WHAT THE COLORADO RIVER STORAGE PROJECT PLAN OFFERS SAN JUAN RIVER BASIN

With pleasure I address the people of the San Juan River Basin in Southwestern Colorado and Northern New Mexico. You are to be commended for sponsoring on a community basis these meetings on the conservation of our national resources. Usually water meetings are attended by a scattering of lawyers, engineers, and officials representing local water companies and governmental administrative bodies. Your presence demonstrates a keen interest by both rank and file of this community in the future use of the west’s most vital resource—water.

You have invited me here to discuss the plan of the Colorado River Storage Project and Participating Projects, a proposal for the development of water and power for the five states comprising the Upper Colorado River Basin, not the least of which states are Colorado and New Mexico. Opportunities to present Reclamation’s views and first-hand information before groups such as yours are welcomed. I understand you are particularly interested in how Southwestern Colorado and Northern New Mexico will participate in the benefits of this proposed basin-wide development.

The plan which I will discuss offers your immediate area possibly as many or more benefits as any other like area in the Upper Colorado River Basin. Local projects included in the request for initial authorization are the Florida Project in Colorado, the Pine River Extension Project in Colorado and New Mexico, and the Hammond Project just across your State Line in New Mexico. Also nearby lies the site of the Navajo
Reservoir, one of the five initial units in the proposed Colorado River Storage Project. In addition there will be the Paonia, Smith Fork and Silt Projects, giving western Colorado 5 out of a total of 12 projects recommended by the Bureau of Reclamation for initial participation. The State of Colorado has also suggested the inclusion of the La Plata Project in the initial group, and likewise New Mexico is suggesting the South San Juan-Indian Shiprock and San Juan-Chama Projects.

The initial units are only the beginning of a plan which provides for continued development to the end whereby Colorado and each State of the Upper Basin will utilize the waters allotted them from the Upper Colorado River system. Investigations over many years have disclosed several possibilities for additional uses of water in Southwestern Colorado and Northern New Mexico. Projects such as the Animas-LaPlata, Dolores, San Miguel, South San Juan, San Juan-Chama, Indian Shiprock and others have been investigated and are being reinvestigated in an attempt to bring out feasible plans for construction.

Unfortunately the future projects of this area, like most new projects throughout the Upper Basin, are costly. Although feasible in most respects, the construction costs for irrigation works, in addition to the annual operation and maintenance charges exceed the repayment ability of the irrigators.

We are now at the crossroads in Reclamation. Practically all new reclamation projects, not only in the Upper Colorado River Basin but also in other basins, require repayment other than that of the irrigator. Present irrigators naturally have developed first the most convenient sources of water, Utilization of remnant waters will entail complicated
exchanges and replacements, long tunnels, conduits, and canals, large storage reservoirs and other expensive works. Financial assistance to new users of irrigation water in the Upper Colorado River Basin is a major purpose of the Colorado River Storage Project.

Another major purpose of the Colorado River Storage Project involves the rights to the use of Colorado River water of Colorado and six of her sister states, namely, Wyoming, Utah, New Mexico, Arizona, Nevada, and California. These rights are set out in compacts and treaties of interstate and international significance. The dividing of these waters involved certain responsibilities with respect to the delivery of water from one state to another state, from one group of states to another group, and from the United States on to Old Mexico. As a result, new uses of Upper Colorado River water are dependent upon river regulation. The particular purpose of the Colorado River Storage Project to which I now refer is river regulation. Only through the process of river regulation can new projects in the San Juan River Basin and in other areas of the Upper Basin secure a firm right to the use of Upper Colorado River water.

Now let us look into the Colorado River. It has an extremely fascinating history. Its force has been felt over geologic ages leaving carvings of splendor and amazement over most its course. Its tributaries and channels at first were barriers to early settlers who found them deeply entrenched in valleys and plateaus extending from the snow-capped mountains of Wyoming, Utah, Colorado and New Mexico to the deserts of Arizona, Nevada, California and old Mexico.

Settlements soon sprang up in the valleys where tributary waters...
could easily be controlled. The advent of the Reclamation Law of 1902 made possible larger undertakings such as the Uncompahgre and Grand Valley Projects in Western Colorado and the Salt River development in central Arizona.

