DEVELOPMENT OF THE UPPER COLORADO RIVER

Paper by E. O. Larson, Regional Director, Region 4, Bureau of Reclamation, United States Department of the Interior, before the 79th Annual Convention, American Water Works Association, San Francisco, California, July 13, 1959

Glen Canyon Dam is the largest concrete dam now under construction in the United States. Larger in volume of concrete than Hoover Dam and almost as high, it will be one of the highest dams in the world and will create the second largest reservoir in the United States. The Glen Canyon powerplant will be one of the ten largest in the United States. Estimates indicate that at today's price levels it will cost about $325 million to build the Glen Canyon Dam and Powerplant. With its large storage capacity and powerplant, the Glen Canyon Storage Unit is the key to the future development of the Upper Colorado River Basin.

The program for development and use of the water resources of the Upper Colorado River Basin with an estimated cost of about $1 billion, is a truly basinwide program as planned and authorized. Public Law 485 authorizing the Colorado River Storage Project and Participating Projects, as the Upper Basin Program is officially known, was signed by the President on April 11, 1956. Authorized for construction as the initial phase were four storage units, of which Glen Canyon is the principal unit, and 11 participating projects on which water will be used for the irrigation of farm land and for municipal and industrial expansion.

Before discussing the Upper Colorado Basin program in more detail, I will draw a brief word picture of the Upper Basin. The Upper Colorado River Basin is a plateau land in the heart of the Intermountain West, including the southwestern portion of Wyoming, the western half of
Colorado, the eastern half of Utah, the northwestern corner of New Mexico, and a small section of northeastern Arizona.

The Upper Basin has been a dry and formidable area. It has been late in exploration and, up to now, slow and limited in settlement and development. Early pioneers largely avoided the area in their treks westward. For the most part, the Colorado and Green Rivers in the Upper Basin were not explored and mapped until 1869 when Major John Wesley Powell made his famous river trip through the winding and deep canyons.

Mining activities on the fringes of the Upper Basin marked the early history. Later, stock raising and irrigation of the bottom lands along the streams came to predominate. Where streams could be easily diverted and used for irrigation, this was done, but on a small scale. Two large and successful projects were built by the Bureau of Reclamation prior to World War I, but since that time only three relatively small irrigation projects have been undertaken. By comparison, elsewhere in the 17 western states, the Bureau of Reclamation built many large and important projects after 1920.

By 1940, the 110,000 square mile Upper Colorado River Basin, which is about the size of the states of Illinois and Wisconsin combined, had only four cities of more than 5,000 population, and Grand Junction, Colorado, with a population of 12,500 was the largest city.

But the Upper Colorado Basin has many resources awaiting development and use. During and following World War II, there has been considerable development of uranium and vanadium; of coal, oil and gas; and of other mineral resources. But this is only the forerunner of much greater progress which will take place when the Colorado River Storage Project and Participating Projects are built.
The Upper Colorado River Basin is rich in resources. It has the water of its rivers. It has canyons with damsites where dams can be built, water stored, and hydroelectric power produced. It has lands that can be farmed under irrigation. It has petroleum, natural gas, and about one-third of the Nation's known coal reserves. It has vast areas of oil shales and rare hydrocarbons. It has the raw materials to supply many strategic metals. It has uranium and other atomic ores. It has mountains of phosphate rock for commercial fertilizer production, and other needed nonmetallic ores.

The key to the development and use of these land and mineral resources is the availability of water and power. The Upper Basin program will make possible the needed water and a sizable block of the needed power under a long-range plan in which all reimbursable costs will be repaid by the beneficiaries as well as interest on all reimbursable costs other than the costs allocated to irrigation. The costs allocated to irrigation do not bear interest under Federal Reclamation law and policy. Approximately 98 percent of the $1 billion estimated cost of the presently authorized works will be reimbursable and about 66 percent will be repaid with interest.

The rights of the Upper and Lower Basins to the use of Colorado River water are set forth in the Colorado River Compact of 1922, which is known as the "law of the river" and is a complex document that cannot be discussed in detail here. By the subsequent Upper Colorado River Compact of 1948, the Upper Basin States (Colorado, New Mexico, Utah, Wyoming, and Arizona) divided among themselves the water allotted the Upper Basin under the 1922 Compact. The Upper Basin's right of 7.5 million acre-feet
per annum under the 1922 Compact approximates one-half the average flow at Lee Ferry in northern Arizona, the dividing point between the Upper and Lower Basins. The Upper Basin’s right is conditional to the delivering of a base flow to the Lower Basin of 75 million acre-feet at Lee Ferry in consecutive 10-year periods.

Since the virgin flows of the Colorado River at Lee Ferry are erratic and vary annually from as little as 5-1/2 million to as much as 25 million acre-feet, large holdover storage reservoirs must be built if the Upper Basin States are to be able to make full use of their right to the residual, or the erratic one-half of the flow.

This explains the initial authorization of four storage units of the Colorado River Storage Project. They are the Glen Canyon Unit on the Colorado River in northern Arizona and southern Utah, the Flaming Gorge Unit on the Green River in northeastern Utah and southwestern Wyoming, the Navajo Unit on the San Juan River in northern New Mexico and southern Colorado, and the Curecanti Unit on the Gunnison River in western Colorado. Holdover storage in the large storage unit reservoirs thus will make possible new diversion and beneficial consumptive use of water on the Participating Projects taking water from tributary streams throughout the Upper Basin. In addition, the hydroelectric powerplants at the storage unit dams will produce power to help meet the pyramiding regional needs and to provide revenues from power sales which will assist in the repayment of the costs of the entire Upper Basin program.

