1980 census, has the highest birth rate (37 per 1,000 population) of any community in the Nation, and the second highest number of persons per household (3.59) among all 323 SMSA's nationwide.

The current economic recession could further result in some housing-related problems, at least over the short run. The population of the area has been projected to grow at an average annual rate of 2.3 percent. At the same time, the housing construction industry in Utah County has been severely impacted by the recession, with building activity falling off. Between 1980 and 1981, for example, the statewide number of permit-authorized new residential units increased by 10.6 percent. In Utah County, over the same period of time, the number of permit-authorized new residential units declined by 18.9 percent. Thus, while the pressures associated with population growth continued to build, a reduced number of new residential units were being authorized for construction.

Education

A mixed picture is suggested for public education. Those areas of concern within education most susceptible to short-term impacts seem to have fared better (i.e., manpower), but it still appears there would be a shortage of classrooms. For example, the average pupil-teacher ratio for the 40 school districts in the State for the 1980-81 school year was 20.4 students per teacher. All three school districts in Utah County had ratios greater than the State average. Provo District was 20.5, tenth highest in the State; Nebo District was 21.6, eighth highest; while Alpine District was 23.1, second highest in the State.

Even though a number of new facilities have been constructed in the past few years, the public school building program may still lag somewhat behind the recent record growth of population in the county. Several indicators point toward a relative deficiency. For example, the age of the structures is slightly older than the State average, and the amount of space per student is below the State level. In 1980, the capacity of the existing facilities in the county exceeded the current occupancy rate by only about 3 percent. The comparable figure for the State was about 24 percent. Thus, there would seem to be relatively less available room within school facilities in Utah County to accommodate a large influx of new students.
Furthermore, it appears that some regional redistributing of school enrollment is occurring within the county. The Alpine District, located in the north part of the county, saw the greatest average annual increase (6.6 percent) between 1977 and 1980. The comparable rates for Provo and Nebo School Districts, located to the south, were 2.4 and 3.2 percent, respectively. Between 1980 and 1982, however, the rate of increase for the Alpine District dropped to 5.2 percent. The rate of enrollment increase for Provo District on the other hand was 3.9 percent and for Nebo District, 5.2 percent. Thus, within the county, it appears that the high rate of growth in the north may be leveling off, while in the south half of the county, it may be increasing.

Health and Medical Care

Health and medical care is another area which could be susceptible to the effects of rapid population growth preceding an economic recession. An evaluation of health manpower data suggests Utah County may fall below the State average, according to several indicators. For example, in 1980, Utah County had 215 physicians, or one physician per 1,000 population. The State average was 1.52 physicians per 1,000 population. In 1981, the county had 1,031 registered nurses (RN's), or 4.73 RN's per 1,000 population. The State average was 5.65 RN's per 1,000 population. These shortcomings are not critical, however. Utah County is not designated under Section 332 of the Public Health Service Act as a manpower shortage area.

To the extent deficiencies may exist in health care, as in the case of education, they seem more acute for facilities than manpower. For example, Utah County had 13 percent fewer hospital beds per 1,000 population compared to the State average. Medical care in Utah County, however, appears to follow a particular role within the larger State health system. More specialized health care is available for Utah County residents in Salt Lake County. Furthermore, there appears to be more facility capacity among other Wasatch Front counties than in Utah County—66 percent more hospital beds per capita, for example. Yet there is balance within the health care system. Less demand is placed locally within Utah County on local health care facilities. For example, the number of patients admitted to hospitals in the rest of the Wasatch Front is 9 percent greater per capita than it is in Utah County, while the average length of stay is 39 percent greater.

Transportation

Traffic volume on the primary transportation system serving the area is relatively high. Traffic passing daily on U.S. Highway 6 between Thistle Junction and Soldier Summit, which is the stretch of highway intersecting with Sheep Creek-Rays Valley Road leading into the project area, averages 4,300 vehicles annually. That number is relatively high compared to other highways of similar type and design. During the summer months, from June to September, when construction would be at its peak, the average daily count rises to 5,440 vehicles.
Along the stretch of U.S. Highway 6-89 northwest of Thistle Junction to Moark Junction, the portion of highway that would intersect with Diamond Fork Road, the average is 5,890 vehicles per day. During the summer months the daily average rises to 7,350 vehicles.

Other

Perhaps one of the most important characteristics of the local area is its homogeneity. Some aspects of this characteristic are measurable, such as religion (the population of Utah County is 86 percent LDS), or race (Utah County is 97.1 percent Caucasian). Other characteristics are not as easily measured, such as the importance placed on community togetherness, especially the role of the family, both extended and nuclear.

The homogeneity of the local population's social characteristics is reflected by its value orientation. Considerable emphasis is placed on the importance and role of the family, religion, individual development, academic achievement, the community, meaningful work, and economic development. Based on key informant data, high levels of change were perceived in Utah County toward economic development, the environment, and the family. All three kinds of change were viewed positively, especially changes in value orientation toward environmental concerns. Generally, Utah County continues to hold to traditional values, especially those associated with the LDS Church.

The role and importance placed on traditional values within the county produces high levels of social cohesion. Deviant behavior of all types is low compared to national and State levels. For example, while the State had fewer felony crimes of all types than the Nation in every category except one, Utah County had only 40 percent as many violent crimes and 60 percent as many property crimes as the State. The overall crime rate per 1,000 population for Utah County was 33.5, down from 39.2 in 1980. The crime rate for the rest of the Wasatch Front in 1981 was 70.4, considerably higher than Utah County.

The arrest rate for liquor violations was also considerably less in Utah County than in the State, even with a large university population. Total arrests for drug abuse were only 57 percent as great in Utah County as in the State. The same generalization holds for less extreme forms of deviant behavior—the bonds of social cohesion in Utah County are strong. This is not because of the presence of a large law enforcement organization. In fact, the number of law enforcement officers per capita in Utah County is the fourth lowest among all 29 counties in the State. It is, instead, the result of other factors. The strength and bonding of local social cohesion lies with the commitment and type of value structure held by the community.

ENVIRONMENTAL IMPACTS

Recommended Plan

Housing.--Reclamation has projected that there would be a population increase in Utah County associated with each of the alternatives (Tables
52 and 53). Most of the project-related population influx would probably seek housing in Utah County, particularly in Provo, Orem, Spanish Fork, Springville, and Payson. The number of housing units necessary to accommodate the influx for the recommended plan is estimated to be about 595.

The relatively brief duration of the proposed project would suggest that housing offering transient accommodations would provide the most practical and feasible housing alternative. Many students both at Brigham Young University and Utah Technical College, however, rely on similar housing. Under the recommended plan, the area is projected to experience an increase in housing demand.

Education.--Impacts associated with the construction of the recommended plan on the school systems in Utah County are expected to be minimal. In the first and last years of construction (1986 and 1989), it is projected that there would be an increase of about 395 school-age children. To maintain approximately the same student-teacher ratio as currently exists would necessitate an additional 18 teachers. In the peak years of construction (1987 and 1988), there would be an increase of approximately 590 school-age children. About 27 additional teachers would be required to maintain a similar student-teacher ratio.

Payment of the costs associated with an increased number of students could vary considerably, depending on the methods the school districts selected to handle the short-term influx. Any cost increase, however, would be paid jointly from local taxes, State funds, and Federal impact-aid funds available under Public Law 81-874 and subsequent amendments to alleviate the effects of Federal projects. No long-term increase of students would be anticipated in the area school systems as a result of the project.

Health and medical care.--The projected peak population influx of about 1,905 people would have minimal impact on the health care services. By national standards, the project-related population increase would generate a need for approximately two additional physicians. With the recent completion of American Fork Hospital (72 beds), Mountain View Hospital in Payson (81 beds), and the Orem Community Hospital (20 beds) and with each having adjacent new medical clinics, new physicians and medical staff are expected to be attracted to the area. Also, the proximity of Utah County to Salt Lake County would allow for reasonable accessibility of medical staff and facilities.

Transportation.--The amount of vehicular traffic created by the project could result in some local highway congestion at the intersections of Diamond Fork Road and U.S. Highway 6-89 and Sheep Creek-Rays Valley Road and U.S. Highway 6. The level of congestion would be greater during the summer months, particularly in the second and third years of construction, and for the intersection of Diamond Fork Road and U.S. Highway 6-89 in the mornings when project-related vehicles coming from the west and north would have to cross the highway. Entrance and exit
lanes would be provided on the improved Diamond Fork Road to reduce the congestion in that area.

Perhaps more significant might be the possible monitoring or restriction of access by the public into the Diamond Fork area during construction. The greatest impact would be during the summer for recreationists and during the fall for deer and elk hunters. Approximately 900 vehicles directly related (e.g., heavy trucks carrying material and equipment to various work sites) and indirectly related (e.g., private automobiles of construction workers) to the project would use the two roads (Diamond Fork and Rays Valley-Sheep Creek) on a daily basis during the first and fourth years of construction. During the second and third years, maximum traffic along the two roads could reach as many as 1,300 vehicles per day.

The following actions could be undertaken to reduce the impacts outlined above, although mitigation is not required. The contractor would be encouraged to organize or sponsor carpooling, which would reduce the traffic flow considerably, thus easing congestion, saving fossil fuels, and reducing auto emissions. Assistance would be available to the contractor through the Utah Energy Office to develop a carpooling program. Since the estimates provided above assume the maximum impact (one private vehicle per worker), carpooling could reduce the impact by two-thirds. Even more effective in reducing construction area traffic congestion would be the busing of construction workers from parking sites located outside of the project area.

Other.--The relatively small number of immigrating project-related residents (less than 1 percent of the county population in the peak construction years) are expected to have minimal impacts on the indigenous population's culture, values, or lifestyles. Any immigrating population bringing with it national norms in crime and other forms of deviant behavior, however, would have potential to adversely impact the county's low crime rate. By national standards, the project-related population influx would generate a need for about two additional law enforcement officers.

Other Alternatives

Housing.--Impacts on housing accommodations in Utah County would be of a similar magnitude for both the Fifth Water and Sixth Water Pumped Storage Alternatives. The maximum demand would come in the fifth year of construction for Fifth Water, and the fourth year of construction for the Sixth Water Pumped Storage Alternative when 1,800 and 1,600 housing units would, respectively, be required. The 1964 DPR Alternative would necessitate about 800 housing units in the second and third years of construction. The No Power Alternative would require half that many units in the second and third years of construction.

Education.--The least significant impact on education would be produced by the No Power and 1964 DPR Alternatives. In the case of the
CHAPTER IV

affected environment and environmental consequences

former, some 180 children would be added to the school system in the first and fourth years of construction and 270 in the second and third years. The 1964 DPR Alternative would cause some 360 children to enter the school system in construction years one and four, and 545 children in years two and three. The Sixth Water Pumped Storage Alternative would have a greater impact over its 6-year construction period than the recommended plan. Its peak impact would come in the fourth year when some 1,065 children would enter the primary and secondary schools. The most significant impact, however, would be caused by the Fifth Water Pumped Storage Alternative. During its 7-year construction period, the greatest impact would come in the fifth year when some 1,195 children would enter the school system.

Health and medical care.--Impacts on the health and medical care services and facilities would be relatively the same for the Fifth Water Pumped Storage and Sixth Water Pumped Storage Alternatives, with each requiring four additional physicians. The 1964 DPR Alternative would have a lesser impact, requiring approximately two additional physicians in the peak year of construction. The No Power Alternative would create a need for only one additional physician.

Transportation.--Impacts associated with transportation would be greatest for the Fifth Water Pumped Storage Alternative which could reach as high as 2,800 vehicles per day in the local project area during the year of maximum construction activity. Local traffic density would be less for all other alternatives. In the peak year of construction, maximum daily traffic could reach 2,500 vehicles for the Sixth Water Pumped Storage Alternative; 1,250 vehicles for the 1964 DPR Alternative; and 600 vehicles for the No Power Alternative.

Infrastructure/values.--None of the alternatives is expected to produce any appreciable impact on the values and belief systems of the communities. The relatively small number of immigrating residents (of which some would come from other counties within the State) and the number and size of the communities within which the residents would relocate would help to lessen impacts that might otherwise accompany a construction labor force.

Impacts on the local law enforcement agencies would be similar for the Fifth Water Pumped Storage and Sixth Water Pumped Storage Alternatives, with each creating a need for about four additional law enforcement personnel. The 1964 DPR Alternative would require approximately two additional law enforcement personnel. The No Power Alternative would have the least impact, generating a need for only one additional law enforcement person.

Effects analysis of social impacts

The above section measures the social, economic, and demographic impacts from the project on the local community. However, it does not
evaluate community perceptions and responses, which largely are determined by attitudes and values. These are the social effects.

The effects analysis was conducted in two steps. First, the impact assessment was taken to the local public, particularly those individuals and organizations responsible for the maintenance and provision of the impacted social services and facilities. The objective at this point was twofold: (1) to provide information in advance to these entities as to when, where, and how Reclamation would impact the local area; and (2) to solicit their response as to how significant they perceive these impacts to be to the local area. Nearly all those involved (e.g., in law enforcement, transportation, health, and public education) indicated to Reclamation their appreciation for the information and, in turn, provided response data. In the second step, these responses were evaluated against the objective impact data using Reclamation’s Multi-Attribute Trade-Off System (MATS).

Based on discussions with knowledgeable individuals, the eight social and economic impact factors were ranked in terms of their relative importance. The factors and their weights are shown in Table 57.

<table>
<thead>
<tr>
<th>Factor</th>
<th>Units</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employment</td>
<td>Jobs</td>
<td>0.30</td>
</tr>
<tr>
<td>Health</td>
<td>Hospital bed-years</td>
<td>0.18</td>
</tr>
<tr>
<td>Economic</td>
<td>Millions of dollars</td>
<td>0.15</td>
</tr>
<tr>
<td>Education</td>
<td>Children</td>
<td>0.09</td>
</tr>
<tr>
<td>Housing</td>
<td>Households</td>
<td>0.09</td>
</tr>
<tr>
<td>Crime</td>
<td>Crime rate</td>
<td>0.06</td>
</tr>
<tr>
<td>Transport</td>
<td>Traffic volume</td>
<td>0.06</td>
</tr>
<tr>
<td>Power</td>
<td>Megawatts</td>
<td>0.06</td>
</tr>
</tbody>
</table>

The impacts of each plan are shown for these factors in Table 58 under the heading "Impact Quantity." These impacts are then translated to a scale of social well-being (SWB), ranging from -100 to 100, as shown under the heading "SWB Level." In order to reflect the importance of each impact category, the SWB levels are then multiplied by the factor weights to produce the "Weighted SWB Scores." These scores, both positive and negative, are added to produce an "Overall SWB Score" for each alternative.

The Fifth Water Pumped Storage Alternative exhibits the greatest net social benefit (net weighted SWB score = 8.4) for any plan. Employment is the most important factor (29.0) and may be considered one of two major social benefits, the second of which is economic stimulus (14.0). Health represents the major adverse effect (-17.3), while education (-8.9) and housing (-7.6) exhibit a moderate adverse effect. Crime (-3.1) and transportation (-3.4) are minor adverse effects while power (5.7) provides a moderate social benefit.
CHAPTER IV

AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

Table 56

<table>
<thead>
<tr>
<th>Factor</th>
<th>Normalized weight</th>
<th>Impact quantity</th>
<th>SWB/ level</th>
<th>Weighted SWB/ score</th>
<th>Social affect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employment/</td>
<td>0.30</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>None</td>
</tr>
<tr>
<td>Health</td>
<td>.18</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>None</td>
</tr>
<tr>
<td>Economic</td>
<td>.15</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>None</td>
</tr>
<tr>
<td>Education</td>
<td>.06</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>None</td>
</tr>
<tr>
<td>Housing</td>
<td>.09</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>None</td>
</tr>
<tr>
<td>Crime</td>
<td>.06</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>None</td>
</tr>
<tr>
<td>Transportation</td>
<td>.06</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>None</td>
</tr>
<tr>
<td>Power</td>
<td>.06</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>None</td>
</tr>
<tr>
<td>Overall SWB/ score</td>
<td></td>
<td></td>
<td></td>
<td>0</td>
<td>None</td>
</tr>
</tbody>
</table>

Sixth Water Flow Through

| Employment/ | 0.30 | 14,370 | 28.7 | 8.6 | Moderate social benefit |
| Health | .10 | 177 | 34.0 | -6.1 | Moderate adverse effect |
| Economic | .15 | 57.2 | 32.2 | 4.9 | Moderate social benefit |
| Education | .09 | 50.2 | 49.2 | -4.4 | Moderate adverse effect |
| Housing | .08 | 3,783 | -1.9 | -3.2 | Minor adverse effect |
| Crime | .06 | 70 | -13.8 | -8.8 | Minor adverse effect |
| Transportation | .06 | 1,112 | -13.9 | -8.8 | Minor adverse effect |
| Power | .06 | 166.2 | 13.9 | .8 | Minor social benefit |
| Overall SWB/ score | | | | 2.0 | Minor social benefit |

Fifth Water Pumped Storage

| Employment/ | 0.30 | 39,170 | 96.7 | 29.0 | The major social benefit for any plan or factor |
| Health | .10 | 48 | -96.0 | -17.3 | The major adverse effect for any plan or factor |
| Economic | .15 | 180.4 | 95.5 | 14.0 | Major social benefit |
| Education | .09 | 1,193 | -99.4 | -8.9 | Moderate adverse effect |
| Housing | .08 | 8,360 | -83.9 | -7.6 | Moderate adverse effect |
| Crime | .06 | 162 | -51.7 | -3.1 | Minor adverse effect |
| Transportation | .06 | 2,720 | -56.2 | -3.4 | Minor adverse effect |
| Power | .06 | 1,147 | 95.6 | 5.7 | Minor social benefit |
| Overall SWB/ score | | | | 8.4 | Moderate social benefit |

Sixth Water Pumped Storage

| Employment/ | 0.30 | 26,165 | 52.1 | 13.7 | Major social benefit |
| Health | .10 | 31 | -66.0 | -13.3 | Major adverse effect |
| Economic | .15 | 157.4 | 62.5 | 9.4 | Moderate social benefit |
| Education | .09 | 1,065 | -86.7 | -7.9 | Moderate adverse effect |
| Housing | .08 | 5,726 | -10.3 | -1.6 | Minor adverse effect |
| Crime | .06 | 126 | -34.7 | -2.1 | Minor adverse effect |
| Transportation | .06 | 4,432 | -59.2 | -2.4 | Minor adverse effect |
| Power | .06 | 423 | 35.3 | 2.3 | Minor social benefit |
| Overall SWB/ score | | | | 1.7 | Moderate social benefit |

1964 DPR

| Employment/ | 0.30 | 13,500 | 26.7 | 7.5 | Moderate social benefit |
| Health | .10 | 15 | -30.0 | -5.4 | Moderate adverse effect |
| Economic | .15 | 89 | 29.7 | 4.5 | Moderate social benefit |
| Education | .09 | 545 | 45.4 | 4.1 | Moderate social benefit |
| Housing | .09 | 2,722 | -3.1 | -1.1 | Minor adverse effect |
| Crime | .06 | 65 | -12.6 | -2.76 | Minor adverse effect |
| Transportation | .06 | 1,200 | -13.8 | -2.83 | Minor adverse effect |
| Power | .06 | 123 | 11.1 | .66 | Minor social benefit |
| Overall SWB/ score | | | | 1.9 | Minor social benefit |

No Power

| Employment/ | 0.30 | 6,310 | 12.8 | 3.8 | Minor social benefit |
| Health | .10 | 8 | -16.0 | -2.9 | Minor adverse effect |
| Economic | .15 | 44.1 | 14.7 | 2.2 | Minor social benefit |
| Education | .09 | 170 | -52.5 | -2 | Minor adverse effect |
| Housing | .09 | 1,350 | -1 | 0 | No effect |
| Crime | .06 | 32 | -1 | 0 | No effect |
| Transportation | .06 | 612 | -1 | 0 | No effect |
| Power | .06 | 0 | 0 | 0 | No effect |
| Overall SWB/ score | | | | 1.6 | Minor social benefit |

1/ Social well-being.
2/ Bureau of Reclamation projections for local direct, indirect, and other jobs from project construction.
3/ Total hospital bed-years required, as determined by current population-bed ratio times total construction-related population influx.
4/ Social effect
5/ Total community household projections.
6/ Children of workers' school-age projections for year of maximum impact.
7/ 1982 Utah County crime rate for year of maximum impact adjusted for population increase.
8/ Traffic volume based on employment projection for year of maximum impact times multiplier of 0.80.
9/ Projected megawatts of power generated.
The Sixth Water Flow Through Alternative exhibits the second highest net social benefit (net weighted SWB score = 2.0) which is approximately 24 percent as great as Fifth Water Pumped Storage Alternative. The most significant social benefit for the Sixth Water Flow Through is employment (8.6); the most significant adverse effect is health (-6.1). Economic stimulus is also a moderate social benefit (4.9), while education (-4.4) is a moderate adverse effect. Housing (-0.2), crime (-0.8), transportation (-0.8), and power (0.8) would only be slightly affected.

The 1964 DPR and Sixth Water Pumped Storage Alternatives are quite similar in their social consequences to the recommended plan. Their net weighted SWB scores are almost identical (1.7 for the Sixth Water Pumped Storage and 1.9 for the 1964 DPR Alternative). For both plans, employment and economic stimulus would produce moderate social benefits, while health would produce a moderate adverse effect. In addition, both plans would produce about the same magnitude of social effect.

The No Power Alternative exhibits only a small social benefit for the project area (net weighted SWB score = 1.1). All of the individual factors would produce either minor social benefits or minor adverse effects. Since the magnitude of social effect is only 1.1, or 13 percent that of Fifth Water, the amount of social change directly attributable to the project would be minimal.

In conclusion, the Fifth Water Alternative would have the greatest magnitude of social effect and produce also the highest level of social benefits. It would also produce the single greatest adverse impact (on the provision of public health) and the single greatest social benefit (employment). The recommended plan, by comparison, would have the second greatest magnitude of social effects and also the second greatest level of net social benefits. The 1964 DPR and Sixth Water Pumped Storage Alternatives are roughly similar in their social consequences while the No Power Alternative would produce comparatively few benefits.

A monitoring program would be established to measure and analyze social and economic effects that may arise during construction of the project. The program would provide the opportunity to objectively assess the changes induced by project construction, as well as provide a basis for interacting with the local communities to cope with any problems.

**Grazing**

**Existing conditions**

Livestock grazing is a long-established industry in Utah County. This land use is socially and economically tied to the agrarian population. Grazing on national forest land during the summer is considered an integral part of livestock operations in the Diamond Fork area.

The Diamond Fork area is part of the Uinta National Forest and is managed by the Forest Service as a multiple-use area. Livestock grazing
in the Diamond Fork drainage is divided into two allotments--Billies Mountain and Diamond Fork.

The Billies Mountain allotment covers 2,744 acres and is bounded by private land owned by M. D. Childs, Inc. A permit for 150 cattle is held by M. D. Childs for this allotment. The Billies Mountain management system consists of grazing the entire allotment early the first year and late the second year, followed by a rest the third year.

The Diamond Fork allotment consists of 115,198 acres, including 3,628 acres of private land inside the national forest boundary. A permit for 2,409 cattle with a grazing season of June 6 to September 30 is held by the Spanish Fork Livestock Association, which includes about 70 members. Some of the Association's cattle also graze an area known as Strawberry Pastures for approximately 750 animal-unit months (AUM's) each year. The cost for Livestock Association wages and other expenses for 1982 was $51,000. The present grazing system on Diamond Fork consists of alternating use of three separate units. One unit is grazed from early June until August 20 (seed ripe time), another unit is grazed during late summer and fall, and the third unit is rested from grazing use.

Total livestock use permitted for the Diamond Fork and Billies Mountain allotments and Strawberry Pastures is 12,114 AUM's. Grazing permits are issued to the Spanish Fork Livestock Association and M. D. Childs, Inc., for 10-year terms.

**Recommended Plan**

Construction and operation of the recommended plan would have considerable impact on livestock management. The proposed Monks Hollow Reservoir, with 343 surface acres, would inundate the Spanish Fork Livestock Association herder camps and corral and block the main artery for trailing cattle to various grazing units during the summer and fall. In total, approximately 760 acres of grazing land would no longer be available for that purpose. Conflict between livestock grazing management and project-induced recreation use is expected. This conflict would be significant in lower Diamond Fork Canyon below Monks Hollow Dam. Syar and Sixth Water Reservoirs would have only negligible effects on livestock management.

Project construction activities would change traditional livestock trailing patterns. Provisions for moving livestock through or around these activities would be needed. The safety hazard created along travel routes with increased traffic created by the project would be a major concern to the traveling public and stockmen. Competition between livestock and big game for forage is expected to increase slightly because of a loss of big game winter range created by the project. Use of land for dams, reservoirs, and other project features represents an irreversible commitment of a resource, since the land would no longer be available for
the production of forage for livestock. The loss of 570 AUM's might be absorbed within the present grazing system or be mitigated by additional grazing capacity through land adjustment (i.e., wildlife mitigation lands).

Actions that could be taken to reduce the impact created by the project on the range program include (1) replacement or relocation of facilities such as fences, cattleguards, livestock trails, access roads, camp locations, and corrals; (2) revegetation of vegetative types which have the potential to produce additional forage for either livestock or wildlife; (3) development of additional water to make existing forage more available to cattle; and (4) revision of the present allotment grazing management system. There may also be opportunities to upgrade the use of other resources (such as reseeding areas disturbed by construction) in conjunction with required changes in livestock management brought about by the project. The specifics of such actions would have to be addressed as project decisions become more definite.

Under the recommended plan, expenses to the permittee would increase by about 80 percent for riding, labor, herding, trucking, and secretary fees. Fence and corral repair costs would increase somewhat. A significant capital expenditure would be required for trails, fences, cattleguards, and rider camps. Costs of Forest Service range administration and noxious weed control would increase from annual expenditures of $24,000 to about $46,800.

**OTHER ALTERNATIVES**

The Fifth Water Pumped Storage Alternative would result in the loss of about 1,400 acres of grazing land and would result in a reduction in grazing of about 1,050 AUM's. In addition to the impacts from Monks Hollow Reservoir described for the recommended plan, the proposed 560-surface-acre Fifth Water Reservoir would inundate the Rays Valley Pasture, which has historically been used in the fall to gather and hold cattle until herds are large enough to make several drives off the national forest. Conflict between grazing management and project recreation use would be significant below Monks Hollow Dam and near Fifth Water Reservoir.

The Sixth Water Pumped Storage Alternative would result in a permanent reduction of about 740 acres of grazing land, the same as for the recommended plan. The reduction in grazing would be approximately 550 AUM's. The inclusion of Monks Hollow Dam and Reservoir would result in the same management concerns as the recommended plan. The 1964 DPR Alternative would result in a loss of 820 AUM's from construction of physical features. The management of the grazing allotments would be essentially unchanged from the present program as administered by the Forest Service. The No Power Alternative would have the least impact on the livestock grazing management system. With the buried Diamond Fork Pipeline extending down Sixth Water and Diamond Fork Canyons, conditions would be about the same as at present, with a loss of only 110 AUM's. A
fence would need to be constructed down the Sixth Water drainage to replace the natural barrier of high flows in Sixth Water Creek and Diamond Fork.

Electrical Energy

The following information has been summarized from a report prepared by Western in its capacity as a cooperating agency for the Diamond Fork Power System. The description of pertinent existing environmental factors for the power generation alternatives has been integrated into the information presented for all of the significant environmental aspects expected to be influenced by the project.

Criteria for selecting routing options

Several routing options were evaluated for each of the Diamond Fork Power System alternatives—reflecting the concerns of the Bureau of Reclamation, the Forest Service, and Western Area Power Administration. As the Forest Service manages most of the land in the Diamond Fork area, that agency was concerned with visual quality near planned and developed recreation areas. The Forest Service was also concerned with potential disturbances to vegetation, wildlife, and soils resulting from the construction, operation, and maintenance of the transmission system. In addition to these environmental considerations, Western and Reclamation were concerned with access to the transmission corridors for construction, operation, and maintenance and with the cost of these activities.

Several alternative corridors were proposed by the involved agencies. The corridors were divided into segments for comparison purposes. With the above mentioned concerns, the Bureau of Reclamation, the Forest Service, and Western Area Power Administration selected the following criteria for the comparison of these segments.

MILES OF LINE

The number of miles of line in each segment was totaled, and this figure was used as a rough measure of cost and of general environmental impact. All else being equal, the longer the line, the more costly the construction, operation, and maintenance activities would be, and the more impact the line would have on the environment.

VISUAL

The total length of line in each segment which would pass through areas not seen from major travel routes was used as a measure of visual impact. Visual impacts were the greatest concern of the Forest Service, and therefore were carefully considered in the comparison of the alternative corridors.
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AFFECTED ENVIRONMENT AND
ENVIRONMENTAL CONSEQUENCES

ACCESS

A qualitative judgment of the availability of existing roads and trails in each segment was used to develop a rating of poor, fair, good, or excellent. Even though portions of the line are planned to be constructed by helicopter, limited access would still be needed in the future for maintenance.

STREAM CROSSINGS

The number of permanent streams crossed per segment was considered in the evaluation. Riparian communities associated with these streams are important because of their scarcity in the arid west. They are often diverse vegetative communities and provide habitat for many wildlife species. The number of streams crossed is, therefore, a measure of the potential impacts to vegetation and wildlife.

ACRES OF DISTURBANCE TO VEGETATION

An estimate of the number of acres of vegetation which would need to be removed in order to construct and operate the line was made for each segment. This is a measure of the potential impacts to streams resulting from erosion, as well as losses of vegetation and wildlife habitat.

SPECIAL CONSIDERATIONS

Special consideration was given areas such as developed or proposed recreation areas, raptor nesting areas, and identified cultural resource sites. An attempt was made to avoid these locations.

Environmental consequences
of transmission facilities

The main impacts from transmission facilities to the interconnected transmission system would result from construction rather than operation. The primary impacts are clearing of trees from the powerline corridors with a consequential loss of some wildlife habitat; visual changes from tree removal and the installation of steel towers or wooden poles; damage to streambanks, riparian habitat, and water quality from stream crossings; additional removal of vegetation from construction of access roads; and the potential for damage to archeological resources. These impacts can generally be avoided by implementation of Western’s standard mitigation procedures, which are listed in Attachment 5.

Western Area Power Administration, in cooperation with the Forest Service, the Bureau of Reclamation, and other governmental agencies, studied several options for switchyard sitings and transmission line alignments for each Diamond Fork Power System alternative in order to determine which alternative would be the most economically and environmentally acceptable. Based on an evaluation of impacts, a preferred
powerline corridor and switchyard site was identified for each project alternative. Only impacts from the preferred options are described herein.

RECOMMENDED PLAN

With the recommended plan, five powerplants would be linked to the interconnected transmission system. Power from the Syar and Monks Hollow plants would be carried to the Rays Valley Substation and Dyne plant, respectively, over two 13.8-kV lines. Two 138-kV lines would connect the Sixth Water and Dyne plants to the substation and two 138-kV lines would connect the substation to the interconnected transmission system (Figure 5). A separate 46-kV line would connect the Diamond Fork plant to the interconnected system.

The preferred transmission line alignments for this plan have been designed to have relatively low visual impact. About 4 miles of the total 19-mile line would not be visible from roads, and care was taken to ensure that most of the remaining line would not be visible on the skyline. Steel towers would be darkened and conductors would be non-reflecting. There would be selective vegetative clearing, mainly of trees, from about 70 acres within the corridor right-of-way of which less than 2 acres would be riparian habitat. Less than 27 acres would be totally cleared for the switchyards and substations. No new access roads would be built, since Western has agreed to use helicopter construction methods in locations not accessible by existing roads and trails. The corridor would span six streams, but since there would be no road crossings and structures would be kept away from streambanks, accelerated soil erosion into these watercourses would be minimal.

Impacts to the fishery and wildlife resources, including endangered species, are included in analyses presented previously in this chapter. As indicated above, there would be no measurable effect on fisheries, because streams would be largely undisturbed. Wildlife impacts would be minor, since only trees that might interfere with powerlines would be removed and acreage cleared for the switchyards would be small. Sensitive areas would be avoided during wildlife breeding seasons. Tree removal would mostly affect nesting and roosting birds but, since there is an abundance of this habitat type in the vicinity, the impact to populations would be minor. The transmission line structures would be designed to preclude electrocution of large raptors. Western would consult with the Utah Division of Wildlife Resources to coordinate construction activities to minimize stress on big game during the winter and during the fawning and calving seasons and to minimize disturbances to nesting golden eagles.

A cultural resources survey of the corridor and switchyard sites has not yet been carried out because specific locations have not been identified. Detailed surveys of about 90 percent of other potential feature sites, however, have not revealed any significant archeological or historical resources requiring mitigation. The remaining sites will
be surveyed once specific locations have been identified. If significant resources are discovered during construction, a mitigation plan would be developed in consultation with the State Historic Preservation Officer and the Advisory Council on Historic Preservation.

Impacts to recreation use would not be significant, nor would the effect on livestock use. Social and economic impacts of these facilities were discussed previously in this chapter.

There would be some electrical effects produced by operation of the transmission facilities. These effects include noise, radio, and television interference, electrostatic and electromagnetic influences, and the formation of ozone and nitrogen oxide. These impacts become more intense as the voltage level increases. The analyses prepared by Western show, however, that these impacts constitute nuisances rather than hazards because of low levels of these effects and safety design standards.

Noise from line hum and the hissing of random power discharges would be less than 31 decibels in rainy weather at a distance of about 200 feet. This noise level would be less than the sound of rain falling. In fair weather, the noise level would be an inaudible 6 decibels. Radio and television interference would occur immediately adjacent to the powerlines, but since the line routings would avoid any residences, no interference is likely.

The maximum electric field immediately beneath a 138-kV line would be less than 250 volts per meter at a point 1 meter above the ground at midspan between two structures. At the edge of the powerline right-of-way, the electric field would be 375 volts per meter. No standards for electric fields from transmission lines have been established. Maximum steady state current emitted directly under a 138-kV line would be less than 1 milliampere, well below the 5-milliampere safety criterion established by Federal regulation. This criterion is well below the level that could induce physiological harm and, hence, would not be a health hazard. Currents induced in nearby metallic objects such as parallel fencing would be minimized by using appropriate grounding techniques in accordance with national safety codes.

Electrical fields around transmission lines produce small quantities of ozone and nitrogen oxides. About 90 percent of this product would be ozone. The national ambient air quality standard for ozone is 120 parts per billion. For the 138-kV line to be used in this project, the ground level ozone concentration would be less than 1 part per billion.

OTHER ALTERNATIVES

For these alternatives, facilities would be needed to transmit power from the various powerplants to the interconnected transmission system in Spanish Fork Canyon.
Vegetation (mostly trees) would be selectively cleared within transmission corridors. Losses of riparian habitat would likely be less than 2 acres. Less than 27 acres would be completely cleared for the switchyards and substations. No new access roads would be built, since Western has agreed to use helicopter construction methods in areas not accessible from existing roads and trails. The transmission corridors could span some streams but, since there would be no road crossings and structures would be placed away from streambanks, accelerated soil erosion into these streams would be insignificant.

Impacts to fish and wildlife resources, including threatened and endangered species, would be similar to those discussed for the recommended plan. As indicated above, there would be no measurable disturbance to fish habitat. Wildlife impacts would also be minor because clearing for powerlines would largely be limited to trees, and acreage cleared for switchyards would be small. Similar habitat is readily available nearby. Transmission line structures would be designed to prevent electrocution of large raptors.

Impacts to recreation and livestock use would be minimal. Social and economic impacts of construction and use of these facilities would be similar to the recommended plan.

The discussion of electrical effects for the recommended plan is also appropriate for these alternatives.

Environmental consequences of distributing Diamond Fork Power

Major transmission system modifications would not be necessary to distribute Diamond Fork power. Western is required by law to market power in a manner which will encourage its most widespread distribution at the lowest possible rates to consumers, consistent with sound business principles. The law also requires that preference be given to municipalities, rural electric cooperatives, and other public entities. A market area is established which permits power to be widely distributed and economically delivered to organizations entitled to preference under the law. Power generated by CRSP and its participating projects, however, is first made available for CRSP project uses. The remaining power, which is the bulk of the power generated, is sold commercially to preference customers in the established market area as discussed above. For purposes of preliminary planning, Western has assumed that the new Diamond Fork power would be allocated to existing Northern Division preference customers in the same proportion as they are currently receiving power from the CRSP system. Actual allocations, however, would be made by Western's Administrator after a public participation process is completed that considers various marketing alternatives and allocation methods. The allocation assumptions are a matter of convenience and necessity for planning purposes but do not foreclose the serious consideration of other alternatives during the allocation process.
CHAPTER IV AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

One of the marketing alternatives that will be considered is the possibility of developing the Diamond Fork Power System in cooperation with non-Federal entities. Under this concept, non-Federal entities, either individually or through consortiums, would fund part or all of the construction of the power system. The extent of their financing would be based on their allocated rights to the power to be produced. Such action could have an impact on Western's transmission responsibility by decreasing the amount of power Western would transmit and market from the project.

There would be few negative socioeconomic impacts which would result from the use of the power generated by the Diamond Fork Power System. As indicated in Chapter II, the power generated by the project will not, by itself, be sufficient to satisfy the needs projected for 1990 when a portion of the Diamond Fork power becomes available. There will be no excess power generated which could cause growth; the power will be used only to satisfy existing needs. Diamond Fork power would cause a positive socioeconomic impact by displacing expensive and polluting fuel-powered generation with cheaper and nonpolluting hydroelectric power.

Recreation and Tourism

Existing conditions

Recreation is one of the major activities in the Diamond Fork area. The Uinta National Forest operates and maintains four camping and picnicking areas along Diamond Fork (Figure 8). These areas are Palmyra, Diamond Fork, Three Forks, and Hawthorn Campgrounds. Since the Diamond Fork area is near the populated Wasatch Front, recreation use in this drainage is greater than in the more remote areas of the forest. The most popular activities include camping, picnicking, fishing, hunting, and horseback riding.

Diamond, Palmyra, Hawthorn, and Three Forks Campgrounds provide 56 single-family and 4 multiple-family camping units, 4 group-use areas, roads, restrooms, and other support facilities. These areas will accommodate up to 834 people. The recorded 1980 recreation use that occurred in the developed campground facilities totaled 104,400 recreation-days. Recreation use for dispersed activities such as viewing scenery, snowmobiling, hiking, horseback riding, gathering forest products, swimming, nature study, snow play, and skiing totaled 124,651 recreation-days in the Diamond Fork area in 1980.26 The existing recreation use is expected to increase at a rate of 6 percent annually, according to the Utah State Outdoor Recreation Plan. At this rate, recreation use would total 460,895 recreation-days by 1992.
CHAPTER IV

RECOMMENDED PLAN

The Recreation Demand and Cost/Benefit for the CUP Diamond Fork System report prepared by the Forest Service in cooperation with the Bureau of Reclamation shows that in 1992 project-induced recreation use would be 13 percent higher than without the project. The without project use was determined by projecting the 1980 recorded use to 1992. In 1992 project-induced recreation use would total 60,400 recreation-days in the Diamond Fork area. The lower Diamond Fork area would account for 24,624 recreation-days at newly developed facilities and 35,764 recreation-days would be in dispersed activities throughout the area. There would be no recreation at Syar and Sixth Water Reservoirs because of the limited access and steep slopes.

The Forest Service has determined a maximum recreation capacity of 1,380,000 recreation-days at dispersed recreation areas and 1,710,720 recreation-days of developed recreation use at potential recreation sites in the Diamond Fork area. These figures were developed using the Uinta National Forest's "Grid Computer Program for Determining Developable Sites" and the Forest Service's computer program, "Recreation Opportunities Spectrum for Dispersed Use." The project-induced recreation for the recommended plan would amount to 2 percent of this total.

Recent recreation trends indicate that recreation use is occurring more often in areas near major population centers. The improved streamflows down Diamond Fork, Monks Hollow Reservoir, improved access roads, and additional recreation facilities to accommodate the public should provide a significant beneficial recreation impact in all respects except big game hunting. Improved access may increase hunting pressure, which may result in a lower success rate and reduced quality of the hunting experience. However, the number of animals harvested and the economic benefits would be greater than at present.

OTHER ALTERNATIVES

The Fifth Water Pumped Storage Alternative would provide a 22 percent increase in recreation use expected without the project. Project-induced recreation would be 100,400 recreation-days, including 24,624 recreation-days at new facilities in the lower Diamond Fork area, 39,969 recreation-days at Fifth Water Reservoir, and 35,764 recreation-days in dispersed activities throughout the area.

The Sixth Water Pumped Storage and No Power Alternatives would result in essentially the same recreation uses and impacts as the recommended plan.

The 1964 DPR Alternative would result in a net loss of recreation opportunities. The high flows in Diamond Fork would force the Forest Service to close the existing Palmyra, Diamond Fork, and Three Forks...
CHAPTER IV

Affected Environment and Environmental Consequences

Campgrounds because of the hazardous waters. The anticipated recreation use and developed facilities at Hayes Reservoir would not compensate for the losses in recreation opportunities in the closed campgrounds.

Cumulative Impacts

The intent of NEPA in accounting for cumulative impacts is to ensure that, at some time in the compliance process, impacts that increase in effect through successive additions are evaluated. The Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act (40 CFR Parts 1500-1508) gives guidance on how an agency should reasonably deal with this kind of impact. A critical element in the impact evaluation is whether or not the effects are truly cumulative; that is, do they increase in effect with each subsequent addition or are they aggregative and only constitute a totaling of incremental effects without a measurable increase in intensity and/or scope. The latter impacts are often not cumulative because they lack common timing and/or geography.

As explained earlier, the entire Bonneville Unit was evaluated in a programmatic Environmental Statement filed in August 1973. The programmatic statement, bolstered by subsequent decisions, determined the basic plan for the unit. The basic decision to accept the resulting cumulative impacts of the unit was made at that time and need not be examined again in detail.

The aspect of cumulative impact evaluation relative to the Diamond Fork Power System has received considerable attention. In the 1973 programmatic statement, discussions of both potential cumulative environmental consequences from all of the Bonneville Unit component systems, as well as from all of the proposed units of the entire Central Utah Project were presented. The impacts discussed therein were for the most part aggregative in nature, being separated by timing and/or geography. Exceptions to this were impacts on endangered fishes and salinity in the Colorado River System. Specific procedures have been implemented to account for the cumulative impacts on these aspects.

The Bureau of Reclamation is presently involved in Section 7 consultation with the Fish and Wildlife Service under the Endangered Species Act. Salinity impacts are studied and evaluated under the Colorado River Basin Salinity Control Act of 1974 and subsequent legislation in 1980 (Public Law 96-375) that specifically authorized feasibility-level studies on 10 salinity units. In addition, for each major system of the Bonneville Unit and for each unit of the Central Utah Project to be completed subsequent to the enactment of NEPA, specific environmental statements with mitigation and compensation plans have been or will be prepared to aid in current decisionmaking.

The discussion of Bonneville Unit cumulative impacts included flows, fisheries, wildlife, esthetics, recreation, social and economic
conditions, cultural resources, land use patterns, water supplies, water quality, flood control, air quality, and use of pesticides. Secondary impacts were also considered. In addition, the impacts of each of the other units of the Central Utah Project (Vernal, Jensen, Upalco, Uintah, and Ute Indian) were summarized. That discussion also arrayed the major impacts of all of the units in a single table. Subsequent studies and observations related to the units of the Central Utah Project have not revealed any additional impacts beyond those previously identified. The cumulative discussion covering Reclamation activities for the entire Colorado River dealt with socioeconomic conditions, aquatic wildlife including endangered fishes, terrestrial wildlife, availability of water, and salinity.

In a lawsuit settlement agreement filed with the court April 20, 1982, Reclamation agreed to prepare environmental impact statements on other Federal actions significantly affecting the quality of the human environment in the Colorado River Basin. The potential for cumulative synergistic impacts would also be considered. Expected impacts from the entire Bonneville Unit were incorporated into a cumulative impact analysis in the Final Environmental Statement for the Municipal and Industrial System of the Bonneville Unit. Further, the site-specific impacts generated by the proposed Diamond Fork Power System would not be cumulative to the basin and need not be identified separately for analysis in this statement.

Four major systems of the Bonneville Unit can be examined for cumulative impacts. The Strawberry Collection System (NEPA compliance in 1973) is located in the Uinta Basin; therefore, its impacts would be isolated from the three systems to be located in the Bonneville Basin. Timing would also be different, since collection system impacts are presently occurring and the impacts of the other systems have not materially begun.

NEPA compliance for the Municipal and Industrial System was attained in 1979. Environmental impacts of this action would mostly be confined to Wasatch, Salt Lake, and north Utah Counties, again providing a geographical barrier to synergistic effects. Depending on construction schedules, impacts may be further isolated by timing differences.

The environmental consequences of the Diamond Fork Power System would mainly be confined to central and south Utah County and dispersed throughout the CRSP marketing area. Again, incremental effects would not be truly cumulative. Synergistic impacts could result from the combined effects of the Diamond Fork Power System and the Irrigation and Drainage System because of the geography and timing overlap. This potential will be evaluated in the site-specific Environmental Impact Statement for the I&D System scheduled for 1985.

Environmental Defense Fund vs. Broadbent, Court Action No. 78-1135.
In summary, a detailed evaluation of potential cumulative impacts relative to the Diamond Fork Power System would not be meaningful and useful in current decisionmaking. This conclusion is based on detailed analyses already made, issues already decided based on the 1973 programmatic statement for the Bonneville Unit, and recognition that most of the environmental consequences from the major unit systems do not have sufficient commonality of timing and geography to constitute bona fide cumulative impacts under the definitions promulgated in the Council on Environmental Quality (CEQ) regulations.
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CONSULTATION AND COORDINATION

In formulating the Diamond Fork Power System, Reclamation obtained planning aid and evaluation of the system purpose from several Federal and State agencies, including the Western Area Power Administration, the Forest Service, the Fish and Wildlife Service, the Utah Division of Wildlife Resources, and the Utah State Historic Preservation Officer. Officials of Salt Lake and Utah Counties were also contacted.

In preparing the Draft Environmental Statement, Reclamation received information from various Federal, State, and other agencies and organizations concerning the present environment and anticipated impacts of the system. The Forest Service and Fish and Wildlife Service provided planning information concerning possible impacts of the system and recommended recreation and fish and wildlife mitigation plans, which Reclamation incorporated into its plan. The Fish and Wildlife Service also furnished information on what it felt would be the impacts of the system on endangered species. Western provided information on the transmission system and power marketing. Information on the geology and water quality of the system came from such agencies and organizations as the U.S. Geological Survey, Environmental Protection Agency, Brigham Young University, Mountainland Association of Governments, and the Eyring Research Institute of Provo, Utah.

In accordance with 36 CFR 800, Protection of Historical and Cultural Properties, consultation with the Utah State Historic Preservation Officer and Advisory Council on Historic Preservation has been completed for this project. Harbridge House, Inc., under contract with Reclamation, provided a social and economic assessment of the area. Subsequent to that assessment, Reclamation conducted additional research in specific areas such as population, employment, public services, recreation, and land use.

In order to address the public concerns and to keep the public informed, Reclamation initiated a continuing public involvement program which has been in progress during the project's planning stage and which would continue during the development and construction phase. Beginning with the formation of an interagency planning team in September 1980, an intensive public involvement program has included public meetings, slide-talk presentations, brochures, news releases to the media, and personal one-to-one contacts with individual citizens. Formal public meetings consisted of a presentation of the plan, followed by a question and answer session and a period of public discussion.

In October 1981, a Notice of Intent to Prepare an Environmental Statement was published in the Federal Register and, subsequently, six environmental scoping meetings were held. In addition to scoping the Draft Environmental Statement, the meetings were held for the purpose of presenting the project alternatives and receiving public input. Another meeting was conducted for the purpose of discussing non-Federal participation in the project. About 40 non-Federal entities responded as being...
interested. To provide additional opportunities for public involvement, five tours of project features were conducted for local community leaders, interested non-Federal power entities, environmental groups, water user associations, and the general public. Major concerns emerging from the meetings centered on electrical energy requirements, road and transmission system alignments, and construction impacts on fish and wildlife. Requests for increased recreational opportunities for stream and flatwater fishing and for information concerning payment for property acquisition were also received.

The Draft Environmental Statement was released in June 1983. Approximately 300 copies were distributed for review to Federal, State, and local agencies and to water-user organizations, conservation groups, educational institutions, news media, and individuals. Copies were also made available for public inspection at local libraries and college and university libraries. A partial distribution list is included in the appendix of this statement. This list specifies agencies and organizations which received the draft statement and those who commented on it.

The review period began with publication of the notice of availability in the Federal Register of June 22, 1983, and officially ended August 23, 1983. Written comments received after that date, however, have been accepted and considered in the preparation of this Final Environmental Impact Statement.

Formal public hearings were held July 26, 27, and 28, 1983, to receive comments on the Draft Environmental Statement. Notice of the hearings was made in the Federal Register of June 22, 1983. The hearings were held in Spanish Fork High School, Spanish Fork, Utah, July 26 at 7 p.m.; in the Salt Lake City and County Building, Salt Lake City, Utah, July 27 at 9 a.m.; and in the Provo City Building, Provo, Utah, July 28 at 7 p.m. The meetings adjourned at 7:30 p.m., 9:45 a.m., and 7:40 p.m., respectively, after all who wished had spoken. James A. Limb, an attorney for the Department of the Interior, Salt Lake City, Utah, conducted the hearings. Assistant Regional Director, Weston J. Hirschi, Upper Colorado Region, Salt Lake City, Utah, and Project Manager, P. Kirt Carpenter, Utah Projects Office, Provo, Utah, were present to officially represent the Bureau of Reclamation and to receive testimony.

A total of about 100 people attended the three hearings. Oral testimony was presented by 12 persons. Following is a list of those testifying, in the order which they appeared at each hearing.