By 1920 private holdings in the Imperial Valley of California were great. Rising flood levels, aggravated by sediment deposition, threatened another break into that valley. The California coastal region was in dire need of large blocks of power and additional municipal water supplies. These three major demands alone called for extensive storage regulation on the lower Colorado River.

Seven states and the federal governments of the United States and Mexico were claiming jurisdiction and interests in the river. The Upper Basin was lagging behind the Lower Basin in population increases and irrigation developments, so further upstream uses were sure to conflict with the proposals being sought by California and Mexico. Some form of an agreement was thus necessary. A concept of the division of water, not among the states but between the upper and lower basins, was finally adopted, and the Colorado River Compact of 1922 thus became the law of the river.

The 1922 Compact also recognized rights of Mexico which were later defined by a separate treaty in 1945. Through the 1922 Compact the lower basin states gained the support of the upper basin states in securing Federal aid for their main-stem developments. On the other hand, the upper basin states felt secure in their rights to future development, believing they had overcome a problem of priority of rights which otherwise would have been established by the downstream appropriators.
Projects were soon constructed on the lower river capable of using most of the water allotted the lower basin. In the upper basin development continued for 20 years on a much smaller scale. A careful study of land and water resources in the upper basin indicated a potentiality of more than 100 new projects with water available, however, for only a fraction of these possibilities. In addition, the flow of the Colorado River failed to measure up to that estimated from sparse records available at the signing of the 1922 Compact. As a result, major new developments in either upper or lower basins could not be undertaken without a knowledge of the rights of individual states.

With an anxious desire to get new projects under way, the upper basin states expedited negotiation of the Upper Colorado River Basin Compact of 1949 which in effect suballocated the use of water apportioned the upper basin by the earlier 1922 Compact. Unresolved difficulties on the lower river have impeded agreements as to the respective state allotments of the use of water apportioned the lower basin.

**APPORTIONED COLORADO RIVER WATER**

(Acre-feet per Annum for Beneficial Consumptive Use)

<table>
<thead>
<tr>
<th>Upper Basin</th>
<th>(lump sum)</th>
<th>50,000</th>
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<tbody>
<tr>
<td>Arizona</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Colorado (51.75% of remainder)</td>
<td>3,855,375</td>
<td></td>
</tr>
<tr>
<td>New Mexico (11.25% of remainder)</td>
<td>838,125</td>
<td></td>
</tr>
<tr>
<td>Utah (23.00% of remainder)</td>
<td>1,713,500</td>
<td></td>
</tr>
<tr>
<td>Wyoming (14.00% of remainder)</td>
<td>1,043,000</td>
<td></td>
</tr>
<tr>
<td><strong>Subtotal—States of Upper Division</strong></td>
<td></td>
<td><strong>7,450,000</strong></td>
</tr>
<tr>
<td><strong>Total Upper Basin (Art. IIIa 1922 Compact)</strong></td>
<td></td>
<td><strong>7,500,000</strong></td>
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| Lower Basin                      |            |        |
| Arizona                          |            |        |
| California                       |            |        |
| Nevada                           |            |        |
| New Mexico                       |            |        |
| Utah                             |            |        |
| **Total Lower Basin (Art. IIIa and b 1922 Compact)** |           | **8,500,000** |
| **Total Apportioned Colorado River Water** |           | **16,000,000** |

*Subject to Article IIId, 1922 Compact requiring delivery of 75,000,000 acre-feet at Lee Ferry each 10-year period.*
The states of the upper division are particularly conscious of Article IIId of the Compact, which would in effect curtail their uses whenever necessary to assure a total delivery of 75,000,000 acre-feet at Lee Ferry over any period of 10 successive years. Since 1934 the summed 10-year flows at Lee Ferry have been inadequate for both the allotted uses in the upper basin and the 10-year demand of the lower basin.

