COLORADO RIVER BASIN PLANNING
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The development of water and related land resources of the Colorado River Basin has evolved through several phases. Although some of the early stages of development may have been primitive and parochial, they certainly entailed elements of water resource planning. Probably the first people who actually put waters of the Colorado River to work on a large scale were the Hohokam. Prior to the dawn of recorded New World history these resourceful people realized the importance of water to their civilization. With primitive tools such as sticks, stones, hides, and mud, combined with ingenuity and hard work, they constructed 150 miles of canals, built 170 villages, and irrigated at one time or another various portions of the Gila and Salt River Valleys. Their ancient canals were capable of supporting 100,000 people on as much as a quarter of a million acres; although the area under cultivation at any one time was probably much smaller. All irrigation was accomplished by direct diversion from the stream. As the low elevation lands became water logged, the Hohokam simply moved to another locality and developed new land. The cause of the exodus of these peoples about 1300 A.D. is unknown. It is believed to have been severe drought. Primitive as they may have been by modern standards, the Hohokam did not do so badly; especially when you consider that they maintained an agrarian society for about fourteen centuries beginning about the dawn of the Christian era. Less than two centuries have elapsed since the United States became an independent nation. There are a lot of doubters today that it will survive another century, not to mention another 1200 years.

Strange as it may seem, the present modern irrigation works in central Arizona are simply making more efficient use of the same streams that at one time made agriculture possible to support a primitive people. Equally interesting is the fact that in the Colorado River Basin, 5 1/2 centuries after the Hohokam disappeared from history, the first white pioneers with tools of iron utilized very similar schemes to divert water from the streams directly to adjacent lands. I guess we can feel good about the fact that our civilized predecessors in this region required only about 200 years to go through the various stages of river basin development to our present status. At least we have outstripped the Hohokam in this respect—as well as in despoiling our environment by
polluting both water and air. So far as the Colorado River Basin is concerned the road to progress has been rough, and the journey stormy. In spite of our haphazard course, man's legal sagacity, persistence, and engineering ingenuity have permitted comprehensive, multiple-purpose development. At least we claim to have subbasin development in the Colorado River Storage Project and participating projects in the Upper Basin.

I am sure that all of you are aware that since the beginning of this century the Colorado River has been the subject of more bitter disputes and major court action than any other interstate and international stream. Except for relatively small amounts of water used for domestic and mining purposes in the last half of the 19th Century, the first really modern, larger-scale consumption of water occurred in the Lower Basin States, particularly in California, which at the same time suffered from severe floods in the Imperial Valley. California's early expansion of agriculture and other uses of water came as a natural result of having an abundance of good soils, an attractive climate, and a strategic location. It soon became apparent to the Upper Basin States, and especially after California began agitation for a large flood control dam at Boulder Canyon, that the Lower Basin States could easily consume all of the Colorado River's water. Under the western States' doctrine of appropriation there would be no water left for increasing demands in the Upper Basin. Before the Lower Basin could have Hoover Dam, the Colorado River Compact of 1922 had to become the basic "law of the river." This document divided the use of water between two political sub-basins, the Upper and the Lower Basins.

Severe legal restrictions are imposed upon the use of Colorado River water by an international treaty, two major interstate compacts, one lesser compact, numerous agreements, and judicial decisions. Compacts as inviolate contracts have been born in areas of insufficient water supply in order to protect one area from another in the acquisition of the limited supply that cannot fully satisfy the needs of both. Insufficiency of water was the underlying stimulus that produced the Colorado River Compact which divided the physical basin into two political subbasins and apportioned the use of water between them. Insufficiency of water was the causative factor behind the Upper Colorado River Basin Compact which apportioned the Upper Basin's use of water among five states and created an administrative agency for four of them. Lack of water for all potential uses in the Lower Basin was the real cause of forty years of bitter disagreement, culminated by eleven years of expensive litigation in Arizona v. California, recently decreed by the United States Supreme Court.

The important concept to keep in mind with regard to the Colorado River Basin is that the violently confused and bitterly complicated alterations concerning the Colorado River are the result of too many people demanding too much from too small a water resource. It is well known that there is a serious water deficiency. This deficiency exists because
there is an imbalance in the supply of water relative to the quantity of other resources, including people, land, minerals, and climate. A crisis is presently being faced by Arizona, California and Nevada in the Lower Basin. The same crisis is year after year burning deeper and deeper into the thirsty throat of the Upper Basin.

