QUALITY OF WATER

COLORADO RIVER BASIN

PROGRESS REPORT NO. 9

JANUARY 1979

UNITED STATES

DEPARTMENT OF THE INTERIOR

Cecil D. Andrus , Secretary

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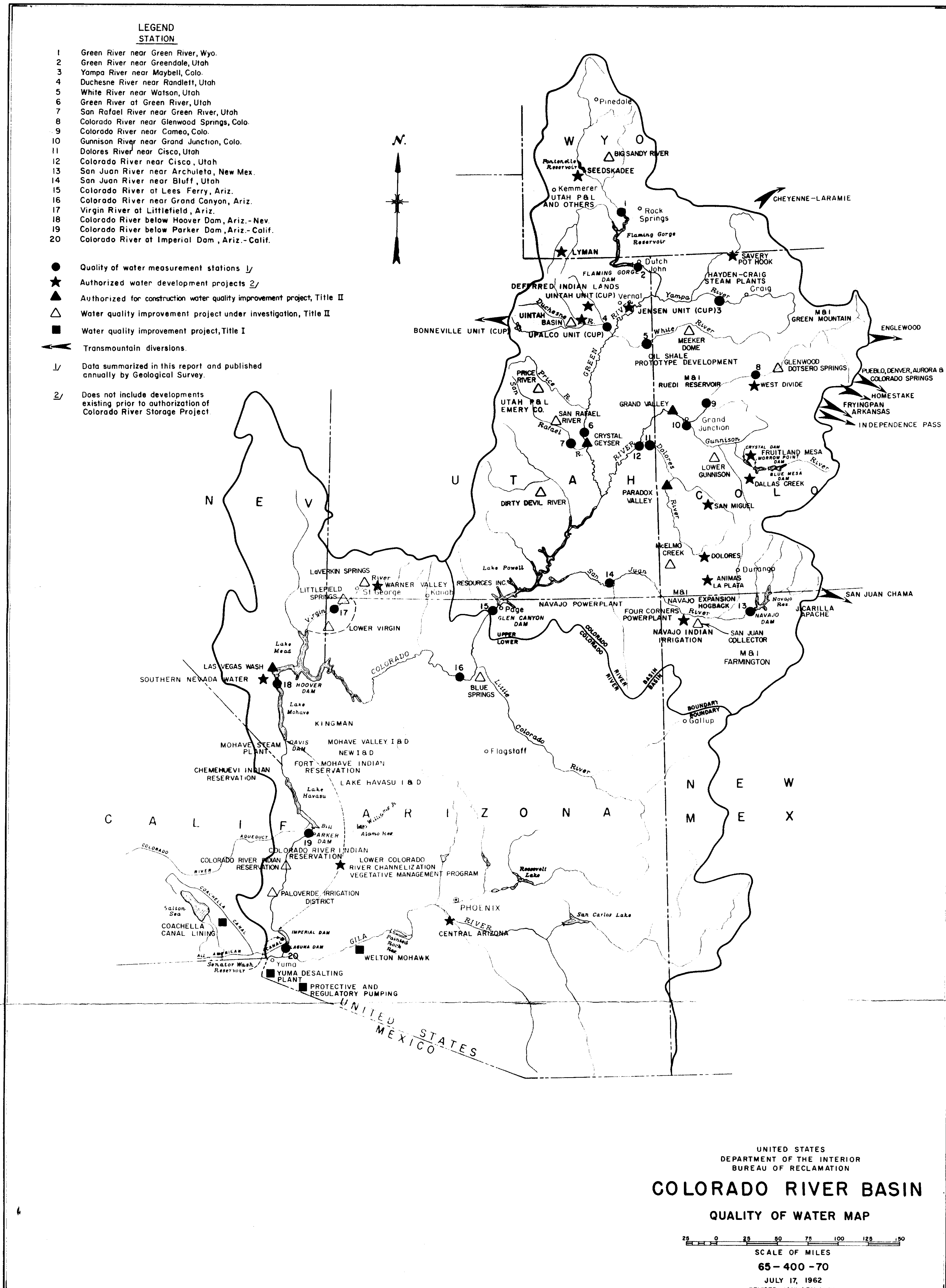
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Transmountain diversions.
1/ Data summarized in this report and published annually by Geological Survey.
2/ Does not include developments existing prior to authorization of Colorado River Storage Project.
N.
W Y O
U T A H
C O L O
N E V
A R I Z O N A
C A L I F
N E W M E X
UNITED STATES
MEXICO
Pinedale
BIG SANDY RIVER
SEEDSKADEE
Kemmerer
UTAH P&L AND OTHERS
Rock Springs
CHEYENNE-LARAMIE
LYMAN
Flaming Gorge Reservoir
FLAMING GORGE DAM
Dutch John
SAVERY POT HOOK
HAYDEN-CRAIG STEAM PLANTS
Craig
DEFERRED INDIAN LANDS
UINTAH UNIT (CUP)
Vernal
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M&I GREEN MOUNTAIN
UINTAH BASIN
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UPALCO UNIT (CUP)
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GLENWOOD DOTSERO SPRINGS
PUEBLO, DENVER, AURORA & COLORADO SPRINGS
M&I RUEDI RESERVOIR
WEST DIVIDE
HOMESTAKE
FRYINGPAN ARKANSAS
INDEPENDENCE PASS
PRICE RIVER
UTAH P&L EMERY CO.
GRAND VALLEY
SAN RAFAEL RIVER
Grand Junction
CRYSTAL GEYSER
FRUITLAND MESA
LOWER GUNNISON
DALLAS CREEK
PARADOX VALLEY
DIRTY DEVIL RIVER
SAN MIGUEL
McELMO CREEK
DOLORES
Durango
ANIMAS LA PLATA
LaVERKIN SPRINGS
WARNER VALLEY
St George
Kanab
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RESOURCES INC.
LITTLEFIELD SPRINGS
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NAVAJO POWERPLANT
M&I NAVAJO EXPANSION HOGBACK
SAN JUAN CHAMA
JICARILLA APACHE
NAVAJO DAM
FOUR CORNERS POWERPLANT
NAVAJO INDIAN IRRIGATION
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PROTECTIVE AND REGULATORY PUMPING
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
COLORADO RIVER BASIN
QUALITY OF WATER MAP
25 0 25 50 75 100 125 150
SCALE OF MILES
65-400-70
JULY 17, 1962
REVISED JANUARY 1979

FIGURE I

QUALITY OF WATER
COLORADO RIVER BASIN
PROGRESS REPORT

SUMMARY

This report prepared and updated every two years presents the various important water quality aspects of the Colorado River. Although several water quality parameters are discussed, the major part of the report is allotted to salinity (total dissolved solids) because it is presently the most serious quality problem on the river system. The historical, present modified, and future salinity conditions of water of the Colorado River down to Imperial Dam are presented in this report. The historical is represented by a tabulation of the recorded or estimated past condition at 20 quality of water stations for the 1941-76 period. Although various other studies have used different periods of records such as the 1906 to present, this report has used the 1941-76 period because most salinity records in the basin do not extend back beyond about 1941. The present (1976) modified condition includes adjustments to the historic condition based on the assumption that all developments existing in 1976 were in operation for the full 1941-76 period. Estimated future conditions are shown for the years 1980, 1990, and 2000. They are estimated projections, including past projects, presently authorized developments, projects proposed for authorization, and other future anticipated projects.

Under historic conditions the average concentration of dissolved solids of the Colorado River at Lees Ferry was about 558 mg/l, below Hoover Dam about 692 mg/l, and at Imperial Dam about 768 mg/l for the 1941-76 period.

Under present modified conditions (that is 1941-76 historical flows modified to reflect present depletions), the concentrations would have been about 602, 738, and 839 mg/l, respectively, at the three stations.

The projection of future water quality conditions was based on 1941-76 averages rather than a year-by-year study. The Colorado River Simulation model was not used because the data base was not completed in time. The Colorado River Storage Project model was also considered, but it does not show quality conditions at any of the selected stations above Lees Ferry. The CRSM and CRSP models are further discussed in Part X.

There are some limitations in using a model based on averages since upper and lower limits are not defined and the actual conditions for several years in the future may not truly be represented.

It has been assumed for purposes of this study that the average rate of pickup of dissolved solids from new irrigated lands would be in the range of zero to 2 tons per acre (zero to 4.5 t/ha) per year. Where comprehensive studies showed a different rate, the different figure was used. The effect of salt contributed from new lands is thus evaluated by computations of salinity concentrations using these rates. It was also assumed no additional pickup of dissolved solids would occur for lands already under irrigation. Large industries such as powerplants were considered to have no return of salts or water, and salt load changes due to municipal and minor industries were assumed negligible.

The estimated concentrations in milligrams per liter projected for 1980, 1990, and 2000 conditions, without salinity control measures, are as follows:

	1980		1990		2000	
	Zero T/A	Two T/A	Zero T/A	Two T/A	Zero T/A	Two T/A
Lees Ferry	615	622	684	708	693	719
Hoover Dam	760	768	857	883	879	907
Imperial Dam	877	889	1074	1118	1100	1148

Since the above figures from Table E, Part VII were computed by using average 1941-1976 values, they show only average conditions. Actual conditions will produce years of higher flow, producing better quality water, or years of lower flow producing poorer quality water.

The depletions used in this report are for the projects, both authorized and proposed for authorization together with present developments and other proposals for developments as presently planned.

This report includes discussions of the effect of salinity on water uses and potential salinity control measures. Investigations of the potential for water quality improvement on the Colorado River were initiated by the Bureau of Reclamation in FY 1972. A report, "Colorado River Water Quality Improvement Program," dated February 1972, describes potential projects for controlling the salinity of the Colorado River. A second report, "Colorado River Water Quality Improvement Program, Status Report," was published by the Bureau of Reclamation in January 1974. This report, with appropriate updating by current investigations is the basis for the discussion of the Colorado River Salinity Control program presented in Part VIII. This evaluation of the program is made in accordance with requirements of the Colorado River Salinity Control Act, Public Law 93-320. The Final Environmental Impact Statement for the Colorado River Water Quality Improvement Program was completed in May 1977. The final Environmental Impact Statement for the Paradox Valley Unit was submitted to Washington in November 1978.

SUMMARY (Continued)

Other phases of water quality, including sources of pollution, and parameters such as dissolved oxygen, temperature, pH, heavy metals, toxic materials, nutrients, bacteria, radioactivity, mercury, and sediment, are discussed.

PART I. INTRODUCTION

A. Authorization for Report

This is the ninth progress report on Quality of Water in the Colorado River Basin. The directive for preparing this and the eight previous reports is contained in four separate public laws. Section 15 of the authorizing legislation for the Colorado River Storage Project and participating projects, Public Law 485, 84th Congress, Second Session, April 11, 1956, states, "The Secretary of the Interior is directed to continue studies and make a report to the Congress and to the States of the Colorado River Basin on the quality of water of the Colorado River."

A progress report to comply with Public Law 84-485 was in preparation when the authorizing legislation for the San Juan-Chama Project and the Navajo Indian Irrigation Project, Public Law 87-483 became effective on June 13, 1962. Section 15 of this act states, "The Secretary of the Interior is directed to continue his studies of the quality of water of the Colorado River system, to appraise its suitability for municipal, domestic, and industrial use and for irrigation in the various areas in the United States in which it is used or proposed to be used, to estimate the effect of additional developments involving its storage and use (whether heretofore authorized or contemplated for authorization) on the remaining water available for use in the United States, to study all possible means of improving the quality of such water and of alleviating the ill effects of water of poor quality, and to report the results of his studies and estimates to the Eighty-Seventh Congress and every 2 years thereafter."

A few weeks later Public Law 87-590, which authorized the Fryingpan-Arkansas Project, was passed with a similar section pertaining to quality of water reports. This public law, however, stipulated that January 3, 1963, would be the submission date for the initial report and that the reports should be submitted every 2 years thereafter.

Section 206 of Title II, Public Law 93-320, Colorado River Basin Salinity Control Act directs the Secretary of the Interior to submit every 2 years to the President, the Congress, and the Advisory Council, a progress report on the Colorado River salinity control program and specifies that it may be included in the Quality of Water, Colorado River Basin Biennial Report.

Nothing in this report is intended to interpret the provisions of the Colorado River Compact (45 Stat. 1057) the Upper Colorado River Basin Compact (63 Stat. 31), the Water Treaty of 1944 with the United Mexican States (Treaty Series 994; 59 Stat. 1219), the decree entered by the Supreme Court of the United States in Arizona vs. California, et al.

(376 U.S. 340), the Boulder Canyon Project Act (45 Stat. 1057), the Boulder Canyon Project Adjustment Act (54 Stat. 774; 43 U.S.C. 618a), the Colorado River Storage Project Act, (70 Stat. 105; 43 U.S.C. 620), or the Colorado River Basin Project Act (82 Stat. 885; 43 U.S.C. 1501).

B. Previous Reports

A series of eight reports starting with the 1963 edition have been prepared prior to this report. Each succeeding report updated the previous report and added changes which occurred within the 2-year interval.

In addition to including 2 more years of record, the major changes in this report from the January 1977 report are as follows: (1) transferring that part of the future estimated depletions that actually occurred during the 2 years to present depletions; (2) updating Part VIII "Colorado River Salinity Control Program" in order to report on the progress of investigations, planning, and construction of salinity control units as required under Title II Section 206 of the Colorado River Basin Salinity Control Act, Public Law 93-320; (3) updating the depletion schedule for future conditions, such as deleting the Savory-Pot Hook and Fruitland Mesa Projects as well as making other changes, (note; the Fruitland Mesa and Savery-Pot Hook Projects have not been de-authorized and therefore left on the map but were not included in the computations) and (4) adding three more stations, the Yampa River near Maybell, Colorado, the White River near Watson, Utah, and the Dolores River near Cisco, Utah.

C. Cooperation

The major portion of this report was prepared by the Bureau of Reclamation. The Geological Survey provided most of the basic data. It also prepared a technical study on salinity in the Flaming Gorge Reservoir and a study of the geologic factors that affect salinity in the Upper Colorado River Basin. A continuing cooperative program between the Bureau of Reclamation and the Survey for the collection of streamflow quality data and the exchange of information has been in effect for a number of years. This cooperation provides for the collection of data at stations other than basic data stations maintained by the Geological Survey in order to obtain additional data at key points in the basin.

In the Upper Basin, data are obtained at various points along the river and in drains cooperatively with the Geological Survey and other agencies. Along the main stem below Lees Ferry, data are obtained on a regular basis at a network of stations that includes essentially all significant diversions, surface return flows, and major river stations. The Bureau of Reclamation is the lead agency of an ongoing task force for coordinating the collection of other quality data in the Lower Basin. Other members of the task force are composed of representatives from the Geological Survey, International Boundary and Water Commission, and Environmental Protection Agency.

PART II. DESCRIPTION OF BASIN

A. Geology

Rocks of all ages from those of the Archean age (the oldest known geological period) to the recent alluvial deposits, including igneous, sedimentary, and metamorphic types, are found in the Colorado River Basin. The high Rocky Mountains which dominate the topography of the upper regions are composed of granites, schists, gneisses, lava, and sharply folded sedimentary rocks of limestone, sandstone, and shale. Many periods of deposition, erosion, and upheaval have played a part in the present structure of these mountains.

In contrast to the folded rocks of the mountains which fringe the basin, the plateau country of southwestern Wyoming, eastern Utah, and northern Arizona is composed principally of horizontal strata of sedimentary rocks. Slow but constant elevation of the land area has allowed the Colorado River and its tributaries to cut narrow, deep canyons into the flat-topped mesas. This type of erosion reaches its culmination in the Grand Canyon where the Colorado River has cut through all of the sedimentary rocks down to the oldest Archean granites. (Detailed information is presented in Part X, Special Studies regarding the geologic factors affecting salinity in the Upper Colorado River Basin.)

The Lower Basin is characterized by broad, flat valleys separated by low mountain ranges. These valleys are filled by large accumulations of alluvial deposits.

Sediment removed by constant erosion of the upper areas was deposited in Arizona, California, and Mexico and now forms the great delta of the Colorado River.

Reservoirs constructed above Lee Ferry (Lake Powell, Flaming Gorge, Fontenelle, Navajo, Morrow Point, and Blue Mesa), together with Lake Mead downstream, have caused some major changes in stream regimen: (1) The stream channels inundated by these reservoirs are no longer subject to natural stream erosion; (2) the accumulation of sediment and water within the reservoir slows the growth and flooding of the Colorado River delta; (3) flooding has diminished in many areas; and (4) sections of sediment-laden streams have given way to clear water streams and lakes.

The salt concentration in runoff generally increases from the headwater areas downstream and occurs in relation to the geologic character of the terrain across which the Colorado River and its tributaries flow. The geologic formations that largely contribute to the salinity concentrations in natural runoff are evaporites of Paleozoic age, shale of Cretaceous age, and salt and gypsum of Tertiary age.

B. Soils

The soils of the Colorado River Basin closely resemble the geologic formations of their origin. Only in limited areas at the higher elevations has the precipitation leached the soil mass of its soluble constituents. Over most of the area both residual and transported soils are basic in reaction and well supplied with carbonates with normal or mature soils exhibiting a distinct horizon of carbonate accumulation. The impress of soil-forming factors has resulted in a wide range of soil development. Soils formed in areas with low precipitation are classified in the orders Entisols and Aridisols. Those formed in areas with high precipitation are classified in orders Mollisols and Alfisols. Saline and alkali (sodic) soils occur in many parts of the basin.

The residual soils comprise the larger area and are usually shallow in depth over shale and sandstone of various ages. Many of the shales are saline but contain much gypsum as well as other chloride and sulphate salts. Some formations are high in sodium chloride and some have sodium carbonate or bicarbonate strata. Very few residual soil areas are suitable for irrigation development. A large part of the salt pickup occurs in areas where the natural runoff contacts the saline shales before entering the streams.

The alluvial materials are extremely variable and range from alluvial fans and terraces, outwash plains, to lacustrine sediments. Some areas have soils from material transported only short distances and resemble the original materials. Other areas have soils which have been transported and mixed extremely well. Most of the agricultural areas are on these well-mixed alluviums and, therefore, the soils are quite variable.

Extensive areas of Eolian deposits occur in parts of the basin, principally in southwestern Colorado. The uniformly textured soils are reddish brown in color and have no resemblance to either the underlying formations or adjacent areas. These are excellent agricultural soils, but in many areas topography makes agriculture difficult.

C. Climate

The Colorado River Basin has climatic extremes, ranging between year-round snow cover and heavy precipitation on the high peaks of the Rocky Mountains to desert conditions with very little rain in the southern part of the basin. This wide range of climate is caused by differences in altitude, latitude, and by the configuration of the high mountain ranges. The encircling mountain ranges obstruct and deflect the air masses to such an extent that storm patterns are more erratic than in most other parts of the United States. Most of the moisture for precipitation on the Upper Basin is derived from the Pacific Ocean and the Gulf of Mexico. The Pacific source predominates generally from October through April and the Gulf source during the late spring and early summer.

In the northern part of the basin most precipitation falls in the form of winter snows and spring rains. Summer storms are infrequent but are sometimes of cloudburst intensity in localized areas. In the more arid southern portion the principal rainy season is in the winter months with occasional localized cloudbursts in the summer and fall.

Extremes of temperature in the basin range from 50° F. (10 °C) below zero to 130° F. (54 °C) above zero. The northern portion of the basin is characterized by short, warm summers and long, cold winters, and many mountain areas are blanketed by deep snow all winter. The southern portion of the basin has long, hot summers, practically continuous sunshine, and almost complete absence of freezing temperatures.

The entire basin is arid except in the extremely high altitudes of the headwaters areas. Rainfall averages as low as 2.5 inches (63.5 mm) in the southern end of the basin while total precipitation in the mountain tops could reach as high as 40 to 60 inches (1020 to 1520 mm) annually.

D. Vegetation

Areas of higher elevation are covered with forests of pine, fir, spruce, and silver-stemmed aspens, broken by small glades and mountain meadows. Pinon and juniper trees, interspersed with scrub oak, mountain mahogany, rabbit brush, bunch grasses, and similar plants grow in the intermediate elevations of the mesa and plateau regions. Large areas in the Upper Basin are dominated by big sagebrush and related vegetation. Many of the streams are bordered by cottonwood, willows, and salt cedar. Scattered cottonwoods and chokecherries grow in the canyons with the cliff rose, the redbud, and blue columbine. A profusion of wildflowers carpets many mountain parks. At lower elevations large areas are almost completely devoid of plant life while other sections are sprinkled with desert shrubs, Joshua trees, other Yucca plants, and saguaro cacti, some of the latter giant plants reaching 40 feet (12 m) in height. Occasionally, cottonwoods or desert willows are found along desert streams with mesquite and creosote bush or catclaw and paloverde. Many river flood plains have been overrun with tamarisk or salt cedar to the extent that a large volume of water is being consumed by such vegetation.

E. Hydrology

The Colorado River begins where peaks rise more than 14,000 feet (4300 m) high in the northwest portion of Colorado's Rocky Mountain National Park, 70 miles (113 km) northwest of Denver. It meanders southwest for 640 miles (1030 km) through the Upper Basin to Lee Ferry.

The Green River, its major tributary, rises in western Wyoming and discharges into the Colorado River in southeastern Utah--730 river miles (1175 km) south of its origin and 220 miles (350 km) above Lee Ferry. The Green River drains 70 percent more area than the Colorado River above their junction but produces only about three-fourths as much water. The Gunnison and the San Juan are the other principal tributaries of the Upper Colorado River.

The flows of the San Juan River are now controlled by the Navajo Dam, the Green River by Fontenelle and Flaming Gorge Dams, and the Gunnison River by the Curecanti Unit Dams. Glen Canyon Dam is the only major dam on the main stem of the Colorado above Lee Ferry, but it will permit control of almost all flows leaving the Upper Basin.

The flow at various points in streams in the Colorado River Basin for the 1941-76 period is given in Tables 1 through 20. The records of flow depict the characteristic wide fluctuations from month-to-month and the considerable variation from year-to-year. The storage reservoirs now level out some of the fluctuations in the reaches below the dam.

The natural drainage area of the lower Colorado River below Lee Ferry and above Imperial Dam is about 75,100 square miles (195,000 km^2). This section of the river is now largely controlled by a series of storage and diversion dams starting with Hoover Dam and ending at Imperial Dam.

At the present time there is no significant storage on the main river or on the tributaries between Glen Canyon Dam and Lake Mead. The intervening tributary inflow is erratic but amounts to almost enough to offset the evaporation from Lake Mead.

Lake Mead provides most of the storage and regulation in the Lower Colorado River Basin with the water being stored for irrigation and municipal and industrial uses, generation of electrical power, flood control, and other beneficial uses.

Lake Mohave, the reservoir formed by Davis Dam, backs water at high stages about 67 miles (108 km) upstream to the tailrace of Hoover Powerplant. Storage in Lake Mohave is used for some reregulation of releases from Hoover Dam, for meeting treaty requirements with Mexico, and for developing power head for the production of electrical energy at Davis Powerplant.

The river flows through a natural channel for about 10 miles (16 km) below Davis Dam at which point the river enters the broad Mohave Valley 33 miles (53 km) above the upper end of Lake Havasu.

Lake Havasu backs up behind Parker Dam for about 45 miles (72 km) and covers about 25,000 acres (10,100 ha). Lake Havasu serves as a forebay from which the Metropolitan Water District of Southern California pumps water into the Colorado River Aqueduct. Havasu Lake will also serve as forebay for the Central Arizona Project pumping plants and aqueducts. Lake Havasu and Alamo Dam and Reservoir are used to control floods originating below Davis Dam and above Parker Dam.

Headgate Rock Dam, Palo Verde Diversion Dam, and Imperial Dam all serve as diversion structures with practically no storage. Imperial Dam, located some 150 miles (240 km) downstream from Parker Dam, is the major diversion structure to irrigation projects in the Imperial Valley and Yuma areas. It diverts water on the right bank to the All-American Canal which delivers water to the Yuma Project in Arizona and California and Imperial and Coachella Valleys in California. It diverts on the left bank to the Gila Gravity Main Canal.

The Senator Wash Dam also affords regulation in the vicinity of Imperial Dam and assists in the delivery of water to Mexico. This dam and reservoir is used for pump back storage, power generation, and recreation.

PART III. HISTORY OF WATER RESOURCE DEVELOPMENT

A. Irrigation Development

Irrigation development in the Upper Basin took place gradually from the beginning of settlement about 1860 but was hastened by the purchase of land from the Indians in 1873. About 800,000 acres (324,000 ha) were irrigated by 1905. Between 1905 and 1920 the development of irrigated land continued at a rapid pace, and by 1920 nearly 1,400,000 acres (567,000 ha) were irrigated. The development then leveled off and increase since that time has been slow. In 1965, 1,600,000 acres (648,000 ha) were under irrigation in the Upper Basin. Since 1965, there has been very little change.

The slow growth in irrigated acreage in the Upper Basin in the last 50 years is ascribed to both physical and economic limitations on the availability of water. By 1920 most of the lower cost and more easily constructed developments were in operation, and, although some new developments have taken place since that time, they have been partially offset by other acreages going out of production.

Irrigation development began in the Lower Basin about the same time as in the Upper Basin. Development was slow because of difficult diversions from the Colorado River with its widely fluctuating flows. Development of the Gila area began in 1875 and the Palo Verde area in 1879. Construction of the Boulder Canyon Project in the 1930's and other downstream projects since that time has provided the means for a continued expansion of the irrigated area. In 1970 an additional 21,800 acres (8,800 ha) were irrigated by private pumping either directly from the Colorado River or from wells in the flood plain. In 1974, there were nearly 849,000 acres (343,000 ha) in the United States irrigated from Colorado River diversions below Hoover Dam. About 25,500 acres (10,300 ha) of Lower Basin lands in Utah and 12,000 acres (4,900 ha) in Nevada are also now under irrigation.

B. Streamflow Depletions

Development and utilization of the basin's water resources result in depletions of streamflows. Consumptive use of water by irrigated crops and exports to other basins produce the greatest flow depletions. Reservoir evaporation and consumptive use of water for municipal and industrial purposes also produce significant depletions.

The 1976 estimated consumptive use of water by irrigated crops and municipal and industrial users in the Upper Basin was more than 2,200,000 acre-feet (2,700 x $10^6 m^3$). Depletions related to irrigation such as evaporation from irrigation reservoirs (not Colorado River

Storage Project Reservoirs) was estimated to be about 150,000 acre-feet ($185 \times 10^6 m^3$) per year.

Water exported from the Upper Basin during the period 1941-70 averaged about 360,000 acre-feet ($440 \times 10^6 m^3$) per year. Completion of the large projects such as the Colorado-Big Thompson, Duchesne Tunnel, Roberts Tunnel, and the more recent projects such as the San Juan-Chama Fryingpan-Arkansas, Homestake and partially completed Strawberry Aqueduct resulted in increased diversions to about 700,000 acre-feet ($863 \times 10^6 m^3$) in 1976.

Reservoir evaporation varies from year-to-year but the variations have little effect on average streamflow depletions. For the period of record considered, average reservoir evaporation in the Upper Basin was not large until about 1963 when the Colorado River Storage Project Reservoir started to store water. In 1975 about 653,000 acre-feet ($805 \times 10^6 m^3$) were evaporated from the reservoirs and about 678,000 ($836 \times 10^6 m^3$) in 1976. Under normal operating conditions, evaporation from the Colorado River Storage Project reservoirs is expected to average about 568,000 acre-feet ($701 \times 10^6 m^3$) annually.

In the Lower Basin, water is diverted to municipal and industrial projects and to irrigation districts. These M&I projects include the Southern Nevada Water Project which diverts water from Lake Mead above Hoover Dam, and the Metropolitan Water District which diverts water from above Parker Dam and exports it to the Southern California coastal areas. Below Parker Dam water is diverted for irrigation to the Colorado River Indian Reservation and to the Palo Verde Irrigation District. At Imperial Dam the water is divided into three parts. On the left it irrigates the Gila and Yuma Projects, on the right it goes to the Imperial and Coachella water districts through the All American canal, with the remaining water going to Mexico. Below the Imperial Dam, water is delivered to Mexico as required by the treaty with Mexico. There is essentially no flow below Morelos Diversion Dam except for the bypassed saline flows from the Wellton-Mohawk Drain Extension.

C. Legal Aspects, Water Quantity

1. Colorado River Compact

Water of the Colorado River was divided between the Upper and Lower Colorado River Basins by the Colorado River Compact which was signed in 1922 by a commissioner of each of the seven States of the river basin and by a representative of the United States. All States but Arizona ratified the compact prior to its effective date in 1929. The dividing point on the river between the Upper and Lower Basins is at Lee Ferry which is defined as a point 1 mile (1.6 km) below the mouth of the Paria River. (Not to be confused with Lees Ferry which is the site of the gaging station just above the Paria River.) The compact apportions from the Colorado River system to each of the Upper and Lower Basins in perpetuity for exclusive beneficial consumptive use, a total of 7,500,000 acre-feet (9,251 x $10^6 m^3$) annually. In addition to the apportionment of 7,500,000 acre-feet (9,251 x $10^6 m^3$), the Lower Basin is given the right to increase its beneficial consumptive use of water from the Colorado River system by 1 million acre-feet (1,233 x $10^6 m^3$) annually. The compact further provides that the States of the upper division will not cause the flow of the river at Lee Ferry to be depleted below an aggregate of 75 million acre-feet (92,512 x $10^6 m^3$) for any period of 10 consecutive years.

One provision in the compact permits exportation of the water out of the basin as long as it is used beneficially in the seven Basin States, and another provision recognizes the obligations of the United States to the Indian Tribes. The compact prescribes the manner in which the water of the Colorado River system may be made available to Mexico under any water rights recognized by the United States.

The compact, in effect, cleared the way for legislation authorizing the construction of major projects such as Boulder Canyon Project, and it also cleared the way for compacts or agreements within the Upper and Lower Basins to further divide the water among the States.

2. Mexican Treaty of 1944

The treaty with Mexico, signed in 1944, provides for the annual guaranteed delivery by the United States of 1,500,000 acre-feet (1,850 x $10^6 m^3$) of Colorado River water to Mexico. This treaty does not mention water quality, and water from different sources had been used to supply the 1,500,000 acre-feet (1,850 x $10^6 m^3$) right. Because of this and other reasons, a problem of quality arose which had become of much concern to both countries. The quality aspects of the relationship with Mexico is covered later under "Legal Aspects, Water Quality."

3. Upper Colorado River Basin Compact

With the water allocated to the Upper Basin by the Colorado River Compact and with the 1944 Mexican Treaty signed, the Upper Basin States began negotiations which resulted in the signing of the Upper Colorado River Basin Compact in 1948. Under the terms of the compact, Arizona is permitted to use 50,000 acre-feet (62 x $10^6 m^3$) of water annually from the Upper Colorado River system, and the remaining water is apportioned to the other Upper Basin States in the following percentages.

State of Colorado	51.75 percent
State of New Mexico	11.25 percent
State of Utah	23.00 percent
State of Wyoming	14.00 percent

Congress had previously been unwilling to approve projects without assurance that a water supply would be available, so this division of water among the States permitted development to proceed and resulted primarily in the authorization of most of the Federal projects above Lee Ferry that are mentioned in this report.

Neither of the compacts specifically mentions water quality, but it has been recognized as a factor to be considered in developing projects, and water quality studies have been required by recent legislation authorizing the construction of projects in the Upper Basin.

4. Arizona vs. California Suit in the Supreme Court

The States of the Lower Basin have never agreed to a compact for the division of use of the waters of the Lower Colorado River Basin. The State of Arizona filed suit in the Supreme Court of the United States in October 1952 against the State of California and others for the determination of the rights to use the waters of the Lower Colorado River system. The Supreme Court gave its decision on June 3, 1963, and issued a decree on March 9, 1964, providing for the apportionment of the use of the waters of the main stream of the Colorado River below Lee Ferry among the States of Arizona, California, and Nevada. The States of Arizona and New Mexico were granted the exclusive use of the waters of the Gila River system in the United States. The decree did not affect the rights or priorities to the use of water in any of the other Lower Basin tributaries of the Colorado River.

The decree permitted the States of the Lower Basin to proceed with developments to use their apportionments of Colorado River water. Major new developments include the Southern Nevada Water Project in Nevada, and the Central Arizona Project in Arizona. Development of the Indian lands is expected to use all of the water allocated to them by the decree. These lands include the Colorado River Indian Reservation, Arizona-California; the Fort Mohave Indian Reservation, Arizona-California-Nevada; and the Chemehuevi Indian Reservation, California.

5. Colorado River Basin Project Act (Public Law 90-537, 90th Congress, September 30, 1968)

The major items provided in the law include the following:

Construction of the Central Arizona Project consisting of a system of main conduits and canals including a main canal and pumping plants (Granite Reef aqueduct and pumping plants) for diverting and carrying water from Lake Havasu to Orme Dam or suitable alternative.

Construction of five multiple-purpose projects in Colorado; the Animas-La Plata, Dolores, Dallas Creek, West Divide, and San Miguel; and one in Utah, the Uintah Unit of the Central Utah Project, upon completion and approval of a feasibility report to Congress.

Establishment of a Lower Colorado River Development Fund.

Development of criteria for the coordinated long-range operation of the Federal reservoirs, equalizing the storage in Lake Mead and Lake Powell.