**VIRGIN FLOW AT LEE FERRY**

(Million acre-feet)

<table>
<thead>
<tr>
<th>Description</th>
<th>Value (Million acre-feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Annual Virgin Flow (1917)</td>
<td>24 (9 excess)</td>
</tr>
<tr>
<td>Minimum Annual Virgin Flow (1934)</td>
<td>5.6 (8.4 deficient)</td>
</tr>
<tr>
<td>Maximum 10-year Virgin Flow (1914-23)</td>
<td>188 (38 excess)</td>
</tr>
<tr>
<td>Minimum 10-year Virgin Flow (1931-40)</td>
<td>118 (32 deficient)</td>
</tr>
</tbody>
</table>

In other words an unregulated river would supply but 58 percent of the water apportioned the upper basin. On the other hand the high flow period 1906 to 1933 might be used to compensate for the low flow period 1934 to present. The key for overcoming this deficiency and putting to use the remaining 42 percent of the upper basin’s water is simply the impoundment of excess water in a system of long-time holdover storage reservoirs during periods of prolonged high flow for release during periods of prolonged low flow to supplement deficient flows at Lee Ferry. The result would be a regulated river of more or less uniformly equated flow that would be highly conducive to the generation of firm hydroelectric energy at many sites within the system.

Herbert Hoover, prior to his becoming President of the United States, was Chairman of the Colorado River Commission which settled the Colorado River Compact in 1922. In later years he also had many duties relating to the development of the river. In answer to a request for his views
on the water supply of the Colorado River he wrote the following on March 17, 1945.

"The allocations of water made by the Colorado River Compact in 1922 were necessarily based on so short a period of stream flow records that we were compelled to keep the allocations to the different areas within the safe limits. Many delegates were convinced that the demands for water, particularly in the lower basin, could not be satisfied within the allocations as made. But it was thought better to proceed for a period of years until a more accurate determination could be made, both of the water supply and the requirements of the several States, before attempting a final allocation of the complete supply.

"Further experience has shown great changes in the whole problem of supply:

"1. Reduction in water supply estimates.--The longer the period of stream flow records, the less becomes the safe yield of the river in extended low flow periods.

"As a result of the records of run-off for the period of 1931 to 1940, inclusive, it has been necessary to reduce the figure of safe water supply by at least 1,000,000 acre-feet.

"2. Excess of demand over supply in the upper basin.--In 1922 there was general agreement that the allocation of 7,500,000 acre-feet per annum to the upper basin would be more than ample to meet its ultimate requirements.

"At that time, diversions of water outside the basin were
estimated at not over 750,000 acre-feet. Today there are under construction and investigation transmountain diversion projects considered feasible, which will divert over 2,000,000 acre-feet per annum from the upper basin, and others are being discussed requiring another 1,000,000 acre-feet. As a result, it is now realized that the allocation will fall far short of ultimate needs of the upper basin.

3. The upper basin's guaranty to the lower basin.--In 1922 the compact requirement, that the upper States never deplete the flow of the river to less than 75,000,000 acre-feet in any 10-year period, was not considered burdensome.

"Studies now available show that to meet this obligation the upper States will have to provide at least 20,000,000 acre-feet of holdover storage to be used during low flow periods, comparable to 1931-40, or, lacking storage, will have to limit their use to about 64 percent of their allocation, in order to make available the 75,000,000 acre-feet at Lees Ferry.

4. Unanticipated uses in the lower basin.--In 1922 no one conceived of an aqueduct taking 1,000,000 acre-feet per annum out of the basin to the coastal plain of southern California. This aqueduct has now been built and is in operation.

"In 1922 the possibility of a project over several hundred miles long, involving continuous tunnels 80 miles or more in length for the carrying of main stream water to central Arizona for irrigation purposes, was thought fantastic. Today such a project is under detailed study."
"5. Conclusion as to the water supply.--From the foregoing and other facts, there can be only one conclusion: That as time passes, the safe water supply of the Colorado River is found to grow less, while the requirements for, and value of, that water increase manyfold. The Colorado River as a natural resource of the United States becomes of greater and greater importance and value each year; it should be guarded and preserved for the use and benefit of our people."

Mr. Hoover's statement has proven an excellent forerunner to the plan introduced in the Congress of the United States on April 2, 1953 with the unanimous approval of the five upper basin states.

