THE COLORADO RIVER

A Comprehensive Report on the Development
of the Water Resources of the Colorado River Basin
for Irrigation, Power Production, and other Beneficial Uses

IN

Arizona, California, Colorado, Nevada
New Mexico, Utah, and Wyoming

BY

UNITED STATES
DEPARTMENT OF THE INTERIOR
J. A. Krug, Secretary

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Under Supervision of
BUREAU OF RECLAMATION
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a few miles above where Lieutenant Ives had been stopped, he achieved the hitherto impossible feat of traversing a thousand miles of unknown rapids and formidable canyons. He became the first white man to gaze up the sheer walls of the Grand Canyon throughout its entire length and live to tell the tale.

Subsequently, Major Powell and others made additional voyages to explore the canyons. With the river explored, active investigation began to make it useful for man.

Settlement

Settlement of the Colorado River Basin has slowly but steadily progressed. Rural settlements have been scattered along streams. Towns and cities have grown up mainly near farms and mines and at important railroad points.

The early settlers endured many hardships in carving homes from the wilderness--the rigors of an arid climate, the depredations of Indians and wild beasts, and the arduous and wearisome existence of frontier life.

Missionaries influenced early settlement in the basin. Father Kino, a Spanish priest, founded the first settlements subsequent to his visit to the region in 1691. Spaniards established resident fathers in the Santa Cruz River Valley as early as 1700, and soon after several missions were constructed on the banks of the stream.

Among the early colonizers of the basin were Mormon pioneers, who settled in small agricultural communities along river valleys, cultivated the more favorable farming lands adjacent to streams where irrigation water was readily accessible, and grazed livestock on nearby range lands. Old Fort Supply in Wyoming and Santa Clara, Utah, were established by Mormons in 1854. Mormon settlements spread into other parts of Utah, and in Arizona and Nevada in the 1860's and '70s.

The lure of gold was a chief factor influencing early settlements. Many a pioneer settler came seeking his fortune in the gold rushes, but, finding that his dreams of easy riches would never materialize, stayed to raise livestock or to farm.

Several rich mines were discovered throughout the basin by transient prospectors and these discoveries were responsible for a temporary population influx. Miners and prospectors pushed over the mountains from older mining districts on the eastern slope of the Continental Divide. The placer ground at Breckenridge, Colorado, near the crest of the divide attracted the first settlers to this region in 1859. Within the next decade other mining camps were established near the mountain tops. Some miners turned to farming and found a lucrative business in supplying agricultural products to the mining communities. Settlement grew downward from the mountains into the valleys in this western slope section of Colorado,the advance being slowed somewhat by the hostility of the Indians who occupied the territory.

CLAIMING THE BASIN

The greater part of the Uinta Basin in Utah was established as an Indian reservation in 1861.

Mining was active in southeastern Arizona from 1847 to 1860 under protection of the Federal Government, but during the Civil War hostile Indians caused nearly all of the early mining settlements to be abandoned. After the Civil War mining was resumed.

The establishment of amicable relations with the Indians and the construction of railroads through the basin finally made permanent settlement possible. The Union Pacific Railroad was completed to Green River, Wyoming, in 1869. The Southern Pacific Railroad reached the Colorado River at Yuma, Arizona, in 1877, and the Atlantic and Pacific Railroad crossed the river at Needles, California, in 1883. With the coming of the railroads, navigation soon declined. Other than by railroad, early transportation was by horse and mule, pack train, or freight wagon traversing trails and primitive roads.

For many years mining was the leading industry in the Colorado River Basin but declined in relative importance with the development of irrigated agriculture. Many rich gold and silver lodes pinched out. Aspen, Telluride, and Silverton in Colorado, once prosperous cities pouring out gold and silver, became dozing towns. Production of copper, lead, and zinc became more important, and Arizona displaced Colorado as the leading producer of minerals in the basin. Where valuable mines were discovered, towns sprang up in their immediate vicinity, and where possible, irrigated agriculture was practiced nearby to supply the demands of local markets.

Cattlemen were attracted to the expansive grazing areas of the basin and in many sections were the first settlers.

Colonization in the basin has been accompanied by a continual search for a satisfactory irrigation water supply. Settlers migrated to areas more readily irrigated and concentrated along river courses. A few small settlements were made in favored isolated areas.

The history of early settlement along the lower reaches of the Colorado River is a story of community struggles with destructive floods. Many towns were established only to be abandoned later when it became evident to the settlers that it was impossible for them to control the rivers. Dams were repeatedly washed out, crops withered and died in time of drought, and flash floods ravaged the fields and towns.

Private and community efforts were responsible for the establishment of early settlements. Some present-day settlements, however, followed in the wake of Federal Reclamation developments. These projects, making available new areas of fertile farm land and attracting many new settlers, have been the nuclei around which farming communities and trade centers have evolved.

Population

Referred to as an area of "wide open spaces," the Colorado River Basin is sparsely populated. On the basis of the 1940 census, which

reported fewer than a million people in the basin, the average population density of the entire area, including urban centers, was 3.6 persons a square mile, as compared with a national average of 44.2 persons a square mile.

Population Growth

Except for short-lived surges resulting from mining, the population of the Colorado River Basin has steadily increased since its colonization. At the beginning of the Twentieth Century the basin supported only 261,197 persons, or little more than an average of one person a square mile. The population has more than tripled in the first 40 years of this century.

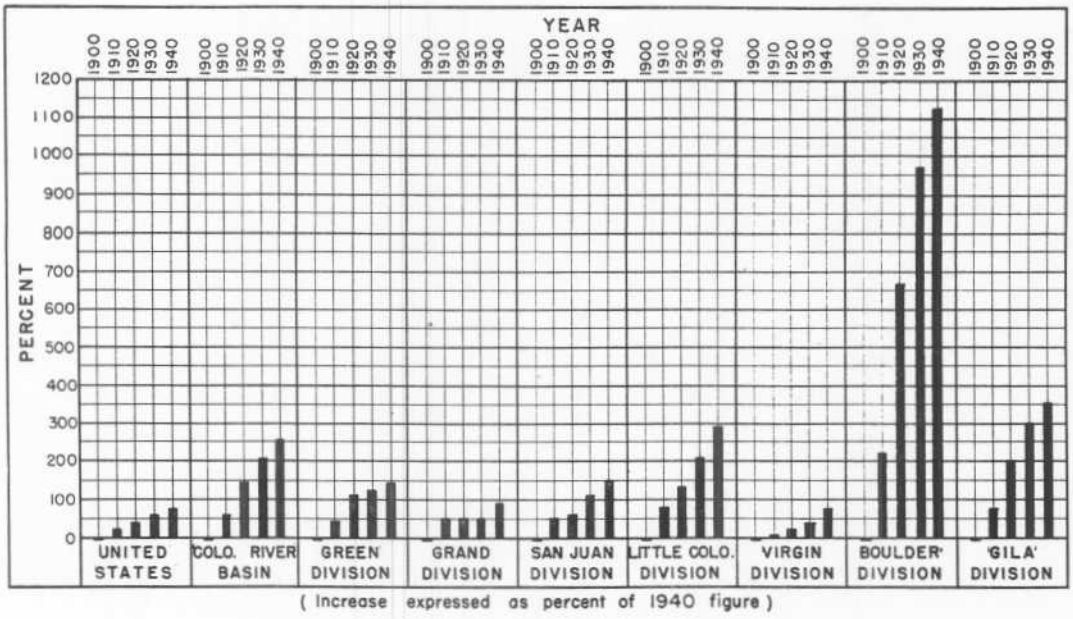
The first settlements which grew into permanent communities were largely the result of farming. But farming was slow to develop into a stable industry, and in the early stages it was not adapted to the support of sizable centers of population. Urban communities began to rise with the development of Federally-financed irrigation projects. The city of Phoenix, Arizona, grew rapidly in the decade 1910-1920 when great strides were taken in the development of irrigation in the immediate vicinity.