Directed that the Secretary of the Interior shall conduct full and complete reconnaissance investigations for the purpose of developing a general plan to meet the future water needs of the Western United States, except that for a period of 10 years from the date of the act, studies shall not be undertaken of any plan for the importation of water into the Colorado River Basin from any other natural river drainage basin lying outside the States of Arizona, California, Colorado, New Mexico, and those portions of Nevada, Utah, and Wyoming which are in the natural drainage basin of the Colorado River.

Directed the Secretary to make annual reports of annual consumptive use and losses of water from the Colorado River system after each successive 5-year period beginning with the 5-year period starting on October 1, 1970.

D. Legal Aspects, Water Quality

Various water quality legislative acts have been passed by the Congress of the United States and the Legislatures of the Basin States. Discussion of four Federal acts that are of special significance to the Colorado River Basin follows:

1. Water Quality Act of 1965 and Related Developments

The Water Quality Act of 1965, Public Law 89-234, amended the Federal Water Pollution Control Act and establish a Federal Water Pollution Control Administration (now the Environmental Protection Agency), to provide grants for research and development, to increase grants for construction of sewage treatment works, to require establishment of water quality criteria, and for other purposes. Section 5 of this Act requires States to adopt water quality criteria applicable to interstate waters or portions thereof within their boundaries by June 30, 1967.

Each of the seven Basin States proceeded with actions directed toward establishment of water quality standards for interstate streams.

Early in the standards setting process, it became apparent to the States that because of legal and institutional constraints combined with lack of technical knowledge of salinity control and management, it would be very difficult to establish numerical salinity standards on the Colorado River which would be workable, equitable, and enforceable. The seven Basin States subsequently developed water quality standards which did not include salinity standards.

The "Seventh Enforcement Conference in the Matter of Pollution of the Interstate Waters of the Colorado River and Its Tributaries" was held in Las Vegas (February 15-17, 1972) and Denver (April 26-27, 1972).

The conferees, (official representatives of the seven Basin States) and the Environmental Protection Agency, unanimously adopted conclusions and recommendations pertaining to the salinity problems of the Colorado River. The conclusions and recommendations were approved by Mr. William D. Ruckelshaus, Administrator of the Environmental Protection Agency in June 1972. The more significant conclusion being as follows:

> "I. It is recommended that: A salinity policy be adopted for the Colorado River system that would have as its objective the maintenance of salinity concentrations at or below levels presently found in the lower main stem. In implementing the salinity policy objective for the Colorado River System, the salinity problem must be treated as a basinwide problem that needs to be solved to maintain Lower Basin water salinity at or below present levels while the Upper Basin continues to develop its compact-apportioned waters.
>
> "II. The Salinity control program as described by the Department of the Interior in their report entitled "Colorado River Water Quality Improvement Program," dated February 1972, offers the best prospect for implementing the salinity control objective adopted herein."

The conferees further suggested that the Bureau of Reclamation should have the primary responsibility for investigation, planning, and implementing the Colorado River Basin Salinity Control Program with the assistance of the Office of Saline Water and the Environmental Protection Agency at the Federal level.

2. <u>The Federal Water Pollution Control Act Amendments of 1972</u>

The object of the Federal Water Pollution Control Act Amendments of 1972 (Public Law 92-500) is to restore and maintain the chemical, physical, and biological integrity of the Nations waters. It declares that the national goals are to eliminate discharge of pollutants into navigable waters by 1985 with an interim goal of attaining by July 1983, water quality which provides for the protection and propogation of fish, shellfish, and wildlife and for recreation in and on the Nation's water.

The Act authorizes the Environmental Protection Agency, after cooperation with other Federal agencies, State water pollution control agencies, interstate agencies and municipalities and industries involved, to prepare or develop comprehensive programs for preventing, reducing, or eliminating the pollution of the navigable waters and ground waters and improving the sanitary condition of surface and underground waters.

Some of the more important aspects of the Act briefly explained are as follows: The Act authorizes the Environmental Protection Agency to provide grants for research or demonstration projects and construction of treatment works to Federal Agencies, States, or private organizations. It also authorizes the Environmental Protection Agency to publish and revise from time to time, water quality criteria and to revise standards to include intrastate as well as interstate streams. The law also provided that by July 1, 1977, the best practical water pollution control technology must have been applied followed by the best available technology economically achievable by July 1, 1983. Section 402 of the Act provides for the Governmental regulation of pollutant discharges through a mandatory permit program, monitoring, inspection, and periodic reporting. Section 404 requires those dischargers of fill or dredge material into a navigable stream to obtain a permit from the Corps of Engineers.

Enactment of Public Law 92-500 introduced a new factor into the salinity problem. The legislation has been interpreted by EPA to require that numerical standards for salinity on the Colorado River be set. Consequently in November (1973) the EPA submitted to several of the Colorado River Basin States proposed requirements and procedures for Salinity Control of the Colorado River System and proposed the establishment of an interstate organization to develop a salinity control plan.

The Basin States, in response to EPA's submittal of the proposed requirements, and to discuss several other questions that had been generated relative to certain sections of Public Law 92-500, met on November 8 and 9, 1973, and among other things, formed the "Colorado River Basin Salinity Control Forum." A statement of position for use in discussing the proposed requirements and procedures for salinity control was adopted on November 9, 1973, and states in part:

> "The States have established a mechanism for interstate cooperation (Colorado River Basin Salinity Control Forum) and for preparation and semiannual reports on the development of numeric criteria and the adoption of such criteria by October 18, 1975."

The Forum members also at the November 8-9, 1973, meeting agreed to request EPA that:

> ". . . The Final statement on proposed water quality standards and plan of implementation for salinity control should be consistent for all seven States of the Colorado River Basin; and opportunity should be provided for further direct discussion between representatives of the Environmental Protection Agency and the Forum before the proposed regulations are published in the Federal Register. . . ."

Following the formulation of the Colorado River Basin Salinity Control Forum, meetings were held with representatives of the EPA in January, March, and April 1974 to discuss the proposed regulation on Colorado River Salinity.

The Environmental Protection Agency published a notice of proposed amendments to (40 CFR Part 120) COLORADO RIVER WATER SYSTEM, Salinity Control Policy and Standard Procedures in FR DOC 74-13683 dated June 12, 1974. After hearings in Las Vegas, Nevada, and Denver, Colorado, in August 1974, the final regulation was published on December 18, 1974, in the Federal Register. The regulation states that 40 CFR Part 120 is amended by adding Section 120.5 Colorado River System Implementation Plan, which reads as follows:

> "(a) 'Colorado River System' means that portion of the Colorado River and its tributaries within the United States of America.
>
> "(b) It shall be the policy that the flow weighted average annual salinity in the lower main stem of the Colorado River System be maintained at or below the average value found during 1972. To carry out this policy, water quality standards for salinity and a plan of implementation for salinity control shall be developed and implemented in accordance with the principles of paragraph (c) of this section, on the following page.
>
> "(c) The States of Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming are required to adopt and submit for approval to the Environmental Protection Agency on or before October 18, 1975:
>
> > "(1) Adopted water quality standards for salinity including numeric criteria consistent with the policy stated above for appropriate points in the Colorado River System, and

"(2) A plan to achieve compliance with these standards as expeditiously as practicable provided that:

"(i) The plan shall identify State and Federal regulatory authorities and programs necessary to achieve compliance with the plan.

"(ii) The salinity problem shall be treated as a basinwide problem that needs to be solved in order to maintain lower main stem salinity at or below 1972 levels while the Basin States continue to develop their compact-apportioned waters.

"(iii) The goal of the plan shall be to achieve compliance with the adopted standards by July 1, 1983. The date of compliance with the adopted standards shall take into account the necessity for Federal salinity control actions set forth in the plan. Abatement measures within the control of the States shall be implemented as soon as practicable.

"(iv) Salinity levels in the lower main stem may temporarily increase above the 1972 levels if control measures to offset the increases are included in the control plan. However, compliance with 1972 levels shall be a primary consideration.

"(v) The feasibility of establishing an interstate institution for salinity management shall be evaluated.

"(d) The States are required to submit to the respective Environmental Protection Agency Regional Administrator, established procedures for achieving (c)(1) and (c)(2) above within 30 days of the effective date of these regulations and to submit progress reports quarterly thereafter. EPA will on a quarterly basis determine the progress being made in the development of salinity standards and the implementation plan."

The Colorado River Basin Salinity Control Forum prepared a report entitled, "Proposed Water Quality Standards for Salinity Including Numeric Criteria and Plan of Implementation for Salinity Control, Colorado River System," in June of 1975. The Forum held public meetings in Las Vegas, Nevada, on August 4, 1975, and Grand Junction, Colorado, on August 7, 1975, and received written comments through August 8, 1975, on the proposal. Based on the comments received, the Forum developed a supplement including modifications to the report. This Supplement is dated August 26, 1975.

Based upon the Forum's proposal and supplement thereto, each of the Colorado River Basin States held formal public hearings in accordance with their individual authority and public participation requirements of Public Law 92-500. As a result of the public hearings, the States adopted the "Proposed Water Quality Standards for Salinity Including Numeric Criteria and Plan of Implementation for Salinity Control, Colorado River System, June 1975" and the "Supplement" thereto dated August 26, 1975. Together these documents would constitute the water quality standards as required by Section 303 of Public Law 92-500 and by the regulation promulgated in the Federal Register of December 18, 1974.

The EPA published a notice of Availability for Public Review and Comment for the proposed Standards in the Federal Register of March 31, 1976. A 60-day period following publication was allowed for comments. The State government administrators in all 7 states were notified by letter from EPA during the period November 8 to November 23 that the standards have been formally adopted.

The following is a summary of the adopted standards:

Summary

The Federal Water Pollution Control Act Amendments of 1972, P.L. 92-500, in Section 303 require the adoption of water quality standards applicable to interstate waters. Pursuant to that requirement, the Environmental Protection Agency on December 18, 1974, issued a regulation requiring the States of the Colorado River Basin to adopt water quality standards for salinity, consisting of numeric criteria and plan of implementation for salinity control. The standards were to be submitted for approval to the Environmental Protection Agency on or before October 18, 1975.

This report, prepared by the seven State Colorado River Basin Salinity Control Forum, presents in a single document the water quality standards for salinity submitted for adoption by each of the States in the Basin. The standards are to be reviewed at three-year intervals and modified, if appropriate.

Consistent with the regulation, the recommended flow-weighted average annual numeric salinity criteria for three locations in the lower main stem of the Colorado River System are as follows:

	Salinity in mg/l
Below Hoover Dam	723
Below Parker Dam	747
Imperial Dam	879

The plan of implementation comprises a number of Federal and non-Federal projects and measures to maintain the flow-weighted average annual salinity in the lower main stem at or below the recommended numeric criteria through 1990, as the Basin States continue to develop their compact-apportioned waters. The principal components of the plan are as follows:

1. Prompt construction and operation of the initial four salinity control units authorized by Title II of P.L. 93-320, the Colorado River Basin Salinity Control Act.

2. Construction of the 12 other units listed in Title II of P.L. 93-320 or their equivalent after receipt of favorable planning reports.

3. The placing of effluent limitations, principally under the NPDES permit program provided for in Section 402 of P.L. 92-500 on industrial discharges.

4. The reformulation of previously authorized, but unconstructed, Federal water projects to reduce the salt loading effect.

5. Use of saline water for industrial purposes whenever practical, programs by water users to cope with the river's high salinity, studies of means to minimize salinity in municipal discharges, and studies of future possible salinity control programs.

The report recognizes that many natural and man-made factors affect the river's salinity. Consequently, the actual salinity will vary above and below the recommended numeric criteria. However, under the assumptions of streamflow equivalent to the long-term average, a "moderate" rate of increase in water depletions and full implementation of needed salinity control measures, the average salinity can be maintained at or below 1972 levels during the study period of the next 15 years.

The Federal regulations provide for temporary increases above the 1972 levels if control measures are included in the plan. Should water development projects be completed before control measures are identified or brought on line, temporary increases above the criteria could result and these increases will be in conformance with the regulations. With completion of control projects, those now in the plan or those to be added subsequently, salinity would return to or below the criterial level.

Periodic increases above the criteria as a result of reservoir conditions or periods of below long-time average annual river flow also will be in conformance with the regulation. With satisfactory reservoir conditions and when river flows return to the long-time average annual flow or above, concentrations are expected to be at or below the criteria level.

3. Clean Water Act of 1977

Public Law 95-217, the Federal Water Pollution Control Act Amendments of 1977, (Commonly referred to as the Clean Water Act) includes among other things, several significant amendments which will have a bearing upon salinity control activities in the Colorado River Basin. It assures State authority to allocate rights to quantities of water. By July 1, 1978, the Administrator of the Environmental Protection Agency, after consultation with the States, should have submitted a report to Congress which analyzes the relationship between programs of the Clean Water Act and the programs by which State and Federal agencies allocate quantities of water including recommendations to improve coordination to reduce and eliminate pollution in conjunction with programs for managing water resources.

The Act also includes provisions to require that Section 208 plans consider return flows from irrigated agriculture. Irrigated agriculture return flows are excluded from the "point source" definition and are not subject to NPDES permits unless the individual States so desire.

A new program was established under Section 208 to provide technical and financial assistance to landowners and operators in rural areas to implement area-wide management plans. Farmers may contract with the Department of Agriculture for cost sharing assistance to reduce agricultural runoff if the measures proposed are part of the 208 "best management practices." The Federal share could be as high as 50 percent. Federal agencies may also receive funds for implementing approved 208 plans.

Section 404 was modified to exempt normal farming, silviculture, and ranching activities from dredge and fill permit regulations. Federal activities specifically authorized by Congress may be exempted from 404 permit requirements if an environmental impact statement, which has information on the effects of such discharge, is submitted to Congress before the actual discharge of dredged or fill material occurs.

Section 303(c) of the Clean Water Act requires that from time to time but at least once each three years applicable water quality standards be reviewed and revised as appropriate. Consequently, the Colorado River Basin Salinity Control Forum began reviewing the 1975 standards and plan of implementation in late 1977. Based upon their review a report entitled "1978 Revision - Water Quality Standards for Salinity Including Numeric Criteria and Plan of Implementation for Salinity Control - Colorado River System" was disseminated for public review. Public meetings were conducted in Las Vegas, Nevada, on November 14, 1978, and in Grand Junction, Colorado, on November 16, 1978. Based upon comments received, the Forum developed a supplement to the report.

As of this writing each of the Colorado River Basin States are following their individual authority and procedures to adopt the 1978 Revision as a part of their water quality standards. The Forum found that the numeric criteria adopted in 1975 for the lower main stem stations are still adequate and the plan of implementation requires only minor modifications from that adopted in 1975.

4. Relations With Mexico

The average annual salinity of the water delivered to Mexico at the Northerly International Boundary increased in 1961 from about 800 mg/l to nearly 1400 mg/l and to over 1500 mg/l in 1962. The completion of the drainage wells and subsequent pumping of 151,500 acre-feet (187 x $10^6 m^3$) of drainage water in 1961 from the Wellton-Mohawk District added over 1 million tons (907,000 t) of salt to the Colorado River. The district further increased their pumping to 213,000 acre-feet (263 x $10^6 m^3$) in 1962 and added over 1.7 million tons (1.5 million t) of salt. If the flow in 1961 leaving Imperial Dam and arriving at the Northerly International Boundary (NIB) had remained at the same volume as in 1960, the salinity at the NIB would have been less in 1961. Since the flow in 1961 was limited to approximately the treaty obligation, about 800,000 acre-feet (987 x $10^6 m^3$) less than in 1960, a larger salinity was observed resulting in a water quality of nearly 1400 mg/l at the NIB. The reduced flow was the result of low runoff and the installation of structures in the Colorado River Basin in the United States that allowed retention of large volumes of water for future use. Approximately 75 percent of the rise in the salinity at the NIB was caused by the Wellton-Mohawk Drainage returns. The remaining 25 percent was caused by the reduction in the excess deliveries to Mexico.

The increase in salinity resulted in negotiations between the United States and Mexico. In March 1965, Minute No. 218 was signed and approved by the two Governments. Beginning on November 16, 1965, Wellton-Mohawk drainage flows were bypassed around Morelos Dam and replaced by water from other United States sources during periods of minimum flow which amounted to about 55,000 acre-feet (68 x $10^6 m^3$) per year. The minimum flow of 900 ft^3/s (25 m^3/s) at the NIB occurs during the winter months for a period not to exceed 180 days. This agreement was in effect until June 30, 1972, and reduced the average annual salinity of waters delivered to Mexico at NIB under the treaty to about 1,245 mg/l.

On July 14, 1972, another agreement, Minute No. 241, was entered into. This Minute provided that the United States would increase the bypass of Wellton-Mohawk drainage, without charge against scheduled Treaty deliveries to Mexico, to the annual rate of 118,000 acre-feet (146 x $10^6 m^3$) and substitute equal volumes of other waters of better quality to be discharged to the Colorado River above Morelos Dam. This reduced the salinity of waters delivered to Mexico at NIB under the treaty by an estimated 100 mg/l. Minute 241, with three extensions, was in effect from July 1, 1972, through December 31, 1972.

Minute No. 242

In keeping with President Nixon's objective to find a permanent, definitive, and just solution to the salinity problem with Mexico, accord was reached on August 30, 1973, with the execution of Minute 242 of the International Boundary and Water Commission. The Minute was developed following an intensive study of the problem by former Attorney General Herbert Brownell and a federal Task Force appointed to assist him. Participation of the Basin States was sought by Mr. Brownell and representatives of the Governors (identified as the Committee of Fourteen), assisted in defining the solution. The key elements of the agreement were:

> "1. Referring to the annual volume of the Colorado River waters guaranteed to Mexico under the Treaty of 1944, of 1,500,000 acre-feet (1,850,234,000 cubic meters):
>
> > "a. The United States shall adopt measures to assure that not earlier than January 1, 1974, and no later than July 1, 1974, the approximately 1,360,000 acre-feet (1,677,545,000 cubic meters) delivered to Mexico upstream of Morelos Dam, have an annual average salinity of no more than 115 ppm ± 30 ppm United States count (121 ppm ± 30 ppm Mexican count) over the annual average salinity of Colorado River waters which arrive at Imperial Dam, with the understanding that any waters that may be delivered to Mexico under the Treaty of 1944 by means of the All-American Canal shall be considered as having been delivered upstream of Morelos Dam for the purpose of computing this salinity.
> >
> > "b. The United States will continue to deliver to Mexico on the land boundary at San Luis and in the limitrophe section of the Colorado River downstream from Morelos Dam approximately 140,000 acre-feet (172,689,000 cubic meters) annually with a salinity substantially the same as that of the waters customarily delivered there.
> >
> > "c. Any decrease in deliveries under point 1(b) will be made up by an equal increase in deliveries under point 1(a).
> >
> > "d. Any other substantial changes in the aforementioned volumes of water at the stated locations must be agreed to by the Commission.

"e. Implementation of the measures referred to in point 1(a) above is subject to the requirement in point 10 of the authorization of the necessary works.

"2. The life of Minute 241 shall be terminated upon approval of the present Minute. From September 1, 1973, until the provisions of point 1(a) become effective, the United States shall discharge to the Colorado River downstream from Morelos Dam, volumes of drainage waters from the Wellton-Mohawk District at the annual rate of 118,000 acre-feet (145,551,000 cubic meters) and substitute therefor an equal volume of other waters to be discharged to the Colorado River above Morelos Dam; and, pursuant to the decision of President Echeverria expressed in the Joint Communique of June 17, 1972, the United States shall discharge to the Colorado River downstream from Morelos Dam the drainage waters of the Wellton-Mohawk District that do not form a part of the volumes of drainage waters referred to above, with the understanding that this remaining volume will not be replaced by substitution waters. The Commission shall continue to account for the drainage waters discharged below Morelos Dam as part of Article 10 of the Water Treaty of February 3, 1944.

"3. As a part of the measures referred to in point 1(a), the United States shall extend in its territory the concrete lined Wellton-Mohawk bypass drain from Morelos Dam to the Arizona-Sonora international boundary, and operate and maintain the portions of the Wellton-Mohawk bypass drain located in the United States.

"4. To complete the drain referred to in point 3, Mexico, through the Commission and at the expense of the United States, shall construct, operate and maintain an extension of the concrete-lined bypass drain from the Arizona-Sonora international boundary to the Santa Clara Slough of a capacity of 353 cubic feet (10 cubic meters) per second. Mexico shall permit the United States to discharge through this drain to the Santa Clara Slough all or a portion of the Wellton-Mohawk drainage waters, the volumes of brine from such desalting operations in the United States as are carried out to implement the Resolution of this Minute, and any other volumes of brine which Mexico may agree to accept. It is understood that no radioactive material or nuclear wastes shall be discharged through this drain, and that the United States shall acquire no right to navigation, servitude or easement by reason of the existence of the drain, nor other legal rights, except as expressly provided in this point.

"5. Pending the conclusion by the Governments of the United States and Mexico of a comprehensive agreement on ground water in the border areas, each country shall limit pumping of ground waters in its territory within five miles (eight kilometers) of the Arizona-Sonora boundary near San Luis to 160,000 acre-feet (197,358,000 cubic meters) annually.

"6. With the objective of avoiding future problems, the United States and Mexico shall consult with each other prior to undertaking any new development of either the surface or the ground water resources, or undertaking substantial modifications of present developments, in its own territory in the border area that might adversely affect the other country.

"7. The United States will support efforts by Mexico to obtain appropriate financing on favorable terms for the improvement and rehabilitation of Mexicali Valley. The United States will also provide nonreimbursable assistance on a basis mutually acceptable to both countries exclusively for those aspects of the Mexican rehabilitation program of the Mexicali Valley relating to the salinity problem, including tile drainage. In order to comply with the above-mentioned purposes, both countries will undertake negotiations as soon as possible.

"8. The United States and Mexico shall recognize the undertakings and understandings contained in this Resolution as constituting the permanent and definitive solution of the salinity problem referred to in the Joint Communique of President Richard Nixon and President Luis Echeverria dated June 17, 1972.

"9. The measures required to implement this Resolution shall be undertaken and completed at the earliest practical date.

"10. This minute is subject to the express approval of both Governments by exchange of Notes. It shall enter into force upon such approval; Provided, however, That the provisions which are dependent for their implementation on the construction of works or on other measures which require expenditure of funds by the United States, shall become effective upon the notification by the United States to Mexico of the authorization by the United States Congress of said funds, which will be sought promptly."

The passage of the Colorado River Basin Salinity Control Act, Public Law 93-320, on June 24, 1974, authorized construction of the Yuma desalting plant and other works necessary for the United States to comply with the provisions of Minute 242.

5. Colorado River Basin Salinity Control Act

On June 24, 1974, Public Law 93-320 was signed by the President. This Act is cited as the "Colorado River Basin Salinity Control Act." The act is divided into Title I, which includes features to comply with the United States obligations to Mexico under Minute 242 of the International Boundary and Water Commission, and Title II, which authorizes construction and planning of salinity control features and the goal of maintaining lower mainstem salinity concentrations at or below 1972 levels. Features authorized for construction under Title I include a 100 million gallon a day (4.38 m^3/s) desalting plant, a brine discharge canal, lining of the Coachella Canal, acreage retirement and irrigation efficiency improvement programs in the Wellton-Mohawk Irrigation District, and development of a well field along the international boundary. Title II authorizes construction of the Paradox Valley, Grand Valley, Law Vegas Wash, and Crystal Geyser salinity control units and the expedited planning of 12 other salinity control projects in the basin above Imperial Dam.

E. Economic Conditions

The prosperity of agriculture in the Upper Colorado River drainage basin generally parallels the prosperity of the livestock industry. With vast areas of fine rangeland available for summer grazing, livestock production is limited by the production of hay for winter feed.

Intensified development of mineral resources in recent years has created new employment opportunities, including off-the-farm work for many farmers. The most extensive and commercially important mineral resources of the Upper Basin are coal, oil, and natural gas. The Upper Basin is also the leading domestic source of vanadium, uranium, radium ore, and molybdenum. Copper, zinc, lead, silver, and gold are also commercially important. In recent years mining of trona has become extensive in the State of Wyoming.

The recent shortage of energy has resulted in an intense search for new sources. As a result, investigations are underway for the commercial development of shale oil in Colorado, Utah, and Wyoming. Fossil fuel powerplants are either being constructed or are in the planning stage for construction in the Upper Basin States. Coal gasification is an emerging industry in northwestern New Mexico where several billion tons of strippable coal are available. These developments have already and will continue to provide job opportunities throughout the area. The increase in population resulting from new job opportunities has created new markets for locally produced and imported products, has taxed municipal facilities and water supplies in several areas, and has increased demands for electricity. Raw materials are also stimulating industrial activities in areas adjoining the upper drainage basin, particularly areas near Denver, Colorado; Pueblo, Colorado; Provo, Utah; and Salt Lake City, Utah. These adjoining areas all import water from the Colorado River Basin and without the imported water their economic growth would be limited.

Tourism as an industry has increased significantly in recent years because of the recreational developments and the many natural attractions. Manufacturing as a basic industry is of relatively minor importance in the Upper Basin.

The irrigated lands in the Lower Basin that use Colorado River's main stream water are some of the most highly productive lands in the United States because agricultural practices are generally year long and highly intensified. The average gross crop income per acre in 1974 was about $800 per acre for the 849,000 acres (344,000 ha) irrigated by main stem waters in the Lower Basin.

Southern California is one of the most rapidly developing regions both industrially and population-wise in the Nation. Colorado River water for municipal and industrial purposes is supplied to approximately 130 incorporated towns and other communities in this area with a population of about 10 million people. The Metropolitan Water District diverted 794,600 acre-feet ($980 \times 10^6 m^3$) of Colorado River water in 1976. Flows to the Metropolitan Water District has been reducing and will be further reduced when the Central Arizona Project starts diverting. State project water was blended with Colorado River water to provide a better quality water for the southern California area. The Colorado River supplies about 36 percent of all of the developed water in the 4,900-square-mile (13,000 km^2) service area. This water ranges from a minor supply for some entities to a complete supply for others.

PART IV. CAUSES OF SALINITY

A. Increased Concentration from Salt Additions

1. Natural Sources of Salinity

Flow and quality records reveal that along certain reaches of the Colorado River there are large increases in the dissolved-solids load that cannot be attributed to irrigation or other man-related activity. This increase is mainly due to natural diffused sources and saline springs.

Natural diffused sources are those sources of salt contribution which occur gradually over long reaches of the river system. Salt pickup occurs over large areas of surface and underlying soils, from stream channels and banks, and is difficult to identify, measure, or control. This source contributes the largest overall share of the salts to the Colorado River. Natural point sources are mainly saline springs where the contribution of salt and water is easily identified, issuing from single or concentrated sources.

Very little information was obtained prior to irrigation, making it difficult to identify the magnitude of specific natural sources of salinity in the Colorado River Basin.

Upper Basin.--Past records indicate a substantial increase in salt load in the Lake Powell area above Lees Ferry and below the Green River Utah, Cisco, and Bluff stations. Iorns and others (1965, p. 20) presented estimates of dissolved-solids loads in this river reach based on the period 1914-57 adjusted to 1957 conditions of development. Unaccounted inflow of dissolved solids in this reach amounted to about 5 percent of the load at Lees Ferry. Most of this resulted from natural diffused sources with the San Rafael and Dirty Devil areas being fairly heavy contributors.[1]

Other areas in the Upper Basin with large amounts of natural diffused sources of salt are the Grand Valley, Uncompahgre, Lower Gunnison, and McElmo Creek areas in Colorado; Price, and Uinta Basin in Utah; and Big Sandy River and Blacks Fork area in Wyoming. Although a large amount of salt pickup in these areas is due to natural runoff, a large amount can also be attributed to irrigation in some parts of the areas.

Table A summarizes information about the contribution of water and dissolved salts by point sources, including the springs and wells in the Upper Colorado River system. Although wells are man-made and not a natural source, abandoned saline flowing wells are shown with the natural springs. The largest contributors in the Upper Basin are the

Table A
Saline Springs and Wells
Upper Colorado River Basin[1/]

Spring and location	Flow (c.f.s.)	Flow (m³/s)	Total dissolved solids concentration (tons/ac.-ft.)	Total dissolved solids concentration (mg/l)	Total dissolved solids load (tons/year)	Total dissolved solids load (tonnes/year)
Castle Creek Spring near Moab, Utah	0.245	.0069	6.0	4,390	1,060	962
Onion Creek Spring near Moab, Utah	0.122	.0035	12.4	9,120	1,100	998
Cold Kendall Spring near Kendall Ranger Sta., Wyo.	1.400	.0396	2.8	2,100	2,880	2,613
Ragen Spring on Muddy Creek west of Ft. Bridger, Wyo.	0.089	.0025	12.6	9,210	800	726
Dotsero Springs 1.5 mi. west of Dotsero, Colo.	17.000	.4811	14.5	10,700	182,600	165,655
Glenwood Springs area, Glenwood Springs, Colo.	18.000	.5094	25.5	18,900	355,000	303,912
Steamboat Springs at Steamboat Springs, Colo.	1.400	.0396	8.4	6,140	8,500	7,711
Lithia Springs, Steamboat Springs, Colo.	0.022	.0006	7.8	5,770	110	100
Piceance Creek Spring, Meeker, Colo.	0.022	.0006	6.5	4,650	72	65
Trimble Hot Spring, Durango, Colo.	0.066	.0019	4.4	3,250	36	33
Pagosa Hot Spring, Pagosa, Colo.	2.300	.0651	4.4	3,240	7,300	6,623
Pinkerton Hot Spring, Durango, Colo.	0.500	.0141	5.0	3,670	1,820	1,651
Yellow Creek Spring, Rangely, Colo.	0.089	.0025	12.7	9,370	840	762
Ridgway Hot Spring, Ridgway, Colo.	1.000	.0283	3.9	2,850	2,550	2,313
Paradise Hot Spring, Dunton, Colo.	0.111	.0031	7.5	5,490	620	562
Big Sulpher Spring, Meredith, Colo.	0.333	.0094	3.1	2,250	730	662
Arsenic Spring, Crystal Mining Camp	2.000	.0566	2.8	2,030	4,000	3,629
Coal Mine Drainage, Oak Creek, Colo.	0.666	.0188	4.7	3,430	2,260	2,050
South Drain Ashley Cr. Oil Field, Vernal, Utah	2.200	.0623	3.6	2,670	5,800	5,262
Strawberry River Springs	0.100	.0028	10.9	8,000	785	712
Crystal Geyser, Green River, Utah	0.207	.0059	19.0	14,000	3,000	2,722
Flowing Well near Aneth, Utah	0.133	.0038	6.2	4,560	580	526
Drainage, Iles Dome Oil Field near Loyd, Colo.	2.900	.0821	2.9	2,180	6,200	5,625

1/ List of springs and wells limited to those with T.D.S. concentrations in excess of 2,000 mg/l

Dotsero and Glenwood Springs which supply the major part of the salts from point sources.

Lower Basin.--The inflow for the reach the Colorado River at Lees Ferry to the Colorado River near Grand Canyon has varied from a low of 18,000 acre-feet (22 x $10^6 m^3$) in 1949 to a high of 939,000 acre-feet (1,158 x $10^6 m^3$) in 1941 with an average annual inflow for the 1941-76 period of 310,000 acre-feet (382 x $10^6 m^3$). The total tons of inflow in this reach varied from a low of 498,000 tons (452,000 t) in 1962 to a high of 2,022,000 tons (1,834,000 t) in 1941 with an average inflow of 1,070,000 tons (971,000 t) per year. Springs in the lower portion of the Little Colorado River contribute about half of the measured increase in dissolved-solids discharge in the Colorado River between Lees Ferry and Grand Canyon.

The annual inflow in acre-feet and tons with the average concentration for each year is shown in Table B for this reach.

Large amounts of dissolved solids are also added to the Colorado River between Grand Canyon and Hoover Dam. Some of this results from the solution of material in the bed of Lake Mead, but like the reach above Grand Canyon, most is contributed by springs and tributary inflows.

For the whole reach from Glen Canyon Dam to Hoover Dam recent studies have been made by the Geological Survey and the Bureau of Reclamation to provide information about the contribution of springs to the Colorado River.

Major springs and spring-fed tributaries which could be measured were found to contribute about 757,000 tons (687,000 t) of dissolved solids annually to the Colorado River between Glen Canyon Dam and Lake Mead. Storm runoff in small tributaries in this reach of the Colorado River contributes an unknown, but probably much smaller, load to the river. The contribution of dissolved solids by these sources of inflow between Glen Canyon and Lake Mead equals about 10 percent of the average dissolved-solids load of the Colorado River at Lees Ferry.

The annual dissolved-solids contributions of the measured major springs, streams, and spring-fed tributaries to the Colorado River between Glen Canyon Dam and Lake Mead and to the Virgin River are summarized in Table C.