<table>
<thead>
<tr>
<th>Date and name</th>
<th>Representing</th>
</tr>
</thead>
<tbody>
<tr>
<td>July 26, 1983</td>
<td></td>
</tr>
<tr>
<td>Milton Theobald</td>
<td>Strawberry Water Users Association</td>
</tr>
<tr>
<td>Robert Phelps</td>
<td>Utah Wildlife Federation</td>
</tr>
<tr>
<td>Donald Elliott</td>
<td>Western Area Power Administration employee</td>
</tr>
<tr>
<td>Max Knight</td>
<td>Springville City councilman</td>
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<tr>
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| July 27, 1983 | Lynn F. Ludlow  
               Fred Reimherr  
               Peter Hovingh  
               Eugene Riordan  
               Douglass Hunter | Central Utah Water Conservancy  
                                      District  
                                      Federation of Fly Fishermen--Utah  
                                      Chapter  
                                      Local citizen  
                                      National Wildlife Federation  
                                      Intermountain Consumer Power Association |
| July 28, 1983 | Robert N. Reid  
               John C. Patrick  
               Garth R. Morgan | Local citizen  
                                      Landowner  
                                      Local citizen |

A verbatim transcript of each hearing was recorded by an official reporter. Copies of the transcripts can be purchased from the reporting service, Bay Street Company, 18 Trimont Street, Boston, Massachusetts 02108. Copies are also available for public inspection at the locations listed below.

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Washington, D.C. 20240

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Salt Lake City, Utah 84147

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Denver, Colorado 80225

Projects Manager  
Utah Projects Office  
302 East 1860 South  
Provo, Utah 84601

The following pages include summaries of concerns expressed orally at the hearings; comments received by the Bureau of Reclamation in letter form which were also read at the hearings; and written comments submitted by government entities, organizations, and individuals during the review period, all with Reclamation's responses. The FEIS has been expanded and modified where appropriate to accommodate the input received in these comments. When the comments were made, the Fifth Water Pumped Storage Alternative was the recommended plan. As discussed in Chapter I, an assessment of non-Federal interest in developing and financing the power system conducted in early 1984 indicated inadequate support for the pumped storage alternative. As a result, Reclamation has selected the Sixth Water Flow Through Alternative as the recommended plan, and responses to the comments have been made applicable, where appropriate, to that alternative.

The comment and response section has two major divisions: (1) oral comments and responses and (2) written comments and responses. Each of these major divisions has two subdivisions: (1) comments and responses

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relating to the Sixth Water Flow Through Alternative and (2) other comments and responses. The first subdivision (comments relating to the Sixth Water Flow Through Alternative) includes comments generally relating to the plan recommended in the Draft Environmental Statement (Fifth Water Pumped Storage Alternative) but which were likely to have been made on the current recommended plan.

Oral comments at the hearings centered on fish and wildlife issues, water-use philosophy, the taking of private land for project purposes, geological concerns, and economic considerations. Responses to the major issues raised at the hearings are presented on the following pages. Where the same issues are raised in both oral and written comments (letters), the responses are presented only in the written comments section.

Oral Comments and Responses

Comments and responses relating to the Sixth Water Flow Through Alternative

1. **Comment:**

One concern is that these fragmented environmental impact statements are made for a piece of the project at a time and do not cover the entire project. This might not give a true picture of the final impact on wildlife.

**Response:**

The issue of fragmented environmental statements is discussed in the responses to comments 130 through 132 and in Chapter I (under "Interrelationships") and Chapter IV (under "Cumulative Impacts").

2. **Comment:**

Page 14 of the Draft Statement implies that the Central Utah Water Conservancy District is responsible for the development of 15,800 acre-feet of water to satisfy the requirements of a fishery agreement entered into on February 27, 1980. The district does not agree with the interpretation of the agreement and requests that Reclamation correct this concept so that all of the parties of the agreement are charged with the responsibility to develop this water. If this total effort by all of the parties is unsuccessful, then it is understood that the project will yield and provide the water.

**Response:**

The February 1980 fishery agreement commits the Central Utah Water Conservancy District to provide 15,800 acre-feet of water from the Bonneville Unit for fishery purposes. This amount, plus 6,500 acre-feet already in the project plan and 22,100 acre-feet to be developed by the
other parties to the agreement, makes a total of 44,400 acre-feet. The signatory parties have agreed to work together to provide the entire 44,400 acre-feet. This situation has been clarified under "Water Requirements" in Chapter II of the FEIS.

3. **Comment:**

As a part of the EIS an explanation of whatever agreements exist between the Strawberry Water Users and the Bureau and the CUP should be a matter of public record and should be included in the EIS. Clearly there are water rights concerns between these three organizations that have not been adequately spelled out.

**Response:**

The Strawberry Water Users have contracted for and have the right to the 61,000-acre-foot yield of the original Strawberry Reservoir. They also have rights to revenues from lands adjacent to the reservoir under their 1924 repayment contract. The Central Utah Water Conservancy District, under contract with the Federal Government for the Bonneville Unit, will be entitled to the yield of the enlarged portion of the reservoir.

4. **Comment:**

The EIS does not adequately show that the Spanish Fork River can withstand the high flows that it will be forced to carry between the junction of Diamond Fork and the mouth of the canyon.

**Response:**

The Bonneville Unit would not result in increased peak flows in the Spanish Fork River between the junction of Diamond Fork and the mouth of Spanish Fork Canyon. Peak flows now result from runoff floods in the Spanish Fork River drainage, including Diamond Fork. Releases to Utah Lake during winter months for exchange to Jordanelle, etc., and supplemental irrigation deliveries to irrigated land in the south Utah County area would be well within existing channel capacities and would not be made during flood periods.

5. **Comment:**

The EIS states that the Spanish Fork River will receive increased flows in the lower regions between the mouth of the canyon and Utah Lake. It is unclear where these waters come from; what volume of water will be transmitted between the Spanish Fork, mouth of the Spanish Fork Canyon, and the Utah Lake; what will be the timing of those flows; is there a specific agreement between the Division of Wildlife Resources and the Fish and Wildlife Service regarding the establishment of such flows; and will public access be provided in this area.
CONSULTATION AND COORDINATION (Continued)

Response:

Increased flows in the lower regions of the Spanish Fork River would occur when project water is released to Utah Lake for exchange to Jordanelle Reservoir or to meet other project demands from Utah Lake. The water would come from the enlarged Strawberry Reservoir. After full Bonneville Unit operation, an annual average of 70,100 acre-feet of project water from Diamond Fork would flow into the Spanish Fork River. After diversions for consumptive use in the Spanish Fork area, approximately 32,700 acre-feet of project water would be delivered to Utah Lake. Exchange releases would usually be made during winter months. Supplemental irrigation releases would occur in summer months when other supplies are low and, as stated in the response to comment No. 4 above, both would be well within present channel capacity.

Since all required fishery mitigation would be achieved on Diamond Fork below Monks Hollow Reservoir, the plan does not include either streamflow agreements or the establishment of public access on the Spanish Fork River.

6. Comment:

A major problem with this EIS is that there are no specific water-use figures provided for the fate of the Strawberry water coming through the Diamond Fork System. The EIS does not state where the water is going, who is going to purchase it, or how it is to be used.

Response:

The 1973 Bonneville Unit FES shows the use of water delivered via the Diamond Fork Power System (refer to Figure A-15, page 64). Overall, the planned use has not changed significantly from that described in the 1973 FES. Some modifications of this use could occur with refinements to the project plan such as a delivery of municipal and industrial water for a proposed powerplant in Juab County or inclusion of High Line Canal deliveries in the Wasatch Aqueduct. The uses planned for the Bonneville Unit at the present time are discussed in Chapter I.

7. Comment:

Strawberry Reservoir water could potentially be used in four or five areas. Some of the water could be moved back into the Uintah Basin, some could be moved north directly into Deer Creek, some could be moved into the Price River area, or it could all be moved, as planned in the EIS, directly into the Diamond Fork.

It is unclear what represents the best utilization of this water. Prior to constructing any conveyance facility out of Strawberry Reservoir, this decision should be clearly stated, so that it can be a matter of public record and public examination.
Response:

The Bonneville Unit recommended plan has always provided and continues to provide for a transbasin diversion of water from the enlarged Strawberry Reservoir to the Wasatch Front via Diamond Fork. This recommended plan continues to be the most cost effective and provides the greatest benefits to the greatest number of people of all the alternatives considered. The Diamond Fork Power System continues to represent a viable component of the Bonneville Unit Recommended Plan.

8. Comment:

One concern is how the project will be funded, whether it will be incorporated into the Colorado River Storage Project or involve non-Federal participation. If it is non-Federal participation, a list of non-Federal participants should be included in the EIS.

Response:

Refer to the responses to comment Nos. 111 and 112.

9. Comment:

An independent study demonstrating the need for the Diamond Fork Power System is needed in light of WPPS: the people in the northwest were told they needed 20 nuclear powerplants some years ago; now they don't even need one.

Response:

Refer to the response to comment No. 111.

10. Comment:

The allocation of the water for power and nonpower needs should be stated. Farmers in Utah Valley shouldn't be expecting to get irrigation water when indeed they won't be.

Response:

Refer to the responses to comment Nos. 113 and 145.

11. Comment:

Who is actually going to be paying for this project?

Response:

Costs allocated to commercial power would be paid by non-Federal project participants with front-end construction funds. The costs of joint-use facilities, such as Syar Tunnel, Monks Hollow Dam, and the Diamond Fork Pipeline would be allocated equitably to each project purpose according
CONSULTATION AND COORDINATION (Continued)

to Reclamation cost allocation procedures. Costs allocated to municipal and industrial water would be repaid by the municipal and industrial water users. Costs allocated to irrigation would be repaid partly by the irrigators, and the remainder would be repaid with CRSP revenues apportioned to the State of Utah. Costs allocated to flood control, recreation, and fish and wildlife are nonreimbursable and would be paid by the Federal Government. A preliminary cost allocation is outlined in a supplement to the 1964 Bonneville Unit Definite Plan Report which will be made available in the fall of 1984. Copies of this report will be made available on request.

12. Comment:

What is the loss of revenue from diverting Diamond Fork water from the Colorado River Basin and not allowing it to go over Glen Canyon and Hoover Dams?

Response:

Refer to the response to comment No. 152.

13. Comment:

What is the destination of the 197,000 acre-feet of water?

Response:

Refer to the responses to comment Nos. 144 and 145.

14. Comment:

The effect of the transbasin diversion on Utah Lake and Great Salt Lake economies and ecologies should be stated. If there is a flooding situation like this year, will the Central Utah Water Conservancy District be responsible for its share of flooding from the transbasin diversion to Utah Lake? The unnecessary diversion of water into a flooded area is reckless responsibility.

Response:

Refer to the response to comment No. 144.

15. Comment:

How will this project be kept within the guidelines of the 1965 repayment contract which limited the cost to some $300 million?

Response:

An additional repayment agreement will be negotiated to supplement the existing agreement. The additional agreement will increase repayment coverage for municipal and industrial water costs.
CONSULTATION AND COORDINATION (Continued)

16. **Comment:**

The cost-benefit ratio is understated basically because of the flow-through component associated with the power system and because Reclamation's estimates are very conservative.

**Response:**

Benefits for the Diamond Fork Power System were based on the cost of the most economical thermal generation alternatives. All benefits and costs were determined in accordance with Reclamation and Department of the Interior instructions as well as guidelines from the Water Resources Council.

17. **Comment:**

Is the proposed Sheep Creek Substation site inundated by the new Thistle Lake?

**Response:**

The Sheep Creek Substation site was not inundated by Thistle Lake. The site is approximately 10 miles upstream from the landslide and 620 feet higher than the maximum water surface reached in Thistle Lake.

18. **Comment:**

Which use has priority: power demand or the irrigation demands?

**Response:**

Refer to the response to comment No. 113.

19. **Comment:**

Were dissolved oxygen, turbidity, and temperature effects estimated 1/2 mile downstream from Monks Hollow? 1 mile downstream from Monks Hollow? 1.5 miles downstream from Monks Hollow? And what were the results?

**Response:**

The effects of the project on dissolved oxygen, turbidity, and temperature were estimated for the entire Diamond Fork stream below Monks Hollow Dam, rather than at specific 1/2-mile increments. These estimates are summarized in the Water Quality section in Chapter IV of the Final Environmental Statement.

Two extreme temperature scenarios were evaluated. When warm, aerated waters are released from Strawberry Reservoir into the Diamond Fork Power System, water temperatures and dissolved oxygen levels in Diamond Fork would be very similar to present conditions.
When cold, anoxic waters are released from Strawberry Reservoir (the worst-case condition), water temperatures could be several degrees colder than under present conditions. This water would warm up very little in the 2-mile reach between Monks Hollow Dam and Wanrhodes Creek. Consequently, impacts at the stream locations in question were based on the same temperatures as immediately below Monks Hollow. Below Wanrhodes Canyon, Diamond Fork would warm up faster as tributaries added to the streamflow.

During the worst-case condition, Diamond Fork would aerate rapidly and reach nearly saturated dissolved-oxygen conditions within a quarter to a half a mile below Monks Hollow. The stream would be well aerated at the three stream locations in question.

Suspended solids (and associated turbidity) levels below Monks Hollow Dam would be reduced significantly from present conditions. The sediment load would be reduced from 22,500 tons per year to 2,070 tons per year, or a 91-percent reduction. The stream section in question would pick up very little sediment load; therefore, the turbidity at the three stream locations in question would be very similar to that immediately below Monks Hollow Reservoir.

The effects of these water-quality conditions on the fishery within the various stream reaches is covered under "Fish and wildlife" in Chapter IV.

20. Comment:

Why is the Diamond Fork Powerplant at the mouth of Diamond Fork Canyon sized for 298 second-feet while the pipeline supplying water to the powerplant is sized for 450 second-feet? What is the incremental difference in cost? What is the incremental justification?

Response:

The Diamond Fork Powerplant would receive only a portion of the Diamond Fork Pipeline flow. A bifurcation works would be constructed in the pipeline just upstream from the powerplant to direct a portion of the flow into the proposed Wasatch Aqueduct of the Irrigation and Drainage System. The remainder would enter a penstock leading to the powerplant. The water discharged from the powerplant would enter the Diamond Fork stream channel for a short distance and subsequently the Spanish Fork River.

The questions about incremental difference in cost and incremental justification are unclear and, therefore, are not responded to.

21. Comment:

The loss of 45 acres of riparian habitat is not significant in the State of Utah.
CONSULTATION AND COORDINATION (Continued)

Response:

Although it appears that 45 acres of riparian habitat is not significant in the State of Utah, this loss is significant when considering the small amount of riparian areas occurring naturally in the Diamond Fork drainage. State and Federal resource agencies have given riparian habitat a high priority for replacement considering its value for a high diversity of wildlife species.

22. Comment:

The assessed adverse impact to upper grazing lands may be significant to a few, but the increased water supply in other units for cattle and feed production will more than offset this loss in this unit.

Response:

Although some special interests, such as the ranchers who use forest grazing lands, may be adversely affected by this project, the overall benefits to larger groups of people in other areas outweigh the specific loss in this instance.

23. Comment:

For the United States to spend money in an effort to mitigate the scenic impacts of a transmission line is unwarranted. Powerlines should be constructed as needed without attempting to make less ugly something that is already so ugly it cannot be salvaged.

Response:

Western is committed to minimize or soften the visual impact of transmission lines wherever possible. To accomplish this, specific measures would be taken in the design and construction of these facilities as outlined in Appendix A of the FEIS to reduce these impacts. The Forest Service, Bureau of Land Management, Bonneville Power Association, and Western Area Power Administration have all been involved in extensive research and analyses to determine the effectiveness of these measures, and all have concluded that they are useful and valuable. In addition, visual resources must be treated equally with all other resources associated with a given project, which includes an analyses of impacts and development of means to adequately minimize any adverse effects on esthetics.

Other comments and responses

24. Comment:

What will the cost of the peaking power be? The cost of petroleum products, water, and electricity has increased substantially as use declines.
Response:

Refer to the response to comment No. 204.

25. **Comment:**

Have studies been included to indicate the amount of power that could be produced that would offset the amount of power needed for the pumping cycles?

Response:

The amount of pumping energy required for operation of the Fifth Water Pumped Storage Powerplant is a function of the amount of plant operation (plant factor). As the plant factor increases, the amount of pumping energy increases. At a 17-percent plant factor, Fifth Water Pumped Storage Powerplant would generate approximately 1,698,000 MWh of energy per year and would use approximately 1,860,000 MWh of energy for pumping per year.

26. **Comment:**

How much power is lost because of sustained fishery releases in Fifth Water Creek?

Response:

If the Fifth Water Pumped Storage Alternative were adopted, approximately 3,200 MWh of additional energy per year could be generated by the Fifth Water Pumped Storage Powerplant if Fifth Water Creek were completely dried up. Reclamation believes, however, that it would not be prudent or acceptable to completely dewater the stream.

27. **Comment:**

The statement on page 98 concerning the slight increase in seismic risk created by the weight of water in the reservoir seems to be based upon someone's professional judgment. If it is based on fact, then those facts should be presented.

Response:

In the FES, the Comparative Analysis of Impacts section in Chapter III indicates that underground fluid pressures which might be caused by Fifth Water Reservoir could increase the possibility of subsurface activity. Additional studies would be needed to investigate this remote possibility if the pumped storage features are added to the power system at some future date. Under the recommended plan, Fifth Water Reservoir would not be constructed.
Written Comments and Responses

About 30 letters commenting on the Draft Environmental Statement have been received by the Bureau of Reclamation. Some of the views expressed in these comments parallel those given at the public meetings, but they cover a much wider range of concerns. Responses to the written comments are included on the following pages. The responses are grouped alphabetically in four categories, as follows: (1) Federal agencies, (2) State agencies, (3) private organizations and companies, and (4) individuals. The original letters of comment are on file in the Upper Colorado Regional Office of the Bureau of Reclamation in Salt Lake City, Utah, and a copy of each is included at the end of this section. Letters requiring no response are also included. Letters were received from the following.

Federal Agencies

Department of Agriculture  
Forest Service  
*Soil Conservation Service  
*Department of the Army  
Department of Health and Human Services  
Public Health Service  
*Department of Housing and Urban Development  
Department of the Interior  
*Bureau of Indian Affairs  
Bureau of Land Management  
Bureau of Mines  
Fish and Wildlife Service  
Geological Survey  
National Park Service  
Department of Transportation  
Federal Aviation Administration  
Environmental Protection Agency

State Agencies

State of Colorado  
*Division of Local Government  
*Division of Wildlife Resources  
*Division of Water Resources  
Colorado River Board of California  
State of Utah  
Natural Resources and Energy, Wildlife Resources  
Office of the Governor  
State of Wyoming  
Executive Department  
State Engineer's Office  
Public Service Commission  
Recreation Commission

*No response needed.
Private Organizations and Companies

*C-E/Neyrpic
Central Utah Water Conservancy District
Environmental Policy Center
Intermountain Water Alliance
National Wildlife Federation
Strawberry Water Users Association
*Utah Municipal Power Agency
Utah Nature Study Society

Individuals

Robert J. Anderson
Barrie Marchant
Jon R. Miller
Garth R. Morgan
John C. Patrick

Comments and responses relating to the Sixth Water Flow Through Alternative

Comments from Forest Service letter dated August 23, 1983

Note: Functional and editorial comments have not been responded to directly, but appropriate changes have been made in the text.

28. Comment:

Sixth Water Creek Flow Maintenance and Fisheries Improvement

This concern was addressed in both our February 25 and March 31, 1983, responses to preliminary drafts of the Environmental Impact Statement (EIS). We still feel very strongly that the Sixth Water stream should be improved for fisheries. On page 160, it is pointed out that the fisheries in Sixth Water represent an excellent opportunity for stream fisheries enhancement; however, it states that such enhancements could only be justified as mitigation if the 1964 DPR Alternative were selected.

The possibility of developing a fisheries flow through a powerplant at the outlet of the Strawberry Tunnel is mentioned as a potential way to maintain the fisheries in Sixth Water. We would support such a proposal and feel that this possibility should be further evaluated and discussed in the Final Environmental Impact Statement (FEIS) for this project.

Another option for providing fishery flows down Sixth Water Creek is to continue to release water down this stream until such time as it may be established that all available water above a minimum flow is necessary for peaking power production. An interim agreement has been discussed with your Provo office and they have indicated a willingness to explore such a proposal. Item 15 of our specific comments, which follows, suggests wording to be added in recognition of the flexibility that seems apparent in the operation of the Fifth Water Powerplant.

*No response needed.
If options which will add sufficient water do not become available, then we feel that the Bureau has a responsibility to rehabilitate the stream channel in Sixth Water. As stated in our response to the advanced draft, this responsibility occurs by virtue of the fact that the Sixth Water channel is being used as a conveyance system under the current Strawberry Project, to which the Bureau was a party. The Diamond Fork Power System is an enlargement of this project and is replacing the old Strawberry Tunnel with a new system. The Bureau recognized some responsibility for Sixth Water when it included cost estimates for channel rehabilitation in previous plans. It may be necessary to require special financing for a rehabilitation project.

We believe it would be more desirable and cost efficient to implement the Interagency Biological Team streamflow recommendations than to stabilize the stream channel. The possibilities mentioned above could provide the needed water to accomplish this.

Response:

The rationale for Reclamation's position on the improvement of the fishery potential in Sixth Water Creek was presented on pages 155 and 160 of the DES and has not been changed for the FEIS. Reclamation has evaluated the possibility of developing a fishery flow in Sixth Water Creek by building and operating a small powerplant at the Strawberry Tunnel outlet to which water could be committed. This evaluation indicates that such a plant would not be feasible because of its low head, the large capital cost involved in reconstruction of the old Strawberry Tunnel, and the annual loss of power revenue which would result from not running the water through the project powerplants and generating energy.

The option of continuing to release water into Sixth Water Creek until all available water would be needed for peaking power production is impractical. All energy produced by the system would be in full demand when construction is completed. All water would flow through the powerplants according to downstream demands. There would be no "interim operation period" during which the demand for energy would start at a low level and increase over time. Any water taken into Sixth Water Creek would bypass the Syar, Sixth Water, and possible Dyne Powerplants, resulting in the total loss of energy and associated revenue. Therefore, there would be no economically sound way to provide additional water to Sixth Water Creek.

The Sixth Water Creek channel would be rehabilitated under the Diamond Fork Power System only if the 1964 DPR Alternative is constructed with a subsequent requirement for fishery mitigation, as explained in both the DES and FEIS. However, Reclamation recognizes the desirability of maintaining a fishery in Sixth Water Creek and is committed to working with the Forest Service and other resource agencies in an effort to achieve a satisfactory solution to this problem. Channel rehabilitation and/or additional water could be provided as mitigation for stream fishery losses in another system of the Bonneville Unit. These measures
are currently identified as potential mitigation measures for the Straw­berry Aqueduct and Collection System. Also, Reclamation is currently committed to the installation of a flow-bypass valve in the connection between Syar Tunnel and the existing Strawberry Tunnel to insure that future options are available for augmenting the flow in Sixth Water Creek.

29. Comment:

Diamond Fork Pipeline

This item was addressed in our previous correspondence also. We still question that the benefits of the pipeline will be as significant as explained in the EIS. Flows of 425 cfs would still occur in the existing channel which would not be much different from the flows which now exist during most of the irrigation season. Based on the undesirable effect of these flows, we continue to support the construction of a pipeline that would accommodate at least 600 cfs or more.

Response:

The fishery impact analysis on lower Diamond Fork was an interagency effort that included the Forest Service. The method selected for this evaluation was viewed by the team as the best available method in considering those physical stream parameters which collectively make up trout habi­tat. The angler-use benefits attributed to the pipeline are based on a reliable method developed by Binns and Eisermann (1979). Full docu­mentation of these benefits on Diamond Fork is available from any of the interagency team members.

The projected fishery benefits, along with power produced in the Diamond Fork Powerplant, justify the inclusion of the Diamond Fork Pipeline in the project plan. A pipeline size any greater than 450 cfs is not justi­fied economically. Larger sizes do produce higher fishery and power benefits, but these are not sufficient to offset the high cost of the larger pipe, thereby making the larger size uneconomical. Because the pipe is an enhancement feature, the benefit to the fishery must equal or exceed the cost of the pipe.

The 425-cfs maximum flow mentioned is not continuous, but represents a peak flow that would be in the channel for only a few days during one month of the year (July). In addition, this flow would occur in one year out of the 43-year (2 percent) period of record used in the hydrol­ogy study. Peak flows under existing conditions have attained levels of 500 cfs, which are higher than those projected with the project. Average monthly flows were used by the interagency team in conducting the fishery impact analysis. As indicated in project flow tables in the FEIS, average monthly flows in July under existing conditions are 298 cfs, while projected flows would range from 220 to 249 cfs. In addition, average monthly flows in June and August would be reduced even more drastically under project operation. This is the decrease in average
CONSULTATION AND COORDINATION (Continued)

monthly flows that the team determined would provide the fishery benefits indicated in the analysis. While significant if prolonged over a long period of time, peak flows would be of short duration and, therefore, not significant to the fishery.

30. **Comment:**

**Construction and Mitigation**

We recognize the difficulty the Bureau has in obtaining construction and mitigation funds concurrently. However, because of legal and essential resource requirements, we insist that the mitigation construction issue be emphasized in the FEIS. In light of recent curtailment in the use of Section 8 funds for recreation and wildlife mitigation, we must stress that we cannot represent to the public that all is well. We feel it is necessary for Reclamation to disclose the current status and the future outlook for mitigation in this FEIS. We would need to go on record as opposing the continuation of the project without adequate mitigation.

**Response:**

In accordance with current departmental policy, our objective is to obtain management rights through the purchase of easements or fee title. Section 8 funds are currently available to acquire the management rights necessary to mitigate the impacts of the Sheep Creek-Rays Valley access road. The remainder would be acquired in conjunction with mitigation for the remaining project features. Required wildlife mitigation for all other project features would be accomplished through obtaining options to buy easements on the other lands identified in the FEIS or by purchasing them by fee title. Sufficient section 8 funds would be programmed to acquire management rights concurrent with the realization of adverse impacts to wildlife.

**Comments from Public Health Service letter dated August 8, 1983**

31. **Comment:**

We have concern about the predicted water quality for the reservoirs of the Diamond Fork Power System and the quality of the releases to these proposed reservoirs from the Strawberry Reservoir. The construction of any of these reservoirs for recreational and water quality benefits might be made contingent upon the development and implementation of a satisfactory water quality and lake management plan. The construction of these reservoirs might also be made contingent upon the existence of controls for non-point and point sources of pollution sufficient to maintain and attain the applicable State water quality standards and designated uses of the proposed and/or affected surface waters.

**Response:**

Your concern about the predicted water quality for the reservoirs of the Diamond Fork Power System and the quality of the releases to these
proposed reservoirs from Strawberry Reservoir is apparently for the worst case condition described in the DES. This worst case condition is when waters below the thermocline are released from Strawberry Reservoir and contain relatively high nutrient (phosphorus) levels and low dissolved oxygen levels. This water, and the water in the proposed project reservoirs, would be no worse than the bottom releases of water from other reservoirs in the State such as Deer Creek Reservoir northeast of Provo. If any dissolved oxygen problems develop in the Diamond Fork System, they would exist for only a short time, even under the worst case conditions.

Because no major water quality problems are expected under project conditions, no specific plans for mitigation have been developed. The best approach appears to be to monitor the system during operation and address any significant problems when and if they occur. Because of rapid aeration, impacts to streams are expected to be minimal, but baffles or mixers could be added if necessary. Stream temperature problems are not expected to occur, but multiple outlets could be added if necessary.

Reclamation does not believe construction of the proposed Syar, Sixth Water, and Monks Hollow Reservoirs needs to be contingent upon the development and implementation of a water quality and lake management plan. A watershed management plan is presently being developed for Strawberry Reservoir, which would be the source of water for the power system. The watershed for the proposed reservoirs is relatively very small and entirely within the Uinta National Forest. Activity within the watershed is limited to recreation, cattle grazing, and associated access. The Forest Service has watershed plans to protect water quality and control erosion.

It is expected that the project reservoirs would meet applicable State water quality standards equally as well as other reservoirs in the State and that the project waters released would meet the requirements of the designated or intended uses of the water.

32. Comment:

We believe that the EIS should address the potential impacts associated with vectorborne disease or nuisance problems in the area. The design and construction of this project system must not allow any increase to occur in local vector populations which have the potential to cause vectorborne disease or nuisance problems. We suggest that the local and State health department be contacted for a history of the vectorborne disease and nuisance problems in the area and the steps necessary to mitigate and prevent the occurrence of any potential health problems. General health guidelines have been developed for controlling and preventing vector problems in conveyance and distribution systems, impoundments, and recreational areas. These guidelines and our publication, Mosquitoes of Public Health Importance and Their Control, 1977, are available upon request.
After investigating existing vector problems in the project area, Reclamation has concluded that no increase in vector problems would result from the project. In fact, mosquito habitat may be decreased. A discussion supporting this conclusion has been included in Chapter IV of the FEIS.

The cover and title page of the document should read "Environmental Impact Statement" rather than "Environmental Statement" to comply with 40 CFR 1508.1 and 1508.11.

The cover and title page of the final document have been revised as suggested.

To reduce impacts to a minimum BLM would encourage maximum use of wheeling as described on pages S-5. Transmission lines should be planned in existing corridors where possible.

If the Fifth Water Pumped Storage Alternative were selected, Reclamation and Western agree that power should be wheeled over existing transmission lines wherever possible. The two agencies also agree that any new lines should be constructed in corridors included in existing BLM and Forest Service plans.

A true "no action" alternative is not described in Chapter III nor analyzed in Chapter IV.

The Diamond Fork Power System is part of a larger project—the Bonneville Unit. A 1973 FES achieved final NEPA compliance for the Strawberry Aqueduct and Collection System and also provided a programmatic discussion and evaluation of the other systems of the Bonneville Unit. A 1974 court decision (Sierra Club v. Stamm, 507 F. 2d 788 [10th Cir. 1974]) stipulated that the 1973 FES "explains and describes the entire Bonneville Unit to facilitate an overall appraisal of its environmental impact and to allow an objective examination of a reasonable array of alternatives to the proposed plan". The 1973 FES and subsequent litigation committed the Bureau of Reclamation to preparing site-specific
environmental statements for the remaining major systems of the Bonneville Unit, including the Diamond Fork Power System. The alternatives analyzed for the Diamond Fork Environmental Impact Statement are options within the system, not to the system. Alternatives to the system were evaluated in the 1973 FES. The intent to make the transbasin diversion was discussed in the 1973 FES. However, NEPA compliance for specific amounts of water was deferred to future environmental statements. Thus, for the Diamond Fork Power System Environmental Impact Statement, the "no action" alternative is the No Power Alternative. The "no action" option is then the alternative of no power development presented in this statement.

Comments from Bureau of Mines letter of August 2, 1983

36. Comment:

The Bureau of Mines primarily is concerned with potential conflict between the proposed project and mineral resources in the project area which lies within the Spanish Fork Mining District. Known mineral resource production from the district, however, is minor. Minerals known to occur in Utah and Wasatch Counties include base and precious metals, stone, sand, gravel, and clay. Apparently stone, sand, and gravel are presently being produced or have been produced in or adjacent to the project area.

This is an organized and well written report and we have no objection to it as written. We suggest, however, that subsequent versions of the document include an inventory of known and potential mineral resources in or adjacent to the project area, and a brief discussion of the effects the project might have on such resources.

Response:

Information on known mineral resources and anticipated project impacts on those resources are summarized below. This information is not included in the FEIS since project impacts would be minimal.

No mining claims shown in the 1982 Geographic Mining Claim Index for the project area would be affected by any of the project features. No base or precious metals are known to occur in the project area; however, non-metal deposits such as clay, gravel, building stone, and low-grade phosphate occur in the project area.

Clay deposits, probably bentonite, occur in decomposed volcanic ash beds in the Flagstaff, Colton, Green River, and Uinta Formations. No commercial deposits are exposed near the project features, and none have been developed in the project area.

Gravel deposits are common in stream terraces along Diamond Fork. However, the gravel is poorly sorted, with considerable fines, and is generally unsuitable for concrete aggregate. Gravel for concrete aggregate for project use would be excavated from the Monks Hollow Reservoir basin
and from existing commercial deposits near the mouth of Spanish Fork Canyon.

Materials suitable for building stone may exist in the area. Algal limestone has been quarried from the North Horn Formation near Birdseye, Utah, about 13 miles southwest of the Monks Hollow Dam site. Flagstaff limestone and North Horn Formation occur in the project area and are known to contain the algal limestone. However, no known commercial quality deposits would be affected by any of the project features.

Low grade phosphate deposits occur in the middle Park City member, about 4 miles northwest of the proposed Monks Hollow Dam site, near the head of Little Diamond Creek. This 10-foot-thick, oolitic, and slightly silicic deposit was strip mined. The mine is no longer in operation. No commercial phosphate deposits would be affected by any of the project features.

Comments from U.S. Fish and Wildlife Service letter of August 19, 1983

37. Comment:

Page 25, third paragraph; pages 39-40; page 53, fourth paragraph; page 61, first paragraph; and page 231, recommendation 1. The DES obligates the BR to acquire and develop lands, for wildlife management, that are presently in private ownership. Fee title or perpetual easements of 4,443 acres for wildlife is a part of the recommended plan (page 49, Table 6). These lands will also provide fisherman access on the lower 5 miles of Diamond Fork Creek (pages 50 and 61).

Implementation of this mitigation plan is dependent upon future appropriations of funds provided by Section 8 of Colorado River Storage Project Act. It is our understanding, however, that there is presently a moratorium on the use of these funds to acquire lands.

We believe the BR should seek an exemption to the moratorium for this project or an alternative source of funding to implement the wildlife mitigation plan. This seems necessary in order to assure implementation of the wildlife mitigation plan concurrently and proportionately with project construction.

Response:

See the response to comment No. 30. There is no moratorium on the use of Section 8 funds.

38. Comment:

Page 39, second paragraph. Other alternatives to screening outlet works to prevent the loss of fish may be possible. The FWS wishes to work closely with your staff and other involved agencies in developing plans to avoid losses of fish through power penstocks if possible. If losses cannot be prevented, we shall seek means for mitigation.
Response:

Reclamation will cooperate with the Fish and Wildlife Service and other involved agencies in developing plans to prevent fish losses through penstocks. If significant numbers of fish are lost through penstocks under project operation, Reclamation will consider mitigation commensurate with the loss. The structural and economic viability of screens or other fish-protection devices, as well as penstock design changes to reduce intake velocities to an acceptable level for fish escapement, would be examined for Monks Hollow Reservoir.

39. Comment:

Pages 40, 42. Railroad and highway relocations necessitated by the Thistle Slide affected some of the recommended wildlife mitigation lands. Consequently, the wildlife habitat on these areas needs to be reevaluated.

Response:

The lands and the wildlife habitat involved have been reevaluated by the interagency team, and the results have been incorporated into the impact analysis in the FEIS. No change was required in the mitigation plan as a result of the reevaluation.

40. Comment:

Page 112, fourth paragraph. The marsh at the mouth of Diamond Fork Canyon was affected by railroad and highway relocation work necessitated by the Thistle Slide. Consequently, wildlife habitat values of this area need to be reevaluated.

Response:

The loss of this 5-acre marsh would not have a significant effect on wildlife values assigned to this land parcel. However, the loss was considered in the revised impact analysis included in the FEIS. The revised analysis did not change the mitigation plan.

41. Comment:

Page 155, paragraph 3 and the first half of page 16. During an April 20, 1983, interagency meeting with your staff, the Utah Division of Wildlife Resources (UDWR), U.S. Forest Service (USFS), and Fish and Wildlife Service (FWS), it was agreed that project plans should be reviewed to determine if additional streamflows in Sixth Water Creek could be provided on an interim basis without impairing power production. It was our understanding that this would be investigated by your Utah Projects Office.

Response:

See the response to comment No. 28.
CONSULTATION AND COORDINATION (Continued)

42. **Comment:**

Pages 172-173, Endangered Species. Presently, the FWS is reviewing information and requesting comments to determine if the June Sucker (*Chasmistes liorus mictus*), should be proposed as an endangered species. This species inhabits Utah Lake and uses the Spanish Fork and Provo Rivers for spawning and larval rearing. Potential impacts to this species by the proposed project should be analyzed. It is possible that this species could be proposed for listing and/or listed prior to the initiation of project construction. If so, all compliances of the Endangered Species Act and the 1982 amendments would have to be met.

**Response:**

All conditions of the Endangered Species Act of 1973 and amendments would be met regarding the June sucker.

**Comments from U.S. Geological Survey letter of August 17, 1983**

43. **Comment:**

The effects that the Diamond Fork Power System would have on the geologic and seismologic environment are not adequately evaluated to permit judgments as to the environmental soundness of the proposed installations. Only the depth to bedrock at the several sites is given quantitatively in the section on geology. Throughout the text there are assertions, mostly regarding bedrock, alluvium, and soil, that are inadequately supported by data. The text should include ranges and means of test results of such critical physical properties as permeability, shear strength, fracture frequency, and bulk density. It is stated that "Most of the proposed reservoir basin area is blanketed with a layer of relatively impervious earth material which should prevent seepage" (page 174, paragraph 4). The "earth material" should be identified and its thickness should be specified. "Relatively impervious" should be explained. The spacing of any permeability tests and their results should be given.

In the sections on seismic conditions and related impacts (p. 177-178) the data bases used are not current, nor are all site-specific studies integrated into the evaluation. A more adequate analysis of seismic risk and dam safety should be provided for the two proposed dams. Stability of slopes around the reservoirs should be evaluated, since they are partly in narrow, steep-walled canyons. The hazard of dam overtopping and downstream flooding in event of a landslide into a reservoir should not be overlooked.

**Response:**

The section on "Geology and Seismicity" in Chapter IV of the FEIS includes a summary of available data on physical properties of feature sites of the recommended Sixth Water Flow Through Plan. Additional
CONSULTATION AND COORDINATION (Continued)

exploration is planned to obtain samples for physical properties testing. The FEIS also includes an expanded and updated discussion of the seismicity of the project area.

44. Comment:

Abstract. It is stated that the increased water deliveries produced by the project will in part be used for municipal and industrial purposes; the probable distribution of the water for those purposes should be addressed.

Response:

Initially, approximately 90,000 acre-feet of municipal and industrial water annually is planned to be delivered through the Diamond Fork Power System for use in the Municipal and Industrial System of the Bonneville Unit. Of the total, approximately 70,000 acre-feet is expected to be used in the metropolitan Salt Lake City area with the remaining 20,000 planned for use in the Provo-Orem area. With full development of the Bonneville Unit, approximately 30,600 acre-feet of municipal and industrial water would be conveyed through the power system. This water would be used in southern Utah and Juab Counties.

45. Comment:

p. 105. The statement should indicate whether herbicides are to be used in clearing and maintaining right-of-way and facilities; if so, impacts on ground water and surface water should be evaluated.

Response:

It is not expected that herbicides would be used in clearing operations for rights-of-way or facilities. If the use of herbicides were determined to be necessary, Federal and State regulations would be complied with.

46. Comments:

p. 174, par. 1. "The general geology" should be changed to read "The location of faults relative to the main drainages."

p. 174, par. 2. For the Syar tunnel, additional information on geology is necessary in order to judge soundness.

p. 174, par. 3. A "fairly narrow valley bottom" is too general a description of the proposed Fifth Water Damsite, and "good rock conditions" should be explained.

p. 174, par. 5. The results of the in-hole tests should be given: lithology and depth of the hydrofracture experiment; what in-situ shear stresses were indicated at failure; whether the orientation of principal stresses was defined, and if so, how it compares with the regional state
of stress; and what specifically the stress tests indicate regarding the excavation of the large chamber. The "overall suitable rock conditions" should be explained in more specific terms.

p. 175. Figure 27 should not be referred to as a geologic map. "Location of Faults" would be a more appropriate title.

p. 177. The unpublished map of seismicity might be replaced by published maps that are accessible to the public. Figure 1-5 or figure 7-1 in reference #15 are of better quality and more recent than the map on page 177. Also, inclusion of figure 7-6 from the reference would be helpful.

p. 178, par. 1. The report referred to (reference #16) has been superseded by U.S. Geological Survey Open-File report 82-1033, which should be used in this evaluation.

P. 178, par. 2. The discussion of maximum credible earthquakes associated with major faults mentions faults located 4.5 and 9 miles east of the eastern-most end of the project area but fails to discuss the Wasatch Fault, which appears to be somewhat closer to at least one of the proposed sites.

p. 178, par. 3. The reference to "a very remote possibility" should clarify whether this takes into consideration the results of in-situ stress measurements, and if not, why not.

Response:

The "Geology and Seismicity" section of Chapter IV of the FEIS incorporates all of the above concerns pertaining to the recommended Sixth Water Flow Through Plan. The results of hydrofracture tests at the underground powerplant site for the Fifth Water Pumped Storage Alternative are available at Reclamation's Utah Projects Office in Provo, Utah.

47. Comment:

p. 180 to 197. The evaluation of effects on population growth should include an assessment of resultant impacts on water-supply and sewerage systems in affected communities.

Response:

The present sources of municipal water are sufficient for some cities and suburban areas to meet the increase in demand for a few more years, while for others the present supplies are not sufficient to meet existing demand during a growth year. Available supplies are not being fully used in some areas because of a lack of reservoir capacity to store and regulate and a lack of conveyance facilities to transport the water supply to points of use. Surface waters are exchanged for spring waters to meet supply shortages in some cases. Larger communities have adequate capacity to meet the projected needs of the near future.
time, Payson is reevaluating its distribution system. Smaller communities lack adequate capacity in their distribution systems and may require expansion.

Most of the smaller communities impacted by the project rely on septic tanks for sewerage disposal. Of the larger communities, most have adequate capacity to meet projected needs through the project construction period. The exceptions are Payson, Salem, and Spanish Fork, which are already overloaded. Spanish Fork is currently expanding its capacity, while Payson and Salem are considering alternatives. Postconstruction impacts on sewerage disposal are expected to be minimal, since little or no additional postconstruction population is expected from the project.

Comments from National Park Service letter of August 5, 1983

48. Comment:

The site of the proposed Diamond Fork Powerplant lies at the base of Thistle Canyon Landslides, a potential National Natural Landmark. While we do not anticipate that the powerplant will have any direct impact on this potential landmark, it should be taken into consideration during further project planning and efforts made to avoid adverse visual impacts to the greatest extent possible.

Response:

Reclamation does not anticipate that the Diamond Fork Powerplant will impact the Thistle landslide because the powerplant would be located about 2 miles north of the base of the slide. Potential impacts will be considered in future project planning.

Comments from Federal Aviation Administration letter received August 15, 1983

49. Comment:

During your planning process for determining final transmission line routing, keep in mind that notice to the Federal Aviation Administration (FAA), is required when any structure or catenary would exceed 200 feet above ground level or when any structure or catenary within 20,000 feet of a public use airport with a runway more than 3,200 feet in length exceeds a 100:1 slope from the airport (within 10,000 feet of a public use airport with a runway not more than 3,200 feet in length exceeds a 50:1 slope from the airport). Enclosed is FAA Advisory Circular, "Proposed Construction or Alteration of Objects That May Affect the Navigable Airspace," for your use. If you do need to file a notice with the FAA, please call Ms. Kathy Paul of our Airspace and Procedures office in Seattle, (206) 431-2535 or (FTS) 446-2535, prior to filing notice.

Response:

Western Area Power Administration will comply with all FAA siting guidelines and notify the FAA of transmission-line routes.
CONSULTATION AND COORDINATION (Continued)

Comments from U.S. Environmental Protection Agency letter of August 23, 1983

50. Comment:
EPA is primarily concerned with the potential effects on water quality related to transbasin diversion in the Bonneville Unit. The transbasin diversions associated with the Diamond Fork Power System will increase salinity in the Colorado River Basin. Therefore, it is necessary that these water quality impacts be identified and quantified in the final EIS.

Response:
All Bonneville Unit impacts on the salinity of the Colorado River System would result from the Strawberry Collection System and not from the other unit systems such as the Diamond Fork Power System. These impacts were evaluated in the 1973 Bonneville Unit Final Environmental Statement on pages 398, 440-441, 475, 482, and 486 and will again be evaluated in the Environmental Impact Statement on the Irrigation and Drainage System scheduled for 1985.

51. Comment:
P. 39--The draft states that a minimum D.O. of 5 mg/L must be maintained to support the fishery and that if upon operation of the system, D.O. falls below that, "appropriate measures will be implemented." The Final EIS should specify what these measures are and who will implement them, if needed.

Response:
No specific measures have been identified for reaerating the water below Monks Hollow Reservoir because D.O. (dissolved oxygen) would be above 5 mg/L most of the time and this is not expected to be a problem. However, if a problem develops, Reclamation is committed to alleviating it by whatever measures are necessary, such as the installation of baffles and mixers. These measures would be determined at that time through coordination with other resource agencies. Reaeration occurs naturally in a turbulent mountain stream, and D.O. would exceed 5 mg/L within about a quarter mile, based on Reclamation observations of the Provo River below Deer Creek Reservoir.

52. Comment:
P. 42--The discussion of mitigation - water quality refers only to mitigation of water quality impacts related to the construction phase. Mitigation should also be discussed for the operation phase.

Response:
Studies by Reclamation indicate that no water quality mitigation measures would be necessary during the operational phase. However, as indicated
in Chapter III of the Final Environmental Impact Statement, Reclamation is committed to monitoring water quality during project operation and providing mitigation measures if a problem is indicated at that time.

53. Comment:

P. 95--Table 20 indicates the potential for a significant lowering of D.O. What will be the impact on receiving waters and how does this compare to the stream classification and criteria?

Response:

The impact of the seasonal potentially low-dissolved-oxygen water on receiving waters is discussed in Chapter IV, under "Water Quality." Under "worst case" conditions, Diamond Fork would reaerate within a quarter to a half mile. The local impact on stream classification and criteria would be no worse than present conditions below Strawberry Tunnel releases to Sixth Water Creek or releases below Deer Creek Reservoir on the Provo River.

54. Comment:

P. 96--The first paragraph discusses only temperature. Other water quality parameters such as nutrients, D.O., heavy metals, etc. should also be discussed.

Response:

The only water quality parameters of significant concern that might be impacted by the project are water temperature, dissolved oxygen, nutrients, and suspended solids. Table 20 and the related discussion are only a summary comparison of impacts. Temperature, dissolved oxygen, and turbidity are discussed in Chapter III under "Comparative analysis of impacts." The second paragraph on water quality elaborates on temperature because it is the water quality parameter receiving the greatest impact. Other parameters are discussed under "Water Quality" in Chapter IV.

55. Comment:

P. 112--The DEIS acknowledges that riparian habitat is very limited (5%) in the project area. Therefore, it is critical that adverse impacts be avoided and/or mitigated.

Response:

The construction plan would be designed and implemented to minimize damage to riparian habitat. All practical alternatives to adversely impacting the riparian ecosystem would be evaluated. Furthermore, the wildlife mitigation plan is designed to include as much riparian zone as practical.
56. Comment:

P. 115—How does the slide at Thistle impact the information provided regarding flows in the Spanish Fork River?

Response:

The impact of the Thistle slide on flows of the Spanish Fork River depends on the fate of the lake behind the slide. For safety reasons, the lake has been drained. After studies to determine the stability of the slide have been completed, a decision will be made regarding its permanent future. If it is determined that the lake should remain drained and appropriate bypass facilities are constructed to prevent filling from ever occurring again, the flows of the Spanish Fork River would be the same as presented in Table 23. If it is determined that the lake should be refilled and operated as a reservoir, operation studies would be required to determine the resulting flows in the Spanish Fork River.

57. Comment:

P. 118—Table 24. Are the following "Project monthly flows" correct? Maximum year, February and March? Also minimum year, August?

Response:

Table 24 in the DES, which gives streamflow effects with a 200-cfs Wasatch Aqueduct (I&D System), is now Table 25 in the FEIS. A new Table 24 has been added to the FEIS giving streamflows with a 325-cfs Wasatch Aqueduct. In both tables, the project monthly streamflows are flows which would occur in the designated streams under computer-simulated operating conditions. They represent streamflows which would have occurred during the period from 1930 through 1973 if the project had been constructed and fully operational. The values in Tables 24 and 25 are for maximum, minimum, and average annual operating conditions. For wet periods, operational releases from the reservoirs would be less, since downstream demands would be partially supplied from the wet climatic conditions. For dry periods, a greater release would be necessary to meet downstream demands.

Under simulated project operating conditions, releases to downstream users were made from Monks Hollow Reservoir, but excess flows were diverted into the Diamond Fork Pipeline and conveyed to the Diamond Fork Powerplant.

58. Comment:

P. 122—The discussion of water quality would be clarified by including a "pre" and "post" project comparison in table format. Perhaps Table 26 could be expanded for this purpose.
CONSULTATION AND COORDINATION (Continued)

Response:

Table 26 was intended to give a general indication of water quality throughout the project area and adjacent areas. The project would only affect lower Diamond Fork and the Spanish Fork River and only the parameters of temperature, dissolved oxygen, nutrients, and suspended solids. Tables 28-31 compare project impacts on temperature, dissolved oxygen, and suspended solids for the various alternatives. Table 28 has been revised to include present conditions for maximum stream temperature and dissolved oxygen range.

59. Comment:

P. 123--The DEIS acknowledges that water from Strawberry Reservoir would be of poorer quality in terms of nutrients and dissolved oxygen. What impacts will this have on receiving waters and how would this relate to current stream classifications and criteria? What measures are being proposed to mitigate adverse water quality impacts?

Response:

The Draft Environmental Statement acknowledges that, under present conditions, the quality of the water imported to Diamond Fork from Strawberry Reservoir is poorer in terms of nutrients and dissolved oxygen. The quality of water to be released from the future enlarged reservoir is projected to be about 30 percent lower in nutrient levels and generally no worse in oxygen levels than that presently released. Therefore, Reclamation does not believe mitigation measures for adverse water quality impacts are warranted.