The relatively high rate of natural increase, the improvement in transportation facilities, the opening of scenic features of the country to tourists, the accessibility of outside markets, and migrations from the Middle West have been largely responsible for the increase in population during the 1930-1940 period.

Population growth has not been uniform throughout the basin. Between 1900 and 1940 the Lower Basin increased its population five times while during the same period the Upper Basin little more than doubled. A phenomenal growth was experienced by the southern California area where the population increased more than 12 times in the same 40-year period.

TABLE II
POPULATION GROWTH IN THE COLORADO RIVER BASIN

Division	1900	1910	1920	1930	1940
Upper Basin					
Green	42,110	59,450	85,320	93,330	99,710
Grand	57,050	84,590	84,380	84,050	105,450
San Juan	32,340	47,890	53,450	66,920	81,290
Total	131,500	191,930	223,150	244,300	286,450
Lower Basin					
Little Colo. R.	19,057	34,631	44,146	60,986	75,341
Virgin	9,569	10,305	11,706	13,879	17,213
Boulder	10,414	33,871	79,899	111,558	127,568
Gila	90,657	161,969	275,433	363,466	411,497
Total	129,697	240,776	411,184	549,889	631,619
Colo. R. Basin	261,197	432,706	634,334	794,189	918,069
S. California	282,090	703,675	1,253,800	2,791,927	3,524,860
United States	75,994,575	91,972,266	105,710,620	122,775,046	131,669,275



(Increase expressed as percent of 1940 figure)

FIG. 1 - POPULATION GROWTH, 1900 - 1940

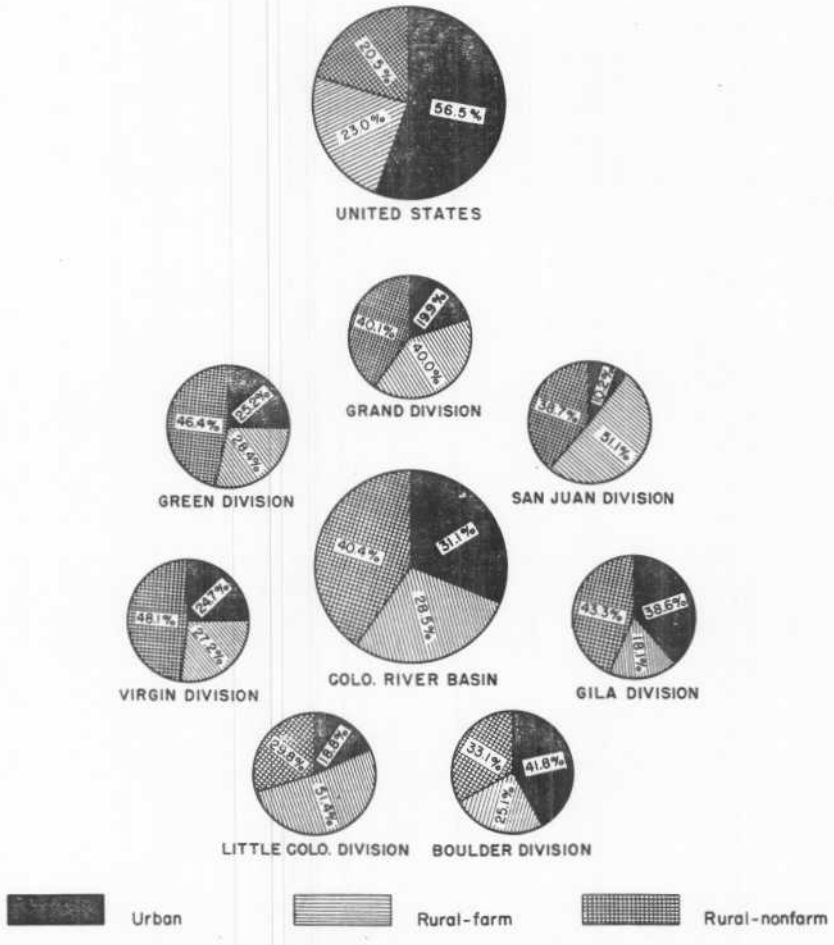


FIG. 2 - DISTRIBUTION OF POPULATION, 1940 CENSUS

The people of the Colorado River Basin are predominantly white, 85 percent of the population being so classified in 1940. Of the nonwhite races, Indians are in greatest number in the Upper Basin and Mexicans in the Lower Basin, which is to be expected as the area borders on Mexico. Indian, Mexican, and Negro populations are increasing.

Distribution of Population

Approximately 69 percent of the 1940 population of the Colorado River Basin was classified as rural. This means that approximately 630,000 people lived either in the open country or in towns and villages of fewer than 2,500 population. Only 28 percent of the total population lived on farms and approximately that proportion was directly dependent upon agriculture for a livelihood.

Urban centers are scattered throughout the basin. Largest settlements in the Upper Basin are mining, agricultural, and railroad centers. In the Lower Basin concentration of population is mainly where irrigation is extensive although recreational and scenic attractions have been responsible for the location and growth of many cities. Conforming to a National trend, there is an increasing concentration of population in urban centers. Principal towns and cities in the basin are:

Division	Population (1940)
Green	
Rock Springs, Wyo.	9,827
Price, Utah	5,214
Helper, Utah	2,843
Green River, Wyo.	2,640
Craig, Colo.	2,123
Vernal, Utah	2,119
Kemmerer, Wyo.	2,026
Grand	
Grand Junction, Colo.	12,479
Montrose, Colo.	4,764
Delta, Colo.	3,717
Glenwood Springs, Colo.	2,253
Gunnison, Colo.	2,177
Fruita, Colo.	1,466
Rifle, Colo.	1,373
San Juan	
Durango, Colo.	5,887
Farmington, New Mexico	2,151
Shiprock, New Mexico	2,131
Escalante, Utah	1,106
Little Colorado	
Gallup, New Mexico	7,041
Flagstaff, Arizona	5,080
Winslow, Arizona	4,577
Holbrook, Arizona	1,184

Division	Population (1940)
Virgin	
St. George, Utah	3,591
Hurricane, Utah	1,524
Caliente, Nevada	1,500
Kanab, Utah	1,365
Pioche, Nevada	1,182
Boulder	
Brawley, California	11,718
El Centro, California	10,017
Las Vegas, Nevada	8,422
Yuma, Arizona	5,325
Williams, Arizona	2,622
Gila	
Phoenix, Arizona	65,414
Tucson, Arizona	36,818
Douglas, Arizona	8,625
Prescott, Arizona	6,018
Bisbee, Arizona	5,853
Nogales, Arizona	5,135
Silver City, N. M.	5,044
Safford, Arizona	2,266

Population Movement

The towns first established in the basin were little more than temporary camps, and a look at a map of 40 or 50 years ago will reveal names of communities which are today but memories of a romantic past.

From the beginning the population possessed a high degree of mobility, particularly in the Lower Basin. Although the number and size of permanent communities have increased since the turn of the century the population has not lost its trait of mobility. The University of Arizona found from a recent study of population trends in Arizona that while the decade 1930-1940 brought 134,000 people into the State, the net population gain was only 63,000 persons, of which 32,000 could be attributed to the natural increase in the resident population. Some 103,000 people had claimed Arizona as a place of residence during that decade but had failed to become permanently established.