Table B
Average Inflow Between Lees Ferry and Grand Canyon

Year	Inflow 1000 AF	Inflow million m^3	Inflow 1000 Tons	Inflow 1000 Tonnes	Concentration T/AF	Concentration mg/l
1941	1/ 939	1,158	1/ 2,022	1,834	2.15	1,583
1942	134	165	805	730	6.00	4,417
1943	211	260	1,658	1,504	7.86	5,778
1944	311	384	1,423	1,291	4.58	3,364
1945	346	427	1,596	1,448	4.61	3,392
1946	368	454	1,396	1,266	3.79	2,789
1947	301	371	1,782	1,616	5.92	4,353
1948	124	153	1,268	1,150	10.23	7,519
1949	2/ 18	22	1,300	1,179	72.22	3/ 53,104
1950	34	42	1,364	1,237	40.11	29,498
1951	33	41	1,306	1,185	39.57	29,100
1952	203	250	2,186	1,983	10.77	7,918
1953	75	93	1,208	1,096	16.11	11,843
1954	135	167	789	716	5.84	4,297
1955	321	396	946	858	2.95	2,167
1956	115	142	661	600	5.75	4,226
1957	210	259	617	560	2.94	2,160
1958	322	397	574	521	1.78	1,311
1959	247	305	882	800	3.57	2,626
1960	364	449	741	672	2.03	1,497
1961	425	524	1,187	1,077	2.79	2,054
1962	400	493	2/ 498	452	1.24	915
1963	246	303	533	484	2.17	1,593
1964	339	418	872	791	2.57	1,891
1965	188	232	1,177	1,068	6.26	4,603
1966	488	602	899	816	1.84	1,355
1967	472	582	1,051	953	2.23	1,637
1968	591	729	1,092	991	1.85	1,359
1969	465	574	954	865	2.05	1,509
1970	453	559	711	645	1.57	1,154
1971	310	382	1,050	953	3.39	2,490
1972	455	561	968	878	2.13	1,564
1973	784	967	890	807	1.14	4/ 835
1974	227	280	587	533	2.59	1,901
1975	250	308	868	787	3.46	2,550
1976	272	336	675	612	2.48	1,825
Total	11,176	13,785	38,536	34,958		
Average	310	383	1,070	971	3.45	2,539

1/ Largest inflow.
2/ Smallest inflow.
3/ Highest concentration.
4/ Lowest concentration.

Table C-
Contribution from Major Springs and Tributaries
Between Glen Canyon and Hoover Dams

Source	Dissolved-solids discharge per year	
	1000 tons	1000 tonnes
Paria River	30	27
Little Colorado River above Blue Spring	130	118
Springs in Lower Little Colorado River	550	499
Bright Angel Creek	7	6
Tapeats Creek	12	11
Kanab Creek (base flow)	4	4
Havasu Creek (base flow)	24	22
Total inflow in Colorado River (Glen Canyon Dam to Lake Mead)	757	687
LaVerkin Springs (inflow to Virgin River)	109	99
Littlefield Springs (inflow to Virgin River)	174	158
Total inflow from major springs and tributaries to Colorado and Virgin Rivers	1,040	944

The minimum annual inflow of 1,040,000 tons (790,000 t) from these sources results in an increase of about 73 mg/l in the Colorado River on the basis of an average annual flow of 10.5 million acre-feet (12,952 x $10^6 m^3$) at Hoover Dam.

2. Agricultural Sources of Salinity

Irrigation in the Colorado River basin has increased the total dissolved solids in the Colorado River. Return flows from the irrigated lands pick up salts from the soils and underlying shales and transport them to the river system. The development of future irrigation projects will further increase the salt load to the river.

Studies prior to irrigation would be helpful to determine contribution from irrigation, but they have not been made in most areas. The amount of salt from this source must therefore be estimated or determined by detailed investigations possibly with the use of simulation models.

Salt balance conditions exist when the amount of dissolved solids carried off the land is equal to that amount added. Pickup of salt as used in this report represents an unbalanced condition shown by the increase of total dissolved-solids load in the return flow over the total load in the applied water. Salt pickup chargeable to irrigation would be only that additional which occurs as a result of irrigation and should not include the amount resulting from natural sources.

The small amount of data presently available gives indications of much variation in the amount of pickup from land due to irrigation. The estimated salt pickup in this report for projects without specific information is based on values of zero and 2 tons per acre (zero and 4.5 t/ha) from newly irrigated land. Zero or minimum conditions occur generally after initial leaching in areas where soils are loose and contain very little salt and a salt balance of inflow and outflow has been reached. The 2-ton-per-acre (4.5 t/ha) value was selected as the higher end of the range for the average pickup over a project area. It was also assumed in this report no additional pickup would result from supplemental water applied to presently irrigated lands. On projects where detailed information on salt pickup was available through use of models or by special investigations, these more specific figures were used.

3. Municipal and Industrial Sources of Salinity

Salt loads contributed to the Colorado River system by municipal and industrial sources are generally minor, totaling about 1 percent of the basin salt load. Future increases in salt loads from these sources are expected to be small relative to the total basin salt burden and will have only a minor effect on salinity levels.

With the exception of concentrated return flows from the Las Vegas area, most municipal and industrial wastes are relatively low in total salt load in comparison with natural and agricultural sources, and complete elimination of such waste discharges would have little effect on salinity concentrations in the main river system. Since these wastes are point sources of salinity, control could be achieved if salinity levels in the waste being discharged (i.e., industrial brines) warrant such control.

The recent energy shortage has caused an increase of interest for construction of large energy producing industries within the Colorado River Basin. With emphasis placed on improving the water quality in the basin, these industries have been under pressure by State and Federal agencies to prevent the return of salts to the river by consuming all water diverted for use.

B. Increased Concentration from Water Depletions

Addition of salts to the river system is not the only cause of increased salinity concentrations. The depletion of water of better quality than in downstream reaches produces a concentrating effect on the waters of the downstream reaches. This concentrating effect occurs to a greater degree when the diverted salts return to the river than when they are depleted along with the water.

1. <u>In-basin Depletions</u>

Consumptive use of water for irrigation within the basin is responsible for the largest depletions while municipal and industrial uses accounts for a lesser depletion. Evaporation from reservoir and stream surfaces also produces large depletions. Phreatophytes cause significant water losses by evapotranspiration, especially in the Lower Basin below Hoover Dam. In most cases where in-basin depletions occur, the diverted salts return to the river system, adding significantly to the increase in concentration. Only in the case of large industries such as steam powerplants are the salts depleted along with the water.

2. <u>Transbasin Depletions</u>

The major part of the transbasin depletions are made at higher elevations where the salinity concentrations are very low. This removal of high quality water results in the remaining flows downstream to become more concentrated even though some salts are removed by the water delivered to another basin. Many transbasin diversions have been made for several years and an additional number will divert in the future. The largest future diversions will be by the Bonneville Unit of the Central Utah Project, the Denver-Englewood and Homestake Diversions, the San Juan-Chama Project, and the Fryingpan-Arkansas Project, all of which are presently diverting some water.

PART V. EFFECTS OF SALINITY ON WATER USE

Water quality can be a factor in limiting the use of a water supply. Different water uses require waters of different qualities, and a supply may be acceptable for some uses but unsuitable for others. Most water uses have a range of quality within which a supply may be acceptable for that use. Use of water at the low quality end of this range may impose an economic, a social, and/or a political penalty on the water user in comparison to use of the water at a higher quality. The suitability of the quality of a water supply for use is thus a relative matter and must be evaluated with regard to specific uses and the social and economic aspects of such use.

An important objective of salinity investigations is to assess the suitability of Colorado River water for various beneficial uses. The following sections discuss the physical and economic effects of salinity on water uses in the Colorado River Basin.

A. In-stream Use

The major in-stream uses (uses where water is not depleted) of water in the Colorado River Basin include hydroelectric power production, propagation of fish and aquatic life, recreation (including water contact sports), and aesthetics. Within the range of salinity concentrations expected in the foreseeable future, salinity should have no significant effects on these uses.

B. Irrigation Use

The major portion of the basin water supply is consumptively used for irrigation. Any effects of water quality on this use are thus of major importance. Crops grown in the basin differ in sensitivity to a salt concentration in the soil root zone, with some crops tolerating significantly higher concentrations in the root zone than the more sensitive crops. Also, most crops require a lower salinity concentration in the root zone during the germinating and seedling stage than they do later in the growing cycle. Salinity concentrations in the root zone are affected by the salinity concentration of the irrigation water, method of irrigation, irrigation efficiency, depth and concentration of ground water, drainability and texture of the soil, weather patterns, and other factors. If, however, all other factors remain unchanged, the salinity concentration of the root zone will vary with the salinity concentration of the irrigation water. Thus an increase in the salinity concentration of the irrigation water will decrease the productivity of the salt-sensitive crops if its tolerance limit of salinity concentration in the root zone is exceeded. Because of the many factors affecting the salinity concentration in the root zone, an exact irrigation water concentration that will damage a crop cannot be determined. For economic studies to determine Lower Basin damages, a salinity level of 750 mg/l was assumed as the level at which losses begin to occur.

Damage to salt-sensitive crops can be prevented by applying additional irrigation water to flush the salts from the soil. If natural drainage or an existing drainage system is inadequate to remove the additional water, it may be necessary to install additional drains.

In the Upper Basin, salinity concentrations during the irrigation season are relatively low except in local areas. The impact of salinity on irrigation in the Upper Basin is thus minimal and will continue to be in the future.

In the Lower Basin, present peak salinity concentrations are approaching critical levels for some salt-sensitive crops, and, while suitable for irrigation of most crops, are high enough that special irrigation practices are used in some cases. Economic losses will occur as salinity levels increase throughout the basin.

C. Industrial Use

Colorado River water has not yet been widely used for industrial purposes within the basin but extensive use has been made of this water from transmountain diversions outside the basin. Since the quality of the water diverted from the Upper Basin is relatively high, only minimal pretreatment is required for most industrial uses. In the Lower Basin, the higher salinity levels in the diverted flows may require more extensive pretreatment for some types of industrial uses.

The quality of water required for industrial use varies widely and is dependent upon the purposes for which the water is utilized. Within any industrial plant, water may have several functions; however, cooling is the largest single use of industrial water supplied from the Colorado River. Future industrial uses are expected to increase tremendously with the increased requirements for energy.

D. Domestic Use

For domestic water use it is desirable to have a safe, clear, potable, aesthetically pleasing water supply which meets the recommended limits of the National Interim Primary Drinking Water Regulations of December 24, 1975 and any other Federal or State drinking water standards. High salinity levels affect the taste of drinking water and may affect the digestive system in some people. Water hardness, which may increase with increases in salinity concentrations, also requires more soap and laundry additives to achieve acceptable cleaning results.

If the water becomes too hard, softening of the supply in large-scale municipal plants or in individual home units may be required. Scaling of water heaters and corrosion of pipes also accelerate with increased salinity or hardness levels.

Water quality in the Upper Basin will generally meet the Public Health Service standards with normal levels of treatment--settling, filtration, and disinfection. In some cases only disinfection is required. In contrast to the Upper Basin, the quality of the water supply at most points in the Lower Basin does not meet the Public Health Service recommended limits of 500 mg/l for total dissolved solids. Mineralized water supplies with salinity concentrations in the range of those values observed in the Colorado River, however, are commonly accepted in the southwestern United States, with little detriment to the potability of the supply. The use of this mineralized supply imposes an increased treatment cost as hardness levels are high enough that water softening is desirable in addition to normal treatment. Another means of reducing the problem is by mixing better quality water with the saline water. This solution is limited to those areas having other supplies and is an additional cost.

E. Economic Impacts

In the United States, the total damages attributable to salinity in the Colorado River system as of 1973 was about $53 million per year. By the year 2000, without control measures, these damages would amount to about $124 million per year. These economic impacts are based on Bureau of Reclamation studies which showed that annual direct and indirect losses amount to about $230,000 per mg/l increase in salinity at Imperial Dam. The estimates of damage do not include affects below 500 mg/l for municipal and industrial water and 750 mg/l for agricultural use.

A consortium of Water Resources Centers in the States of Arizona, California, Colorado, and Utah has completed a report entitled "Salinity Management Options for the Colorado River - Damage Estimates and Control Program Impacts." Indications are the annual direct and indirect damage to the agricultural, municipal and industrial water users could be between $325,000 and $375,000 per mg/l increase in salinity at Imperial Dam.

PART VI. EVALUATIONS OF EXISTING SALINITY CONDITIONS

A. Quality of Water Stations

A primary purpose of this report is to summarize water quality conditions for the Colorado River Basin. This part summarizes chemical quality under both historical and present conditions of water resource development and utilization. Anticipated changes in future chemical quality are discussed in Part VII. Other water quality parameters are discussed in Part IX.

Evaluations of the salinity of the water in the basin are based on quality of water and streamflow records at 20 selected stations. Each station is considered to reflect flow and water quality conditions at its location. Records were generally available at each station for the time period considered by this report, 1941 to 1976. Where records were not available, missing data were estimated by correlation with other stations.

Basic data summarized in this report were primarily obtained from records of the Geological Survey developed by a continuing program for collection of water data which is supported in part by a transfer of funds from the Bureau of Reclamation.

Locations of the 20 key stations are shown on Figure 1. Available flow and quality records for each station are shown on Figure 2. The source and method of derivation of basic data for each of the stations are briefly discussed in the following sections.

1. Key Stations with Complete Records

Records of flow and water quality are available for all of the 1941-76 period for the Green River at Green River, Utah (Station No. 6); Colorado River near Cameo, Colorado (Station No. 9); Gunnison River near Grand Junction, Colorado (Station No. 10); Colorado River near Cisco, Utah (Station No. 12); and San Juan River near Bluff, Utah (Station No. 14). Minor extensions only were needed to fill in short periods of record for a few of these stations. The Colorado River near Glenwood Springs gage was moved from above to below the Roaring Fork at the end of the water year 1966. Subsequent records for this station were adjusted by subtracting the Roaring Fork flows. All records were obtained from the Geological Survey publications. Current Geological Survey data may be obtained from the respective U.S. Geological Survey, Water Resource Division computer data storage banks in Reston, Virginia, or from the Environmental Protection Agency's STORET system.

Colorado River Basin
Flow and Quality of Water Records
1941 – 1976

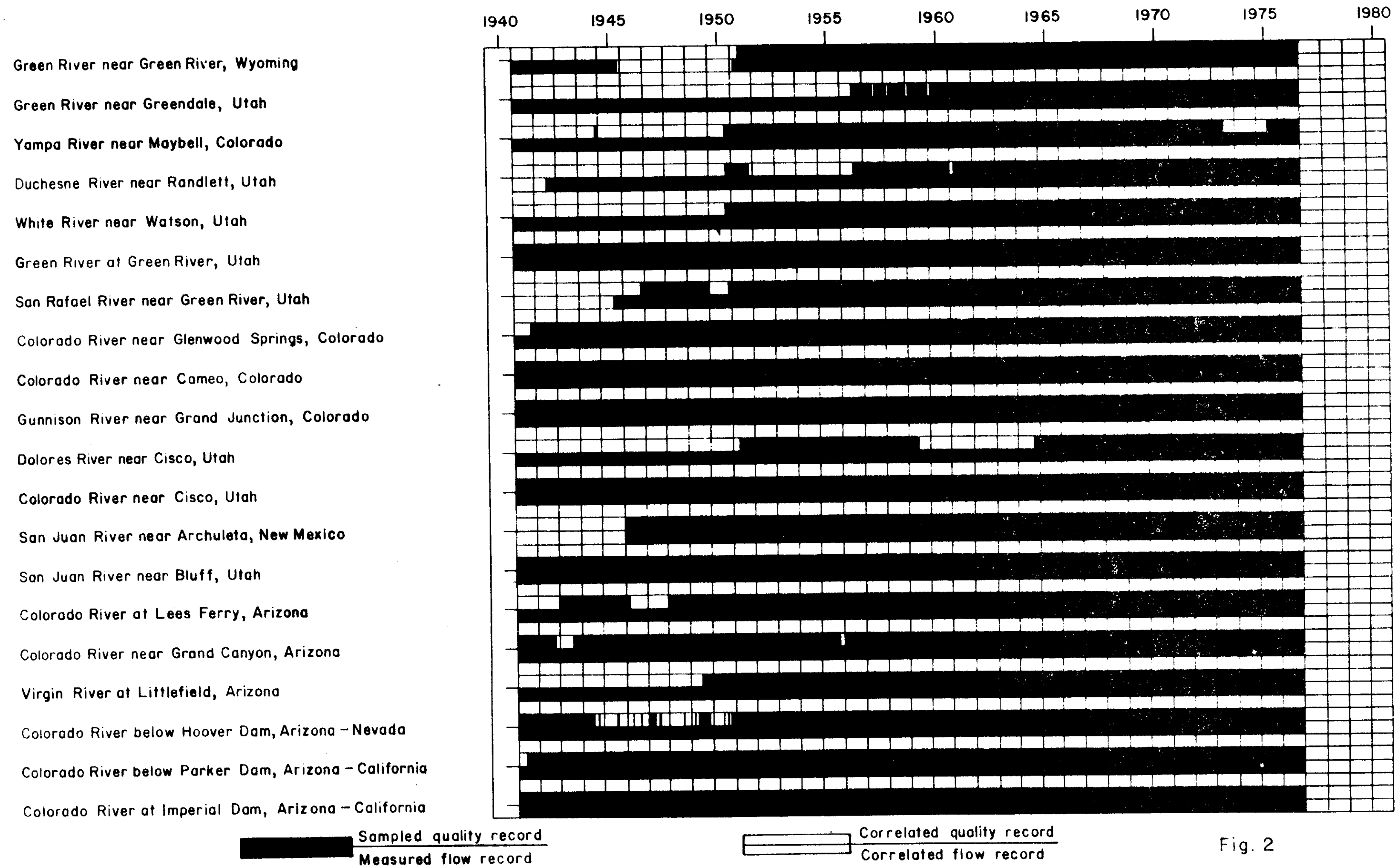


Fig. 2

2. Key Stations with Partial Records

Green River near Green River, Wyoming (Station No. 1).--Flow records are available at this station from April 1951 and quality records from May 1951. The records have been extended back to 1941 by correlation with nearby stations.

Green River near Greendale, Utah (Station No. 2).--Flow measurements or comparable data are available for this station for the report period, but chemical quality data are available only for the years 1957 through 1976, inclusive. Extensive correlations with other available records on the Green River system were employed to develop estimates for dissolved solids.

Yampa River near Maybell, Colorado (Station No. 3).--Flow measurements for this station are recorded for the entire report period, but water quality data are available only from November 1950 through August 1973 and from July 1975 to the current year. The quality data for the missing periods were estimated by correlation with flow measurements.

Duchesne River near Randlett, Utah (Station No. 4).--Flow records have been obtained continuously since 1943, and quality data are available for 1951 and 1957 through 1976. Correlations with other stations in the Duchesne River system were employed to estimate the data for the missing period.

White River near Watson, Utah, (Station No. 5).--Flow data are available for the entire report period, and quality data are recorded continuously from December 1950. Correlation with flow measurements were used to extend the quality data back to January 1941.

San Rafael River near Green River, Utah (Station No. 7).--Correlations were used to estimate flow at this gage from 1941 to 1945 after which measurements of flow were available. Quality sampling started in 1946 and is complete for the remainder of the study period except for 1950. Extensions of available data provided satisfactory estimates of quality for the missing years.

Colorado River near Glenwood Springs, Colorado (Station No. 8).--Correlations were used to estimate the quality data for the 1941 year prior to October 1. Quality records are available after October 1, 1941. Flow records are available for the entire period of study.

Dolores River near Cisco, Utah (Station No. 11).--Flow records from January 1951 and quality records from March 1951 are available at this station. Flow records from January 1941 to December 1950 and quality records from October 1947 to February 1951 for the Dolores River at Gateway, Colorado, 21 miles (34 km) upstream, were used without modification as no perennial stream enters between the gages. The quality record was extended back to 1941 by correlation with the flow records.

San Juan River near Archuleta, New Mexico (Station No. 13).--For the period 1954 to 1974 flow and quality data presented are a combination of measurements obtained near Archuleta and at Blanco, New Mexico, with a few adjustments and correlations. Correlations were employed to estimate the data for 1941-54. Quality data for 1969 through 1976 were estimated from once-a-month sampling at the Archuleta gaging station. In 1974 electrical conductivity measurements were started on a 3-time per week basis along with occasional chemical analyses. These measurements indicate the quality to be very uniform since the station is close to the outlet works of the Navajo Dam.

Colorado River at Lees Ferry, Arizona (Station No. 15).--This station has complete flow records available for the study period but lacks quality of water measurements for 1941, 1942, 1946, and 1947. Quality data for these years were estimated by extensive multiple correlations using data for the Colorado River near Cisco, Utah, and near Grand Canyon, Arizona; the Green River, Utah; and the San Juan River near Bluff, Utah. Water samples are collected monthly by the Geological Survey for a chemical analysis of major constituents and nutrients analysis. Samples for minor element analyses are collected quarterly. Specific conductance and field water temperature measurements are made daily.

Colorado River near Grand Canyon, Arizona (Station No. 16).--Flow records are available for the report period and chemical quality records are also available except for the period December 1942 to August 1943. Quality data for the period of missing records were estimated from records at upstream stations. Water samples are collected and chemical analyses are made monthly by the Geological Survey with records dating back to 1925.

Virgin River at Littlefield, Arizona (Station No. 17).--Flow records are available for the report period, but quality data are available only from July 1949 to the present. Detailed correlations were employed to estimate the data for the missing period. Determinations are made daily by the Geological Survey for specific conductance, and water temperature chemical analyses are made monthly unless significant changes in conductivity occur.

Colorado River below Hoover Dam, Arizona-Nevada (Station No. 18).--Discharge and quality records are available from October 1939 until the present, except for water quality records during the period November 1944 to September 1950. The water quality for this time period is based on specific conductance records and intermittent chemical analyses. The samples used for the chemical analyses are collected monthly by the Geological Survey stream gaging station below the dam.

Colorado River below Parker Dam, Arizona-California (Station No. 19).--Flow records at this station are available from October 1934 and have been published or are available from the Geological Survey. The water quality data for the period January 1964 through December 1970 were taken at the Geological Survey station, Colorado River below Parker Dam. The water quality data for the period January 1941 through December 1963 used in the "Quality of Water Colorado River Basin Progress Report No. 5" were based on chemical analyses of Colorado River Aqueduct flows made by the Metropolitan Water District. These data have been adjusted based on a correlation of concurrent Metropolitan Water District records with records made by the Geological Survey below Parker Dam for the year 1964-70. The correlated data was then used for the period 1941-63.

Colorado River at Imperial Dam, Arizona-California (Station No. 20).--Although Figure 4 indicates flow records are available for the report period, no single station was used to obtain the record. It was obtained from a combination of several stations. Records from January 1941 through September 1942 are from the station, Colorado River near Picacho, California. Records from October 1942 through September 1960 are based on the combined records of discharge obtained at gaging stations on Colorado River at Yuma, All-American Canal near Imperial Dam, Gila Gravity Main Canal at Imperial Dam, Yuma Main Canal at Laguna Dam, and North Gila Valley Canal at Laguna Dam less that of Gila River near Dome, Arizona. Records after September 1960 are based on the combined daily discharge of Colorado River passing Imperial Dam and at gaging stations on All-American Canal near Imperial Dam and Gila Gravity Main Canal at Imperial Dam and the diversion to Mittry Lake.

Quality data from 1943 through October 1970 were obtained from Geological Survey records and are based on data for the Yuma Main Canal below the Colorado River Siphon. The water quality data for November and December 1970 and for calendar years 1971-1976 were obtained from the Geological Survey records for the water quality station at Imperial Dam. The samples are presently being collected by the Geological Survey and the Bureau of Reclamation above the trash racks at the diversion to the All-American Canal. Salinity analyses are made by the Geological Survey in cooperation with the Bureau of Reclamation. Field analyses and bacteria determinations are made by the Geological Survey in cooperation with Environmental Protection Agency.

3. Other Quality of Water Stations

In addition to the key stations discussed above, there are many more points at which water quality data are obtained. Most of these sampling stations are operated by the Geological Survey; however, a number are operated by the Bureau of Reclamation and other Federal, State, and private agencies.

The type of data obtained and the purpose of the sampling vary with each station. Many of the stations provide data for the Water Quality Improvement Program in Part VIII and special studies described in Part X.

B. Methods of Chemical Analyses

Published quality of water records consist of a combination of stream discharges with chemical analyses of stream water samples collected at more or less regular intervals. The reliability of the records depend on the accuracy of the streamflow records, the frequency of collection and representativeness of the samples, the stability of the samples during the storage periods prior to making of the analyses, and the completeness and accuracy of the individual analyses.

Most of the chemical analyses of water samples which provided the water quality data were made in the laboratories of the Geological Survey at Washington, D.C., Albuquerque, New Mexico, and Salt Lake City, Utah, using standard procedures by chemists specifically trained in water analysis. During the 36-year period considered there were several changes in laboratory techinques and procedures mostly due to introduction of new instrumental methods. New procedures were adopted only after careful investigation to insure results consistent with those obtained previously. Some of the quality of water records are based on analysis of samples by Bureau of Reclamation laboratories. Bureau of Reclamation results and methods have been checked by the Geological Survey to insure comparable records. It is probable that errors in the load computations due to errors in chemical analysis are less than those due to changes in the samples upon storage, inaccuracies in sampling, or inaccuracies in the determination of stream discharges.

Prior to about 1970 the U.S. Geological Survey analyzed water quality on a composite sample basis and also determined and published the annual total dissolved-solids loads. Since that time the results of the analysis in the Colorado River Basin have been those of individual samples rather than composites and no totals for the year have been computed. At present individual samples are taken and analyzed about once a month together with daily conductivities. The annual total dissolved-solids loads since this change, have been determined from daily conductivities applied to a curve or conversion factors relating conductivities and total dissolved-solids concentrations.

C. Historic Conditions

1. Total Dissolved-Solids Concentrations

Historic streamflow, total dissolved-solids salinity concentrations, and salt-load data for the 20 key stations for the 1941-76 period of record are presented in Tables 1 to 20 with each table number corresponding to a station number. The concentrations as shown were determined on a flow weighted basis.

To simplify tabulation, monthly values of flow and total dissolved-solids loads were rounded to the nearest 1,000 acre-feet and 1,000 tons. This resulted in some differences between the recorded and the computed monthly concentrations when the flows were low, for example, below 1,000 acre-feet in the San Rafael and Duchesne Rivers. Similarly, minor differences from published data in monthly concentrations occur in isolated instances in the flow and quality tables for the other stations.

The water quality at the Lees Ferry and the four other key stations on the main stem of the Lower Colorado River has been affected by abnormal conditions during the 1959-76 period because of low runoff in 1959, 1960, 1961, 1963, 1964, 1966, and 1967 and the storage of water in Lake Powell in 1963 to 1976. Figure 3 shows the historical flow weighted average salinity concentration for these five stations and the combination of the Green River at Green River, Utah, San Rafael near Green River, Utah, Colorado River near Cisco, Utah, and the San Juan River near Bluff, Utah.

The Grand Canyon station has the longest water quality record on the Colorado River, 1926-76. It is of interest that the average salinity concentration for the period 1941-76 is only slightly higher than the average salinity concentration for the period 1926-40, 0.84 to 0.81 tons per acre-foot (618 to 596 mg/l), respectively.

Generally the salinity concentration increases at each succeeding downstream station as a result of depletions by diversions; reservoir and stream evaporation; consumptive use by irrigated crops and phreatophytes; and by salt loading from natural springs, streams, solution of salt from reservoir basins, and by irrigation return flows. The flows of the Bill Williams River often dilute the flow of the Colorado River in Lake Havasu which sometimes results in a decrease in the salinity concentration from the below Hoover Dam station to the below Parker Dam station. Figure 3 shows the concentration changes between the five lower stations and the combined four stations above Lake Powell on the Colorado River. Note also that Lake Mead has a dampening and delaying effect, about 2 years, on the salinity concentrations at the downstream stations. This is especially noticeable for the high

WEIGHTED AVERAGE DISSOLVED SOLIDS CONCENTRATIONS, COLORADO RIVER ABOVE AND BELOW LEE'S FERRY, ARIZONA

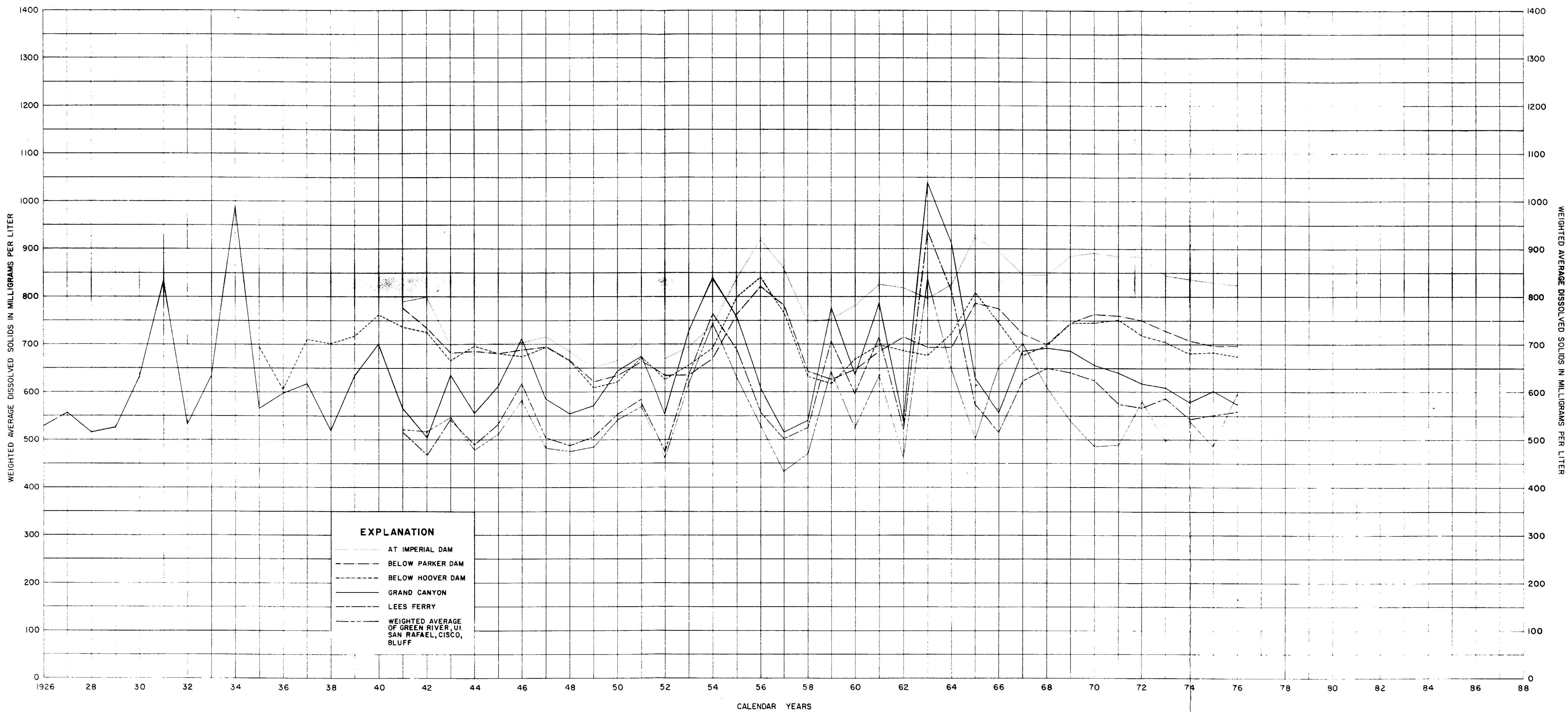


Fig. 3

salinity concentrations of 1963 at the Lees Ferry and Grand Canyon stations.

D. Present Modified Conditions

The 1941-76 period average present modified flow and quality at any station, as defined in this report, is the average of the flows and quality that would have resulted if the present (1976) level of depletions and salt loading instead of actual depletions and loading had occurred each year of the period. This average present modified flow and quality, therefore, represent an average condition based on the 1941-76 water supply period occurring at the present (1976) time. This is shown for each station on Table E in Part VII. Adjustments to the historic flow that were made to develop the present modified flow included: (1) adjustments for the increase in depletion in 1976 over that for years prior to 1976; (2) removal of storage effects below large reservoirs by adding the historical storage and subtracting storage releases to obtain unregulated flows at each station; and (3) adjustments for historic evaporation as compared to average present evaporation. The large reservoirs considered in these adjustments were Flaming Gorge, Lake Powell, Curecanti Unit Reservoirs, Navajo and Fontenelle Reservoirs in the Upper Basin and Lake Mead, Lake Mohave, and Lake Havasu in the Lower Basin.

Average present evaporation from the Colorado River Storage Project Reservoirs plus Navajo and Fontenelle Reservoirs was estimated to be 568,000 acre-feet (701 x $10^6 m^3$) per year. (Note: This is the latest evaporation estimate pending results from additional investigations being conducted.) This would include evaporation from Lake Powell of 460,000 acre-feet (567 x $10^6 m^3$); Flaming Gorge, 50,000 acre-feet (62 x $10^6 m^3$); Curecanti Unit Reservoirs, 10,000 acre-feet (12 x $10^6 m^3$); Navajo, 26,000 acre-feet (32 x $10^6 m^3$) ; and Fontenelle Reservoir, 22,000 acre-feet (27 x $10^6 m^3$). These figures were chosen to represent present conditions rather than using the 1976 historical evaporation since a single year record could show an above-or-below normal condition. Present evaporation of the Lower Basin Reservoirs was assumed the same as historical since these reservoirs have been operating for a number of years.