60. Comment:

P. 133--See comments for page 123 (comment No. 59).

Response:

Refer to response No. 59. As stated in "Water Quality" in Chapter IV of the FEIS, no mitigation measures are thought to be necessary, but Reclamation would monitor project operation and mitigate for low dissolved-oxygen levels, if necessary.

61. Comment:

P. 138--What impact may the possible "anaerobic" bottom sediments have on receiving waters? Are there any possible heavy metal problems in any of the associated reservoirs and/or streams?

Response:

Anaerobic bottom sediments are not anticipated under the recommended Sixth Water Flow Through Alternative. If any should occur, the anaerobic bottom sediments would have little impact, except occasional low
dissolved-oxygen levels and increased nutrient levels in the overlying water, the same as currently exists in Strawberry and other area reservoirs. There are no heavy metal problems in Strawberry Reservoir or the Diamond Fork stream system, and none are expected under project operation.

62. Comment:

P. 174--Are there any similarities between the geology at the Thistle slide site and the geology in the project area? Geographically, the two sites are not that far apart.

Response:

There are general similarities in the geology of the Thistle slide site and the project area. The FEIS includes a discussion of the similarities between the two areas in the section on Geology and Seismicity in Chapter IV.

63. Comment:

We understand the EIS is intended to fulfill requirements for exemption from a Section 404 permit. The granting of a Section 404(r) exemption should not preclude the desirability for a sediment control plan. The preparation and implementation of such a plan is necessary to assure that water quality degradation during both construction and system operation is minimized.

This sediment control plan should include, as a minimum, the following:

1. Identification and location of temporary measures such as berms, dikes, dams, sediment basins, fiber mats, netting, gravel filters, mulches, grasses, slope drains, or other control devices which are in place or would be installed to control sediment resulting from all sources of water flowing into the construction area.

2. Methods of controlling drainage from haul roads and access roads.

3. A listing of material, machinery, and manpower available at the site for erosion control.

4. The identification and location of permanent erosion control measures such as stabilization and revegetation or terracing of steep slopes and other disturbed areas as well as any other measures necessary to assure long-term protection of water quality.

5. Maintenance of a buffer zone along the stream, whenever practicable, to protect water quality. Clearing of vegetation in the reservoir pool areas should be minimized until construction of a dam has progressed to the point that runoff from disturbed areas can be controlled. The sediment control plan should indicate the location and extent of buffer strips and contain a schedule of clearing activities.
6. Identification of an on-site water quality control officer who would be responsible for implementing water quality control measures.

7. Tentative schedule of implementation of temporary and permanent control measures.

8. The sediment control plan should include a water quality monitoring program. As a minimum, this program should consist of sediment and turbidity sampling and analysis to be conducted at stations established above and below the construction site and at any other location within the construction area which may be a source of pollutants to the principal drainage. Samples should be collected at least twice weekly during the construction period.

The State of Utah may also require a sediment-control plan as part of the Section 401 water quality certification. One well-prepared plan should satisfy the requirements for both Sections 401 and 404.

Response:

The section on water quality mitigation measures in Chapter III has been revised in the FEIS to reflect that sediment control plans will continue to be a requirement in all contract specifications for project features. Your list of eight minimum requirements for the plan has also been incorporated into this section.

Comments from Colorado River Board of California letter of July 12, 1983

64. Comment:

Our only comment is in regard to the possible differences in water requirements between a system with only flow-through powerplants versus a pumpback system. Since the pumpback system requires a larger reservoir and would consume more water because of evaporation, it would seem that this alternative requires additional water for export from the Colorado River Basin. However, the report seems to indicate a diversion of 197,600 acre-feet per year for all of the alternatives.

Response:

The average annual transbasin diversion would remain constant for all alternatives under project operating conditions. More water would be lost by evaporation from the reservoirs of a pumped-storage system than from the reservoirs of a flow-through system; however, the loss would be negligible and would occur as a shortage to the project irrigation supply.

Comments from Utah Natural Resources and Energy, Division of Wildlife Resources letter of September 1, 1983

65. Comment:

Page S-6, Summary Table 2: In the rows on "Fish (lb/year): Streams and Reservoirs," the numbered values are incorrect for each development alternative. The values on the following page are correct.
CONSULTATION AND COORDINATION (Continued)

<table>
<thead>
<tr>
<th>Development alternative</th>
<th>Fish (lb/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Streams</td>
</tr>
<tr>
<td>Future without condition</td>
<td>+2,384</td>
</tr>
<tr>
<td>Fifth water pumped storage</td>
<td>+2,794</td>
</tr>
<tr>
<td>Sixth water flow through</td>
<td>+2,734</td>
</tr>
<tr>
<td>Sixth water pumped storage</td>
<td>+2,734</td>
</tr>
<tr>
<td>1964 DPR</td>
<td>-444</td>
</tr>
<tr>
<td>No power</td>
<td>+2,734</td>
</tr>
</tbody>
</table>

Response:

The incorrect values in Summary Table 2 (and in Table 20) have been revised in the FEIS.

66. Comment:

In addition to the above table corrections, it should be stated in the table (as a footnote or in the Environmental category heading as "Wild fish (lb/yr)" that the fish biomass values are for wild trout only. The inclusion of hatchery trout values would greatly increase biomass estimates.

Response:

Summary Table 2 has been revised as suggested.

67. Comment:

Page 117, paragraph 4, sentence 2: Is the reach of Diamond Fork River between Spanish Fork River and Monks Hollow Powerplant 7 miles as stated, or 8 miles as stated in the USBR Fisheries Impact Analysis and Mitigation Recommendations report of June 1983?

Response:

This reach of Diamond Fork is 8.0 miles in length. However, the length of stream containing enhanced fishery flows would be 7.5 miles, with the remaining 0.5 mile being adversely affected by high flow releases from the Diamond Fork Powerplant and the recent construction of a new road and railroad across the mouth of Diamond Fork. The FEIS reflects the 7.5 miles of enhanced fishery.

68. Comment:

Page 117, paragraph 5, sentence 7: Just how long is the "short reach of Diamond Fork Creek above the Spanish Fork confluence" that will receive 875 cfs. We understood that the 450 cfs Diamond Fork pipeline would extend clear from Monks Hollow Dam to the Spanish Fork River, and based our impact assessment accordingly.
The 875-cfs figure was in error. The peak flow in that reach of stream would be 550 cfs. The reach of Diamond Fork that would receive the 550-cfs peak flow is about 0.5 mile in length. However, about half of this length has already been removed from significant fish production by the new road and railroad construction resulting from the Thistle mudslide. The remaining half represents about 3 percent of the total stream reach below Monks Hollow Dam. Therefore, the fisheries impact analysis for lower Diamond Fork would only be minimally affected.

69. Comment:
Page 245 [145], Table 33, Stream Reach 3: Angler use (days/year) should be 104, not 107.

Response:
Table 33 (Table 34 in the FEIS) has been revised.

70. Comment:
Page 150, Table 37, Stream Reach 1: Habitat units should be 94, not 86.

Response:
The habitat unit value of 86 as indicated in Table 37 (Table 38 in the FEIS) is correct.

71. Comment:
Pages 154, 159, and 161, Tables 41, 43, and 44, Headings: The trout fishery evaluation values are for 1992 (5 years into operation), not for the first year (1987).

Response:
Tables 41 and 44 (Tables 42 and 45 in the FEIS) have been corrected to indicate that values shown are for the fifth year of operation. Table 43 (Table 44 in the FEIS) has not been changed because values for the 1964 DPR Alternative occur in the first year of operation.

72. Comment:
Page A-14, include as item 8: Sixth Water Creek fish habitat restoration. Restoration is specified as fishery mitigation under the 1964 DPR alternative by the Fish and Wildlife Service Coordination Act Report (Part I - Streams).

Response:
This comment has been accommodated in item 21 of the "Environmental Commitments" section of the appendix. See also the response to comment No. 28.
Comments from State of Utah letter of August 16, 1983

73. Comment:

P. 43, par. 3--Sediment and erosion control plans must be reviewed by the Utah Division of Environmental Health prior to granting construction permits to insure protection of water quality and aquatic habitat.

Response:

The water quality discussion has been revised to indicate that sediment and erosion control plans would be reviewed by the Utah Division of Environmental Health.

74. Comment:

P. 43, par. 4--Reservoir sites must not be cleared until dam construction is near completion to prevent erosion and excessive downstream siltation.

Response:

The water quality discussion has been revised to indicate that reservoir clearing would be minimized to the extent possible until dam construction is sufficiently completed to control runoff from disturbed areas.

75. Comment:

P. 43--Inspections by Water Pollution Control staff prior to and during construction must be conducted to assure compliance with approved plans.

Response:

The water quality discussion has been revised to indicate that such inspections would be conducted.

76. Comment:

P. 46, par. 4--Sanitary and other pollution control facilities must be inspected prior to operation as well as approved before construction.

Response:

This section has been revised to indicate that such facilities would be inspected prior to operation and approved before construction.

77. Comment:

P. 123, par. 1--Certain stream sections may need to be upgraded to a 1C classification if utilized for drinking water at a future date.
CONSULTATION AND COORDINATION (Continued)

Response:

The paragraph referred to has been revised to indicate that some stream segments may need to be upgraded. Existing water quality data indicates that these streams normally meet most State standards, including Class 1C. The Diamond Fork Power System would not preclude future upgrading.

78. Comment:

P. 123, par. 2—Although present turbidity levels are high, State Water Quality Standards for turbidity are probably not violated. There is an incorrect interpretation of State Standards.

Response:

The paragraph referred to has been revised to delete the reference to State turbidity standards.

79. Comment:

P. 127, par. 4—The nutrient budget and loading for the present Strawberry Reservoir watershed has been evaluated. The statement that the reservoir is even more eutrophic than the phosphorus loading model indicates does not agree with our evaluation. The high inflow loadings should predict a eutrophic level.

Response:

Present and projected nutrient budget and loading for Strawberry Reservoir has been updated, based on an analysis of significant additional data, and the new projection is included in the FEIS. The new data show that the present total phosphorus load is 8,933 kg/yr or 0.354 g/m²/yr. The Vollenweider model (1973) (U.S. Environmental Protection Agency, 1977. Quality Criteria for Water. Office of Water and Hazardous Materials, Washington, D.C.) rates this loading as borderline between mesotrophic and eutrophic. The Canfield-Bachmann model (1981) gives a calculated in-lake total phosphorus concentration of 0.031 mg/L. The Dillon-Rigler model (1974) gives a concentration of 0.038 mg/L. Extensive field investigations show that present phosphorus concentrations average about 0.045 mg/L, which is significantly higher than any of the models predict. Other in-lake sampling (profiles) and chemical and biological analyses also indicate that Strawberry Reservoir is very eutrophic—more than the models predict. This analysis also agrees with the "208" study (Mountaintop Association of Governments, 1977. Water Quality Assessment of Several Major Lakes and Reservoirs of Summit, Utah, and Wasatch Counties of Utah. MAG Technical Working Paper No. 14. Provo, Utah. p. 86). The State applied the Carlson trophic-state index to limited data from 1979 and 1980 and obtained a mesotrophic-eutrophic rating. Reclamation believes the reservoir is strongly eutrophic and needs to be improved. Following recent discussions, the Utah Division of Environmental Health basically agrees with Reclamation's findings.
80. Comment:

P. 131, par. 4--We also disagree with the predicted trophic level of the enlarged Strawberry Reservoir. Without a reduction in phosphorus loadings, the west and upper ends of the system will probably remain eutrophic. The lower end from the present Strawberry Dam to the new Soldier Creek Dam will have better water quality because the major phosphorus loadings enter in the opposite end. Also, according to present reservoir flow release patterns, currents will also be westward toward the Diamond Fork aqueduct. The east portion of the enlarged reservoir will probably be closer to mesotrophic which is the recommended level for a healthy and productive reservoir system.

Response:

Following recent discussions, Reclamation and Utah Division of Environmental Health personnel basically agree on the predicted trophic level of the enlarged Strawberry Reservoir (some portions will remain eutrophic, and others will tend toward mesotrophic conditions). The loading model applies simply to an entire reservoir and does not consider the shape of the reservoir or the locations of inflows or outflows. The phosphorus loading discussion under the "Future Enlarged Strawberry Reservoir" heading in the Water Quality section of Chapter IV has been revised to reflect this situation.

81. Comment:

P. 41, Fig. 10--Rerouting of the D&RGW railroad and Highway 6-89 from Diamond Fork east to east of Thistle as a result of the Thistle Slide has reduced the habitat unit values of several parcels of land identified as possible mitigation for the project. Parcels of land impacted include: C-6, FS-3, C-4, K, C-5 and possibly FS-5 and S-4. Habitat unit values will need to be recalculated and worked into the mitigation plan accordingly.

Response:

See the response to comment No. 39.

82. Comment:

P. 44, lines 8 and 9--Forbs and shrubs should also be included in revegetation plans.

Response:

The sentence referred to has been revised as suggested.

83. Comment:

P. 112, line 6--Water surface area cannot be classified as wetland habitat as stated and rated as such.
Response:

Water surface area resulting from project reservoirs may appropriately be classified as wetland habitat in accordance with the definition presented in Executive Order 11988, which states in part that "Wetlands could also be interpreted to include canals, seeps, reservoirs, drains, and other conditions resulting from or associated with features of water control projects." However, the term "aquatic habitat" has been substituted for "wetland habitat" in the FEIS.

84. Comment:

P. 112, lines 41-43--This statement is no longer valid since the relocation of the D&RGW railroad and Highway 6-89 as a result of the Thistle Slide has eliminated the marsh.

Response:

The statement has been deleted.

85. Comment:

P. 166, lines 32 and 33--Diamond Fork is the proper deer herd unit name rather than Diamond.

Response:

The sentence referred to has been revised as suggested.

86. Comment:

P. 202, par. 2--Western's standard mitigation measures include modifying construction activities during breeding seasons of sensitive species (Appendix 3). Accordingly, construction activities on transmission lines should be coordinated with the Division of Wildlife to avoid seasons when wildlife are under stress. These would involve primarily big game winter ranges (November 1 through May 1) and deer fawning and elk calving seasons (May 1 through June 30). Additionally, construction on any transmission line passing within 1/2 mile of a golden eagle nest should be restricted during the nesting period from February 15 through May 15.

Response:

The paragraph referred to has been revised to indicate that the Utah Division of Wildlife Resources would be consulted to insure that wildlife impacts resulting from construction activities would be minimized.

87. Comment:

P. 209, par. 2--Additional impacts which should be listed include disturbance impacts during critical seasons for wildlife as listed in the previous comment.
CONSULTATION AND COORDINATION (Continued)

Response:

This section has been deleted in the FEIS since no modifications of the interconnected transmission system would be required with the recommended Sixth Water Flow Through Alternative. If an alternative were selected which required modifications of the system, disturbance impacts during critical seasons would be listed as an impact.

88. Comment:

P. 210, par. 4—This will be the case in all respects except big game hunting. Improved access will increase hunting pressure, which will result in a lower success rate and reduced quality of hunting.

Response:

The paragraph referred to has been revised as suggested. The revision also points out that the number of animals harvested and the economic benefits would be greater than at present.

89. Comment:

General map facing the title page—Location of Diamond Fork Powerplant probably interferes with the relocated D&RGW roadbed and the realignment of US-6 around the Thistle Slide.

Response:

The site for the Diamond Fork Powerplant is several hundred feet upstream on Diamond Fork from the new Highway 6 road fill that crosses the mouth of Diamond Fork. Reclamation does not expect any conflict between these features.

90. Comment:

P. 74, Fig. 18—There is a possibility that the Hayes Reservoir site at the mouth of Diamond Fork, 1964 DPR Alternative, would be compromised through the realignments of the D&RGW tracks and US-6.

Response:

If Hayes Dam were built, its axis might need to be shifted upstream because of the highway relocation. Also, additional flood storage capacity might be required in the reservoir to insure that the maximum probable flood could safely pass through the new highway and railroad embankments.

91. Comment:

P. 196, par. 3—Peak year expected employment for the recommended alternative is approximately 2,100 private and government employees. As noted in the DEIS, this addition to an already heavily used roadway could result in some local highway congestion. Carpools are suggested
CONSULTATION AND COORDINATION (Continued)

as a mitigating action. The state, through programs implemented through the Utah Energy Office, actively encourages carpooling that not only eases congestion but saves precious fossil fuels and reduces auto emissions. Assistance is available to the selected contractor through the state to develop a program. Sponsor endorsement should be as strong as possible to assure the contractor pursues carpooling efforts.

Response:

Although the traffic increase under the recommended Sixth Water Flow Through Alternative would be significantly less than under the Fifth Water Pumped Storage Alternative, carpooling is still considered an appropriate action. Therefore, the paragraph referred to has been revised to indicate that the contractor would be encouraged to organize or sponsor carpooling to ease congestion, save fuel and reduce emissions, and to indicate that State assistance to the contractor would be available.

92. Comment:

P. 196, par. 3—There is a general concern as to the effect additional water delivered to the Great Basin, due to the transbasin diversion, will have on roads crossings over and near the Spanish Fork River, Utah Lake, Jordan River, Jordan River Parkway, Great Salt Lake.

Response:

The transbasin diversion would have no effect on road crossings at the locations mentioned. Flows would be released down the Spanish Fork River to Utah Lake at times of low natural flow, so that flooding, streambed erosion, and loss of fishery habitat would be minimized. Operation studies indicate that fluctuations on Utah Lake would be reduced with the transbasin diversion in operation. Water would be released to Utah Lake only as needed to compensate for water taken from the Provo River for municipal and industrial use and to provide irrigation water to new agricultural lands to be developed. The operation studies indicate that under project operation, spills from Utah Lake to the Jordan River would be reduced during wet years. This reduction of spills would benefit both the Jordan River and the Great Salt Lake.

93. Comment:

P. 14, par. 4—A more crucial aspect for USBR to address in the final EIS is the relationship between the marketability of CRSP power and the price at which the DFPS output would be sold. It is our understanding that the price of this new power would be rolled in over the rate structure of the entire CRSP system. Through this average cost pricing approach, the power would be very attractive in terms of comparative costs with other potential sources of peaking power. Consequently, the marketability of this power would not be in serious doubt. Confirmation of this understanding would be appreciated.
CONSULTATION AND COORDINATION (Continued)

Response:

Many non-Federal financing options exist for the power system, one of which is financial integration with CRSP. The relationship between the cost and marketability of Diamond Fork power will be determined by the community of potential funding participants. The power system will not be built unless sufficient non-Federal funding exists. Reclamation believes the power is fully marketable with the recommended Sixth Water Flow Through Alternative.

94. Comment:

P. S-3, Summary Table 1, p. 94, Table 19--Sixth Water Penstock is listed as 1,400 miles and is obviously in error.

Response:

The tables have been corrected to reflect the correct penstock length of 1,400 feet.

Comments from Wyoming Executive Department letter of August 10, 1983

95. Comment:

The only concern directly affecting Wyoming is the financial integration of the Central Utah Project into the power rate structure for the Colorado River Storage Project. The dialogue that WAPA and the Bureau are developing with the states and CREDA may reduce some of the problems associated with the pay-back requirements of the Colorado River Storage Project Act.

Response:

As stated in Chapter I of the FEIS, all power not needed for project use will be funded by non-Federal participants. Preliminary information from Western Area Power Administration indicates that CRSP rates may increase slightly if power system costs are integrated into the CRSP rate base. This effect would be fully disclosed in Western's power marketing and rate setting processes.

Comments from Wyoming State Engineer's Office letter of August 4, 1983

96. Comment:

The project should not have any effect upon the State of Wyoming from a water resources standpoint, but it may have some effect from a power standpoint. There are some potential impacts on Colorado River Storage Project power rates, depending on which alternative is chosen and also whether non-Federal financing is used for the project.
CONSULTATION AND COORDINATION (Continued)

Response:
See the response to comment No. 95.

Comments from Wyoming Public Service Commission letter of August 3, 1983

97. Comment:
Utility rates could be affected if a utility operating in Wyoming chooses to become involved financially in the project. Rates Wyoming utilities pay Western Area Power Administration for Colorado River Storage Project Power could be affected by the inclusion of power from said project in CRSP allocations.

Response:
See the response to comment No. 95.

Comments from Wyoming Recreation Commission letter of July 29, 1983

98. Comment:
As a variety of measurements of recreation use exist, it would be most helpful if a recreation day was defined.

Response:
As used in the Diamond Fork Environmental Statement, a "recreation day" is defined as a visit by an individual to a recreation area for recreation purposes during a significant portion or all of a 24-hour day. For statistical consistency, a recreation day is assumed to consist of 2.5 activity days or occasions of a mixture of activities.

99. Comment:
From a professional standpoint, the recreation capability estimates seem high. It appears a per acre capacity figure may have been multiplied times the acreage available for recreational use. This methodology, and the resultant estimate of recreation capability, may be inappropriate. The quality of the recreation opportunities demanded within the project area and the ability of the administering agency to manage the new facilities should be considered in determining the recreation capability. Additionally, the length of the use season should be specified. Perhaps these items were considered. If so, it would be helpful if the preparers mentioned the methodologies utilized to assess recreation capability. Such an explanation would justify their results.

Response:
Recreation capability was determined using the Forest Service's "GRID Computer Program" for determining developable sites and its "Recreation Opportunity Spectrum" and Reclamation's "RUNPROJ," developed by
CONSULTATION AND COORDINATION (Continued)

F. Liljegren and L. Boynton. Data base information included Forest Service RIM report 2300-1, Utah State University's Utah Resident Outdoor Recreation Participation, 1976-1977, volume I, and Recreation and Wildlife Summaries, published annually by Reclamation. The recreation-use estimates were prepared by the Uinta National Forest in coordination with Reclamation. The Uinta National Forest prepared the report because it would be the administering agency for these facilities. The season for recreation use would be approximately 6 months long. Facilities would be opened to the public on or about May 15 and would be closed on or about November 15.

Comments from Central Utah Water Conservancy District letter of August 3, 1983

100. Comment:

Summary Table 1 indicates that the Sixth Water Flow Through Alternative is more economical than the 1964 DPR Plan ($14,000,000 versus $11,500,000 annual increment net benefits). The capacity of the Syar Tunnel is shown at 600 cfs for the Sixth Water Flow Through Plan and 400 cfs for the 1964 DPR Plan. The Syar Tunnel is therefore at 45% capacity versus 68% for the 1964 DPR Plan. The two electrical generation systems are, therefore, running at different plant factors and are not readily comparable. For instance, if the 1964 DPR plan were increased to 600 cfs, it would probably have greater net benefits than the Sixth Water Flow Through System.

Response:

In formulating the Sixth Water Flow Through Alternative, various configurations and feature sizes were compared to determine which combination would produce the maximum annual net benefits. A configuration similar to the 1964 DPR Alternative was examined, with various Syar Tunnel capacities (400-835 cfs). This configuration also included a small powerplant below Hayes Dam. Maximum net benefits of $17,574,000 per year were obtained for this configuration with a Syar Tunnel capacity of 600 cfs. This compares with annual net benefits of $18,873,000 for the Sixth Water Flow Through Alternative as described in the DES. The net benefits were based on January 1981 costs and benefits rather than the January 1983 costs and benefits shown in the DES.

101. Comment:

Page S-5, "Permanent losses of vegetation, mostly from reservoir inundation would total about 1,000 acres for the recommended plan, including about 45 acres of scarce riparian habitat. Temporary losses of vegetation, mostly from construction of the Diamond Fork Pipeline and development of borrow area, would total about 400 acres, most of which is reseeded and mountain brush communities. Why is 4,440 acres being acquired for mitigation?"
CONSULTATION AND COORDINATION (Continued)

Response:

About 4,000 acres would be acquired for mitigation with the recommended Sixth Water Flow Through Alternative. In addition to direct permanent losses of wildlife habitat from reservoir inundation, the project would have significant indirect permanent impacts on wildlife which add to the required amount of mitigation (Table 48 of the FEIS). Permanent disturbance by major new roads is an example. Another factor involved is that the mitigation lands have existing habitat values of varying quality. A considerable amount of mitigation is achieved through improvement of these lands to increase their wildlife value from some existing conditions. Thus, in this case, it takes more than a one-to-one acreage matchup to provide sufficient habitat value through improvement to compensate for losses.

102. Comment:

Page 49, Table 6 Lands for Project features: The acreages acquired for project purposes appear to be greatly exaggerated to mitigate actual project losses.

Response:

Acreages to be acquired for project features were based on projected needs for reservoir management and roadway, powerline, and pipeline, maintenance. Acreages required for wildlife mitigation were based on actual disturbance caused by feature construction, disturbance corridors surrounding the features (roads in particular), and the habitat value of the lands to be acquired for mitigation. (See also the response to comment No. 101.)

103. Comment:

Page 91, Table 18 Wildlife Mitigation Options: It is not clear why the recommended acreages were selected on any basis other than preference. What about animal unit months, range capacity, etc. Apparently, these were not considered.

Response:

The recommended wildlife mitigation plan is based on a combination of biological, economic, and social considerations. Habitat unit values are the basis for the wildlife impact and mitigation analysis. Deer day-use and carrying capacity (equivalent to animal unit months and range capacity) were used in the derivation of habitat unit values for all cover-habitat types in the project area.

104. Comment:

Page 95, Table 20 Comparison of environmental impacts of Diamond Fork Power System Alternatives: It is not clear what units esthetics are measured in.
As indicated in Chapter IV under "Topography and Scenery," ratings of esthetics were prepared by the Forest Service and were based on a model using visual changes observed from travel routes on national forest lands. The values in Table 20 are derived from this model and represent the relative comparison of visual impact among alternatives. Footnote 20 (footnote 22 of the FEIS) of the table has been revised to clarify this situation.

105. Comment:

General: It appears that an exceptionally large area has been incorporated in the project take line boundary, resulting in a like amount of land to be acquired for mitigation purposes. This District questions the need for such a large acquisition and the accompanying mitigation.

Response:

We assume the take line referred to is the study area boundary shown on Figure 10 of the DES (Figure 9 in the FEIS). The boundary shown is not a take line and has no direct relationship to the amount of land required for wildlife mitigation. The boundary includes all areas that potentially would be disturbed by construction and/or operation of the various project alternatives. (See also the responses to comment Nos. 101 and 102.)

Comments from Environmental Policy Center letter of August 11, 1983

106. Comment:

It is unclear from reading the document where the mitigation lands for the project will be located. It is our position that mitigation should be done concurrently with project construction, rather than be added or considered after the fact.

Response:

Wildlife mitigation lands are shown in Figure 9 of the FEIS. Each parcel is delineated and set apart from others by a letter/number designation which is used whenever referring to specific parcels. (See also the response to comment No. 30.)

107. Comment:

It is also unclear from reading the document what the impact of the reservoir(s) fluctuation will be. How many acres of mudflats will be created, what will be the access to the reservoirs, what will be the impacts on the high quality wetlands, as well as the fisheries. There was little mention of measures to eliminate the problem of fish in the power system. In addition, it was pointed out that water stratification will result in excessive algal growth in the project. What impact will this have on recreation and fishing?
CONSULTATION AND COORDINATION (Continued)

Response:

With the recommended plan, daily fluctuations would create up to 8 acres of mudflats at Syar Reservoir and about an acre at Sixth Water Reservoir. Seasonal fluctuations would result in up to 25 acres of mudflats at Monks Hollow Reservoir at the end of the irrigation season.

The existing Diamond Fork Road and a new 3.3-mile-long road to the day-use area on the north side of Monks Hollow Reservoir would provide vehicle access to the reservoir for recreation. Small boats could be launched at the day-use area and a trail would provide access by foot around the south side of the reservoir. Since no recreation facilities would be available at Syar and Sixth Water Reservoirs, no public access would be permitted. Roads would provide access to these reservoirs for maintenance and service purposes only.

Reservoir fluctuation would have no impact on high quality wetlands because none occur in the project area. Impacts to wetlands are described in Chapter IV of the FEIS. Because of their small size and fluctuating water levels, Syar and Sixth Water Reservoirs would not support viable fisheries. Monks Hollow Reservoir would support a marginal fishery which would not be adversely affected by drawdown since the reservoir would not fluctuate greatly on a daily basis but would be drawn down gradually during the year.

The problem of fish in the power system is addressed in the response to comment No. 38.

Algal growth in project reservoirs would be similar to that which occurs in other reservoirs with similar size and operation. The recreation and fish analyses, including projected recreation and fishing benefits, were based on this factor, as well as projected conditions of fluctuation, stratification, water quality, etc.

108. Comment:

Another issue that made reviewing the document difficult was the absence of cost figures for the project and alternatives. Is this project part of the Central Utah Project System, therefore part of the questionable benefit/cost ratio of 3.2 to 1 (project data sheets list the b/c as 1.6 to 1) or does the system stand alone?

Response:

The total estimated construction cost of each alternative for the Diamond Fork Power System is given in Summary Table 1 (also Table 19). The Diamond Fork Power System is part of the Bonneville Unit of the Central Utah Project. The benefit-cost ratio for the Bonneville Unit with the recommended Sixth Water Flow Through Alternative is 1.68 to 1. The 1.6 to 1 benefit-cost ratio is for the Bonneville Unit with the 1964 DPR Alternative for the power system (see also the response to comment No. 119).
109. Comment:

There is also the question of the number of jobs that are to be created by this proposal. The project is due to be constructed over a seven year period (based on a 12 month construction cycle which is rather difficult to imagine given the location). During the peak year, the project will provide direct employment to about 2,100 private and government employees. That would be a total of 14,700 jobs if every year were the peak year. Yet tables on page 95 show the employment to be 20,646 jobs for this project. What is the formula for figuring jobs on these projects?

Response:

Over the 4-year construction period, the recommended Sixth Water Flow Through Alternative would create 5,620 jobs of direct employment, 5,900 jobs of indirect employment, and 2,850 jobs of other employment (Table 55). Because a 7-month construction season is assumed, the annualized figure for direct employment is less (i.e. 3,525 person-years). Indirect and other employment for the recommended plan are already given in person-years. A total of 12,275 person-years of all types of employment would be created by the recommended plan.

Direct employment is calculated on the basis of project cost, with labor requirements varying, depending on the type of construction activity (see footnote 1, Table 55). The number of indirect jobs was calculated by the Bureau of Reclamation Economic Assessment Model (BREAM) and is within the range of the multiplier for new construction in Utah County, which ranges between 2.0 and 2.5. (Refer to footnote 2, Table 55.) "Other employment" is calculated on the basis of 30 percent of the value of materials, equipment, etc., sold in Utah County and induced and stemming from project construction, divided by the 1980 annual average wage in Utah County.

110. Comment:

Also lacking in the report is any considerable discussion on the geology of the area. Most of the projects in this Unit have been beset with seepage and other problems requiring extensive work to fix. Rather than relying on "available data" an extensive review of the site geology should be undertaken given what I would call "unstable" conditions in the area.

Response:

In the FEIS, the section on Geology and Seismicity in Chapter IV contains more detailed information on site geology than was given in the DES.

111. Comment:

The last area that is most troublesome is the discussion on whether the power is needed or not, or whether the power is being produced because
the basin-to-basin water transfer will provide the opportunity. The Draft Environmental Statement does not address questions such as where the power will specifically go because of the Basin wide approach that is taken to "wheeling" power. There is no discussion on the rationale behind Western's projections, they are just given to us as accepted. Early discussions in the Draft mention the great growth expectations for the Wasatch area but the power is spoken of in where it can tie in Basin wide (Colorado).

Response:

Western Area Power Administration has the responsibility for marketing all surplus power generated at Reclamation powerplants. Power generated by the Diamond Fork Power System is intended to satisfy baseload and peak demands within the CRSP market area. During the early planning stages of Diamond Fork Power System, it was assumed that the system would be Federally funded and that all power generated would be marketed by Western. It was, therefore, a logical decision to base the Diamond Fork planning studies on Western's power market survey.

After planning studies for Diamond Fork were well underway, Reclamation was directed to seek non-Federal funding for the power system. As a result, the portion of the power required for project use (Bonneville Unit pumping) would be funded by the Federal Government and the remainder would be funded by non-Federal participants. Construction would not begin until agreements with both power and financial participants have been negotiated and signed.

Reclamation's determination that a demand exists for the power will be based on non-Federal entities' interest in the project. That interest will be measured by the willingness of those entities to participate in the financing. Reclamation will consider signed financing and power purchase agreements to be verification that sufficient power demand exists.

As stated in Chapter I, an assessment of non-Federal interest in developing the power system conducted in early 1984 indicated inadequate support for the Fifth Water Pumped Storage Alternative recommended in the Draft Environmental Statement. As a result, the Sixth Water Flow Through Alternative, which more adequately satisfies current power market needs, has been selected by Reclamation as the recommended plan.

112. Comment:

In addition, who the power will be allocated to or whether the project is going to be Federally or non-Federally constructed has an impact on not only the CUP but also the whole CRSP system. I was under the impression that power revenues from this project would be used to take care of the portion of farmers payment above their "ability to pay" or would be fed back into the CRSP system. Is this not the case? If non-Federal entities cooperate with construction and later share the energy produced, what would those last revenues be allowed use towards?
CONSULTATION AND COORDINATION (Continued)

Response:

Since Diamond Fork power not needed for project use would be financed with non-Federal funds, the revenue would go to the non-Federal participants. Repayment of costs associated with irrigation and drainage features of the Bonneville Unit in excess of the farmers' ability to pay would be accomplished with revenue derived from the CRSP Upper Basin Fund.

113. Comment:

Has it been clearly established that the operation of this project would not impinge on the irrigation purposes of the project?

Response:

Water deliveries would have priority over power generation under all circumstances. Operating agreements with non-Federal participants would insure that irrigation and municipal and industrial water would be delivered as needed.

Comments from Intermountain Water Alliance letter of August 15, 1983

Note: General comments have not been responded to because they are included in more specific comments later in the Alliance's letter.

114. Comment:

The public has already been denied opportunity two years ago to address the high BU water costs and municipal and industrial (M&I) water charges as well as opportunity to vote, via public referendum, their willingness to continue support for development of this water. There are misrepresentations in the EIS of the amount of M&I water to "be received" by the Central Utah Water Conservancy District, over that contracted for in 1965, as the Bureau and the District evaded signing a contract renewal by using terms of the 1958 Water Supply Act. Similar efforts to evade disclosure of the best energy supply options for citizen taxpayers, for their communities, and for their children appear to be taking place by means of this EIS. In fact, a Bureau official, responding to a question at a Diamond Fork Power System hearing, stated that the function of the Bureau was not one of evaluating (energy) supply options but one of supplying a service - implying that it is up to the public to determine "the best bang for the buck."

Intermountain Water Alliance recently made some casual streetside inquiries to determine what the general public knows and understands about the CUP-Bonneville Unit; its purpose, its need, what its development will cost them. Some 17 years after commencement of development, the general public has only the vaguest ideas about it - let alone their obligations for paying for the water. Other discussions with many citizens indicate serious concern that Utah citizens are not being well served by promoters
CONSULTATION AND COORDINATION (Continued)

of costly and outmoded water supply solutions. They are critical that needed Wasatch Front water management opportunities have been purposely delayed—deferred to CUP development. They are seeing the irrationality and failure to deal with a 1,690,000-acre-foot Bear, Weber, and Jordan Rivers system which flows into a lake with no outlet, and a salt lake at that. They are further concerned at the degree of power over Utah's water which the Federal Government is achieving now—without public review or agreement.

Response:

Reclamation, in conjunction with the Central Utah Water Conservancy District, has made considerable effort in recent years to inform the public about the Bonneville Unit. Public meetings have been held in many of the areas affected by the unit, news releases have been provided to the media, and newsletters have been regularly distributed to numerous government and private interests. In spite of these and other efforts, Reclamation agrees that the general public understands very little about the Bonneville Unit. Reclamation is sensitive to public concern over project costs and repayment and is conducting an extensive public information program through public meetings and the news media.

Reclamation also shares your concern that suitable repayment procedures are arranged to recover the remaining reimbursable costs of municipal and industrial water. A supplemental repayment contract will be re-negotiated and the negotiations will be open for public observation. A news release announcing the negotiations will be made available to the media.

The Reclamation official you quoted was saying essentially the same thing you said earlier in the second paragraph of your letter. "Utilities and agencies are now revising studies which should examine impacts on power demand due to the economic recession but also due to public conservation efforts which reduce demand which has been their response to increased rates for their energy." These utilities and agencies will help the public determine the future demands and the willingness of the public to pay for future supplies.

Reclamation and the State of Utah have evaluated and are aware of the potential water supplies of the Bear, Weber, and Jordan River systems. The State has made the decision to pursue and support the Central Utah Project. An extensive public review of the Bonneville Unit has been initiated by the Governor of Utah and the Regional Director of the Bureau of Reclamation. The review may result in further refinement of the Bonneville Unit plan. The State is also considering other sources of water for development after the Central Utah Project is developed and demand increases. Reclamation is assisting in the development of water resources in Utah at the invitation of the State and continues to work closely with State and local officials.
115. Comment:

Intermountain Water Alliance requests that all further Bonneville Unit, CUP water development be halted until there is a public forum to adequately inform the public about range of services and costs of these to them, to their communities, and to their children. And, that the public be given full opportunity to vote on their choice of water and energy management.

Response:

This request is beyond the scope of the Diamond Fork Environmental Statement. However, we believe that the public has had considerable opportunity to learn about the Bonneville Unit and to be involved in the planning and decisionmaking processes. In 1964, the public had the opportunity to review project costs and benefits and to vote on a repayment agreement. Public hearings were held to receive public comment on the 1973 Bonneville Unit and 1979 M&I System environmental statements. Public involvement activities for the Diamond Fork Power System are discussed in Chapter I of the FEIS. These activities include numerous press releases, newsletters, project tours, information meetings, scoping meetings, and public hearings. As development on the Bonneville Unit progresses, Reclamation will continue to inform the public and receive input to the planning and decisionmaking processes.

116. Comment:

The EIS provides insufficient information to demonstrate need for hydropower, peaking power, or the magnitude of a pump storage peaking power facility recommended by the Bureau. It is not adequate to refer to studies made in 1981 when current facts show that energy demand projections have been wildly off base. IWA requests that the following deficiencies in information be supplied. There are:

- No amounts or kind of power demand which is current today.

- No population characteristics laid out, no evaluation of willingness of people and communities to pay for how much and what kind of power.

- No studies of acts which currently reflect reduced power demand and reasons for it. There is evidence that the economic turndown itself is not solely responsible — that conservation measures on the part of the public plays a significant role here. Also, there is no data on effects of increased costs and pricing on energy demand, how this has affected energy conservation, and no discussion of the role of utilities in reducing demand.

- No evaluation of related power producers and alternatives for supply which reflects public response to rate increases.
CONSULTATION AND COORDINATION (Continued)

- No discussion of land management options for energy producers.
- No criteria set forth to prevent overprojections of need, i.e. WPPSS.
- No information on current excess energy available.

Response:

The need for Diamond Fork power is discussed in the response to comment No. 111. Excess energy, overprojections, land management, alternative supplies, and population increases must be evaluated from each potential non-Federal participant's perspective.

117. Comment:

No evaluation of possible consequences of Bureau hydropower management: over-compensating; extra capacity not used, not needed, or selling at a loss; no way to pay for it.

Response:

See the response to comment No. 111.

118. Comment:

No evaluation of Bureau hydropower alternatives related to Wasatch Front studies.

Response:

The objectives of the Wasatch Front Total Water Management Study which Reclamation and the State of Utah, Division of Water Resources, are conducting under joint agreement are as follows.

A. Improve the data base for determining the availability of surface and ground water supplies for development and management potentials.

B. Through data synthesis, assess the resource capability of the river basins in terms of water, land, water quality, environmental, and recreation resources.

C. Identify current and long-term (through year 2020) water needs in the Wasatch Front area. Relate the water resources capability of the various river basins for meeting and solving identified problems and needs.

D. Identify and evaluate opportunities for better water management.
CONSULTATION AND COORDINATION (Continued)

The Wasatch Front study will not be investigating hydropower alternatives. The overall goal of the study is to assist the water organizations along the Wasatch Front to more efficiently use their water resources. Therefore, it is highly improbable that any studies on Wasatch Front total water management will be looking at hydropower alternatives.

119. Comment:

No detailed disclosure of costs for the recommended project, rumored to be some $1 billion.

Response:

As shown in Table 19 of the FEIS, the construction cost of the recommended Sixth Water Flow Through Alternative for the power system is approximately $390 million based on January 1983 prices. More detailed information on this cost is included in a draft Supplement to Definite Plan Report on the Bonneville Unit, which will be available upon request in the fall of 1984.

120. Comment:

No guidelines yet addressed for cost sharing: who pays for what and who receives what revenues. The fact that guidelines are just being developed makes this Bureau proposal premature. The public has a right to know and understand all the ramifications of cost sharing prior to any decisionmaking. While the Bureau refers to interested parties in participation in this hydropower proposal, it is not enough that such interest is referred to only. What entities are interested, to what extent are they interested, why? The public is not in a "trust us" mood today. What commitments support interest of entities?

Response:

See the responses to comment Nos. 111 and 178. Since non-Federal financing arrangements can be of varying complexities, each case is handled on an individual basis. In May 1984, Reclamation prepared a non-Federal financing proposal for the Fifth Water Pumped Storage Alternative. Copies of that proposal and the decision which led to selection of the Sixth Water Flow Through Alternative as the recommended plan are available.

121. Comment:

In view of the 1983 Legislature's change of the Conservancy District law allowing for power generation and marketing, it is necessary that the role of the District in any Diamond Fork power project be spelled out: its role and purpose of its role and how this will be accomplished if power revenues are to be used to repay Bonneville Unit M&I water development costs.
CONSULTATION AND COORDINATION (Continued)

Response:

Because of the principle of non-Federal participation in the Diamond Fork Power System and the law referenced above, one potential non-Federal financing arrangement could be to have the Central Utah Water Conservancy District participate in the funding of the power system. The revenues that the district would receive as a result of this participation would be used to retire bonds issued for the district’s share of the power system. Conceivably, surplus revenues might be used to help meet other Bonneville Unit repayment obligations. Whether or not the district will participate in the funding of the Diamond Fork Power System is presently unknown, but as of this time the district has expressed no positive interest in participating.

122. Comment:

Page 5, Chapter 1, EIS - "A total annual water supply of 310,400 acre-feet would be provided, including 99,000 acre-feet of M&I water, 204,900 acre-feet for irrigation and 6,500 acre-feet for stream fisheries."

In lieu of signing a supplemental contract in 1980, the District used terms of the 1958 Water Supply Act to continue construction and agreed to "receive" 39,000 acre-feet of M&I water. This amount is not the amount agreed upon in the 1965 contract with the public. It is only one half the amount. How then do we now have 99,000 acre-feet of M&I water to be delivered?

What does "receipt" of 39,000 acre-feet of water mean? What is to happen to the other 60,000 acre-feet? Is it committed to another purpose? What purpose? Does it flow down into the Great Salt Lake unused? How will this reduced amount of M&I water affect development of hydropower in the Diamond Fork System?

Response:

The water supply shown in the DES was in error. As indicated in Chapter 1 of the FEIS, the Bonneville Unit water supply is 294,400 acre-feet; consisting of 121,100 acre-feet for municipal and industrial use, 166,800 acre-feet for irrigation, and 6,500 acre-feet for stream fisheries. The 39,000 acre-feet is the estimated quantity of municipal and industrial water that could be provided under the terms of the existing repayment contract. The remaining 82,100 acre-feet is still committed to municipal and industrial use, but it is assumed that additional repayment coverage would be required before this water could be provided to the District. None of the 121,100 acre-feet would flow into the Great Salt Lake unused. The amount delivered through the Diamond Fork Power System would vary from large imports in dry years to small imports in wet years when local supplies would be abundant. This operation would make the Diamond Fork Power System highly compatible with other hydroelectric power operations in the CRSP market area. During wet years, an abundance of hydroelectric energy would be available within the CRSP system; therefore, a reduced output from Diamond Fork would have no
adverse impact. During dry years, there would be a shortage within the system; therefore, output from Diamond Fork would be beneficial.

123. Comment:

The EIS states that 204,900 acre-feet of Colorado River water is to be used for irrigation. Yet Ed Clyde, lawyer for the District, stated that the Bonneville Unit, Central Utah Projects water development is now an energy development. This changes the economics of the Bonneville Unit. The question must be answered whether, in fact, Bonneville Unit water is being developed cheaply, at Federal subsidy costs for irrigation water, and under the guise of developing irrigation water, when in fact it will be ultimately a more costly M&I water project.

Response:

The Bonneville Unit is a multipurpose project designed to meet existing or projected needs for municipal, industrial, and agricultural water; recreation; electric power; and flood control. The Diamond Fork Power System would utilize the transbasin diversion of unit water from the Uinta Basin to the Bonneville Basin to generate power but would consume essentially no water. As stated in Chapter I of the FEIS, the water supply for irrigation is 166,800 acre-feet (the amount of 204,900 acre-feet used in the DES was in error). Although there are no plans to do so at this time, if some of this water were converted to municipal and industrial uses in the future, project costs would change very little, but repayment would differ. All costs of municipal and industrial water must be repaid with interest, thus the amount of money repayable to the United States would include interest over the repayment period.

124. Comment:

Bureau of Indian Affairs Development: This is the first time IWA has heard of this classification of any Indian system of the Bonneville Unit. When did this change take place? Under what circumstances? Since the Ultimate Phase, Ute Indian Unit, has been dropped by the Bureau and declared infeasible (this unit was to resolve the priorities of Indian water rights, among other actions), where is this resolution or adjudication now taking place for Indian water rights? It is not stated in the EIS.

Response:

The Bureau of Indian Affairs Activity, erroneously referred to as the Bureau of Indian Affairs Development in the DES, is discussed on pages 104-108 of the 1973 Bonneville Unit FES. Reclamation is working with the Ute Tribe to identify alternative plans for satisfying the requirements of the "Indian Deferral Agreement."

125. Comment:

Statement from the EIS:
"The CUWCD has overall responsibility for administration of the Bonneville Unit and would contract with the United States and the water users for repayment of reimbursable project costs for irrigation and municipal and industrial water. However, no such costs would be associated with the Diamond Fork Power System. Water conveyance facilities, reservoirs, and powerplants would be operated and maintained by Reclamation. Switchyards and transmission lines would be operated by Western, which also would market the power...

In view of proposed changes in other entity participation in both construction and marketing of power, such a statement is wholly inadequate today.


Since the District already failed to contract a supplemental water supply, to meet its water development obligations, what will its obligations be for (a) water supply costs, and for whom? (b) energy supply costs and for whom? If energy revenues are to be used to repay M&I water development costs, how and when will this modification of Federal policy be brought about? Under what kind of conditions will the public be involved in this procedure? How will they be given a choice? When?

- What are the Federal regulations which condition, and how, the disbursement of costs when both water is developed and hydropower? When both developments are shared to produce separate products? Full disclosure of BuRec procedures must be spelled out: costs of construction for what product and what purpose, and for what benefits.

- What are the Federal regulations which condition costs and benefits to participants in Federal water and power generation?

Response:

Reclamation is currently preparing updated documentation of Bonneville Unit costs, benefits, cost allocations, and repayment schedules in a Supplement to the Bonneville Unit Definite Plan Report. This Supplement will reflect cost changes and refinements in the project plan that have occurred since the Definite Plan Report was published in 1964. This information will be available to the public by request in the fall of 1984.

126. Comment:

Page 8, Chapter 1 - CRSP Power: In view of changes either taking place or proposed in CRSP power revenues, as well as in power generation by
non-Federal entities, some clarification of this situation must be provided to the public. Where are the guidelines? What is the supervisory and regulatory review process, over whom, for what purpose? What options do CRSP power contractors retain now, or in the future? What impacts will changes in CRSP bring about?

Response:

In response to increased costs that are repayable by power, increased CRSP firm power rates were placed in effect on an interim basis during January 1981 and again during June 1983, thereby increasing annual CRSP revenues. Western has published procedures followed in adjusting rates which provide for public participation. Rates are developed by Western and approved and placed into effect on an interim basis by the Deputy Secretary of Energy, subject to final confirmation and approval of the Federal Energy Regulatory Commission. Fiscal year 1982 CRSP power repayment studies indicated that an additional rate increase will be needed, and Western expects to initiate another rate adjustment in 1984. Notice of the proposed adjustment will be published in the Federal Register. Persons interested in the power repayment study policies and methodologies, including how participating project costs are handled in the power repayment study, are free to discuss them with Western and Reclamation during a 90-day consultation and comment period. Power repayment studies supporting the two most recent rate adjustments included some costs for a 133-MW flow-through Diamond Fork Power System. The studies for the rate adjustment to be undertaken in 1984 are expected to assume non-Federal financing of the Diamond Fork Power System, consistent with Reclamation's latest plans. Opportunities to comment on the plan to construct the Diamond Fork powerplants with non-Federal funds will be provided when Western's proposed Diamond Fork marketing plan is published.

127. Comment:

Page 8, Chapter 1; Page 99, 100, 101, Chapter 3 - All Discussions of Western Area Power Administration Involvement: It is not publicly satisfactory that involvement of WAPA in marketing and delivering of Diamond Fork hydropower is to be addressed sometime in the future and separately, with its own EIS. What is proposed is leaving the tip of the iceberg undisclosed to the public who is being asked to make decisions now: costs, economic factors, load management, marketing and delivery, environmental trade-offs for Utahns for a product outside their State, fluctuating economic and energy situations which will condition WAPA marketing roles — all these factors are outside current public review. The public appears to lack both specific and comprehensive information on which to make decisions which will affect their pocketbooks, their way of life, and the State public resources.