Economic depressions and disasters in other states have dislodged many people from permanent moorings, and those thus affected have moved aimlessly about the country. The droughts and dust storms which occurred in the Middle West in the 1930's resulted in such migrations. Hearings before the House of Representatives Committee of the 77th Congress investigating migratory labor problems revealed that 63 percent of all migrants into Arizona and southern California during this period came from the Middle West. The committee found that while 66 percent of the group investigated had been farm operators or owners prior to migration, less than 15 percent became owners or operators of farms in their new locations. The majority of the migrants from the Middle West became farm laborers or joined the ranks of the semiskilled or unskilled workers, depending on seasonal or other temporary employment.

The population of the Upper Basin has been less affected by immigration than that of the Lower Basin. Instead of growing from migration, Utah lost by outward movement of its residents from 1920 to 1940. Many young people left the State to seek work and opportunities in larger industrial centers and metropolitan areas. Despite its outward migration, Utah has had a net population gain each decade because of its high birthrate. In 1930 Utah had the highest rate of natural increase in the Nation.

The rise of war industries during World War II brought to the area its most rapid influx of people. The most significant movements were to southern Nevada and central Arizona. Las Vegas, Nevada tripled in population during the war period, and the city of Phoenix, Arizona, increased approximately 130 percent. At the same time, thousands of young men left the area to join the Nation's armed forces. Thus, the war induced movements into and out of the basin.

The relatively undeveloped state of the basin and its store of natural resources indicate that by no means has the population reached its peak growth.

plant growth occur in isolated tributaries but the injurious effects are local and generally unimportant. Diluted by larger streams of the system, these soluble salts of tributary streams cease to be harmful. Water of the main river becomes progressively more saline as it moves downstream and receives return flows from irrigation and drainage from basin lands but is considered suitable for irrigation at the lowest diversion. (See Chapter VIII, Geological Survey "Quantity and Quality of Water.")

Tributaries entering the middle and lower sections of the Colorado River, notably the San Juan, Little Colorado, and Virgin Rivers, have highly erosive watersheds and hence contribute great quantities of silt to the main stream. At normal flow stages little silt is carried, but more is picked up in spring and early summer when flows become high and turbulent. Occasional summer cloudbursts cut into unstable earth sections, flushing large amounts of mud and silt into the streams.

Early Development of the River

Irrigation

The first white irrigators in the Colorado River Basin were the Jesuits who established themselves at the old missions of Cuevavi and San Xavier in Arizona in 1732. In the period 1768 to 1822, considerable irrigation was practiced along the Santa Cruz River near the missions and the Spanish presidios of Tubac and Tucson.

After the Gadsden Purchase in 1854, a number of Americans--military followers, stragglers from the immigrant stream to California, and others, pioneers by instinct--began to settle and develop irrigation in Arizona. Thomas H. Blythe moved to the Palo Verde Valley in 1856 and commenced the first recorded use of the Colorado River in California. In 1877 he made the first filing on Colorado River water in California. About the same time the first modern irrigation works were being constructed in Wyoming, Utah, and Colorado. In 1854 Mormon pioneers began to irrigate from Blacks Fork, a tributary of Green River, in Wyoming. Irrigation in the basin in Colorado began in the 1860's and '70's when prospectors and miners came over the Continental Divide from the older mining districts on the eastern slope of the Rockies. The Federal Government first attempted to reclaim arid lands on the Colorado River Indian Reservation in 1867. In 1883 the Grand Valley Canal, a private development, was started to irrigate a relatively large area in Grand Valley on the western slope of the Rockies in west-central Colorado.

The possibility of exporting water from the Colorado River to the Imperial Valley of California by a simple diversion canal passing in part through Mexico was recognized even before the Civil War. In 1876 Lt. Eric Bergland made surveys on the lower river for the War Department for the purpose of investigating flood conditions and to determine the feasibility of diverting water from the Colorado River to the Imperial Valley through a canal wholly within the United States. He reported unfavorably on such a canal but efforts continued for a water supply to the Imperial Valley. Despite the difficulties and undesirability of a canal through Mexico for the irrigation of Imperial Valley from the

Colorado River, construction of an international canal was finally begun in 1902 by the California Development Company. By September 1904 nearly 8,000 people had settled in the valley; 700 miles of canal were in operation; and 75,000 acres of land were cropped.

After passage of the Reclamation Act by Congress in 1902, the Reclamation Service (Bureau of Reclamation since 1923) of the United States Department of the Interior began investigations to determine the feasibility of constructing large irrigation works in the West. Some of the early projects constructed in the Colorado River Basin by the Reclamation Service were the Uncompahgre and Grand Valley projects in Colorado, the Strawberry Valley project in Utah, and the Yuma and Salt River projects in Arizona.

Irrigation continued to expand in both the Upper and Lower Basins. In 1922 the approximate irrigation development in the entire Colorado River Basin, according to a report by F. E. Weymouth, then Chief Engineer of the Reclamation Service, was as follows:

TABLE IV
IRRIGATION DEVELOPMENT IN THE COLORADO RIVER BASIN (1922)

	Area irrigated (acres)	Area irrigable (acres)	Total (acres)
Upper Basin	1,450,000	2,750,000	4,200,000
Lower Basin	950,000	1,350,000	2,300,000*
Total in U.S.	2,400,000	4,100,000	6,500,000
Mexico	200,000	800,000	1,000,000
Total	2,600,000	4,900,000	7,500,000*

*Includes 430,000 acres irrigated and 400,000 irrigable in the Gila River Basin.

Irrigation in the Upper Basin was mainly in scattered small developments on the main stream and many tributaries. General farm crops predominated, and in a large portion of the irrigated area, particularly in much of the Green River country, wild hay for livestock feed was the principal crop. At that time a total of 115,000 acre-feet of water annually was being exported from the Upper Basin for irrigation in adjoining basins. The Strawberry Valley project was diverting water from Strawberry River, a tributary of Duchesne River, to Spanish Fork in the Bonneville Basin in Utah. Several other small diversions were being made into the South Platte and Arkansas watersheds in Colorado. Additional large diversions, amounting to over 400,000 acre-feet, were being considered for development in these States, including transmountain diversions for the municipal water supply of Denver.

Topography and the high cost of projects, as well as climate and lower crop values, were limiting the rate of irrigation expansion in the Upper Basin.

Development in the Lower Basin, with its climatic conditions favorable to intensive cultivation of semitropical fruits, cotton, lettuce, and melons, was being hampered by limited low-season stream flows. Irrigation on the Gila was well advanced by 1922. The Imperial Valley, which then had over 400,000 acres under irrigation by direct diversion from the Colorado River without storage regulation, suffered a water shortage in each low-water year. The canal serving Imperial Valley lands also supplied water for the irrigation of 200,000 acres or more in Mexico, thus exporting some 3,000,000 acre-feet annually out of the basin for use in both countries.

Flood Control

Uncontrolled the Colorado River was a natural menace. Before the construction of Boulder Dam, the lower stretches of the river were annually subject to long sustained floods from the melting snows of the high mountains in Colorado, Wyoming, and Utah. Floods originating in the lower tributaries were of shorter duration but extremely erratic and perhaps not less damaging. The tragic menace from floods, however, was not fully realized until 1905. Then the Colorado, swollen by flood waters from the Gila, broke through a cut which was made four miles below the international boundary by the California Development Company, operators of the Alamo Canal. For 16 months the Colorado poured its entire flow into Imperial Valley's sunny fields and flourishing communities. It enlarged the Salton Sea to a lake 76 feet deep and 488 square miles in area, and threatened permanently to engulf the entire valley. The break was finally closed with great difficulty and expense, but about 30,000 acres of arable land had been inundated, farms ruined, homes destroyed, highways washed away, and railroad tracks wrecked. Miles of mainline track of the Southern Pacific Railroad had to be moved to higher ground, and tangible damage into the millions of dollars was sustained. Here, in the need for flood control, was the prime motivating reason for the construction of Boulder Dam.