Historical flows since 1941 have been affected by the transmountain diversions of the Colorado-Big Thompson Project, Duchesne Tunnel of Provo River Project, Roberts Tunnel of the city of Denver, and a number of small in-basin developments in the Upper Basin. More recently the Independence Pass expansion, Collbran, Paonia, Smith Fork, Silt, Florida, Hammond, Bostwick Park, San Juan-Chama, Navajo Indian Irrigation and Emery County Projects and Vernal Unit of Central Utah Project have come into operation. In addition water is used by the Hayden Steamplant, Four Corners Steamplant, expansion of Hogback Indian lands, and the municipalities and industries in Wyoming. In the Lower Basin, corrections have been made for the Southern Nevada Water Project, the Metropolitan Water District diversion at Lake Havasu, the Colorado River Indian Reservation, and the Palo Verde Irrigation District. The depletions from all of the above projects have been extended back to 1941, from the time they became operational, so that when increased depletions on existing projects or new depletions on new projects occur they can be imposed directly on the present modified condition to show the anticipated effect of all development on the river. In the near future several projects now under construction will become operational. The addition of these new depletions will result in slight increases in dissolved-solids concentrations under present modified conditions.

Quality data for present modified conditions were computed by taking into consideration (1) the flow weighted average of the concentrations of total dissolved solids for the various transmountain diversions, (2) the change in dissolved solids resulting from the existing upper in-basin developments on the basis of an assumed pickup of 2.0 tons of dissolved solids per acre (4.5 t/ha) of irrigated land and a depletion of 1.5 acre-feet of water per irrigated acre (4,500 m^3/ha), and (3) in the Lower Basin a consumptive use of 4 acre-feet per acre (12,000 m^3/ha) and a 2.0 tons per acre (4.5 t/ha) pickup for irrigation of the Palo Verde Irrigation District, the Fort Mohave, Chemehuevi, and Colorado River Indian lands. The value of 4 acre-feet per acre (12,000 m^3/ha) is the rate presented in the Colorado River Basin Project hearings before the Subcommittee on Irrigation and Reclamation of the Committee on Interior and Insular Affairs, House of Representatives.

The present modified conditions are shown on Table E and are used as a base value for developing the anticipated effect of new depletions from new projects and the full development of present partially developed projects in the river basin.

Following is a brief description of the large existing dams and reservoirs on the Colorado River.

1. <u>Fontenelle Reservoir</u>

Fontenelle Reservoir, located on the Green River above Green River, Wyoming, has a storage capacity of 345,000 acre-feet (426 x $10^6 m^3$) [150,000 acre-feet (185 x $10^6 m^3$) active] and regulates the flow in the Green River above Flaming Gorge Reservoir. It will be used to supply water to the Seedskadee Project including municipal and industrial uses and for wildlife refuge purposes. Flood control and hydroelectric generation are other operating features of the reservoir.

2. Flaming Gorge

This storage unit is located on the Green River in northeastern Utah and southwestern Wyoming. The primary purposes of the Flaming Gorge Unit are river regulation, storage of flood flows of the Green River, and the generation of hydroelectric power. The reservoir has a storage capacity of 3,789,000 acre-feet (4,674 x $10^6 m^3$) [3,516,000 acre-feet (4,337 x $10^6 m^3$) active]. The stored water assists in complying with the terms of the Colorado River Compact and, by exchange, furnishes an irrigation supply for the participating projects in the Upper Basin States. In addition there are benefits from fish and wildlife conservation and recreational facilities. Storage commenced November 1, 1962, and from the records taken immediately below the dam it shows that the reservoir releases are more uniform in quality than uncontrolled streamflow prior to reservoir construction.

3. Curecanti Unit

Facilities of the Curecanti Unit, located in west-central Colorado, include the Blue Mesa, Morrow Point, and Crystal Dams, Reservoirs, and Powerplants. The primary purposes are regulation and storage of flood flows of the Gunnison River and generation of hydroelectric power. In addition benefits are provided to recreation, fish and wildlife conservation, and irrigation. The reservoirs of the Curecanti Unit help regulate the flows of the Colorado River at Lees Ferry. The storage capacity provided is 941,000 acre-feet (1,161 x $10^6 m^3$) [749,000 acre-feet (924 x $10^6 m^3$) active] at Blue Mesa, 117,000 acre-feet (144 x $10^6 m^3$) [42,000 acre-feet (52 x $10^6 m^3$) active] at Morrow Point, and 27,000 acre-feet (33 x $10^6 m^3$) [13,000 acre-feet (16 x $10^6 m^3$) active] at Crystal Reservoir with total reservoir evaporation losses estimated to average 10,000 acre-feet (12 x $10^6 m^3$) annually for all three units. Storage was initiated late in 1965 at the Blue Mesa Reservoir and on January 24, 1968, at the Morrow Point Reservoir. Construction has just been completed on Crystal Dam.

4. Navajo

The Navajo Dam and Reservoir are located on the San Juan River in northwestern New Mexico and southwestern Colorado. Total storage capacity of the reservoir is 1,709,000 acre-feet (2,108 x $10^6 m^3$) [1,036,000 acre-feet (1,278 x $10^6 m^3$) active]. This reservoir regulates the flow of the river for irrigation of the Hammond Project, the Navajo Indian Irrigation Project, and for other uses including by exchange potential uses above the reservoir and transmountain diversions to the San Juan-Chama Project. It also helps regulate the flows of the Colorado River at Lees Ferry. Other purposes include recreation, sediment control, fish and wildlife propagation, and flood control. Storage began July 1, 1962, and the effect on quality is recorded at the Archuleta station below Navajo Dam.

5. Glen Canyon

The Glen Canyon Dam is located on the Colorado River in Arizona, 4 miles (6 km) south of the Utah-Arizona boundary and 16 miles (26 km) upstream from Lees Ferry. The bulk of the reservoir lies in Utah. At a normal water surface elevation of 3,700 feet (1,100 m)m.s.l., Lake Powell extends 186 river miles (200 km) up the Colorado River and 71 miles (114 km) up from the mouth of the San Juan River. River mile 71 (114 km) on the San Juan River is 133 river miles (221 km) from Glen Canyon Dam. This 27,000,000 acre-foot (33,304 x $10^6 m^3$) [20,876,000 acre-feet (25,751 x $10^6 m^3$) active] reservoir regulates the flow of the river for compact delivery purposes and for power generation and thus permits exchanges for upstream consumptive use of the water. Fish and wildlife conservation and recreation are also of major significance. Storage in Lake Powell commenced March 31, 1963.

6. Hoover

Lake Mead is formed behind Hoover Dam and is used for the storage of water for flood control, irrigation, municipal water supplies, and power generation. Lake Mead is the only reservoir on the Colorado River that has a specified space allocated exclusively for mainstream flood control. The present total capacity is about 28,000,000 acre-feet (34,538 x $10^6 m^3$).

7. Davis

Lake Mohave is formed behind Davis Dam, a zoned earthfill type, and is used for power generation, regulation for irrigation demands, and to aid in satisfying the requirements of the Treaty of 1944 with Mexico. It has a capacity of 1,800,000 acre-feet (2,220 x $10^6 m^3$).

8. Parker

Lake Havasu is formed behind the concrete arch Parker Dam and is used for flood control, power generation, regulation for irrigation demands, and as a pool from which water is pumped by the Metropolitan Water District of Southern California (MWD) to the Colorado River Aqueduct. The Central Arizona Project will also pump from this reservoir. It has a capacity of 619,000 acre-feet (764 x $10^6 m^3$).

9. Senator Wash

Senator Wash Dam forms an offstream reservoir and is located 3 miles (5 km) upstream of Imperial Dam. The reservoir is used for pump-back storage, power generation, and regulation for downstream users. This reservoir has resulted in a savings of water with respect to over deliveries to Mexico because of the 3-day travel time for water released from Parker Dam. It has a capacity of 14,000 acre-feet (17 x $10^6 m^3$).

10. Imperial

Imperial Dam, a concrete slab and buttress-type dam constructed in 1938, is used as a diversion structure for water to the Yuma, Arizona area, the Imperial-Coachella Valley in California, and for the delivery of water to Mexico.

PART VII. ANTICIPATED EFFECTS OF ADDITIONAL DEVELOPMENTS

In order to estimate the probable effect of the authorized, partially completed, or contemplated developments on the quality of water at certain points along the Colorado River, the developments have been generally listed in downstream order. By following the flow and salts down the river the estimated effects of the development can be shown at the pertinent stations for the years 1980, 1990, and 2000. These results are tabulated in Table E for the new period of record used in this report. The table was computed on the basis of the 1941-76 average annual flow and total dissolved solids. An additional station, "Colorado River above Parker Dam," was included in the table for purposes of clarification and maintaining continuity in computations. It should be noted that future concentrations were estimated without consideration to possible future control measures. Salinity control measures are discussed separately in Part VIII.

The anticipated future conditions evaluated in Table E would result from the construction of both Federal and non-Federal developments. Pickup of dissolved solids from newly irrigated lands where comprehensive studies have not yet been made has been computed for two assumed conditions, zero and 2 tons per acre (0 and 4.5 t/ha). The future increase in evaporation over average present evaporation, by the Colorado River Storage Reservoirs, was considered negligible and therefore not included in future depletions. Present evaporations are reflected in present modified conditions.

Following is a discussion of the various projects including a brief description of the physical conditions for each development authorized or contemplated for authorization. It should be recognized that the acreages and depletions as listed could change with change of plans on some of the contemplated projects. The figures presented below and in Table D are those which were current at the time of writing this report. In addition to the developments listed, a number of smaller private industrial developments either under construction or contemplated will result in certain depletions and will have some effect on water quality.

The effects of all upstream developments are carried on down to and including Imperial Dam.

A. Description of Projects

1. Above Green River near Green River, Wyoming

Seedskadee Project.--This multipurpose project is located adjacent to the Green River in southwestern Wyoming.

Water uses of the Seedskadee Project are not definite, but it now appears that most of the water will be used for industrial purposes. A total of 281,000 acre-feet ($347 \times 10^6 m^3$) depletion exclusive of Fontenelle evaporation is anticipated. Of this, an estimated 20,000 acre-feet ($25 \times 10^6 m^3$) is planned for wildlife purposes while the remaining 261,000 acre-feet ($322 \times 10^6 m^3$) of depletions was assumed to be for industrial purposes. Irrigation, however, may not yet be completely out of the picture. Industrial users include Pacific Power & Light Co., Sun Oil, and other possible industries. It was assumed the 20,000 acre-feet ($25 \times 10^6 m^3$) of water for refuge purposes would neither pick up nor lose salts, but the remaining water for industrial purposes would deplete the salts as well as the water. The salinity concentration of the water in the future at the Green River, Wyoming, gage would remain almost the same as present because diversions to industries are anticipated to be about the same location as the present gage.

2. Between Green River Green River, Wyoming, and Green River near Greendale, Utah

Lyman Project.--This is a multipurpose project located in southwestern Wyoming. Project facilities consist of two dams and reservoirs. One is located at the Meeks Cabin site on the Blacks Fork in Wyoming and provides 33,000 acre-feet ($41 \times 10^6 m^3$) of storage capacity. The other is being constructed at the Stateline site of the East Fork of Smith Fork in Utah and will provide 14,000 acre-feet ($17 \times 10^6 m^3$) of storage capacity. The project when completed will have the primary purpose of providing supplemental water to 36,000 acres (15,000 ha) of existing farmland along with fish and wildlife and recreation benefits. Construction of Meeks Cabin Dam has been completed. This project will present an opportunity to study the water quality effects of adding supplemental water to lands already irrigated. Of the 10,000 acre-feet ($12 \times 10^6 m^3$) total depletions, only 4,000 acre-feet ($5 \times 10^6 m^3$) remain since 6,000 acre-feet ($7 \times 10^6 m^3$) from Meeks Cabin Reservoir is now depleted.

Utah Power & Light Co.--This steam powerplant is located at Kemmerer, Wyoming, with present depletions of about 8,000 acre-feet ($10 \times 10^6 m^3$). Total present and future depletions of this plant and other industrial developments will amount to about 65,000 acre-feet/year ($80 \times 10^6 m^3$/year). No salt return is anticipated.

3. Above Yampa River near Maybell, Colorado

Hayden and Craig Steam Powerplants.--The addition of new units will require estimated increases of 20,000 acre-feet ($25 \times 10^6 m^3$)) of water by 1980. Present depletions amount to 4,000 acre-feet ($5 \times 10^6 m^3$). It was assumed the plants would return no salt or water.

4. Above Duchesne River near Randlett, Utah

Central Utah Project (Bonneville Unit).--The Bonneville Unit will include a transmountain diversion of water from the headwaters of the Duchesne River in the Uinta Basin portion of the Colorado River Basin to the Bonneville Basin. The project will develop water for irrigation, municipal and industrial use, and power production. It will also provide benefits to recreation, fish and wildlife, flood control, water quality control, and area redevelopment.

The total depletion to the Green River will be 166,000 acre-feet ($205 \times 10^6 m^3$) with about 36,000 acre-feet ($44 \times 10^6 m^3$) being depleted in 1977.

Central Utah Project (Upalco Unit).--The Upalco Unit will be located in Duchesne County near Roosevelt, Utah. The plan of development is primarily to provide supplemental irrigation water to Indian and non-Indian lands along Lake Fork River and to enhance recreation and fish and wildlife, while maintaining flood control. The mean annual stream depletion is estimated to be about 12,000 acre-feet ($15 \times 10^6 m^3$).

Central Utah Project (Uintah Unit).--The Unitah Unit of the Central Utah Project will provide a full supply to irrigate 7,800 acres (3,200 ha) of new lands and supplemental water to other lands on the south slope of the Unita Mountains in the Uinta and Whiterocks Rivers drainage areas. The new annual depletion will be about 28,000 acre-feet ($35 \times 10^6 m^3$).

Deferred Indian Lands.--It is estimated that depletion of 50,000 acre-feet ($62 \times 10^6 m^3$) of water for these lands will begin between year 1980 and year 2000. Approximately 29,100 acres (11,800 ha) of new land including the 7,800 acres (3,200 ha) in the Uintah Unit will receive irrigation. This will result in a net 21,300 acres (8,600 ha) exclusive of the Uintah Unit.

5. Above the White River near Watson, Utah

Oil Shale Prototype Development.--It is estimated that oil shale development would require 78,000 acre-feet ($96 \times 10^6 m^3$) in Colorado and 24,000 acre-feet ($30 \times 10^6 m^3$) in Utah by 1990. It was also estimated that the heavy use of water would not occur until about mid-1980's and by 1990 the total 102,000 acre-feet ($126 \times 10^6 m^3$) would be required.

6. Between Green River near Greendale, Yampa River near Maybell Duchesne River near Randlett, White River near Watson, and Green River at Green River, Utah

Cheyenne-Laramie, Wyoming.--The city of Cheyenne diverts water from the Little Snake River to a tributary of the North Platte in exchange for water diverted from Douglas Creek for municipal use by the city of Cheyenne. This transmountain diversion is now using about 7,000 acre-feet (9 x $10^6 m^3$) and it is estimated that this city and the Laramie area will ultimately deplete the Colorado River by an additional 24,000 acre-feet (30 x $10^6 m^3$) beyond the year 2000.

Central Utah Project (Jensen Unit).--This unit will be located in Uintah County along the Green River east of Vernal. Storage of water in Red Fleet (Tyzack) Reservoir on Brush Creek together with pumping from the Green River will supply 440 acres (180 ha) of new land and 3,640 acres (1,470 ha) of presently irrigated lands. Approximately 15,000 acre-feet (19 x $10^6 m^3$) of water is anticipated to be depleted by this project.

7. Above San Rafael River near Green River, Utah

Utah Power and Light, Huntington, Emery County.--The anticipated future effects on the San Rafael River would be steam-electric plants depleting about 21,000 acre-feet (26 x $10^6 m^3$) of water and replacing an estimated 5,000 acres (2,000 ha) of presently irrigated lands with industries. The salt was assumed to be depleted with the water. The Huntington powerplant started 1 unit in 1975, another in 1977 and 2 other units are planned. The Emery County powerplant is now under construction and the units are scheduled for 1978 and 1980.

8. Above Colorado River near Glenwood Springs, Colorado

Denver, Englewood, Colorado Springs, and Pueblo, Colorado.--Expansion of municipal supplies for these four cities will eventually deplete the Colorado River by 235,000 acre-feet (290 x $10^6 m^3$) above present uses. These are transmountain diversions from the Blue, Fraser, and Eagle Rivers in the headwaters of the Colorado River. The diversions would vary according to runoff each year.

M&I--Green Mountain.--Most of the water stored in Green Mountain Reservoir will probably be released for industrial use in the vicinity of Rifle, in Garfield County, Colorado. This depletion will ultimately be about 45,000 acre-feet (56 x $10^6 m^3$).

Homestake Project, Colorado.--The Homestake Project in Colorado, constructed by the cities of Aurora and Colorado Springs, will ultimately divert an additional average annual amount of 49,000 acre-feet (60 x $10^6 m^3$) to the eastern slope from the headwaters of the Colorado River although the diversions will vary from year to year. Present diversions amount to about 25,000 acre-feet (31 x $10^6 m^3$).

9. Between Colorado River near Glenwood Springs and Colorado River near Cameo, Colorado

Independence Pass.--This water is diverted from the upper Roaring Fork to the east slopes of the Rocky Mountains. The present depletions will ultimately be increased by an additional 7,000 acre-feet ($9 \times 10^6 m^3$).

Fryingpan-Arkansas Project.--This transmountain diversion project delivers water from the headwaters of the Colorado to the Arkansas River. It is a multipurpose development to supply supplemental irrigation water, municipal water, and water for power production. In addition the project will also control floods originating above Pueblo, retain sediment, preserve fish and wildlife, and provide recreation opportunities. Diversions initiated in 1973 increased to about 36,000 acre-feet ($44 \times 10^6 m^3$) in 1976. Additional diversions beyond 1976 of 33,000 acre-feet ($41 \times 10^6 m^3$) are anticipated making a future total of about 69,000 acre-feet ($85 \times 10^6 m^3$). A depletion of about 1,000 acre-feet ($1 \times 10^6 m^3$) by evaporation from Ruedi Reservoir is also occurring.

M&I--Ruedi Reservoir, Colorado.--Approximately 24,000 acre-feet ($30 \times 10^6 m^3$) would be used for oil shale or other industrial development along the Colorado River in Colorado. The water would be stored in Ruedi Reservoir on the Fryingpan River and released through natural channels to the points of use.

West Divide Project, Colorado.--It is presently estimated the West Divide Project will consumptively use about 50,000 acre-feet ($62 \times 10^6 m^3$) of water by 1990 for irrigation and municipal and industrial uses. The irrigation water will ultimately supply about 12,700 acres (5,100 ha) of new land and 17,200 acres (7,000 ha) of land presently irrigated.

Project water will be obtained from a series of Colorado River tributaries south of the river in west-central Colorado. The above uses could be altered in the definite plan report due to changing conditions and plans.

10. Above Gunnison River near Grand Junction, Colorado

Dallas Creek Project, Colorado.--The Dallas Creek Project as now planned will develop water of the Uncompahgre River and tributaries for irrigation and municipal and industrial use. The project will provide supplemental water to lands presently irrigated. Depletion of the Colorado River will amount to about 17,000 acre-feet ($21 \times 10^6 m^3$) annually. Salt loading effects were based on a detailed study especially made for this project.

11. Above the Dolores River near Cisco, Utah

Dolores Project, Colorado.--The Dolores Project will divert water from the Dolores River Basin to the San Juan drainage for the irrigation of new and presently irrigated lands. Some 35,000 acres (14,000 ha) will be new land. This project will divert 105,000 acre-feet (130 x $10^6 m^3$) of water from the Dolores River of which 81,000 acre-feet (100 x $10^6 m^3$) will be depleted and the balance return to the San Juan River. Salt loading was determined by a special study for this project.

Return flows from lands in the Montezuma Valley are presently used for irrigation of land in McElmo Canyon outside the project area. Analyses show these flows have relatively high concentrations of soluble salts but are successfully used for irrigation, because of the internal drainage characteristics of the soils.

San Miguel Project, Colorado.--The San Miguel Project will regulate flows of the San Miguel River for irrigation, municipal and industrial use, recreation, flood control, and fish and wildlife conservation. The project will supply water to 11,500 acres (4,700 ha) of new land and 12,500 acres (5,100 ha) of land now receiving a partial supply. Estimated depletion of Colorado River water will be about 53,000 acre-feet (65 x $10^6 m^3$). Salt loading was determined by a special study.

12. Above San Juan River Near Archuleta, New Mexico

San Juan-Chama Project.--Construction has been completed on this transmountain diversion project. Delivery of water to the Rio Grande Basin was initiated in 1971. Average depletions from 1971 to 1976 has been about 90,000 acre-feet (111 x $10^6 m^3$). The project, will eventually divert an average of 110,000 acre-feet (136 x $10^6 m^3$) annually from the headwaters of the San Juan River across the Continental Divide to the Rio Grande Basin. The effect of this depletion of the Colorado River will be that some dissolved solids will be transported out of the basin and less high quality water will be available downstream for dilution of lower quality water.

The water will be used in New Mexico for municipal and industrial developments and for irrigation.

Navajo Indian Irrigation Project.--Construction activities are continuing on this project with some water having been delivered in 1976 and 1977. Studies completed for the project for the all sprinkler irrigation system by the Southwest Region indicate an Agricultural consumptive use of 226,000 acre-feet (279 x $10^6 m^3$). A department of the Interior Solicitor's opinion indicates probable depletion by the Navajo Indians totaling 254,000 acre-feet (313 x $10^6 m^3$) as originally authorized. It was decided for this analysis to use the 508,000 acre-feet (63 x $10^6 m^3$) diversion and 254,000 acre-feet (313 x $19^6 m^3$) depletion. The water would be diverted above the Archuleta gage with return flow to the San Juan River below the gage. The 110,000 acres (44,500 ha) of new land as authorized is still considered the project area to be irrigated.

Jicarilla Apache.--The water to supply 3,000 acre-feet (4 x $10^6 m^3$) depletion was assumed to be used for municipal and industrial purposes in the Dulce, New Mexico area.

The effect of the San Juan-Chama and Navajo Indian Irrigation Projects and depletions by the Jicarilla Apache Tribe on the quality of water at the Archuleta station would be small since the water is presently of very good quality and the station is located only a short distance below the Navajo Dam where there would be no return flows.

13. Between San Juan River near Archuleta, New Mexico, and San Juan River near Bluff, Utah

Farmington Municipal and Industrial.--This future depletion to Farmington, New Mexico is for 5,000 acre-feet (6 x $10^6 m^3$) out of the San Juan River. It was estimated that this would begin by year 1990.

Animas-La Plata Project, Colorado-New Mexico.--The Animas-La Plata Project will develop flows of the Animas and La Plata River systems for irrigation, municipal and industrial use, recreation, and fish and wildlife conservation. The project will supply water to about 49,000 acres (20,000 ha) of new land and 21,500 acres (8,100 ha) of presently irrigated land. The new lands will include some Indian lands. The total new depletion will amount to 154,000 acre-feet (190 x $10^6 m^3$). Project features include four storage dams, lengthy canals, and several diversion dams. Salt loading was determined by a special study.

Expansion Hogback.--This direct diversion to Indian land adjacent to the San Juan River will result in a new depletion of about 8,000 acre-feet (10 x $10^6 m^3$) over present depletions. These lands, in the vicinity of Shiprock, New Mexico, have been developed in small blocks by the Bureau of Indian Affairs over a period of years with further expansion planned for the future. The return flows directly seeps into the San Juan River, but the quality of these flows has not been determined.

Four Corners Powerplant.--In northwestern New Mexico, a large steam electric powerplant, by Utah International Inc., is now using about 20,000 acre-feet (25 x $10^6 m^3$) of water. A total of 39,000 acre-feet (48 x $10^6 m^3$) use is expected under future expansion. This will supply water for full operation of the 5 units located at the Four Corners totaling 2,154 MW. The water and salts used in future expansion of the plant will not be returned to the river.

Navajo M&I Contracts.--Several energy related industries and possibly municipalities near the Four Corners area of New Mexico have either purchased or are considering the purchase of Navajo Reservoir water on a temporary basis. Under present authorities, the annual delivery of water under these contracts may not exceed 100,000 acre-feet

($123 \times 10^6 m^3$). The contracts are scheduled to be terminated in year 2005 and the water returned to the river system. These users include the San Juan Powerplant, Utah International Inc., (coal gasification), El Paso (coal gasification), and others including possibly the city of Gallup.

Gallup Municipal.--In addition to possible water obtained on a temporary basis as a part of the 100,000 acre-feet ($123 \times 10^6 m^3$) Navajo M&I contracts, 2,000 acre-feet ($2 \times 10^6 m^3$) of water was assumed to be available on a permanent basis.

Return Flow Dolores and Navajo Indian Irrigation Project.--The return flows from the Dolores Project and the Navajo Indian Irrigation Project were identified because they do not return back to the system above the "Dolores River near Cisco," "Colorado River near Cisco," and "San Juan River near Archuleta" gages, respectively. They do return above the "San Juan River near Bluff" gage and must be accounted for at this gage. The additional salts brought in with these return flows would be those picked up from the new lands that are irrigated plus the salts originally in the water diverted.

14. Between Green River at Green River, Utah, San Rafael River near Green River, Utah, Colorado River near Cisco, Utah, San Juan River near Bluff, Utah, and Colorado River at Lees Ferry, Arizona

Resources Incorporated, Utah.--Resources Incorporated, proposed to construct a large powerplant in Utah near Lake Powell using coal from the Kaiparowits Plateau for fuel and water from Lake Powell for plant operation. This plan was discontinued, however. The expected annual depletion to the Colorado River would now be 30,000 acre-feet ($37 \times 10^6 m^3$), based on the company's application to the State of Utah for that much water. Designated uses were domestic, mining, coal gassification and possibly slurry uses. The exact date of this depletion is not known at present but it was assumed to occur sometime between 1980 and 1990. It is expected that the salt will be depleted with the water. After 1990 additional water depletions will cease but due to an increase in concentration, additional salt will be depleted.

Navajo Powerplant.--About 34,000 acre-feet ($42 \times 10^6 m^3$) will be used in that portion of Arizona within the Upper Basin by 1980 and would be diverted above Lees Ferry with most of it being used by the Navajo Powerplant at Lake Powell. It is expected that the salt will be depleted with the water. No additional water depletions are expected beyond 1980 but due to increased concentrations, additional salts will be depleted.

Other M&I in Arizona.--Of the Upper Colorado River Compact's allocated 50,000 acre-feet ($62 \times 10^6 m^3$) to Arizona from the Upper Colorado

River system, about 13,000 acre-feet (16 x $10^6 m^3$) is presently being used. Besides the 34,000 acre-feet (42 x $10^6 m^3$) to the Navajo Powerplant, other M&I uses are expected to consume the remainder of the 50,000 acre-feet (62 x $10^6 m^3$) allocation.

15. Above the Virgin River at Littlefield, Arizona

Dixie Project, Utah.--The authorized Dixie Project was under contract negotiations between the Washington County Water Conservancy District and the Bureau of Reclamation during 1973. At a meeting on February 8, 1973, it was announced by the District that they desired to cease negotiations and not continue with the project.

Warner Valley, Utah.--The Washington County Water Conservancy District and the City of St. George have since engaged in studies to construct a smaller dam and reservoir at Warner Valley, a former Dixie Project damsite. There are plans for the construction of a reservoir with a capacity of 55,000 acre-feet (68 x $10^6 m^3$) for the storage of 10,000 acre-feet (12 x $10^6 m^3$) of water to be used for cooling purposes for a 500 megawatt coal fired powerplant and 26,000 acre-feet (32 x $10^6 m^3$) for future municipal and industrial demand and supplemental irrigation water. Nevada Power would utilize 375 megawatts and the City of St. George would utilize 125 megawatts at some time in the future. The powerplants would receive coal by slurry pipeline from Alton, Utah, and would burn approximately 6,000 tons (5,400 t) of coal a day. The project which was scheduled for completion by 1979 but has been delayed because of environmental issues. The construction of the project has been delayed indefinately but, it has been assumed to be on line in 1990.

16. Between the Colorado River at Lees Ferry, Arizona, Virgin River at Littlefield, Arizona, and Colorado River below Hoover Dam, Arizona-Nevada

Southern Nevada Water Project, Nevada.--The first stage of the Southern Nevada Water Project was completed by the Bureau of Reclamation and was accepted by the Colorado River Commission on November 1, 1971. The project is operated by the Las Vegas Valley Water District to provide supplemental municipal and industrial water to the cities of Las Vegas, North Las Vegas, Henderson, and Boulder City, and to Nellis Air Force Base. It will also provide water to the potential Eldorado Valley development. The second stage is under construction and is expected to be completed in 1982.

The total annual diversion for the Southern Nevada Project and the other existing systems in Southern Nevada are shown in the following tabulation with the water allocated by water rights to the various users through the pipelines in the vicinity of Lake Mead.

	Maximum Diversion Acre-feet	Million m^3	Net Depletion Acre-feet	Million m^3
Southern Nevada Water Project	299,000	369	209,300	258
BMI Pipeline	41,277	51	41,277	51
Boulder City Pipeline	5,890	7	5,890	7
National Park Service Pipelines	2,000	2	2,000	2
Total	348,167	429	258,467	318

Prior to 1975, no creditable return flow from these diversions has been listed in the "Compilation of Records in Accordance with Article V of the Decree of the Supreme Court of the United States in the Arizona v. California." Starting in calendar year 1975 a method for determination of a credit for surface return flows was made to Nevada for Colorado River diversions into Las Vegas Valley. The resulting values for 1975 and 1976 were as follows:

	1975 Acre-feet	Million m^3	1976 Acre-feet	Million m^3
Total Colorado River Diversions to Las Vegas 1/	81,744	101	84,630	104
Surface Return Flow	29,150	36	31,357	38
Consumptive Use	52,594	65	53,273	66
Southern Nevada Water Project Pumpage	64,970	80	72,602	90

1/ Includes Southern Nevada and BMI pipelines.

Assuming that depletions equal 0.7 of the pumpage from the pipeline, the expected depletions for the Southern Nevada Water Project would be an additional depletion of 29,400 acre-feet (36 x $10^6 m^3$) by 1980. The projected depletion for the 1980-1990 time period would be an additional 43,100 acre-feet (43 x $10^6 m^3$). The projected annual depletion for the period 1990-2000 would be 33,200 acre-feet (41 x $10^6 m^3$) for a total of 159,000 acre-feet (196 x $10^6 m^3$) by the year 2000. The above depletions are based on the assumption that the Southern Nevada Water Project will pump from Lake Mead 118,100 acre-feet (146 x $10^6 m^3$) in 1980, 179,700 acre-feet (222 x $10^6 m^3$) in 1990, and 227,200 acre-feet (280 x $10^6 m^3$) in the year 2000. The 299,000 acre-feet (369 x $10^6 m^3$) of pumpage is projected to occur in 2019 according to the Nevada Division of Colorado River Resources.

It has been determined that the return flows from the Southern Nevada Water Project carry as much salt as pumped from the river. In addition, the hydrologic system would contribute an added load of 0.2 ton per acre-foot (143 mg/l) of depletion under zero pickup and 0.4 ton per acre-foot (216 mg/l) of depletion for the 2 ton per acre (4.5 t/ha) pickup condition.

Other Nevada Projects.--The Southern Nevada Water Project and other systems estimated net annual depletion would be 258,000 acre-feet (318 x $10^6 m^3$) of the 300,000 acre-feet (370 x $10^6 m^3$) depletion allotted to Nevada from the Colorado River. Of the 41,500 acre-feet (51 x $10^6 m^3$) of uncommitted allotment, it is expected that 7,000 acre-feet (9 x $10^6 m^3$) will be used by the Fort Mohave Indian Reservation while the remaining 34,500 acre-feet (43 x $10^6 m^3$) has not be allocated. It was projected for this report that this water would probably be utilized at the rate of 5,000 acre-feet (6 x $10^6 m^3$) by 1980, an additional 5,000 acre-feet (6 x $10^6 m^3$) by 1990, and additional 5,000 acre-feet (6 x $10^6 m^3$) by the year 2000 and the remaining 19,500 acre-feet (24 x $10^6 m^3$) after the year 2000. These other projects could include such items as fish and wildlife uses, irrigation projects, additional energy requirements and municipal and industrial projects.

17. Between Colorado River below Hoover Dam, Arizona-Nevada, and Colorado River at Imperial Dam, Arizona-California

Mohave Steamplant.--A portion of the Southern Nevada Water Project allotment has been obtained via contractual arrangements by the Southern California Edison Company for diverting up to 23,000 acre-feet (28 x $10^6 m^3$) annually from the Colorado River for thermal power production purposes at a site about 3 miles (5 km) downstream from Davis Dam. Use of this water until July 1, 2006, by the Southern California Edison Company is in accordance with two contracts--one with the State of Nevada and the Southern California Edison Company and one with the Bureau of Reclamation and the State of Nevada. The depletions for the Mohave Steamplant in 1976 were 14,700 acre-feet (18 x $10^6 m^3$). The anticipated total depletion for the years 1980, 1990, and 2000 would be 20,000, 23,000, and 23,000 acre-feet (25 x $10^6 m^3$, 28 x $10^6 m^3$, and 28 x $10^6 m^3$), respectively. No diversion is anticipated after 2006. The diversion is not shown under the Southern Nevada Water Project since the point of diversion is below Hoover Dam.