Many of the conditioning factors related to Diamond Fork Power System are unknowns to the public, some unknowns to the participants in developments. The EIS is premature, inadequate, and does not fulfill public need in the processes proposed.
Response:

See the response to comment No. 178. Preliminary consultation with the Bureau of Land Management and the Forest Service indicates that there are no insurmountable obstacles that would prevent development of appropriate transmission routes if additional transmission is needed for the Fifth Water Pumped Storage Alternative.

128. Comment:

Instream Flow Agreement: Effects of Agreement on Hydropower Participants and vice versa

The EIS must spell out specific management proposals for maintaining the Instream Flow Agreements. Both by Bureau and CUWCD as well as by Agencies obligated to come up with the balance of the water to sustain flows of 44,500 acre-feet.

In addition, there must be a discussion of which streams are to be sacrificed, which streams are to be provided flows, and what protection these flows will provide for which species.

Response:

The details of the instream flow agreement are beyond the scope of this statement. This information is available from the Utah Projects Office, Uinta National Forest (Provo), Fish and Wildlife Service (Salt Lake City), Utah Division of Wildlife Resources (Salt Lake City), and the Central Utah Water Conservancy District.

If the goal of providing 44,400 acre-feet of water for the instream flow agreement cannot be met and the transbasin diversion is reduced by 15,800 acre-feet, the annual energy produced by the five flow through plants would be reduced by 28,800 MWh. This change would cause a decrease in annual net benefits of approximately $1.8 million.

129. Comment:

Fish and Wildlife Mitigation

The public is not willing to put up with inadequate mitigation for lost wildlife habitat. It is absolutely essential that the following criteria be met:

- Mitigation in kind: species, seasonal/migratory habitat, migratory movement

- Mitigation within disturbed areas - not miles away

- Mitigation provided by the Bureau, and or participants, to replace lost or disturbed habitat. Mitigation cannot be transferred to a land managing agency responsible for the
CONSULTATION AND COORDINATION (Continued)

- Habitat to begin with, assuming loss of habitat created by the development agency can be managed for automatically.

- Mitigation must be satisfactory to wildlife and habitat managers as fulfilling their responsibilities.

- Mitigation must be concurrent with destruction of habitat actions.

Response:

The wildlife mitigation plan is described in Chapter III. It has been developed in cooperation with the Fish and Wildlife Service, the Forest Service, and the Utah Division of Wildlife Resources and meets the listed criteria.

Comments from National Wildlife Federation letter of August 12, 1983

130. Comment:

The Transbasin Diversion Decision Must First Be Made. The Diamond Fork Power System Draft Environmental Statement (hereinafter "Diamond Fork EIS") purports to analyze "site-specific environmental aspects of the Diamond Fork Power System of the Bonneville Unit of the Central Utah Project." Diamond Fork EIS at 1. The purported antecedent for this site-specific statement is an environmental impact statement prepared in 1973 titled Central Utah Project, Bonneville Unit, Final Environmental Statement (INT 73-42) (hereinafter "1973 EIS") which the Bureau refers to as a "programmatic final environmental statement for the entire Bonneville Unit." Diamond Fork EIS at 1. This characterization of the 1973 EIS is incorrect.

The scope of the 1973 EIS was contested in litigation. See Sierra Club v. Stamm, 507 F.2d 788 (10th Cir. 1974). The Sierra Club court found the 1973 EIS to be a satisfactory final statement as to only one system of the Bonneville Unit - the Strawberry Aqueduct and Collection System.

It would appear that now it is agreed that the Statement is intended to be a final one only as to the Strawberry Aqueduct and Collection System. The major federal action of Defendant Secretary Morton was limited to the approval of immediate construction of the Currant Creek Dam and to the continuation of the construction of the Strawberry Aqueduct and Collection System on a logical construction schedule.

In short, the 1973 EIS is not a programmatic EIS for the Bonneville Unit. Rather, it is an environmental statement for one feature of the Bonneville Unit - the Strawberry Aqueduct and Collection System - which the court perceived to have "independent utility."
CONSULTATION AND COORDINATION (Continued)

Response:

The Findings of Fact and Conclusions of Law for the 1974 court case (No. 4) states: "The FES under review purports to be a final environmental statement for only the Strawberry Aqueduct and Collection System, but contains a programmatic description covering an explanation and discussion of the other systems and features of the Bonneville Unit, as well as the entire Central Utah Project." Finding of Fact No. 14 states: "In accordance with the said CEQ Guidelines, the FES describes the physical elements of the entire Bonneville Unit that are in various stages of final planning, design, and construction. It explains and describes the entire Bonneville Unit to facilitate an overall appraisal of its environmental impact, and to allow an objective examination of a reasonable array of alternatives to the proposed plan. It expressly states, however, that it is intended to be the final impact statement only in regard to the Strawberry Aqueduct and Collection System, which has a high priority for construction." Thus, Reclamation believes that the decision of the court was that the 1973 FES was programmatic for the entire Bonneville Unit.

131. Comment:

As such, the Bureau has yet to satisfy NEPA requirements with regard to the major, and pivotal, decision of whether to divert any water from the Uinta Basin to the Bonneville Basin. Until that critical decision is made and supported by an environmental statement, it is premature to address the decision to build, and the site-specific environmental consequences of, the Diamond Fork Power System.

Response:

The 1974 litigation determined that the 1973 FES had clearly presented to the public a comprehensive description of the proposed plan for the entire Bonneville Unit, as well as an analysis of environmental impacts (including the diversion of 136,600 acre-feet of water from the Uinta Basin) sufficient to allow for an overall appraisal of what would happen if the project were completed in accordance with that plan. Thus, the intent to make the transbasin diversion was openly stated to the public. However, final decisions to divert project waters were deferred to future environmental statements in order to allow for additional planning input and site-specific impact analyses. Reclamation's actions are consistent with the court Finding of Fact No. 15 that states: "There are numerous features to the Bonneville Unit, and project works will develop numerous sources of water supply, both in the Uinta Basin and in the Bonneville Basin. However, the FES divides the entire Bonneville Unit into six systems, according to location and function. The court finds that because of its size and complexity and the ongoing construction program, the Bonneville Unit can best be described and its environmental impact assessed by dividing it into said six systems, according to location and function, designated as follows: (1) Starvation Collection System, (2) Strawberry Aqueduct and Collection System, (3) Diamond Fork Power System, (4) Irrigation and Drainage System, (5) Municipal
and Industrial Water System, and (6) Bureau of Indian Affairs [now the Ute Indian Tribal Development]. The Starvation Collection System, consisting of the Knight Diversion Dam, the Starvation Feeder Conduit, and the Starvation Reservoir, have all been completed. The FES being challenged herein is the final environmental statement on the Strawberry Aqueduct and Collection System, which is under construction. The FES expressly states that additional environmental statements will be prepared for all the other four Bonneville Unit systems which are proposed, but are not yet under construction, so that the provisions of NEPA will be fully complied with prior to any decision to proceed with the remaining systems of the Bonneville Unit."

Reclamation is proceeding to develop the Bonneville Unit in accordance with the 1973 FES and the 1974 court decision. The Reclamation effort has been geared towards achieving NEPA compliance and making decisions on incremental amounts of the total proposed average transbasin diversion of 137,400 acre-feet of water annually. Not only function and location, but also the amount of water to be developed have been emphasized. In this manner, current water needs are being considered prior to making decisions to divert water from the Uinta Basin. The 1979 FES for the Municipal and Industrial (M&I) Water System evaluated the provision of 90,000 acre-feet of water annually for use in Salt Lake County and northern Utah County. This system would also provide $\frac{1}{14}$,100 acre-feet of supplemental irrigation for use in the Heber-Francis area of Summit and Wasatch Counties. Thus, the decision was made and evaluated under NEPA for the need and use of $\frac{1}{104}$,100 acre-feet of the total proposed diversion of 137,400 acre-feet.

Under the final 1973 plan, the water for the M&I System would be developed by exchanging part of the evaporative savings, resulting from the diking of Utah Lake, upstream for storage in Jordanelle Reservoir. This would be Provo River water that presently flows into Utah Lake. The diking of Utah Lake was initially proposed to be part of the M&I System. However, as project planning was refined, it became evident that needed water for the Wasatch Front could be provided more quickly if the water for storage in Jordanelle Reservoir were developed on an interim basis by making an exchange with Strawberry Reservoir, which has been enlarged under the Strawberry Aqueduct and Collection System. Water would be released from Strawberry Reservoir, through the rehabilitated existing Strawberry Tunnel (part of the Strawberry Valley Project), into the Diamond Fork drainage and eventually into Utah Lake. A corresponding amount of water would then be stored in Jordanelle Reservoir. This modification of the Bonneville Unit plan represents a change in timing for water supply development and not a change in the project configuration delineated in the 1973 FES. The diking of Utah Lake would now be part of the Irrigation and Drainage (I&D) System.

1/ The water supply for the M&I System was in error in the 1979 FES. The irrigation supply should have been 15,100 acre-feet for a total of 105,100 acre-feet.
No construction would be necessary in the Diamond Fork drainage until about 1993 to accomplish this exchange because the affected stream channels can accommodate additional flows up to 30,000 acre-feet without experiencing significant damage. However, diversions greater than 30,000 acre-feet would exceed the capacity of the stream and cause unacceptable environmental damage.

The Diamond Fork Power System as proposed would be operational by about 1993 to exchange the 104,100 acre-feet of water evaluated in the 1979 FES. This system would provide for environmentally sound conveyance of increased amounts of Bonneville Unit water even if the No Power alternative were selected. Thus, the development of power is independent of conveyance of water and does not control the amount of the transbasin diversion.

Because of the relationship between the M&I Water System and the proposed Diamond Fork Power System, the 1979 FES included the discussion and impact analysis of several options for conveying the increment of water between 30,000 and 104,100 acre-feet, including a summary of the power production alternatives. The Diamond Fork Power System FEIS analyzes in detail the environmental impacts of the power alternatives as well as the system to convey the full 137,400 acre-foot transbasin diversion from the Uinta Basin into the Bonneville Basin. However, the evaluation of the environmental impacts of using the remaining 33,300 acre-feet of the proposed full diversion is not complete enough to allow a final decision. Alternative uses for this water and the expected environmental impacts are discussed in the Diamond Fork FEIS. The final and more detailed analysis of this increment will be accomplished in the environmental impact statement for the Irrigation and Drainage (I&D) System scheduled for 1985. Hence, implementation of neither the M&I System nor the Diamond Fork Power System mandates the construction of the I&D System. The I&D System environmental statement will evaluate the use of the final 33,300 acre-feet of the transbasin diversion in detail and will discuss the extent to which the M&I System water supply would be derived from the exchange with the enlarged Strawberry Reservoir or from the diking of Utah Lake.

In the event that the I&D System is not constructed, the 33,300 acre-feet could be used for supplemental irrigation service in the Spanish Fork River area or for municipal and industrial uses in southern Utah and Juab Counties. If this water were used for irrigation, no additional facilities would be required. If the water were used for municipal and industrial purposes, however, some new facilities would be required. In either event, appropriate NEPA compliance would be accomplished.

In summary, the planning and development of the Bonneville Unit has been following the plan set forth in the 1973 FES and presented to the courts during subsequent litigation. The 1979 FES for the M&I System supported the decision to make a transbasin diversion of 104,100 acre-feet of water, but provided a detailed impact analysis for the conveyance of only 30,000 acre-feet of water. The Diamond Fork Environmental Impact
CONSULTATION AND COORDINATION (Continued)

Statement examines the impacts of conveying the full 137,400 acre-feet of the proposed transbasin diversion, but does not completely analyze the impacts of using the final 33,300 acre-feet of the diversion. The amount of water transported to the Bonneville Basin depends on municipal, industrial, and irrigation demands, rather than the type and size of the hydropower facilities. These facilities have been designed to maximize power production from the water conveyed through the system.

Decisions related to the diking of Utah Lake and the rest of the I&D System are not controlled by decisions pertinent to the Diamond Fork Power System. Reclamation has made specific decisions related to the transbasin diversion and is making future decisions in accordance with the basic plan developed in 1973.

132. Comment:

Further, even if the Sierra Club court had found that the 1973 EIS constituted a programmatic EIS for the Bonneville Unit, the Bureau could no longer rely on that determination. The 1973 EIS is 10 years old and obsolete. NEPA requires the Bureau to continuously evaluate new circumstances and information that might be relevant to the environmental impacts of its actions and to prepare supplements to already prepared environmental statements as necessary. See 42 U.S.C. § 4332(2) (A), and (B); 40 C.F.R. § 1502.9(C); Warm Springs Dam Task Force v. Gribble, 621 F.2d 1017 (9th Cir. 1980). If the decision-making framework changes, so must the analysis and, in some cases, the decision.

The decisional framework has changed substantially since 1973. The estimated cost of the Bonneville Unit in 1973 was $490 million. 1973 EIS at 383. The current estimate is over $2 billion. See Fiscal Year 1984 Project Data Sheet. The water and power demand projections utilized during project design have been called into question by the recent discovery that these commodities are price elastic. And the current flooding problems in the Bonneville Basin reveal that the Bonneville Basin may not be able to accommodate additional transbasin diversion water.

In addition, the present project configuration is substantially different from that presented in the 1973 EIS. In 1973, the concept was to build a Strawberry Aqueduct and Collection System that was an independent project capable of developing water to satisfy water demands wherever they might occur. It was then thought there was a need for that water in the Bonneville Basin. Alternatively, the water developed by the Strawberry Aqueduct and Collection System could stay in the Uintah Basin for energy development, either directly or through exchange projects. This purported independence was critical in the Sierra Club court's finding that the Strawberry Aqueduct and Collection System constituted an independent "major federal action" and that a programmatic EIS for the entire Bonneville Unit was not a necessary predicate for continuing construction on that particular system.
CONSULTATION AND COORDINATION (Continued)

Since the publication of a 1979 environmental statement titled "Central Utah Project, Bonneville Unit, Municipal and Industrial System, Final Environmental Statement (INT FES 79-55)" (hereinafter "M&I EIS"), it is clear that this professed independent utility of the Strawberry Aqueduct and Collection System is no longer apt. The Municipal and Industrial System (M&I System) requires Strawberry Aqueduct and Collection System water (for exchange) in order to be viable. This is in contrast to the M&I System that was identified in the 1973 EIS. In 1973, the M&I System was said, also, to be independent - i.e. it did not rely on any other system of the Bonneville Unit for its utility or viability. Rather, the exchange water required for the construction and operation of the Jordanelle Reservoir was to be developed by the diking of Utah Lake, which was then identified as a component of the M&I System. In 1979, however, the Utah Lake diking portion of the M&I System was excised. As a result, the M&I System now relies totally on the Strawberry Aqueduct and Collection System for its exchange water. This exchange water must be transferred from the Uintah Basin to the Bonneville Basin. The Diamond Fork Power System is now proposed as the conduit for this transfer. Indeed, the justification for the Diamond Fork Power System is the need to convey water from the Strawberry Aqueduct and Collection System for use as exchange water so that the M&I System can be built.

The three systems together - the Strawberry Aqueduct and Collection System, the M&I System, and the Diamond Fork Power System - are now an integrated transbasin water diversion project. The underlying premise of the 1973 EIS that the Strawberry Aqueduct and Collection System is an independent water development project is, therefore, no longer valid. The three systems must be analyzed as a unit and not as separate independent pieces.

Despite these dramatic changes - increased cost, questionable water and power demand projections, increased Bonneville Basin flooding problems, and the current interdependence of at least three systems of the Bonneville Unit - the Bureau has failed to supplement the 1973 EIS. Without such supplementation, reliance on the 1973 EIS as a programmatic environmental statement for the Bonneville Unit is misplaced.

Response:

CEQ Guidelines subpart 1502.9 states that agencies shall prepare supplemental impact statements if (1) there are significant changes to the proposed action relevant to environmental concerns and/or (2) there are significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts. The Federation identified five changes which they believe require that the 1973 FES be supplemented. The changes claimed are (1) that the cost had substantially increased, (2) that water and power demand projections were questionable, (3) that current flooding problems in the Bonneville Basin would be increased by operation of the Bonneville Unit, (4) that the present configuration of the project is substantially different than that presented in 1973, and (5) that the 1973 FES purported that the Strawberry Aqueduct and Collection System was an independent segment of
CONSULTATION AND COORDINATION (Continued)

the Bonneville Unit; however, this professed independent utility is no longer appropriate. These issues are discussed below, although issue (5) is not directly related to NEPA impact analysis.

The cost of the Bonneville Unit has increased considerably since the 1973 FES; however, benefits have also increased proportionally. The unit remains economically feasible with a benefit-cost ratio of 1.88 to 1.

Water and power demand projections are thoroughly reviewed at each incremental decision point for the transbasin diversion, and thus are continually updated.

Projected water demands are discussed on pages B-27 to B-36 in the 1979 FES on the M&I System. Regarding power demands, refer to the response to comment No. 111.

The Bonneville Unit would be operated to minimize the transbasin diversion of water during years when water levels in the Bonneville Basin are high and maximize diversions when levels are low (for additional information see the response to comment No. 144).

There have been no major changes in the configuration of the Bonneville Unit since 1973. The six systems identified in the 1973 FES and specified in the 1974 court decision have remained the same. However, in order to expedite a more rapid development of the needed water supply on the Wasatch Front, the M&I System as described in the 1973 FES was altered. This change relegated the diking of Utah Lake to the I&D System, rather than keeping it as part of the M&I System as originally planned (refer to response No. 131 for more details). This modification will not alter the objectives of the configuration initially planned for the Bonneville Unit, nor will it result in any significant environmental impacts that have not been discussed in the 1973 FES or which will be covered in more detail in the site-specific environmental statement for the Irrigation and Drainage System. Supplemental NEPA analyses have been carried out for planning requirements, including a change in design for Upper Stillwater Dam, the recreation facilities for the enlarged Strawberry Reservoir, the wildlife mitigation plan for the Strawberry Aqueduct and Collection System, the rehabilitation of the Strawberry Tunnel inlet, and the construction of the Sheep Creek-Rays Valley Road. Thus, changes in project planning which are routine are continually being made and are accompanied by appropriate NEPA analyses, or in the case of major systems, the site-specific environmental impact statements committed to in the 1973 FES.

The 1973 FES and resulting litigation purported that the Strawberry Aqueduct and Collection System had utility which was independent of the remaining systems of the Bonneville Unit, namely the Municipal and Industrial System, the Diamond Fork Power System, and the Irrigation and Drainage System. The Strawberry Aqueduct and Collection System still has the potential for independent utility, just as it had in 1973. However, now that the M&I System has been approved for construction
under NEPA and the NEPA evaluation for the Diamond Fork Power System is currently in progress, operation of this system independently is no longer appropriate. As explained in the 1973 FES, it was always intended that the Bonneville Unit would be operated as an integrated project. The concept of independent utility of the collection system was important primarily for decisionmaking purposes in 1973 to demonstrate that if the project should be terminated prior to completion, those features built to date had utility independent of the rest of the project, and the concept has much less significance now that the other systems are nearing reality.

The environmental impacts of integrated construction and operation of the entire Bonneville Unit were first evaluated in the 1973 FES under the discussion of cumulative impacts. More discussion of cumulative impacts as well as the integrated operation of the three systems in question were described in the 1979 FES for the M&I System and in the environmental statement for Diamond Fork. Thus, the systems have been analyzed as a unit. The power portion of the Diamond Fork Power System has utility independent of the water supply development and distribution systems. Lastly, decisions for the Irrigation and Drainage System do not depend on the other systems and will be considered on their own merits.

In summary, Reclamation contends that there is no need for a supplement to the 1973 FES, because the requirements of NEPA and the 1974 court decision have been and continue to be satisfied.

133. Comment:

Power Demand Projections Are Not Justified. The Bureau relies totally on a 1981 Western Area Power Administration (WAPA) Power Market Survey which suggests that both peaking and base load power supply is needed to meet future loads. The Bureau fails to fulfill its obligation to independently verify the accuracy of these projections. Moreover, the projections made in the WAPA survey are based on unverified information supplied to WAPA by utility companies in the survey area for 1975 to 1979. As such, the power projections are more akin to growth targets for the utility companies rather than rational estimates of the anticipated demand.

More importantly, the projections do not appear to adequately consider the price elasticity of power, or the effect of conservation measures on power demand.

Obviously, the power demand projections are critical in this instance. The Diamond Fork EIS states that the Diamond Fork Power System concept of diverting water from the Uintah Basin to the Bonneville Basin was selected "because it maximizes hydroelectric capacity and energy generation." Diamond Fork EIS at 2. If power demand projections are not justified, then the Diamond Fork Power System decision may not be justified.
Response:

See the response to comment No. 111.

134. Comment:

Operational Impacts Are Not Adequately Addressed. There is only a cursory review of the true environmental effects of the Diamond Fork Power System operation. It is misleading to talk about the "initial operation" effects when the project is purportedly justified on its "maximum operation" capability. The passing reference to daily drawdowns minimizes the dramatic aesthetic, ecologic, and safety impacts of the drawdowns that can be expected at Monks Hollow Reservoir and Fifth Water Reservoir. There is no identification of studies done which justify a minimization of this drawdown. There are no illustrations of the impacts of the drawdown. There is no mention of user acceptance of this drawdown. Without user acceptance, recreational benefits may be overstated. There is no description of the effect of this drawdown on the ecology of the area. And finally, there is no discussion of the operational problems of this drawdown during the winter season when ice forms on the surface of the reservoirs.

Response:

Syar and Sixth Water Reservoirs would be relatively small reservoirs which would not store water for consumptive use downstream. Maximum drawdowns would occur on a daily basis. Under the recommended Sixth Water Flow Through Alternative described in this FES, Syar Reservoir would fluctuate about 26 feet daily and Sixth Water Reservoir would fluctuate about 4 feet daily. Monks Hollow Reservoir would provide storage through the winter months and regulate releases to downstream users throughout the entire year. Fluctuations in Monks Hollow Reservoir would be about 50 feet on a seasonal basis. The seasonal drawdown would occur during the summer irrigation season of May through September. No recreational use is planned for Syar or Sixth Water Reservoirs. The reservoir fluctuations described on page 46 of the DES were intended to show the effects from minimum and maximum operating conditions for the Fifth Water Pumped Storage Alternative. The annual net benefits given in Table 19 for that alternative are based on a plant factor of 17 percent, which represents an average operating condition. The maximum operating condition is equivalent to a plant factor of approximately 30 percent.

Daily fluctuations under the Fifth Water Pumped Storage Alternative would range from 8 to 16 feet for Fifth Water Reservoir. Daily fluctuations in Monks Hollow Reservoir would range from 14 to 25 feet. The effects of reservoir operation on the ecology of the area are included in Chapter IV of the FES (see also comment No. 107).

During public information and scoping meetings, a strong desire was expressed by the public to include recreation facilities for Fifth Water and Monks Hollow Reservoirs. This desire was expressed even after the
CONSULTATION AND COORDINATION (Continued)

high fluctuations in the reservoirs were described, which indicates that user acceptance would be relatively high.

Ice formation on the reservoirs is not expected to be a serious operational problem, since the inlet/outlet structures in each reservoir would be located below the depth at which ice would form.

135. Comment:

Construction Costs Are Not Identified. The cost to construct the Diamond Fork Power System is extremely important to the decision-maker and the public. Someone has to pay for this project. Yet, no information about the economic impact of this project on the federal taxpayer, the local taxpayer, and the local or regional rate payer is included in the Diamond Fork EIS. The taxpayer may support a project which destroys recreational and aesthetic amenities if it will produce direct benefits to him at a certain cost. A different decision may be made if the costs are to be borne by the taxpayer in one state while the power benefits are exported and enjoyed in other states. These costs and economic issues are especially important in the Diamond Fork Power System context since the Bureau is considering non-federal participation in financing the project. The Diamond Fork EIS should discuss what the economic effects of this project are on the local taxpayer with and without non-federal participation. In addition, the EIS should discuss the economic effects on C.R.S.P. states if non-federal participation is allowed. These economic effects should include, inter alia, a discussion of the burden on other C.R.S.P. states if the revenues from the Diamond Fork Power System are not paid into the Colorado River Basin Fund.

Response:

A detailed accounting of project costs and benefits is beyond the scope of an environmental impact statement. This information is available at the Utah Projects Office in Provo. Estimates of construction costs for all Diamond Fork Power System alternatives are shown in Summary Table 1 (also Table 19). Reclamation's approach regarding non-Federal participation in the project allows the market to insure that costs to the taxpayers would be minimized. Preliminary information from Western Area Power Administration indicates that CRSP rates may increase slightly if the Diamond Fork Power System costs are integrated into the CRSP system. However, this effect would be fully disclosed through Western's power marketing and rate setting processes.

136. Comment:

Indian Deferral Agreement Is Not Discussed. The Diamond Fork EIS does not adequately address the effect of the Indian Deferral Agreement. If the Ute Indian Unit and the Bureau of Indian Affairs development is not on line by the year 2005, water may not be able to be diverted trans-basin through the Diamond Fork Power System. This may render the Diamond Fork Power System useless. (Indeed, it may well be that the impacts of the Ute Indian Unit and the Bureau of Indian Affairs development should
be addressed in this EIS inasmuch as those developments seem to be an integral part of the viability of the Diamond Fork Power System.)

Response:

The Central Utah Water Conservancy District and Reclamation are committed to satisfying the requirements of the Indian Deferral Agreement. A number of structural and nonstructural alternatives are being investigated. A reduction in the transbasin diversion is possible but would not render the power system useless. Impacts related to developments associated with the Indian Deferral Agreement and the Ute Indian Tribal Development will be addressed in future NEPA documents specific to those developments.

137. Comment:

Endangered Species Act Is Not Addressed. Despite assertions to the contrary, the Endangered Species Act is implicated because this project will effect a depletion of water from the Green River. Portions of the Green River are critical habitat areas for a number of endangered fish. See, e.g., Memorandum to State Director, Utah State Office, Bureau of Land Management from Acting Regional Director, Region 6, Fish and Wildlife Service regarding "Biological Opinion - White River Dam Project, Utah" dated February 24, 1982. Interestingly, the 1973 EIS which is relied upon by the Bureau, did not address the transbasin diversion effects on these endemic fish.

Response:

Reclamation is aware of the endangered fish species in the Green and Colorado River systems which could be potentially affected by the Bonneville Unit. Consultation with the Fish and Wildlife Service on the endangered fish species began as early as October 20, 1977, when Reclamation requested formal consultation on the Strawberry Aqueduct and Collection System. On January 5, 1978, the Fish and Wildlife Service responded with a threshold examination which stated that "the project may jeopardize the continued existence of the Colorado squawfish and the humpback chub." On October 28, 1979, the Service extended the consultation period until the Colorado River Fisheries Investigation information was available. On February 27, 1980, the Service issued a Biological Opinion which stated "the Collection System of the Bonneville Unit, considered with other units of the Central Utah Project, is likely to jeopardize the continued existence of the endangered Colorado squawfish and the humpback chub." The opinion for the aqueduct and collection system also concurred with Reclamation's position as follows: "Operation of the M&I system and other features of the Bonneville Unit including the Diamond Fork Power System and the Bonneville Irrigation and Drainage System will not directly impact the Colorado squawfish or the humpback chub. However, these systems depend upon the collection system for water. Because this biological opinion addresses impacts of the collection system on the two fishes of concern, further consultation on the above-mentioned systems of the Bonneville Unit do not need to include
CONSULTATION AND COORDINATION (Continued)

effects on the Colorado squawfish and humpback chub." Consultation on
the Bonneville Collection System has been reinitiated now that major
studies have been completed. We are working with the Service to insure
that the collection system will not have an adverse impact on squawfish.
A new biological opinion should be issued by FWS within a few months.
If current consultation on the collection system results in modifications
to the Diamond Fork Power System, Reclamation will evaluate environ­
mental impacts of the modifications and prepare appropriate NEPA
compliance documents.

138. Comment:

In light of the foregoing discussion, the National Wildlife Federation
makes the following recommendations with regard to the Diamond Fork EIS:

(Recommendation) Hold the Diamond Fork Power System decision in abey­
ance until the Bureau lawfully makes the decision to proceed with the
transbasin diversion project. That transbasin diversion decision must
be supported by an adequate environmental impact statement that ad­
dresses the synergistic and cumulative impacts of the major federal
action that is proposed by the Bureau at this time – a transbasin diver­
sion project consisting of the Strawberry Aqueduct and Collection System
together with some form of the M&I System, the Diamond Fork Power System,
and probably the Ute Indian Unit and the Ute Indian Tribal Development.

Response:

The response to comment No. 131 explains Reclamation's position regard­
ing NEPA compliance for the transbasin diversion of Bonneville Unit
water. This position is consistent both with the intent of NEPA and
1974 court findings. No further environmental statements other than
for the Irrigation and Drainage System (scheduled for mid-1985) are re­
quired for the transbasin diversion. Additional NEPA compliance is
needed for the Ute Indian Tribal Development.

139. Comment:

(Recommendation) Prepare a realistic market analysis to determine the
actual power needs of the survey area. This market analysis should
include, inter alia, a realistic appraisal of the effects of conservation
measures and the effects of price elasticity on power demand. This par­
ticular recommendation appears especially prudent (as well as legally
mandated) in light of the catastrophic overprojections of power demand
recently discovered in the Pacific Northwest.

Response:

See the response to comment No. 111.

140. Comment:

(Recommendation) Make a more comprehensive review of the impacts asso­
ciated with the reservoir fluctuations associated with the operation of
the Diamond Fork Power System. These fluctuations may well be intolerable from an economic and environmental point of view. If so, the proposed power yield from the Diamond Fork Power System may have to be reduced.

Response:

See the response to comment No. 134.

141. Comment:

(Recommendation) Include a comprehensive discussion of the construction costs of the project. Identify the individuals, regions, states, etc. who will pay for the Diamond Fork Power System, and also those who will benefit from the power system.

Response:

A supplement to the 1964 Bonneville Unit Definite Plan Report is currently being prepared and will contain information on costs, benefits, and repayment. The supplement is expected to be available in the fall of 1984 and will be furnished upon request.

Power benefits would be allocated on a pro rata basis, according to the percentage of "front end" construction costs provided by non-Federal participants.

142. Comment:

(Recommendation) Include a comprehensive analysis of the effect of the Indian Deferral Agreement on the viability of the Diamond Fork Power System. This analysis should include a discussion of the consequences of not satisfying the Indian Deferral Agreement, as well as the environmental impacts of providing the facilities necessary to satisfy the Indian Deferral Agreement. The analysis should contain solicited input from the Indians.

Response:

See the responses to comment Nos. 136 and 138.

143. Comment:

(Recommendation) Include an Endangered Species Act consultation report from the Fish and Wildlife Service discussing the impact of the trans-basin diversion of water on the endangered fish and their habitat in the Green River.

Response:

See the response to comment No. 137.
CONSULTATION AND COORDINATION (Continued)

Comments from Utah Nature Study Society letter of August 2, 1983

144. Comment:

The major issue of the Bonneville Unit of the Central Utah Project is the transbasin diversion of 150,000 to 292,000 acre-feet of water per year (average 197,000 acre-feet) from the Colorado River Basin to the Bonneville Basin of the Great Basin. Although the Draft Environmental Impact Statement mentions the amount of water that will be diverted to the Bonneville Basin, there is no mention of how this water will be utilized, by whom this water will be utilized, and where this water will go. At this time one cannot assume that the water will be utilized by the Irrigational and Drainage component of the Bonneville Unit of the Central Utah Project because this Project has not yet been examined and no Draft Environmental Impact Statement has been written on the project.

Thus at this time one can only assume that from 150,000 to 292,000 acre-feet of water will be entering the Utah Lake and the Great Salt Lake. According to the value of 85,000 acres of surface which Utah Lake may have, the Diamond Fork Power system will elevate the surface of Utah Lake from one to over three feet. There is no mention on the effect of this flooding of Utah Lake wetlands, adjacent farmlands, and highways and state parks or on the fisheries of Utah Lake. There is no mention of whether or not the Diamond Fork Power system will transport water from the Colorado River Basin to the Bonneville Basin of the Great Basin during times of high flooding. Assuming that power generation is of highest economic value for the entire Central Utah Project, it must also be assumed that water will be diverted to the Bonneville Basin at all times, even during flooding times, as the spring and summer of 1983. Certainly then the sponsoring agent or agents of the Bonneville Unit of the Central Utah Project will contribute to the cost of the flooding and compensate all those who have received damage from the flooding. Certainly the Final Environmental Impact Statement must address this entire question and contain stipulations of power generation during times of flooding of Utah Lake and the Great Salt Lake.

Response:

The Diamond Fork Power System is planned to convey water from the Uinta Basin to the Bonneville Basin for use by the existing Strawberry Valley Project, the Municipal and Industrial (M&I) System, and the Irrigation and Drainage (I&D) System. If the I&D System were not constructed, an alternative use would be made of the water planned for that system. The planned utilization of the water and alternative use for the I&D System water are discussed under "Interrelationships" in Chapter II.

The primary function of the power system would be for water supply with power generation secondary. During wet climatic periods, project releases from Strawberry Reservoir would be less than the average annual release determined from simulated project operation for the period of study (refer to the response to comment No. 122). When Utah Lake levels are high, project pumping facilities on the lake shore associated with
the I&D System would use the increased capacity of Utah Lake to meet irrigation demands in adjacent areas. During these periods the water that would normally be released from Strawberry Reservoir to meet these demands would then be held in that reservoir and not released through the power system for power generation. Project water required for use in southern Utah County, Juab County, and the Sevier River Basin would be conveyed through the Wasatch Aqueduct, a feature of the I&D System, under normal operating conditions. High streamflows in Diamond Fork and the Spanish Fork River below the confluence would be no greater than those which have occurred historically. Consequently, inflows to Utah Lake would be no greater than occurred historically. Spills from Utah Lake to the Jordan River would be reduced from an average of 31,100 acre-feet historically to an average of 27,800 acre-feet under project conditions. Average annual flows of the river would increase under operation of the M&I System because of the importation of project water to the Salt Lake Valley. After allowing for estimated consumptive use and return flows for all incremental water supplies, including increased ground water development, the estimated increase would be about 30,000 acre-feet per year with the delivery of the full project supply. This increase would raise the level of the Great Salt Lake less than one half inch.

145. Comment:

The second concern of the reading of the Diamond Fork Power System Draft EIS is that it assumes the Irrigation and Drainage System of the Bonneville Unit of the Central Utah Project will be built and that in the 1990's when this segment may be built that there will be agricultural lands to irrigate. It is important at this time to know just to whom and where the water from the transbasin diversion of the Colorado River Basin to the Great Basin is going. The cost of the water to the farmers must also be known and the farmers must by now have signed an agreement to take the water. Furthermore, stipulations must be mentioned in the Diamond Fork Power System Final Environmental Impact Statement on the relationship between the water users for irrigation and drainage and the water use for generating power. Since agriculture through irrigation contributes to the summer peaking of electrical energy use, the irrigators may be faced with no energy to irrigate or much energy but no water. The stipulation must cover just how the Bureau of Reclamation will react to these situations. One can readily see the scenario where the entire transbasin diversion will go for power generation revenues with no water remaining for the irrigators and agricultural uses.

Response:

Reclamation's ongoing plan of NEPA compliance for the Bonneville Unit is explained in the response to comment No. 131. As each increment of project water is moved to the Bonneville Basin, both its use and the means of its conveyance are evaluated under NEPA. Where appropriate, refinements are made. The evaluation of the Irrigation and Drainage (I&D) System is scheduled for 1985. If there is no demand or less demand for
irrigation water at that time, the option of using the water for municipal and industrial purposes would be examined. However, irrigation presently remains a project purpose. The electrical energy needed to operate the I&D System has been reserved in the Diamond Fork Power System. The irrigation contemplated for the I&D System would be flood irrigation not requiring pumping; therefore, there would be sufficient energy to operate the project.

The last sentence of the comment suggests that a situation could develop in which there would be no water left for agriculture because it would all be used for power production. However, production of hydroelectric power is virtually a nonconsumptive use of water, independent of its use after the transbasin diversion. The Diamond Fork Power System environmental statement discusses in general terms the potential irrigation use of project water as presently contemplated. The I&D System environmental statement will present a detailed discussion of this use.

146. Comment:

Neither the topic of where the water goes after the transbasin diversion or whether or not it will be available for the Irrigation and Drainage System was discussed in the Draft Environmental Impact Statement. THIS POINTS TO THE FACT THAT THE TRANSBASIN DIVERSION IS THE MAJOR ISSUE TO BE DISCUSSED IN THE DIAMOND FORK POWER SYSTEM, even if it means that the Draft Environmental Impact Statement of the Irrigation and Drainage System be completed before the issuing of the Final EIS of the Diamond Fork Power System.

Response:

See the response to comment No. 131. In summary, decisions concerning the conveyance of the transbasin diversion proposed in the 1973 FES are being made on an incremental basis consistent with the NEPA compliance plan presented in the 1973 programmatic environmental statement on the Bonneville Unit.

147. Comment:

It would be important for the Final Environmental Impact Statement to discuss the relation of the Diamond Fork Power System to the Central Utah Water Project and to the Central Utah Water Conservancy District. Will the Central Utah Water Conservancy District be financially responsible for the Diamond Fork Power System? Will the Central Utah Water Conservancy District operate the Diamond Fork Power System or will the Central Utah Water Conservancy District lease the Diamond Fork Power System to the Bureau of Reclamation and "Western" to operate?

Response:

Because the power system would be non-Federally financed, the funding role of the Central Utah Water Conservancy District (CUWCD) has not been defined. If the district became a participant in development of the
power system, it would be financially responsible for its proportionate share of the power and would likely meet this obligation by wholesaling the power to power retailers. Operation of the powerplants would be negotiated as part of the non-Federal financing arrangements. The option exists for the CUWCD or another non-Federal entity to operate the power system. Reclamation would operate the water conveyance facilities and reservoirs, and Western would operate the switchyards and transmission lines. It is unlikely that the district would lease the power system to the Federal Government to operate.

148. Comment:

There is mention of 7500 acre-feet of the transbasin water going for M&I water demands. Is this a fixed amount or a percent of the transbasin water diversion (between 150,000 and 292,000 acre feet)?

Response:

The 7,500 acre-feet mentioned in the draft environmental statement was in error and has been corrected to 30,600 acre feet in the FES. The 30,600 acre-feet is a long-term average of municipal and industrial water demands from the operation study. The 137,400 acre-feet for transbasin diversion is also a long-term average, derived from the same operation study.

149. Comment:

What portion of the cost of the Diamond Fork Power System is covered by the 1965 election which limited the cost of the entire Bonneville Unit of the Central Utah Project to $320,000,000 plus 20% cost overrun and to the repayment obligation of the electorate of $130,673,000 plus 20% upward adjustment? I assume that the repayment obligation has not exceeded the $130,673,000 that the voters approved. Certainly clarification of the role of the Central Utah Water Conservancy District and its repayment obligations is important for discussion in the Diamond Fork Power System.

Response:

Assuming non-Federal participation, all separable construction costs and a portion of the joint construction costs for power of the Diamond Fork Power System would be funded by the non-Federal participants in the project. These costs would not be covered by the 1965 repayment contract but would be repaid by the non-Federal participants through a separate contract. The $320,000,000 figure is not the contract ceiling, but was the estimated cost of the entire Bonneville Unit, as presented in the 1964 Definite Plan Report. The current contract ceiling for repayment of municipal and industrial water is approximately $150 million (including a $10 million contribution by the Central Utah Water Conservancy District) and this amount has not been exceeded. Additional repayment coverage will be necessary prior to construction of Jordanelle Reservoir of the Municipal and Industrial System.
CONSULTATION AND COORDINATION (Continued)

150. Comment:

In the Draft Environmental Impact Statement of the Diamond Fork Power System there is only one study cited which demonstrated the need for the power. This study was published in 1981 by the Western Area Power Administration (WAPA) for Colorado, Utah, Wyoming, Nevada, Arizona, and New Mexico. WAPA is not necessarily an independent study in as much as WAPA may also be wheeling the electricity to its constituents. But of greater concern, the electrical (and all form of energy) energy use patterns have greatly changed in recent years - since 1981. To begin with the evidence we look at the FINAL Environmental Impact Statements for Emery 3 and 4 (1979) (now called Hunter 3 and 4), Intermountain Power Project (1979) and the Moon Lake Power Project 1 and 2 (1981).

First the Emery 3 and 4 Final EIS. The case comes from the Public Service Commission of Utah records (Appendix I-3). "Applicant has experienced tremendous growth in the demand for electrical energy for the historical period 1973 through 1977. It appears that such growth will continue at a substantial rate for the forecast period 1978 through 1986." "The denial of approval of Emery 3 and 4 may well result in Applicant being either unable to serve its customers or being able to serve only at a very high cost, with reliability of service being substantially impaired. By 1984 the situation could become considerably worse, resulting in possible serious outages and blackouts." Because of the lack of demand and total miscalculation of consumer reaction to greatly increased cost of electricity, Emery 4 (Hunter 4) has been delayed indefinitely. Emery 3 (Hunter 3) is rather underutilized. Parts of the transcript from the Final EIS are enclosed.

Second the Intermountain Power Project. "Information obtained from a representative of the California Energy Resources Conservation and Development Commission by the telephone, September 14, 1979, indicated that power needs projections remain unchanged in California." "The Utah representative of the commission (Public Service Commission) indicated that the earlier comments of February 15, 1977 were the best available information and did not propose to update it." Quotations from the Final EIS of IPP are enclosed.

Third the Moon Lake Project. "Deseret's members have contracted to purchase 176 MW from the Intermountain Power Project (IPP). It is currently anticipated that the IPP unit will be operational, unit 1-1986, unit 2-1987, unit 3-1988, and unit 4-1989." "Deseret will attempt to bring Moon Lake unit 1 on line by March 1985 when its contract with UP&L for supplemental power terminates. It will attempt to bring Moon Lake unit 2 on line by 1988 when additional power is needed." Table 1-3 forecasts an annual growth of energy between 1979-1984 of 13.7%, between 1984-1989 of 14.2%, and between 1989-1994 of 7.6%.

It is of interest therefore to note that Intermountain Power Project has been cut in half - from 3000 megawatts to 1500 megawatts and that Utah Power and Light's share from 750 megawatts to 60 megawatts. Furthermore, it is unlikely that unit 2 of Moon Lake will be constructed in the 1980's.
CONSULTATION AND COORDINATION (Continued)

What is demonstrated here has happened all over the country. Tennessee Valley Authority has greatly cut back (moth-balled) many of its projects in construction and eliminated many projects on the drawing boards. (Clinch River breeding participation being one project). The Bonneville Power Authority over the auspices of the Washington Public Power System (WHOOPS) moth-balled two power plants and possibly four power plants - after initially proposing to build 20 power plants - and now hopes to finish only one of the plants. IT HAS BECOME APPARENT THAT PLANNERS OF PRODUCTS OF ENERGY (ELECTRICAL, FOSSIL FUEL, PETROLEUM) and WATER HAVE MADE THEIR FORECASTS ON CURRENT NEEDS AND HAVE IGNORED THE EFFECTS OF THE COST OF THEIR PRODUCTS ON THE CONSUMER. If the baseload forecast have been cut in half (at least), certainly peaking demands must also be cut in half (at least). HENCE WE RECOMMEND THAT BEFORE THE FINAL ENVIRONMENTAL IMPACT STATEMENT IS PUBLISHED THAT A NEW STUDY BE CONDUCTED BY AN INDEPENDENT SOURCE TO DETERMINE JUST WHAT THE PRESENT DAY FORECASTS ARE and that this study be incorporated into the Final Environmental Impact Statement. We also ask that all the participants cited in the Final Environmental Impact Statement of Emery 3 and 4, Intermountain Power Project, and Moon Lake 1 and 2 be asked just what their current plans are. It should be noted that nowhere has a study been conducted in Utah (and probably in the Intermountain region) of forecast demand together with forecast cost on the consumer and the effect of the increase in cost of the elimination of the demands (negative feedback mechanism). This study should also be done for the Final Environmental Impact Statement.

There is still the question of how the Diamond Fork Power Project will be financed and who will receive the electrical energy. There is mention of non-Federal participation. This must be the only way the Project is built. Non-Federal participation is the only measure whether or not the Project is needed. When the non-Federal participants sell bonds, or get voter approval, then the need for the project is known. For instance, when Utah Power and Light started selling bonds to finance its involvement in the Intermountain Power Project, its bond ratings were lowered. The lowering of the bond ratings were the first real criteria which indicated that the Intermountain Power Project was too costly and hence not needed, especially since the Public Service Commission of Utah never was allowed to examine critically the entire Intermountain Power Project and Utah Power and Light's involvement in this project. There could be justified fears that the Diamond Fork Power Project will be built without non-Federal involvement because 1) it is now the cornerstone to the entire Bonneville Unit of the Central Utah Project and 2) the Power is not needed in the Intermountain region.

Response:

See the response to comment No. 111.

151. Comment:

The Final Environmental Impact Statement of the Diamond Fork Power System should contain letters from the utility companies on their intent
in 1) participation in the project and 2) use of the electrical energy derived from the project.

Response:

No construction would begin on the Diamond Fork Power System until agreements for non-Federal funding have been negotiated and signed. Power generated by the project could be allocated by Western through a standard power allocation, on a pro rata basis according to the percentage of funding contributed by each participant, or by some other agreed-upon basis. The Federal Government expects to fund only the portion of the project required for project use (Bonneville Unit pumping). See also the response to comment No. 11.

152. Comment:

How much revenue will be lost because of the 197,000 (150,000-292,000) acre-feet of water [that] will be diverted from generating electricity at Glen Canyon Dam and Hoover Dam?

Response:

The transbasin diversion figure is slightly larger in the FEIS (198,400 acre-feet) because current water studies are based on a slightly wetter period. This 198,400 acre-feet of water includes 61,000 acre-feet for the Strawberry Valley Project which has been diverted to the Bonneville Basin since 1922 and 137,400 acre-feet for the M&I and I&D Systems of the Bonneville Unit. This is part of the water for which the State of Utah has consumptive-use entitlement as a result of the Upper Colorado River Basin Compact. The primary purpose of the Diamond Fork Power System is to deliver this water to points of use. Power generation is a secondary purpose. Based on the current CRSP composite rate of 10.26 mills per kilowatt-hour, the diversion of 137,400 acre-feet of Bonneville Unit water through Diamond Fork would reduce revenues at Glen Canyon and Hoover Powerplants by approximately $1.6 million annually.

153. Comment:

Has any engineering studies been completed since the mud slide that created Thistle Lake and how is the geology in Diamond Fork different from Spanish Fork?

Response:

The geology in Diamond Fork and Spanish Fork Canyon is similar. Two large landslides are located in Diamond Fork Canyon, both downstream from the Monks Hollow Reservoir site. Slippage of either of these slides would not pose a hazard to major project features. Chapter IV, "Geology and Seismicity" provides additional information on the Thistle landslide and landslides in Diamond Fork Canyon. Extensive geological investigations will be conducted for the features of the recommended plan.
154. **Comment:**

In the Final Environmental Impact Statement on the Municipal and Industrial System of the Bonneville Unit, there was mention of 104,000 acre-feet of water being developed. In the current Draft Environmental Impact Statement on the Diamond Fork Power System, this figure has been changed to 105,100 acre-feet. Which statement is correct and what accounts for the change?

**Response:**

The figure given in the Municipal and Industrial System FES was 104,100 acre-feet, which included 14,100 acre-feet of irrigation water in the Heber-Francis area. These figures were in error by 1,000 acre-feet of irrigation water for the Heber Valley. The correct amounts are a total of 105,100 acre-feet and an irrigation supply of 15,100 acre-feet.

155. **Comment:**

If the U.S. Forest Service is to maintain new recreational sites, will Congress appropriate money to the Forest Service for this maintenance, or will the money come from the Bureau of Reclamation?

**Response:**

Reclamation would secure funding for and construct the recreation facilities. The Forest Service would collect user fees to fund the operation and maintenance of the facilities after construction.

156. **Comment:**

Can the Bureau of Reclamation or any water developing agency operate water projects in a multiple-use manner for water supply, for M&I, for agriculture, for recreation, for flood control, and for power generation? These are all competing uses. Flood control results in loss of revenue from power generation, from water sales to M&I use and water sales to agriculture, and decreases recreational uses. Further, as evidence from the spring of 1983, with all the water projects in place, there was still ample flooding because water managers try to keep the reservoirs full in the spring.

**Response:**

Water projects can be operated for competing multiple uses, although some uses must have priority over others. For example, in operating the Diamond Fork Power System power generation at Syar, Sixth Water, Dyne, Monks Hollow, and Diamond Fork Powerplants would depend on downstream irrigation and municipal and industrial water demands. Almost all of the storage for irrigation and municipal and industrial water is in Strawberry Reservoir. This situation allows greater flexibility for flood control in the Diamond Fork drainage because in extremely wet years water would not be released from Strawberry Reservoir to the
Bonneville Basin, but would be stored in Strawberry Reservoir or released to the Colorado River System.

157. **Comment:**

Members of Utah Nature Study Society are greatly concerned with the quality of environment in Utah and the west. The cost of projects has a direct correlation with the amount of environmental damage, either in situ to the supplies of steel and cement, or other natural resources imported to the site. Because so many concerns have not been addressed in the Draft Environmental Impact Statement, perhaps the Bureau of Reclamation should consider redoing the Draft Statement on the Diamond Fork Power System after the Irrigation and Drainage System Final Environmental Impact Statement is completed. Although the Scoping meetings and concerns were addressed at earlier times, the flooding of Utah Lake and the Great Salt Lake have never been a part of Utah's water policy - only managing water for drought. Obviously wet cycles do occur - even in arid regions. Thus the Scoping sessions were rather narrowly put into focus.

**Response:**

Reclamation can find no unaddressed concerns that would warrant redoing the Diamond Fork Environmental Impact Statement after the Irrigation and Drainage System Environmental Statement has been completed. Reclamation is following the NEPA compliance plan presented in the 1973 FES for the Bonneville Unit and sanctioned by a court decision in 1974. See also the second paragraph of the response to comment No. 144 regarding impacts of the power system on Utah Lake and Great Salt Lake.