Protection of the delta lands lying principally below the level of the Colorado had required the building of levees in both United States and Mexico. Each year these were lashed by silt-laden floods. The levees were built higher and stronger. Maintenance of the levees was an expensive burden and was complicated by international problems.

Levees constructed to protect the Yuma project on the Colorado just north of the international boundary line had broken several times with disastrous local results. Another similar flood occurred in 1922 when the levees along the Palo Verde Valley in California were broken. To protect the lands on the lower river, 150 miles of levees were maintained. Although many additional breaks occurred, the major levees were intact in the early 1920's. Defensive measures, however, became more and more burdensome. From 1906 to 1924, ten and a quarter million dollars were spent by various agencies on levee construction and maintenance on the lower Colorado River, including protection for Imperial Valley. Even this large expenditure did not eliminate the menace. The continued threat of a major break from some unexpected river change still remained and 100,000 people lived in fear that the river might overwhelm them.

Silt Problems

The difficulty of maintaining an adequate levee system was aggravated by siltation. Each year the Colorado River was depositing over 100,000 acre-feet of silt in the delta region, lifting itself higher and higher and making a larger and continuous expenditure necessary to maintain levees protecting the Imperial Valley. In 1923 and 1924 the Imperial Valley Irrigation District was spending over $500,000 annually to remove silt from its canal systems. In addition, it was estimated that Imperial Valley farmers expended about $1,000,000 to repair damages from silt deposits on their farms.

Hydroelectric Power

In the early 1920's the existing hydroelectric power developments in the Colorado River Basin were largely confined to the tributaries of the Colorado River. Thirty-six plants with a combined capacity of about 37,000 kilowatts were in operation, the largest being the Shoshone plant of the Colorado Power Company on the main stream above Glenwood Springs, Colorado, and the plant built by the Bureau of Reclamation at Roosevelt Dam on the Salt River in Arizona. Each of these plants had an installed capacity of approximately 10,000 kilowatts.

In 1922 the Salt River Valley Water Users' Association started the construction of a series of three dams below Roosevelt Dam on the Salt River for irrigation storage and power production to help supply the needs of the Phoenix area.

In the early 1920's the southern California coastal plains centering around the Los Angeles metropolitan area were experiencing a phenomenal growth, the population more than doubling from 1920 to 1930. A great potential power market thus was being created. Serious consideration was also being given to the electrification of railroads in the Colorado River Basin. Although the power uses within the basin at that time were small in the aggregate and the sparse population needed little power development for ordinary local uses, the rapidly growing market in the southern California area combined with advancement in electric power transmission had created a demand for a large amount of additional power. The growth of the power load was rapidly exhausting the available hydroelectric resources of southern California and an additional source of power was much needed for its growing industrial development.

Municipal Water Supply

With no large cities in the basin, the needs and developments for municipal water supply within the area had been small, but in the early 1920's it was becoming increasingly evident that the rapidly growing southern California metropolitan area would soon demand a new source of water. Los Angeles was utilizing fully its Owens Valley water and had studied other sources from which water could be obtained. The only adequate practical source appeared to be the Colorado River, whose flood waters, if properly conserved, could be made available for such use.

The need for a source of domestic water supply became an additional and potent reason for urging the development of the Colorado River. In 1923 the first reconnaissance for an aqueduct route from the Colorado River to the southern California area was undertaken by the City of Los Angeles. The general feasibility of such an aqueduct was soon established, and on June 28, 1924, the City of Los Angeles made a filing with California State authorities on a flow of 1,500 second-feet of water from the Colorado River, or 675,000 gallons per minute.

Summary of Conditions in the Early 1920's

By 1920 the population of the Colorado River Basin was 634,334 persons, with the Lower Basin growing more rapidly than the Upper Basin. In the early 1920's mining was being replaced by irrigated agriculture as the leading industry in the basin. Livestock grazing was important, lumbering was a lesser industry, and the tourist trade was just starting to develop.

Several important National parks had been formed in the basin, the most important being the Rocky Mountain National Park, established in 1914, and the Grand Canyon National Park established in 1919. The Fall River Road over the Continental Divide in Rocky Mountain National Park was completed in 1920. By that time health resorts and scenic attractions in the basin along the transcontinental railroads long had been enjoyed by the traveling public, but automobiles and the rapid development of a network of good highways were just beginning to make accessible generally the basin's more remote areas.

Large sections of land in the basin had been set aside as Indian reservations. Over 17,000,000 acres in Arizona alone were under the jurisdiction of the Office of Indian Affairs. The Indian population, which was about 80,000 in 1920, had remained practically constant for years, but began to increase materially during the 1920's.

Livestock grazing continued to be an important industry in the basin. By 1920 control of large grazing areas by the Forest Service was stabilizing and making more profitable the livestock industry.

Irrigation development in the Upper Basin was considered to be lagging behind that in the Lower Basin, where rapid progress was being made in the Gila River Basin. Main stream developments on the lower river, however, were being impeded by lack of storage facilities; existing developments were suffering frequent shortages and, moreover, were being threatened by continued flood hazards aggravated by silt problems.

Thus by 1920 the situation with respect to the Colorado River had become very tense. Increasing upstream depletions were accompanied by increased requirements for irrigation development in California and Mexico. The constant threat of an unmanageable break of the river into Imperial Valley during flood stages was also becoming more serious with the rising level of the river and its flood plains within the levees protecting the Imperial Valley. Meanwhile the rapid growth of the metropolitan district of the southern California coastal region was

creating a great demand for a large block of power and for additional municipal water supplies. Similar demands for municipal water for the growing city of Denver in the adjacent Platte River Basin were anticipated.

About the same time a keen interest in the Colorado River was displayed by various public and private agencies, seeking the right to develop hydroelectric power but proposing to provide storage and flood control incidentally.

An extensive investigation by the Bureau of Reclamation to develop ways and means of meeting all of the various needs resulted in the recommendation for the construction of a dam either in Boulder Canyon or Black Canyon for flood control, navigation improvement, irrigation storage, silt control, and power development. The long standing need for a canal wholly within the United States also was recognized and it was recommended that such a canal connecting the river at Laguna Dam with the Imperial Valley be constructed and thus eliminate all international complications.

Between the Upper and Lower Basins

Forces Activating Interstate Agreement

For a number of years prior to 1922 the Lower Basin area, growing more rapidly in population than the Upper Basin, had pressed for development of the lower river and the Upper Basin had objected. In 1919 and again in 1920 bills were introduced in Congress for Federal assistance in building an all-American Canal. In April 1922 a third bill had proposed not only the building of an all-American Canal, but also the building of a storage dam on the main river below the mouth of the Green River.

It was rapidly becoming apparent that the normal flow of the Colorado River would not be adequate to supply all of the uses envisioned by the Colorado River Basin States. The proposals for storage in the Lower Basin without guaranties to the Upper Basin States were regarded by the latter as threatening to establish priorities which would preclude later use of the water in the Upper Basin.

The law respecting rights to the use of waters of interstate streams was not well settled. Each of the various States claimed exclusively the right to regulate the appropriation of water within its boundaries. At the same time claims were made that the Federal Government had jurisdiction over the waters of interstate streams. It was argued that no reasonable regulation of the flow of the Colorado River by storage appeared to be feasible except with the approval and the control of some authority higher than the States and that the Federal Government logically should effect the regulation of Colorado River development. The lower part of the stream was or had been navigable and, therefore, was subject to jurisdiction by the United States. At the same time the desire prevailed to obtain Federal aid in the financing of the huge multiple-purpose development considered necessary for the utilization of the stream flow of the lower Colorado River.