Fort Mohave Indian Reservation.--The Fort Mohave Indian Reservation, located below Davis Dam, is allocated water by the Supreme Court Decree to irrigate 18,974 acres (7,689 ha) of land--14,916 acres (6,037 ha) in Arizona, 2,119 acres (858 ha) in California, and 1,939 acres (785 ha) in Nevada with a maximum annual diversion from the Colorado River of 122,648 acre-feet (151 x $10^6 m^3$). The consumptive use required for irrigation of these lands is estimated to be 4 acre-feet per acre (12,000 m^3/ha) which would result in main-stream depletion of about 75,900 acre-feet (94 x $10^6 m^3$) annually. None of the reservation lands were developed as of 1974. In 1976 5,700 acres (2,300 ha) of reservation lands in Arizona and California had been developed according to the Bureau of Indian Affairs. The following table shows the depletion credited to the reservation from 1974 to 1976 and the dramatic development of use of their water rights. The development of land is not expected to continue at the current rate.

Year	Diversion[1/] Acre-feet	Million m^3
1974	0	0
1975	3,300	4
1976	20,801	26

1/ No surface return flows.

An estimated 2,540 acres (1,030 ha) of land was developed from 1976 to 1977. An arbitrary uniform land development rate of 2,000 acres (810 ha) per year was assumed for the rest of Fort Mohave Indian Reservation. By 1980 there would be a total additional development of 8,540 acres (3,460 ha) for an additional depletion of 34,160 acre-feet (42 x $10^6 m^3$) above the depletion in 1976. From 1980 to 1990 the remaining 4,734 acres (1,916 ha) of land on the reservation would be developed for a total additional depletion of 18,936 acre-feet (23 x $10^6 m^3$).

The consumptive use of 4 acre-feet per acre (12,000 m^3/ha) for irrigation of the Fort Mohave, Chemehuevi, and Colorado River Indian lands is based on the rate presented in Colorado River Basin Project hearings before the Subcommittee on Irrigation and Reclamation of the Committee on Interior and Insular Affairs, House of Representatives. This value is under study and may be subject to change in future reports.

Chemehuevi Indian Reservation.--The Chemehuevi Indian Reservation, located above Parker Dam, is allocated water by the Supreme Court Decree to irrigate 1,900 acres (770 ha) of land in California with a maximum annual diversion from the main-stream of the Colorado River of 11,340 acre-feet (14 x $10^6 m^3$). The consumptive use required for irrigation of these lands is estimated to be 4 acre-feet per acre (12,000 m^3/ha), which would result in a main-stream depletion of about 7,000 acre-feet (8 x $10^6 m^3$) annually. The lands that are irrigable are above the river and not feasible for farming at this time. It is anticipated that the reservation will develop 7,000 acre-feet (8 x $10^6 m^3$) of consumptive use for municipal and industrial, and/or irrigation purposes by the year 2000.

Central Arizona Project.--The Colorado River Basin Project Act authorizes the Central Arizona Project for the purposes of furnishing irrigation and municipal water supplies to the water-deficient areas of Arizona and western New Mexico through direct diversion or exchange of water. This project is now under construction with water deliveries expected in 1985 to Phoenix, and 1987 for deliveries to Tucson. this project will provide water to Indian lands and a supplemental water supply to lands now being irrigated. Water made available to non-Indian lands can be used only on lands having a recent irrigation history. The Central Arizona Project must stand shortages up to its full allocation if there is insufficient main-stream water to satisfy an annual consumptive use of 7,500,000 acre-feet (9,251 x $10^6 m^3$) allocated under the Supreme Court Decree of march 1964 to the States of Nevada, Arizona, and California. When shortages occur, diversions to the Central Arizona Project will be limited to assure California water users 4,400,000 acre-feet (5,427 x $10^6 m^3$) of main-stream water. A maximum of 2,172,000 acre-feet (2,679 x $10^6 m^3$) of Colorado River water is all that could be diverted with a canal capacity of 3,000 ft^3/s (85 m^3/s).

Contracts--Boulder Canyon Project.--Separate contracts have been signed with the City of Kingman, Arizona, the Lake Havasu Irrigation and Drainage District, and the Mohave Valley Irrigation and Drainage District for diversion, respectively, of 18,500 acre-feet, 14,500 acre-feet, and 51,000 acre-feet (23 x $10^6 m^3$, 18 x $10^6 m^3$, and 63 x $10^6 m^3$) annually. As a result of terms im Mohave Valley Irrigation and Drainage District's contract, they will lose 10,000 acre-feet (12 x $10^6 m^3$) of their diversion. The 10,000 acre-feet (12 x $10^6 m^3$) will be used for municipal and industrial and irrigation purposes on lands not part of Mohave Valley Irrigation and Drainage District.

At the present time the City of Kingman does not divert Colorado River water nor are there plans to divert Colorado River water in the near future. It has been anticipated that there will be no use of their contract water until 1990. From 1990 to 2000 it was assumed they will develop 9,250 acre-feet (11,000 x $10^6 m^3$) of their contract water.

The Lake Havasu Irrigation and Drainage District used 7,327 acre-feet (9 x$10^6 m^3$) of water in 1976 according to the Arizona v. California Decree accounting of the waters of the Colorado River. It is anticipated that 14,500 acre-feet (18 x $10^6 m^3$) of water use will be developed by the District by 1990 which will mean an additional depletion of 2000 acre-feet (2 x $10^6 m^3$) by 1980 and 5,100 acre-feet (6 x $10^6 m^3$) by 1990.

In 1976 the decree accounting shows that Mohave Valley Irrigation and Drainage District used 14,598 acre-feet (18 x $10^6 m^3$). The 1976 decree accounting, however, does not show the total use of water within the District. The 1977 decree accounting of approximately 24,900 acre-feet (31 x $10^6 m^3$)for the District reflects the total use of water while there was little change in irrigated acreage from 1976. It is anticipated that half of the remaining 16,100 acre-feet (20 x $10^6 m^3$) or 8,505 acre-feet (70 x $10^6 m^3$) of use will be developed by 1990 and an additional 5,800 acre-feet (7 x $10^6 m^3$) of use will be developed by the year 2000. Of the 10,000 acre-feet (12 x $10^6 m^3$)of water formerly under contract to the District, it is anticipated there will be a use of 2,200 (3 x $10^6 m^3$) by 1980 with full development of the use of the 10,000 acre-feet (12 x $10^6 m^3$) by 2020. The 10,000 acre-feet (12 x $10^6 m^3$) is shown under New Districts in the table.

Colorado River Indian Reservation.--The Colorado River Indian Reservation is located along the Colorado River just below Parker Dam, Arizona, with most of the land in Arizona and the remainder in California. The Supreme Court Decree allocated 717,148 acre-feet (885 x $10^6 m^3$) of diversions to the Colorado River Indian Reservation for irrigation of 197,588 acres (79,964 ha) of land. There are 99,375 acres (40,217 ha) of land in Arizona, of which 72,377 acres (29,291 ha) have been developed and 8,213 acres (3,324 ha) of land in California to be developed. The consumptive use require for irrigation of these lands is estimated to be 4 acre-feet per acre (12,000 m^3/ha) which would result in an annual main-stream depletion of 430,352 acre-feet (531 x $10^6 m^3$). The estimated consumptive use in 1976 from irrigation of 72,377 acres (29,291 ha) is 289,500 acre-feet (357 x $10^6 m^3$). This leaves an additional depletion of about 141,000 acre-feet (174 x $10^6 m^3$) per year for future development of irrigated lands.

The Bureau of Indian Affairs has reported a general 2,000 acres (800 ha) per year land development rate on the reservation in the past. The land development rate of 2,000 acres (800 ha) per year was assumed for the future even though the Bureau of Indian Affairs feels the land development rate may slow down in the near future. Therefore, by 1980, there will be an additional 8,000 acres (3,200 ha) and 32,000 acre-feet (39 x $10^6 m^3$) of use, by 1990, 20,000 acres (80,000 ha) and 80,000 acre-feet (99 x $10^6 m^3$) of use and by 2000, 7,211 acres (2,918 ha) and 28,844 acre-feet (36 x $10^6 m^3$) of additional use.

Lower Colorado River Channelization Project, Arizona-California.--Between Davis Dam and Parker Dam channelization work in the Mohave Valley Diversion was begun in 1949 and completed in 1960 to salvage 65,000 acre-feet (80 x $10^6 m^3$) of water per year.

Below Parker Dam 24,200 acre-feet (30 x $10^6 m^3$) of water salvage by channelization was planned for the two sections of the Parker Division Work. This was started in 1966 and section one of the division was completed in 1967. It has been estimated that half of the salvage work associated with the division has been completed. Work began in 1962 and was completed in 1966 to salvage 10,000 acre-feet (12 x $10^6 m^3$) in the Palo Verde Division. In 1964 work to salvage 36,000 acre-feet (44 x $10^6 m^3$) began in the Cibola Division and was complete in 1970.

No future salvage of water has been anticipated. Salvage of water by vegetation of phreatophyte areas with vegetation which uses less water and is environmentally more beneficial is being considered.

18. Augmentation

Public Law 90-537 (dated September 30, 1968) states that augmentation of the Colorado River will be a national obligation to order to supply the Mexican Treaty requirements. Although temporary periods of subnormal water supply can be satisfied from storage releases, permanent deficiencies caused by full utilization of the waters allocated to the States would require augmentation.

Table D
Projects Depleting Colorado River Water
Incremental Change in Flow and Salt Load 1976 to 2000

	Increase 1976 to 1980				Increase 1980 to 1990				Increase 1990 to 2000			
	Depletion (1,000 ac.-ft.)	T.D.S. load (1000 tons) OT/A	2T/A	New irrigation lands (acres)	Depletion (1,000 ac.-ft.)	T.D.S. load (1,000 tons) OT/A	2T/A	New irrigation lands (acres)	Depletion (1,000 ac.-ft.)	T.D.S. load (1,000 tons) OT/A	2T/A	New irrigation lands (acres)
Above the gage Green River near Green River, Wyoming												
Seedskadee, Wyoming including Jim Bridger powerplant and others	30	-11	-11	1/	95	-37	-37	1/	55	-24	-24	1/
Between the above gage and the gage Green River near Greendale, Utah												
Lyman, Wyoming	4	0	0	2/	0	0	0	0	0	0	0	0
Utah Power and Light and others, Wyoming	0	0	0	0	50	-22	-22	1/	7	- 3	- 3	1/
Above the gage Yampa River near Maybell, Colorado												
Hayden, Craig powerplants, Colorado	20	- 4	- 4	1/	0	0	0	0	0	0	0	0
Above the gage Duchesne River near Randlett, Utah												
Central Utah Project, Utah												
Bonneville Unit	39	- 7	- 7	3/	91	-15	-15	3/	0	0	0	0
Upalco Unit	0	0	0	0	12	0	0	2/	0	0	0	0
Uintah Unit	0	0	0	0	28	0	16	7,800	0	0	0	0
Deferred Indian Lands, Utah	0	0	0	0	40	0	34	17,000	10	0	9	4,300
Above the gage White River near Watson, Utah												
Oil shale prototype development, Colorado, Utah	0	0	0	0	102	-55	-55	1/	0	0	0	0
Between the gages Green River near Greendale, Utah: Yampa River near Maybell, Colorado; Duchesne River near Randlett, Utah; White River near Watson, Utah; and Green River at Green River, Utah												
Cheyenne-Laramie, Wyoming	3	0	0	3/	6	- 1	- 1	3/	4	- 1	- 1	3/
Central Utah Project, Utah												
Jensen Unit	4	0	1	440	11	0	0	1/	0	0	0	0
Above the gage San Rafael near Green River, Utah												
Utah Power and Light-Huntington, Emery Co., Utah	9	- 7	- 7	1/	9	- 9	- 9	1/	0	0	0	0
Above the gage Colorado River near Glenwood Springs, Colorado												
Denver, Englewood, Colorado Springs, Pueblo; Colorado	56	- 6	- 6	3/	53	- 6	- 6	3/	60	- 6	- 6	3/
Green Mountain M & I, Colorado	0	0	0	0	45	-26	-26	1/	0	0	0	0
Homestake, Colorado	10	- 1	- 1	3/	39	- 2	- 2	3/	0	0	0	0
Between the above gage and gage Colorado River near Cameo, Colorado												
Independence Pass, Colorado	7	0	0	3/	0	0	0	0	0	0	0	0
FryingPan-Arkansas, Colorado	33	- 2	- 2	3/	0	0	0	0	0	0	0	0
Ruedi M & I, Colorado	0	0	0	0	0	0	0	0	24	-15	-15	1/
West Divide, Colorado	0	0	0	0	50	0	25	12,700	0	0	0	0
Above the gage Gunnison River near Grand Junction, Colorado												
Dallas Creek, Colorado	0	0	0	0	13	8	8	2/ 4/	4	2	2	2/ 4/
Above the gage Dolores River near Cisco, Utah												
Dolores, Colorado	0	0	0	0	5/ 102	-17	-17	4/ 34,000	3	- 1	- 1	4/ 1,360
San Miguel, Colorado	0	0	0	0	53	0	7	4/ 11,500	0	0	0	0
Between the gages Colorado River near Cameo, Colorado; Gunnison River near Grand Junction, Colorado; Dolores River near Cisco, Utah and the gage Colorado River near Cisco, Utah	0	0	0	0	0	0	0	0	0	0	0	0
Above the gage San Juan River near Archuleta, New Mexico												
San Juan-Chama, New Mexico	20	- 3	- 3	3/	0	0	0	0	0	0	0	0
Navajo Indian Irrigation, New Mexico	136	-33	-33	29,000	330	-79	-79	72,000	0	0	0	0
Jicarilla Apache	0	0	0	0	3	0	0	1/	0	0	0	0
Between the above gages and the gage San Juan River near Bluff, Utah												
Farmington M & I	0	0	0	0	5	0	0	1/	0	0	0	0
Animas-LaPlata, Colorado, New Mexico	0	0	0	0	147	0	- 6	4/ 49,000	7	0	0	0
Expansion Hogback, New Mexico	3	0	3	1,500	5	0	2	2,500	0	0	0	0
Four Corners Powerplant, New Mexico	5	- 3	- 3	1/	14	-10	-10	1/	0	0	0	1/
Navajo M & I contracts	6	- 3	- 3	1/	89	-55	-55	1/	0	0	0	0
Gallup Municipal	0	0	0	0	2	- 1	- 1	1/	0	0	0	0
Return flow--Dolores and Navajo Indian Irrigation, Colorado-New Mexico	-68	0	92	5/ 6/	-188	138	248	5/ 6/	- 1	1	1	5/ 6/
Between the gages Green River at Green River, Utah; San Rafael River near Green River, Utah; Colorado River near Cisco, Utah; and San Juan River near Bluff, Utah; and the gage Colorado River at Lee's Ferry, Arizona												
Resources, Utah	0	0	0	0	30	-28	-28	1/	0	- 2	- 2	1/ 7/
Navajo Powerplant, Arizona	22	-19	-19	1/	0	- 3	- 3	1/ 7/	0	- 3	- 3	1/ 7/
Other M & I, Arizona	3	0	0	1/	0	0	0	0	0	0	0	0
Subtotal Upper Basin	342	- 99	- 3	30,940	1,236	-220	-32	206,500	173	-52	-43	5,660

1/ In basin depletion for municipal and industrial use
2/ Supplemental Irrigation only
3/ Trans-Colorado River Basin diversion
4/ Salt pickup determined by special study
5/ In-basin transfer from Dolores River drainage to the San Juan River drainage--estimated 24,000 acre-foot return flow to the San Juan River
6/ Diversion at Navajo Reservoir, estimated 254,000 acre-foot return flow to the San Juan River below the gage near Archuleta, New Mexico
7/ Additional salt removed because of future increased concentration with no increase in water depletion.

Table D Continued
Projects Depleting Colorado River Water
Incremental Change in Flow and Salt Load 1976 to 2000

	Increase 1976 to 1980				Increase 1980 to 1990				Increase 1990 to 2000			
	Depletion 1,000 AF	T.D.S. increase (1,000 tons)		New irrigation lands-acres	Depletion 1,000 AF	T.D.S. increase (1,000 tons)		New irrigation lands-acres	Depletion 1,000 AF	T.D.S. increase (1,000 tons)		New irrigation lands-acres
		OT/A	2T/A			OT/A	2T/A			OT/A	2T/A	
Between the gage Colorado River at Lee's Ferry and the gage Colorado River near Grand Canyon, Arizona	0	0	0	0	0	0	0	0	0	0	0	0
Above the gage Virgin River at Littlefield, Arizona												
Warner Valley	0	0	0	0	0	0	0	0	36	-7	-7	9/
Between the gages Colorado River near Grand Canyon, Arizona, and Virgin River at Littlefield, Arizona, and the gage Colorado River below Hoover Dam, Arizona-Nevada												
Southern Nevada Water Project, Nevada	29	6	12	0	43	9	17	0	33	7	13	0
Other Nevada Projects	5	1	2	9/	5	1	2	9/	5	1	2	9/
Between the above gage and the gage Colorado River below Parker Dam, Arizona-California												
Mojave Steam Plant, Nevada	5	-5	-5	0	3	-3	-3	0	0	0	0	0
Fort Mojave Indians, Arizona, California, and Nevada	34	0	17	8,540	19	0	9	4,734	0	0	0	0
Chemehuevi Indians, California	0	0	0	0	4	0	0	9/	3	0	0	9/
Kingman, Arizona	0	0	0	0	0	0	0	0	9	-9	-9	0
Mojave Valley I&D District, Arizona	2	0	0	9/	6	0	0	9/	6	0	0	9/
New District, Arizona	2	0	0	9/	2	0	0	9/	2	0	0	9/
Lake Havasu I&D District, Arizona	2	0	0	9/	5	0	0	9/	0	0	0	0
Central Arizona, Arizona 8/												
California diversions limited to 4.4 million acre-feet 8/												
Between the above gage and the gage Colorado River at Imperial Dam, **Arizona-California**												
Colorado River Indian Reservation, Arizona-California	32	0	16	8,000	80	0	40	20,000	29	0	14	7,211
Subtotal Lower Basin	111	2	42	16,540	167	7	65	24,734	123	-8	13	7,211
Total Colorado River	453	- 97	39	47,480	1,403	-213	33	231,234	296	-60	-30	12,871

8/ The Central Arizona Project diversions will vary depending on the depletions by other projects on the river and depending on the total amount of water available from the system in a given year. Maximum annual diversions to Central Arizona could be 2,172,000 acre-feet. With the full depletions by the projects tabulated, the consumptive use to California would be reduced to an annual 4,400,000 acre-feet. This reduction would assure a full supply to the tabulated projects in Arizona in addition to supplying water for the Central Arizona Project. (Bureau of Reclamation water supply studies, based upon the 1906-77 runoff period in the Colorado River Basin, result in average diversions for the Central Arizona Project of 1,687,000 acre-feet and 1,086,000 acre-feet in the year 1990 and the year 2000 respectively.)

9/ In-basin depletion without new irrigated lands.

Table E
Summary of Historical, Present Modified and Estimated Future Water Conditions at Twenty-One Stations
Colorado River Basin[1/] [2/]

(Units: 1,000 except concentrations)

1	Historical condition Flow (AF) 2	Historical condition T.D.S. (T) 3	Historical condition Concentration (T/AF) 4	Historical condition Concentration (mg/l) 5	Present modified condition 1976 Flow (AF) 6	Present modified condition 1976 T.D.S. (T) 7	Present modified condition 1976 Concentration (T/AF) 8	Present modified condition 1976 Concentration (mg/l) 9
Green River near Green River, Wyoming	1,319	556	0.42	310	1,284	564	0.44	323
Green River near Greendale, Utah	1,593	937	0.59	433	1,603	932	0.58	428
Yampa River near Maybell, Colorado	1,069	229	0.21	158	1,066	229	0.21	158
Duchesne River near Randlett, Utah	432	398	0.92	677	382	392	1.03	755
White River near Watson, Utah	489	296	0.61	445	489	296	0.61	445
Green River at Green River, Utah	4,205	2,611	0.62	457	4,139	2,612	0.63	464
San Rafael River near Green River, Utah	89	207	2.33	1,709	74	207	2.80	2,057
Colorado River near Glenwood Springs, Colorado	1,627	592	0.36	268	1,464	594	0.41	298
Colorado River near Cameo, Colorado	2,788	1,529	0.55	403	2,557	1,521	0.59	434
Gunnison River near Grand Junction, Colorado	1,720	1,452	0.84	621	1,701	1,471	0.86	636
Dolores River near Cisco, Utah	594	478	0.80	591	594	478	0.80	591
Colorado River near Cisco, Utah	4,925	4,080	0.83	609	4,622	4,114	0.89	654
San Juan River near Archuleta, New Mexico	902	199	0.22	162	803	190	0.24	174
San Juan River near Bluff, Utah	1,606	978	0.61	448	1,486	1,010	0.68	500
Colorado River at Lees Ferry, Arizona	**10,281**	**7,805**	**0.76**	**558**	**10,243**	**8,380**	**0.82**	**602**
Colorado River near Grand Canyon, Arizona	10,592	8,866	0.84	615	10,554	9,441	0.89	658
Virgin River at Littlefield, Arizona	153	345	2.25	1,658	153	345	2.25	1,658
Colorado River below Hoover Dam, Ariz.-Nev.	10,128	9,537	0.94	692	10,081	10,120	1.00	738
Colorado River above Parker Dam, Ariz.-Calif.	9,746	9,231	0.95	696	9,742	9,803	1.01	740
Colorado River below Parker Dam, Ariz.-Calif.	9,108	8,627	0.95	696	8,955	9,011	1.01	740
Colorado River at Imperial Dam, Ariz.-Calif.	8,401	8,773	1.04	768	8,053	9,187	1.14	839

1	1980 condition, Zero pickup: Flow (AF) 10	Zero pickup: T.D.S. (T) 11	Zero pickup: Concentration (T/AF) 12	Zero pickup: Concentration (mg/l) 13	T.D.S. pickup at 2T/A: T.D.S. (T) 14	T.D.S. pickup at 2T/A: Concentration (T/AF) 15	T.D.S. pickup at 2T/A: Concentration (mg/l) 16
Green River near Green River, Wyoming	1,254	553	0.44	324	553	0.44	324
Green River near Greendale, Utah	1,569	921	0.59	432	921	0.59	432
Yampa River near Maybell, Colorado	1,046	225	0.21	158	225	0.21	158
Duchesne River near Randlett, Utah	343	385	1.12	825	385	1.12	825
White River near Watson, Utah	489	296	0.61	445	296	0.61	445
Green River at Green River, Utah	4,039	2,590	0.64	472	2,591	0.64	472
San Rafael River near Green River, Utah	65	200	3.08	2,263	200	3.08	2,263
Colorado River near Glenwood Springs, Colorado	1,398	587	0.42	309	587	0.42	309
Colorado River near Cameo, Colorado	2,451	1,512	0.62	454	1,512	0.62	454
Gunnison River near Grand Junction, Colorado	1,701	1,471	0.86	636	1,471	0.86	636
Dolores River near Cisco, Utah	594	478	0.80	591	478	0.80	591
Colorado River near Cisco, Utah	4,516	4,105	0.91	668	4,105	0.91	668
San Juan River near Archuleta, New Mexico	647	154	0.24	175	154	0.24	175
San Juan River near Bluff, Utah	1,384	968	0.70	514	1,063	0.77	565
Colorado River at Lees Ferry, Arizona	**9,901**	**8,281**	**0.84**	**615**	**8,377**	**0.85**	**622**
Colorado River near Grand Canyon, Arizona	10,212	9,342	0.91	673	9,438	0.92	680
Virgin River at Littlefield, Arizona	153	345	2.25	1,658	345	2.25	1,658
Colorado River below Hoover Dam, Ariz.-Nev.	9,705	10,028	1.03	760	10,131	1.04	768
Colorado River above Parker Dam, Ariz.-Calif.	9,321	9,706	1.04	766	9,826	1.05	775
Colorado River below Parker Dam, Ariz.-Calif.	8,534	8,886	1.04	766	8,996	1.05	775
Colorado River at Imperial Dam, Ariz.-Calif.	7,600	9,062	1.19	877	9,188	1.21	889

1	1990 condition, Zero pickup: Flow (AF) 17	Zero pickup: T.D.S. (T) 18	Zero pickup: Concentration (T/AF) 19	Zero pickup: Concentration (mg/l) 20	T.D.S. pickup at 2T/A: T.D.S. (T) 21	T.D.S. pickup at 2T/A: Concentration (T/AF) 22	T.D.S. pickup at 2T/A: Concentration (mg/l) 23
Green River near Green River, Wyoming	1,159	516	0.45	327	516	0.45	327
Green River near Greendale, Utah	1,424	862	0.61	445	862	0.61	445
Yampa River near Maybell, Colorado	1,046	225	0.21	158	225	0.21	158
Duchesne River near Randlett, Utah	172	370	2.15	1,582	420	2.44	1,795
White River near Watson, Utah	387	241	0.62	458	241	0.62	458
Green River at Green River, Utah	3,604	2,460	0.68	502	2,511	0.70	512
San Rafael River near Green River, Utah	56	191	3.41	2,508	191	3.41	2,508
Colorado River near Glenwood Springs, Colorado	1,261	553	0.44	323	553	0.44	323
Colorado River near Cameo, Colorado	2,264	1,478	0.65	480	1,503	0.66	488
Gunnison River near Grand Junction, Colorado	1,688	1,479	0.88	644	1,479	0.88	644
Dolores River near Cisco, Utah	439	461	1.05	772	468	1.07	784
Colorado River near Cisco, Utah	4,161	4,062	0.98	718	4,094	0.98	723
San Juan River near Archuleta, New Mexico	314	75	0.24	176	75	0.24	176
San Juan River near Bluff, Utah	977	961	0.98	723	1,162	1.19	875
Colorado River at Lees Ferry, Arizona	**8,665**	**8,061**	**0.93**	**684**	**8,345**	**0.96**	**708**
Colorado River near Grand Canyon, Arizona	8,976	9,122	1.02	747	9,406	1.05	770
Virgin River at Littlefield, Arizona	153	345	2.25	1,658	345	2.25	1,658
Colorado River below Hoover Dam, Ariz.-Nev.	8,421	9,818	1.17	857	10,118	1.20	883
Colorado River above Parker Dam, Ariz.-Calif.	7,998	9,493	1.19	873	9,819	1.23	903
Colorado River below Parker Dam, Ariz.-Calif.	6,755	8,018	1.19	873	8,293	1.23	903
Colorado River at Imperial Dam, Ariz.-Calif.	5,608	8,194	1.46	1,074	8,525	1.52	1,118

1	2000 condition, Zero pickup: Flow (AF) 24	Zero pickup: T.D.S. (T) 25	Zero pickup: Concentration (T/AF) 26	Zero pickup: Concentration (mg/l) 27	T.D.S. pickup at 2T/A: T.D.S. (T) 28	T.D.S. pickup at 2T/A: Concentration (T/AF) 29	T.D.S. pickup at 2T/A: Concentration (mg/l) 30
Green River near Green River, Wyoming	1,104	492	0.45	328	492	0.45	328
Green River near Greendale, Utah	1,362	835	0.61	449	835	0.61	449
Yampa River near Maybell, Colorado	1,046	225	0.21	158	225	0.21	158
Duchesne River near Randlett, Utah	162	370	2.28	1,679	429	2.65	1,947
White River near Watson, Utah	387	241	0.62	458	241	0.62	458
Green River at Green River, Utah	3,528	2,432	0.69	507	2,492	0.71	519
San Rafael River near Green River, Utah	56	191	3.41	2,508	191	3.41	2,508
Colorado River near Glenwood Springs, Colorado	1,201	547	0.46	335	547	0.46	335
Colorado River near Cameo, Colorado	2,180	1,457	0.67	491	1,482	0.68	500
Gunnison River near Grand Junction, Colorado	1,684	1,481	0.88	647	1,481	0.88	647
Dolores River near Cisco, Utah	436	460	1.06	776	467	1.07	788
Colorado River near Cisco, Utah	4,070	4,042	0.99	730	4,074	1.00	736
San Juan River near Archuleta, New Mexico	314	75	0.24	176	75	0.24	176
San Juan River near Bluff, Utah	971	961	0.99	728	1,162	1.20	880
Colorado River at Lees Ferry, Arizona	**8,492**	**8,009**	**0.94**	**693**	**8,302**	**0.98**	**719**
Colorado River near Grand Canyon, Arizona	8,803	9,070	1.03	758	9,363	1.06	782
Virgin River at Littlefield, Arizona	117	338	2.89	2,124	338	2.89	2,124
Colorado River below Hoover Dam, Ariz.-Nev.	8,174	9,767	1.19	879	10,083	1.23	907
Colorado River above Parker Dam, Ariz.-Calif.	7,731	9,433	1.22	897	9,775	1.26	930
Colorado River below Parker Dam, Ariz.-Calif.	6,729	8,210	1.22	897	8,508	1.26	930
Colorado River at Imperial Dam, Ariz.-Calif.	5,605	8,386	1.50	1,100	8,754	1.56	1,148

1/ Without water quality improvement program.

2/ Several factors influencing the salinity levels portrayed herein warrant caution in using this table. First, projections in the table of future salinity conditions do not represent forecasts of anticipated future salinity levels that might actually occur in any given year in the future. The underlying basis for projections in the table is the long-term average (1941-1976) salinity condition, as modified, for example, by projected year 1980, 1990, and 2000 level water depletions attributable to projects now planned for operation prior to each of these three specific years. The average salinity conditions during the period 1941-1976 in the segmented 10-year projections has been modified to reflect what the salinity condition would have been during said period if the planned after-built projects and depletions had been in existence throughout the period 1941-1976. It would only be coincidental if the base average salinity condition for any given year in the past, or the future, were the same as the annual salinity level that did in fact occur. Moreover, there can be no guarantee that any or most of the planned future water projects, and the consequent projected water depletions incorporated into the figures in this table, will be completed, or be in operation at the time now forecast. There is a second reason for caution in using this table. Recent studies indicate a significant deviation in the runoff-salt load relationship for the past several years. Preliminary findings indicate a statistically significant reduction in salt load entering Lake Powell. We have undertaken a detailed examination of the hydrologic data to ascertain the underlying reasons for this reduction and its implications as to salinity control. It is possible that the cause of this reduction is such that it could lead to reductions in salt-loading now projected for future years. Third, since this table is based on 1941-1976 averages, recent downward trends in salinity levels are recognized only to the extent that they influence the long-term average.

PART VIII. COLORADO RIVER SALINITY CONTROL PROGRAM

Section 206 of Title II of the Colorado River Basin Salinity Control Act, Public Law 93-320, of June 24, 1974, directs the Secretary of the Interior, commencing on January 1, 1975, and every 2 years thereafter, to submit, simultaneously, to the President, the Congress and the Advisory Council, a report on the Colorado River Salinity Control Program covering the progress of investigations, planning and construction of salinity control units for the previous fiscal year, the effectiveness of such units, anticipated work needed to be accomplished in the future to meet the objectives of Title II with emphasis on the needs during the 5 years immediately following the date of each report, and any special problems that may be impeding progress in attaining an effective salinity control program. Section 206 also provides that this report may be included in the Quality of Water-Colorado River Basin biennial progress report.

A. Projects Authorized for Construction

Title II of Public Law 93-320 authorized the Secretary of the Interior to construct as the initial stage of the Colorado River Water Quality Improvement Program, the Paradox Valley Unit, Colorado; the Grand Valley Unit, Colorado; the Crystal Geyser Unit, Utah; and the Las Vegas Wash Unit, Nevada. The schedule of definite plan reports for projects authorized for construction is shown on Figure 4. This section of the report presents a brief description and summary of the status of investigations for each of the projects authorized for construction.