Severe hydrologic conditions limit the consumptive use of water. The calculated, undepleted or "virgin" flow of the Colorado River at Lee Ferry, Arizona is an index of the water supply in the Basin. The annual flows of the river are extremely variable. The annual virgin flow at Lee Ferry has varied between 5.6 million acre-feet and 24 million acre-feet since 1896, with a long-term average amounting to 14.9 million acre-feet. In 1922, at the time the Colorado River Compact was executed, available records indicated that the average virgin flow amounted to almost 17 million acre-feet. By 1964 this average had dropped to 14.9 million acre-feet. The negotiators of the Upper Colorado River Basin Compact of 1948 used 1914-45 records as a basis for their work. The average virgin flow for that period appeared to be 15.6 million acre-feet. For the years 1922-64, since the signing of the Colorado River Compact, the average virgin flow dropped to 13.8 million acre-feet. For two ten-year periods within thirty-two years, 1931-40 and 1954-63, the average was only 11.8 million acre-feet. These are the lowest ten-year periods on record.

Due to the erratic and widely variable nature of the annual river flows it has been necessary to construct large reservoirs on the main stem and principal tributaries in the Upper Basin in order to store water for long periods, from years of large runoff to years of small flows. Only through the device of long-term storage is it possible for the Upper Basin States to deliver 75 million acre-feet of water in every ten-year period to the Lower Basin and at the same time continue to expand water uses in the Upper Basin. The Glen Canyon Dam on the Colorado River, Flaming Gorge Dam on the Green River, and the Navajo Dam on the San Juan River have been constructed to fulfill this purpose. Numerous participating irrigation projects, such as the Central Utah Project, the Seedskadee Project in Wyoming, the Silt and Paonia Projects in Colorado, and the San Juan-Chama and Navajo Indian Projects in New Mexico are examples of concurrent expansion of water consuming projects in the Upper Basin.

The paramount reasons behind the acute concern about water resources of this Basin are the growing population, expanding industrialization, increasing irrigated agriculture, and the rising standard of living. Each of these phenomena is working overtime in the Colorado River Basin at rates in excess of national trends. The Colorado will be the first major river system in the nation to have all of its water consumptively used so that not a drop will spill to waste to the ocean. The point of complete usage is imminent in the Lower Basin and is rapidly approaching in the Upper Basin. This is the reason why controversy in the Basin rolls merrily
along its nonconstructive path. This is the reason why the much-needed Central Arizona Project is stymied in the Congress.

Water supply analyses have been made in recent years by Engineers representing Arizona, California and Nevada, by the Bureau of Reclamation, and the Upper Colorado River Commission. All studies indicate that any large increase in use of water in Arizona must even now be supplied in part from water apportioned by Compact to the Upper Basin, but which is presently unused by it. As the Upper Basin progresses with its development the amount of unused water will diminish until ultimately no surplus Upper Basin water will be available for use in the Lower Basin. Three States of the Upper Basin that still have unused water available believe that the Central Arizona Project will jeopardize their future unless there are concurrently authorized with the Central Arizona Project certain solid assurances that water will be added to the river from outside sources so that it will be physically available in the quantities needed and at the time needed. These Upper Basin States realize the likelihood that in some future lawsuit Arizona might prevail upon the Supreme Court in the interest of protecting an existing, expanded economy in Arizona, created with Upper Basin water, to rewrite the documents that constitute the present "law of the river." Although the Compact was executed to guard against that very contingency, Arizona persuaded the Supreme Court in Arizona v. California to sever the Colorado River Compact from the Boulder Canyon Project Act into which Upper Basin Senators in 1928 thought they had inseparably woven it. Arizona has also served notice that she intends to persuade the Supreme Court that when Congress gave its consent to the Compact it imposed a new meaning to it which excludes accounting for uses of water from Arizona's tributaries under the Colorado River Compact, thereby enlarging the Upper Basin's share of the Mexican Treaty burden. If Arizona were to prevail in this assertion the Upper Basin States' future water development would be even further curtailed.

In the latest version of the Central Arizona Project bill supported by Arizona and opposed by three of the Upper Basin States and California, Arizona refused to support even a study of an importation of water into the Colorado River and the construction of a large hydropower dam on the Colorado River as a means of providing revenues with which to aid in paying for a future water supply augmentation program. These are the assurances deemed essential by the States opposed to the Senate version of the CAP legislation. California, in addition, in the event there are less than 7.5 million acre-feet available for the Lower Basin would like to have 4.4 million acre-feet of her present water uses of 5.1 million acre-feet given a perpetual priority over the Central Arizona Project. Because of the limited remaining water supply, those States opposing the Central Arizona Project believe that authorization of such a large development without some assurances of a water augmentation program would be tantamount to shifting water shortages from one entity to another.
Presently two bills are pending before the Congress, either of which, if enacted, would authorize the construction of the Central Arizona Project. S. 1004 to authorize a CAP has been passed by the Senate. H.R. 3300 to authorize a Colorado River Basin Project (including CAP) is a regional bill that would also authorize studies of water supply augmentation and a large hydropower dam in Bridge Canyon of the Colorado River to produce revenues to aid in paying for augmenting the river. A stalemate now exists. Because the 90th Congress has over another year's life the ultimate fate of these two bills is unknown.