**Comments from Robert J. Anderson's letter of June 30, 1983**

158. **Comment:**

The report does not address offsite effects on flood plains and wetlands. The referenced sections deal only with the Diamond Fork area. The flow of additional water through any power system to the greater part of the Great Salt Lake basin will affect the flood plain of the Great Salt Lake. Economic damage to minerals industry, highways, and communities could result during periods of lake aggradation. The wetlands along the Great Salt Lake and adjacent to it would also be affected. An increase in diversions above the current level would seem to be significant from an environmental and economic standpoint.

**Response:**

See the response to comment No. 144.

159. **Comment:**

The economic analysis does not speak clearly to the sale of power from this project. Will the power be sold at a profit?
CONSULTATION AND COORDINATION (Continued)

Response:

Rates for power generated by the Diamond Fork Power System would be determined by Western to recover the investment of the non-Federal entities that participate in the project. It is assumed that the rates would be high enough to recover at least the participants' investment costs, including interest, plus some additional margin for profit on the investment.

160. Comment:

Would water diverted through this system produce larger revenues if it was allowed to remain in the Colorado River System. The investment of a billion dollars for the project seems excessive given the in-place generating capacity on the Colorado River System.

Response:

See the response to comment No. 152.

161. Comment:

The final portion of the statement that I would criticize is the lack of discussion on other Bureau of Reclamation projects. The delivery of water for power generation to the great basin river systems removes water from the Colorado River System. This removal will elevate costs for desalinization of Colorado River water prior to delivery of the water to Mexico. What is the economic cost of the additional desalinization required as a result of this proposed project.

Response:

See the response to comment No. 50. The economic cost of the increased salinity resulting from Bonneville Unit depletions has not been calculated, however, since it is believed that the right to divert and deplete streamflows in the Upper Colorado River Basin, as provided by the Colorado River Compact of 1922, are associated with a corresponding right to concentrate the salt load of the river without penalty.

The Federal Water Pollution Control Act Amendments of October 1972 (P.L. 92-500) set forth a public policy of nondegradation for water quality, pollution effluent discharge limitations, and eventual zero pollution discharge by 1985. In response to this policy and related Federal and State program enforcement guidelines, the Colorado River Water Quality Improvement Program was implemented following enactment of the Colorado River Basin Salinity Control Act of June 1974 (P.L. 93-320). A goal of the program is to maintain salinity concentrations at or below 1972 levels, while the Colorado River Basin States continue to develop waters apportioned to them by the Colorado River Compact.

1/ Amended by the Clean Water Act of 1977 (Public Law 95-217).
CONSULTATION AND COORDINATION (Continued)

162. Comment:
In conclusion, I find the environmental analysis for this project to be lacking the detail to present a true picture of the project. This document does not comply with the National Environmental Policy Act or Executive Orders 11988 or 11990.

Response:
The scope of the Diamond Fork Power System Environmental Statement covers in detail the production of hydroelectric power and the conveyance of Bonneville Unit water from the Uinta Basin to the Bonneville Basin. Impacts for the overall Bonneville Unit are being analyzed in accordance with the format identified in the 1973 Bonneville Unit FES (see response to comment No. 131). Thus, Reclamation has followed all required procedures to fully comply with NEPA as well as Executive Orders 11988 and 11990. All impact analyses emphasize consideration of flood plains and wetlands.

Comments from Barrie Marchant's letter of August 2, 1983

163. Comment:
In the EIS, it is claimed that there will be small positive impacts upon the Spanish Fork River primarily due to year round flows in section 4 of that river (currently section 4 is dewatered annually) and increased flows in the river as a whole. As you know, the Spanish Fork Channel is extremely unstable. The extreme differences between high summer flows and low winter flows combined with poor land use practices has resulted in unstable banks, poor pool structure, and a lack of spawning habitat. Under current proposals, fluctuations in flow will be intensified over present levels. At the same time water coming from Strawberry Reservoir will be much cleaner as it will not have picked up a silt load from Diamond Fork. As a result of these two factors, the water will have increased ability to erode the streambed of the Spanish Fork River, thus perhaps changing the nature of the riverbed and invalidating predictions made regarding the fishery.

Response:
Fishery projections under project conditions have been revised to reflect the increased streambed erosion potential in the Spanish Fork River. Eroding streambanks, however, was only one of nine trout-habitat parameters used in the analysis of impacts conducted by the interagency team of biologists. Consideration of all factors resulted in the fishery benefits presented in the FES. Reaches 2 and 3 would have substantial fisheries enhancement over historically dewatered conditions, while adverse fishery impacts would occur in reaches 4 and 5, primarily as a result of increased water velocities. The reduction in turbidity may result in some increase in erosion; however, the most significant cause of any potential erosion would be higher flow volumes in the channel. Under project conditions, Spanish Fork River flows would increase by about 5 to 25 percent on an average annual basis.
CONSULTATION AND COORDINATION (Continued)

164. Comment:

My second concern relates to Sixth Water Creek. While it is true that the Diamond Fork Power System will enhance fish habitat in the drainage due to great improvement in Diamond Fork River, Sixth Water will remain in very poor shape. This stream has suffered extensive damage from the water flows from Strawberry Reservoir. The banks have eroded and the streambed has dropped as much as forty feet in elevation. Throughout much of its course bedrock is exposed. As a result, there are few pools, and little chance for streamside vegetation to provide fish cover. I have to assume that the stream will have great difficulty in rehabilitating itself, and it will be very susceptible to further degradation. While the lack of pool area and cover limit adult trout habitat, there is also very limited spawning habitat. Currently the fish population in Sixth Water is increased by recruitment from Strawberry Reservoir through the diversion tunnel. With implementation of the power system, this will no longer be possible, thus only section 3, Dip Vat Creek, and perhaps Fifth Water will have spawning area available for the system. The EIS has not addressed the possibility that these will not provide sufficient recruitment for Sixth Water.

While the proposed system is an improvement over current operations (and the only environmentally positive aspect of the Bonneville Unit), it leaves Sixth Water in an extremely degraded condition. The "Fisheries Analysis, Diamond Fork Power System, Bonneville Unit, Central Utah Project (Part I - Streams)," pg. 21 states, "... there is a unique and justifiable opportunity and perhaps at least a moral obligation to restore a highly productive stream fishery degraded by the Strawberry Valley Project." I concur with this assessment and would like to see at least minimal rehabilitative measures applied to Sixth Water.

Response:

See the response to comment No. 28. The potential impacts associated with the blockage of spawning migrations into Sixth Water Creek by Monks Hollow Reservoir are discussed in Chapter IV of the FES.

Comments from Jon R. Miller's letter of August 1, 1983

165. Comment:

At the outset, let me note that the issue of water demand should not be dismissed by mere reference to the EIS on the municipal system and future examination of the I&D System. Water demand along the Wasatch Front is overstated in past projections, due largely to the use of the "requirements approach" used in these projections. This approach ignores the significant reduction in water demand forthcoming from increased water charges for Bonneville Unit water. M&I water will likely cost $400 to $500 per acre-foot, five times present water costs. It is quite possible that no Bonneville Unit water will be demanded at these prices.
CONSULTATION AND COORDINATION (Continued)

Response:

At this time, Bonneville Unit water to be delivered through Diamond Fork is committed for use in the Municipal and Industrial System and the Irrigation and Drainage System. Projected future municipal and industrial water needs are discussed in the Municipal and Industrial System Final Environmental Statement (p. B-28 through B-36). That document also contains a detailed discussion of the effects of pricing and other conservation measures on water use (p. H-6 through H-11). This discussion indicates that price increases would result in reductions in water use of only 10 percent or less over a long-term period. Reductions in per capita use from present rates were taken into account in the water-use projections presented in the Municipal and Industrial System FES. No evidence has arisen in the intervening 5 years to indicate that these projections were significantly inaccurate. In fact, the Salt Lake County Water Conservancy District has petitioned for 50,000 acre-feet of Bonneville Unit water, while the city of Orem has petitioned for 7,500 acre-feet. The Metropolitan Water District of Salt Lake City has indicated it will petition for 20,000 acre-feet in the near future. Recently, local elected officials such as the mayor of West Valley City have publicly expressed an immediate need for the water. Mayors of several north Utah County communities also recently indicated that they will petition for Bonneville Unit water in the near future.

Reference to the future cost of municipal and industrial water is purely speculative. Reclamation studies indicate that if Bonneville Unit water were available now, it would cost about $220 per acre-foot. Since most of the costs of facilities associated with M&I water are now in place, the future cost of this water is not expected to increase significantly.

166. Comment:

In addition to lack of information on water demand, the draft EIS is deficient in its justification of demand for Diamond Fork power. In times when the Pacific Northwest finds itself in the greatest power-related debacle (WPPSS) of all time, when the capacity of the Intermountain Power Project has been reduced 50 percent, when conservation efforts are reducing power demands nationwide, it is incumbent upon the Bureau of Reclamation to justify the need for power. Reference to Western's power marketing survey is not sufficient in this regard. In light of the recent history of power demand forecasts, we must be much more thorough in demand estimation.

Response:

See the response to comment No. 111.

167. Comment:

Finally, it is very difficult to compare economic aspects of even the structural alternatives. More detail would certainly be required for any thorough evaluation. One point is certainly in error, however. The
CONSULTATION AND COORDINATION (Continued)

Bonneville Unit, inclusive of the Diamond Fork preferred alternative, certainly does not have a benefit-cost ratio of 3.2-1, if analysis is done under Federal guidelines. The authorized interest rate is not the rate to use in discounting benefits and costs from power in this instance.

Response:

Under current policy, new projects authorized are to be evaluated using current guidelines. However, the Bonneville Unit was authorized in 1956 and is governed by Senate Document 97, which directs that the planning interest rate to be used is the rate established at the time of authorization. For the Bonneville Unit, this rate was 2 1/2 percent. An administrative decision was subsequently made to use a rate of 3 1/8 percent, which was the rate in effect in FY1965 when the Definite Plan Report on the Bonneville Unit was completed. Since the Bonneville Unit went immediately into construction, the 3 1/8 percent rate has been retained for updating economic analyses. Using this rate, the benefit-cost ratio for the Bonneville Unit with the recommended Sixth Water Flow Through Alternative for the Diamond Fork Power System is 1.88 to 1.

168. Comment:

The preferred alternative in the EIS is not a minor addition to an already authorized project. The Diamond Fork Power System is a major new project.

Response:

All of the Diamond Fork Power System alternatives are authorized as part of the Central Utah Project (initial phase), a participating project of the Colorado River Storage Project, under the Colorado River Storage Project Act of April 11, 1956 (70 Stat. 105). This act specifically authorizes the Secretary of the Interior to construct, operate, and maintain the Central Utah Project, "including power-generating and transmission facilities related thereto." The recommended plan for the power system is consistent with the Bonneville Unit plan identified in the 1964 Definite Plan Report.

169. Comment:

The preferred alternative increases generating capacity tenfold. It has increased Bonneville Unit costs allocated to power 50 percent in the last 2 years.

Response:

As discussed in Chapter I, the Fifth Water Pumped Storage Alternative is no longer the recommended plan. The allocation of power for the recommended Sixth Water Flow Through Alternative is slightly higher than for the 1964 DPR Alternative.
CONSULTATION AND COORDINATION (Continued)

170. Comment:

The project should be examined with either the current discount rate for Federal water projects or that recommended by OMB, a rate in the neighborhood of 10 percent. An incremental benefit cost ratio needs to be calculated on the power system itself, with the proper discount rate. Net benefits would be reduced substantially under proper analysis. I hope this correct economic analysis can be undertaken before the final EIS is issued.

Response:

The incremental benefit-cost ratio for the recommended Sixth Water Flow Through Alternative for the Diamond Fork Power System only at the current interest rate (7 7/8 percent) is 1.97 to 1. However, as previously mentioned, 3 1/8 percent is the authorized interest rate for the entire Bonneville Unit.

Comments from Garth R. Morgan’s letter of August 12, 1983

171. Comment:

I read with alarm the Forest Service policy on mitigation of land for wildlife probigation, which states, "The Forest Service does not favor the use of forest land specifically for wildlife mitigation because of its legislative mandate for multiple-use management. Also, changing management emphasis to the single purpose of wildlife benefits would result in added and significant social and economic impacts to both current and future forest users beyond direct impacts of the Diamond Fork Power System features. For example, livestock grazing would have to be reduced about 50% on any forest lands set aside for wildlife in order to meet the specific mitigation objectives. Additionally, this type of management change would create substantial administrative and financial difficulties for the forest service in adjusting present and proposed management plans and would require a reformulation of the draft management plan for the Uinta National Forest, which has received considerable public review and input." This policy is appalling and is a socialistic approach to mitigating of such problems. It is appalling to say the least.

Alternatives for mitigation do not address the improvement of government owned public lands. I see nowhere in the environmental impact statement showing a cost effective analysis of each of the alternatives and also the purchase price of private lands and their development versus the improvement of already owned public lands by the government being improved for wildlife habitation.

Response:

The recommended wildlife mitigation option for each alternative is based on a combination of biological, economic, and social considerations for
CONSULTATION AND COORDINATION (Continued)

that alternative. The basis is described in Chapter III of the FES. A critical element of the plan is that management rights or fee title would only be obtained from willing landowners who would be compensated fairly. The potential for improvement of Forest Service lands for wildlife mitigation was addressed as an option under each of the major project alternatives in the DES. Costs of acquisition can be determined only through appraisals that cannot be accomplished until specific negotiations are initiated. As stated above, economics was only one of the criteria used in developing the recommended mitigation plan.

172. Comment:

The taxpayers who will pay for this entire project, either through taxes or power cost, should know the cost for each alternative. Alternative number five utilizes the greatest amount of acreage and thus takes the greatest amount of acreage out of service for wildlife probigation. In turn, the Federal Government is required to follow the ludicrous policy to purchase private lands for wildlife mitigation. If any of the wildlife specialists would spend an evening surveying the fenced private properties and the number of deer that feed in these fenced areas, the wildlife specialists would soon find that more deer feed per acre each evening on private lands that are fenced than do feed on public lands that are unfenced and are used for grazing of livestock. Thus, it is my contention and opinion that the wildlife mitigation practice legislated by the government is far from being an accurate means of supplying grazing areas of wildlife. My father-in-law, Mr. John C. Patrick and many of his family, including myself, have counted upwards of fifty to one hundred head of deer feeding on his one hundred-sixty acre parcel of land in any one evening. We have also studied the surrounding areas of publicly owned lands where grazing is permitted and found considerably fewer deer browsing in these areas, simply because of over feeding by all grazing and browsing animals. Thus, the justification for purchasing private lands for wildlife mitigation, does not measure up to its legislative mandate.

Response:

Reclamation does not question the existing high use of private lands by feeding deer. The deer use mentioned is primarily occurring during the spring, summer, and fall. However, the critical period for deer survival is during the winter, when they use south-facing slopes at lower elevations. The deer winter range is the most critical and has the highest value. Therefore, it is the habitat with the most current value and improvement potential for mitigation. Private lands in the Diamond Fork area have a high potential for improvement as deer winter range. The recommended mitigation plan calls for acquisition of management easements rather than purchase of land in fee title.

173. Comment:

In the Environmental Impact statement, only one route is shown for power lines going back up the canyon and over the Sheep Creek area. No other
alternative is shown. No costs are presented for the cost per mile for power lines. The justification of routing the power lines back up the canyon and over the Sheep Creek area is very weak in my opinion when the power lines could be routed straight down the Diamond Fork Canyon. If the Diamond Fork area had not been touched by man with his fences, wrecked automobiles, roads, etc., then I would consider the impact of the power lines of a greater consequence, going down the canyon. However, with all of man's impact on the environment that has already occurred, it appears to me to be a waste of taxpayer's money to route the power line up over the Sheep Creek area. The Sheep Creek area, at present, has less impacted areas by man than does the Diamond Fork area. Thus, the alternative of routing the power lines over the Sheep Creek area will have a greater environmental impact.

Response:

Several transmission line corridors were evaluated for each of the Diamond Fork Power System alternatives, reflecting the concerns of Reclamation, the Forest Service, and the Western Area Power Administration. The various corridors were compared based on miles of line, visual impacts, access, number of stream crossings, acreage of vegetation disturbed, and special considerations such as recreation areas, raptor nesting areas, and cultural resource sites. Corridors down Diamond Fork Canyon (east-west) were considered highly undesirable by the Forest Service because of potential impacts to developed or proposed recreation areas. Visual impacts to forest users would be high if corridors in the canyon were selected. A north-south corridor (Figure 5) was selected because of low visual and vegetative impacts, fair access, and small impacts to recreation and raptor nesting areas and known cultural resource sites. In addition, the north-south corridor would have less potential impact resulting from stream crossings than the corridors in Diamond Fork Canyon.

Comments from John C. Patrick's letter of July 24, 1983

174. Comment:

I note that in all of the Wildlife Mitigation options listed in Table 18, page 91, that my property would be acquired by the government for wildlife use. I want to make my position clear—I do not wish to dispose of my property.

Response:

Acquisition of Mr. Patrick's land parcel is the recommended mitigation option only for the 1964 DPR and No Power Alternatives (considered the least likely project alternatives). Mr. Patrick's land is not considered for acquisition under the mitigation plan for either the recommended Sixth Water Flow Through Plan or the Fifth Water Pumped Storage Alternative. Table 18 has been revised to clarify these ambiguities.
CONSULTATION AND COORDINATION (Continued)

175. **Comment:**

In your preferred Wildlife Mitigation option for the recommended Fifth Water Pumped Storage Plan, you plan to acquire about 4,443 acres of private lands under single ownership. This would provide the "greatest and best distribution of compensatory biological values in the Diamond Fork study area." (Page 40)

I fail to see why this plan or a portion of it combined with acquisition of other large areas of land would not satisfy your needs under any of the options you might be forced to accept. The Redford and Schneider properties and Brimhall ranch come to mind as viable compensatory additions in the event that part of the Childs' ranch is covered with the Hayes Reservoir. Selling of a portion of the Brimhall ranch would help compensate the Spanish Fork Livestock Association for the likely reduction of their operation because of this project.

**Response:**

The recommended wildlife mitigation option for each alternative is based on a combination of biological, economic, and social considerations for that alternative. The recommended options have been refined to consider obtaining management rights from willing sellers only.

**Other comments and responses**

Comments from Forest Service letter dated August 23, 1983

176. **Comment:**

**Dam Heights**

In previous discussion and correspondence, it was requested and agreed upon that an evaluation of dam heights be made to determine what effect a reduction in draw-down areas would have on economics, esthetics, and recreation at the reservoirs. This draft of the EIS does not contain that evaluation. We, again, request that the evaluation be made and included in the FEIS.

**Response:**

Reclamation's geologic investigations indicate that the proposed dam heights for the Fifth Water Pumped Storage Alternative are the maximum at which a dam could be safely constructed. Because of this, no reduction in drawdown by increasing dam heights would be possible; therefore, economics, esthetics, and recreation would remain the same.

177. **Comment:**

**Impacts of Borrow Areas on Recreation and Esthetics**

The proposed campground site at Fifth Water Reservoir is listed as a potential borrow area on page 25. If the site is used as a borrow area,
CONSULTATION AND COORDINATION (Continued)

it will be rendered unsuitable for recreation development. We recommend that this site be excluded as a borrow area.

The rock quarry proposed for development below Fifth Water Reservoir will have a significant negative impact on visual quality. When the time comes to remove rock material from the ledges in this canyon, the rock should be randomly split rather than being removed by the straight-shear method. In that way, the remaining rock ledges would have a more natural appearance, and visual quality impacts could be reduced.

Response:

The proposed campground site at Fifth Water Reservoir would be one of the last borrow areas designated for use in constructing the dam. If this area were used, the topsoil would be stripped and stockpiled. At most, only about 4 feet of material would be removed. The excavated area would be contoured to match the surrounding terrain and topsoil placed on top. Reclamation would cooperate with the Forest Service to minimize damage to this site if it were used.

The Forest Service recommendation to randomly split rather than using the straight-shear method to remove rock from the proposed rock quarry has been considered. Reclamation would try to accommodate this technique if it proves to be feasible and practical.

178. Comment:

Interconnecting Power Transmission System and Corridors

The lack of an indepth analysis of the impacts associated with the interconnecting power system outside the Diamond Fork Project area results in incomplete compliance with the NEPA process.

We accept that, in the April 1983 meetings with Western Power referred to on page 206, the Forest Service indicated they felt an acceptable plan could be developed. This was conditional upon a commitment from Western to work with and involve the Forests in a scoping process (43 CFR 1501.7) for the complete distribution system. The finalization of the scoping process will need to address Forest management direction contained in land and resource plans.

The Forest Service proposed that a Task Force of the affected agencies be organized. We feel a firm commitment to do this has been made in the statement on page 208. The Task Force should be involved in developing the scoping process of the entire transmission system.

Ultimately, the Forest Service expects the scoping process to lead to the development of an EIS that addresses the entire transmission system needed for the Diamond Fork Power System. Addressing the entire transmission system will permit compliance with NEPA and assure participation of local, State, and Federal agencies and private persons involved in developing significant and cumulative impacts.
CONSULTATION AND COORDINATION (Continued)

Although the process Western will use in the detailed evaluation of the need for transmission system modifications is described, the Diamond Fork Power System FEIS should also recognize the need to develop a schedule for completing the transmission system scoping process. The actual schedule would depend on information in Western's final marketing and allocation plans. The schedule should be finalized immediately following the release of the plans.

We are also concerned that the system used by Western and referred to as a sensitivity analysis will meet CEQ Regulations for NEPA. On page A-15, mitigation measures, item 10 is a commitment that various local, State, and Federal laws and regulations will be complied with. We strongly endorse this statement.

As part of National Forest land and resource management planning, certain transmission routes across National Forest lands have been or are in the process of being identified. Some of these routes have been or will be identified as potential corridors. It is hopeful this process will be completed in 1985. It will be a Forest Service objective to keep all transmission lines in the identified corridors. Pages 207 and 208 identified certain problem areas related to power corridors or routes discussed during the April meeting. Since that time, the Forests involved have further refined the information provided. Needed changes by individual Forests are included in our specific comments.

Page 209 of the DEIS refers to Western's standard mitigation procedures for powerline construction and is referred to as Attachment 3 in the draft. We suggest that Forest Service standard mitigation procedures be referred to and included in the FEIS when referring to the National Forest lands. It would be well for the Bureau to coordinate an effort to include all affected agencies which have their own specific requirements. The Forest Service and Bureau of Land Management have developed joint mitigation procedures which are available.

Response:

As discussed under "Purpose of the Environmental Statement" in Chapter I, the Fifth Water Pumped Storage Alternative is no longer the recommended plan. Under the presently recommended Sixth Water Flow Through Alternative, no new facilities would be required in the interconnected transmission system; therefore, no additional NEPA compliance would be required for that system.

Comments from Bureau of Land Management letter dated August 12, 1983

179. Comment:

BLM concurs with the Bureau of Reclamation statements on pages S-9, 1, and 101 that site specific environmental documents will be required for the power distribution system. Because the power generation and transmission facilities would both be required for a complete system, it may
be appropriate to better define the required transmission system and analyze it as part of the Diamond Fork EIS. This is addressed under 40 CFR 1502.4 which requires that proposals or parts of proposals which are related closely enough to be a single course of action be evaluated in a single impact statement. Decisions for investment of funds in a power generation system without assurance or concurrent decisions on a power transmission system may be contrary to 40 CFR 1506.1 which directs federal agencies to not carry out actions on a program being studied under NEPA when it tends to determine subsequent development or limit alternatives. If the power generation system were in place, the "no action" alternative would no longer be available for the transmission system without jeopardizing a substantial investment.

Response:

See the response to comment No. 178 regarding NEPA compliance for the power distribution system. If a pumped-storage system were built, a "no-action" alternative would not be a practical alternative to the transmission system because the power production facilities would be in place. For this reason, Western and Reclamation met with BLM and the Forest Service prior to circulating the DES to assess whether or not there were any known impediments that would preclude the proper siting of a transmission system. The consultation with these agencies indicated that environmentally acceptable transmission corridors are available.

180. Comment:

The discussion of Moab District Concerns on page 206 may not be pertinent as the descriptions of plan 1 and plan 2 (pp. 99-103) do not include any facilities in the Moab District.

Response:

As a result of selecting the Sixth Water Flow Through Alternative, no modification to the interconnected transmission system would be required. Therefore, the section of the DES which included page 206 is not included in the FEIS.

Comments from U.S. Fish and Wildlife Service letter dated August 19, 1983

181. Comment:

We find that the DES is adequate in regard to anticipated fish and wildlife impacts and mitigation measures in the Diamond Fork Drainage. However, impacts attributable to new transmission facilities to distribute power generated by the project have not yet been evaluated nor has an acceptable plan to mitigate for these damages been developed.
182. **Comment:**

It is not clear in the DEIS as to whether the Section 404(r) would also cover the proposed transmission lines outside of the Diamond Fork Drainage. If this is intended, we do not feel that 404(r) is appropriate as the proposed transmission lines outside of the Diamond Fork Drainage have not been evaluated.

**Response:**

The Corps of Engineers 404(r) exemption was intended to cover only proposed transmission lines within the Diamond Fork drainage. Should the Fifth Water Pumped Storage Alternative be selected and permits be required for construction of these lines, Western would be responsible for compliance with the Clean Water Act.

183. **Comment:**

Pages 99-101 discuss alternatives to provide transmission and distribution facilities for power that will be generated by the project. The general types of environmental impacts that can be expected are addressed and it is stated (page 209) that implementation of Western Area Power Administration's standard mitigation procedures listed in Attachment 3 would, in most cases, avoid impacts to wildlife habitat. However, page 204 states that it is not possible at this time to identify specific corridors or impacts relating to the needed transmission system modifications.

Since the transmission system is a part of the Diamond Fork Power Project, we feel that impacts should be investigated by our Service in cooperation with other involved State and Federal agencies under authority of the Fish and Wildlife Coordination Act. Until such time that the impacts are quantified and acceptable mitigation plans are assured, exemption for Corps of Engineer permits in accordance with Section 404(r) for the transmission system is not appropriate.

**Response:**

See response to comment No. 182.

184. **Comment:**

Page 164, Table 45. At the minimum pool elevation, with the Fifth Water and Sixth Water Pumped Storage alternatives, the increase in standing crop (lb/year) should be 810 rather than 870. Similar corrections should also be made in the first and third paragraphs on page 165.
CONSULTATION AND COORDINATION (Continued)

Response:

Table 45 (Table 46 in the FEIS) and the paragraphs referred to have been revised as suggested.

Comments from Utah Natural Resources and Energy, Division of Wildlife Resources letter dated September 1, 1983

185. Comment:

Page 25, paragraph 4, sentence 6: is the "normal discharge" range 0 to 2 cfs in Fifth Water Creek, as stated, or is it 1-20 cfs as according to page 114, paragraph 4, sentence 4, or 0.5 to 20 cfs as stated on page 116, paragraph 5, sentence 4?

Response:

The normal discharge from Fifth Water Reservoir into Fifth Water Creek would range from 0.5 to 20 cfs for fishery purposes. The discussion of flows on page 114 of the DES refers to those existing under natural conditions in First, Second, Third, Fourth, and Fifth Water Creeks collectively, and not Fifth Water Creek specifically. The pages referred to have been changed in the FEIS to correct the inconsistencies in the DES.

186. Comment:

Page 130: Is this illustration Figure 25?

Response:

The illustration on page 130 of the Draft Environmental Statement is Figure 25.

187. Comment:

Page 163, paragraph 4, sentence 1: The reference to "Youngs and Heimlich" should have a date in parentheses, and the complete reference should be included in the literature citation section.

Response:

The page referred to and the list of references have been revised as suggested.

188. Comment:

Page 164, Table 45, Project alternative - Fifth Water and Sixth Water Pumped Storage: The "Increase in Standing Crop (1b/yr)" value should be 810, not 870.

Response:

Table 45 (Table 46 in the FEIS) has been revised as suggested.
189. **Comment:**

*Page 165, paragraph 1, sentence 1 and paragraph 3, sentence 2:* In each sentence, "870" should be "810".

**Response:**

The sentences referred to have been revised as suggested.

**Comments from State of Utah letter dated August 16, 1983**

190. **Comment:**

P. 134, par. 4--The proposed reservoirs on the recommended Fifth Water alternative will be filled with water heavily laden with phosphorus from Strawberry. The reservoirs will probably not be influenced by the phosphorus, and problems associated with eutrophic systems (oxygen depletion, algae bloom, etc.) will not be significant due to water level fluctuations and short detention times.

**Response:**

Reclamation basically agrees with this comment. The comment also pertains to Syar and Sixth Water Reservoirs of the recommended Sixth Water Flow Through Alternative as well as to the small reservoirs of the other alternatives. Chapter IV has been revised to reflect this comment.

191. **Comment:**

P. 164, Table 45--The increase in standing crop (lb./yr.) at the minimum water level in Monks Hollow Reservoir for the Fifth Water and Sixth Water Pumped Storage alternative should be 810 instead of 870.

**Response:**

Table 45 (Table 46 in the FEIS) has been revised as suggested.

192. **Comment:**

P. 165, line 2--870 should be 810.

**Response:**

The page referred to has been revised as suggested.

193. **Comment:**

P. 165, line 29--870 should be 810.

**Response:**

The page referred to has been revised as suggested.
CONSULTATION AND COORDINATION (Continued)

194. Comment:

P. 3, par. 2—We suggest that the DFPS not use oil-fueled plants to provide part of the energy needed for the pumped storage system for two reasons. First, this would be counter productive in light of the national policy of minimizing the level of foreign oil imports into this country. By not using oil-fired generation to provide energy for pumping, there could be a small, but nevertheless measurable impact on foreign oil imports. Secondly, while world oil prices are now relatively low and stable, there is a certainty that this situation will not last long. World oil prices will undoubtedly increase by the time the DFPS is brought on line, and price stability since 1973 has been anything but stable. The net effect of this is that the cost of power from the DFPS will have an inherent, built-in, price instability which would be unfavorable to the intent and purposes of the DFPS.

Response:

Page 3 of the DES was in error; no oil-fired generation would be used for pumping in operation of the pumped-storage system. The erroneous statement has been deleted in the FEIS.

195. Comment:

P. 217—Utah Division of Wildlife Resources. The position of Kendall L. Nelson should be "Regional Resource Analyst," and his education should be B.S. Wildlife Management, M.S. Range Management.

Response:

The page referred to has been corrected as suggested.

Comments from Wyoming Public Service Commission letter dated August 3, 1983

196. Comment:

The Draft Environmental Statement cites the possible construction of a 115-kV transmission line from Archer to Glenrock to Casper to Yellowtail. The personnel at the Western Area Power Administration area office that would own and operate such a line say they know of no such line. They say USBR may have looked upon such a line as a means of marketing the available power in a very narrow sense. WAPA is planning an Archer-Alcova-Thermopolis-Yellowtail 230-kV line as an overall cure of problems forthcoming in its system and in the Rocky Mountain area in general.

Response:

The transmission alternatives described in the Draft Environmental Statement were not intended to represent a final plan but to show that a transmission system to distribute Diamond Fork power could be developed if the Fifth Water Pumped Storage Alternative were constructed. With
the recommended Sixth Water Flow Through Alternative, no modifications to the interconnected transmission would be required.

Comments from Central Utah Water Conservancy District letter dated August 3, 1983

197. Comment:

Page 5 footnote: It has not yet been determined if the 15,800 acre-feet will be provided as part of the Bonneville Unit. It has not yet been determined that the recirculation plan will be the selected alternative.

Response:

Chapter I has been revised to accommodate this concern.

198. Comment:

Page 12, second line: Rays Valley runs north and south, not laterally along Fifth Water Creek.

Response:

In the FES, this sentence states "... Rays Valley intersects Fifth Water Creek. . . ."

199. Comment:

Page 14, third paragraph: This paragraph should be rewritten.

Response:

The paragraph has been revised.

200. Comment:

Page 18, Flood Damage and Erosion: A description of the flood of 1983 should be included.

Response:

The section referred to has been revised to include a description of the 1983 flood.

201. Comment:

Page 88, Table 17 Lands for Project features - No Power Alternative: It is not clear why any mitigation is required for this alternative.

Response:

Mitigation for the No Power Alternative, as for the other alternatives, is required because the construction of project features would cause the
CONSULTATION AND COORDINATION (Continued)

permanent and temporary removal of vegetative habitat and added distur­
ance of a major new road. In this case, most of the permanent habitat
loss would be caused by construction and use of the Sheep Creek-Rays
Valley access road.

202. Comment:

Page 89, Alternative capacities considered for the Fifth Water Pumped
Storage Alternative: The discussion of the 500 MW and the 2,000 MW
alternative is a trivial effort and appears to only justify the pre­
selected size. Why was 1,200 MW or 1,400 MW not selected?

Response:

The discussion in the Draft Environmental Statement on the 500- and
2,000-megawatt sizes of the Fifth Water Pumped Storage Alternative was
only intended to show that the plan would be economically feasible at a
capacity smaller or larger than 1,000 megawatts. This discussion has
been deleted from the FEIS because the Fifth Water Pumped Storage Alter­
native is no longer the recommended plan.

203. Comment:

Page 87, third paragraph: Why would Reclamation operate and maintain
the project facilities of the No Power Alternatives? This is in oppo­
sition to the contract with CUWCD which provides that Reclamation would
operate the power system and CUWCD would operate everything else.

Response:

The paragraph referred to has been revised to indicate that the district
would operate and maintain the facilities of the No Power Alternative.

Comments from Intermountain Water Alliance letter
dated August 15, 1983

204. Comment:

The EIS addresses:

No economics of Diamond Fork pump storage power versus small need or no
need, Bureau alternatives elsewhere, or alternative kind of supply which
might be more cost efficient, i.e. gas turbine systems.

Response:

Total construction costs for the recommended plan and alternatives are
given in Table 19. Net economic benefits are given in Table 20. De­
tailed analyses used in developing these data are available in the Utah
Projects Office in Provo.

Alternative sites for pumped storage facilities are discussed in Chapter
III of the FEIS.
Regarding alternatives to pumped storage, it is more economical today to generate peaking power by burning natural gas, but the supply and the cost in the future is unknown. The trend by utilities is to phase out the use of oil and natural gas to lower the requirements for oil and gas imports. According to Electric Power Monthly (June 1983), the use of natural gas to produce electricity has dropped between 1982 and 1983 by 16.1 percent in the "Mountain Region."

Pumped storage systems can improve the operating efficiency of fossil-fuel-fired generation plants by using excess energy during off-peak load periods. The Diamond Fork Power System would be managed with fossil fuel plants, so that peak demands could be met with minimal energy waste. Based on such an operation, it is estimated that each megawatt of installed pumped-storage capacity could provide the energy equivalent of 3,500 barrels of oil annually.

As mentioned previously, construction of the power system will not begin until non-Federal participants have committed for the nonproject portion of the power (see the response to comment No. 115).

Comments from National Wildlife Federation letter dated August 12, 1983

205. Comment:

Environmental Analysis of the Transmission Lines Cannot Be Deferred. The Diamond Fork EIS acknowledges that new transmission facilities will be required to distribute the proposed Diamond Fork Power System power. The Bureau has not, however, addressed the environmental impacts associated with these new transmission lines. "It is not possible at this time to identify specific corridors or impacts relating to these modifications (of the interconnected transmission system) because the allocation of the power has not yet been made." Diamond Fork EIS at 204. The Bureau assumes that the transmission lines will be built, apparently at whatever environmental cost. Indeed, the existence of the transmission lines is assumed in the Diamond Fork EIS in order to justify the Diamond Fork Power System. This assumption ignores the interdependence of power generating facilities and power transmission facilities. The two must be analyzed as a single unit. If certain transmission facilities cannot be built for economic or environmental reasons, then the generating facility may need to be scaled down to reflect the reduction in power demand associated with the elimination of that transmission facility.

The separate analysis — i.e., "segmented" — approach invoked in discussing the Diamond Fork Power System concept does not give the public an opportunity to intelligently consider all the logical consequences of interrelated projects. Thus, it constitutes an unlawful segmentation of a major federal action under NEPA. See 40 C.F.R. § 1502.4.

Response:

See the response to comment No. 178.
206. Comment:

The Summary Table presented on page S-3 identifies five alternatives covered in the statement. Our review indicates the "No Power Alternative" really means no federal power development and should be so identified. We believe the demand for power and energy, and the unique physical opportunity (2600 feet of head) including availability of water already developed are such that even though the Bureau of Reclamation did not develop the power potential, non-federal interests would certainly do so.

Response:

Reclamation agrees that if the power system was not developed by Reclamation, it would probably be developed by non-Federal interests. Therefore, the development of any power system in Diamond Fork would preclude development of the No Power Alternative.

As discussed in Chapter III, "Comparative Analysis of Recommended Plan and Alternatives," the No Power Alternative would be the minimum development required to maintain the integrity of the Bonneville Unit. Impacts associated with this alternative were not adequately evaluated in the 1979 Final Environmental Statement and, therefore, are included in the Diamond Fork statement.

207. Comment:

The statement covering the "No Power Alternatives" shown in Table 15 and Figure 21, is not clear with respect to how the existing Strawberry water would be delivered. We presume the delivery of such water would continue as in the past, or as may be agreed by the Association and the Bureau of Reclamation.

Response:

Under the No Power Alternative, Strawberry Valley Project water would be released through Syar Tunnel into Sixth Water Creek. These releases would continue as they have in the past or as otherwise agreed to by the Association and Reclamation.

Comments from Utah Nature Study Society
letter dated August 2, 1983

208. Comment:

There is mention that the users of the peaking power will have to pump water uphill to have their peaking power. If the user burns oil for its baseload electrical generation, no net saving in oil occurs - in fact oil is wasted. The Draft EIS mentions that most of the region is
served by coal and oil generators of electricity. Fossil fuel is a non-renewable resource which has many applications. Figure 7 shows a typical pump storage scene. Most of the equipment is under plastic wrap. Is this typical pump storage project operating? One pump storage operation (Consumers Power and Detroit Edison in Michigan), the Ludington Pump storage, provides the pumping power with nuclear power energy. The Helms Pump Storage Project, built by Pacific Gas and Electric in California is not yet operating and again was built in conjunction with the Diablo Nuclear Power Plant (which is also not operating). Just where are the typically operating Pump storage projects and what is the energy source to pump the water uphill? Furthermore, do any of these typical projects allow recreation use of the down hill and up hill reservoirs?

Response:

Figure 7 (Figure 12 in the FEIS) is a photograph of the Helms Pumped Storage Powerplant under construction by Pacific Gas and Electric Co. in California. The purpose of the photograph is to illustrate the size of the underground chamber, which is similar to the proposed Fifth Water underground chamber. As of January 1983, there were 26 pumped storage units in service in the western United States and western Canada. These plants utilize either coal-fired or nuclear energy for pumpback. Recreation use at pumped storage reservoirs is quite limited because of the fluctuating water levels. The degree of recreation use depends mainly upon the timing, magnitude, and frequency of the fluctuations.

209. Comment:

Other questions arise upon reading the Draft Environmental Impact Statement. Will CRSP pump water up hill in the Diamond Fork Power System by electricity generated from releasing water at Glen Canyon, Hoover Dam, and Flaming Gorge?

Response:

Non-Federal interests or the United States would obtain the energy necessary for pumping from the cheapest source. This could be from their own generation or from purchases from other utilities. If the energy were purchased from the CRSP, the electricity would be generated by water released through Glen Canyon, Flaming Gorge, and/or another CRSP powerplant.

The objective of any pumped-storage system is to improve the power system by enhancing the economics of generation and increasing the flexibility and reliability. Pumped-storage systems are used to respond to the daily, weekly, or seasonal peak-load demands, improve the capacity factor of base-load thermal plants, regulate system frequency by load following, and improve system power factor by operating as a synchronous condenser.
210. **Comment:**

If it takes 4 kwhr to generate 3 kwhrs of peaking power by pump-storage electricity, would it not be more economic to generate peaking power by burning natural gas (which is now in great abundance), especially if the pump-storage is operated by burning fossil fuel?

**Response:**

See the response to comment No. 204.

211. **Comment:**

Should not the Bureau of Reclamation forego all recreation on the two reservoirs in the pump-storage system because of the tremendous fluctuation of water levels creating hazards for the recreationist? It seems that these areas should be fenced off.

**Response:**

The reservoir fluctuations with the pumped storage alternatives would reduce the expected recreation potential, but would not be of a magnitude which would be particularly hazardous to boaters and fishermen, except for the inlet and outlet areas of the impoundments. If a pumped storage alternative were constructed, all hazardous areas would be fenced or otherwise blocked off.
Mr. Clifford I. Barrett  
Regional Director  
Upper Colorado Region  
Bureau of Reclamation  
P.O. Box 11568  
Salt Lake City, UT 84147

Dear Cliff:

Our general comments and concerns on the Diamond Fork Power System Draft Environmental Impact Statement (DEIS) (DES 53-46) are as follows:

1. Sixth Water Creek Flow Maintenance and Fisheries Improvement.

   This concern was addressed in both our February 25 and March 31 responses to preliminary drafts of the Environmental Impact Statement (EIS). We still feel very strongly that the Sixth Water stream should be improved for fisheries. On page 160, it is pointed out that the fisheries in Sixth Water represent an excellent opportunity for stream fisheries enhancement; however, it states that such enhancements could only be justified as mitigation if the 1964 DPR alternative were selected.

   The possibility of developing a fisheries flow through a power plant at the outlet of the Strawberry Tunnel is mentioned as a potential way to maintain the fisheries in Sixth Water. We would support such a proposal and feel that this possibility should be further evaluated and discussed in the Final Environmental Impact Statement (FEIS) for this project.

   Another option for providing fishery flows down Sixth Water Creek is to continue to release water down this stream until such time as it may be established that all available water above a minimum flow is necessary for peaking power production. An interim agreement has been discussed with your Provo office and they have indicated a willingness to explore such a proposal. Item 15 of our specific comments, which follows, suggests wording to be added in recognition of the flexibility that seems apparent in the operation of the Fifth Water Power Plant.

   If options which will add sufficient water do not become available, then we feel that the Bureau has a responsibility to
rehabilitate the stream channel in Sixth Water. As stated in our response to the advanced draft, this responsibility occurs by virtue of the fact that the Sixth Water channel is being used as a conveyance system under the current Strawberry Project, to which the Bureau was a party. The Diamond Fork Power System is an enlargement of this project and is replacing the old Strawberry Tunnel with a new system. The Bureau recognized some responsibility for Sixth Water when it included cost estimates for channel rehabilitation in previous plans. It may be necessary to request special financing for a rehabilitation project.

We believe it would be more desirable and cost efficient to implement the Interagency Biological Team streamflow recommendations than to stabilize the stream channel. The possibilities mentioned above could provide the needed water to accomplish this.

2. Diamond Fork Pipeline

This item was addressed in our previous correspondence also. We still question that the benefits of the pipeline will be as significant as explained in the EIS. Flows of 425 cfs would still occur in the existing channel which would not be much different from the flows which now exist during most of the irrigation season. Based on the undesirable effect of these flows, we continue to support the construction of a pipeline that would accommodate at least 600 cfs or more.

3. Construction and Mitigation

We recognize the difficulty the Bureau has in obtaining construction and mitigation funds concurrently. However, because of legal and essential resource requirements, we insist that the mitigation construction issue be emphasized in the FEIS. In light of recent curtailment in the use of Section 8 funds for recreation and wildlife mitigation, we must stress that we cannot represent to the public that all is well. We feel it is necessary for Reclamation to disclose the current status and the future outlook for mitigation in this FEIS. We would need to go on record as opposing the continuation of the project without adequate mitigation.

4. Dam Heights

In previous discussions and correspondence, it was requested and agreed upon that an evaluation of dam heights be made to
determine what effect a reduction in draw-down areas would have on economics, esthetics, and recreation at the reservoirs. This draft of the EIS does not contain that evaluation. We, again, request that the evaluation be made and included in the FEIS.

5. Impacts of Borrow Areas on Recreation and Esthetics

The proposed campground site at Fifth Water Reservoir is listed as a potential borrow area on page 25. If the site is used as a borrow area, it will be rendered unsuitable for recreation development. We recommend that this site be excluded as a borrow area.

The rock quarry proposed for development below Fifth Water Reservoir will have a significant negative impact on visual quality. When the time comes to remove rock material from the ledges in this canyon, the rock should be randomly split rather than being removed by the straight-shear method. In that way, the remaining rock ledges would have a more natural appearance, and visual quality impacts could be reduced.

6. Interconnecting Power Transmission System and Corridors

The lack of an indepth analysis of the impacts associated with the interconnecting power system outside the Diamond Fork Project area results in incomplete compliance with the NEPA process.

We accept that, in the April 1983 meetings with Western Power referred to on page 206, the Forest Service indicated they felt an acceptable plan could be developed. This was conditional upon a commitment from Western to work with and involve the Forests in a scoping process (43 CFR 1501.7) for the complete distribution system. The finalization of the scoping process will need to address Forest management direction contained in land and resource plans.

The Forest Service proposed that a Task Force of the affected agencies be organized. We feel a firm commitment to do this has been made in the statement on page 208. The Task Force should be involved in developing the scoping process for the entire transmission system.

Ultimately, the Forest Service expects the scoping process to lead to the development of an EIS that addresses the entire transmission system needed for the Diamond Fork Power System. Addressing the entire transmission system will permit compliance
with NEPA and assure participation of local, state, and federal agencies and private persons involved in developing significant and cumulative impacts.

Although the process Western will use in the detailed evaluation of the need for transmission system modifications is described, the Diamond Fork Power System FEIS should also recognize the need to develop a schedule for completing the transmission system scoping process. The actual schedule would depend on information in Western's final marketing and allocation plans. The schedule should be finalized immediately following the release of the plans.

We are also concerned that the system used by Western and referred to as a sensitivity analysis will meet CEQ Regulations for NEPA. On page A-15, Mitigation Measures, item 10 is a commitment that various local, state, and federal laws and regulations will be complied with. We strongly endorse this statement.

As part of National Forest land and resource management planning, certain transmission routes across National Forest lands have been or are in the process of being identified. Some of these routes have been or will be identified as potential corridors. It is hopeful this process will be completed in 1985. It will be a Forest Service objective to keep all transmission lines in the identified corridors. Pages 207 and 208 identified certain problem areas related to power corridors or routes discussed during the April meeting. Since that time, the Forests involved have further refined the information provided. Needed changes by individual Forests are included in our specific comments.

Page 209 of the DEIS refers to Western's standard mitigation procedures for powerline construction and is referred to as Attachment 3 in the draft. We suggest that Forest Service standard mitigation procedures be referred to and included in the FEIS when referring to the National Forest lands. It would be well for the Bureau to coordinate an effort to include all affected agencies which have their own specific requirements. The Forest Service and Bureau of Land Management have developed joint mitigation procedures which are available.

Additional functional and editorial comments are included as an enclosure to this letter.

We have appreciated working with your Provo office as a cooperating agency on this EIS.
In concept, we can accept the DEIS as it applies to the Diamond Fork Project area; however, we find the DEIS incomplete as it applies to the distribution system. It is hopeful that the concerns we have can be resolved.

Sincerely,

J. S. TIXIER
Regional Forester

Enclosure
1. Page S-1, paragraph 1

It should be made clear in this introductory paragraph that there would be a need for modified or new, extra high voltage (EHV) and high voltage (HV) power transmission systems as a result of the project proposals. This need would involve powerline construction activities in portions of six western states.

2. Pages S-2 through S-4

The description of alternatives does not include a discussion on the need to construct a backbone HV/EHV transmission system for project power distribution. This should be done.

3. Page S-4, 3rd full paragraph

Assumptions are made that the interconnecting power systems would be capable of accepting the project powerload. These assumptions should be clarified as being dependent upon existing utility company concurrence.

4. Page 13

We suggest the following changes here: (a) first sentence change "5" to "15," (b) 3rd sentence insert "50" between "US" and "6," and (c) 4th sentence change "3" to "12"

5. Page 36, 1st paragraph, 1st sentence

Add: "...to a point just south of the abandoned coal mine campground."

6. Page 36

Under Operating Facilities and Project Administration, the responsibility for road maintenance should be addressed.

7. Page 44, 1st paragraph, 2nd sentence

Change "district ranger" to "Forest Supervisor."

8. Page 48, 2nd full paragraph

Change the word "may" in the last sentence to the word "will." Environmental analysis, in addition to that presented in the EIS, will be required for project work on National Forest lands.

Page 48, 6th paragraph, 1st sentence

Add "and (4) Road Use Permits."
9. Page 51, before 1st sentence in 1st paragraph under Construction Activities and Schedule, add this sentence: "Where feasible, materials needed for construction activities will be obtained from reservoir basins, tunnel excavation, or other such disturbed sites."

Also, at the end of the first paragraph, add this sentence: "Intensive efforts to revegetate and stabilize such materials will be required."

10. Page 59

Recreation Facilities. The recreation trail around the south side of Monks Hollow Reservoir, included on page 64, is not mentioned. This trail is needed in all alternatives which involve Monks Hollow Reservoir and has been included on pages 64 and 70.

11. Page 83, under Relocations, last sentence

Change "grazing rights" to "grazing privileges."

12. Page 87, 2nd paragraph

Four and seven-tenths miles of existing road improvement seems to be low for this alternative, since 57 acres of roads are visualized for use in table 17 on page 88.

13. Page 97, last sentence, last paragraph

Change the last sentence to read, "The no-power alternative would have the least cost."

14. Page 141, last paragraph

Cubic feet per second (cfs) is not a velocity; change "velocities" to "flows."

15. Page 155, 3rd full paragraph, after last sentence

Add the following: "However, Reclamation recognizes the desirability of maintaining and improving the fishery in Sixth Water Creek and will work with the Forest Service and other resource agencies toward achieving a satisfactory solution to the problem through opportunities provided by the operational flexibility of the power system."