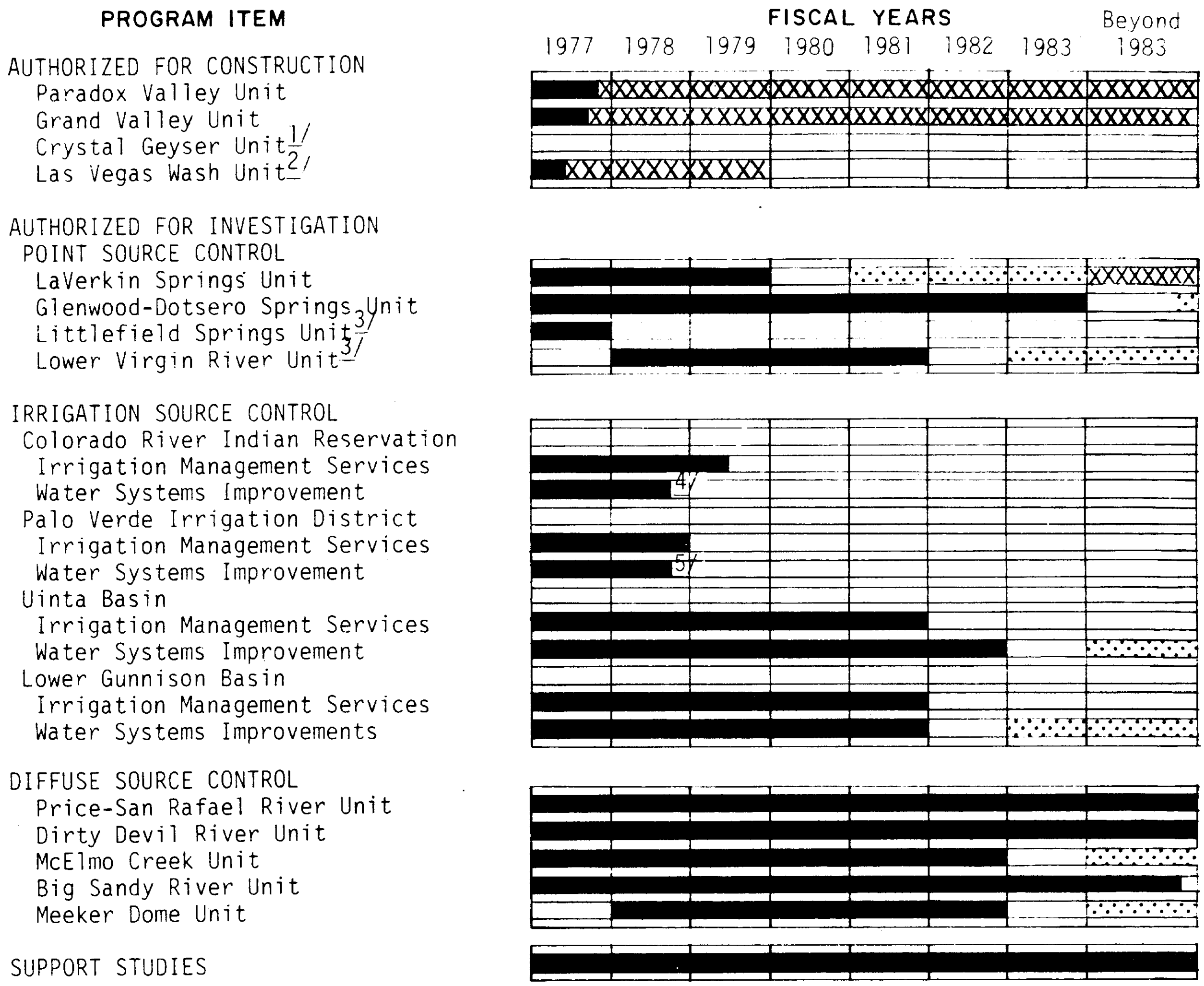
1. Paradox Valley Unit

Paradox Valley, a collapsed salt anticline, is a northwest-southeast trending valley 3 to 5 miles (5 to 8 km) wide located in southwestern Colorado. It has an arid climate, dry and hot in the summer and dry and cold in the winter.

Geologic investigations in the Colorado Plateau have established the existence of a series of five major northwest-southeast trending salt anticlines (elongated swells) about 100 miles (160 km) long, with the La Sal Mountains, an extrusive mass, perched over the center of the anticline region. Paradox Valley lies along the axis of one of these salt anticlines and is essentially the result of erosion of faulted and uplifted sandstone and shale formations from above a residual gypsum cap overlying about 14,000 feet (4,300 m) of pure salt and salt-rich shale. The Dolores River remained in its ancient streambed as the uplift and erosion of the valley developed and crosses the valley near its midpoint. West Paradox Creek heads in the La Sal Mountains and flows southeast through the northwestern half of Paradox Valley to the Dolores River. East Paradox Creek, an intermittent stream, drains the southeastern half of Paradox Valley before flowing into the Dolores River.

INVESTIGATION AND CONSTRUCTION SCHEDULE

COLORADO RIVER WATER QUALITY IMPROVEMENT PROGRAM



1/ Construction not scheduled.
2/ Las Vegas Wash Unit will require reformulation of plans because of changing conditions of flow and salinity concentration. Reformulation will be scheduled when flow and salinity conditions stabilize.
3/ The Lower Virgin River Unit supplants the Littlefield Springs Unit.
4/ Status Report released July 1978-BIA will improve the canals and laterals
5/ Status Report released July 1978. Expect that 208 report will recommend a local agency improve the canals and laterals

INVESTIGATION
PRECONSTRUCTION INVESTIGATIONS
XXXX CONSTRUCTION

Fig. 4

Previous estimates of salinity contribution from the Paradox Valley were based on spot measurements of the flow and water quality of the Dolores River as it enters and leaves the valley. Stream gaging stations and a water quality sampling program were established in 1972. Analysis of 5 years of streamflow and water quality records modified the previous estimate to 205,000 tons (186,000 t) per year salinity contribution to the Dolores River as it traverses across the valley.

Feasibility studies were initiated in 1972, when stream gaging and water quality sampling stations were established on the Dolores River where it flowed into and out of Paradox Valley. To determine the path by which salt was entering the Dolores River, in 1973 a resistivity survey was conducted along the river and exploratory holes and observation wells were drilled. The resistivity study estimated contours of the brine interface so that the exploratory drill holes and observation wells could be located to better define the subsurface water conditions. The five exploratory drill holes and twelve observation wells indicate that a 100-150-foot (30-46 m) deep pocket of gravel exists in midvalley to the west of the river and that 15-30 feet (5-9 m) of unconsolidated overburden overlies a brecciated gypsiferous NaCl salt rich formation to the east of the river. A brine with a concentration of 266,000 mg/l (93 percent sodium chloride) is near the surface east of the river and is overlaid by brackish water with concentrations over 2,000 mg/l west of the river. The brine occurs in a low pressure artesian aquifer situated above a massive salt dome. The pressure in this aquifer is sufficient for the brine interface to surface in the river channel about midvalley. Upstream from this point, the river is unchanged in its freshness, but downstream there is a semi-diffused leakage of brine into the river along a 1.2-mile (1.9 km) reach. The brine contribution results in salt concentrations in the Dolores River ranging from less than 200 mg/l at high flows to 166,000 mg/l during extreme low flows as measured at the outlet of Paradox Valley.

A 16-inch (406 mm), 300-foot-deep (90 m) exploratory test well was drilled through 100 feet (30 m) of deep lensatic river deposits and into the underlying fractured gypsum cap of the salt anticline. Pumping tests of the lensatic gravels and of the fractured gypsum cap indicate that the salt contribution to the Dolores River in this area can be effectively controlled by pumping from the brine zones. The estimated annual removal of salt is 180,000 tons (163,000 t).

During 1975-76 two additional test wells were drilled and tested and approximately 30 locations were drilled and piezometer clusters installed. Brine from this test was conveyed to a temporary disposal pond constructed on the west bank of the river at the north end of the valley. Due to insufficient yields from the two additional wells, information for determining design capacity of the well field, size of the pumping plants, pipeline, or evaporation pond was not obtained.

However, the tests indicated that the inflow of brine into the river could be significantly reduced by pumping water from a series of wells in sufficient quantity to lower the pressure in the artesian aquifer below the river channel. The planning and future development of project facilities is divided into two phases. The first phase consists of a design data collection program and involves drilling and testing of wells and a short-term disposal system. The second phase would consist of converting the wells to full production status, construction of a hydrogen sulfide stripping plant and a pipeline and eight pumping plants to a long-term evaporation pond. In the summer of 1977, 18 test wells were drilled and the temporary brine disposal pond was enlarged. If the freshwater-brine interface can be successfully lowered, then the collection of design data for features of the proposed Paradox Valley Unit could begin. The design data collection program then, will test the well field by pumping to the temporary pond. This testing began in October 1978, and will continue for 1 1/2 to 2 years. The data collected will be used in the design of the proposed facilities for disposal of the brine.

During the design data collection program, the brine wells will be tested and the data will be used in identifying the need for additional wells. The process of well field development will also produce information for accurate sizing of the permanent facilities to be constructed. Well field evaluations and sizing studies conducted during this program will be completed before starting construction of the major facilities.

Initial sizing of the major facilities has been based on a pumping rate of 5 ft^3/s (142 m^3/s) from the brine well field. The design data collection program would permit final preconstruction sizing of the long-term disposal facilities and provide an opportunity to look at alternative disposal plans including deep well injection if the pumping rate is much lower than 5 ft^3/s (0.142 m^3/s).

The plan based on 5 ft^3/s (0.142 m^3/s) provides for pumping the brine and piping it from the well field to a nearby hydrogen sulfide stripping plant, where potentially toxic and corrosive gas would be converted into sulfur. The treated brine and sulfur would be piped from the stripping plant to the proposed Radium Evaporation Pond for disposal. The pond would be located in Dry Creek Basin to the southeast of the well field, and eight pumping plants would be installed on the pipeline to lift the brine over the divide between Paradox Valley and the basin. Statistics on these project features are on the following page.

	No.	Depth		Capacity	
		Feet	Meters	$ft.^3/s$	m^3/s
Wells					
Brine Production Wells	18	48-155	15-47	0.1-1.1	4.72×10^{-5} - 5.19×10^{-4}
Ground Water Monitoring Wells	68	20-300	6-91		
		Length			
		Miles	Kilometer		
Brine Pipeline		20.5	33.0	5	2.36×10^{-3}
Brine Pipeline Pumping Plants	8			5.26	2.48×10^{-3}
		Radium Dam		Radium Dike	
		Feet	Meters	Feet	Meters
Dams					
Height Above Streambed		87	27	56	17
Crest Length		8,300	2,500	7,500	2,300
		Acre-feet	Million Cubic Meters		
Evaporation Pond Capacity					
Flood Control		18,700	23.07		
Inactive		62,060	76.55		
Dead		6,040	7.45		
Total		86,800	107.07		
Surcharge		6,540	8.07		
		Acres	Hectare		
Maximum Water Surface Area		3,750	1,520		

To reduce adverse impacts on wildlife, a wildlife area would be developed near the evaporation pond and other areas temporarily disturbed by construction would be seeded with plant species valuable as wildlife habitat. Since the wildlife area was not included in the unit plan when it was authorized, the approval of the appropriate congressional committees would be required. Also included as part of the unit would be a cultural resource program to collect and preserve archaeological information from two sites located within the proposed evaporation pond.

A study to determine the feasibility of injecting the brine in a deep formation will begin in 1979. If the test pumping program determines that pumping 2 ft^3/s (0.0566 m^3/s) or less from the wells will lower the brine-freshwater interface below the river bottom and the study indicates deep well injection is feasible, a deep well injection test will probably be conducted in 1980 and 1981.

The Definite Plan Report has been printed and sent to the E&R Center and Washington for approval (September 29, 1978). The FES was printed and submitted to Washington November 2, 1978.

Construction and operation of the Paradox Valley Salinity Control unit could have the following environmental impacts:

a. A noticeable decrease in the low flow salt concentrations in the Dolores River downstream from Paradox Valley resulting in a decrease or elimination of salt encrustations along the river and in the lowlands adjacent to the river. Elimination of the high salt concentrations could enhance the fishery, wildlife, and scenery in the downstream reaches.

b. The construction of well installations along the river--with associated pumping plants, powerlines, transformer stations, and pipelines--would require the removal of some of the brush along the river, but would have minimal effects on wildlife.

c. Constructing the pipeline to Dry Creek Basin would create a scar requiring a few years to heal. Booster pumping plants and their associated transformer stations and powerlines would be constructed along the pipeline at several locations. The plant growth along the pipeline and around the pumping stations would probably be reduced, but the effect on animal life should be minor.

d. The evaporation pond in Dry Creek Basin would store the salt removed from Paradox Valley, estimated to be 180,000 tons (163,000 t) annually.

e. The pond would inundate approximately 3,750 acres (1,520 ha) of land that would be lost for wildlife habitat and stock grazing.

f. This pond would be sterile, and the existing vegetation would be killed by the saline water. After a few years, the pond would reach an equilibrium between evaporation and inflow, and a salt flat would be exposed around the lake each summer.

g. Approximately 4 miles (6 km) of county road would have to be relocated around the evaporation pond.

The estimated capital investment, as of January 1977, for the brine wells, pumping plants, pipeline, and evaporation pond structures, wildlife mitigation and cultural resource program is $56,203,000. The estimated annual operation, maintenance, and replacement costs based on the expected life of equipment and a 5.625 percent interest rate of $332,300.

Local benefits would be limited to the effects of decreasing the salinity of the Dolores River in Paradox Valley and downstream. The annual loss of water by evaporation is estimated at a maximum of about 3,950 acre-feet (4.87 x $10^6 m^3$). Most of the benefits would occur in the lower Colorado River Basin with 18.2 mg/l reduction of the salinity concentration at Imperial Dam.

2. Grand Valley Unit

The Grand Valley of Colorado is near the western edge of Mesa County. Grand Junction, the largest city in Colorado west of the Continental Divide, is located in the Valley. The Valley was carved in the Mancos Shale formation (a high salt bearing marine shale) by the Colorado River and its tributaries and for the most part is surrounded by steep, rough terrain. Within the Valley the irrigated lands have been developed on recent alluvial plains consisting of broad coalescing alluvial fans and on older and higher alluvial fans, terraces, and mesas. Other lands in this arid setting, where rainfall averages only about 9 inches (230 mm) per year, include the stream flood plains and rough broken land occurring as terrace escarpments, high knobs and remnants of former mesas.

First irrigation in the Valley began in 1882 with the construction of what is now the Grand Valley Canal (Grand Valley Irrigation Company). Other private systems were built during the period between 1882 and 1908. Construction of the last major system, the Grand Valley Project under the Reclamation Service, began in 1908 with the major construction completed in 1926. This project consists of two divisions, the Garfield Gravity and the Orchard Mesa Divisions, on the north and south sides of the river, respectively.

A total of about 76,000 acres (28,700 ha) are served water by these irrigation entities with appproximately 42,000 acres (17,000 ha) under Federal projects. Major crops produced in the valley are corn, sugar beets, small grains, alfalfa, and various orchard crops.

The Grand Valley is estimated to contribute an average of about 780,000 tons (708,000 t) of salt annually to the Colorado River. Most of these salts are thought to be leached from the soil and underlying Mancos Shale and washed into the river by deep percolation and water delivery system losses.

The Mancos shale is a very thick sequence of saline drab gray fissile shale that lies between the underlying Dakota sandstone and the overlying Mesa Verde Formation. The thickness of the shale usually varies between 3,000 (900 m) and 5,000 feet (1,500 m). Due to this great thickness and its easy erodibility, the shale forms most of the large valleys of western Colorado and eastern Utah. Many white patches of salt and alkali are visible on the nonirrigated surfaces and some patches also visible on the irrigated lands where drainage is poor. The salts present in the Mancos shale are mostly calcium sulfate with smaller amounts of sodium chloride, sodium sulfate, and magnesium sulfate. Calcium sulfate (gypsum) is commonly found in crystal form in open joints and fractures of the shale.

Due to the compactness of the clay and silt particles making up the shale, the formation is not considered as water bearing at depth. However, the weathered zone near the surface does transmit water along joints, fractures, and open bedding planes. This zone is the area from which percolating water, often originating from irrigation of croplands, may dissolve salts present in the shale. In addition, most of the soil forming the irrigated lands have been derived from Mancos shale. As a result, the soils are a source of salinity.

A gravel and cobble layer also has been found under some of the irrigated areas in the Grand Valley and is believed to serve as an aquifer for ground water. Studies have identified areas where the ground water has Artesian pressure in the cobble aquifer due to the confining effect of the Mancos shale beneath and the tight clay soil above. This situation is believed to be responsible for some areas of high water tables. The cobble aquifer will be studied to determine its extent and its influence on the ground water.

The programs underway in the Grand Valley are a combination of water system improvements (WSI), irrigation management services (IMS), and Soil Conservation Service sponsored on-farm improvements. The WSI, when implemented, in combination with the IMS program, and the on-farm improvements, is expected to reduce the contribution of dissolved minerals to the river by an estimated 410,000 tons (372,000t) per year.

The purpose of the irrigation management services (IMS) program is to optimize water management to attain one or more specific goals of maximizing yields, net returns, water use efficiencies or minimizing indirect adverse effects. In the Grand Valley, IMS is being evaluated as to its potential to improve efficiency of water use and thereby reduce the salt loading from the irrigated lands.

In the Grand Valley area, irrigation efficiencies were measured during the 1964 through 1968 period and found to average about 33 percent. Improvement of on-farm irrigation systems through the Department of Agriculture programs in conjunction with IMS should result in higher irrigation efficiencies. These improvements would involve such measures as landforming, lining field ditches, automation of delivery system, use of sprinklers, and gated pipe systems.

Four irrigation entities divert water from the Colorado River. These include the Grand Valley Water Users Association (Bureau of Reclamation Project) and three private companies--the Grand Valley Irrigation Company, the Palisade Irrigation District, and the Mesa County Irrigation District. A fifth irrigation company, the Redlands Power and Water

Company, diverts water from the Gunnison River. A number of other small companies have carriage agreements with the major canal companies for delivery of water. There are a total of approximately 210 miles (340 km) of canals and 500 miles (800 km) of laterals in the valley, with a few of the laterals and parts of some canals presently being concrete or gunite-lined.

Investigations for improving the canals and lateral systems to reduce seepage and improve water delivery were begun in Fiscal Year 1972. Capacities were computed for the conveyance systems based on crop consumptive use employing the Jensen-Haise Formula for the cropping patterns and climatic data for the valleys and improved irrigation efficiency. The cropping pattern was determined by updating a 1969 survey by the Agriculture Engineering Department of Colorado State University. As the peak period capacities arrived at by this method were close to the existing capacities the proposed capacities will, at a minimum, convey the maximum flows now existing. Canal and lateral structures will be designed to improve control of the irrigation water. In particular, the use of pipe will allow for much needed flexibility and corresponding increased efficiencies of on-farm improvements.

Fencing will be installed along both sides of open concrete-lined sections where there is a safety hazard, and safety features are included for structures on canals and large laterals.

In areas where two or more laterals parallel each other very closely, consideration will be given to combining these laterals into a single lateral. Other than this type of combining laterals, the various irrigation companies will not consider any combination of their systems.

Water quality sampling and flow measurement stations have been established on 60 locations in the Valley. Data collected at these stations will assist in evaluating the present conditions and any salinity reductions resulting from irrigation scheduling and water systems improvements.

To acquire detailed information on surface and ground water quality and sources, a system of observation wells has been drilled to define the water table and for sampling the ground water for quality determinations. Piezometers monitor vertical gradients of water pressure through the soil profile, and gaging stations measure surface inflow and outflow from the area. Data are being collected to ascertain the change in salinity levels due to project construction.

An initial phase of the unit, known as Stage One, will be constructed in the study area. Extensive monitoring will be conducted to determine project effects on salinity and wildlife. Construction of the remainder of the unit will not proceed prior to completion of the monitoring period and preparation of an environmental impact statement.

Modifications are being considered for the drains in the area. At the present time, sufficient information has not been obtained to arrive at any definite drainage rehabilitation plans. A large number of ground water observation wells have been installed in the Valley and are being monitored to obtain information which might be used for future drainage design. In addition, Colorado State University is conducting several experiments in the Valley, one of which is a detailed study of drain spacing requirements.

Other programs and activities used to derive a viable salinity control program in Grand Valley include:

a. Research on increasing irrigation efficiency and determination of mineral weathering and salt precipitation as a function of irrigation management was conducted by the Agricultural Research Service under contract with the Bureau of Reclamation. The results are available in Alleviation of Salt Load in Irrigation Water Return Flow of the Upper Colorado River Basin dated September 1977.

The Agricultural Research Service is attempting to measure the deep percolation occurring for various irrigation efficiencies and methods with the resulting salt leaching or precipitation. The Agricultural Research Service is also working with the Bureau of Reclamation to conduct seepage loss studies for the distribution system.

b. Research on automated systems by the Colorado Water Conservation Board. The Colorado Water Conservation Board is conducting a pilot demonstration project for automated irrigation systems in the Grand Valley. Their primary objective is to test various modern on-farm irrigation systems and develop them for use in this area. They have conducted work on three systems; an automated border irrigation system, an automated pump back system, and a drip irrigation system.

c. Initiation of conservation practices by the Agricultural Stabilization and Conservation Service in cooperation with the Soil Conservation Service.

The Soil Conservation Service has since the middle 1940's been concerned with drainage, reclamation of salted areas, and restoration of productivity. In recent years, their activities have been oriented toward increased irrigation efficiency and reduction of salt contribution to the river from irrigated land. The Agricultural Stabilization and Conservation Service in cooperation with the Soil Conservation Service has been involved in cost sharing of conservation practices such as ditch lining, pipelines, land leveling, drainage, and water control structures.

The Soil Conservation Service inventoried the irrigated area fields in the Valley and prepared a report of the work and estimated cost to improve all farm systems (including land leveling) to increase on-farm irrigation efficiency to the maximum possible with the IMS program.

d. The Agricultural Engineering Department, Colorado State University (CSU), conducted salinity research for the Environmental Protection Agency. The researchers monitored the salinity of water before and after its use for irrigation. They monitored approximately 12 square miles (31 km^2) between Grand Junction and Clifton where they are attempting to accurately establish the salt contribution from irrigation on various types of soil and subsurface material. Canals, laterals, and drains throughout this area are frequently sampled and measured to establish salt loading and irrigation efficiency.

A number of fields within this area are actually being irrigated by Colorado State University to ensure maximum control and measurement of water. Recorders are employed to check water on and off the field and salinity measurements are made.

e. The Grand Valley Salinity Coordinating Committee, a group of Federal, State, and local agencies formed to eliminate duplication of effort and bring about a better understanding of salinity control programs.

Base maps and location maps have been prepared, acreages served tabulated, and conveyance capacities determined for all canals and laterals. Design criteria for the canals and laterals and associated structures have been established. Water quality samples are being collected and analyzed for drains and ground water observation wells throughout the valley.

Aerial topography has been obtained. Additional ground water observation wells have been sampled and the samples analyzed. Quality data collection will be continued for surface and ground water return flows. The collected data have been used in making ground water studies, sedimentation studies, and flood studies on cross drainages. Studies are being made to better estimate the salt load reduction resulting from the salinity control programs in Grand Valley.

Studies for the Environmental Assessment are complete. The final draft of the Environmental Assessment was completed in December 1977. A negative determination of impact was approved by the Commissioner in July 1978 for the Stage One only. A full environmental statement will be prepared on the entire unit. The Definite Plan Report for Stage One was printed and submitted to Washington November 24, 1978.

Negotiation and drafting of contracts with the canal and lateral owners defining responsibility during construction and operation maintenance and replacement after construction is completed as required by Public Law 93-320, will continue until all contracts are completed.

Construction would have to be accomplished from November to March during the non-irrigation season for the larger canals and laterals and could be accomplished year around for the smaller laterals. Construction is estimated to take about 10 years.

Other expected local benefits of the WSI Programs, on-farm, and IMS include improved control of water deliveries and reduced ground water and drainage problems. They would provide flexibility and, consequently, improved efficiencies of on-farm practices. Other beneficiaries would be water users in the lower Colorado River Basin and Mexico.

The estimated capital investment cost of the water systems improvements is $171,397,000 (January 1978 prices).

As the studies progressed, environmental impact analysis has fitted into the plan formulation process. Data collection activities are completed and evaluation of alternatives and their impacts were presented in the December 1977 Environmental Assessment. A more complete environmental analysis will be completed using monitoring results on Stage One and will be presented in a Draft Environmental Statement.

3. <u>Crystal Geyser Unit</u>

The Crystal Geyser, a privately owned abandoned oil test well, located 3.5 miles (5.6 km) south of the town of Green River, Utah, on the east bank of the Green River contributes about 3,000 tons (2,700 t) of salt annually to the Colorado River system. The saline water erupts in the form of a geyser at about 5-hour intervals due to carbon dioxide accumulations. The concentration of the water ranges from 11,000 to 14,000 mg/l and the annual flow amounts to about 150 acre-feet (185,000 m^3). The climate at the geyser is a desert type with an average annual temperature of 52° F (11 °C) and an average annual precipitation of 6 inches (150 mm). The vegetation in the geyser area is sparse with tamarisk and scattered cottonwood trees along the edges of the river and cactus, Brigham tea, greasewood and shadscale elsewhere.

The estimated annual removal of salt by the alternative plans is about 3,000 tons (2,700 t), a relatively minor amount. Salinity concentrations of the Colorado River at Imperial Dam would be reduced by an estimated 0.3 mg/l.

The Definite Plan Report, Environmental Assessment and Negative Determination of Environmental Impact have been completed and were submitted in June 1976.

The plan is to collect the flows and convey them to evaporation ponds about 3 miles (5 km) downstream. A compacted earth embankment would be constructed on the stream side of the geyser to collect and temporarily store the water from the eruption. A plastic pipe would convey the water from the temporary storage pond at a uniform rate to the evaporation ponds about 3 miles (5 km) downstream. The pipeline will cross many small drainages and the Little Grand Wash. Bedrock may also present some difficulties while laying the pipe. The evaporation ponds will be located about 3 miles (5 km) downstream on a typical river flood plain of lean clay with lenses of silt, sand--sometimes clean, and gravel. The ponds will require a flexible polyvinyl lining to assure that no leakage back to the river occurs. About 2 miles (3 km) of the access road to the geyser will need improvement by grading, installing culverts and possibly gravel surfacing. The access road to the evaporation ponds will also need some improvement.

The estimated capital investment cost was $2,841,000. Construction of this unit has been delayed indefinitely.

4. Las Vegas Wash Unit

Las Vegas Wash is a natural channel draining the entire Las Vegas Valley watershed area of 2,200 square miles (5,700 km^2) and discharges into the Las Vegas Bay arm of Lake Mead. Located in Southern Clark County, Nevada, the Las Vegas Valley contains the largest population center in the State. The wash flows through the valley in a generally southeast direction and provides drainage for the three principal cities of North Las Vegas, Las Vegas, and Henderson. Studies evaluating salinity contributed by the wash are concerned mainly with the 11 mile portion between Las Vegas and Lake Mead consisting of about 1,800 acres (730 ha) of dense marsh and phreatophyte vegetation.

Historically, Las Vegas Wash has been an intermittent stream discharging only during periods of high rainfall producing storm runoff. With the growth of the communities in the valley, the stream has become perennial. Return flows to the wash are from industrial plants, from continually increasing discharges of the secondary treated municipal wastewater of the cities and unincorporated areas and from agricultural and municipal irrigation. These sources contribute large amounts of residual nutrient bearing and saline water to the Lower Colorado River via Las Vegas Wash and Lake Mead.

The vigorous development that has taken place in the Las Vegas Valley for the last several years has resulted in a steady increase in the total wastewater and total flow in the Wash. The flow for the USGS gaging stations on Las Vegas Wash are shown in the following tabulation:

Year	Las Vegas Wash near Henderson acre-feet	Million cubic meters	Las Vegas Wash near Boulder City acre-feet	Million cubic meters
1967	19,110	23.57	---	
1968	22,000	27.14	---	
1969	28,730	35.44	---	
1970	31,550	38.92	37,130	45.80
1971	28,220	34.81	34,790	42.91
1972	33,530	41.36	41,560	51.26
1973	36,400	44.90	44,920	55.41
1974	39,950	49.28	48,360	59.65
1975	45,390	55.99	55,430	68.37
1976	48,560	59.90	62,390	76.96

In 1977 the definite plan report on Law Vegas Wash was drafted. Results of the hydrology investigations showed most of the inflow to the gage near Henderson was from the three municipal sewage treatment plants, Las Vegas, Clark County, and Henderson. Inflow between the gage near Henderson and the gage near Boulder City was a result of ground water seepage into the Wash from unlined evaporation ponds.

A rather large ground water mound has been formed due to historical and current methods of disposal of wastewater into unlined evaporation ponds from industrial plants and sewage treatment plants. The mound grew during the 1944-56 period to cover about 50 square miles (130 km^2) with a maximum change of over 20 feet (6 m) in ground water elevation. Most of the mound is concentrated under ponds constructed to dispose of tailings and wastewater from the Basic Management Incorporated (BMI) plant during World War II and consists of highly saline water. The ponds cover over two square miles in area and were constructed to dispose of the water by evaporation and store the tailings. However, the ponds were on a coarse gravel fan and the water sank rapidly into the ground. Apparently, only a few ponds were required for waste disposal as many indicate no use by a field inspection. Outflow from the mound accounts for the ground water seepage into Las Vegas Wash between the gage near Henderson and at Boulder City. The source for the water that feeds the mound is the highly saline BMI plant wastewater and the effluent from Henderson sewage treatment plant No. 2.

The hydrology studies indicated that the ground water seepage into the Wash was attributable to industrial discharge which accounted for 6,480 acre-feet (7.99 x $10^6 m^3$) of the 43,510 acre-feet (53.67 x $10^6 m^3$) of outflow from Las Vegas Wash into Lake Mead based on a 1970-75 average. The same industrial discharge accounted for 97,720 tons (88,650 t) of the total 201,790 (183,060 t) of salt outflow from Las Vegas Wash into Lake Mead on the 1970-75 average.

The original purpose of the Las Vegas Wash Unit was to intercept saline ground water in the Las Vegas Wash, preventing it from flowing into Lake Mead and the Lower Colorado River system. The original concept was to build the project in two stages: the first, a total evaporation complex including an interception subsurface dam and solar evaporation ponds; and the second, a desalting plant when needed. The project's initial goal was to ultimately remove 83,000 tons (75,300 t) of the approximately 200,000 tons (181,000 t) of salt discharged by the Wash annually into Lake Mead. This would reduce the salinity at Imperial Dam near the Mexican boundary by about 9 mg/l.

At the time the Definite Plan Report on Las Vegas Wash Unit was prepared, lined ponds were being built to impound the highly saline industrial discharges. The result of curtailing the primary source of saline water to the ground water mound was predicted to have profound effects on the hydrology of the Wash. In the studies it was determined that certain portions of the ground water mound would dissipate more rapidly than others based on geologic formation differences but that after 13 years, the highly saline mound would be dissipated.

As of January 1977, the industrial wastewater was discharged to lined evaporation ponds. Monitoring of ground water levels and quality has been continued on Las Vegas Valley since 1974. Monitoring of surface water flows to check the results of the ground water hydrology studies were begun in 1977. Early results of the monitoring programs have shown a more rapid dissipation of the highly saline ground water mound than predicted.

As a result of the reduction in salinity levels in the ground water along with the increased costs of removing the salts, the Bureau of Reclamation has decided to delay the construction of the Las Vegas Wash Unit pending further study. A plan more adaptable to the present and predictable conditions in the Wash may still provide a significant reduction in the salinity of the Colorado River and as a result the hydrosalinity system of Las Vegas Wash will undergo further study. The decision to delay the construction of the Las Vegas Wash unit which was scheduled for June 1978 has the concurrence of the Colorado River Basin Salinity Control Forum, composed of representatives of the seven Colorado River Basin States.

B. Projection of Salinity Levels Assuming Actual Operation of Congressionally Authorized Salinity Control Units

A table has not been included in this Progress Report that would reflect projected salinity levels assuming actual operation of authorized salinity control units.

Table F of Progress Report No. 8 (p. 68) had projected salinity levels at various points on the Colorado River on the assumption that three planned, congressionally authorized salinity control units were in place. In addition, Table F reflected the further assumption that planned, congressionally authorized water resource development projects were on stream, and, for purposes of the projections, anticipated depletions from these potential projects were included in the depletion schedule. The projections in Table F did not include salinity control units or Federal water resource projects that had not then been authorized by Congress. And, where a substantial question had arisen about the future of an authorized control unit or development project, it was not considered in developing the projections.

At the present time, the future of several control units and development projects has become more clouded. Significant questions have arisen about the future of two of the four congressionally authorized salinity control units, viz. the Crystal Geyser Unit and the Las Vegas Wash Unit (see discussion on ps. 82-85 of this Report). Moreover, there is now a substantial question as to whether or when construction of certain previously authorized water resource projects will be undertaken, e.g., the Fruitland Mesa and Savery-Pot Hook projects.

There has also been a significant decline in recent years in the run-off salt load entering Lake Powell. Possible salinity control implications of this event are now under study by the Bureau of Reclamation (see footnote to Table E herein).

Because of the circumstances desacribed above, we do not believe it would serve a meaningful purpose to include in this Report a table comparable to Table F of Progress Report No. 8.

C. Projects Authorized for Planning

Section 203(a)(1) of Public Law 93-320 authorized and directed the Secretary of the Interior to expedite completion of the planning reports on units described in the Secretary's report, "Colorado River Water Quality Improvement Program, February 1972," Section 203(b)(2) directs the Secretary to undertake research on additional methods of accomplishing the objective of this title, (Title II of Public Law 93-320).

There are three categories of projects listed under Section 203, (1) irrigation source control, (2) point source control, and (3) diffuse source control. The schedule of reports for projects authorized for investigation is shown on Figure 4. The investigative program for each project is viewed periodically to accelerate the completion of the reports. A brief description and status of the listed projects follows:

1. Irrigation Source Control Projects

Under the CRWQIP, major program emphasis for control of irrigation sources is placed on improved irrigation management through an

Irrigation Management Services (IMS) and improved control of water flow in canals, laterals, and drainage systems through a Water Systems Improvements (WSI) program. Basically, the IMS program is a nonstructural management technique for increasing irrigation water efficiency and reducing salt loading. This is a demonstration-type program based on the concept that the water user will take over and operate the program. Under requirements in provisions of Public Law 92-500, this practice is expected to spread to other irrigated areas in the basin. Benefits expected to be derived from IMS irrigation scheduling include increased yields, labor savings, reduced leaching of soils, and reduced drainage requirements.