Presently the Colorado River Basin is in a stage which might be termed "regional planning." This program originated with the recommendations of the Senate Select Committee on National Water Resources. The over-all program for the nation was presented to the Congress by the President in his fiscal year 1963 Budget Message.

The Water Resources Planning Act of 1965 established the Water Resources Council at the national level. The Water Resources Council was given the job of organizing and supervising the Type I, Framework Studies for eighteen regions in the United States. In the Pacific Southwest the Pacific Southwest Inter-Agency Committee was designated to be the coordinating agency. For the purpose of these Framework Studies the Pacific Southwest has been divided into four regions—California, Great Basin, the Lower Colorado, and the Upper Colorado Regions. The latter two regions cover the entire Colorado River Basin.

The Bureau of Reclamation has been selected as the lead agency for the Lower Colorado Region State-Federal Interagency Group. In the Upper Colorado Region, the Upper Colorado River Commission was designated as the chair agency. In this regional planning effort, representatives of the seven Colorado River Basin States and the Upper Colorado River Commission are participating with about sixteen federal agencies in making the investigations and compiling reports.

According to the guidelines approved by the Water Resources Council, the "basic objective in the formulation of Framework plans is to provide a broad guide to the best use or combination of uses of water and related land resources of a region to meet foreseeable short and long-term needs." This appears to be a statement covering a wide spectrum of possibilities. I am sure that this is its intent, but I am also sure that there is no intention to circumscribe, limit, or preclude the type of water resource development desired at the local and State level. Nor is there any intent to incase in concrete water development planning to the point that changing economic and social conditions in the future cannot be met by altering the nature of water uses when necessary. My friend, Mr. Tom Helseth, State Conservationist of California, who is also chairman of the Pacific Southwest Inter-Agency Committee, and who follows me on your program, will, I am sure, describe these Type I studies in more detail.
The Type I studies are to be reconnaissance in nature and must rely largely on existing data and the reasonable judgement of competent planners. Probably one of the greatest values to be derived from these comprehensive, regional studies will be the inventory of present water supply and their uses. A correlative value will be to give some idea of the best way in which the remaining water and related land resources might be developed. Presently these Type I Framework Studies are well underway in both the Upper and Lower Basins of the Colorado River. They will completed by 1970. It is anticipated that the results of these initial studies will justify their being followed by Type II Studies that will be a great deal more definitive by actually going into examinations of alternative future possible uses of water and land.

Colorado River Basin planners of the future must face the fact that in recent years Congress has enacted several laws that will have increasingly greater influences upon their activities. As examples, let us mention four that are now on the books and one that will be there soon from all indications.

Of four laws that will greatly influence future water and related resources planners, first I want to mention the Water Resources Planning Act of 1965, to which reference has already been made. In addition to creating a water resources council at a Presidential Cabinet level, consisting of the Secretaries of the Interior, Agriculture, Army, Health, Education and Welfare, Transportation, and the Chairman of the Federal Power Commission, this act provides for an assessment of the adequacy of water supplies, the creation of river basin planning commissions, and for financial assistance to States for comprehensive water and related land resource planning. The Federal-State River Basin Commissions and a Water Resources Council at the national level to act as clearing houses for river basin investigations cannot help but have some influences upon the nature, scope, priority of future water and land resource planning and development. Planning experts must take these influences into consideration, whether time proves them to be beneficial—as we hope—or otherwise.

Another law which will have far-reaching effects is the Federal Water Pollution Control Act. Undoubtedly this Act was needed more in the eastern States than in the Colorado River Basin because of the East's greater density of population and industries. The law is now with us in the West. In the Colorado River Basin we must comply as well as those who live in the northwest, east, or southeast must comply with it. As western States, if we cannot establish and enforce satisfactory pollution control criteria on interstate streams, the Federal government will do it for us. Either way the job has to be done. On the Colorado, until now, we have been content with short-run measures involving engineering and management. Man is now threatening the stability of his own existence by his insistence upon unlimited freedom to reproduce and his demand for an endless variety of industrial products. Pollution is not
a new problem. It is a problem that is pyramiding nationally with the sophisticated needs of modern society. The Colorado River region is no exception. We are fortunate in this Basin by still having proportionately more space, land and other resources than people. We can do something about preventing the pollution problem from becoming more serious. We are unfortunate, on the other hand, by having too little water in relation to the number of people the Basin could support if an adequate supply were available. In addition to all of the other management procedures involved in effective pollution control, it is inevitable that the time will arrive when existing water supplies must be augmented for aiding pollution control—not to mention for satisfying consumptive uses. The point is, the planners of the future must give more attention to the prevention and control of water pollution than ever before. There is a law on the books to make this facet of planning mandatory.