16. Page 160, Item 2, top of page

Add this sentence: "A winter flow of 32 cfs would optimize conditions for trout."

17. Page 166, 2nd paragraph

Change "severe" to "critical."
18. Pages 174 through 178

Section on Geology and Seismicity needs to be expanded to address land stability, i.e., landslides into the proposed reservoirs.

There should be a brief discussion on impacts on existing and/or future oil and gas leases, as well as a statement as to acreage that will no longer be available for mineral exploration if Reclamation withdrawals are prescribed.

19. Page 175, figure 27

The geology figure is inadequate, as it only shows faults and not bedrock. With the recent experience of the nearby Thistle slide and the new map of that area, the project geology map could be improved as an analysis tool.

20. Page 176, last paragraph

Magnitude and intensity are not merely different scales for the same thing (as Fahrenheit and Celsius are for temperature). The last sentence could be better stated: "That magnitude 4 is generally comparable to an intensity V."

21. Page 205, 1st full paragraph

Will Western Area Power Administration's sensitivity analysis adhere to the NEPA and the associated CEQ Regulations? The Forest Service will require adherence to the NEPA process for all project analysis work involving National Forest lands. The last paragraph on page 101 of the draft should be restated on page 205.

22. Page 206, 3rd paragraph

A statement should be added regarding National Forest lands and resources management planning. Add the following: "National Forest lands and resources management plans will be completed by late 1985. Power transmission routes, identified by Western as part of the interconnecting system, will be coordinated with the utility corridor evaluation section of these plans with the objective being to keep the routes within Forest Service designated corridors."

23. Page 207, Item 4

Rewrite Item 4 as follows: "The Fishlake National Forest has identified five existing transmission line rights-of-way that may be designated as corridors, as a result of the Forest planning. Studies conducted as part of this Forest planning will determine the expansion potential of these routes and other potential corridors on the Forest. Avoidance areas will also be designated. The existing transmission line rights-of-way are: the Sigurd-Cedar City 138 KV line; the Sigurd-Nevada State Line 230 KV line; the Sigurd-Cedar City 230 KV line; two 345 KV lines in Salina Canyon, one from Huntington to Sigurd, the other from Emery to Sigurd; and the two 345 KV lines from Lynndyl to Mona through Leamington Pass."
24. Page 207, Item 5

The Wasatch-Cache National Forest has identified potential corridors which may or may not be designated as utility corridors in the Forest land and resources management plan. Reference to corridors must be modified by the word "potential."

If the Flaming Gorge to Hyrum interconnecting transmission line crossed the Wasatch-Cache National Forest on the North Slope of the Uinta Mountains, the line route would need to be evaluated as a corridor by the Forest. This would be done by amending the utility corridor section of the Forest Plan. The Plan presently does not address potential corridors in the area in question.

25. Page 207, Item 6

Rewrite Item 6 as follows: "The Manti-LaSal National Forest has identified three potential utility corridors in the vicinity of the Diamond Fork Power Interconnecting System. These potential corridors are the areas adjacent to and along the (1) proposed Deseret Generation and Transmission Cooperative 345 KV transmission line right-of-way, (2) existing UP&L 345 KV transmission line right-of-way from Huntington Power Plant to the Mona substation, and (3) existing Mountain Fuel Company gas pipeline right-of-way from Price to Payson. Preliminary corridor evaluation indicates that corridor widths along these routes would be limited, in most areas, to existing right-of-way widths."

26. Pages 207 and 208, Item 7

The right-of-way that is referred to—as not to be expanded—is the Bridger Valley 69 KV transmission line route. This route presently crosses the Flaming Gorge National Recreation Area. The right-of-way was in place prior to establishment of the NRA. This needs clarification in the FEIS.

It should also be stated in the FEIS that the corridor evaluation process of Forest land and resources management planning will state "any future utility proposals across the Flaming Gorge NRA would be in conflict with the law, intent, and purpose for which Congress established the area."

27. Page 208, Item 8

Change the word "corridor(s)" to "route(s)" in the paragraph. Corridor designation has not been finalized.

28. Page 208, Item 9

The Dixie National Forest has only one 183 KV transmission line right-of-way through the Mountain Meadow area.

There is also an existing 230 KV transmission line right-of-way in the Johns Valley area of the Forest.
The 500 KV transmission line route would only be designated a corridor if so evaluated in the Forest planning effort.

As with all National Forests, the Dixie is in the process of completing a Land and Resources Management Plan; thus, the last sentence of this paragraph should be changed to read, "The Forest is presently evaluating potential utility corridors as part of the land and resources management planning process."
August 15, 1983

C. I. Barrett
Regional Director
Bureau of Reclamation
P. O. Box 11568
Salt Lake City, UT 84147

Dear Cliff:

We have reviewed the Draft Environmental Impact Statement for the Central Utah Project Bonneville Unit Diamond Fork Power System. We have no comments.

We appreciate the opportunity to review the document.

Sincerely,

[Signature]

FRANCIS T. HOLT
State Conservationist
Mr. Clifford I. Barrett,
Regional Director
Bureau of Reclamation
P.O. Box 11568
Salt Lake City, Utah 84147

Dear Mr. Barrett:

The Draft Environmental Statement, Diamond Fork Power System, Bonneville Unit, Central Utah Project, transmitted to the Executive Director of Civil Works Environmental Programs, Office of the Chief of Engineers, has been referred to the Sacramento District for direct reply.

We have reviewed the Draft Statement and have concluded that the proposed project will neither conflict with nor adversely affect flood control, navigation, or other jurisdictional responsibilities of the Corps of Engineers.

The Draft Statement indicates that flood control would be provided by Syar, Sixth Water, and Monks Hollow Reservoirs. Preliminary flood control evaluations have been made by our District. More detailed studies and development of flood control operating criteria will be made as appropriate to your detailed study needs.

We have reviewed the Draft EIS with respect to the requirements of Section 404 of the Clean Water Act. It is our judgement that the Draft EIS contains the requisite information necessary for evaluation of the proposed discharges under Section 404(b)(1) guidelines. It is further our judgement that the proposed discharges are consistent with these guidelines.

Thank you for the opportunity to provide review comments.

Sincerely,

George C. Weddell
Chief, Engineering Division
Regional Director
Bureau of Reclamation
125 South State
P.O. Box 11568
Salt Lake City, Utah 84147

Dear Sir:

We have reviewed the Draft Environmental Impact Statement (EIS) for the Diamond Fork Power System, Bonneville Unit, Central Utah Project. We are responding on behalf of the U.S. Public Health Service and are offering the following comments for your consideration in preparing the final document.

We understand that the proposed project (Fifth Water Pumped Storage Alternative at a total construction cost of $1.118 billion dollars) would develop hydroelectric energy by means of transbasin diversion of water through a system of tunnels, pipelines, two reservoirs and powerplants. Other benefits include recreation, fish and wildlife measures, and flood and water quality control.

We have concern about the predicted water quality for the reservoirs of the Diamond Fork Power System and the quality of the releases to these proposed reservoirs from the Strawberry Reservoir. The construction of any of these reservoirs for recreational and water quality benefits might be made contingent upon the development and implementation of a satisfactory water quality and lake management plan. The construction of these reservoirs might also be made contingent upon the existence of controls for non-point and point sources of pollution sufficient to maintain and attain the applicable State water quality standards and designated uses of the proposed and/or affected surface waters.

We believe that the EIS should address the potential impacts associated with vectorborne disease or nuisance problems in the area. The design and construction of this project system must not allow any increase to occur in local vector populations which have the potential to cause vectorborne disease or nuisance problems. We suggest that the local and State health department be contacted for a history of the vectorborne disease and nuisance problems in the area and the steps necessary to mitigate and prevent the occurrence of any potential health problems. General health guidelines have been developed for controlling and preventing vector problems in conveyance and distribution systems, impoundments, and recreational areas. These guidelines and our publication, Mosquitoes of Public Health Importance and Their Control, 1977, are available upon request.

We would appreciate the opportunity to review the Draft EIS. Please send us one copy of the final document when it becomes available. Should you have any questions about these comments, please call Mr. Robert L. Kay, Jr. or me at FTS 236-4161 or 236-4257, respectively.

Sincerely yours,

Frank S. Lisella, Ph.D.
Chief, Environmental Affairs Group
Environmental Health Services Division
Center for Environmental Health
July 11, 1983

Mr. Clifford I. Barrett
Regional Director
Bureau of Reclamation
PO Box 11568
Salt Lake City, UT 84147

Dear Mr. Barrett:

Thank you for the opportunity to review and comment on the Draft Environmental Impact Statement, Diamond Fork Power System, Bonneville Unit, Central Utah Project.

Your Draft has been reviewed with specific consideration for the areas of responsibility assigned to the Department of Housing and Urban Development. This review considered the proposal's compatibility with local and regional comprehensive planning and impacts on urbanized areas. Within these parameters, we find this document adequate for our purposes.

If you have any questions regarding these comments, please contact Mr. Carroll F. Goodwin, Area Environmental Officer at (303) 837-3102.

Sincerely,

Robert J. Matuschek
Director
Office of Regional Community Planning and Development, 8C
DATE: AUG 17 1983

REPLY TO ATTN OF: Phoenix Area Director

SUBJECT: Draft Environmental Statement - Diamond Fork Power System, Bonneville Unit, Central Utah Project (DES 83/46)

TO: Bureau of Reclamation
   Regional Director
   Salt Lake City, Utah

A review of the above subject has been completed by the Uintah and Ouray Agency and our Area Environmental staff. There will be no direct impact to reservations under the Phoenix Area Office's jurisdiction. We, therefore, have no comment.
Memorandum

To: Regional Director, Bureau of Reclamation

From: Deputy State Director, Resources, USO, BLM

Subject: Comments on the Diamond Fork Power System Draft Environmental Impact Statement

We have reviewed the Diamond Fork EIS and find that at this stage of the project the analysis of the power transmission systems that would affect BLM is only conceptual and cannot be responded to in detail. In regards to the statement on page 206 of the draft that BLM indicated an environmentally acceptable plan could be developed, it should be noted that BLM has not committed to permitting of any proposed corridors and could not do so until full NEPA compliance is carried out for the power transmission system corridors.

BLM concurs with the Bureau of Reclamation statements on pages S-9, 1, and 101 that site specific environmental documents will be required for the power distribution system. Because the power generation and transmission facilities would both be required for a complete system, it may be appropriate to better define the required transmission system and analyze it as part of the Diamond Fork EIS. This is addressed under 40 CFR 1502.4 which requires that proposals or parts of proposals which are related closely enough to be a single course of action be evaluated in a single impact statement. Decisions for investment of funds in a power generation system without assurance or concurrent decisions on a power transmission system may be contrary to 40 CFR 1506.1 which directs federal agencies to not carry out actions on a program being studied under NEPA when it tends to determine subsequent development or limit alternatives. If the power generation system were in place, the "No Action" alternative would no longer be available for the transmission system without jeopardizing a substantial investment.

We also have the following specific comments.

1. The cover and title page of the document should read "Environmental Impact Statement" rather than "Environmental Statement" to comply with 40 CFR 1508.1 and 1508.11.
2. To reduce impacts to a minimum BLM would encourage maximum use of wheeling as described on pages 5-5. Transmission lines should be planned in existing corridors where possible.

3. A true "No Action" alternative is not described in Chapter III nor analyzed in Chapter IV.

4. The discussion of Moab District Concerns on page 206 may not be pertinent as the descriptions of plan 1 and plan 2 (pp. 99-103) do not include any facilities in the Moab District.

We appreciate the opportunity to review and comment on the Diamond Fork EIS. We have not commented on the full scope of the analyses but only on those items of concern to BLM.
Memorandum

To: Regional Director, Bureau of Reclamation, P.O. Box 11568, Salt Lake City, Utah 84147

From: Chief, Intermountain Field Operations Center

Subject: Draft Environmental Statement - Diamond Fork Power System, Bonneville Unit, Central Utah Project DES 83-46

The proposed project, located entirely within the Uinta National Forest, would consist of a series of projects including three tunnels, one pipeline, two dams, four powerplants, and appurtenant facilities. Estimated hydroelectric power generation could amount to 1,147 megawatts.

The Bureau of Mines primarily is concerned with potential conflict between the proposed project and mineral resources in the project area which lies within the Spanish Fork Mining District. Known mineral resource production from the district, however, is minor. Minerals known to occur in Utah and Wasatch Counties include base and precious metals, stone, sand, gravel, and clay. Apparently stone, sand, and gravel are presently being produced or have been produced in or adjacent to the project area.

This is an organized and well written report and we have no objection to it as written. We suggest, however, that subsequent versions of the document include an inventory of known and potential mineral resources in or adjacent to the project area, and a brief discussion of the effects the project might have on such resources.

Donald P. Blasko
MEMORANDUM

TO: Regional Director, Bureau of Reclamation (BR)
   Upper Colorado Regional Office
   Salt Lake City, Utah

FROM: Field Supervisor, Ecological Services
      Salt Lake City, Utah

SUBJECT: Draft Environmental Statement for the Diamond Fork Power System, Bonneville Unit, Central Utah Project (DES 83-46)

This is in response to your memorandum of June 17, 1983 requesting our review of the subject DES. We have reviewed the DES and offer the following comments.

General Comments

We find that the DES is adequate in regard to anticipated fish and wildlife impacts and mitigation measures in the Diamond Fork Drainage. However, impacts attributable to new transmission facilities to distribute power generated by the project have not yet been evaluated nor has an acceptable plan to mitigate for these damages been developed. The Thistle Slide has affected wildlife habitat of the area, and reevaluations of involved land values is warranted although we do not believe that this will substantially change the mitigation recommendations.

Specific Comments

The Environmental Staff of your Utah Projects Office pointed out errors in fisheries evaluation data contained in the Summary Table 2 (pages 5-6), Tables 40 and 41 (page 154), Table 44 (page 161) and Table 45 (page 164). We agree with the corrections that they indicated.

Page 1, third paragraph and page 46, first paragraph of Actions Required to Implement the Plan. Mention is made that the BR intends to pursue a course of action provided for by Section 404(r) relative to permits from the Corps of Engineers to discharge dredge-and-fill material below the normal high water level.
Page 2

It is not clear in the DEIS as to whether the Section 404(r) would also cover the proposed transmission lines outside of the Diamond Fork Drainage. If this is intended, we do not feel that 404(r) is appropriate as the proposed transmission lines outside of the Diamond Fork Drainage have not been evaluated.

Page 25, third paragraph; pages 39-40; page 61, first paragraph; and page 231, recommendation 1. The DES obligates the BR to acquire and develop lands, for wildlife management, that are presently in private ownership. Fee title or perpetual easements of 4,443 acres for wildlife is a part of the recommended plan (page 49, Table 6). These lands will also provide fisherman access on the lower 5 miles of Diamond Fork Creek (pages 50 and 61).

Implementation of this mitigation plan is dependent upon future appropriations of funds provided by Section 8 of Colorado River Storage Project Act. It is our understanding, however, that there is presently a moratorium on the use of these funds to acquire lands.

We believe the BR should seek an exemption to the moratorium for this project or an alternative source of funding to implement the wildlife mitigation plan. This seems necessary in order to assure implementation of the wildlife mitigation plan concurrently and proportionately with project construction.

Page 39, second paragraph. Other alternatives to screening outlet works to prevent the loss of fish may be possible. The FWS wishes to work closely with your staff and other involved agencies in developing plans to avoid losses of fish through power penstocks if possible. If losses cannot be prevented, we shall seek means for mitigation.

Pages 40-42. Railroad and highway relocations necessitated by the Thistle Slide affected some of the recommended wildlife mitigation lands. Consequently, the wildlife habitat on these areas needs to be reevaluated.

Pages 99-101 discusses alternatives to provide transmission and distribution facilities for power that will be generated by the project. The general types of environmental impacts that can be expected are addressed and it is stated (page 209) that implementation of Western Area Power Administration's standard mitigation procedures listed in Attachment 3 would, in most cases, avoid impacts to wildlife habitat. However, page 204 states that it is not possible at this time to identify specific corridors or impacts relating to the needed transmission system modifications.

Since the transmission system is a part of the Diamond Fork Power Project, we feel that impacts should be investigated by our Service in cooperation with other involved State and Federal agencies under authority of the Fish and Wildlife Coordination Act. Until such time that the impacts are quantified and acceptable mitigation plans are assured, exemption for Corps of Engineers permits in accordance with Section 404(r) for the transmission system is not appropriate.
Page 3

Page 112, fourth paragraph. The marsh at the mouth of Diamond Fork Canyon was affected by railroad and highway relocation work necessitated by the Thistle Slide. Consequently, wildlife habitat values of this area need to be reevaluated.

Page 155, paragraph 3 and the first half of page 16. During an April 20, 1983 interagency meeting with your staff, the Utah Division of Wildlife Resources (UDWR), U.S. Forest Service (USFS), and Fish and Wildlife Service (FWS), it was agreed that project plans should be reviewed to determine if additional streamflows in Sixth Water Creek could be provided on an interim basis without impairing power production. It was our understanding that this would be investigated by your Utah Projects Office.

Page 164, Table 45. At the minimum pool elevation, with the Fifth Water and Sixth Water Pumped Storage alternatives, the increase in standing crop (lb/year) should be 810 rather than 870. Similar corrections should also be made in the first and third paragraphs on page 165.

Pages 172-173, Endangered Species. Presently, the FWS is reviewing information and requesting comments to determine if the June Sucker (Chasmistes liorus mictus), should be proposed as an endangered species. This species inhabits Utah Lake and uses the Spanish Fork and Provo Rivers for spawning and larval rearing. Potential impacts to this species by the proposed project should be analyzed. It is possible that this species could be proposed for listing and/or listed prior to the initiation of project construction. If so, all compliances of the Endangered Species Act of 1973 and the 1982 amendments would have to be met.

Pages A-12 and 13, recommendations 11, 12, 15, 17 and 19, require coordination by the FWS with the USFS. We are presently coordinating with the USFS on these recommendations and will advise you as soon as possible what agreements are reached.

We appreciate this opportunity to comment on the subject DES.

Robert L. Jordan
Memorandum

To: Regional Director, Bureau of Reclamation
Salt Lake City, Utah

From: Assistant Director for Engineering Geology

Subject: Review of draft environmental statement for Diamond Fork Power System, Bonneville Unit, Central Utah Project, Utah and Wasatch Counties, Utah

We have reviewed the subject document as requested in a memorandum of June 17 from the Director, Office of Environmental Affairs.

General Comments

The effects that the Diamond Fork Power System would have on the geologic and seismologic environment are not adequately evaluated to permit judgments as to the environmental soundness of the proposed installations. Only the depth to bedrock at the several sites is given quantitatively in the section on geology. Throughout the text there are assertions, mostly regarding bedrock, alluvium, and soil, that are inadequately supported by data. The text should include ranges and means of test results of such critical physical properties as permeability, shear strength, fracture frequency, and bulk density. It is stated that "Most of the proposed reservoir basin area is blanketed with a layer of relatively impervious earth material which should prevent seepage" (p. 174, par. 4). The "earth material" should be identified and its thickness should be specified. "Relatively impervious" should be explained. The spacing of any permeability tests and their results should be given.

In the sections on seismic conditions and related impacts (p. 177-178) the data bases used are not current, nor are all site-specific studies integrated into the evaluation. A more adequate analysis of seismic risk and dam safety should be provided for the two proposed dams. Stability of slopes around the reservoirs should be evaluated, since they are partly in narrow, steep-walled canyons. The hazard of dam overtopping and downstream flooding in event of a landslide into a reservoir should not be overlooked.
Specific Comments

Abstract. It is stated that the increased water deliveries produced by the project will in part be used for municipal and industrial purposes; the probable distribution of the water for those purposes should be addressed.

p. 105. The statement should indicate whether herbicides are to be used in clearing and maintaining rights-of-way and facilities; if so, impacts on ground water and surface water should be evaluated.

p. 174, par. 1. "The general geology" should be changed to read "The location of faults relative to the main drainages."

p. 174, par. 2. For the Syar tunnel, additional information on geology is necessary in order to judge soundness.

p. 174, par. 3. A "fairly narrow valley bottom" is too general a description of the proposed Fifth Water Dam site, and "good rock conditions" should be explained.

p. 174, par. 5. The results of the in-hole tests should be given: lithology and depth of the hydrofracture experiment; what in-situ shear stresses were indicated at failure; whether the orientation of principal stresses was defined, and if so, how it compares with the regional state of stress; and what specifically the stress tests indicate regarding the excavation of the large chamber. The "overall suitable rock conditions" should be explained in more specific terms.

p. 175. Figure 27 should not be referred to as a geologic map. "Location of Faults" would be a more appropriate title.

p. 177. The unpublished map of seismicity might be replaced by published maps that are accessible to the public. Figure 1-5 or figure 7-1 in reference #15 are of better quality and more recent than the map on page 177. Also, inclusion of figure 7-6 from that reference would be helpful.

p. 178, par. 1. The report referred to (reference #16) has been superseded by U.S. Geological Survey Open-File report 82-1033, which should be used in this evaluation.

p. 178, par. 2. The discussion of maximum credible earthquakes associated with major faults mentions faults located 4.5 and 9 miles east of the easternmost end of the project area but fails to discuss the Wasatch Fault, which appears to be somewhat closer to at least one of the proposed damsites.

p. 178, par. 3. The reference to "a very remote possibility" should clarify whether this takes into consideration the results of in-situ stress measurements, and if not, why not.

p. 180 to 197. The evaluation of effects on population growth should include an assessment of resultant impacts on water-supply and sewerage systems in affected communities.

James F. Devine
Memorandum

To: Regional Director, Bureau of Reclamation, Salt Lake City, Utah

From: Associate Regional Director, Planning and Resource Preservation, Rocky Mountain Region

Subject: Review of Draft Environmental Statement for the Diamond Fork Power System, Bonneville Unit, Central Utah Project, Utah and Wasatch Counties, Utah (DES 83/46)

The National Park Service has completed its review of the subject document and would like to offer the following comments.

We wish to commend the Bureau of Reclamation for the recreation research and planning which were done in conjunction with this project and the preparation of this document. We were pleased to see that the Utah Statewide Comprehensive Outdoor Recreation Plan (SCaRP) was consulted and that the proposed recreation facilities have been designed to help alleviate specific recreation shortages outlined in the SCaRP.

The site of the proposed Diamond Fork Powerplant lies at the base of Thistle Canyon Landslides, a potential National Natural Landmark. While we do not anticipate that the powerplant will have any direct impact on this potential landmark, it should be taken into consideration during further project planning and efforts made to avoid adverse visual impacts to the greatest extent possible.

We are also aware that the recent landslide in this area has changed the topographic features of this section of Spanish Fork Canyon and that project modifications may have to be made. We will look forward to reviewing any further documentation outlining changes in the proposed project and/or alternatives.

Richard A. Strait
Dear Mr. Barrett

We have reviewed the draft Environmental Impact Statement on your proposed Diamond Fork Power System Project and do not foresee any impact on aviation or its activities.

During your planning process for determining final transmission line routing, keep in mind that notice to the Federal Aviation Administration (FAA), is required when any structure or catenary would exceed 200 feet above ground level or when any structure or catenary within 20,000 feet of a public use airport with a runway more than 3200 feet in length exceeds a 100:1 slope from the airport (within 10,000 feet of a public use airport with a runway not more than 3200 feet in length exceeds a 50:1 slope from the airport). Enclosed is FAA Advisory Circular, "Proposed Construction or Alteration of Objects That May Affect the Navigable Airspace," for your use. If you do need to file a notice with the FAA, please call Ms. Kathy Paul of our Airspace and Procedures office in Seattle, (206) 431-2535 or (FTS) 446-2535, prior to filing notice.

Thank you for the opportunity to review your proposed project.

Sincerely,

Joseph W. Harrell
Policy and Planning Officer

Enclosure
Regional Director
Bureau of Reclamation
P.O. Box 11568
125 South State Street
Salt Lake City, Utah 84147

Dear Sir:

The Region VIII Office of the Environmental Protection Agency has completed its review of the Diamond Fork Power System Draft Environmental Impact Statement (DEIS). Our comments on the Diamond Fork Power Project action of the Bonneville Unit of the Central Utah Project (CUP) are directed only to the present draft of the environmental impact statement, and should be considered supplemental to previous EPA comments on this and other actions of the CUP.

EPA is primarily concerned with the potential effects on water quality related to trans-basin diversion in the Bonneville Unit. The trans-basin diversions associated with the Diamond Fork Power System will increase salinity in the Colorado River Basin. Therefore, it is necessary that these water quality impacts be identified and quantified in the final EIS. We offer the enclosed comments and concerns for your consideration in the preparation of the final environmental impact statement.

According to our guidelines, we have rated this DEIS as LO-2. This means that we have no objections to the proposed action as presented in the DEIS. We do feel that more information and/or some modifications are necessary as our comments indicate. If you have any questions regarding EPA concerns, please contact Mike Hammer of my staff at (303) 837-2351.

Sincerely yours,

John B. Welles
Regional Administrator

Enclosure
The following are EPA's detailed comments:

p. 39 The draft states that a minimum D.O. of 5 mg/l must be maintained to support the fishery and that if upon operation of the system, D.O. falls below that, "appropriate measures will be implemented". The Final EIS should specify what these measures are and who will implement them, if needed.

p. 42 The discussion of mitigation - water quality refers only to mitigation of water quality impacts related to the construction phase. Mitigation should also be discussed for the operational phase.

p. 95 Table 20 indicates the potential for a significant lowering of D.O. What will be the impact on receiving waters and how does this compare to the stream classification and criteria?

p. 112 The DEIS acknowledges that riparian habitat is very limited (5%) in the project area. Therefore, it is critical that adverse impacts be avoided and/or mitigated.

p. 115 How does the slide at Thistle impact the information provided regarding flows in the Spanish Fork River?

p. 118 Table 24. Are the following "Project monthly flows" correct? Maximum year, February and March? Also minimum year, August?

p. 122 The discussion of water quality would be clarified by including a "pre" and "post" project comparison in table format. Perhaps Table 26 could be expanded for this purpose.

p. 123 The DEIS acknowledges that water from Strawberry Reservoir would be of poorer quality in terms of nutrients and dissolved oxygen. What impacts will this have on receiving waters and how would this relate to current stream classifications and criteria? What measures are being proposed to mitigate adverse water quality impacts?

p. 133 See comments for page 123.

p. 138 What impact may the possible "anaerobic" bottom sediments have on receiving waters? Are there any possible heavy metal problems in any of the associated reservoirs and/or streams?
p. 174 Are there any similarities between the geology at the Thistle slide site and the geology in the project area? Geographically, the two sites are not that far apart.

We understand the EIS is intended to fulfill requirements for exemption from a Section 404 permit. The granting of a Section 404(r) exemption should not preclude the desirability for a sediment control plan. The preparation and implementation of such a plan is necessary to assure that water quality degradation during both construction and system operation is minimized.

This sediment control plan should include, as a minimum, the following:

1. Identification and location of temporary measures such as berms, dikes, dams, sediment basins, fiber mats, netting, gravel filters, mulches, grasses, slope drains, or other control devices which are in place or will be installed to control sediment resulting from all sources of water flowing into the construction area.

2. Methods of controlling drainage from haul roads and access roads.

3. A listing of material, machinery, and manpower available at the site for erosion control.

4. The identification and location of permanent erosion control measures such as stabilization and revegetation or terracing of steep slopes and other disturbed areas as well as any other measures necessary to assure long-term protection of water quality.

5. Maintenance of a buffer zone along the stream, whenever practicable, to protect water quality. Clearing of vegetation in the reservoir pool areas should be minimized until construction of a dam has progressed to the point that runoff from disturbed areas can be controlled. The sediment control plan should indicate the location and extent of buffer strips and contain a schedule of clearing activities.

6. Identification of an on-site water quality control officer who will be responsible for implementing water quality control measures.

7. Tentative schedule of implementation of temporary and permanent control measures.

8. The sediment control plan should include a water quality monitoring program. As a minimum, this program should consist of sediment and turbidity sampling and analysis to be conducted at stations established above and below the construction site and at any other location within the construction area which may be a source of pollutants to the principal drainage. Samples should be collected at least twice weekly during the construction period.

The State of Utah may also require a sediment control plan as part of the Section 401 water quality certification. One well-prepared plan should satisfy the requirements for both Sections 401 and 404.
Mr. Clifford I. Barrett  
Regional Director  
Bureau of Reclamation - Code 730  
Upper Colorado Regional Office  
P. O. Box 11568  
Salt Lake City, Utah 84147  

SUBJECT: Draft Environmental Impact Statement  
Diamond Fork Power System of the  
Bonneville Unit, Central Utah Project  

Dear Mr. Barrett:  

The Colorado Clearinghouse has received the above-referenced Draft Environmental Impact Statement and has distributed it to interested state agencies. Comments received from the Colorado Division of Wildlife and the Office of the State Engineer are enclosed for your information.  

Thank you for the opportunity to review this matter.  

Sincerely,  

Stephen O. Ellis  
Chief Planner  

SE/HL  
Enclosures
MEMORANDUM

July 29, 1983

TO: Steve Ellis
Colorado Clearinghouse

FROM: Ann B. Hodgson
Wildlife Program Specialist

RE: Diamond Fork Power System, Bonneville Unit, Central Utah Project (Bureau of Reclamation)

The Colorado Division of Wildlife has reviewed the above-referenced document and has determined that the proposal is not anticipated to affect fish and wildlife resources in the State of Colorado.

Thank you for the opportunity to comment. Please don’t hesitate to call if you have any questions.

ABH: jb
cc: P. Olson (for distrib)
USFWS/Denver, SLC
EPA/Denver
file
MEMORANDUM

TO: State Clearinghouse

FROM: Jim Hall, Water Resource Engineer
For: Hal D. Simpson, Assistant State Engineer

SUBJECT: Diamond Fork Power System, Draft Environmental Impact Statement (DEIS)

We appreciate the opportunity to review the above referenced DEIS. We have no comments on the report at this time.

HDS/JRH:ma
July 12, 1983

Mr. Clifford I. Barrett
Regional Director
U.S. Bureau of Reclamation
Region 4
P.O. Box 11569
Salt Lake City, Utah 84111

Dear Mr. Barrett:

We have reviewed the Draft Environmental Statement for the Diamond Fork Power System of the Bonneville Unit, Central Utah Project (DES 83-46), which was enclosed with your letter of June 17, 1983.

Our only comment is in regard to the possible differences in water requirements between a system with only flow-through powerplants versus a pumpback system. Since the pumpback system requires a larger reservoir and would consume more water because of evaporation, it would seem that this alternative requires additional water for export from the Colorado River Basin. However, the report seems to indicate a diversion of 197,600 acre-feet per year for all of the alternatives.

Thank you for the opportunity to review this report.

Sincerely yours,

Myron B. Holburt
Chief Engineer
September 1, 1983

Mr. Clifford I. Barrett
Regional Director
U.S. Bureau of Reclamation
P.O. Box 11568
Salt Lake City, UT 84147

Subject: Comments on the Draft Environmental Statement for the CUP Diamond Fork Power System; Aquatic Wildlife.

Dear Cliff:

The following are our aquatic wildlife comments on the subject document. We previously transmitted our terrestrial wildlife comments. Our comments below refer to page, paragraph (with paragraph 1 being the first on the page, even if continued from preceding page), table, or figure, and sentence.

Page 5-6, Summary Table 2:

In the rows on "Fish (lb/year: Streams and Reservoirs", the numbered values are incorrect for each development alternative. The following values are correct:

<table>
<thead>
<tr>
<th>Development Alternative</th>
<th>Fish (lb/yr)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Streams</td>
<td>Reservoirs</td>
</tr>
<tr>
<td>Future without condition</td>
<td>+2,384</td>
<td>—</td>
</tr>
<tr>
<td>Fifth water pumped storage</td>
<td>+2,794</td>
<td>+2,077</td>
</tr>
<tr>
<td>Sixth water flow through</td>
<td>+2,734</td>
<td>+ 519</td>
</tr>
<tr>
<td>Sixth water pumped storage</td>
<td>+2,734</td>
<td>+ 864</td>
</tr>
<tr>
<td>1964 DPR</td>
<td>- 444</td>
<td>+1,337</td>
</tr>
<tr>
<td>No power</td>
<td>+2,734</td>
<td>-0-</td>
</tr>
</tbody>
</table>

In addition to the above table corrections, it should be stated in the table (as a footnote or in the Environmental category heading as "Wild Fish (lb/yr)") that the fish biomass values are for wild trout only. The inclusion of hatchery trout values would greatly increase biomass estimates.

Page 25, paragraph 4, sentence 6:

Is the "normal discharge" range 0 to 20 cfs in Fifth Water Creek, as stated or is it 1-20 cfs as according to page 114, paragraph 4, sentence 4, or 0.5 to 20 cfs as stated on page 116, paragraph 5, sentence 4?
Page 117, paragraph 4, sentence 2:
Is the reach of Diamond Fork River between Spanish Fork River and Monks Hollow power plant 7 miles as stated, or 8 miles as stated in the USBR Fisheries Impact Analysis and Mitigation Recommendations report of June 1983?

Page 117, paragraph 5, sentence 7:
Just how long is the "short reach of Diamond Fork Creek above the Spanish Fork confluence" that will receive 875 cfs. We understood that the 450 cfs Diamond Fork pipeline would extend clear from Monks Hollow Dam to the Spanish Fork River, and based our impact assessment accordingly.

Page 130:
Is this illustration Figure 25?

Page 245, Table 33, Stream Reach 3:
Angler use (days/year) should be 104, not 107.

Page 150, Table 37, Stream Reach 1:
Habitat units should be 94, not 86.

Pages 154, 159, and 161, Tables 41, 43, and 44, Headings:
The trout fishery evaluation values are for 1992 (5 years into operation), not for the first year (1987).

Page 163, paragraph 4, sentence 1:
The reference to "Youngs and Heimlich" should have a date in parentheses, and the complete reference should be included in the literature citation section.

Page 164, Table 45, Project alternative - Fifth Water and Sixth Water Pumped Storage:
The "Increase In Standing Crop (lb/year)" value should be 810, not 870.

Page 165, paragraph 1, sentence 1 and paragraph 3, sentence 2:
In each sentence, "870" should be "810".

Page A-14, include as item 8:
"Sixth Water Creek fish habitat restoration. Restoration is specified as fishery mitigation under the 1964 DPR alternative by the Fish and Wildlife Service Coordination Act Report (Part I - Streams).

These comments conclude our response to the subject document. We appreciate the opportunity to aid in early project planning.

Sincerely,

[Signature]

Douglas F. Day
Director
August 16, 1983

Mr. Clifford I. Barrett
Regional Director
Bureau of Reclamation
P.O. Box 11568
125 South State Street
Salt Lake City, UT 84147

Dear Mr. Barrett:

The State of Utah recognizes that the Diamond Fork Power System Draft Environmental Impact Statement adequately describes the environmental impacts of each of the five alternatives described. The Diamond Fork project represents a true multiple use concept in water resource development.

Selection of any one of the four alternatives described, excluding the no power alternative would be satisfactory. Of course, the particular alternative chosen will depend on the support ultimately shown by interested investors. The Diamond Fork Power System is essentially in harmony with other water resource development in the state and should compliment state of Utah water projects.

Enclosed are more detailed comments which are offered in a supportive and constructive spirit.

Sincerely,

Governor

SMM:tar
Enclosure
<table>
<thead>
<tr>
<th>Page</th>
<th>Paragraph Line, Figure, Table</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>43</td>
<td>Paragraph 3</td>
<td>Sediment and erosion control plans must be reviewed by the Utah Division of Environmental Health prior to granting construction permits to insure protection of water quality and aquatic habitat.</td>
</tr>
<tr>
<td>43</td>
<td>Paragraph 4</td>
<td>Reservoir sites must not be cleared until dam construction is near completion to prevent erosion and excessive downstream siltation.</td>
</tr>
<tr>
<td>43</td>
<td></td>
<td>Inspections by Water Pollution Control staff prior to and during construction must be conducted to assure compliance with approved plans.</td>
</tr>
<tr>
<td>46</td>
<td>Paragraph 4</td>
<td>Sanitary and other pollution control facilities must be inspected prior to operation as well as approved before construction.</td>
</tr>
<tr>
<td>123</td>
<td>Paragraph 1</td>
<td>Certain stream sections may need to be upgraded to a LC classification if utilized for drinking water at a future date.</td>
</tr>
<tr>
<td>123</td>
<td>Paragraph 2</td>
<td>Although present turbidity levels are high, State Water Quality Standards for turbidity are probably not violated. There is an incorrect interpretation of State Standards.</td>
</tr>
<tr>
<td>127</td>
<td>Paragraph 4</td>
<td>The nutrient budget and loading for the present Strawberry Reservoir watershed has been evaluated. The statement that the Reservoir is even more eutrophic than the phosphorus loading model indicates does not agree with our evaluation. The high inflow loadings should predict a eutrophic level.</td>
</tr>
<tr>
<td>131</td>
<td>Paragraph 4</td>
<td>We also disagree with the predicted trophic level of the enlarged Strawberry Reservoir. Without a reduction in phosphorus loadings, the west and upper ends of the system will probably remain eutrophic. The lower end from the present Strawberry Dam to the New Soldier Creek Dam will have better water quality because the major phosphorus loadings enter in the opposite end. Also, according to present reservoir flow release patterns, currents will also be westward toward</td>
</tr>
</tbody>
</table>
the Diamond Fork aqueduct. The east portion of the enlarged reservoir will probably be closer to mesotrophic which is the recommended level for a healthy and productive reservoir system.

The proposed reservoirs on the recommended Fifth Water alternative will be filled with water heavily laden with phosphorus from Strawberry. The reservoirs will probably not be influenced by the phosphorus, and problems associated with eutrophic systems (oxygen depletion, algae bloom etc.) will not be significant due to water level fluctuations and short detention times.

Rerouting of the D&RGW railroad and Highway 6-89 from Diamond Fork east to east of Thistle as a result of the Thistle Slide has reduced the habitat unit values of several parcels of land identified as possible mitigation for the project. Parcels of land impacted include: C-6, FS-3, C-4, K, C-5 and possibly FS-5 and S-4. Habitat unit values will need to be recalculated and worked into the mitigation plan accordingly.

Forbs and shrubs should also be included in revegetation plans.

Water surface area cannot be classified as wetland habitat as stated and rated as such.

This statement is no longer valid since the relocation of the D&RGW railroad and Highway 6-89 as a result of the Thistle Slide has eliminated the marsh.

The increase in standing crop (lb./yr.) at the minimum water level in Monks Hollow Reservoir for the Fifth Water and Sixth Water Pumped Storage alternative should be 810 instead of 870.

870 should be 810.

870 should be 810.
### WILDLIFE RESOURCES (continued)

<table>
<thead>
<tr>
<th>Page</th>
<th>Paragraph Line, Figure, Table</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>166</td>
<td>Lines 32 &amp; 33</td>
<td>Diamond Fork is the proper deer herd unit name rather than Diamond.</td>
</tr>
<tr>
<td>202</td>
<td>Paragraph 2</td>
<td>Western's standard mitigation measures include modifying construction activities during breeding seasons of sensitive species (Appendix 3). Accordingly, construction activities on transmission lines should be coordinated with the Division of Wildlife to avoid seasons when wildlife are under stress. These would involve primarily big game winter ranges (November 1 through May 1) and deer fawning and elk calving seasons (May 1 through June 30). Additionally, construction on any transmission line passing within one-half mile of a golden eagle nest should be restricted during the nesting period from February 15 through May 15.</td>
</tr>
<tr>
<td>209</td>
<td>Paragraph 2</td>
<td>Additional impacts which should be listed include disturbance impacts during critical seasons for wildlife as listed in the previous comment.</td>
</tr>
<tr>
<td>210</td>
<td>Paragraph 4</td>
<td>This will be the case in all respects except big game hunting. Improved access will increase hunting pressure, which will result in a lower success rate and reduced quality of hunting.</td>
</tr>
</tbody>
</table>

### TRANSPORTATION

<table>
<thead>
<tr>
<th>Page</th>
<th>Paragraph Line, Figure, Table</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Map Facing Title Page</td>
<td>Location of Diamond Fork Power Plant probably interferes with the relocated D&amp;RGW roadbed and the realignment of US-6 around the Thistle Slide.</td>
<td></td>
</tr>
<tr>
<td>74</td>
<td>Figure 18</td>
<td>There is a possibility that the Hays Reservoir site at the mouth of Diamond Fork, 1964 DPR Alternative, would be compromised through the realignments of the D&amp;RGW tracks and US-6.</td>
</tr>
<tr>
<td>196</td>
<td>Paragraph 3</td>
<td>Peak year expected employment for the recommended alternative is approximately 2100 private government employees. As noted in the DEIS, this addition to an already heavily used roadway could result in some local highway congestion. Carpools are suggested as a mitigating action. The state, through programs implemented through</td>
</tr>
</tbody>
</table>
the Utah Energy Office, actively encourages carpooling that not only eases congestion but saves precious fossil fuels and reduces auto emissions. Assistance is available to the selected contractor through the state to develop a program. Sponsor endorsement should be as strong as possible to assure the contractor pursues carpooling efforts.

There is a general concern as to the effect additional water delivered to the Great Basin, due to the transbasin diversion, will have on roads crossings over and near the Spanish Fork River, Utah Lake, Jordan River Jordan River Parkway, Great Salt Lake.

The need for the power from the project is established on the basis of a 1981 Western Area Power Administration (WAPA) power marketing survey. The survey estimated both peaking and baseload resources were needed in addition to existing resources and those presently committed for construction. This is a survey and, consequently, represents a projection by the utilities surveyed rather than a detailed forecast. The survey does not reflect changes that have occurred in power generation projections on almost a yearly basis. The state of Utah plans to request that WAPA update its power survey and keep it updated on at least a biannual basis. However, this should not be construed as a request that the EIS be delayed pending such an update.

A more crucial aspect for USBR to address in the final EIS is the relationship between the marketability of CRSP power and the price at which the DFPS output would be sold. It is our understanding that the price of this new power would be rolled in over the rate structure of the entire CRSP system. Through this average cost pricing approach, the power would be very attractive in terms of comparative costs with
other potential sources of peaking power. Consequently, the marketability of this power would not be in serious doubt. Confirmation of this understanding would be appreciated.

Frankly, we strongly back the application of revenues to the Bonneville Unit repayment of municipal and irrigation water once the payback of allocated costs has occurred. This should take place in lieu of returning these revenues to the Upper Basin Fund.

The Diamond Fork Power System (DFPS) is proposed to provide additional hydroelectric capacity and generate additional energy available as the result of the transbasin diversion of water as part of the Central Utah Project. In this proposal the DFPS will require electrical energy from the CRSP Interconnected Transmission System to pump water into the pumped storage system of the DFPS. The present proposal provides for operation in coordination with coal and oil-fired plants, to provide energy for pumping water into the storage system. We suggest that the DFPS not use oil-fired plants to provide part of the energy needed for the pumped storage system for two reasons. First, this would be counter productive in light of the national policy of minimizing the level of foreign oil imports into this country. By not using oil-fired generation to provide energy for pumping, there could be a small, but nevertheless measurable impact on foreign oil imports. Secondly, while world oil prices are now relatively low and stable, there is a certainty that this situation will not last long. World oil prices will undoubtedly increase by the time the DFPS is brought on line, and price stability since 1973 has been anything but stable. The net effect of this is that the cost of power from the DFPS will have an inherent, built-in, price instability which would be unfavorable to the intent and purposes of the DFPS. An alternative to oil-fired generation for pumping is, however, available.

There is surplus electrical generating capacity available here in Utah to provide the necessary energy for the DFPS pumped storage facility. This energy will be available from the Deseret
Generation and Transmission's Moon Lake Power Plant and the Intermountain Power Plant (IPP), both presently under construction. It makes no sense at all to use oil-fueled electrical generation from the west coast for pumping power at the DFPS when Utah is already, and will continue to increase generating electrical energy in coal-fired power plants solely for export to the west coast. Pumping power for the DFPS should be obtained from these coal-fired plants in Utah rather than the proposed plan in the DFPS. Obtaining pumping power from CRSP dams, such as Glen Canyon Dam, would be a more reasonable alternative than using oil-fueled power plants. But, since there is already a surplus of coal-fired electrical generation in Utah, these plants should be used for pumping power before any oil-fueled plants anywhere are used.

Sixth Water penstock is listed as 1,400 miles and is obviously in error.

Utah Division of Wildlife Resources. The position of Kendall L. Nelson should be "Regional Resource Analyst", and his education should be B.S. Wildlife Management, M.S. Range Management.
Mr. Clifford I. Barrett  
Regional Director  
Bureau of Reclamation  
Upper Colorado Regional Office  
P.O. Box 11568  
Salt Lake City, Utah 84147  

Dear Mr. Barrett:

Several state agencies have reviewed the draft environmental impact statement for the Diamond Fork Power System, Bonneville Unit, Central Utah Project and offer the enclosed general comments.

The only concern directly affecting Wyoming is the financial integration of the Central Utah Project into the power rate structure for the Colorado River Storage Project. The dialogue that WAPA and the Bureau are developing with the states and CREDA may reduce some of the problems associated with the pay-back requirements of the Colorado River Storage Project Act.

Thank you for providing the State of Wyoming with an opportunity to comment on the proposed Diamond Fork Power System.

Yours sincerely,

[Signature]

EH:ww1  
Enclosures
MEMORANDUM

TO: Paul Cleary, State Planning Coordinator’s Office

FROM: George L. Christopulos, State Engineer

SUBJECT: Diamond Fork Power System, Central Utah Project, Draft Environmental Statement, State Identifier No. 83-125

We have reviewed the above-referenced report on the Diamond Fork Power System as requested in your Memorandum of June 30, 1983. The project should not have any effect upon the State of Wyoming from a water resources standpoint, but it may have some effect from a power standpoint. There are some potential impacts on Colorado River Storage Project power rates, depending on which alternative is chosen and also whether non-Federal financing is used for the project.
MEMORANDUM

TO: STATE PLANNING COORDINATOR
FROM: Jon F. Jacquot, Lead Electrical Engineer, PSC
DATE: August 2, 1983
SUBJECT: Diamond Fork Power System, Central Utah Project, 83-125

The possible impact of the subject project on Wyoming will be the following:

1. Utility rates.
2. Power line construction.
3. Allocation of Colorado River water.

Utility rates could be affected if a utility operating in Wyoming chooses to become involved financially in the project. Rates Wyoming utilities pay Western Area Power Administration for Colorado River Storage Project power could be affected by the inclusion of power from said project in CRSP allocations.

The Draft Environmental Statement cites the possible construction of a 115 KV transmission line from Archer to Glenrock to Casper to Yellowstone. The personnel at the Western Area Power Administration area office that would own and operate such a line say they know of no such line. They say USBR may have looked upon such a line as a means of marketing the available power in a very narrow sense. WAPA is planning an Archer-Alcova-Thermopolis-Yellowtail 230 KV line as an overall cure of problems forthcoming in its system and in the Rocky Mountain area in general.

Whether Utah has sufficient unused water allocations under the Colorado River Compact to provide water for this project may need to be answered. We will leave this to the State Engineer to answer.

JFJ: cap
July 29, 1983

Mr. Dick Hartman  
State Planning Coordinator  
Wyoming State Clearinghouse  
2320 Capital Avenue  
Cheyenne, WY 82002

RE: 83-125

Dear Mr. Hartman:

The draft EIS of the Diamond Fork Power System is complete and well-written. Although the recreational benefits of this project will not affect Wyoming, I do, however, have several comments regarding the recreation information presented on pages 18 and 210. They are as follows:

1) As a variety of measurements of recreation use exist, it would be most helpful if a recreation day was defined.

2) From a professional standpoint, the recreation capability estimates seem high. It appears a per acre capacity figure may have been multiplied times the acreage available for recreational use. This methodology, and the resultant estimate of recreation capability, may be inappropriate. The quality of the recreation opportunities demanded within the project area and the ability of the administering agency to manage the new facilities should be considered in determining the recreation capability. Additionally, the length of the use season should be specified. Perhaps these items were considered. If so, it would be helpful if the preparers mentioned the methodologies utilized to assess recreation capability. Such an explanation would justify their results.

Thank you for the opportunity to review the document.

Sincerely,

Karen Andrews  
Recreation Resource Economist
Regional Director  
BUREAU OF RECLAMATION  
Code 730  
P.O. Box 11568  
Salt Lake City, UT  84147  

Attention: Clifford I. Barrett  
Regional Director  

Subject:  UC-731, 500.2  
Draft Environmental Statement  
Diamond Fork Power Systems  
Bonneville Unit, Central Utah Power (DES-93-46)  

We have received a copy of the above noted Draft Environmental Statement for review and comments. C-E/Neyrpic, a subsidiary of Combustion Engineering, Inc., manufactures hydropower equipment. As such, it is with particular interest we reviewed the various power generation alternatives proposed in this study.  

We, C-E/Neyrpic, take this opportunity to express our interest in participating in development of the Diamond Fork Power System. We would appreciate being kept informed as specific guidelines for participation are developed. In the meantime, we would be willing to assist the Bureau by supplying technical and pricing information for use in future studies.  

Very truly yours,  

JOANNE REDDING  

JR/jb/4051
August 3, 1983

Mr. Clifford I. Barrett, Regional Director
Bureau of Reclamation
Code 730
P. O. Box 11568
Salt Lake City, UT 84147

Dear Cliff:

The District has reviewed the Draft Environment Statement for Diamond Fork Power Systems Bonneville Unit, Central Utah Project and offer the following comments.

1. Summary Table 1 indicates that the Sixth Water Flow Through Alternative is more economical that the 1964 DPR Plan ($14,000,000 versus $11,500,000 Annuals increment net benefits). The capacity of the Syar Tunnel is shown at 500 cfs for the Sixth Water flow through plan and 400 cfs for the 1964 DPR Plan. The Syar Tunnel is therefore at 45% capacity versus 68% for the 1964 DPR Plan. The two electrical generation systems are therefore running at different plant factors and are not readily comparable. For instance, if the 1964 DPR plan were increased to 600 cfs, it would probably have greater net benefits than the Sixth water flow through system.