The significance of the storage units in the Upper Basin development is clearly evident. Therefore, construction of the storage units
was begun first. Construction of Glen Canyon Dam on the Colorado River near Lee Ferry was started late in 1956, and it is scheduled for completion and the first production of power probably in 1963. At the Glen Canyon damsite, the diversion tunnels are now completed, and the river is diverted. Work is underway on the foundation excavation and on the erection of the highline cableways, concrete batch plant, aggregate plant, and other facilities so that the placing of the first concrete can be done early this fall. Glen Canyon Reservoir will store 28 million acre-feet of the 35 million acre-feet of water storage provided by the four initially authorized storage units. The Glen Canyon powerplant will provide 900,000 kilowatts of installed generating capacity out of the nearly 1,200,000 kilowatts at the four storage units.

Prime contracts were awarded in June 1958 for the construction of two other storage units -- namely, the Flaming Gorge Dam on the Green River in northeastern Utah near the Wyoming stateline and the Navajo Dam on the San Juan River near Farmington, New Mexico.

Flaming Gorge Dam will be a concrete arch dam about 500 feet high with a powerplant of 108,000 kilowatts of installed capacity. The reservoir created by the dam will store almost 4 million acre-feet of water. At the present time, the heavy road construction at the damsite has been completed, the single diversion tunnel has been excavated and is now being concrete-lined, and the river will be diverted in September. The total cost of the Flaming Gorge Unit will be about $65 million.

Navajo Dam will be a tremendous earth and rockfill structure. With 26,300,000 cubic yards in the embankment, it will be the second
largest to be built by the Bureau of Reclamation. About 5 million cubic yards of materials have now been placed. The Navajo Storage Unit will cost about $42 million and will store more than 1,700,000 acre-feet of water.

Construction of the Curecanti Storage Unit, consisting of three dams and powerplants on the Gunnison River in western Colorado, are scheduled to be undertaken in near future years.

Construction was begun on two of the 11 authorized participating projects this year. The 11 authorized participating projects, when completed, will provide supplemental water supplies for 232,000 acres of presently irrigated land that are short of water nearly every year, and a full water supply to about 115,000 acres of dry land. However, the irrigation of new lands is not scheduled for several years. The authorizing legislation earmarked 25 additional participating projects for study as to feasibility. In future years and as demands arise, these projects could bring about the irrigation of more than one million acres of supplemental and new land areas. In addition, plans for the participating projects will include, where needed, the supply of water for municipal and industrial development.

We speak of the plan and authorization of the Colorado River Storage Project as being different from the usual water resource development plan. Actually, it is. It was planned as an integrated, long-range basinwide program in close cooperation with the State and local interests, the Upper Colorado River Commission, and the Federal agencies concerned. Fundamentally, the large storage units of inter-state significance will be operated and maintained by the Bureau of Reclamation, in accordance with
the 1922 and 1948 Compacts. Individual participating projects are to be operated by water users organizations with the use of the water governed by State laws and the Compacts.

The authorizing Act has several significant and unique provisions which are worthy of mention. There is authorized a separate fund in the Treasury of the United States to be known as the Upper Colorado River Basin Fund for carrying out the Reclamation provisions of the Act. The Congress makes appropriations into the Basin Fund and all income from the irrigation, municipal, and industrial water users, from the sale of power, from other minor sources, are credited to the Basin Fund for repayment of reimbursable costs. Annual reports are required to be submitted to the Congress detailing the expenditures from the Basin Fund and the anticipated revenues into the fund to show that the repayment plan is currently solvent. The Act also provides for the apportionment among the Upper Basin States of surpluses accruing in the Basin Fund to be available for appropriation by the Congress for the construction of additional projects.

The Act provides that the Secretary of the Interior is authorized and directed to investigate, construct, operate, and maintain public recreation facilities, and facilities to mitigate losses of and improve conditions for the propagation of fish and wildlife. Funds appropriated for these purposes are to be nonreimbursable. By this provision recreational development on Reclamation reservoirs becomes a fully recognized benefit of local and Nationwide significance.
In conclusion, the program for the Upper Colorado River Basin has been planned and authorized, and is now being carried out, as an overall long-range, coordinated development which will give the Upper Basin States the opportunity to make full use of their shares of the waters of the Colorado River. It is a plan that permits the development and use of water for all purposes, now and in the future, as circumstances change and needs evolve.

The benefits to the Upper Basin States and to the Nation will probably surpass in extent and magnitude anything we can now state with certainty—for such has been the history on other Federal Reclamation programs. However, here is a summary of the benefits which can be anticipated:

1. Water to supplement the present scant supply which retards the growth of many areas in the Upper Basin, and, when appropriate, water for new lands, both to produce food to meet the needs of an increasing population and for a higher standard of living.

2. Crops from irrigated land to create a better balance in the use of our ranges by providing winter feed, thereby increasing the carrying capacity of our range lands without destructive overgrazing.

3. The growing of a variety of crops needed by the Region and the Nation.

4. The creation of irrigated areas in the desert—oases, if you please—which will serve as centers for large and small industrial development.
5. As a multiple use, makes water available for industrial expansion and future population growth.

6. Power for remote parts of the region to develop valuable minerals and other resources now virtually untouched.

In summary, we are confident that the possibilities for future growth in the Upper Colorado River Basin will exceed expectations as water becomes available to support expanded irrigation agriculture, to meet the needs of new industries utilizing the almost untouched, extensive mineral resources, and to serve growing cities and towns.