Two other recently enacted laws should at least be mentioned--The Water Resources Research Act of 1964, which provides for research investigation, experiments, and training at qualified colleges and universities through Water Resources Research Institutes will, as time elapses, make its results felt in the field of resource planning. The various disciplines at the university level should be able to contribute many good ideas and concepts to improve planning for the use of the nation's remaining water resources. The Federal Water Project Recreation Act of 1965 incorporated new departures and cost sharing for recreation and fish and wildlife enhancement. As we all know, all forms of recreation, especially those that are water oriented, are playing major roles in the nation's economy. Colorado River Basin planners cannot overlook these possibilities in the future.

Another law that Congress is about to enact will create a National Water Commission to consist of seven Presidential appointees. This Commission in five years is supposed to review present and anticipated national water resource problems, making such projections of water requirements as may be necessary. It is supposed to identify alternative ways of meeting these requirements, giving consideration, among other things, to conservation and more efficient use of existing supplies. Although this bill has not yet become a law, its influence has already been manifest. The possibility that it will become a law has been seized upon as an excuse to defer construction of certain water resource projects. It has also been used as an excuse for precluding even a reconnaissance study of water importation into the potentially water-deficient Colorado River. How potent will be the influence of the National Water Commission after the law is enacted can only be ascertained by studying future developments. It should be our sincere hope that the Commission's work will be constructive.

As planners in water and land development we must never lose sight of the fact that fresh water is a critically important resource. As supplements to our prayers for rain, our supplications to the rain gods,
beating the medicine men's tom-toms, or what have you, we have an obligation to act now on the premise that the conservation and wise use of water will be a decisive factor in the welfare of future generations. I believe that we are astute enough to recognize the necessity of increasing the degree of rational management of water based on detailed and authentic knowledge. We must continue to seek reliable information on which to base measures to maximize the usefulness of water for the farm, for the home, for power generation, and for industry—and to minimize the adverse consequences of floods, pollution, salting and river degradation.

To again pinpoint the Colorado River, reliable engineers in all seven States realize that the fundamental issue is the water deficiency of the entire Basin. If supplemental water could be injected into the already water-short, lower Colorado River service area, the potential resource development of the Upper Basin could be protected simultaneously and the growth of its economy assured. Part of an increased water supply must be derived from improved management, reuse of water, phreatophyte control, conduit linings, and other conservation practices. Part of the increase may be realized at some time in the future from desalting sea water or weather modification, if projected technology proves to be as good as prognosticated. Presently, it would be improvident planning to rely on wishful, dramatic, but highly speculative breakthroughs in techniques of desalination or weather modification. Neither of these processes can be guaranteed now technically, economically, or legally. The immediate and long-range requirements are so enormous that additional water will have to be imported from outside the basin.

In the Colorado River Basin, or rather in the West, we have reached the stage when it is mandatory that comprehensive, basin-wide, water resource planning—even our present concept of regional investigations—must be superseded by interregional planning and development.

Before any interregional transfer of large quantities of water can be accomplished, detailed studies of water and related natural resources are essential. These studies must encompass not only hydrology, engineering and financial feasibility, and project economics, but must also include emphasis on the national interest, the demands for water for every conceivable use, and the protection of those potential demands in the basin of origin. Only surplus water (excess water with no reasonable potential use) should be exported from a basin.

Interregional planning will require broadened horizons in thinking and changes in concepts relating to local and national interests. Local, individual projects, and even individual basin-by-basin planning, must be superseded by expanded interstate and interbasin planning involving regional transfers and exchanges of water supplies from one river system to another. Surplus waters that originate in, or are adjacent to, one area, and usually go to waste, must provide for the needs of people in other parts of the nation; in this manner, the national interest can be served and the general economy expanded.
If we fail to make the necessary interregional investigation, obtain the necessary facts and apply them, what will be the result? The answer is contained in the rivers of other civilizations which were relatively as advanced in their day as we are in ours. Afghanistan, Mesopotamia, Babylon—and don't forget the Hohokam—died in dust because they failed to properly manage their water and land resources. For too long we have tended to adhere too closely to the ancient philosophy that the solution of water problems is to migrate to an area that has not been despoiled. This system will no longer work because, as stated by R. L. Nace and L. J. Tison, "After 5,000 years of solving mistakes by fleeing from them, that solution is no longer possible because there is no place to go. It seems evident that man is approaching a crisis which, unless adequately prepared for, could bring disaster within the lifetimes of people already born."

Provisions for future water requirements must be in terms of people and their relationship to natural resources. Potential as well as present populations must be considered. In the Colorado River Basin billions of units of undeveloped resources in various forms of energy, minerals, and land can be exploited when water is made accessible. New jobs, new homes, and enlarged tax bases will aid the nation, states, and local communities.

As members of the Western States Soil Conservation Commission, you have an important role to play in water and related land resources planning.