The suggested plan of basin development includes two major features—one is the storage project and the other consists of the participating projects. The storage project is the very backbone of the plan. It comprises a system of dams, reservoirs, and power plants, also referred to as main-stem developments, located at strategic points above Lee Ferry on the main stem of the river and its important tributaries. This feature would provide the necessary regulation for discharge of the responsibility to the lower basin, thereby permitting uncurtailed use in the upper basin of its apportioned water.

There is a growing market demand for the energy produced by the storage project. The year 1970 potential market for electric energy in the upper basin alone would require 1.1 million kilowatts, or two-thirds the proposed installed capacity of the power plants of the storage project. The estimated lower basin year 1970 market deficiency is 4.4 million kilowatts. A satisfaction of these growing markets for low-cost
hydroelectric energy requires expedition of the construction of all 10 units of the storage project. The anticipated net revenues from the sale of energy generated by the storage project are sufficient to retire the entire costs of constructing the storage project and, in addition, furnish financial assistance to attractive participating projects, the second feature. Justification for the participation of worthwhile irrigation projects in the revenue benefits of the storage project stems from the physical relationship of the storage project with respect to new irrigation uses of upper basin water.

This type of financial assistance would make possible complete utilization of each state's apportioned share of Upper Colorado River Basin water. This, however, cannot occur overnight. For example, it has taken 100 years to develop existing projects which use less than 2-1/2 million acre-feet of the 7-1/2 million annual allotment. The 12 new projects being recommended for initial participation will use less than an additional 1/2 million acre-feet annually. Under an expedited program, possibly the remainder of the upper basin's water could be put to use in the next 75 years.

The plan has the unanimous approval of all five states comprising the upper basin. In addition the comments of Nevada and California are construed to be favorable. It is not an authority, but a plan. An authority is an administrative vehicle. Instead, this is a plan that embodies long established Reclamation principles applied to the broad-scale development of the upper basin.

As I stated previously, we are now at the crossroads in Reclamation. Unless Congress approves the principle of the plan, practically all new
Reclamation projects, both in and out the Colorado River Basin, will require assistance direct from the Treasury of the United States. It is felt this plan offers a more practical solution.

Now let's look again to the Colorado River Storage Project, the backbone of the Upper Basin plan. You are probably interested in how we arrived at the total required capacity of 48-1/2 million acre-feet for the proposed regulatory reservoir system. That is a tremendous amount of storage. It is half again as large as the capacity of Lake Mead. It provides 22-1/2 million acre-feet for silt retention, minimum power heads, and fish propagation. The remaining 26 million acre-feet is for conservation storage, 3 million of which will be required by participating projects such as the Central Utah Project and the Navajo Shiprock Project.

No single site on the Colorado River or its tributaries is capable of storing that amount of water. For instance the proposed 26-million acre-foot Glen Canyon Reservoir, due to a tremendous load of 20 million acre-feet of sediment in 200 years, could provide but one-fourth of the necessary conservation storage. Thus, the proposed Glen Canyon Reservoir, near the very outlet of the upper basin, would need the assistance of several upstream reservoirs. A large dam at the Glen Canyon site is not only a natural but also a must. Lying near the outlet of the basin, it offers opportunity for final control of Colorado River water deliveries to the lower basin. Although a capacity in excess of 26 million acre-feet would be possible, a larger Glen Canyon Reservoir would seriously encroach upon the beautiful Rainbow Natural Bridge. Capacity beyond that point also breaks out of the narrow confining canyon walls.
and would entail excessive evaporation. It is, therefore, highly desirable to establish a substantial amount of regulatory storage on tributaries near the headwaters where additional advantage could be taken of the power profile of the river system and where evaporation and sediment tolls would be less.

In selecting a team of 10 dams out of a great many possibilities, careful consideration was given to important factors such as water supply and its utilization, power production and its distribution, recreation, sedimentation and reservoir evaporation. In this light we have painstakingly examined many combinations. These investigations show that the team of 10 units selected would provide maximum water utilization and power production with a minimum loss of water from evaporation, and at the least cost. Two of the team's units would inundate a part of the Dinosaur National Monument. We have been unable to find any substitutes for these two units that would not materially jeopardize the team's chances for success.