CHAPTER IV

DEVELOPING THE BASIN

Water holds a key position in developing the resources of the Colorado River Basin. It is the "critical material" because of its limited supply and great demand. Development and utilization of other resources in this arid land depend upon the availability of water. Crops must be irrigated; cattle on the vast ranges must be partially fed from hay produced on irrigated land; towns and cities must be located within distance of dependable domestic and municipal water supplies; and mining and many other industries depend to an extent on the availability of hydroelectric power.

The use that has been made of the basin's resources by those people who have claimed this land as their home and the needs and problems confronting them must be understood before any solution or plan can be suggested to improve present conditions and create additional opportunities. For that purpose this chapter includes a survey and appraisal of the basin's resources and economic activities.

The Colorado River Basin is a part of America's frontier. It is, perhaps, as little developed as any comparable area in the United States. Yet it is known that here lie buried one-sixth of the entire world's coal reserves, billions of barrels of oil in shale and sand (equivalent to many times the known petroleum reserves in all the oil fields of the United States) and vast treasures of other minerals including petroleum, natural gas, copper, lead, zinc, gold, silver, rare hydrocarbons, vanadium, molybdenum, phosphates, and many others. For only a few of these can it be said that development has had even a good beginning.

Crop production in the basin is dependent almost wholly on irrigation. More than $2\frac{1}{2}$ million acres--much with an inadequate late season supply--are now irrigated. Development of the basin's land and water resources is little beyond the half-way mark toward ultimate potentialities. Livestock raising is the basin's principal agricultural pursuit, but the numerous herds of cattle and sheep that graze the vast ranges and forests are dependent on supplemental feed from irrigated farms.

Only in the last two decades has a good start been made in exploiting the possibilities of the Colorado River for generating hydroelectric power. Construction of Boulder Dam to control the flow of the lower river was the first big development. Even with completion of all present and authorized construction which will give to the river system

installed generating capacity of 2,000,000 kilowatts, only a little more than a third of the basin's water power will be harnessed.

Extending more than two-thirds the distance across the Nation, from Mexico to Canada, the Colorado River Basin is crossed in an east-west direction by several transcontinental railroads and highways. North-south transportation is dependent very largely on a few highways. The improvement of highways and transportation facilities characterizing this generation has bettered living conditions in the basin and has increased the basin's economic contributions to the Nation. Some important agricultural and mineral areas, however, are today a hundred miles or more from railroads. Further improvement and expansion of transportation facilities within the basin would be a National asset.

Practically the only manufacturing in the basin is the processing of farm and forest products on a limited scale. Most of the food, fiber, and minerals produced or mined in the area is shipped away in raw state. In recent years the Los Angeles metropolitan area has become one of the Nation's principal manufacturing areas due in large measure to low-cost power produced at Boulder Dam.

The spectacular natural beauty, shrouded in the romantic aura of frontier adventure, delights the tourist and health seeker. The basin is fast becoming a National playground. Rocky Mountain, Mesa Verde, Bryce Canyon, Zion, and Grand Canyon National Parks, the Painted Desert, Petrified Forest and Boulder Dam National Recreational Area as well as many National monuments lie wholly or partly within the basin. Unmatched trout fishing in mountain streams and lakes, big game hunting, and Indian reservations add to the basin's outstanding attractions.

The people on the basin's irrigated farms and those in the cities and towns that rise on the commerce created by irrigated agriculture and by mining exercise purchasing power that establishes markets for automobiles, farm machinery, and other products manufactured and grown in all parts of the country.

Permanent settlement of this frontier region is approaching the end of a century, but only in small measure have the basin's bounties been applied to man's use. Present developments are indicative of future possibilities. A growing Nation and a world power is demanding full development and use of all its resources.

DEVELOPING THE BASIN

UPPER BASIN

Agriculture, particularly livestock raising, and mining are the principal industries of the Upper Basin. Oil refining, lumbering, transportation, trade, recreation, and construction are of lesser but growing importance.

Growth and distribution of population were discussed in Chapter II. With its 1940 population of 286,450 distributed over 110,500 square miles, the Upper Basin's average of 2.6 persons per square mile is only one-seventeenth of the National population density. Sparse settlement and great distances between communities create special economic and social problems. Goods and services are more difficult to obtain and more costly than in thickly populated areas. A few ranch homes are 100 miles from medical, dental, and hospital facilities. Many families are located long distances from schools, churches, and trading centers. Opportunities for many forms of recreation and social and educational activity are restricted.

In such a large, sparsely settled area difficult problems arise in providing and maintaining roads and other public services. Many local roads are poor and during parts of the year impassable by motor vehicles. Some rural homes are without electric service, but power lines are being extended to small communities, farms, and ranches, thereby adding to the convenience and comfort of the people.

Labor Force

The economy of a region is affected more by the labor force, employed workers and those actively seeking work, than by any other segment of the population. It is this group that is the highest in both production and consumption of goods.

The labor force expands or contracts with changing economic conditions. In good times its ranks are swelled by young people leaving school before completing their courses and by housewives, retired persons, and others who normally are not employed. The size of the labor force also is influenced by the composition of the population. Where the percentage of children or old people is above average the labor force is likely to be small. Employable persons who make up the labor force are most likely to migrate to areas where economic opportunities are greater. The percentage of the total population in the labor force generally is an index to the economic prosperity of a region.

The United States census for 1940 shows a male labor force, over 14 years of age, of 72,317 in the Upper Basin, equivalent to 25 percent of the total population, compared with 30 percent for the Nation as a whole. Thirty-four percent of the Upper Basin's workers were employed in agriculture, 13 percent in mining, and 35 percent in other regular occupations. The other 18 percent were either employed on Government "relief" projects or were seeking work, the proportion of the labor force in this group being larger than for the average of the Nation.

	Acres	Percent of total area
Irrigated land	1,325,000	1.9
Cultivated without irrigation	272,000	0.4
Grazing land:		
Publicly owned	29,221,000	41.4
Privately owned	8,775,000	12.4
State and county owned	2,860,000	4.0
Indian reservations	8,775,000	12.4
National forests	13,378,000	18.9
National parks and monuments	586,300	0.8
Miscellaneous areas	5,503,700	7.8
Total	70,696,000	100.0

About 70 percent of the total land area is classed as grazing land in the tabulation. Grazing is also extensive on National forest lands and on other areas so that much more than 70 percent of the total area is actually grazed. The 1940 U.S. Census reported 285,000 acres of irrigated land used as pasture.

The better grazing lands are in the higher stream valleys and on the mountains and foothills. These lands are used for summer grazing of cattle and sheep, and the scanty vegetation in the lower desert areas provides winter range for sheep.

Crop land, both irrigated and dry-farmed, comprised only 2.3 percent of the total acreage in 1939 and only 1.9 percent was actually cropped.

Farming without irrigation is generally unsuccessful in the Upper Basin because of the uncertain rainfall. It is practiced, however, to some extent in the Yampa and White River Basins, and favorable climatic conditions in the past few years together with high prices have encouraged expansion of dry farming in the Dry Side area of the La Plata River Basin and on the upland mesa between Cortez, Colorado, and Monticello, Utah. In general, at altitudes where rainfall is sufficient during the summer to grow crops without irrigation, the season is too short for crops to mature.

Soils

The entire Upper Basin is underlain with sandstones, limestones, and shales composing the parent rock from which the soil forming material has been derived. Four types of soil are found: (1) alluvial soils made up from stream-deposited materials; (2) glacial soils in the form of glacial deposits or out-wash plains derived partly from granites and other igneous material of the higher mountains; (3) residual soils formed in place by the weathering of surface rocks but altered in places through deposition from higher residual lands; and (4) aeolian, or wind deposited soils, appearing in a few places as sand dunes and other formations.