The WSI program, on the other hand, involves a structural water management tool for improving water delivery conveyances and, thus, reducing drainage seepage and salinity pickup. The lining of canals and laterals would result in decreased deep percolation losses, thus reducing water contact with highly saline soils, shales, and saline ground waters.

A considerable amount of water diverted for irrigation in the Colorado River Basin is returned to the parent stream. However, with continued use the water become concentrated with salt, thus lowering the quality. In some cases, particularly after repeated use the return flow water becomes undesirable for irrigation or municipal and industrial use without treatment. A few specialized industries, however, can use water of poor quality for cooling purposes. With the advent of increased need for electric generating and fuel-producing entities, wastewater flows have assumed new importance. In addition to the above program, planning reports evaluating irrigation source control units will also indicate the potential for collection of return flows for industrial use or of treatment to improve the quality of the receiving streams.

Lower Gunnison Basin Unit.--The Lower Gunnison Basin Unit encompasses the Gunnison River drainage area below the Curecanti Unit, a feature of the Colorado River Storage Project. Within this area, there are a number of private and Federal projects presently irrigating approximately 160,000 acres (64,750 ha).

The Lower Gunnison Basin contributes an estimated 1,100,000 tons (1,000,000 t) of salt annually to the Colorado River. As in the Grand Valley, it is believed that a substantial amount of the salt load pickup is caused by excessive irrigation applications and delivery system losses. The valleys in the Lower Gunnison area are generally eroded from the Mancos shale, a thick gray saline fissile shale 3,000 (900) to 5,000 feet (1,500 m) thick. It is believed that water percolating through the weathered shale or soils derived from the Mancos Shale, leaches out the soluble salt which is then carried to the streams.

1. Irrigation Management Service Program.--The Irrigation Management Services program began with the 1974 irrigation season and is currently operated by the Uncompahgre Valley Water Users.

2. Water Systems Improvement Project.--The Lower Gunnison Unit would include Water Systems Improvements (WSI) similar to those planned for the Grand Valley Unit. The physical improvements would be concentrated in the Uncompahgre Valley. Data collection began in 1973 with water quality sampling. Land classification, a structural survey, phase one of a wetlands study, and aerial topographic mapping have been completed. The feasibility report is scheduled for 1981. The Soil Conservation Service of the Department of Agriculture has started planning for the on-farm improvement program for inclusion in the feasibility report.

Uintah Basin Unit.--The Uinta Basin lies between the Uinta Mountains on the north and the Tavaputs Plateau on the south in northeastern Utah. The climate in the basin is extremely variable. The summers are normally hot, with low humidity, and the winters are relatively severe.

Extreme fluctuations in precipitation and temperature occur over the area. Average annual precipitation is about 7.5 inches (190 mm) in Roosevelt, Utah, and about 8.5 inches (216 mm) in Altamont, Utah. The average annual temperature is 47° F (8° C) ranging from minus 32° F (-36° C) to 105° F (41° C). Irrigated lands in the Uinta Basin totaling 170,000 acres (69,000 ha) are located primarily on alluvial materials adjacent to rivers and on benches and mesas. The Uinta Mountains, several peaks of which exceed 13,000 feet (5,300 m), are the main source of water for the Basin. The mountain front stream above the irrigated lands produce high quality water with total dissolved solids ranging from 30 to 350 mg/l. Water quality in the basin deteriorates as return flow from irrigated areas enter the Duchesne River and its tributaries. Concentrations in the Duchesne River below most irrigated land range from 200 to 3,400 mg/l with an average of 680 mg/l.

1. Irrigation Management Service (IMS).--Irrigation scheduling began with the 1973 season. Contracts were signed with irrigation organizations and the Ute Tribal Enterprise. Several problems are: (a) irrigation limitations by non-existent late season water supply; (b) canals, laterals, and structures in such poor condition that the irrigators can not determine the amount of water being applied; (c) field sizes too small; (d) irrigation deliveries when users are at other jobs; and, (e) drought conditions with only sufficient water for one irrigation such as in 1977. These factors resulted in all organizations except the Ute Tribal Enterprise, canceling their contracts.

Before the IMS program can succeed in the Uinta Basin, it will be necessary to improve the delivery systems, including control and measurement structures in the canals and laterals. Also desirable is additional storage capacity to provide a late season water supply.

2. Water Systems Improvement Program.--Systems improvement possibilities consist principally of the improvement of irrigation conveyance systems such as lining canals, use of pipe systems, and upgrading diversion and measurement structures.

Seepage loss studies have been completed on canal systems presently proposed for rehabilitation. Studies were conducted by Bureau of Reclamation, Soil Conservation Service, Geological Survey, and by contract with a consulting engineering firm. Infrared photography, soils data, canal company interviews and results of geologic studies were used in addition to seepage measurements to determine reaches of canals to be photographed and mapped for use in feasibility design.

A contract for topography and cross sections on 120 miles (193 km) of canal has been completed and another contract for similar data on an additional 30 miles (48 km) of canal has been initiated. Reconnaissance design estimates for alternative methods of system improvement are presently being computed and will be used to determine the recommended feasibility plan.

A detailed study of salt loading mechanisms in the Hancock Cove area has been completed and mass balance computations for the Uinta Basin have been initiated. In many areas, the primary mechanism for salt loading appears to be the displacement of saline ground water coupled with dissolution of salts from the soil and subsurface materials overlaying the shale or sandstone barriers. Salt loading from those areas should be reduced by the proposed improvement plan.

Public involvement meetings have been held jointly with the SCS and a MOP technical team has been formed. The SCS has completed a draft report for the on-farm portion of the Uinta Basin Study.

A feasibility report which will contain benefits and cost analysis for a coordinated system improvement and management plan is scheduled to be completed by FY 1982.

The Uinta Basin contributes about 450,000 tons (410,000 t) of salt annually. The Irrigation Management Service and Water Systems Improvement and on-farm improvement programs could reduce the salt load pickup by 100,000 tons (90,000 t) annually resulting in a salinity concentration reduction of 10 mg/l at Imperial Dam.

<u>Colorado River Indian Reservation Unit, Arizona</u>.--The Colorado River Indian Reservation has a total of 268,850 acres (108,800 ha) located in the Lower Colorado River Basin below Parker Dam in northern Yuma County, Arizona, and in the eastern part of San Bernardino and Riverside Counties, California.

The United States Supreme Court allocated water to irrigate 107,588 acres (43,541 ha), of which 99,374 acres (40,217 ha) are in Arizona and 8,213 acres (3,324 ha) are in California. The court's allocation also provided for a maximum diversion of 717,148 acre-feet (884,589,000 m^3) per year. In 1974, there were 66,000 acres (26,700 ha) irrigated with Colorado River water diverted at Headgate Rock Dam. About 200 miles (320 km) of canals and laterals delivered water to irrigate this acreage. The irrigation system will be expanded to supply water to irrigate about 80,000 acres (32,400 ha) in Arizona by 1980. Irrigation return flows are collected in a 100-mile (160 km) drainage system and returned to the river.

The purpose of the Colorado River Indian Reservation Unit investigation was to formulate a plan to reduce the salt loading to the Colorado River from irrigation on the reservation. In an appraisal of the unit as published in a status report released in July 1978, it was found that the reservation did not make a salt contribution to the river. As a result of these findings, it has been concluded that the investigation of the unit be discontinued. Inflow and outflow of salt from the reservation will continue to be monitored.

1. Irrigation Management Services.--The Irrigation Management System program was initiated on the Colorado River Indian Irrigation Project during 1973. At the scheduled termination of the agreement, June 30, 1978, the parties agreed that a successful on-farm IMS program had been demonstrated. A new agreement has been prepared and is now being circulated for officials' signatures.

The BIA and Colorado River Indian Tribal Council agreed to continue the IMS field scheduling and increase the manpower as funds permit. The Bureau of Reclamation's manpower will probably be reduced to one whose responsibility is to develop a computerized system of scheduling for management of irrigation water through canals and laterals. The Computerized System Scheduling demonstration phase of the IMS program by the Bureau of Reclamation will not extend beyond June 30, 1980. At the conclusion of the demonstration state, the Bureau of Indian Affairs and the Colorado River Tribal Council would continue the program.

2. Water Systems Improvement.--The possibility of reducing salt loading through lateral lining and other system improvements was investigated. It was concluded that the salinity control benefits did not justify the cost of such improvements. The Bureau of Indian Affairs has planned a program of irrigation system improvements to reduce canal and lateral seepage losses and to reduce operational spills from the water delivery systems. The Bureau of Indian Affairs proposes to construct the necessary system improvements within the next decade.

Palo Verde Irrigation District Unit, California.--The Palo Verde Irrigation District is a privately developed district located in

Riverside and Imperial Counties, California. Water for irrigation is diverted from the Colorado River at the Palo Verde Diversion Dam and is conveyed through 295 miles (475 km) of main canals and laterals to serve approximatly 91,400 acres (37,000 ha) of irrigated land within the District. The irrigation return flows are collected in a 153-mile (246 km) drainage system and returned to the Colorado River.

An analysis based on 1974 operational data indicated that the 914,000 acre-feet (1,130 x $10^6 m^3$) diverted contained 945,000 tons (847,000 t) of salt, and that 467,000 acre-feet (576 x $10^6 m^3$) of return flows to the river contained 1,097,000 tons (995,000 t) of salt. The difference of 152,000 tons (138,000 t) of salt was the net discharge to the river. For analysis the District was divided into seven subareas, which were found to vary greatly in their salt discharge. Based largely on 1974 data, five subareas were found to discharge various amounts of salt and two were found to retain salt. The variation among them apparently results mainly from differences in the quality of the underlying ground water.

The subarea with the greatest discharge by a substantial margin is the Palo Verde Subarea in the southwestern part of the District, which discharged 144,000 tons (131,000 t). This Subarea was found to be underlain by a sizable body of saline ground water that is gradually being flushed out by percolating irrigation leaching water and canal seepage. The ground water aquifer subject to flushing contains an estimated 6.65 million tons (6.03 million tonnes) of salt. In the future the salt discharge is expected to continue in gradually declining amounts until the ground water is the same concentration as the deep percolation, a process which will take over a hundred years, although most of it will probably be gone within 60 years.

The rate of salt discharge is theoretically proportional to the amount of subsurface drainage, so an improvement in water use efficiency would result in a reduction in annual salt discharge. The present on-farm irrigation efficiency in the Palo Verde Subarea is estimated to be approximately 42 percent. The unlined water distribution system also contributes to subsurface drainage.

Further analysis of the 1974 data show that significant amounts of salt discharge to the Colorado River can be stopped by improving on-farm efficiency and lining canals.

1. Irrigation Management Service Program.--Based on studies of the district for 1974, it has been estimated that if the irrigation efficiency was improved to 60 percent the salt loading to the river would be reduced by 67,400 tons (61,100 t) in the Palo Verde sub area. Irrigation management of water deliveries would improve the irrigation efficiency and reduce the salt loading to the Colorado River. Success of the IMS program is, however, dependent on local cooperation.

On May 18, 1976, the PVID Board of Directors stated their intention not to undertake a district IMS program but agreed to evaluate the program for another year. On April 12, 1977, the Bureau contacted the district by letter to determine if in the past year there had been any basic change in attitude in the Board of Directors toward the program. By letter of April 22, 1977, Mr. Jones, District Manager, wrote that at the "regular board meeting of April 19, 1977, the members voted to let the IMS program terminate."

The Irrigation Management (IMS) program was terminated at close of business on October 31, 1977. This action was taken in response to the wishes of the Palo Verde Irrigation District Board of Directors.

2. Water Systems Improvement Program.--Systems improvement possibilities consist principally of the improvement of irrigation conveyance systems such as lining canals, use of pipe systems, and upgrading diversion and measurement structures.

In an analysis of the irrigation district based on 1974 conditions it has been determined that significant reduction in salt loading could be achieved by water systems improvement. An estimated 88,500 tons (80,300 t) of salt load reduction could be achieved by improving the on-farm irrigation efficiency to 60 percent and by lining the laterals within the Palo Verde Subarea.

3. Utilization of Return Flows.--The San Diego Gas and Electric Company (SDG&E) had proposed to build the Sun Desert nuclear powerplant on the Palo Verde Mesa adjacent to the Palo Verde Irrigation District. The SDG&E powerplant would have obtained 17,000 acre-feet ($21 \times 10^6 m^3$) of cooling water via the Metropolitan Water District, and from those municipalities participating in the powerplant, and by retiring land within the Palo Verde Irrigation District to obtain water that was used to irrigate the land. The Sun Desert Powerplant would have used outflow from the irrigation district in exchange they would let the water they could have diverted from the Colorado River pass downstream. The Sun Desert Powerplant would have reduced the salt discharge from the district in two ways: (1) use of drainage water from the district which is at approximately 1,700 ppm in exchange for nonuse of 700 ppm Colorado River water; (2) reduction in irrigation would reduce deep percolation and the associated flushing of salts from the soil. The plans for construction of the powerplant have been halted because necessary approval of the State of California could not be obtained.

2. Point Source Control Projects

The four units in the following section have been identified as point source contributors of salt to the Colorado River. They are thermal springs that discharge high concentrations of dissolved salts.

LaVerkin Springs Unit.--LaVerkin Springs, located on the Virgin River in the southwestern corner of Utah, contribute an average salt load of 109,000 tons (98,900 t) per year with a flow of about 11.5 ft^3/s (0.325 m^3/s) that has total dissolved solids averaging 9,650 mg/l. A feasibility report of a plan for collecting and desalting the springs was forwarded to the Commissioner's Office in December 1974. A reformulation of the LaVerkin Spring Unit under the Water Resource Council Principles and Standards of Water Resource planning is scheduled for completion in 1979.

The LaVerkin Springs Unit studies for controlling the salt discharges from this point source are evaluating all reasonably practical means for abating the salt pollution of the springs. The investigations included: locating various potential sites and developing plans for evaporating all of the spring discharge; evaluating the possible industrial uses for the water; determining the potential for deep well injection of the spring water; studying alternative methods of collecting the springflow; and determining the cost of desalting using various methods now technically operational. The effect on the environment was evaluated for each of the potential control methods.

Early results from the new studies indicate that the project plan will involve collecting and desalting the LaVerkin Springs. The desalting plan would use a bypass system, consisting of two small diversion dams and a bypass pipeline, to divert the river aound the springs and collect the spring water. Spring flows would be pumped to a reverse osmosis desalting plant. About 6,330 acre-feet (7.81 x $10^6 m^3$) per year of product water would be returned to the river and 2,300 acre-feet (2.84 x $10^6 m^3$) of brine would be pumped to a solar evaporation pond. It is anticipated that upstream diversion rights can be purchased to replace brine loss so that in essence there would be no stream depletion caused by the project. A salt load of 103,000 tons (97,000 t) per year would be removed from the stream, which would reduce the salinity of the river by 9 mg/l at Imperial Dam. The total effect of the LaVerkin Springs Unit may not be immediately apparent because a part of the discharge appears to contribute to the source of Littlefield Springs which may take many years to surface.

Littlefield Springs Unit.--Littlefield Springs are a widely scattered group of springs located along the Virgin River upstream from Littlefield, Arizona. Littlefield is in the extreme northwestern part of Mohave County about 3 miles (5 km) east of the Nevada State line and 5 miles (8 km) south of the Utah State line. The principal communities in the vicinity are Littlefield, Arizona, and Mesquite and Bunkerville, Nevada. St. George, the largest community in the area, is located 28 miles (45 km) upstream from the springs.

Feasibility studies on the unit were started in 1974. The area studied included the reach of the Virgin River from where it enters the

"First Narrows" canyon above the Arizona-Utah State line to the vicinity of Littlefield. The relationship between the Virgin River and saline springflows in the Littlefield, Arizona, area is complex and not completely understood. As the river enters the rugged canyon near the State boundary between Utah and Arizona, it loses up to 70 ft^3/s (1.98 m^3/s) of its flow to the alluvium of the bed. During periods of low flow, from May to October, the entire Virgin River flows are lost into the alluvium and the river is dry. The upwelling springs in the lower end of "The Narrows" canyon and the stream gain in the area appear to originate from the flows lost by the river at the upper end of the canyon. However, the flows have been modified in that the springs have a nearly uniform year-round salt concentration and are thermal in nature with a temperature of about 78° F (26° C).

During the summer months the Littlefield Springs supply almost the entire agricultural water supply for the farming communities of Littlefield, Arizona; Mesquite, Riverside, and Bunkerville, Nevada. The area below the Littlefield Springs discharge area is also one of the last remaining habitats of the endangered woundfin minnow. As a result of of these and other considerations the Littlefield Springs Unit investigation has been expanded to include the entire Lower Virgin Rive from just above the Littlefield Springs discharge to Lake Mead and has been renamed the Lower Virgin River Unit.

Lower Virgin River Unit.--The Lower Virgin River Unit investigation began in 1978. The investigation has identified at least two different alternative plans. The Clark County Nevada 208 planning staff has submitted a plan of water systems improvements and increasing irrigation efficiencies which would reduce the salt loading of the irrigated areas in the Mesquite, Bunkerville, and Riverside Nevada area. The Bureau has submitted a plan to collect saline ground water under flow within the stream alluvium under the Virgin River during the low flow months at a location below the irrigated areas. The reach of river below the irrigated areas is dry during low flow months because of irrigation diversions and infiltration of water into the stream alluvium. The investigation of Lower Virgin River Unit is scheduled for completion at the end of the 1981 fiscal year.

Blue Springs.--The Blue Springs area is located on the lower portion of the Little Colorado River within the Navajo Indian Reservation of north-central Arizona. The springs contribute an average of 160,000 acre-feet (197 x $10^6 m^3$) per year which have a collective salinity of 2,500 mg/l and a total salt load of about 550,000 tons (500,000 t) per year.

The lower portion of the river flows through a meandering canyon of about one mile (1.6 km) in width and half mile (0.8 km) depth. The walls of this rugged gorge are a series of nearly vertical cliffs of massive limestone and sandstone separated by steep slopes or benches of shale, siltstone, or thin-bedded sandstone. The bottom can be reached near Blue Springs only by a rugged foot trail from the rim or by helicopter. The springs originate from ground water which moves into the area from the east and south and emerges as springflows where the canyon has penetrated the Redwall and Mauv limestones below the regional water table. There are many spring openings along two relative well-defined reaches.

The spring flows are clear, salty, slightly acidic, and from 65° (18° C) to 70° (21° C) F. Chemically, they are typically sodium chloride water, with secondary concentrations of calcium bicarbonate. Large amounts of calcium carbonate precipitate to form a fine white mud on the bottom of the stream.

Full-scale feasibility studies for this project are not planned due to the expected high capital cost of the project and environmental problems resulting from the significant historical and religious value of the area to the Hopi Indians.

Glenwood-Dotsero Springs Unit.--The largest point source contributors of dissolved solids to the Upper Colorado River are in the river between the mouth of the Roaring Fork River at Glenwood Springs and the mouth of the Eagle River near Dotsero. These contributions are from thermal springs rising in or near the bed of the river and from ground water entering this reach of the river. Inflow-outflow measurements indicate this reach of the river contributes approximately 25,000 acre-feet ($30 \times 10^6 m^3$) of water containing over 500,000 tons (454,000 t) of dissolved solids annually. Based on a 5-year period of data collection, the springs that could be identified and measured have a combined flow of about 16 ft^3/s (0.453 m^3/s) and an average dissolved mineral content of approximately 14,200 mg/l. These identified flows would carry about 250,000 tons (227,000 t) of dissolved solids into the Colorado River annually.

Although only very generalized geologic data are available on the Glenwood and Dotsero Springs and an extensive exploration program will be necessary to delineate the geology and hydrology, early studies have led to the assumption that ground water in the area travels along faults or related fracture zones, dissolves out salts principally from the Paradox Formation, becomes heated by deep-lying intrusive bodies, and returns to the surface as warm, saline springs.

During the preliminary studies to date, several methods of disposing of or treating the saline water have been considered. Methods that could be used to control or eliminate point source flows include evaporative ponds, deep-well injection, diversion for industrial use or various types of treatment plants. After cursory evaluation of each of the alternatives, some type of treatment plant to remove the bulk of the salts is being evaluated in more detail. In addition, this would be the only solution that could salvage the fresh water for return to the Colorado River.

An Appraisal Report was issued in June 1976. The Feasibility Report is scheduled for 1983.

3. Diffuse Source Control Projects

This method of control deals with salt loading or concentrating effects that occur over comparatively large areas such as the tributary subbasins. The techniques available for control include collection, desalting, evaporation, special use, watershed management, and vegetative control.

Big Sandy River Unit.--The Big Sandy River originates in the Wind River Mountains of west central Wyoming and flows southerly to the Big Sandy Reservoir and Dam where most of the flow is diverted to irrigate the Eden Project. From Big Sandy Dam, it flows southwesterly to the Green River. Near the mountains, the water is of high quality containing less than 50 mg/l of dissolved solids. After flowing across several miles of desert, the dissolved solids increase to 70-120 mg/l at Big Sandy Reservoir. Below Big Sandy Dam it picks up the irrigation return flows from the Eden Project and many saline seeps along the river channel. The Big Sandy River annually discharges approximately 180,000 tons (163,000 t) of dissolved solids at concentrations ranging from 300 to 3,900 mg/l to the Green River. The climate is cold and dry in the winter with minimum temperature often -40° (-40° C) F. The summers are dry and mild with maximum temperatures only occasionally getting above 90° (32° C) F.

Because of the low winter temperatures, it was thought that natural freezing methods might be used to desalt low flows of the Big Sandy River. A test of natural freezing conducted during the winter of 1973-74 indicated that a product water with a concentration of less than 100 mg/l could be produced from a saline water. The test showed, however, that a source of heat was needed to prevent the spray nozzles from freezing and a impervious lining would be needed to line the holding ponds and the areas of ice.

Subsequent investigations have shown that the saline seeps come from an aquifer of up to 60 feet (18 m) below the river. It appears that a confined aquifer extends to the east of the Eden Irrigation Project. Quality of the water in the aquifer varies from about 2,000 mg/l to 6,500 mg/l where it surfaces along the stream. Twenty to thirty ft^3/s (.57 to .85 m^3/s) seeps into the channel along the 15 mile (25 km) reach. It is estimated that the seeps contribute over 100,000 tons (91,000 t) of salt annually.

Pumping test wells indicate that the saline water could be intercepted before seeping into the River. However, the quantity and quality of the water presently available from the Green River will satisfy industrial requirements in the area so use of the saline flows by industry does not appear feasible at the present time. It is estimated that 80,000 tons (73,000 t) annually could be removed by treatment, but, up to 6,000 acre-feet (7.4 x $10^6 m^3$) of water might be evaporated as brine. This would reduce the salinity concentration by about 7 mg/l at Imperial Dam. Investigations have not advanced sufficiently to prepare an estimate of cost. The feasibility report is scheduled for 1984.

Price, San Rafael, and Dirty Devil River Units.--The Price, San Rafael and Dirty Devil Rivers originate in the mountains of the Wasatch and Aquarius Plateaus and provide tributary flows to the Green and Colorado Rivers in east-central Utah. Elevations in these river systems range from about 4,000 feet (1,200 m) above sea level on the Colorado River to over 11,000 feet (3,400 m) above sea level in the mountain ranges and high plateaus to the west. Drainage areas contain 1,500, 1,670, and 4,200 square miles (3,900, 4,330, and 10,900 km^2) for the Price, San Rafael, and Dirty Devil Rivers, respectively. These study areas are principally desert, with an arid to semiarid climate. The summers are hot and dry and the winters are usually dry and cold. Temperatures range from over 100° (39° C) F in summer to well below zero (-20° C) in the winter. For example, Hanksville, Utah, has recorded a high temperature of 112° (44° C) F and a low of minus -35° (-37° C) F. Snowfall is generally light and amounts to only a few inches during the winter season, except at the higher elevations, where substantial amounts accumulate on the ground.

The geological formations in these river basins consist primarily of sedimentary rock. About 60 percent of the Dirty Devil drainage and 75 percent of the Price and San Rafael drainages are composed of mudstones, claystones and shales which could be the main source of salt pickup in these rivers. Much of the irrigated lands are located on these salt-producing formations particularly in the upper portions of the Price and San Rafael drainages.

The estimated total dissolved solids contributed by the Price, San Rafael, and Dirty Devil Rivers are 240,000, 190,000 and 200,000 tons (218,000 t, 172,000 t, and 181,000 t), respectively.

The estimated annual removal of salt by potential control programs are 100,000 tons (91,000 t) on the Price River and 80,000 tons (72,000 t) each for the San Rafael and Dirty Devil Rivers. Salinity concentrations of the Colorado River at Imperial Dam would be reduced by an estimated 10 mg/l for the Price River and 8 mg/l for each of the San Rafael and Dirty Devil Rivers. Depletions of flow by the salinity control projects would also reduce the estimated effects at Imperial Dam.

Investigations thus far have consisted of limited field surveys and data gathering. Streamflow and water quality data are being obtained at several locations on each of the rivers. These data and future investigations will locate areas of greatest salt loading. Further studies will be made to determine if other methods such as water systems improvement, irrigation scheduling and farm management could be used along with selective withdrawal.

Additional sampling stations will be established as needed in conjunction with geologic investigations of each drainage basin.

Data gathering will continue. Feasibility reports are scheduled for 1985. Investigations have not progressed sufficiently to provide an estimate of costs.

Control of the salt loading from these diffuse sources could have the following environmental impacts; some degradation of natural scenery would result from construction of diversion dams and evaporating ponds or desalting plants. The accumulation of salts in the evaporating ponds may become scattered by wind or may be accidentally discharged into the Colorado River system. Water diverted out at low flows may result in some adverse effects downstream to plant and animal life.

McElmo Creek Unit.--McElmo Creek drains 350 square miles (906 km^2) which includes the irrigated area in Montezuma Valley in Southwestern Colorado and flows into the San Juan River a few miles below the Colorado-Utah State line. The lands in Montezuma Valley are irrigated with water diverted from the Dolores River. Irrigation return flows from Montezuma Valley contribute a substantial amount of salt to McElmo Creek and Mud Creek, a tributary of McElmo Creek which drains the southern part of the valley. The land is derived from and underlain by Mancos shale, a saline and impervious marine foundation.

Data collected starting in 1972 on McElmo Creek at the Colorado-Utah State line indicates an average annual salt load of 120,000 tons (110,000 t).

An extensive data collection program is underway to try to identify the cause of the salt loading and possible methods of reducing the salt load. Various planning teams provide a mechanism for input from the public and governmental agencies in the selection of a plan. Public meetings are held regularly in the project area to allow th public to comment on alternative plans being investigated and to provide input on the selection at a recommended plan.

The planning study has not progressed far enough at this time to array potential alternatives; nor is the available data adequate to support an estimate of salinity reduction that would result from a potential alternative. Presently it is impossible to determine what the eventual recommended plan might be. A feasibility report is scheduled for 1982.

Meeker Dome Unit.--The Meeker Dome, site of the Meeker Well and several other abandoned wells, is a local anticlinal uplift located in northwestern Colorado, 3 miles (5 km) east of the town of Meeker and on the right bank of the White River.

The Meeker Well, originally drilled for oil exploration purposes and abandoned in 1915, was identified as a significant point source of salinity in the Colorado River system. In 1968, before the well was plugged to a depth below 550 feet (170 m), it was flowing at a rate of about 3 ft^3/s (0.08 m^3/s), and its highly saline water (19,200 mg/l) was increasing the Colorado River's salt load by about 57,000 tons (52,000 t) per year.

In February 1969 two abandoned wells, 2 miles (3 km) north of Meeker Well, were reported to be flowing saline water. These wells were also plugged in October 1969. In the late summer and fall of 1969, seepage appeared in four areas within a 1-mile (1.6 km) radius of the plugged Meeker well.

Two years of data collection (1973-74) indicate that the seepage is continuing and that variable loads of salt are being transmitted into the White River and consequently into the Colorado River.

One possible solution to eliminate the salinity problem in this area would be to redrill the Meeker Well and attempt to plug it at a much greater depth. Other possible solutions would be to collect the seeps that are occurring in the area, or to redrill the Meeker Well and collect its flow and provide some type of treatment before it reaches the Colorado River, or to utilize the water for other purposes.

Feasibility studies on the Meeker Dome Unit are being conducted under the Federal Water Pollution Control Act of October 18, 1972 (Public Law 92-500) and the Colorado River Basin Salinity Control Act of June 24, 1974 (Public Law 93-320).

A search of available geologic and hydrologic literature was completed in December 1976 to aid in determining appropriate actions to control this point source of salinity. Thermal imagery of the area was made by the State of Colorado two years ago and copies have been ordered by the E&R Center.

A contract will be negotiated in the next few months with a private engineering firm to investigate and prepare plans to reduce the salinity contribution of the Meeker Dome Unit. Studies will be conducted in accordance wth the Principles and Standards and a multidisciplinary team will be organized in the near future. The Feasibility Report and a Draft Environmental Statement are to be completed in 1982.

PART IX. OTHER WATER QUALITY ASPECTS

Although salinity is considered to be the most serious water quality problem in the Colorado River Basin, there are a number of other water quality problems of varying degrees. The following sections include discussion of the most significant sources of water quality degradation exclusive of salinity and the effects of such degradations on water uses as measured by various parameters. The EPA and States have largely controlled the discharge of pollutants through issuances of permits through the P.L. 92-500, Section 402 program. In addition, Section 404 of P.L. 92-500 requires permits to be issued by the Corps of Engineers for discharge of dredged or fill material.

A. Pollution Sources Other Than Salinity

1. Municipal Wastes

Municipal wastes are described herein as those liquid-carried wastes of domestic and service industry origin. Within the Colorado River Basin the majority of the discharges from waste water treatment plants enter the river system and are the primary sources of bacteriological and organic pollution. Most of the municipal waste sources in the basin receive secondary treatment plus disinfection which is the minimum degree of treatment required by the Basin States.

Municipalities are required to have their waste discharges meet water quality standards set by the States. At the present time, any pollution from municipal waste sources is confined to those reaches of stream immediately downstream of the waste effluent, and measures are being enforced by the State and Environmental Protection Agency for the control or abatement of pollution from these sources.

2. Industrial Wastes

Industrial wastes are defined as those spent process waters, cooling waters, wash waters, and other waste waters associated with industrial operations. The principal pollutants derived from industrial wastes other than salinity are toxic materials, oils and grease, floating materials, radioactivity, organic and oxygen-demanding substances, heat, color-, taste-, odor-producing substances, and bacteria.

With the establishment of water quality standards and compliance schedules for the implementation of these standards, the pollution from industrial waste sources in the basin has been or is being abated or controlled.

3. Agricultural Wastes

Except for salinity, pesticides and fertilizers are the primary water pollutants associated with agriculture in the Colorado River Basin. Here again the Environmental Protection Agency and States have been endeavoring to control the discharge of these pollutants into the waterways. (Discharges from irrigated agriculture return flows, however, do not require a section 402 NPDES permit nor does a discharge or dredge or fill material from normal farming require a section 404, PL 92-500, Army Corps of Engineers Permit.)

The chlorinated hydrocarbon group, e.g., DDT and Toxaphene, are the most persistent pesticides and are of primary concern because of their long-range impact. Efforts are being made, however, to control use of these types of pesticides. The organic phosphate compounds do not persist in the environment for the period the chlorinated hydrocarbons do, but they are more toxic to fish and humans.

Nitrogen and phosphorus fertilizers are the most commonly used in the basin. Studies conducted in other areas of the United States show a relationship between the concentrations of nutrients from agricultural lands and water quality problems caused by excessive fertiliziation of aquatic plants. Within the Colorado River Basin the animal waste pollution is minimal because outside surface water has been prevented from entering the feedlots either by directing the drainage away from the operation or by locating the facility in a favorable topographic position. Additional discussion of toxic materials and nutrients are presented later in sections 5 and 6 Part IX.

4. Mine Drainage

During the period 1966 to 1968 approximately 75 locations were sampled to determine the heavy-metal concentrations contributed by mine drainages, tailing piles, and natural sources within the Colorado River Basin. Since that time the States and the Environmental Protection Agency have been endeavoring to control the pollution from these sources.

B. Water Quality Parameters Other Than Salinity

Detailed information concerning the following parameters can be obtained from results of special studies made in the various reaches of the Colorado River Basin. Some of these studies are mentioned in Part X.

1. Dissolved Oxygen

The dissolved-oxygen concentration is a measure of the water capacity to support life and assimilate organic wastes. The records show that the dissolved-oxygen concentrations in the Colorado River Basin are generally above established standards. A marked reduction in the concentration can be found during the summer months, however, below some municipal and industrial discharges and in some streams with very low flows. A 1966 investigation indicated that there might be a wide diurnal variation in the oxygen concentrations in some reaches because of the large amount of algae in the streams with oxygen saturation being reached during a sunlit day and minimal concentration occurring at night when oxygen is used by the plants. Samples also have indicated that at some of the lower depths in Flaming Gorge Reservoir anaerobic conditions exist. Releases are made, however, through the powerplant at higher elevations where the oxygen content is greater, thus maintaining sufficient oxygen in the stream below for fish life.