Reservoir evaporation is a very important item since it constitutes a charge against the upper basin allotment of Colorado River water. Generally it is advantageous to store water at the higher elevations. Lake Mead, with a water surface elevation of 1,232 loses approximately a depth of 90 inches of water each year through evaporation, whereas the proposed Curecanti Reservoir at elevation 7,635 on the Upper Gunnison River in Colorado would lose approximately a depth of 25 inches of water each year through evaporation.
There is also a great variation in the contribution of water and sediment from various parts of the Upper Colorado River Basin. Because of its position, Glen Canyon Reservoir must catch most of the sediment and it can do so more economically than the other reservoirs.

**WATER AND SEDIMENT CONTRIBUTIONS**

<table>
<thead>
<tr>
<th>Water Supply</th>
<th>Sediment</th>
</tr>
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<tbody>
<tr>
<td>San Juan River below Bluff, Colorado River below Cisco, and Green River below Green River, Utah</td>
<td>5%</td>
</tr>
<tr>
<td>Colorado River above Cisco</td>
<td>45%</td>
</tr>
<tr>
<td>San Juan River above Bluff</td>
<td>16%</td>
</tr>
</tbody>
</table>

The project's power potentialities are dependent upon two main items—first, the quantity of regulated water which relates to the size of the reservoir and natural flow, and second, power head which relates to the height of the dam above the river.

Sediment deposits in the reservoirs will not lessen the original power head. Upstream use of water for irrigation and other consumptive purposes, however, would diminish the annual output of the system from an initial 9 billion kilowatt-hours to an ultimate 6 billion kilowatt-hours.

A dam at Glen Canyon giving a rise in water elevation of 560 feet would warrant a power installation of 800,000 kilowatts which is 2/3 the capacity of the Hoover Plant and less than 1/2 the capacity of the Grand Coulee Plant; yet it is half the power capacity of the proposed upper basin system. The other nine dams in the upper basin system with
river rises aggregating 3,460 feet (six times that at Glen Canyon), would utilize the component tributary flows and would entail power installations aggregating 822,000 kilowatts.

The Echo Park Reservoir is a remarkable storage vessel located at the junction of two major tributaries, the Green and Yampa Rivers. Percentage-wise, its evaporation losses are exceeded by all other sites possessing major possibilities in the upper basin. It is second only in size and importance to Glen Canyon. Being less subject to the toll of sediment deposition, this relationship in size improves considerably with age.

With respect to power production Echo Park is again second to Glen Canyon. This relationship is further amplified when considering the great contribution from Echo Park's regulated flows with respect to increased production at the downstream Split Mountain and Gray Canyon sites of future development. Next to Glen Canyon the power production costs at Echo Park are the lowest in the system.

Just as Glen Canyon's position favors power markets on the lower river system, Echo Park is strategically situated in the heart of the Colorado, Wyoming and Utah market areas for low-cost hydroelectric energy at the upper end of the river system. It also constitutes a flexible wheelhorse in the midst of a cluster of smaller proposed developments, all of which will benefit through stabilized power generation and transmission.

In presenting a plan to the affected states, the Bureau of Reclamation proposed immediate construction of Echo Park and Glen Canyon Units with an interconnecting basic transmission system upon which the eight remaining units of the Colorado River Storage Project could be added when justified.
by power market demands. The states, however, recognized a need for early construction of three of the eight remaining units, there being possibilities for use of each of these three units as points of diversion for their participating projects. Under the terms of the Upper Basin Compact the states have first right to the use of all or any part of storage sites needed in connection with their apportioned uses. We therefore also find in the request for initial authorization the Flaming Gorge Unit for assistance in the Central Utah Project diversion, the Navajo Unit for assistance of diversion under the South San Juan Project and Shiprock Indian Project in New Mexico. Colorado has also requested the inclusion of the Curecanti Unit on the Gunnison River with a restriction in its recommended size.

The three reservoirs just mentioned have special local significance in that they constitute possible points for diversion of water for irrigation and other purposes. As a rule, however, the Colorado River Storage Project reservoirs are of joint concern to all users of Upper Basin water. Inasmuch as the delivery of water to Lee Ferry is a joint obligation of all Upper Division states, it matters not in which state all or part of the main stem regulatory reservoirs are located. Although no main stem regulatory reservoirs are contemplated in Wyoming, that state nevertheless will share in the benefits of Glen Canyon and the other units. Likewise low-cost hydroelectric energy will be delivered at a uniform rate estimated to be less than 6 mills per kilowatt-hour to Southwestern Colorado, Northern New Mexico, and every other area within range of the interconnecting transmission system.