In the upper valleys lands suitable to agricultural development are largely composed of alluvial soils and are confined to the bottom lands, terraces, and valley fills. These soils are high in organic matter and are inherently fertile. They are generally of sandy loam to loam in texture. Most of these soils have good natural drainage provided by light textured soil over gravelly subsoil and a moderate slope. With the exception of small localized areas the soils in the upper valleys are free from harmful accumulations of alkali. The depth of the soil and the amount of rock on the surface usually determine the suitability of the lands for agriculture.

Mesas, plateaus, basin-like depressions caused through erosion, and narrow valleys along the various streams characterize the lower sections of the Upper Basin. The broader valleys and depressions that have been covered with alluvial soils are more suitable for cultivation where soil is of sufficient depth. Vast areas of residual soils are too shallow or too alkaline for agricultural development. Extensive drainage is often necessary in the lower valleys where irrigation is practiced.

Wind formed soils are not extensive. Some are found in small areas south of the San Juan River along the northeastern sides of ridges or other topographic uplifts which break the winds and harbor the deposited materials. The largest area of arable aeolian soil is east of Chaco River on the high benches south of Farmington, New Mexico.

Agriculture

Types of Farming

All farms are classified by the Bureau of Census into types according to the major source of income. In the Upper Basin livestock farms predominate.

TABLE VII
TYPES OF FARMS IN UPPER BASIN (1939)

State area	Types of farms according to major source of income (percent of total number of farms)				
	Livestock and livestock products	Field crops	Other crops	Products used in household	Total
Wyoming	77.8	7.8	0.3	14.1	100
Colorado	35.7	32.3	9.8	22.2	100
Utah	39.8	19.2	1.1	39.9	100
New Mexico	27.9	21.0	5.5	45.6	100
Upper Basin	37.6	26.9	6.9	28.6	100

In 1939, livestock and livestock products accounted for 75 percent of the total value of the products sold and traded in the Upper Basin. Livestock alone amounted to 55 percent and wool to 10 percent of the total. Compared with the Nation as a whole the Upper Basin farm income from animals and wool was greater, while income from dairy products,

UPPER COLORADO RIVER BASIN

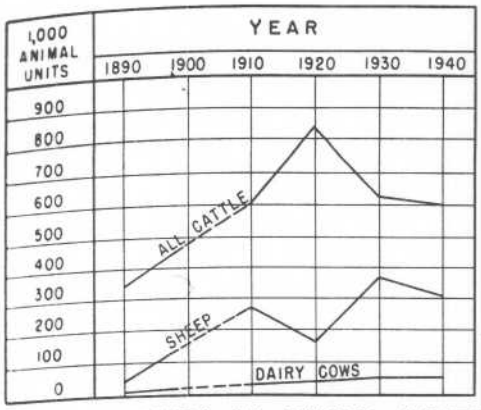


FIG. 3 – TRENDS IN ANIMAL UNITS 1890-1940

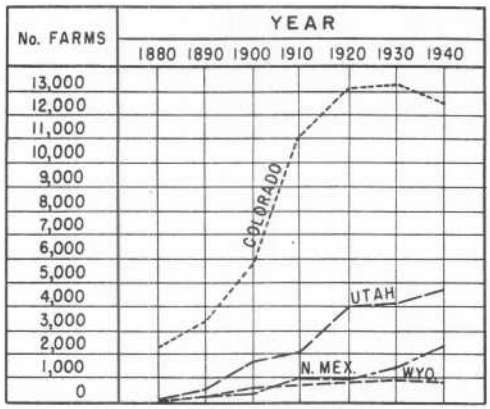


FIG. 4 – NUMBER OF FARMS 1880-1940

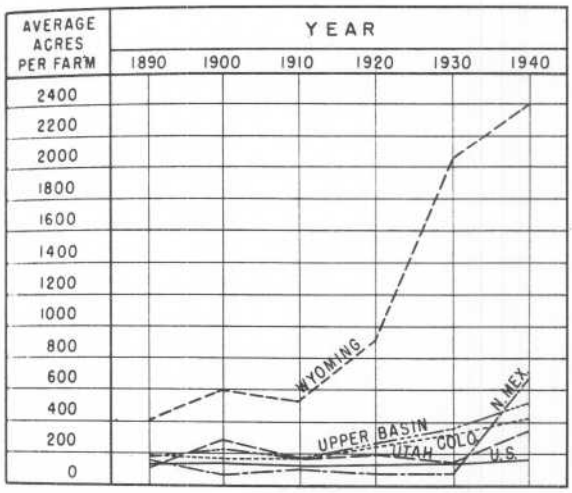


FIG. 5 – SIZE OF FARMS 1890-1940

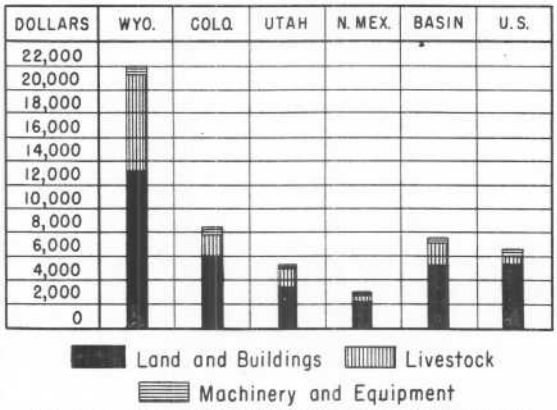


FIG. 6 – VALUE OF FARM PROPERTY 1939

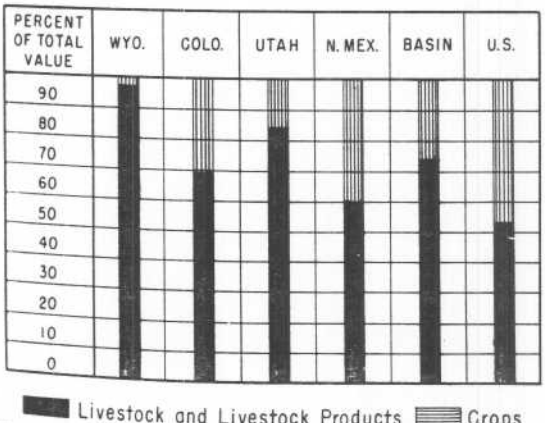


FIG. 7-VALUE OF AGRICULTURAL PRODUCTS 1939

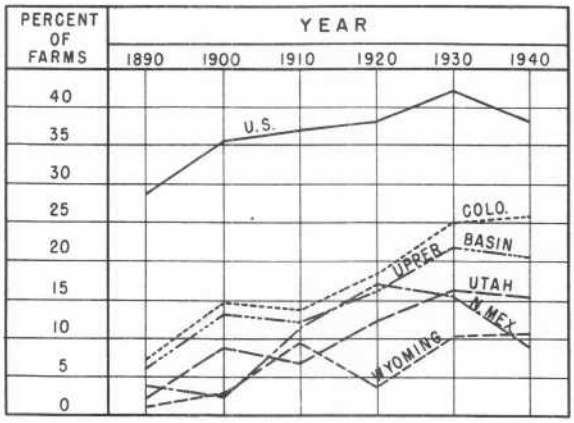


FIG. 8 – FARM TENANCY 1890-1940

Number and Size of Farms

Arizona is representative of the Lower Basin with reference to the size of farms. In 1940 Arizona with an average of 1,389 acres per farm, had larger farms than any Upper Basin state except Wyoming. Livestock raising was the major farming activity on large farms. Between 1930 and 1940 the number of large farms (those over 100 acres) in the Lower Basin increased 2.1 times, while the percent of the total area of such farms increased only 1.6 times. The most significant increase in large farms took place between 1935 and 1940. During that period the number of farms of fewer than 10 acres was cut almost in half.