2. Page 5-5,* Permanent losses of vegetation, mostly from reservoir inundation would total about 1000 acres for the recommended plan, including about 45 acres of scarce riparian habitat. Temporary losses of vegetation, mostly from constructions of the Diamond Fork Pipeline and development of borrow area, would total about 400 acres, most of which is receded and mountain brush communities. Why is 4440 acres being acquired for mitigation?

3. Page 5 Footnote: It has not yet been determined if the 15,800 acre-feet will be provided as part of the Bonneville Unit. It has not yet been determined that the recirculation plan will be the selected alternative.

4. Page 12 second line: Rays Valley runs North and South not laterally along Fifth Water Creek.

5. Page 14 third paragraph: This paragraph should be rewritten.

6. Page 18, Flood Damage and Erosion: A description of the flood of 1983 should be included.
7 - Page 49 Table 6 Lands for Project features: The acreages acquired for project purposes appear to be greatly exaggerated to mitigate actual project losses.

8 - Page 88, Table 17 Lands for Project features - No Power Alternative: It is not clear why any mitigation is required for this alternative.

9 - Page 89, Alternative capacities considered for the Fifth Water Pumped Storage Alternative.

The discussion of the 500 MW and the 2000 MW alternative is a trivial effort and appears to only justify the pre-selected size. Why was 1200 MW or 1400 MW not selected?

10 - Page 87, third paragraph: Why would Reclamation operate and maintain the project facilities of the No Power Alternatives? This is in opposition to the contract with CUWCD which provides that Reclamation would operate the power system and CUWCD would operate everything else.

11 - Page 91, Table 18 Wildlife Mitigation Options: It is not clear why the recommended acreages were selected on any basis other than preference. What about animal unit months, range capacity, etc. Apparently, these were not considered.

12 - Page 95, Table 20 Comparison of environmental impacts of Diamond Fork Power System Alternatives: It is not clear what units aesthetics are measured in.

General:

It appears that an exceptionally large area has been incorporated in the project take line boundary, resulting in a like amount of land to be acquired for mitigation purposes. This District questions the need for such a large acquisition and the accompanying mitigation.

Very truly yours,

[Signature]

Lynn S. Ludlow
General Manager

LSL: sc

The Diamond Fork Power System, as part of the Bonneville Unit of the Central Utah Project, is another phase of a massive project that has already been charged with causing environmental, social, and economic degradation. These impacts range from the destruction of trout fisheries for 200 miles of streams, elimination of wildlife habitat and destruction of part of an alpine ecosystem to increasing the level of salinity of the Colorado River, increases for the level of the Great Salt Lake to proceeding with a project that is in need of a new repayment contract because of cost-ceiling problems.

The Diamond Fork Power System, in addition to contributing to the above consequences may create even more problems. The recommended plan, the Fifth Water Pumped Storage Alternative, consists of acquiring and managing at least 4440 acres of private land for wildlife mitigation. The disturbance to vegetation would require at least five to ten years for grasses, shrubs, and forbs to grow back, and at least 25 years for pinyon-juniper. It is unclear from reading the document where the mitigation lands for the project will be located. It is our position that mitigation should be done concurrently with project construction, rather than be added or considered after the fact.

It is also unclear from reading the document what the impact of the reservoir(s) fluctuation will be. How many acres of mudflats will be created, what will be the access to the reservoirs, what will be the impacts on the high quality wetlands, as well as the fisheries. There was little mention of measures to eliminate the problem of fish in the power system. In addition, it was pointed out that water stratification will result in excessive algal growth in the project. What impact will this have on recreation and fishing?

Another issue that made reviewing the document difficult was the absence of cost figures for the project and alternatives. Is this project part of the Central Utah Project System, therefore part of the questionable benefit/cost ratio of 3.2 to 1 (project data sheets list the b/c as 1.6 to 1) or does the system stand alone?

There is also the question of the number of jobs that are to be created by this proposal. The project is due to be constructed over a seven year period (based on 12 month construction cycle which is rather difficult to imagine given the location). During the peak year, the project will provide direct employment to about 2,100 private and government employees. That would be a total of 14,700 jobs if every year were the peak year. Yet tables on page 95 show the employment to be 20,646 jobs for this project. What is the formula for figuring jobs on these projects?

Also lacking in the report is any considerable discussion on the geology of the area. Most of the projects in this Unit have been beset with seepage and other problems requiring extensive work to fix. Rather than relying on "available data" an extensive review of the site geology should be undertaken given what I would call "unstable" conditions in the area.

EPC is a project of the Environmental Policy Institute

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The last area that is most troublesome is the discussion on whether the power is need or not, or whether the power is being produced because the basin-to-basin water transfer will provide the opportunity. The Draft Environmental Statement does not address questions such as where the power will specifically go because of the Basin wide approach that is taken to "wheeling" power. There is no discussion on the rationale behind Western's projections, they are just given to us as accepted. Early discussions in the Draft mention the great growth expectations for the Wasatch area but the power is spoken of in where it can tie in Basin wide (Colorado).

In addition, who the power will be allocated to or whether the project is going to be Federally or non-federally constructed has an impact on not only the CUP but also the whole CRSP system. I was under the impression that power revenues from this project would be used to take care of the portion of farmers payment above there "ability to pay" or would be fed back into the CRSP system. Is this not the case? If non-federal entities cooperate with construction and later share the energy produced, what would those lost revenues be allowed use towards?

Has it been clearly established that the operation of this project would not impinge on the irrigation purposes of the project?

One can only conclude from reading the Draft Environmental Statement that it is based on concepts and information that are included in the big picture of the Central Utah Project Bonneville Unit, a project that few understand. The public and the nation's taxpayers deserve a clearer picture of the implications of the construction of this project and the planned completion of the Bonneville Unit.
Clifford Barrett, Regional Director  
Bureau of Reclamation  
CODE 730, P.O. Box 11568  
Salt Lake City, Utah 84147  

August 15, 1983

Dear Mr. Barrett:

Intermountain Water Alliance requests that the following comments and recommendations be included in the responses to the Draft Environmental Statement for Diamond Fork Power System, Bonneville Unit, Central Utah Project.

General Comments on Diamond Fork Power Project EIS

The Diamond Fork Power Project EIS and its recommended pump storage peaking power development appears to be wholly deficient in providing the public current information on which to determine need for hydropower, what kind of hydropower, needed by whom, for what purposes and where, and willingness or ability of consumers to buy. There is no demonstrated need for peaking power of the magnitude recommended by the Bureau of Reclamation. WAPA and other power demand studies are not current enough to reflect regionwide and nationwide reduced power demand. Utilities and Agencies are now revising studies which should examine impacts on power demand due to the economic recession but also due to public conservation efforts which reduce demand and which has been their response to increased rates for their energy.

The EIS lacks recent and relevant information necessary to the public to determine need for the transfer of Colorado River water, the basis for Bureau proposed hydropower generation. The 1983 Wasatch Front flooding demonstrates the availability of surplus Wasatch Front water as well as dollar, human and land resource costs and destruction which could have been minimized if long recommended water management technologies had been pursued on the Wasatch Front.

In the absence of any current energy supply framework in the EIS, showing reduced energy demand, as well as excess energy available, and in the absence of relevant water supply alternatives and alternative energy suppliers' options, realistic socio-economic responses from local, State, Federal, private and municipal entities, who have to be involved in both energy and water supply, is not possible. The public cannot evaluate dollar and environmental costs and trade-offs to them and their communities for both water and energy supply. Bureau of Reclamation compliance with NEPA in this EIS appears to be limited in scope to specific land resource impacts whereas NEPA requires consideration of any and all socio-economic impacts resulting from a project.

Within our State, energy production has been reduced by half by Intermountain Power Project—from 3000 to 1500 megawatts. Utah Power and Light Hunter Plant #3 is underutilized and Hunter Plant #4 construction is delayed indefinitely. Other regional facilities are placed on hold because of reduced load growth; Allen-Werner Valley plant in Nevada, Washington Public Power Supply System nuclear Units 4 and 5 cancelled and Unit 1 mothballed. Inaccuracies by utilities in projecting reduced power demand, as well as impacts on demand from increased rates and public conservation, has raised questions that load growth may actually be less than zero through the end of the century. Slower load growth in the large midwestern States which purchase the majority of Northern Plains coal has led to massive overcapacity at existing mines. Yet the EIS contains no review of load management opportunities either by other utilities or by the Bureau. With WPPSS left with some $7 billion in debts, the worst utility debacle to date, the public in Utah has reason to demand presentation of all relevant economic and energy information which affects their decision-making.

For the Bureau to ignore this situation in promoting its own power generation, to fail to address load management and supply options, and based on current economic indicators, and to casually put off energy marketing on WAPA's future efforts, is action bordering on the irresponsible. For the Bureau to further segment this Bonneville Unit water transfer and power proposal from drastic new Wasatch Front flooding information and its subsequent $1,100,000 appropriation for studying this, is self-serving. The latter action is an admission that there are viable alternatives to costly CUP water, independently calculated to cost between $3 to $6 billion. And, hydropower generation opportunities, less costly than a $1 billion Diamond Fork Power Project, will be available in any Wasatch Front water management planning. There appears to be
hidden agendas on the part of the Bureau since there is no clarification of the relationship of the Bonneville Unit, CUP, to Bureau Wasatch Front water studies.

In view of these kinds of deficiencies in this EIS, the assumption can be made that the Bureau of Reclamation motives are not ones of cost efficient water management and energy supply; they are pursuit of power revenues to repay Bonneville Unit (BU) municipal and industrial water development costs. In such a case, the public needs to understand that there are severe resource misallocations which occur when hydropower revenues subsidize the price of urban water. Neither the price of hydropower nor the price of urban water reflect the true cost to the user. The ramifications of this policy upon the public are that resources are not being used judiciously and may further exacerbate the justification for unneeded projects (e.g. when water is priced lower than its real costs, the rate design promotes water usage. Growth in water demand is a well used rationale for building more projects).

Recommendations of Intermountain Water Alliance

The public has already been denied opportunity two years ago to address the high BU water costs and municipal and industrial (M & I) water charges as well as opportunity to vote, via public referendum, their willingness to continue support for development of this water. There are misrepresentations in the EIS of the amount of M & I water to "be received" by the Central Utah Water Conservancy District, over that contracted for in 1965, as the Bureau and the District evaded signing a contract renewal by using terms of the 1958 Water Supply Act. Similar efforts to evade disclosure of the best energy supply options for citizen taxpayers, for their communities and for their children appear to be taking place now in mist of this EIS. In fact, a Bureau official, responding to a question at a Diamond Fork Power System hearing, stated that the function of the Bureau was not one of evaluating (energy) supply options but one of supplying a service - implying that it is up to the public to determine "the best bang for the buck".

Intermountain Water Alliance recently made some casual streetside inquiries to determine what the general public knows and understands about the CUP-Bonneville Unit; its purpose, its need, what its development will cost them. Some 15 years after commencement of development, the general public has only the vaguest ideas about it - let alone their obligations for paying for the water. Other discussions with many citizens indicate serious concern that Utah citizens are not being well served by promoters of costly and outmoded water supply solutions. They are critical that needed Wasatch Front water management opportunities have been purposely delayed - deferred to CUP development. They are seeing the irrationality and failure to deal with a 1,690,000 acre foot Bear, Weber, and Jordan Rivers system which flows into a lake with no outlet, and a salt lake at that. They are further concerned at the degree of power over Utah's water which the Federal government is achieving now - without public review or agreement.

Intermountain Water Alliance requests, then, that all further Bonneville Unit, CUP water development be halted until there is a public forum to adequately inform the public about range of services and costs of these to them, to their communities, and to their children. And, that the public be given full opportunity to vote on their choice of water and energy management. Cost efficient water management on the Wasatch Front, and for it, may be the most critical problem facing Utahns in development of this Basin. Bureau of Reclamation hydropower generation may or may not be a necessary component of this management. Changed circumstances, updated water management technologies, new economics of both water and energy supply, the presence of CUP development costs escalated 5 - 7 times, the continual modification of Bonneville Unit purposes and plans - all call for a review of Utah water problems and solutions and a public choice in its services.

Deficiencies in the EIS Related to Need for the Power

The EIS provides insufficient information to demonstrate need for hydropower, peaking power, or the magnitude of a pump storage peaking power facility recommended by the Bureau. It is not adequate to refer to studies made in 1965 - when current facts show that energy demand projections have been wildly off base. IWA requests that the following deficiencies in information be supplied. There are -

- No amounts or kind of power demand which is current today.
- No population characteristics laid out, no evaluation of willingness of people and communities to pay for how much and what kind of power.
- No studies of acts which currently reflect reduced power demand and reasons for it.
- There is evidence that the economic downturn itself is a significant factor - that conservation measures on the part of the public play a significant role here. Also, there is no data on effects of increased costs and pricing on energy demand, how this has affected energy conservation, and no discussion of the role of utilities in reducing demand.

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- No evaluation of related power producers and alternatives for supply which reflects public response to rate increases.
- No discussion of load management options for energy producers.
- No criteria set forth to prevent overprojections of need, i.e. WPPSS.
- No information on current excess energy available.

The EIS addresses:
- No economics of Diamond Fork pump storage peaking power versus small need or no need, Bureau alternatives elsewhere, or alternative kind of supply which might be more cost efficient, i.e. gas turbine systems.
- No evaluation of possible consequences of BuRec hydropower management: over-compensating, extra capacity not used, not needed, or selling at a loss, no way to pay for it.
- No evaluation of BuRec hydropower alternatives related to Wasatch Front studies.
- No detailed disclosure of costs for the recommended project, rumored to be some $1 billion.

No guidelines yet addressed for cost sharing: who pays for what and who receives what revenues. The fact that guidelines are just being developed makes this BuRec proposal premature. The public has a right to know and understand all the ramifications of cost sharing prior to any decision-making.

While the Bureau refers to interested parties in participation in this hydropower proposal, it is not enough that such interest is referred to only. What entities are interested, to what extent are they interested, why? The public is not in a "trust us" mood today. What commitments support interest of entities? In view of the 1983 Legislature's change of the Conservancy District law allowing for power generation and marketing, it is necessary that the role of the District in any Diamond Fork power project be spelled out: its role and purpose of its role and how this will be accomplished if power revenues are to be used to repay BU M & I water development costs.

Since these are socio-economic impacts of critical relevance to the public, they must be addressed in the EIS.

Other Comments

Misrepresentation of Available Water and Purposes from Strawberry Collection System

Page 5, Chptr 1 EIS - "A total annual water supply of 310,400 acre feet would be provided, including 99,000 a f of M & I water, 204,900 a f for irrigation, and 6,500 for stream fisheries."

In lieu of signing a supplemental contract in 1980, the District used terms of the 1958 Water Supply Act to continue construction and agreed to "receive" 39,000 a f of M & I water. This amount is not the amount agreed upon in the 1965 Contract with the public. It is only one half the amount. How then do we now have 99,000 a f of M & I water to be delivered?

What does "receipt" of 39,000 a f of water mean? What is to happen to the other 60,000 a f? Is it committed to another purpose? What purpose? Does it flow down into the Great Salt Lake unused? How will this reduced amount of M & I water affect development of hydropower in the Diamond Fork System?

The EIS states that 204,900 a f of Colorado River water is to be used for irrigation. Yet Ed Clyde, lawyer for the District, stated that the BU, CUP water development is now an energy development. This changes the economics of the BU. The question must be answered whether, in fact, BU water is being developed cheaply, at Federal subsidy costs for irrigation water, and under the guise of developing irrigation water, when in fact it will be ultimately a more costly M & I water project.

Page 7, Chptr 1 Bureau of Indian Affairs Development

This is the first time IWA has heard of this classification of any Indian system of the Bonneville Unit. When did this change take place? Under what circumstances? Since the Ultimate Phase, Ute Indian Unit, has been dropped by the Bureau and declared infeasible, and this Unit was to resolve the priorities of Indian water rights, among other actions, where is this resolution or adjudication now taking place for Indian water rights? It is not stated in the EIS.

Page 8 Chptr 1 Clarification, both administrative and legal, is required of the
Diamond Fork Power System
Bonnieville Unit, CUP
Draft EIS - IWA Comments

Statement from the EIS: "The CUWCD has overall responsibility for administration of the Bonnieville Unit and would contract with the United States and the water users for repayment of reimbursable project costs for irrigation and municipal and industrial water. However no such costs would be associated with the Diamond Fork Power System. Water conveyance facilities, reservoirs, and powerplants would be operated and maintained by Reclamation. Switchyards and transmission lines would be operated by Western, which also would market the power..."

In view of proposed changes in other entity participation in both construction and marketing of power, such a statement is wholly inadequate today.

- On what repayment basis will the CUWCD contract with the Federal government? For what product? Water? Energy?

- Since the District already failed to contract a supplemental water supply, to meet its water development obligations, what will its obligations be for (a) water supply costs, and for whom? (b) energy supply costs and for whom? If energy revenues are to be used to repay M & I water development costs, now and when will this modification of Federal policy be brought about? Under what kind of conditions will the public be involved in this procedure? How will they be given a choice? When?

- What are the Federal regulations which condition, and how, the disbursement of costs when both water is developed and hydropower? When both developments are shared to produce separate products? Full disclosure of BuRec procedures must be spelled out: costs of construction for what product and what purpose, and for what benefits.

- What are the Federal regulations which condition costs and benefits to participants in Federal water and power generation?

Page 8, Chptr 1 CRSP Power

In view of changes either taking place or proposed in CRSP power revenues, as well as in power generation by non-Federal entities, some clarification of this situation must be provided the public. Where are the guidelines? What is the supervisory and regulatory review process, over whom, for what purposes? What options do CRSP power contractors retain now, or in the future? What impacts will changes in CRSP bring about?

Page 8, Chptr 1 All Discussions of Western Area Power Administration Involvement

Page 99, 100, 101 Chptr 3

It is not publicly satisfactory that involvement of WAPA in marketing and delivering of Diamond Fork hydropower is to be addressed sometime in the future and separately, with its own EIS. What is proposed, is leaving the tip of the iceberg undisclosed to the public who is being asked to make decisions now: costs, economic factors, load management, marketing, environmental trade-offs for Utahns for a product outside their State, fluctuating economic and energy situations which will condition WAPA marketing roles - all these factors are outside current public review. The public appears to lack both specific and comprehensive information on which to make decisions which will affect their pocketbooks, their way of life, the State public resources.

Many of the conditioning factors related to Diamond Fork Power System are unknowns to the public, some unknowns to the participants in developments. The EIS is premature, inadequate, and does not fulfill public need in the processes proposed.

Instream Flow Agreement: Affects of Agreement on Hydropower Participants and vice versa

The EIS must spell out specific management proposals for maintaining the Instream Flow Agreements. Both by Bureau and CUWCD as well as by Agencies obligated to come up with the balance of the water to sustain flows of 44,500 acre feet.

In addition, there must be a discussion of which streams are to be sacrificed, which streams are to be provided flows and what protection these flows will provide for which species.

Fish and Wildlife Mitigation

The public is not willing to put up with inadequate mitigation for lost wildlife habitat. It is absolutely essential that the following criteria be met:
- Mitigation in kind: species, seasonal/migratory habitat, migratory movement
- Mitigation within disturbed areas - not miles away
- Mitigation provided by the Bureau, and or participants, to replace lost or disturbed habitat. Mitigation cannot be transferred to a land managing Agency responsible for the habitat to begin with, assuming loss of habitat created by the development Agency can be managed for automatically.
- Mitigation must be satisfactory to wildlife and habitat managers as fulfilling their responsibilities.
- Mitigation must be concurrent with destruction of habitat actions.

Sincerely,
Dorothy Harvey, Coordinator

[Signature]
August 12, 1983

Regional Director
Bureau of Reclamation
Code 730
P.O. Box 11568
Salt Lake City, Utah 84147

Re: Central Utah Project, Bonneville Unit, Diamond Fork Power System, Draft Environmental Statement

Sir:

The National Wildlife Federation, a non-profit, District of Columbia corporation, is the nation's largest private conservation organization and, with its affiliates, has more than 4.5 million members and supporters. 1,695 of these members reside in Utah where they are potentially impacted by the Bureau's proposed decision to build the Diamond Fork Power System. The Federation has reviewed the Draft Environmental Statement for the Diamond Fork Power System of the Bonneville Unit of the Central Utah Project and finds that it fails to satisfy NEPA requirements.

A. The Transbasin Diversion Decision Must First Be Made.

The Diamond Fork Power System Draft Environmental Statement (hereinafter "Diamond Fork EIS") purports to analyze "site-specific environmental aspects of the Diamond Fork Power System of the Bonneville Unit of the Central Utah Project." Diamond Fork EIS at 1. The purported antecedent for this site-specific statement is an environmental impact statement prepared in 1973 titled Central Utah Project, Bonneville Unit, Final Environmental Statement (INT 73-42) (hereinafter "1973 EIS") which the Bureau refers to as a "programmatic final environmental statement for the entire Bonneville Unit." Diamond Fork EIS at 1. This characterization of the 1973 EIS is incorrect.

The scope of the 1973 EIS was contested in litigation. See Sierra Club v. Stamm, 507 F.2d 788 (10th Cir. 1974). The Sierra Club court found the 1973 EIS to be a satisfactory final statement as to only one system of the Bonneville Unit—the Strawberry Aqueduct and Collection System.

It would appear that now it is agreed that the Statement is intended to be a final one only as to the Strawberry Aqueduct and Collection System.
Regional Director  
Bureau of Reclamation  
August 12, 1983  
Page 2

* * *

The major federal action of Defendant Secretary Morton was limited to the approval of immediate construction of the Currant Creek Dam and to the continuation of the construction of the Strawberry Aqueduct and Collection System on a logical construction schedule.

In short, the 1973 EIS is not a programmatic EIS for the Bonneville Unit. Rather, it is an environmental statement for one feature of the Bonneville Unit—the Strawberry Aqueduct and Collection System—which the court perceived to have "independent utility." As such, the Bureau has yet to satisfy NEPA requirements with regard to the major, and pivotal, decision of whether to divert any water from the Uinta Basin to the Bonneville Basin. Until that critical decision is made—and supported by an environmental statement—it is premature to address the decision to build, and the site-specific environmental consequences of, the Diamond Fork Power System.

Further, even if the Sierra Club court had found that the 1973 EIS constituted a programmatic EIS for the Bonneville Unit, the Bureau could no longer rely on that determination. The 1973 EIS is 10 years old and obsolete. NEPA requires the Bureau to continuously evaluate new circumstances and information that might be relevant to the environmental impacts of its actions and to prepare supplements to already prepared environmental statements as necessary. See 42 U.S.C. § 4332(2)(A), and (B); 40 C.F.R. § 1502.9(C); Warm Springs Dam Task Force v. Gribble, 621 F.2d 1017 (9th Cir. 1980). If the decision-making framework changes, so must the analysis and, in some cases, the decision.

The decisional framework has changed substantially since 1973. The estimated cost of the Bonneville Unit in 1973 was $490 million. 1973 EIS at 383. The current estimate is over $2 billion. See Fiscal Year 1984 Project Data Sheet. The water and power demand projections utilized during project design have been called into question by the recent discovery that these commodities are price elastic. And the current flooding problems in the Bonneville Basin reveal that the Bonneville Basin may not be able to accommodate additional transbasin diversion water.

In addition, the present project configuration is substantially different from that presented in the 1973 EIS. In 1973, the concept was to build a Strawberry Aqueduct and
Regional Director  
Bureau of Reclamation  
August 12, 1983  
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Collection System that was an independent project capable of developing water to satisfy water demands wherever they might occur. It was then thought there was a need for that water in the Bonneville Basin. Alternatively, the water developed by the Strawberry Aqueduct and Collection System could stay in the Uintah Basin for energy development, either directly or through exchange projects. This purported independence was critical in the Sierra Club court's finding that the Strawberry Aqueduct and Collection System constituted an independent "major federal action" and that a programmatic EIS for the entire Bonneville Unit was not a necessary predicate for continuing construction on that particular system.

Since the publication of a 1979 environmental statement titled "Central Utah Project, Bonneville Unit, Municipal and Industrial System, Final Environmental Statement (INTFES 79-55)" (hereinafter "M&I EIS"), it is clear that this professed independent utility of the Strawberry Aqueduct and Collection System is no longer apt. The Municipal and Industrial System (M&I System) requires Strawberry Aqueduct and Collection System water (for exchange) in order to be viable. This is in contrast to the M&I System that was identified in the 1973 EIS. In 1973, the M&I System was said, also, to be independent—i.e., it did not rely on any other system of the Bonneville Unit for its utility or viability. Rather, the exchange water required for the construction and operation of the Jordanelle Reservoir was to be developed by the diking of Utah Lake, which was then identified as a component of the M&I System. In 1979, however, the Utah Lake diking portion of the M&I System was excised. As a result, the M&I System now relies totally on the Strawberry Aqueduct and Collection System for its exchange water. This exchange water must be transferred from the Uintah Basin to the Bonneville Basin. The Diamond Fork Power System is now proposed as the conduit for this transfer. Indeed, the justification for the Diamond Fork Power System is the need to convey water from the Strawberry Aqueduct and Collection System for use as exchange water so that the M&I System can be built.

The three systems together—the Strawberry Aqueduct and Collection System, the M&I System, and the Diamond Fork Power System—are now an integrated transbasin water diversion project. The underlying premise of the 1973 EIS that the Strawberry Aqueduct and Collection System is an independent water development project is, therefore, no longer valid. The three systems must be analyzed as a unit and not as separate independent pieces.
Despite these dramatic changes—increased cost, questionable water and power demand projections, increased Bonneville Basin flooding problems, and the current interdependence of at least three systems of the Bonneville Unit—the Bureau has failed to supplement the 1973 EIS. Without such supplementation, reliance on the 1973 EIS as a programmatic environmental statement for the Bonneville Unit is misplaced.

In sum, the Bureau has absolutely no justification for relying on the 1973 EIS as the programmatic environmental statement for the Bonneville Unit. Nor can the Bureau rely on the 1973 EIS as the environmental predicate for its apparent decision to construct the three-system transbasin diversion project discussed above. Instead, a legally sufficient environmental statement must first be prepared before the Bureau may make the threshold decision to proceed with the proposed three-system transbasin diversion project. Only after that decision is lawfully made is a site-specific environmental statement on the Diamond Fork Power System timely.

B. Specific Inadequacies of the Diamond Fork Power System EIS

Putting to one side the lack of a proper predicate (i.e. the absence of a legally, supportable decision to bring more water into the Bonneville Basin) for the proposed Diamond Fork Power System, the Diamond Fork EIS is, itself, inadequate for a variety of reasons:

1. Power demand projections are not justified.

The Bureau relies totally on a 1981 Western Area Power Administration (WAPA) Power Market Survey which suggests that both peaking and base load power supply is needed to meet future loads. The Bureau fails to fulfill its obligation to independently verify the accuracy of these projections. Moreover, the projections made in the WAPA survey are based on unverified information supplied to WAPA by utility companies in the survey area for 1975 to 1979. As such, the power projections are more akin to growth targets for the utility companies rather than rational estimates of the anticipated demand.

More importantly, the projections do not appear to adequately consider the price elasticity of power, or the effect of conservation measures on power demand.
Obviously, the power demand projections are critical in this instance. The Diamond Fork EIS states that the Diamond Fork Power System concept of diverting water from the Uintah Basin to the Bonneville Basin was selected "because it maximizes hydroelectric capacity and energy generation." Diamond Fork EIS at 2. If power demand projections are not justified, then the Diamond Fork Power System decision may not be justified.

2. Environmental Analysis of the Transmission Lines Cannot Be Deferred.

The Diamond Fork EIS acknowledges that new transmission facilities will be required to distribute the proposed Diamond Fork Power System power. The Bureau has not, however, addressed the environmental impacts associated with these new transmission lines. "It is not possible at this time to identify specific corridors or impacts relating to these modifications (of the interconnected transmission system) because the allocation of the power has not yet been made." Diamond Fork EIS at 204. The Bureau assumes that the transmission lines will be built, apparently at whatever environmental cost. Indeed, the existence of the transmission lines is assumed in the Diamond Fork EIS in order to justify the Diamond Fork Power System. This assumption ignores the interdependence of power generating facilities and power transmission facilities. The two must be analyzed as a single unit. If certain transmission facilities cannot be built for economic or environmental reasons, then the generating facility may need to be scaled down to reflect the reduction in power demand associated with the elimination of that transmission facility.

The separate analysis --i.e., "segmented"--approach invoked in discussing the Diamond Fork Power System concept does not give the public an opportunity to intelligently consider all the logical consequences of interrelated projects. Thus, it constitutes an unlawful segmentation of a major federal action under NEPA. See 40 C.F.R. § 1502.4.

3. Operational Impacts Are Not Adequately Addressed.

There is only a cursory review of the true environmental effects of the Diamond Fork Power System operation. It is misleading to talk about the "initial operation" effects when the project is purportedly justified on its "maximum operation" capability. The passing reference to daily drawdowns minimizes the dramatic aesthetic, ecologic, and safety impacts of the drawdowns that can be expected at Monks Hollow Reservoir and

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Fifth Water Reservoir. There is no identification of studies done which justify a minimization of this drawdown. There are no illustrations of the impacts of the drawdown. There is no mention of user acceptance of this drawdown. Without user acceptance, recreational benefits may be overstated. There is no description of the effect of this drawdown on the ecology of the area. And finally, there is no discussion of the operational problems of this drawdown during the winter season when ice forms on the surface of the reservoirs.

4. Construction Costs Are Not Identified.

The cost to construct the Diamond Fork Power System is extremely important to the decision-maker and the public. Someone has to pay for this project. Yet, no information about the economic impact of this project on the federal taxpayer, the local taxpayer, and the local or regional rate payer is included in the Diamond Fork EIS. The taxpayer may support a project which destroys recreational and aesthetic amenities if it will produce direct benefits to him at a certain cost. A different decision may be made if the costs are to be borne by the taxpayer in one state while the power benefits are exported and enjoyed in other states. These costs and economic issues are especially important in the Diamond Fork Power System context since the Bureau is considering non-federal participation in financing the project. The Diamond Fork EIS should discuss what the economic effects of this project are on the local taxpayer with and without non-federal participation. In addition, the EIS should discuss the economic effects on C.R.S.P. states if non-federal participation is allowed. These economic effects should include, inter alia, a discussion of the burden on other C.R.S.P. states if the revenues from the Diamond Fork Power System are not paid into the Colorado River Basin Fund.

5. Indian Deferral Agreement Is Not Discussed.

The Diamond Fork EIS does not adequately address the effect of the Indian Deferral Agreement. If the Ute Indian Unit and the Bureau of Indian Affairs development is not on line by the year 2005, water may not be able to be diverted transbasin through the Diamond Fork Power System. This may render the Diamond Fork Power System useless. (Indeed, it may well be that the impacts of the Ute Indian Unit and the Bureau of Indian Affairs development should be addressed in this EIS inasmuch as those developments seem to be an integral part of the viability of the Diamond Fork Power System.)

Despite assertions to the contrary, the Endangered Species Act is implicated because this project will effect a depletion of water from the Green River. Portions of the Green River are critical habitat areas for a number of endangered fish. See, e.g., Memorandum to State Director, Utah State Office, Bureau of Land Management from Acting Regional Director, Region 6, Fish and Wildlife Service regarding "Biological Opinion - White River Dam Project, Utah" dated February 24, 1982. Interestingly, the 1973 EIS which is relied upon by the Bureau, did not address the transbasin diversion effects on these endemic fish.

C. Recommendation

In light of the foregoing discussion, the National Wildlife Federation makes the following recommendations with regard to the Diamond Fork EIS:

1. Hold the Diamond Fork Power System decision in abeyance until the Bureau lawfully makes the decision to proceed with the transbasin diversion project. That transbasin diversion decision must be supported by an adequate environmental impact statement that addresses the synergistic and cumulative impacts of the major federal action that is proposed by the Bureau at this time—a transbasin diversion project consisting of the Strawberry Aqueduct and Collection System together with some form of the M&I System, the Diamond Fork Power System, and probably the Ute Indian Unit and the Bureau of Indian Affairs development.

2. Prepare a realistic market analysis to determine the actual power needs of the survey area. This market analysis should include, inter alia, a realistic appraisal of the effects of conservation measures and the effects of price elasticity on power demand. This particular recommendation appears especially prudent (as well as legally mandated) in light of the catastrophic overprojections of power demand recently discovered in the Pacific Northwest.

3. Make a more comprehensive review of the impacts associated with the reservoir fluctuations associated with the operation of the Diamond Fork Power System. These fluctuations may well be intolerable from an economic and environmental point of view. If so, the proposed power yield from the Diamond Fork Power System may have to be reduced.
4. Include a comprehensive discussion of the construction costs of the project. Identify the individuals, regions, states, etc. who will pay for the Diamond Fork Power System, and also those who will benefit from the power system.

5. Include a comprehensive analysis of the effect of the Indian Deferral Agreement on the viability of the Diamond Fork Power System. This analysis should include a discussion of the consequences of not satisfying the Indian Deferral Agreement, as well as the environmental impacts of providing the facilities necessary to satisfy the Indian Deferral Agreement. The analysis should contain solicited input from the Indians.

6. Include an Endangered Species Act consultation report from the Fish and Wildlife Service discussing the impact of the transbasin diversion of water on the endangered fish and their habitat in the Green River.

We trust these comments will be carefully considered and that, inter alia, the Bureau will proceed with the environmental and economic analyses necessary to determine, in the first place, whether any transbasin diversion is appropriate and justified under the circumstances. Until that decision is made, and lawfully supported, it would be premature to address the decision to build, and the site-specific environmental consequences of, the Diamond Fork Power System.

Sincerely,

NATIONAL WILDLIFE FEDERATION

By

Eugene J. Riordan

EJR:clm
Mr. Kirt Carpenter
Bureau of Reclamation
P.O. Box 1338
Provo, Utah 84601

Dear Kirt:

As requested by your office, we are forwarding to you a copy of the Statement of the Strawberry Water Users Association relating to the Draft Environmental Statement for the Diamond Fork Power System of the Bonneville Unit, Central Utah Project. This statement was submitted at the Spanish Fork meeting on July 26, 1983.

Very truly yours,

Milton V. Theobald
Manager

MVT/ck encls.
The Strawberry Water Users Association has reviewed the Draft Environmental Statement covering Diamond Fork Power System of the Bonneville Unit of the Central Utah Project. The statement reflects extensive investigation and analyses of developing several alternatives of delivery of water from the enlarged Strawberry Reservoir. The statement covers the physical geography, associated engineering facilities, the environmental impacts both positive and negative, and proposed solutions to the opportunities and problems inherent in each alternative. The statement is thorough and carefully and professionally presented. We complement the Bureau of Reclamation on this statement.

The Summary Table presented on page S-3 identifies five alternatives covered in the statement. Our review indicates the "No Power Alternative" really means no federal power development and should be so identified. We believe the demand for power and energy, and the unique physical opportunity (2600 feet of head) including availability of water already developed are such that even though the Bureau of Reclamation did not develop the power potential, non-federal interests would certainly do so. The Strawberry Water Users Association, which manages and controls the Strawberry Valley Project administers water rights amounting to some 7,000 acre-feet of water, rights-of-way, and other pertinent assets and needs only Secretarial approval to develop this power potential. With federal development of the power
features, the Association will cooperate with the Bureau of Reclamation and expects to receive part of the power and energy, consistent with the amount of water contributed.

The statement covering the "No Power Alternatives" shown in Table 15 and Figure 21, is not clear with respect to how the existing Strawberry water would be delivered. We presume the delivery of such water would continue as in the past, or as may be agreed by the Association and the Bureau of Reclamation.

Attention is called to the history pinpointing a power development at Diamond Fork which reaches back to 1913, over 70 years ago when the Reclamation Service filed on Strawberry water to make power for the Strawberry Project. The Association has continued to show a vital interest in this power development. In 1947 the Association asked the Bureau to develop the power potential at Diamond Fork for Strawberry and was told that it would be developed as part of the Central Utah Project and that Strawberry would benefit therefrom.

The Strawberry Water Users Association is pleased to endorse and support the construction of the Diamond Fork Power System.
August 9, 1983

Mr. Clifford I. Barrett  
Regional Director  
U.S. Department of the Interior  
Bureau of Reclamation  
P.O. Box 11568  
Salt Lake City, UT  84147  

Dear Mr. Barrett:

The Utah Municipal Power Agency appreciates the work your organization has done in the preparation of the Draft Environmental Statement for the Diamond Fork Power System of the Bonneville Unit, Central Utah Project. UMPA believes that the benefits achieved from the development of the water and power resources of Diamond Fork far outweigh any adverse environmental consequences and supports the assessment of those consequences set forth in the Draft Environmental Statement.

UMPA would like to reiterate its earlier views and the views of others that the Diamond Fork Power System should be developed consistent with preference provisions of the Federal Reclamation Laws. This would include seeking construction funds from Congress and marketing power on a priority basis to municipally-owned and cooperatively-owned electric systems in accordance with the Colorado River Storage Project Act. UMPA therefore supports the alternative formulation of the Diamond Fork Power System which will lead to this end.

We are grateful for this opportunity to provide you with our comments on this matter.

Sincerely Yours,

Golden Mangelson  
Chairman
Concerning the Draft Environmental Impact Statement on the Diamond Fork Power System of the Bonneville Unit of the Central Utah Project:

The major issue of the Bonneville Unit of the Central Utah Project is the trans-basin diversion of 150,000 to 292,000 acre-feet of water per year (average 197,000 acre-feet) from the Colorado River Basin to the Bonneville Basin of the Great Basin. Although the Draft Environmental Impact Statement mentions the amount of water that will be diverted to the Bonneville Basin, there is no mention of how this water will be utilized, by whom this water will be utilized, and where will this water go. At this time one can not assume that the water will be utilized by the Irrigational and Drainage component of the Bonneville Unit of the Central Utah Project because this Project has not yet been examined and no Draft Environmental Impact Statement has been written on the project.

Thus at this time one can only assume that from 150,000 to 292,000 acre-feet of water will be entering the Utah Lake and the Great Salt Lake. According to the value of 85,000 acres of surface which Utah Lake may have, the Diamond Fork Power system will elevate the surface of Utah Lake from one to over three feet. There is no mention on the effect of this flooding of Utah Lake wetlands, adjacent farmlands, and highways and state parks or on the fisheries of Utah Lake. There is no mention of whether or not the Diamond Fork Power system will transport water from the Colorado River Basin to the Bonneville Basin of the Great Basin during times of high flooding. Assuming that power generation is of highest economic value for the entire Central Utah Project, it must also be assumed that water will be diverted to the Bonneville Basin at all times, even during flooding times, as the spring and summer of 1983. Certainly then the sponsoring agent or agents of the Bonneville Unit of the Central Utah Project will contribute to the cost of the flooding and compensate all those who have received damage from the flooding. Certainly the Final Environmental Impact Statement must address this entire question and contain stipulations of power generation during times of flooding of Utah Lake and the Great Salt Lake.
The second concern of the reading of the Diamond Fork Power System Draft EIS is that it assumes the Irrigation and Drainage System of the Bonneville Unit of the Central Utah Project will be built and that in the 1990's will this segment may be built that there will be agricultural lands to irrigate. It is important at this time to know just to whom and where the water from the transbasin diversion of the Colorado River Basin to the Great Basin is going. The cost of the water to the farmers must also be known and the farmers must by now have signed an agreement to take the water. Furthermore, stipulations must be mentioned in the Diamond Fork Power System Final Environmental Impact Statement on the relationship between the water users for irrigation and drainage and the water use for generating power. Since agriculture through irrigation contributes to the summer peaking of electrical energy use, the irrigators may be faced with no energy to irrigate or much energy but no water. The stipulation must cover just how the Bureau of Reclamation will react to these situation. One can readily see the scenario where the entire transbasin diversion will go for power generation revenues with no water remaining for the irrigators and agricultural uses.

Neither the topic of where the water goes after the transbasin diversion or whether or not it will be available for the Irrigation and Drainage System was discussed in the Draft Environmental Impact Statement. THIS POINTS TO THE FACT THAT THE TRANSBASIN DIVERSION IS THE MAJOR ISSUE TO BE DISCUSSED IN THE DIAMOND FORK POWER SYSTEM, even if it means that Draft Environmental Impact Statement of the Irrigation and Drainage System be completed before the issuing of the Final EIS of the Diamond Fork Power System.

It would be important for the Final Environmental Impact Statement to discuss the relation of the Diamond Fork Power System to the Central Utah Water Project and to the Central Utah Water Conservancy District. Will the Central Utah Water Conservancy District be financially responsible for the Diamond Fork Power System? Will the Central Utah Water Conservancy District operate the Diamond Fork Power System or will the Central Utah Water Conservancy District lease the Diamond Fork Power System to the Bureau of Reclamation and "Western" to operate? There is mention of 7500 af of the transbasin water going for M & I water demands. Is this a fixed amount or a percent of the transbasin water diversion (between 150,000 and 292,000 acre feet)? What portion of the cost of the Diamond Fork Power System is covered by the 1965 election which limited the cost of the entire Bonneville Unit of the Central Utah Project to $320,000,000 plus 20% cost overrun and to the repayment obligation of the electorate of $130,673,000 plus 20% upward adjustment? I assume that the repayment obligation has not exceeded the $130,673,000 that the voters approved. Certainly clarification of the role of the Central Utah Water Conservancy District and its repayment obligations is important for discussion in the Diamond Fork Power System.

In the Draft Environmental Impact Statement of the Diamond Fork Power System there is only one study cited which demonstrated the need for the power. This study was published in 1981 by the Western Area Power Administration (WAPA) for Colorado, Utah, Wyoming, Nevada, Arizona, and New Mexico. WAPA is not necessarily an independent study in as much as WAPA may also be wheeling the electricity to its constituents. But
of greater concern, the electrical (and all form of energy) energy use patterns have greatly changed in recent years—since 1981. To begin with the evidence we look at the FINAL Environmental Impact Statements for Emery 3 & 4 (1979) (now called Hunter 3 and 4), Intermountain Power Project (1979) and the Moon Lake Power Project 1 and 2 (1981).

First the Emery 3 and 4 Final EIS. The case comes from the Public Service Commission of Utah records (Appendix I-3). "Applicant has experienced tremendous growth in the demand for electrical energy for the historical period 1973 through 1977. It appears that such growth will continue at a substantial rate for the forecast period 1978 through 1986." "The denial of approval of Emery 3 and 4 may well result in Applicant being either unable to serve its customers or being able to serve only at a very high cost, with reliability of service being substantially impaired. By 1984 the situation could become considerably worse, resulting in possible serious outages and blackouts." Because of the lack of demand and total miscalculation of consumer reaction to greatly increased cost of electricity, Emery 4 (Hunter 4) has been delayed indefinitely. Emery 3 (Hunter 3) is rather underutilized. Parts of the transcript from the Final EIS are enclosed.

Second the Intermountain Power Project. "Information obtained from a representative of the California Energy Resources Conservation and Development Commission by the telephone, September 14, 1979 indicated that power needs projections remain unchanged in California". "The Utah representative of the commission (Public Service Commission) indicated that the earlier comments of February 15, 1977 were the best available information and did not propose to update it". Quotations from the Final EIS of IPP are enclosed.

Third the Moon Lake Project. "Deseret's members have contracted to purchase 176 MW from the Intermountain Power Project (IPP). It is currently anticipated that the IPP unit will be operational, unit 1-1986, unit 2-1987, unit 3-1988 and unit 4-1989." "Deseret will attempt to bring Moon Lake unit 1 on line by March 1985 when its contract with UP&L for supplemental power terminates. It will attempt to bring Moon Lake unit 2 on line by 1988 when additional power is needed." Table 1-3 forecasts an annual growth of energy between 1979-1984 of 13.7%, between 1984-1989 of 14.2%, and between 1989-1994 of 7.6%.

It is of interest therefore to note that Intermountain Power Project has been cut in half—from 3000 megawatts to 1500 megawatts and that Utah Power and Lights share from 750 megawatts to 60 megawatts. Furthermore, it is unlikely that unit 2 of Moon Lake will be constructed in the 1980's.

What is demonstrated here has happened all over the country. Tennessee Valley Authority has greatly cut back (moth-balled) many of its projects in construction and eliminated many projects on the drawing boards (Clinch River breeding participation being one project). The Bonneville Power Authority over the auspices of the Washington Public Power System (WHOOPS) mothballed two power plants and possibly four power plants—after initially proposing to build 20 power plants—and now hopes to finish only one of the plants. IT HAS BECOME APPARENT THAT PLANNERS OF PRODUCTS OF ENERGY (ELECTRICAL, FOSSIL FUEL, PETROLEUM) and WATER HAVE MADE THEIR FORECASTS ON CURRENT NEEDS AND HAVE IGNORED THE EFFECTS OF THE COST OF THEIR PRODUCTS ON THE CONSUMER. If the baseload forecast have been cut in half (at least), certainly peaking demands must also be cut in half (at least).
HENCE WE RECOMMEND THAT BEFORE THE FINAL ENVIRONMENTAL IMPACT STATEMENT IS PUBLISHED THAT A NEW STUDY BE CONDUCTED BY AN INDEPENDENT SOURCE TO DETERMINE JUST WHAT THE PRESENT DAY FORECASTS ARE and that this study be incorporated into the Final Environmental Impact Statement. We also ask that all the participants cited in the Final Environmental Impact Statement of Emery 3 and 4, Intermountain Power Project, and Moon Lake 1 and 2 be ask just what their current plans are. It should be noted that nowhere has a study been conducted in Utah (and probably in the Intermountain region) of forecast demands together with forecast cost on the consumer and the effect of the increase in cost of the elimination of the demands (negative feedback mechanism). This study should also be done for the Final Environmental Impact Statement.

There is still the question on how the Diamond Fork Power Project will be financed and who will receive the electrical energy. There is mention of non-Federal participation. This must be the only way the Project is built. Non-Federal participation is the only measure whether or not the Project is needed. When the non-Federal participants sell bonds or get voter approval, then the need for the project is known. For instance, when Utah Power and Light started selling bonds to finance its involvement in the Intermountain Power Project, its bond ratings were lowered. The lowering of the bond ratings were the first real criteria which indicated that the Intermountain Power Project was too costly and hence not needed, especially since the Public Service Commission of Utah never was allowed to examine critically the entire Intermountain Power Project and Utah Power and Lights involvement in this project. There could be justified fears that the Diamond Fork Power Project will be built without non-Federal involvement because 1) it is now the cornerstone to the entire Bonneville Unit of the Central Utah Project and 2) the Power is not needed in the Intermountain region.

There is mention that the users of the peaking power will have to pump water uphill to have their peaking power. If the user burns oil for its baseload electrical generation, no net savings in oil occurs— in fact oil is wasted. The Draft EIS mentions that most of the region is served by coal and oil generators of electricity. Fossil fuel is a non-renewable resource which has many applications. Figure 7 shows a typical pump storage scene. Most of the equipment is under plastic wrap. Is this typical pump storage project operating? One pump storage operation (Consumers Power and Detroit Edison in Michigan), the Ludington Pump storage, provides the pumping power with nuclear power energy. The Helms pump storage project, built by Pacific Gas and Electric in California is not yet operating and again was built in conjunction with the Diablo Nuclear Power Plant (which is also not operating). Just where are the typically operating Pump storage projects and what is the energy source to pump the water uphill? Furthermore, do any of these typical projects allow recreation use of the down hill and up hill reservoirs?

The Final Environmental Impact Statement of the Diamond Fork Power System should contain letters from the utility companies on their intent in 1) participation in the project and 2) use of the electrical energy derived from the project.
Other questions arise upon reading the Draft Environmental Impact Statement. Will CRSP pump water up hill in the Diamond Fork Power System by electricity generated from releasing water at Glen Canyon, Hoover Dam, and Flaming Gorge? How much revenue will be lost because of the 197,000 (150,000-292,000) acre-feet of water will be diverted from generating electricity at Glen Canyon Dam and Hoover Dam?

Has any engineering studies been completed since the mud slide that created Thistle Lake and how is the geology in Diamond Fork different from Spanish Fork?

If it takes 4 kwhr to generate 3 kwhrs of peaking power by pump-storage electricity, would not it be more economic to generate peaking power by burning natural gas (which is now in great abundance), especially if the pump-storage is operated by burning fossil fuel?

In the Final Environmental Impact Statement on the Municipal and Industrial System of the Bonneville Unit, there was mention of 104,000 acre feet of water being developed. In the current Draft Environmental Impact Statement on the Diamond Fork Power System, this figure has been changed to 105,100 acre-feet. Which statement is correct and what accounts for the change?

If the U.S. Forest Service is to maintain new recreational sites, will Congress appropriate money to the Forest Service for this maintenance, or will the money come from the Bureau of Reclamation?

Should not the Bureau of Reclamation forego all recreation on the two reservoirs in the Pump-storage system because of the tremendous fluctuation of water levels creating hazards for the recreationist? It seems that these areas should be fenced off.

Can the Bureau of Reclamation or any Water Developing Agency operate water projects in a multiple-use manner for water supply, for M & I, for agriculture, for recreation, for flood control, and for power generation? These are all competing uses. Flood control results in loss of revenue from power generation, from water sales to M & I use and water sales to agriculture, and decreases recreational uses. Further, as evidence from the spring of 1983, with all the water projects in place, there were still amply flooding because water managers try to keep the reservoirs full in the spring.