You people need not be told of what low-cost power would mean to
the growth and development of this area with its many natural resources. More industry, homes and services are inevitable. The unusual feature of this plan, however, is the inducement of the use of water through power—the irrigators' paying partner.

You have long awaited commencement of the Florida Project which would bring 6,300 acres of new land into cultivation and furnish supplemental water to 12,650 acres of land now having an inadequate irrigation supply. Under present-day conditions the prospective irrigators under the Florida Project could return to the government about $1 million dollars towards the total reimbursable project cost of $6,200,000. Yet, should the Congress approve this plan, construction would proceed on the Florida Project and revenues from the sale of power generated by the Colorado River Storage Project would be used to return the $5,200,000 cost in excess of the repayment ability of the irrigators.

Out of a total cost of $2,200,000 for the 3,670 acre Hammond Project, the water users would repay about $200,000.

The same procedure applies to 15,150 acres of new lands awaiting irrigation under the Pine River Extension Project where prospective irrigators can return but $1,700,000 out of a total cost of $4,700,000. In this case power revenue will assist these irrigators to the tune of $3,000,000.

In addition to these three projects there are 9 more initial projects in other parts of the upper basin. In all these, irrigators will pay $33 million dollars towards their costs and receive assistance to the extent of $188 million dollars from power revenues.
These 12 projects are only a beginning. But not every irrigation project in the Upper Basin will be permitted to participate in the benefits of the account since the plan provides for careful appraisal of individual projects and compliance with qualifying criteria some of which are:

It must be a user of apportioned Upper Basin water.

Its irrigators must pay up to their ability for 50 years, paying all their annual O&M and replacement costs and something against their construction costs.

Conservancy-type districts must also assist the irrigators.

A report must be available indicating its probable engineering and economic justification.

Its total benefits must exceed its total costs.

There is reason to believe that there are sufficient qualifying projects and sufficient power revenue to provide for complete utilization of each State's apportionment of Upper Colorado River Basin water.

Investigations are being completed for a status report on the La Plata Project. A status report on the San Miguel Project is nearing completion and will soon be followed by a status report on the Dolores Project. There are also several other smaller projects in Southwestern Colorado which will be investigated in due time. Should the status reports disclose the possibility of these projects meeting the foregoing criteria, more detailed authorizing reports will be prepared recommending to Congress their participation in the benefits of the Colorado River Storage Project plan.
In New Mexico favorable status reports have been prepared on New Mexico's South San Juan and the San Juan-Chama Diversion Projects. The Indian Service has also reported on its study of the Shiprock Indian Project. The State of New Mexico is requesting authorization of these three projects simultaneous with the authorization of the Navajo Unit of the Colorado River Storage Project which is a key structure in connection with future uses on the Upper San Juan River. Completion of the details pertaining to these three projects, however, must await New Mexico's decision as to the final amounts of water to be allotted each of these three projects.

In conclusion may I again state that Southwestern Colorado and Northern New Mexico indeed have much to gain through this basin-wide plan of water resource development. Not only will it share these benefits with many other like areas within the Upper Colorado River Basin, but beneficial effects will extend across the nation. For example, hydroelectric power provides for conservation of our natural resources. Water rushing down our rivers being largely recurring and renewable can't be mined out like our coal, gas and oil. If we use our rivers for production of electric energy we can conserve our fuels for many other uses. The reservoirs constitute ideal spots for recreation. Do you realize that last year the attendance to Lake Mead and Hoover Dam, now a National Recreational Area under the administration of the National Park Service, was exceeded only by the attendance at Yellowstone National Park? Plans in connection with some of the Colorado River Storage Project developments will offer to the public new scenery and recreational attractions of even higher order. Of paramount importance, however, is
the fact that the Colorado River Storage Project plan, when approved by the Congress of the United States, will afford the people of the Upper Colorado River Basin the opportunity and means for complete utilization of their apportioned Colorado River water.