The general trend is toward larger farms. The increase in the size of ranches is due partly to the decrease in the number of livestock the public range can support. Crop farms are increasing in size and number in certain areas because improved machinery makes possible higher efficiency in farm operation.

TABLE XX

NUMBER AND SIZE OF FARMS IN LOWER BASIN

Size Group	1910	1920	1925	1930	1935	1940
	Percent of total number of farms					
Under 10 acres	27.2	7.0	11.1	24.1	26.3	15.0
10 to 49 acres	25.0	31.1	28.4	30.9	33.2	24.5
50 to 99 acres	8.9	17.1	17.6	12.9	11.1	8.4
Subtotal	61.1	55.2	57.1	67.9	70.6	47.9
100 to 499 acres	36.3	36.0	32.2	22.2	19.2	21.5
500 to 999 acres	1.8	4.8	4.8	4.8	4.9	10.5
Over 1,000 acres	0.8	4.0	5.9	5.1	5.3	20.1
Subtotal	38.9	44.8	42.9	32.1	29.4	52.1
Total	100.0	100.0	100.0	100.0	100.0	100.0
	Number of farms					
Under 100 acres	5,643	5,506	6,154	9,624	13,291	8,854
Over 100 acres	3,584	4,469	4,648	4,549	5,533	9,614
Total	9,227	9,975	10,802	14,173	18,824	18,468

Irrigated Farm Acreage

The average number of irrigated acres per farm in the Lower Basin decreased slightly during the period 1910 to 1940. The decrease was due largely to the increase in number of irrigated farms, with a lesser corresponding increase in irrigated acreage. The Little Colorado division had the smallest irrigated farm units as well as the greatest decrease in irrigated acreage per farm. The number of irrigated farms in that division increased from 554 in 1910 to 1,942 in 1940, but the total irrigated acreage increased only 35 percent. The small size of these units results from the high percentage of Indian farms and the large number of subsistence white farms.

UPPER BASIN

An area larger than New York, Pennsylvania, and New Jersey combined, is tributary to the Colorado River above Lee Ferry. This is the Upper Colorado Basin. It includes parts of five Rocky Mountain States. Rimmed by some of the highest mountains in America, snowcapped throughout the year, it is the source of the greater part of the water reaching the Colorado River.

Within the basin 1,325,000 acres are now irrigated. Much of this irrigated acreage produces pasture grasses and hay and serves as a home base for livestock grazing on the vastly larger areas of range and forest land. Some irrigated lands, however, are devoted to more intensive farming with vegetables and fruits as chief crops. The construction of potential projects outlined in this chapter would practically double the Upper Basin's irrigated area and bring supplemental water to half a million acres now lacking a full supply. These potential projects would bring water to lands determined by land classification to be arable. Vast areas of native pasture lands, mostly at high elevations, were not so classified, but would become more productive under irrigation. These lands have not been surveyed, nor have works been designed by which they might be irrigated, which accounts for their exclusion from specific project plans. To provide for the eventual irrigation of these lands and miscellaneous areas of arable lands not otherwise covered in the basin plan an ultimate depletion in the flow of Colorado River at Lee Ferry of 500,000 acre-feet each year is reserved. It is not possible to divide this potential depletion among the divisions or States of the Upper Basin.

Scarcely a start has been made in developing the hydroelectric power resources of the Upper Basin. Present generation of 330 million kilowatt-hours annually could be increased 28 times with full development of water resources in the basin.

The exportation of water for use in adjoining basins, now averaging only about 184,000 acre-feet annually, is only six percent of ultimate potentialities, if it were not for limitations of the Colorado River Compact. In presenting possible exportations of water from the Upper Basin to the adjoining North Platte, South Platte, Arkansas, Rio Grande, and Bonneville Basins it is contemplated that appropriate understandings will be reached between representatives of both the exporting and importing basins concerning the manner in which such projects shall be constructed and operated to safeguard within the Upper Basin the vested and future rights in irrigation; to preserve fishing and recreational facilities and scenic attractions; to maintain conditions of river flow for the benefit of local domestic uses and sanitary purposes; and to utilize the waters for irrigation, power, industrial development and other purposes, in such a manner that the greatest benefits are realized.

Development of ground water resources in the Green River Basin has been limited to a few small wells for stockwatering and domestic uses. Some water obtained from wells is heavily charged with minerals. Neither the quality nor the quantity of ground water now developed is indicative of any substantial use of water from wells for irrigation in the future. Hot springs at Steamboat Springs, Colorado, are the largest of three spring areas in the Yampa River Basin.

Present Development of Water Resources

Irrigation accounts for the greatest use of Green River water at present. Homes, cities, livestock, and industries consume necessary but comparatively small quantities. Five small hydroelectric power installations on tributary streams serve rural areas. Streams and lakes are natural spawning waters for fish, and the mountains and valleys are habitat for wildlife; but little has been done to improve natural conditions.

Irrigation within the Green River Basin commenced in 1854 when Mormon pioneers established old Fort Supply in Wyoming on their immigrant trail and diverted water from Blacks Fork onto adjacent land. From this humble beginning progress has been slow. The short growing season, particularly in the upper Green River Basin in Wyoming, limits the kinds of crops that can be grown successfully. The greater part of the Uinta Basin was established as an Indian reservation in 1861 and lands unoccupied by Indians were not opened to settlement until 1905. The remoteness of much of the basin from railroads has also slowed agricultural progress, but with the growth of highway transportation this disadvantage may largely be overcome.

Approximately 571,000 acres in the Green River Basin are now irrigated and 11,470 acres more will be provided water through works now being constructed. Most of the present use is by simple diversions and easily constructed canals. A large part of these lands suffer late-season water shortages. Some water from tributaries of the Duchesne, Price, and San Rafael Rivers in the Green River Basin is exported westward to the Bonneville Basin in Utah.

Present development of water resources in the Green River division is discussed in more detail under four subdivisions: (1) Upper Green River Basin, (2) Yampa and White River Basins, (3) Uinta Basin, and (4) Price and San Rafael River Basins.

Upper Green River Basin

This area extends from the headwaters of the Green River down to the Yampa River which enters the main stream from the east in Colorado. It is about 90 percent in Wyoming, with the remainder in Utah and Colorado.

Irrigation development in this area includes numerous community or privately owned ditches and small reservoirs. Ditches divert at frequent intervals along the streams. Most of them have been constructed and are maintained at minimum expense. It is common for farmers to have individual ditches, and in some cases single farms are served by several

ditches diverting from a stream at different points. In addition to many small irrigation reservoirs and stockwatering ponds, 17 reservoirs with capacities of 1,000 acre-feet or more, all constructed by private interests, are distributed throughout the basin. Private holdings of irrigated land are large. Most are hay-producing ranches, varying from a few acres to several thousand acres.

The Eden project, being rehabilitated and extended by the Bureau of Reclamation, is the only Federal irrigation project in the upper Green River Basin. As authorized in 1940, the project will furnish a full or supplemental irrigation supply for 20,000 acres. Surplus flows of Big Sandy Creek will be stored in Big Sandy Reservoir No. 2, to have a capacity of 35,000 acre-feet, for use on project lands. With completion of the Eden project, 245,660 acres in the upper Green River Basin will be irrigated.

The seven existing power plants in this subdivision include only one small hydroelectric development with a capacity of 150 kilowatts. Most of the energy is generated at four steam plants and is used largely for coal mining. There are no interconnections with outside systems.