Members of Utah Nature Study Society are greatly concerned with the quality of environment in Utah and the west. The cost of projects is a direct correlation with the amount of environmental damage, either in situ to the supplies of steel, cement, and other natural resources imported to the site. Because so many concerns have not been addressed in the Draft Environmental Impact Statement, perhaps the Bureau of Reclamation should consider redoing the Draft statement on the Diamond Fork Power System after the Irrigation and Drainage System Final Environmental Impact Statement is completed. Although the Scoping meetings and concerns were addressed at earlier times, the flooding of Utah Lake and the Great Salt Lake have never been a part of Utah's water policy--only managing water for drought. Obviously wet cycles do occur--even in arid regions. Thus the Scoping sessions were rather narrowly put into focus.

Sincerely,

[Signature]
Peter Hovingh, President, UNSS

404
Regional Director,
Bureau of Reclamation
Code 730
P.O. Box 11568
Salt Lake City, Utah 84147

30 June 53

Dear Sir: I have reviewed the DEIS for the
Diamond Fork Power System and find it lacking from several
standpoints. The report does not address offsite
effects on flood plains and wetlands. The referenced
sections deal only with the Diamond Fork area. The
flow of additional water through any power system to
the greater part of the Great Salt Lake basin will affect
the flood plain of the Great Salt Lake. Economic damage
to minerals industry, highways, and communities could
result during periods of lake aggradation. The wetlands
along the Great Salt Lake and adjacent to it would also
be affected. An increase in diversions above the current level
would seem to be significant from an environmental and
economic standpoint.

The economic analysis does not speak clearly to the use
of power from this project. Will the power be sold at a profit?
Would water diverted through this system produce larger revenues
if it was allowed to remain in the Colorado river system. The
investment of a billion dollars for the project seems excessive.
given the in place generating capacity on the Colorado River System.

The final portion of the statement that I would criticize is the lack of discussion on other Bureau of Reclamation projects. The delivery of water for power generation to the great basin river systems removes water from the Colorado River System. This removal will elevate costs for desalination of Colorado River water prior to delivery of the water to Mexico. What is the economic cost of the additional desalination required as a result of this proposed project.

In conclusion I find the environmental analysis for this project to be lacking the detail to present a true picture of the project. This document does not comply with the National Environmental Policy Act or Executive orders 11903-11990.

Robert J. Anderson
Dear Sirs,

This letter is a response to the Environmental Impact Study and Mitigation Plan for the Diamond Fork Power System, Bonneville Unit, Central Utah Project. I have two major concerns, both relate to the impacts of this project on fisheries. I would like to first address the impact it will have upon the Spanish Fork River, and then the impact upon Sixth Water Creek.

In the EIS, it is claimed that there will be small positive impacts upon the Spanish Fork River primarily due to year round flows in section 4 of that river (currently section 4 is dewatered annually) and increased flows in the river as a whole. As you know, the Spanish Fork channel is extremely unstable. The extreme differences between high summer flows and low winter flows combined with poor land use practices has resulted in unstable banks, poor pool structure, and a lack of spawning habitat. Under current proposals, fluctuations in flow will be intensified over present levels. At the same time watercoming from Strawberry Reservoir will be much cleaner as it will not have picked up a silt load from Diamond Fork. As a result of these two factors, the water will have increased ability to erode the streambed of the Spanish Fork River, thus perhaps changing the nature of the riverbed and invalidating predictions made regarding the fishery.

My second concern relates to Sixth Water Creek. While it is true that the Diamond Fork Power System will enhance fish habitat in the drainage due to great improvements in Diamond Fork River, Sixth Water will
remain in very poor shape. This stream has suffered extensive damage from the water flows from Strawberry Reservoir. The banks have eroded and the streambed has dropped as much as forty feet in elevation. Throughout much of it's course bedrock is exposed. As a result, there are few pools, and little chance for streamside vegetation to provide fish cover. I have to assume that the stream will have great difficulty in rehabilitating itself, and it will be very susceptible to further degradation. While the lack of pool area and cover limit adult trout habitat, there is also very limited spawning habitat. Currently the fish population in Sixth Water is increased by recruitment from Strawberry Reservoir through the diversion tunnel. With implementation of the power system, this will no longer be possible; thus only section 3, Dip Vat Creek, and perhaps Fifth Water will have spawning area available for the system. The EIS has not addressed the possibility that these will not provide sufficient recruitment for Sixth Water.

While the proposed system is an improvement over current operations, (and the only environmentally positive aspect of the Bonneville Unit) it leaves Sixth Water in an extremely degraded condition. The "Fisheries Analysis, Diamond Fork Power System, Bonneville Unit, Central Utah Project (Part I - Streams)" pg 21 states, "...there is a unique and justifiable opportunity and perhaps at least a moral obligation to restore a highly productive stream fishery degraded by the Strawberry Valley Project." I concur with this assessment and would like to see at least minimal rehabilitative measures applied to Sixth Water.

Sincerely,

Barrie Marchant
Federation of Fly Fishers
August 1, 1983

Mr. Clifford I. Barrett
Regional Director
Bureau of Reclamation
Code 730
P.O. Box 11568
Salt Lake City, Utah 84147

Dear Mr. Barrett:

Thank you for the opportunity to comment on the Central Utah Project, Bonneville Unit, Diamond Fork Power System Draft Environmental Impact Statement. As most of my concerns are related to analysis not in the document, my remarks will be brief. I hope the final EIS will address the issues I examine below.

At the outset, let me note that the issue of water demand should not be dismissed by mere reference to the EIS on the municipal system and future examination of the I & D system. Water demand along the Wasatch Front is overstated in past projections, due largely to the use of the 'requirements approach' used in these projections. This approach ignores the significant reduction in water demand forthcoming from increased water charges for Bonneville Unit water. M & I water will likely cost $400 to $500 per acre foot, five times present water costs. It is quite possible that no Bonneville Unit water will be demanded at these prices.

In addition to lack of information on water demand, the draft EIS is deficient in its justification of demand for Diamond Fork Power. In times when the Pacific Northwest finds itself in the greatest power-related debacle (WPPSS) of all time, when the capacity of the Intermountain Power Project has been reduced 50%, when conservation efforts are reducing power demands nationwide, it is incumbent upon the Bureau of Reclamation to justify the need for power. Reference to Western's power marketing survey is not sufficient in this regard. In light of the recent history of power demand forecasts, we must be much more thorough in demand estimation.

Related to the issue of demand forecasting is that of nonstructural alternatives to pumped storage peaking capacity.
Of special interest is peak load pricing, which obviates the need for additional peaking capacity by spreading the load to nonpeak periods. In addition to peak load pricing, conservation efforts may be more economical than additional capacity.

Finally, it is very difficult to compare economic aspects of even the structural alternatives. More detail would certainly be required for any thorough evaluation. One point is certainly in error, however. The Bonneville Unit, inclusive of the Diamond Fork preferred alternative, certainly does not have a Benefit-Cost ratio of 3.2-1, if analysis is done under federal guidelines. The authorized interest rate is not the rate to use in discounting benefits and costs from power in this instance. The preferred alternative in the EIS is not a minor addition to an already authorized project. The Diamond Fork Power System is a major new project. It increases generating capacity tenfold. It has increased Bonneville Unit costs allocated to power 50% in the last two years. The project should be examined with either the current discount rate for federal water projects or that recommended by OMB, a rate in the neighborhood of 10%. An incremental benefit cost ratio needs to be calculated on the power system itself, with the proper discount rate. Net benefits would be reduced substantially under proper analysis. I hope this correct economic analysis can be undertaken before the final EIS is issued.

Thank you again for the opportunity to comment.

Sincerely,

Jon R. Miller
Associate Professor
August 12, 1983

Clifford I. Barrett
Regional Director
Bureau of Reclamation
Code 730
P.O. Box 11568
Salt Lake City, Utah 84147

RE: Written Comments of the Draft Environmental Statement of Diamond Fork Power Project of the Bonneville, Unit, Central Utah Project (DES 83-46).

Dear Mr. Barrett:

I am submitting these comments as a follow up of the oral statements made at public hearing held in Provo, Utah on July 28, 1983. I have reviewed the draft environmental statement for the Diamond Fork Power System of the Central Utah Project, Bonneville Unit and have found that I have more questions than was able to find answers in the statement.

I read with alarm the Forest Service policy on mitigation of land for wildlife probigation, which states, "The Forest Service does not favor the use of forest land specifically for wildlife mitigation because of its legislative mandate for multiple-use management. Also, changing management emphasis to the single purpose of wildlife benefits would result in added and significant social and economic impacts to both current and future forest users beyond direct impacts of the Diamond Fork Power system features. For example, livestock grazing would have to be reduced about 50% on any forest lands set aside for wildlife in order to meet the specific mitigation objectives. Additionally, this type of management change would create substantial administrative and financial difficulties for the forest service in adjusting present and proposed management plans and would require a reformulation of the draft management plan for the Uinta National Forest, which has received considerable public review and input." This policy is appalling and is a socialistic approach to mitigating of such problems. It is appalling to say the least.

Alternatives for mitigation do not address the improvement of government owned public lands. I see nowhere in the environmental impact statement showing a cost effective analysis of each of the alternatives and also the purchase price of private lands and their development versus the improvements of already owned public lands by the government being improved for wildlife habitation.

The taxpayers who will pay for this entire project, either through taxes or power cost, should know the cost for each alternative. Alternative number five utilizes the greatest amount of acreage and thus takes the greatest amount of acreage out of service for wildlife probigation. In turn, the Federal Government is required to follow the ludicrous policy to purchase
private lands for wild life mitigation. If any of the wild life specialists would spend an evening surveying the fenced private properties and the number of deer that feed in these fenced areas, the wildlife specialists would soon find that more deer feed per acre each evening on private lands that are fenced than do feed on public lands that are unfenced and are used for grazing of livestock. Thus, it is my concension and opinion that the wild life mitigation practice legislated by the government is far from being an accurate means of supplying grazing areas for wild life. My father-in-law, Mr. John C. Patrick and many of his family, including myself, have counted upwards of fifty to one hundred head of deer feeding on his one hundred-sixty acre parcel of land in any one evening. We have also studied the surrounding areas of publicly owned lands where grazing is permitted and found considerably fewer deer browsing in these areas, simply because of over feeding by all grazing and browsing animals. Thus, the justification for purchasing private lands for wild life mitigation, does not measure up to its legislative mandate.

In the Environmental Impact statement, only one route is shown for power lines going back up the canyon and over the Sheep Creek area. No other alternative is shown. No costs are presented for the cost per mile for power lines. The justification for routing the power lines back up the canyon and over the Sheep Creek area is very weak in my opinion when the power lines could be routed straight down the Diamond Fork Canyon. If the Diamond Fork area had not been touched by man with his fences, wrecked automobiles, roads, etc., then I would consider the impact of the power lines of a greater consequence, going down the canyon. However, with all of man's impact on the environment that has already occurred, it appears to me to be a waste of taxpayer's money to route the power line up over the Sheep Creek area. The Sheep Creek area, at present, has less impacted areas by man than does the Diamond Fork area. Thus, the alternative of routing the power lines over the Sheep Creek area will have a greater environmental impact.

Service roads to private lands are not shown in areas where the project is to be built. Apparently, the Bureau of Reclamation has already determined that these private lands will be purchased and if not purchased, will be left landlocked by the projects. The individuals involved in preparing this Environmental Impact Statement have not considered all of the alternatives, the costs of each of the alternatives, and determined the cost effective and environmental impacts. I have been involved in preparation of several environmental impact statements and would find myself greatly embarrassed if I had been associated with preparation of this statement.

I am in favor of developing our natural resources, but not at the expense of government land grabbing of private lands. I am also in favor of those who benefit from the project should pay for the project and those who happen to own private lands should not be penalized and forced to sell as a result of wild life mitigation.
Let's not advance further towards socialistic government tactics by following the Forest Service Wildlife Mitigation policy.

Sincerely yours,

Dr. Garth R. Morgan
Limnologist
Private Citizen

GRM:bb
July 24, 1983

U.S. Department of Interior
Projects Manager
Utah Projects Office
160 North 200 West
Provo, Utah 84601

Dear Sirs;

After reading through the Diamond Fork Power System Draft Environmental Statement, I have some real personal concerns. I note that in all of the Wildlife Mitigation options listed in Table 18, page 91, that my property would be acquired by the government for wildlife use. I want to make my position clear—I do not wish to dispose of my property.

My father homesteaded the land seventy years ago. He provided, in large measure, for the welfare of eight sons and daughters through his energy and unceasing toil. Each of us learned invaluable lessons of industry and thrift as we worked alongside our father and mother. I remember hay, grain, potatoes for seed, alfalfa seed, a vegetable garden, and even delicious watermelons in season. Sometimes, we had cattle to feed and horses to winter or hogs to pasture. There was always the fencing and road mending and preparing for winter. I suppose that what I'm trying to say is that this has always been an active working, producing ranch.

I remember the time during the great Depression days of the thirties when neighbors all around were selling their property back to the government. My father clung, tenaciously, to his property, holding it as a heritage for his posterity.

About fourteen years ago, my wife and I—at some personal cost—purchased the ranch from my father, age 89 at the time, and mother, age 78 at the time. During the following years, we have re-fenced, graveled the roads, developed the water, re-seeded eighty acres to alfalfa and improved our home. The latest improvement being a $45,000.00 addition just now being finished. Our dream has been to furnish an adequate place for family activities and gatherings. Now, at age 70, our dream seems to be on the verge of shattering.
We have always been good neighbors; cooperating with the Forest Service, the Department of Fish and Game, and the Spanish Fork Cattle Association. In fact, we feed hundreds of head of deer each year on our hay ground and eighty acres of grass and native habitat.

In years past, we could cut our hay once and then make a seed crop later in the summer. Now, the deer are so plentiful that we lose all of our second crop bloom. We have never objected to this, figuring that it is a sort of rent for the privilege of living in such a beautiful place.

In your preferred Wildlife Mitigation option for the recommended Fifth Water Pumped Storage Plan, you plan to acquire about 4,443 acres of private lands under single ownership. This would provide the "greatest and best distribution of compensatory biological values in the Diamond Fork study area." (Page 40)

I fail to see why this plan or a portion of it combined with acquisition of other large areas of land would not satisfy your needs under any of the options you might be forced to accept. The Redford and Schneider properties and Brimhall ranch come to mind as viable compensatory additions in the event that part of the Childs' ranch is covered with the Hayes Reservoir. Selling of a portion of the Brimhall ranch would help compensate the Spanish Fork Livestock Association for the likely reduction of their operation because of this project.

I have never entertained the first thought of increasing the housing or changing the use of this land. In fact, we feel that same sense of trust and obligation to our posterity that our father felt toward us.

If I am forced to walk away from this ranch for the last time, it will not only shatter the dreams of a lifetime for my family and myself, but for my 103 year old father who is still alive, alert, and concerned.

I hope that those who make the final decision will sense the feeling of love we have for this land.

Respectfully yours,

John C. Patrick

JCP/smp
ENVIRONMENTAL COMMITMENTS

The following list summarizes major environmental commitments made for Reclamation's recommended plan.

1. Wildlife mitigation will consist of the acquisition, habitat improvement, and management of 4,000 acres of private and/or public land.

2. A total capacity of 450 cfs will be included in the Diamond Fork Pipeline for the purpose of removing project water, as well as existing high irrigation flows, from the lower Diamond Fork to mitigate potential project impacts and provide enhancement to the fishery resource.

3. Disturbance to landscape and vegetation during construction will be minimized, with special attention being given to minimizing impacts on flood plain and wetland values.

4. Reservoirs would be cleared in a manner that would minimize erosion of soil into streams. Vegetative buffer strips would be left along streams to act as filters.

5. All disturbed surfaces will be rehabilitated and revegetated.

6. Heavy construction activities will be avoided to the extent practical during the golden eagle breeding cycle (February 15 to May 15) within 0.5 mile of any of the active nesting territories in the area in order to minimize disturbance to nesting eagles. In addition, operation and maintenance activities will be scheduled to avoid active nesting sites during the eagle breeding cycle.

7. Both permanent and temporary power transmission lines and towers will be designed to prevent electrocution of eagles and located to minimize the exposure of eagles and other raptors to indiscriminant shooting.

8. The rocky cliff areas immediately north of Monks Hollow, important as denning and hunting habitat for bobcats, will be protected from unnecessary habitat destruction or alteration during construction.

9. Public access over project roads located in severe mule deer winter range will be restricted (especially snowmobile) during the winter months of December through April in accordance with the Uinta National Forest Plan.
ENVIRONMENTAL COMMITMENTS (Continued)

10. Construction practices will comply with all Federal and State water quality laws and regulations concerning pollution from point and nonpoint sources.

11. If problems occur with low dissolved oxygen levels in water released to Diamond Fork from Monks Hollow Reservoir, appropriate corrective measures, if achievable at reasonable cost, will be implemented to guarantee a minimum dissolved oxygen content of 5 mg/L within one quarter mile below the stilling basin for protection of the fishery resource in lower Diamond Fork. If the cost is not reasonable, then additional coordination will occur with involved resource agencies to develop a satisfactory solution to the problem.

12. A discovery plan will be developed in consultation with the Utah State Historic Preservation Officer for the evaluation of cultural resources identified during construction or during survey of the remaining 10 percent of the project area. A plan will be developed to mitigate impacts on any significant resources discovered.

13. Delivery of Strawberry Valley Project irrigation water will not be interrupted during postconstruction.

14. Appropriate arrangements will be made with the Forest Service to help alleviate impacts to livestock use.

15. All Federal, State, and local laws pertaining to the safety of construction workers and the public during construction and operation of project facilities will be followed.

16. A study to quantify fish movement through Syar Tunnel for mitigation considerations will be developed and conducted cooperatively with other Federal and State resource agencies after the power system is constructed and operating.

17. To the extent practical, construction facilities will not be located closer than 1 mile to any active golden eagle nesting territories.

18. The feasibility of measures to maintain water temperatures at about 55°F throughout the system for all alternatives will be explored to the extent needed to support predicted fishery benefits on project streams and reservoirs. Impact analyses thus far, however, indicate that predicted stream temperatures under most alternatives would either be close to the optimum 55°F or would not be appreciably different from existing temperatures and, therefore, would not represent a significant impact requiring mitigation.
19. A minimum flow of 50 cfs or natural flow, whichever is less, would be maintained in Sixth Water Creek below Sixth Water Dam.

20. Reclamation will consult with the Forest Service to consider channel rehabilitation work on lower Diamond Fork to insure that the fishery benefits attributable to the Diamond Fork Pipeline are realized and maintained.

21. Reclamation will cooperate with the Forest Service and other resource agencies to resolve the fish habitat problems in Sixth Water Creek resulting from project caused reduced flows. As a potential solution to the problem if flows are available, a flow-bypass valve would be included in the connection between Syar Tunnel and the existing Strawberry Tunnel to allow the release of up to 50 cfs to Sixth Water Creek for a fishery. Because of net fishery benefits provided by the Diamond Fork Pipeline, these impacts do not require mitigation under any of the alternatives except the 1964 DPR Alternative.

22. Reclamation will cooperate with the Forest Service to devise means to minimize adverse impacts to grazing permits.

23. Reclamation will cooperate with Western and the Forest Service to insure that all transmission facilities needed for operation of the power production features are constructed and operated in compliance with all Federal and State environmental requirements.

24. If current consultation with the Fish and Wildlife Service regarding impacts of the Bonneville Collection System on endangered fish species results in modifications to the power system, environmental impacts of the modifications will be analyzed and appropriate NEPA compliance documents prepared.

25. The contractor would be encouraged to consider carpooling or a similar alternative during construction to reduce the number of vehicles and the density of traffic in the project area.

26. A monitoring program would be established to measure and analyze social and economic effects. The program would provide the opportunity to objectively assess the changes induced by project construction and provide a basis for interaction with local communities to cope with any problems.
REFERENCES CITED


REFERENCES CITED (Continued)

Randy D. Radant, Utah Division of Wildlife Resources, Salt Lake City, Utah.


REFERENCES CITED (Continued)


ATTACHMENTS
I. INTRODUCTION

This section evaluates four alternatives of the Diamond Fork Power System having features which would require individual Section 404 permits if these features did not qualify for the Section 404(r) exemption. A description of the features is found in Chapter III, Alternatives. Reclamation anticipates that the exemption would exclude the need for individual 404 permits. Construction of any of the alternatives would require the installation of a limited number of pipeline crossings, the number and locations of which have not been determined at this time. All pipeline crossings, however, would be included under, and also constructed under, the nationwide permit and its conditions for utility lines (33 CFR 330.5).

The No Power Alternative discussed in Chapter III, Alternatives, was not evaluated here because none of the features would require an individual 404 permit. This alternative, however, would include constructing a limited number of pipeline crossings which would be accomplished under the nationwide permit conditions for utility lines.

II. PROJECT DESCRIPTION

A. Location: Refer to Chapter I, Location and Setting.

B. General Description: Refer to Chapter III, Alternatives.

C. Authority and Purpose: Refer to Chapter I, Purpose of the Environmental Statement and Purpose of the Power System.

D. General Description of Dredged or Fill Material

1. General Characteristics of Material

   a. Zone 1 Material: Impervious earthfill, primarily clays of alluvium and glacial outwash.

   b. Zone 2 Material: Pervious rockfill; gravelly, glacial morainal materials.

d. Concrete.

2. Quantity of Material (cubic yards)

a. Sixth Water Flow Through Alternative

- Syar Dam: 810,000
- Sixth Water Dam: 510,000
- Monks Hollow Dam: 150,000

b. Fifth Water Pumped Storage Alternative

- Fifth Water Dam: 5,000,000
- Fifth Water Dike: 185,000
- Monks Hollow Dam: 150,000

c. 1964 DPR Alternative

- Syar Dam: 810,000
- Sixth Water Dam: 510,000
- Hayes Dam: 5,963,000

d. Sixth Water Pumped Storage Alternative

- Syar Dam: 4,408,000
- Sixth Water Dam: 351,000
- Monks Hollow Dam: 150,000


E. Description of Proposed Discharge Sites

1. Location and Type of Site

a. Sixth Water Flow Through Alternative: Refer to Chapter III.

- Syar Dam
- Sixth Water Dam
- Monks Hollow Dam

b. Fifth Water Pumped Storage Alternative: Refer to Chapter III.

- Fifth Water Dam
- Fifth Water Dike
- Monks Hollow Dam
c. 1964 DPR Alternative: Refer to Chapter III
   (1) Syar Dam
   (2) Sixth Water Dam
   (3) Hayes Dam

d. Sixth Water Pumped Storage Alternative: Refer to Chapter III.
   (1) Syar Dam
   (2) Sixth Water Dam
   (3) Monks Hollow Dam

2. Size (acres of wetlands, riparian, and benthos covered by fill).

a. Sixth Water Flow Through Alternative
   (1) Syar Dam
   (2) Sixth Water
   (3) Monks Hollow

b. Fifth Water Pumped Storage Alternative
   (1) Fifth Water Dam and Dike
   (2) Monks Hollow Dam

b. 1964 DPR Alternative
   (1) Sixth Water Dam
   (2) Hayes Dam
   (3) Syar Dam

d. Sixth Water Pumped Storage Alternative
   (1) Syar Dam
   (2) Sixth Water Dam
   (3) Monks Hollow Dam

3. Type of Habitat: Refer to Chapter IV, Vegetation.

4. Timing and Duration of Discharge (Construction)

The Sixth Water Flow Through and the 1964 DPR Alternatives would require a construction period of about 4 years. The Fifth Water Pumped Storage Alternative would require about 7 years, and the Sixth Water Pumped Storage Alternative would require about 6 years.

III. FACTUAL DETERMINATIONS

A. Physical Substrate Determinations

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1. The disposal site for the dams and dike would cover and eliminate the existing rocky substrate within the riverbeds affected.

2. Sediment Type

After inundation, the rocky substrate of the riverbed within the reservoir would fill in and become a silt and mud bottom; however, the general geometry/topography in the reservoir would be essentially unchanged.

3. Dredged/Fill Material Movement

The construction material would be placed and compacted to the extent necessary to retard the downstream movement of fill.

4. Physical Effects of the Benthos

Benthic communities would be eliminated in the embankment (disposal) areas.

Many species of benthos living in the riverine habitat would be lost and replaced with low densities of species living in a reservoir environment. The community structure of the benthos would be altered to lower species diversity, composition, and biomass. The function of the benthic communities, however, would remain the same (providing food for higher organisms and acting as decomposers passing nutrients through the system), although this function would take place at a lower rate.

5. Actions Taken to Minimize Impacts: Refer to Chapter IV, Water Quality.

B. Water Circulation, Fluctuation, and Salinity Determinations

1. Water

   a. Salinity: Not significant. Refer to Chapter IV, Water Quality.

   b. Water Chemistry: Refer to Chapter IV, Water Quality.

   c. Clarity, Color, Odor, Taste: Not significant

       The nutrient loading and subsequent algae growth in the reservoirs would tend to decrease water quality.

   d. Dissolved Gas: Refer to Chapter IV, Water Quality.

   e. Eutrophication: Refer to Chapter IV, Water Quality.
2. Current Patterns and Circulation

a. Current Patterns and Flow: The construction of the impoundments would impede the river flow and back up water that would form the reservoirs.

b. Velocity: The storage capabilities of the dam would make it possible to regulate the tailwater flows.

c. Stratification: Refer to Chapter IV, Water Quality.

d. Hydrologic Regime: Refer to Chapter III, Project Reservoir and Powerplant Operation, for each alternative.

3. Normal High Water Fluctuations

The construction of the dams would permanently alter the normal high water fluctuation of the stream by blocking the channel and forming a reservoir. The dams would make it possible to regulate the tailwater flows.

4. Salinity Gradients: Not significant.

5. Minimize Impacts: Refer to Chapter IV, Water Quality.

C. Suspended Particulate: Turbidity Determination

1. Turbidity

Increased levels of suspended solids and turbidity would result during construction. It is expected that these levels would be local and only temporary.

2. Effects

a. Light Penetration

Light transmission within the dam and diversion structures would be completely eliminated by the fill material. The temporarily increased levels of turbidity and suspended solids resulting from construction activities would reduce overall light penetration in the streams.

b. Dissolved Oxygen: Refer to Chapter IV, Water Quality.

c. Toxics and Organics

The material to be used for fill (except for the core of earthfill dams which would not be in direct contact with surface waters) would be inert material
consisting of concrete, sand, gravel, and rock (rip-rap), obtained from sources in the immediate area.

d. Pathogens: Not applicable.

e. Esthetics: Refer to Chapter IV, Topography and Scenery.

3. Effects on Biota

a. Primary Production

Existing vegetation would be lost in those impoundment areas to be covered by the fill and subject to inundation.

b. Suspension/Filter Feeders

Existing riverine habitat would be changed to lacustrine habitat and result in lower diversity of organisms.

c. Sight Feeders: Refer to Chapter IV, Fish.

4. Minimize Impacts: Refer to Chapter III, Fishery and Wildlife Measures and Mitigation and Other Mitigation Measures for each alternative.

D. Contaminant Determinations

The fill material does not include any contaminants that would degrade the aquatic habitat. The material to be used for fill (except for the core of the earthfill dams which would not be in direct contact with surface waters) would be inert material consisting of concrete, sand, gravel, and rock obtained from sources in the immediate area. In addition, the fill material with particle sizes larger than silt, is substantially the same material as the substrate at the proposed disposal sites.

E. Aquatic Ecosystem and Organism Determination

1. Plankton and Nekton

Present populations within the riverine habitat would be eliminated by the fill material; however, both nektonic and planktonic populations would continue to exist upstream and downstream of the project features.
2. Benthos
   a. Sixth Water Flow Through Alternative
      Approximately 0.5 acre of benthos would be covered by the fill material.
   b. Fifth Water Pumped Storage Alternative
      Approximately 0.4 acre of benthos would be covered by the fill material.
   c. 1964 DPR Alternative
      Approximately 1.8 acres of benthos would be covered by the fill material.
   d. Sixth Water Pumped Storage Alternative
      Approximately 0.5 acre of benthos would be covered by the fill material.

3. Aquatic Food Web
   Not significant because the fill material would not be contaminated.

4. Special Aquatic Sites
   a. Sanctuaries and Refuges: There are no such areas.
   b. Wetlands
      (1) Sixth Water Flow Through and Pumped Storage Alternatives
      The construction of Monks Hollow Reservoir, Monks Hollow Powerplant, Sixth Water Reservoir, access roads and recreation areas would eliminate about 46 acres of riparian habitat. About 393 acres of lacustrine habitat would be created by the Sixth Water Flow Through Alternative, and about 433 acres of lacustrine habitat would be created by the Sixth Water Pumped Storage. There would also be a temporary loss of 28 acres of riparian habitat during the installation of the Diamond Fork Pipeline, of which less than an acre would be cattail marsh habitat. This habitat should re-establish itself once construction ceased.
(2) 1964 DPR Alternative

Hayes, Syar, and Sixth Water Reservoirs would eliminate about 33 acres of riparian-type wetlands. About 747 normal water surface acres of lacustrine habitat would be created by the three reservoirs. There would be a temporary loss of about 5 acres of riparian habitat during the installation of the Wasatch Aqueduct. This temporary habitat loss should reestablish itself once construction ceased.

(3) Fifth Water Pumped Storage Alternative

The construction of Monks Hollow Reservoir, Fifth Water Reservoir, Monks Hollow Powerplant, and recreation areas would eliminate about 47 acres of riparian habitat. About 873 normal water surface acres of lacustrine habitat would be created by the two reservoirs. There would also be a temporary loss of about 28 acres of riparian habitat during the construction of the Diamond Fork Pipeline, of which less than an acre would be cattail marsh habitat. This habitat should reestablish itself once construction ceases.

c. Mudflats: Not applicable.

d. Vegetated Shallows: There are no such areas.

e. Coral Reefs: There are no such areas.

f. Riffle and Pool Complexes

Riffle and pool complexes would be destroyed by the placement of fill for the impoundment and the formation of the reservoir pool. The existing riverine areas within the above areas would be changed to a lacustrine habitat type.

5. Threatened and Endangered Species: Refer to Chapter IV, Endangered Species.

6. Other Wildlife

The food chain production of the lacustrine habitat would be severely limited when compared to the food chain production of existing wetlands/riverine habitats within the reservoir areas. Species diversity for birds, mammals, reptiles, amphibians, insects, and vegetation would be lost within the impoundments. The number of shorebirds
would increase in the area because of the reservoirs and their fluctuating shorelines which would provide food for many of the shorebird species; however, because of the annual reservoir water level fluctuations the resulting environment would be relatively unstable when compared to the existing wetland/riverine habitats. As a result, there would be only limited use by semiaquatic mammals, reptiles, amphibians, aquatic insects, and aquatic vegetation. There would be little or no use of the reservoir basins by many of the existing small mammals and birds now using the area. There would be an increase in waterfowl during their migration periods; however, waterfowl production would be severely decreased because of lack of vegetative cover and food provided by the existing habitat.

7. Actions to Minimize Impacts: Refer to Chapter III, Fishery and Wildlife Measures and Mitigation and Other Mitigation Measures, for each alternative.

F. Proposed Disposal Site Determination

1. Mixing Zone

Not significant. Major areas where fill is to be placed would be dewatered at the time of fill placement. Short-term turbidity increases would occur at feature sites during construction.

2. Determination of Compliance With Applicable Water Quality Standards: Refer to Chapter IV, Water Quality.

3. Potential Effects on Human Use Characteristics

a. Municipal and Private Water Supply: Not applicable.

b. Recreation and Commercial Fisheries: Refer to Chapter IV, Recreation.

c. Water-related Recreation: Refer to Chapter IV, Recreation.

d. Esthetics: Refer to Chapter IV, Topography and Scenery.

e. Parks, National and Historic Monuments, National Seashores, Wilderness Areas, Research Sites, and Similar Reserves: Refer to Chapter IV, Cultural Resources.
ATTACHMENT 1  SECTION 404(b)1 EVALUATION

G. Cumulative Effects: Refer to Chapter IV, Flood plains and Wetlands, Water Quality, Fish, Grazing, and Cumulative Impacts.

H. Secondary Effects: Refer to Chapter IV, Topography and Scenery, Vegetation, Flood plains and Wetlands, Water Quality, Fish, Grazing, and Cumulative Impacts.

IV. FINDINGS OF COMPLIANCE FOR DIAMOND FORK POWER SYSTEM

A. No significant adaptations of the guidelines were made relative to this evaluation.

B. The various practical alternatives are evaluated in the Environmental Statement. The recommended plan has almost the same amount of enhancement as both the Fifth Water Pumped Storage and the Sixth Water Pumped Storage Alternatives, and considerably more enhancement than the other alternatives. Refer to the Chapter IV, Fish, and Table 41.

C. The planned disposal of dredged material will not violate any applicable State water quality standards. An NPDES permit and a State turbidity waiver will be obtained prior to any work affecting State waters.

D. The use of the selected disposal sites will not harm any endangered species or their critical habitat.

E. The proposed disposal of dredged material will not result in significant adverse effects on human health and welfare, including municipal and private water suppliers, recreation and commercial fishing, plankton, life stages of aquatic life, fish, shellfish, wildlife, and special aquatic sites which have not been mitigated. Further, significant adverse effects on aquatic ecosystem diversity, productivity, and stability and recreational, esthetic and economic values will not occur which have not been mitigated.

F. Appropriate steps to minimize potential adverse impacts of the discharge in aquatic systems will be undertaken.

G. On the basis of the guidelines (40 CFS Part 230, published in the December 24, 1980, Federal Register) the proposed disposal sites for the discharge of dredged material is specified as complying with the inclusion of appropriate and practical conditions to minimize pollution or adverse effects to the aquatic ecosystem.
ATTACHMENT 2

FISH AND WILDLIFE SERVICE RECOMMENDATIONS

In a March 1983 memorandum, the Fish and Wildlife Service presented Reclamation with an evaluation of the project relative to affected fish and wildlife resources, along with recommendations for mitigation. Reclamation will monitor the status of these recommendations and, if any changes are needed, will consult with the Fish and Wildlife Service and other involved agencies. The recommendations and Reclamation's responses are summarized below.

Wildlife

1. Recommendation: Adoption of a mitigation plan with preference for option 1, which is acquisition and improvement of private lands.
   Response: The preferred option has been incorporated into the recommended plan.

2. Recommendation: Minimize vegetative disturbance from construction activities.
   Response: This is a Reclamation environmental commitment.

   Response: This is a Reclamation environmental commitment.

4. Recommendation: Avoid heavy construction activities within 0.5 mile of active nesting sites for golden eagles during the breeding season.
   Response: This is a Reclamation environmental commitment.

5. Recommendation: Route the Wasatch Aqueduct or Diamond Fork Pipeline along the canyon bottom rather than on side slopes.
   Response: This factor has been incorporated into the project design as much as possible. The pipeline may have to be routed out of the canyon bottom in some narrow restricted areas.

6. Recommendation: Avoid disturbance to rock cliff areas north of Monks Hollow (Red Hollow area) to protect important bobcat habitat.
   Response: The only impact to this area would be the proposed access road (gravel) to the day-use area at the mouth of Red Hollow.
7. Recommendation: Locate features and construction activities on the north side of the canyon bottom.
Response: Project design has been developed as much as practical to accommodate this recommendation.

8. Recommendation: Route Dyne Aqueduct along Tanner Ridge and avoid heavy construction activities on the lower end of the alignment during the golden eagle breeding season.
Response: This has been incorporated into the project plan.

9. Recommendation: Avoid heavy construction activities for Dyne Powerplant or Fifth Water Discharge Tunnel and Portal during the golden eagle breeding season.
Response: This is a Reclamation environmental commitment.

10. Recommendation: Location of construction facilities should not be less than a mile to any active eagle territories.
Response: This is a Reclamation environmental objective.

11. Recommendations: Request that the Forest Service restrict high-disturbance forest use activities within 0.5 mile of active eagle nesting territories.
Response: The Fish and Wildlife Service will negotiate this recommendation with the Forest Service.

12. Recommendation: The proposed Red Ledges Campground should be deleted from project plans because of its proximity to an eagle eyrie.
Response: This recommendation has been amended by a memorandum dated November 4, 1983, from the Fish and Wildlife Service, which indicates that the location of the proposed campground is acceptable, with the following stipulations: (1) the main Diamond Fork road from Wanrhodes to Monks Hollow should be closed to the public from December 1 through May 15; (2) no public use of the campground should be permitted during this time; (3) no firearms or fireworks should be permitted in the campground; and (4) the proposed stream crossings and developments on the south side of the river should be deleted from the plans. Development of these recommendations was accomplished through coordinated effort between Reclamation, the Forest Service, and the Fish and Wildlife Service.

13. Recommendation: Operation and maintenance activities should be scheduled to avoid active nesting sites during the eagle breeding seasons.
Response: This is a Reclamation environmental commitment.

14. **Recommendation:** Both permanent and temporary power transmission facilities should be designed and built to preclude electrocution hazards to and discriminate shooting of large raptors, particularly eagles which may perch on the power poles.

Response: Western Area Power Administration has committed to accommodate this recommendation.

15. **Recommendation:** Destruction and disturbance to severe winter range for mule deer should be avoided where possible.

Response: Reclamation will provide mitigative measures as appropriate to compensate for any unavoidable impacts to winter ranges. Public access to these areas should be restricted during the winter. Reclamation supports this, but the Fish and Wildlife Service must negotiate with the Forest Service to implement it in harmony with the Uinta National Forest Travel Plan.

16. **Recommendation:** Select the Sheep Creek access road alignment over the Tank Hollow alignment to minimize disturbance to deer winter range.

Response: The Tank Hollow alignment has been selected in deference to the needs of Forest Service management objectives.

17. **Recommendation:** Existing roads not needed after project roads are constructed should be closed and rehabilitated to provide wildlife habitat.

Response: Reclamation supports this, but the cooperation of the Forest Service must also be obtained.

18. **Recommendation:** Enclose the discharge channel from the Fifth Water Tunnel into Monks Hollow Reservoir with big game-proof fencing.

Response: This has been incorporated into the design of the Fifth Water Pumped Storage Alternative.

19. **Recommendation:** Protect and manage riparian woodland and streamside vegetation for the benefit of wildlife.

Response: This is a Reclamation environmental commitment. Forest Service cooperation is required for long-term management.
1. Recommendation: The largest feasible design capacity for the Diamond Fork Pipeline should be selected.

Response: The 450-cfs capacity in the recommended plan is the largest feasible pipeline size.

2. Recommendation: Public fishing access to the lower 5 miles of Diamond Fork Creek should be assured.

Response: Acquisition of this access is part of the recommended plan.

3. Recommendation: The feasibility of measures to maintain water temperatures at about 55°F throughout the system for all alternatives should be explored.

Response: This will be done to the extent required to support anticipated fishery benefits on project streams and reservoirs. Impact analyses, however, indicate that predicted stream temperatures would generally be close to the optimum 55°F or would not be appreciably different from existing temperatures. Conditions, therefore, would not represent a significant impact requiring mitigation.

4. Recommendation: The analysis of project impacts on stream fisheries should be reassessed after completion of ongoing water quality studies by Reclamation.

Response: This is a Reclamation environmental commitment. Dissolved oxygen appears to be the only potential problem and measures to correct any such problems would be investigated after the project becomes operational.

5. Recommendation: Mitigation for the 1964 DPR Alternative should receive more study if this alternative is selected.

Response: Reclamation is committed to this. Restoration of habitat on Sixth Water Creek would be considered in accordance with the recommendations presented as mitigation for this alternative on pages 165-166.

6. Recommendation: Evaluate the need for studies to quantify fish movement through Syar Tunnel after ongoing water quality studies are completed.

Response: Reclamation, in cooperation with the resource management agencies, has determined that facilities to prevent fish movement would not be feasible. However, a study to quantify fish movement through Syar Tunnel for mitigation
considerations would be necessary after the power system is constructed and operating.


Response: The Strawberry Tunnel was not designed to operate as a pressurized conduit; therefore, the full head from Strawberry Reservoir would not be available to operate a powerplant. Furthermore, fish releases through the tunnel would generally be less than 50 cfs which would provide less than 1 megawatt of generation potential. Because of the remoteness of the site, additional access roads and transmission lines would be required. The cost of these facilities, combined with the cost of a powerplant at this site, would not be economical.
April 21, 1981

MEMORANDUM

TO: Regional Director
   Upper Colorado Region
   Water and Power Resources Service
   Salt Lake City, Utah

FROM: Acting Area Manager
      Area 5
      Fish and Wildlife Service
      Salt Lake City, Utah

SUBJECT: Diamond Fork Power System, Bonneville
         Unit, Central Utah Project

This reply is in response to your memorandum dated April 7, 1981. We concur with your conclusion in the biological assessment that no impact either beneficial or adverse should occur to the bald eagles or peregrine falcons as a result of the Diamond Fork Power System Project construction and operation.

We appreciate your cooperation in conserving endangered species.

[Signature]
January 11, 1983

Clifford I. Barrett
Regional Director
Bureau of Reclamation
Upper Colorado Regional Office
P. O. Box 11568
Salt Lake City, Utah  84147

RE: Diamond Fork Power System, Central Utah Project, Multi County

Dear Mr. Barrett:

The Utah Preservation Office has received for consideration your letter of November 17, 1982, requesting consultation about cultural resources and potential effect in the Diamond Fork Power System area, Bonneville Unit, Central Utah Project. After review of the material located in the Preservation Office files, and the report submitted by the University of Utah and Mesa Corporation, our office concurs with the Bureau's determination of no effect as outlined by 36 CFR 800.4.

The above is provided on request as information or assistance. We make no regulatory requirement, since that responsibility rests with the federal agency official. However, if you have questions or need additional assistance, please let us know. Contact Jim Dykman at 533-7039.

Sincerely,

Melvin T. Smith
Director and
State Historic Preservation Officer

JLD:jr:B929/5386c
ATTACHMENT 5

WESTERN AREA POWER ADMINISTRATION
STANDARD MITIGATION PROCEDURES

Generically Committed Mitigation

1. All construction vehicle movement outside the right-of-way will normally be restricted to predesignated access, contractor acquired access, or public roads.

2. The area limits of construction activities will normally be predetermined, with activity restricted to and confined within those limits. No paint or permanent discoloring agents will be applied to rocks or vegetation to indicate survey or construction activity limits.

3. Blasting required for access trails or tower footings will not be done where debris cannot be recovered and removed from the site without further environmental impacts.

4. In construction areas where recontouring is not required, vegetation will be crushed wherever possible and original contour will be maintained to avoid excessive root damage and allow for resprouting. Herbicides would be used to prevent undesirable weed growth in the substation yards and at some transmission-line structures. When used in accordance with recommended procedures (label instructions), the herbicides would not be a hazard to fish or wildlife.

5. In construction areas where recontouring is required, revegetation and/or reseeding will occur after the final grade has been established and as required.

6. The edges of clearings and cuts through trees, shrubbery, and vegetation will be irregularly shaped to soften the undesirable visual impact of straight lines.

7. Drainage and watering facilities will be repaired or replaced if they are damaged or destroyed by construction activities.

8. Tower and conductors will be marked with high-visibility devices where required by governmental agencies (Federal Aviation Administration).

9. On agricultural land, right-of-way will be aligned, insofar as practical, to reduce the impact to farm operations and agricultural production.

10. Measures will be taken to ensure that all applicable Federal, State, and local environmental laws, orders, and regulations will be complied with.
11. All practical methods and devices will be utilized to control, prevent, and otherwise minimize emissions or discharges of both air and water contaminants during the construction of new transmission facilities.

12. Prior to construction, all supervisory construction personnel will be instructed on the protection of cultural and ecological resources. To assist in this effort, the construction contract will address: (a) Federal and State laws regarding antiquities, plants and wildlife, including collection and removal; (b) the importance of these resources and the purpose and necessity of protecting them. Illustrations of protected resources that might occur in the area will be supplied in order to assist in identification.

13. A program for handling and resolving environmental complaints will be established and administered by a designated person with a published telephone number. The program will work to resolve any environmental complaints within the areas of construction activities.

14. Preconstruction Cultural Resource Studies

Following identification of the preferred route, intensive cultural resource surveys will be conducted by an appropriately qualified professional to identify specific properties subject to impact from the construction, operation and maintenance of the proposed project. The cultural resource surveys will include historical, ethnographic, architectural, and archeological elements.

A. The historical element will include, but not be limited to, development of the narrative history of the study area. The purpose of the narrative history will be to provide a framework in which to evaluate individual historic properties.

B. The ethnographic elements will include, but not be limited to, the identification of general and/or specific heritage or ethnic concerns. The purpose of the ethnographic study will be to provide a framework in which to evaluate the concerns of local native Americans for historic and prehistoric properties in the study area and to assess the effect that the proposed action will have.

C. The architectural element of the cultural resource study will focus on, but may not be limited to, the identification of properties within the study area that may be of architectural importance.

D. The archeological element will include, but will not be limited to, identification and evaluation of prehistoric archeological resources within the study area. The archeological study will compile sufficient background information on the prehistory of the study area in order to assess and/or
provide a framework in which to evaluate individual prehistoric properties.

E. An intensive archaeological survey will be conducted within the survey study area. The purpose of the survey will be to identify specific properties within the survey study area that may have cultural resource values. The survey study area will include, but will not be limited to, the proposed right-of-way, access roads, and any other areas that will be disturbed by the construction and/or operation of the proposed transmission line. The survey study area will be established by Western in consultation with the State Historic Preservation Officer (SHPO) or his/her designated representative.

F. Following identification of the cultural resources within the survey study area, a preliminary report(s) will be prepared and maps with site locations will be compiled. The preliminary report will include a brief description and evaluation of the cultural resources located within the survey study area and recommendations for avoidance. The preliminary report and maps will be submitted to the applicants' transmission line engineers. The site information will be used in siting and designing towers, access roads, and other construction areas to avoid, to the extent possible, the cultural resources along the route.

G. A report or separate section of a report(s) will be prepared for each element. Each report will include, but will not be limited to, a description of background research and evaluation of existing data, a description of field inspection methods, a substantive assessment of the results of the survey, recommendations of testing or further analysis, and an evaluation of the significance of each property.

H. A presentation plan will be prepared. The plan will address all four elements—archaeology, history, ethnology and architecture. The preservation plan will include, but not be limited to, the following: (a) identification of those cultural resource properties that are not considered to be eligible for inclusion in the National Register of Historic Places and the rationale of such an evaluation, (b) a detailed description of the type and degree of impact the proposed project will have with regard to those properties identified above, (c) recommendations for mitigating any adverse effects that are expected to occur, (d) recommendations for general protective procedures to be followed during construction, maintenance, and operation of the proposed transmission line.

I. Western will follow the procedures prescribed in 36 CFR 800.4 and 36 CFR 1204 and will consult with the SHPO and Advisory Council on Historic Preservation (ACHP) regarding determination
of eligibility, determination of effect, and identification of measures which will avoid or mitigate any adverse effects.

J. Western will satisfactorily avoid or mitigate the adverse effects to cultural resources resulting from the proposed project in accordance with measures agreed upon by the SHPO and ACHP.

K. If previously unknown cultural resource sites are discovered during the construction of the transmission facilities, the contractor will be required to cease work in the area until a qualified person has evaluated the findings.

15. Western will apply necessary mitigation to satisfy complaints of line-generated radio or television interference.

16. Western will apply necessary mitigation to eliminate problems of induced currents and voltages into conductive objects sharing a right-of-way, to the mutual satisfaction of the parties involved. All structures will be grounded at each pole. To prevent electrification of fence lines, wood-post fences parallel to and within 75 feet of the centerline are grounded at one-quarter mile intervals and fences with steel posts will be grounded at one-half mile intervals. One grounding post will be used at each side of the right-of-way for fences crossing under the line. One grounding post will be used at the hinge end and latch end of each gate.

17. Western will continue to monitor studies performed to determine the effects of audible noise and electrostatic and electromagnetic fields in order to ascertain whether these effects are significant.

Selectively Recommended Mitigation

Access trails

1. No new access will be constructed in designated areas; e.g., construction and maintenance will be accomplished without benefit of new access. This would minimize ground disturbance, limit new or improved access ability and/or reduce scarring (visual contrast).

2. No widening or upgrading of existing access roads will be undertaken in designated areas (same benefits as 1 above).

3. The alinement of any new access trails will follow the area's landform contours, providing that such alinement does not additionally impact resource values. This would minimize ground disturbance and/or reduce scarring (visual contrast).

4. All access trails not required for maintenance will be permanently closed using the most effective and least environmentally damaging
methods appropriate to that area with concurrence of the landowner. This would limit new or improved accessibility into the area.

Tower and conductor design

5. Special tower design will be utilized; e.g., shorter, taller, tubular steel, H-frame. This would minimize ground disturbance, operational conflicts, visual contrast and/or avian conflicts.

6. The finish on steel towers will be dulled and a non-specular conductor will be used. This would reduce visual contrast.

7. Structures will be placed so as to avoid sensitive features and/or to allow conductors to clearly span the features, within limits of standard tower design. This would minimize amount of sensitive feature disturbed and/or reduce visual contrast.

8. Standard structure spacing will be modified to correspond with spacing of existing transmission line structures where feasible and within limits of standard structure design. This would reduce visual contrast.

9. Line will be re-routed to avoid sensitive features. This would eliminate or severely reduce visual or physical conflicts with features.

Construction schedule

10. Construction activities will be modified during breeding season of sensitive listed or proposed threatened or endangered species. This would reduce disturbance to sensitive species.

Preconstruction study programs

11. Prior to construction, a geotechnical field review of tower and access road design will be conducted by an appropriately qualified professional to identify site-specific, soil-erosion impacts and determine the most effective means of mitigating them. Possible mitigation measures could include minor adjustments in tower and road locations, restricting access during periods of high moisture, and utilizing selective biodegradable soil stabilizing agents, etc.

12. Prior to construction, an ecological field review of tower and access-road design will be conducted by an appropriately qualified professional to identify site-specific impacts to threatened, endangered, or otherwise sensitive vegetation and wildlife and to determine the most effective means to mitigate those impacts. Possible mitigation measures could include minor adjustments in tower and road locations, closing access roads, relocating sensitive species, habitat improvements, etc.