Yampa and White River Basins

The Yampa and White Rivers, flowing westward and generally parallel, drain the eastern arm of the Green River Basin. The greater part of their drainage basins is in northwestern Colorado and the remainder is in southern Wyoming and eastern Utah.

Within the two basins 117,230 acres are now irrigated. Most of the irrigated lands are along river or creek bottoms, with only a few small areas on benches from 20 to 40 feet above stream beds. Diversions are made through numerous community or privately owned ditches. Water is stored in several small reservoirs, capacities of which total 14,500 acre-feet. These reservoirs have been built at minimum expense to serve lands belonging to only a few operators. Some of the reservoirs have not been used in recent years because their dams were considered unsafe.

A 200-kilowatt power plant at Meeker, Colorado, is the only hydroelectric development in these basins. A 4,250-kilowatt plant at McGregor and a 375-kilowatt plant at Meeker, both steam-electric, furnish most of the power used in the area.

Uinta Basin

The Uinta Basin, as considered in this report, includes areas drained by the Duchesne River, and Ashley, Brush, Willow and Minnie Maud Creeks. The drainage area is entirely in northeastern Utah, and except for the Willow Creek drainage is west of Green River. The Green River channel from the Yampa River to Minnie Maud Creek is considered to be within the Uinta Basin.

Irrigated lands within the Uinta Basin amount to 165,600 acres, most of which is short of late-season water. Indians once owned 77,000 acres of irrigated land in this basin but have sold 25,300 acres. Present

regulations prevent sales and limit leases. In 1942 Indians leased 26,200 acres, cultivating only 11,800 acres themselves.

Sixteen Government-built main canals and six small ditches make up the Indian irrigation system, totaling 162 miles of canal and 633 miles of laterals and sublaterals. Indian water rights were established before unoccupied lands in the reservation area were opened to outside settlers. Consequently their primary rights consume all late-season water of the Duchesne River and its tributaries, leaving white-owned lands critically short. In normal years Indian lands receive enough water, but they would profit by storage regulation to provide better seasonal distribution. No storage reservoirs have been constructed for Indian lands.

Throughout the basin white settlers have organized mutual irrigation companies for the purpose of building irrigation works and distributing water. Private diversions are largely limited to tributary streams and springs.

Serving Uinta Basin lands are 28 reservoirs, some very small, with a total storage capacity of 74,000 acre-feet. More than half of this was provided by the Bureau of Reclamation with the construction of the Moon Lake project (1935-38), which includes Moon Lake and Midview Reservoirs. Water from Strawberry Valley Reservoir, constructed in 1913 on Strawberry River as one of the earlier Bureau of Reclamation developments, is exported westward by tunnel to lands in the Bonneville Basin. The Duchesne Tunnel, to divert water from the Duchesne River to the Bonneville Basin, is now under construction as a unit of the Provo River project. When completed it will export annually an average of 32,000 acre-feet of flood water from the Colorado River Basin.

The four existing power developments include one diesel and three small hydroelectric plants, with combined capacities of 2050 kilowatts. There are no connections with plants outside the Uinta Basin.

Price and San Rafael River Basins

Adjacent to each other, these two basins are in east central Utah. Both the Price and San Rafael Rivers originate on the eastern slope of the Wasatch Mountains and flow southeast in parallel courses to Green River. The Green River channel from Minnie Maud Creek to the Colorado River, for convenience, is considered as a part of the Price and San Rafael Basin area.

Within this area 15,970 acres are irrigated from Price River, 35,250 from San Rafael River and 2,820 acres from Green River, thus aggregating 54,040 acres. At one time 25,000 acres were irrigated from Price River, but poor soil, erosion, and alkali have caused the irrigated area to be reduced to its present size. Any future expansion of irrigation to new areas is expected to be accompanied by abandonment of a less productive area now irrigated.

Natural flows of Price River are supplemented for irrigation by releases from the Scofield Reservoir on Price River. Scofield Dam, constructed by private interests in 1926 to impound 61,000 acre-feet of water, partially failed two years later. For safety, storage has since been restricted to 30,000 acre-feet. The Bureau of Reclamation was authorized to replace this dam and in 1943 began construction of a new dam 800 feet downstream. The reservoir formed by this new dam will have a capacity of 73,000 acre-feet of water, 30,000 acre-feet of which will replace the usable capacity behind the old dam, and 8,000 acre-feet will be reserved for fish propagation. The remaining 35,000 acre-feet will be held for a time by the United States and ultimately used to store water for irrigating Price River lands in exchange for other water exported from high tributaries of the Price River to the Bonneville Basin.

Huntington, Cottonwood, and Ferron Creeks are the sources of irrigation supply in the San Rafael Basin, each serving independent areas with irrigation companies distributing the flow of each stream. Storage capacity aggregates 5,875 acre-feet on Huntington Creek and 1,310 acre-feet on Ferron Creek. Late-season water shortages are most acute in the Huntington Creek area where the acreage irrigated is greatest in proportion to the available water. Eleven small projects, including the Sanpete project (Ephraim and Spring City tunnels) constructed by the Bureau of Reclamation, divert flood water westward to the Bonneville Basin.

The lands irrigated directly from Green River are in the vicinity of Green River, Utah, and are served mostly by pumping.

Water piped from tributary streams and springs supplies larger municipalities in the Price and San Rafael River Basins. No electric power is produced. Transmission lines carry power into the area from the Bonneville Basin to the west.

Summary. The following tables summarize present irrigation developments in the Green division showing the more important reservoirs, areas irrigated, estimated stream depletion by water consumed within the basin, and amounts exported to adjacent basins.

TABLE XXXI
PRESENT IRRIGATED AREAS IN GREEN DIVISION BY STATES

Subdivision	Acres irrigated			
	Colorado	Utah	Wyoming	Total
Upper Green River Basin	1,840	9,430	234,390*	245,660*
Yampa and White River Basins	104,030	50	13,150	117,230
Uinta Basin	0	165,600	0	165,600
Price and San Rafael River Basins	0	54,040	0	54,040
Total	105,870	229,120	247,540*	582,530*

*Includes 11,470 acres of new land in Eden project, under construction.

TABLE XXXII
ESTIMATED PRESENT AVERAGE ANNUAL WATER CONSUMPTION IN GREEN DIVISION

Subdivision	Water consumed (acre-feet)			
	Colorado	Utah	Wyoming	Total
Upper Green River Basin	2,000	18,000	372,000*	392,000*
Yampa and White River Basins	113,000	0	19,000	132,000
Uinta Basin	0	243,000	0	243,000
Price and San Rafael River Basins	0	97,000	0	97,000
Total	115,000	358,000	391,000*	864,000*

*Includes 17,000 acre-feet for Eden project, under construction.

TABLE XXXIII
ESTIMATED PRESENT AVERAGE ANNUAL WATER EXPORTS FROM GREEN DIVISION

Subdivision Project*	Exporting stream, Green River Basin	Importing stream, Bonneville Basin	Acre-feet
Uinta Basin			
Daniel Creek	Strawberry River	Daniels Creek	3,500
Strawberry Valley**	Strawberry River	Spanish Fork River	66,000
Provo River***	Duchesne River	Provo River	32,000
Price and San Rafael Basin			
Sanpete**	Cottonwood Creek	Oak Creek	4,000
Sanpete**	Cottonwood Creek	Ephraim Creek	4,000
Miscellaneous projects, number			
1	Huntington Creek)		
1	Price River)	Tributaries of	
6	Cottonwood Creek)	Sanpitch River	4,000
2	Ferron Creek)		
Total			113,500

*All projects are in Utah
**Constructed by Bureau of Reclamation.
***Under construction by Bureau of Reclamation.