2. Temperature

The Colorado River Basin water temperatures vary widely, reaching the greatest difference during the summer months when they vary from near freezing in the high mountains to above 90° F (32 °C) in the lower reaches. Warmer temperatures may increase the rate of growth and decomposition of organic matter and of chemical reactions, resulting in bad odors and tastes, and also decrease the dissolved oxygen concentration available to sustain a fishery.

Changes in water temperature in the basin result primarily from natural climatic conditions. The large reservoirs, however, may affect the stream temperatures for a considerable distance below the reservoir. Temperature records indicate that Flaming Gorge Reservoir has little effect on winter temperatures but cools the summer temperatures of the Green River up to 5° F (3 °C) at the Green River, Utah, station. The temperature immediately below Flaming Gorge Dam had been too cold for maximum growth and propagation of fish life. Modification of the outlet works has recently been completed to improve this condition. The effect of this modification remains to be seen. Navajo Reservoir appears to have no effect on the temperatures of the San Juan River at the near Bluff station. Lake Powell appears to warm the winter temperatures of the Colorado River at the Grand Canyon station by up to 10° F (6 °C) and cool the summer temperatures by about the same amount.

Thermal springs, wastewater discharges, and irrigation return flows may increase the temperatures in the receiving water, but the added heat is usually dissipated in a relatively short distance from the source. Flow depletions and changes in stream channel characteristics may also increase the effects of natural climatic conditions causing cooler or warmer water temperatures.

Temperature increases due to municipal and industrial waste discharges have been minimal; however, the construction of large thermal powerplants in the basin with a return of the cooling water to the streams or reservoirs could present a potential for temperature increase. For this and other water quality reasons most of the cooling water discharges from future fossil fuel powerplants will not be allowed to return to the rivers.

3. pH

The pH of the waters in the Colorado River Basin usually range from about 7 to 8. Formerly there were a number of streams receiving acid mine drainage. In these cases the pH was lowered to levels which precluded the establishment of aquatic life and the use of the river for fishery and other purposes. Much of these conditions, however, have been corrected by controlling the mine discharges.

4. Heavy Metals

Various heavy metals such as copper, lead, zinc, iron, manganese, arsenic, selenium, and cyanide are found in the waters of the basin. These have varied from trace amounts to potentially hazardous levels. The presence of these heavy metals is generally contributed by drainage from active and inactive mining operations.

Iron, arsenic, cadmium, selenium, and manganese concentrations occasionally exceed the Public Health Drinking Water Standards in some basin streams. This is particularly evident in the upper reaches of the Colorado, Uncompahgre, and San Juan Rivers and their tributaries. It has been determined that heavy metal concentrations have a marked effect on the aquatic life. Certain reaches of stream have been completely devoid of bottom organisms and fish because of these toxic effects. Approval of the Section 404 permit for the Ridgway Dam, Dallas Creek Project, required a monitoring program to determine the effects of the reservoir on the heavy metals found in the Uncompahgre River. Heavy metals monitoring has also been done on the Dolores Project as well as other projects in the basin.

5. Toxic Materials

In addition to the toxic effects of heavy metal concentration, toxic materials are also contributed to the stream through industrial and agricultural operations. Limited long-term monitoring at four surveillance stations located on the Colorado River has in the past detected the pesticides DDD, DDE, DDT, dieldrin, and endrin. A comprehensive evaluation of the effects of pesticides upon water quality cannot be made at this time because of the lack of sufficient water quality data and incomplete knowledge of the physiological and other effects of pesticides in human, wildlife, fish, and other biological forms. The mere presence of a pesticide in water does not necessarily indicate serious pollution. Pesticides were tested for in samples of fish flesh and water taken from the Wahweap and San Juan River arms of Lake Powell. Pesticides found included DDD, DDE, and DDT. All levels were well below the limits set by the Food and Drug Administration.

The Bureau of Sport Fisheries and Wildlife also ran pesticide tests on fish flesh taken from Imperial Reservoir and Lake Havasu. Their results were very similar to those from Lake Powell.

6. Nutrients

Nutrients, primarily nitrogen and phosphorus, are believed to be the most conducive to the growth of algae. The sources of these nutrients are runoff from agricultural lands, municipal and industrial waste waters, and natural runoff. Phosphorus is normally found in only limited quantities in unpolluted water and the major contribution in the Upper Basin appear to be from natural rather than agricultural sources. Sufficient nitrogen is generally available naturally in basin waters to stimulate algae growth.

Las Vegas Wash flows into Las Vegas Bay, an arm of Boulder Basin of Lake Mead, and carries large loads of phosphorous and nitrogen. The principal sources of water in the Wash are effluents from the Clark County sewage treatment plant and the Las Vegas City sewage treatment plant, which make up between 85-95 percent of the total flow. These sources contribute about 80 percent of the nitrogen and 99 percent of the phosphorous loading found in the Wash.

Several investigators have concluded that the nutrients carried in the effluent from Las Vegas Wash contribute to the euthrophication and degradation of Lake Mead. Nitrogen and phosphorous loads entering the Lake through Las Vegas Wash total 600 and 150 tons (540 to 140 t) per year, respectively. Chlorophyll A values (an indicator of algae mass) have been measured in Las Vegas Bay which are 20 to 25 times greater than comparable measurements in the main body of Boulder Basin.

The Environmental Protection Agency has identified these nutrients as a cause of water quality degradation in Las Vegas Bay and, therefore, causing a violation of the nondegradation provisions of the applicable State-Federal water quality standards for Lake Mead and the Colorado River. A notice of violation was issued to the municipalities and industries discharging waste water into the Wash.

The nutrient load entering Lake Mead from the Wash has increased as the municipal discharges to the Wash have increased. An advanced wastewater treatment plant is now under construction which would strip the phosphate from the effluent.

In the lower reaches of the Colorado River aquatic plant growths have been associated with fertilization by nutrients discharged to irrigation drains. A small increase in the nutrient levels in the river has been attributed to heavy recreational activities along the river below Davis Dam.

7. Bacteria

The coliform group of bacteria is used as an indicator of pollution. This group is made up of bacteria of diverse origin including that found in the intestinal tract of humans and other warm-blooded animals as well as in the soil and on vegetation. High coliform counts in waters indicate the probable presence of pathogenic organisms where bacterial contamination from sewage or animal wastes appears likely. This, however, is only an indicator.

In more recent years, analytical procedures have been developed whereby coliform bacteria of fecal origin can be identified. Fecal coliform tests measure bacteria from both man and animal. All the States of the basin have set standards for fecal coliform as the bacterial indicator of pollution.

High bacterial counts were observed at many locations in the Colorado River Basin during the 1966 water quality study. A number of these resulted from raw sewage discharges into a stream and some was because of poor disinfection of the municipal wastewater treatment plant effluents. The raw sewage discharges which were observed during the 1966 survey have been corrected by the addition of ponding or other treatment.

Bacteriological pollution has also been observed in popular recreation areas. For example, the fecal coliform densities in Lake Mead have been observed at densities higher than the standards set for body contact recreation.

Bacteriological pollution has an effect on most of the uses cited earlier. In those cases where it exceeds the criteria set for body contact recreation, it results in the closure of swimming areas. With high coliform counts, the use of water as a public water supply could be impaired.

8. Radioactivity

An assessment of the radioactivity in the basin waters should also consider strontium 90 (Sr-90) radionuclides associated with atmospheric fallout in addition to radionuclides associated with industrial activities. Strontium 90, like the radionuclide Ra-226, is damaging to human bone cells. The effects of Ra-226 and Sr-90 are additive.

Radioactive pollution from industrial wastewater effluents, i.e., uranium mills, was, prior to 1960, the major source of radioactive pollution in the basin. The majority of the mills have been closed down but a significant portion of the increase of radioactivity originates from the abandoned tailings piles.

Radioactivity does impair the water for beneficial use when concentrations exceed certain limits. For example, the National Interim Primary Drinking Water Regulations stipulate mandatory limits of 8 picocuries/l for Sr-90 or 5 picocuries/l for combined Ra-226 and Ra-228 in community water systems. Maximum contamination levels such as these are derived on the basis that an individual ingesting two liters of water daily will not receive an annual dosage to the body or any internal organ of more than 4 millirems. Moreover, if two or more radionuclides are present in the water supply, the sum of their dose equivalent must not exceed the 4 millirem per year limit.

9. Mercury

A report by the Lake Powell Research Project on mercury[8] published in 1973 and reprinted in 1975 gives the following information.

Samples analyzed by the flameless atomic absorption method showed that mercury levels in mean parts per billion (mg/l) were .01 (.00001) for the lake water, 30 (.030) in bottom sediments, 10 (.010) in shoreline substrates, 145 (.145) in plant debris, 34 (.034) in plant leaves, 28 (.028) in algae, 232 (.232) in fish muscle and 10 (.010) in crayfish. The concentrations were based upon a wet-weight condition for the animals and a dry-weight basis for the rest of the samples. It was found that the mercury content was higher in the sediments with the higher organic content and that the lake transported plant debris had higher contents than the shoreline plants. In the rainbow and brown trouts, bloody tissues had higher mercury levels than the muscles while in the six other species analyzed the levels of bloody tissues heart, kidney, liver, etc., were lower than the muscles. Larger fish of a given species and fish of higher trophic levels have higher mercury concentrations, with the muscle of some large walleye and largemouth bass exceeding the 500 ppb. (.50 mg/l) guideline of the U.S. Food and Drug Administration.

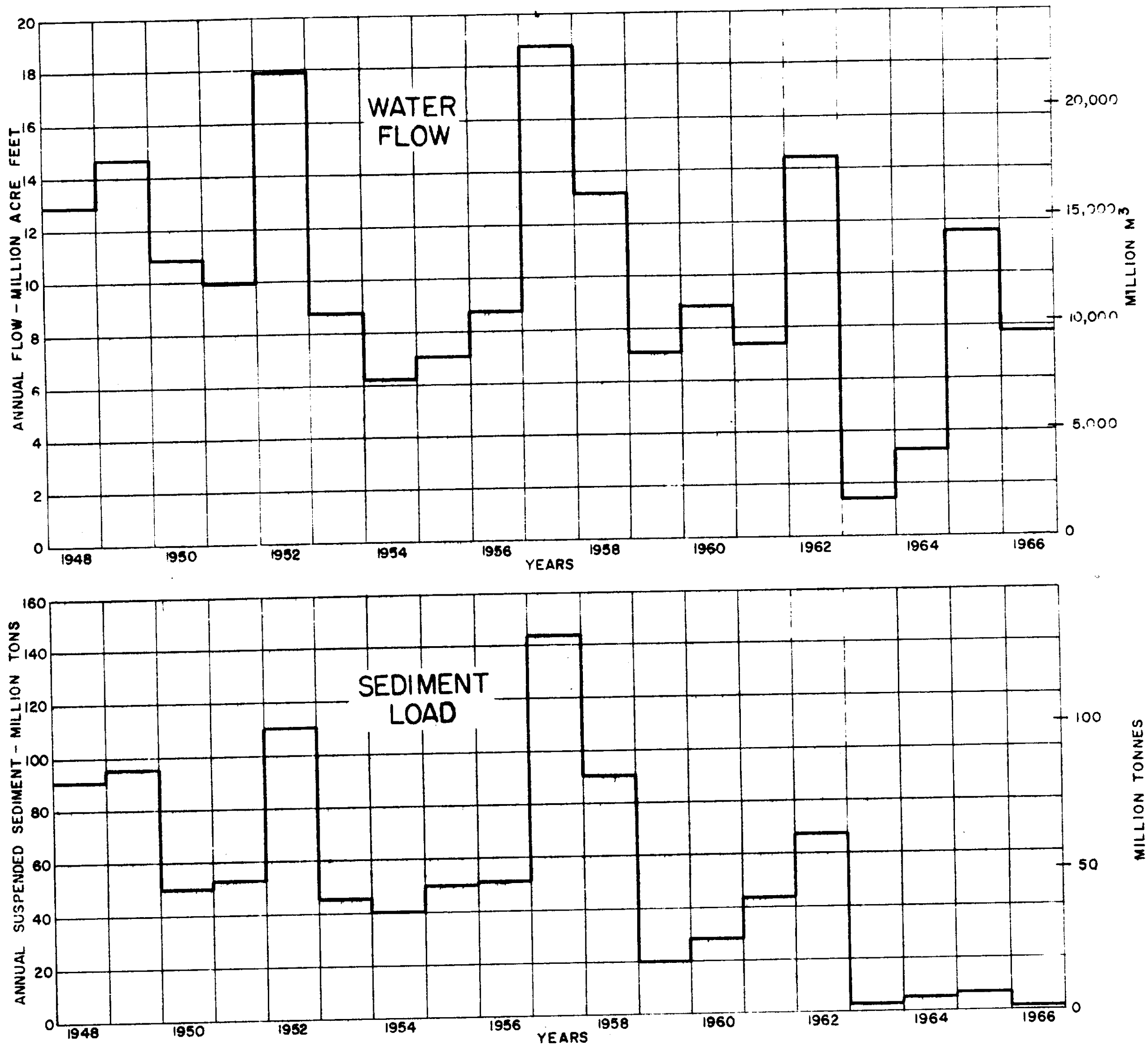
An estimated mercury budget suggested that due to the restriction of flow by the impoundment, the mercury could be accumulative.

10. Sediment

Prior to construction of the storage units of the Colorado River Storage Project, most of the larger tributaries and the main stem of the Colorado River carried large loads of sediment, particularly in their middle and lower reaches.

For example, in 1957 the suspended sediment load of the Colorado River at Lees Ferry, Arizona, gaging station was recorded at 143 million tons (130 million tonnes). This sediment was detrimental to water diverters for consumptive use as well as to high-type fishery and other recreational uses. The construction of Fontenelle, Flaming Gorge, Curecanti Unit, Navajo, and Glen Canyon Dams has produced dramatic changes in the sediment load transported by these streams. For example, the relationship between the water and sediment flows at Lees Ferry during the 1948-66 period is illustrated in Figure 5. In 1959 the cofferdam utilized in the construction of Glen Canyon Dam was finished and diversions began through the tunnels. Sediment was deposited behind the cofferdam in 1959 and 1960 at a sufficient rate to gradually fill the cofferdam lake with the result that by 1962 the annual sediment load at Lees Ferry had increased to 67 million tons (61 million tonnes). This load dropped to 2.2 million tons (2.0 million tonnes) in calendar year 1963 with the closure of Glen Canyon Dam and initial storage in Lake Powell. Lake Powell and other Colorado River Storage Project reservoirs are now effectively trapping and storing almost all of the sediment originating in the Upper Colorado River Basin. Lake Powell and the other Upper Basin Reservoirs trap approximately 75 to 80 percent of the sediment that normally would flow into Lake Mead. By storing the sediment in the Colorado River Storage Project reservoirs, the streams immediately below the dams have been changed to relatively clear trout water fisheries as well as desirable boating and recreational areas. Daily sampling at Lees Ferry was discontinued beginning in water year 1966 because of the lack of sediment.

A comparison of the major portion of the inflowing sediment and flow into Lake Powell with the outflow was made by plotting for a number of years the sum of the sediment loads and flows of the Colorado River near Cisco, San Juan River near Bluff, and Green River at Green River, Utah, stations. This is shown in Figure 6 as compared to the outflow as shown by the Lees Ferry record in Figure 5.



UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

COLORADO RIVER
AT LEES FERRY
SEDIMENT & WATER FLOW

Fig. 5

COMBINED COLORADO RIVER NEAR CISCO
GREEN RIVER AT GREEN RIVER, UTAH
AND SAN JUAN RIVER NEAR BLUFF

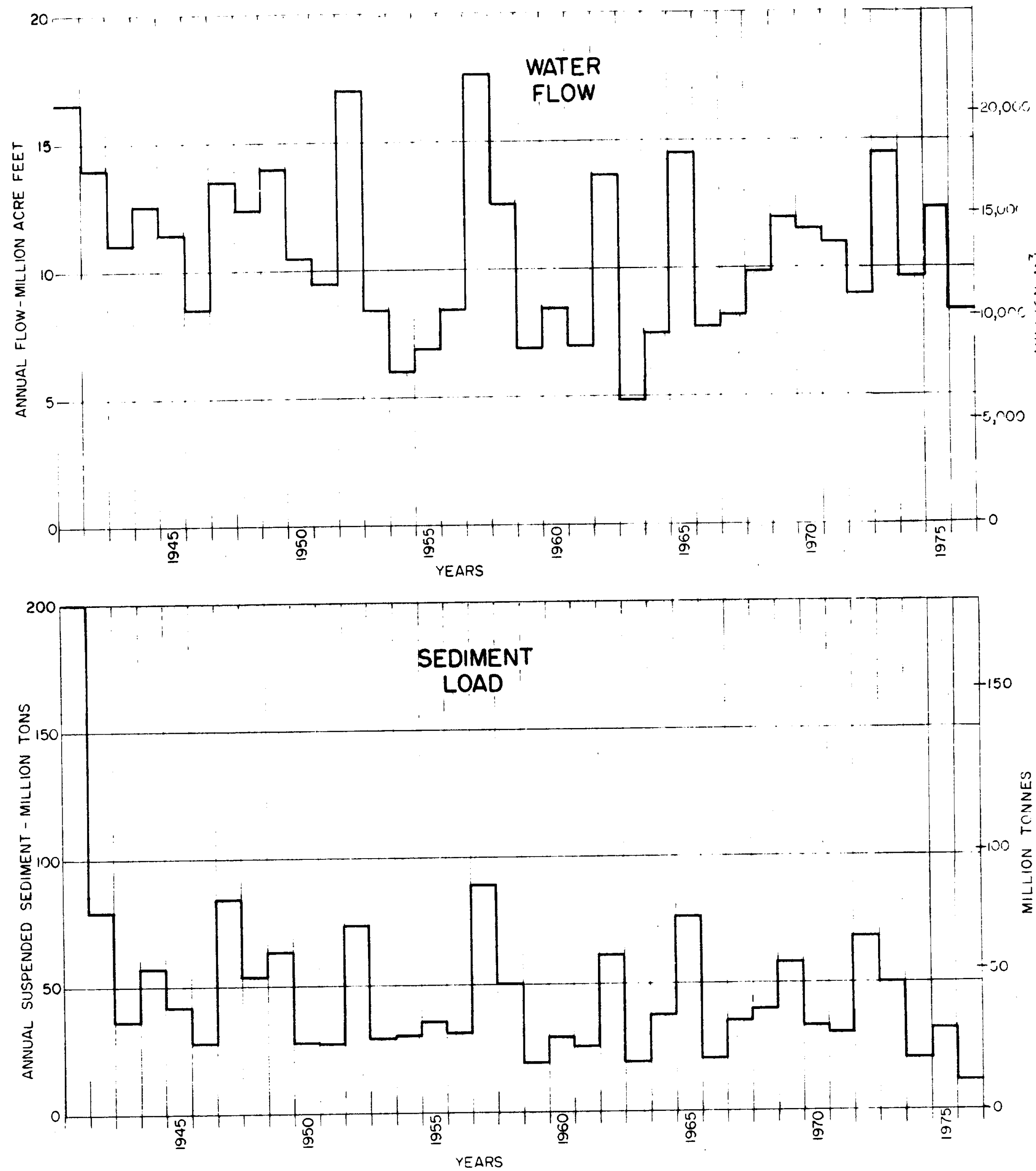


Fig. 6

PART X. SPECIAL STUDIES

A. Geologic Factors that Affect Salinity in the Upper Colorado River Basin

In 1977 the U.S. Geological Survey compiled a report for the Bureau of Land Management that describes the effects of geology in the Colorado, Utah, and Wyoming parts of the Upper Colorado River Basin on salinity in the river system (U.S. Bureau of Land Management, 1978, p. 15-23).[(2)] A summary of that report, revised to include the Arizona and New Mexico segments of the Upper Basin, is given below.

1. Stratigraphy

The source of nearly all the dissolved ions (salinity) in water that enters the Colorado River is the mineral assemblage of the rocks that underlie its drainage basin. Mineral constituents are taken into solution by both overland runoff and ground water runoff (the ground water component of streamflow). The slower moving ground water, having longer contact with the rocks before discharging to streams, dissolves larger amounts of mineral constituents than does overland runoff. The ground water, therefore, contributes significantly to natural salinity of the streamflow.

Principal properties of rocks that affect the natural salinity of water that flows over or through them include their mineral composition, texture, and permeability. These properties are related to the origin, age, and degree of deformation and induration of the rocks.

Some sedimentary rocks of marine and lacustrine origin commonly contain widespread accumulations of such highly soluble minerals as gypsum and halite; whereas most igneous, metamorphic, and sedimentary rocks of terrestrial origin are composed largely of less soluble minerals such as quartz and various silicates. Consequently, runoff from certain rocks of marine and lacustrine origin (especially the shale, mudstone, and marlstone strata of Mesozoic and Cenozoic age) generally has a higher salinity than does runoff from most igneous and metamorphic rocks or sandstone strata of terrestrial origin.

Fine-textured rocks afford more surface contact to water that flows over or through them than do coarse-textured ones. Runoff from fine-textured rocks (such as shale or siltstone) therefore has more opportunity to dissolve mineral constituents, and such runoff generally has a higher salinity than does runoff from coarse-textured rocks (such as conglomerate or coarse-grained sandstone).

Rocks of low permeability will, under equal head, transmit water more slowly than those of high permeability. Water that flows through rocks of low permeability (such as shale or siltstone) has more time before discharging to streams to dissolve mineral constituents than does water that flows through rocks of high permeability (such as fractured sandstone). Ground water runoff from rocks of low permeability is more saline and adds more to the salinity of streams than does ground water runoff from rocks of high permeability.

A large variety of geologic formations ranging in age from Precambrian to Holocene crops out in the Upper Colorado River Basin. They include various types of igneous, metamorphic, and sedimentary rocks of both continental and marine origin. Igneous and metamorphic rocks of Precambrian and Cenozoic age mostly granite, quartzite, schist, gneiss, basalt, and associated volcanic rocks are widely exposed in the higher mountains of the basin, as are many marine sedimentary rocks of Paleozoic age, which consist largely of limestone, dolomite, sandstone, and quartzite. Marine and lacustrine sedimentary rocks of Mesozoic and Cenozoic age, which are composed largely of shale, siltstone, mudstone, and marlstone with some sandstone, conglomerate, and limestone, underlie large parts of the Green River, Washakie, Uinta, Piceance, and San Juan Basins; they also crop out in the Book Cliffs, San Rafael Swell, and along the flanks of the high mountains and plateaus. Terrestrial sedimentary rocks of Mesozoic age, consisting largely of windblown sandstone, are most widely exposed in the Canyonlands. Unconsolidated terrestrial deposits of Cenozoic age, which consist mostly of fluvial, galciofluvial, colluvial, and windblown deposits, are widely scattered throughout the basin.

Iorns, Hembree, and Oakland (1965, p. 4-80 grouped the rocks of the Upper Colorado River Basin into eight hydrologic units on the basis of their age and general hydrologic properties. (P) These hydrologic units are herein regrouped into five geohydrologic units (Figure 7) according to their relative contribution to the natural salinity of runoff in the basin. Criteria used in the regrouping included dominant lithology, origin, and age of the rocks, and (where available) chemical quality of ground and surface water known to be unaffected by irrigation return flows.

The five geohydrologic units as used in this report are described in Table F, with some additional explanatory material presented in the following paragraphs.

Parts of geohydrologic units 3 and 4 underlie high plateaus and mountainous areas where the average annual precipitation exceeds 15 inches (381 mm). In these areas, some of the original highly soluble mineral constituents have been leached. Therefore, the salinity of runoff generated on those geohydrologic units at the higher altitudes (generally above 8,000 feet [2,440 m]) will usually be lower than indicated in Table F and Figure 7. Nevertheless, the salinity of the water that ultimately flows from those geohydroloic units into main-stem streams should, in most cases, be within the range indicated.

For example, runoff in Bitter Creek, which originates on the Green River Formation (in geohydrologic unit 3), is nonsaline in the headwaters area, but is highly saline by the time it discharges into the White River. Part of this increase of salinity is due to concentration by evapotranspiration along the water course; but most is due to the ground water component of the streamflow, which generally is highly saline. This is indicated by chemical analyses of ground water samples collected directly from the Green River Formation adjacent to Bitter Creek (Price and Miller, 1975).[3] Similarly, the salinity of runoff in Wahweap Creek, which heads on the Kaiparowits Plateau, increases from less than 1,000 mg/l near the headwaters area to more than 2,000 mg/l where the creek drains into Lake Powell. This increase is due chiefly to saline inflow of water that has been in contact with the Tropic Shale and the Straight Cliffs Sandstone of geohydrologic unit 4.

Alluvium (geohydrologic unit 5) in most places along main-stem streams yields nonsaline water,chiefly because it is generally highly permeable and because most highly soluble minerals that it may have contained have been leached. Along many of the intermittent and ephemeral streams that drain geohydrologic units 3 and 4 and parts of geohydrologic unit 2, however, the alluvium (most of which is not shown in Figure 7 contains crusts of salt deposited by evaporating shallow ground water or by receded streamflow. Most of the salt is readily taken into solution by subsequent streamflow and is eventually carried to the Colorado River.

Geologic formations that contribute most significantly to the salinity of the Colorado River are shales, such as the Lewis, Mancos, and Kirtland Shales of Cretaceous age (in geohydrologic unit 4), and those formations made up largely of shale, siltstone, and mudstone, such as the Green River, Uinta, Fort Union, and San Jose Formations of Tertiary age (in geohydrologic unit 3). This is especially true in the areas where soils developed on those formations are irrigated, resulting in highly saline return flows to the river system. For example, Spring Canyon Creek, (Price River basin) undergoes a threefold increase in dissolved-solids concentration where it crosses an outcrop of Mancos Shale in an unirrigated area. By contrast, Huntington Creek (San Rafael River basin) and Muddy Creek (Dirty Devil River basin) undergo a fivefold-to-tenfold increase in dissolved-solids concentrations where they cross outcrops of Mancos Shale in irrigated areas (K.M. Waddell, U.S. Geological Survey, written commun., 1977).

Table F

Geohydrologic units in the Upper Colorado River Basin and dominant salinity of natural runoff from those units

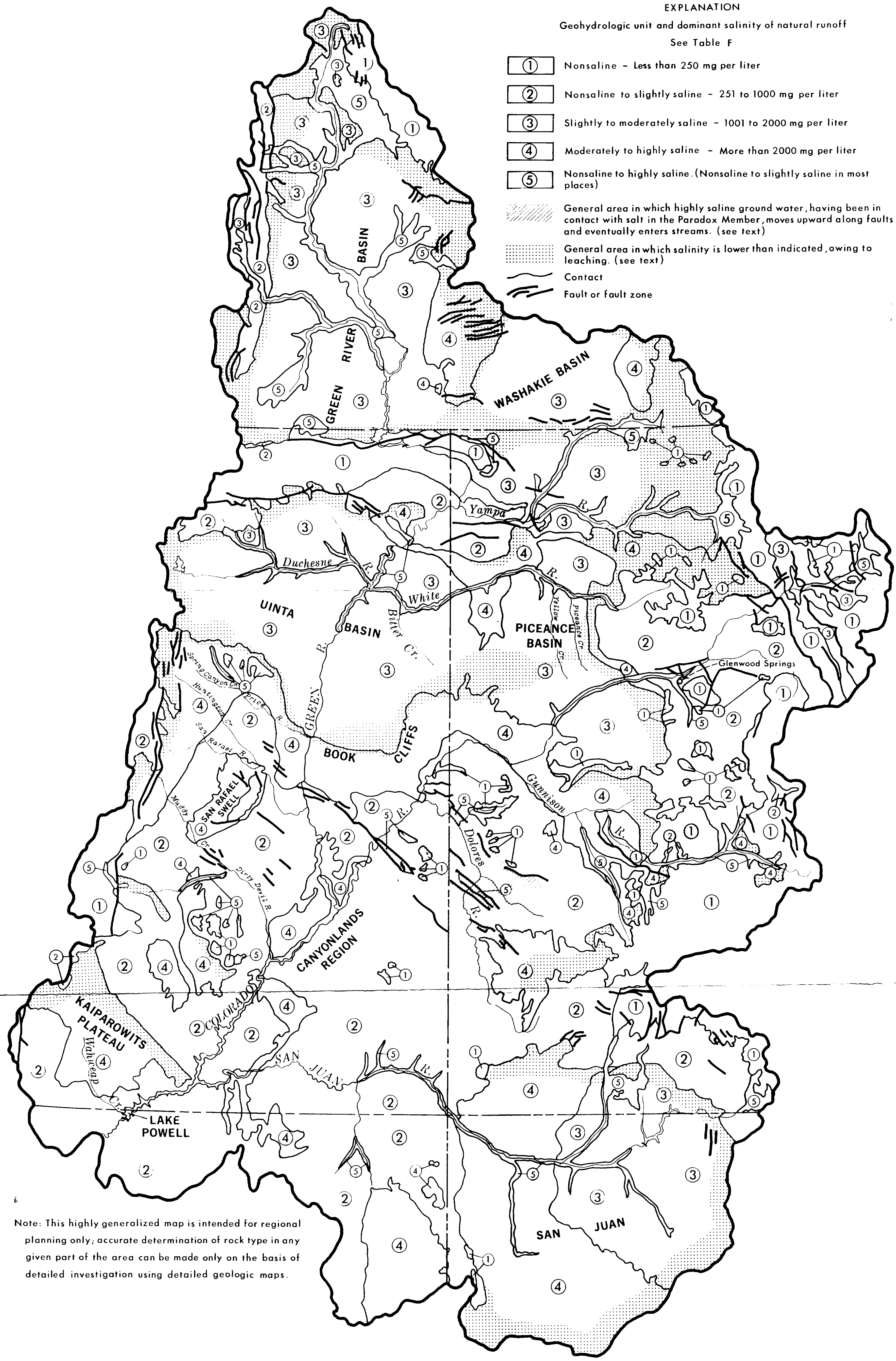
Geohydrologic unit	Dominant salinity of natural runoff	Approximate area: Square miles	Approximate area: Percent of upper basin	Dominant rock types	Representative geologic formations[1]
1	Nonsaline <250 mg/1	11,500	11	Plutonic and metamorphic rocks of Precambrian age and igneous rocks of Tertiary and Quaternary age; include granite, lava flows and related igneous rocks, quartzite, gneiss, and schist	Front Range Granite Group (of former usage), Needle Mountains Group (of former usage), Uinta Mountain Group, Gunnison River Series (of former usage), unnamed igneous rocks
2	Nonsaline to slightly saline 251-1,000 mg/1	45,200	41	Sedimentary rocks of marine and continental origin; include limestone, dolomite, sandstone, and quartzite of Paleozoic age, sandstone of Mesozoic age, and some siltstone, limestone, shale, and conglomerate of Mesozoic and early Cenozoic age	Brazer Limestone, Madison Limestone, Leadville Limestone, Jefferson Limestone, Ouray Limestone, Morgan Formation, Weber Sandstone and Quartzite, Oquirrh Formation, Hermosa Formation, Tensleep Sandstone, Phosphoria Formation, Cutler Formation, Park City Formation, Rico Formation, Glen Canyon Group, Summerville Formation, Entrada Sandstone, Curtis Formation, Morrison Formation, Dakota Sandstone, Cedar Mountain Formation, Mesa Verde Group (locally), North Horn Formation, and Flagstaff Limestone
3	Slightly saline to moderately saline[2] 1,001-2,000 mg/1	31,800	29	Sedimentary rocks of predominantly continental origin; include mostly interbedded sandstone, siltstone, mudstone, and shale with local strata of conglomerate and limestone mostly of Cenozoic and late Mesozoic age; contain considerable carbonaceous material and evaporite deposits	Wasatch Formation, Green River Formation, Uinta Formation, Fort Union Formation, Bridger Formation, Duchesne River Formation, Browns Park Formation, Middle Park Formation, San Jose Formation, Nacimiento Formation, and Mesa Verde Group (locally)
4	Moderately saline[2] to highly saline >2,000 mg/1	19,800	18	Predominantly marine sedimentary rocks of Mesozoic age; include mostly shale with some sandstone, limestone, marlstone, mudstone, conglomerate, and gypsum	Moenkopi Formation, Chinle Formation, Mancos Shale, Tropic Shale, Lewis Shale, Baxter Shale, Cody Shale, Steele Shale, Kirtland Shale, Menefee Formation, Mesa Verde Group (locally), and Straight Cliffs Sandstone
5	Nonsaline[3] to highly saline (nonsaline to slightly saline in most places)	1,200	1	Unconsolidated deposits on Quaternary age: include glacial, alluvial, colluvial, and windblown deposits: clay, sand, and gravel along most streams and in glaciated mountain areas, mostly sand and silt in other areas	Durango Till, Florida Gravel, Cerro Till (of former usage), and many mapped but unnamed unconsolidated deposits

1/ Modified from Iorns, Hembree, and Oakland (1965, table 1).

2/ Generally yield nonsaline to slightly saline water where exposed in high, well-wetted areas (see text).

3/ Glaciofluvial deposits and alluvium along larger main-stem streams yield nonsaline water; colluvium and windblown deposits in geohydrologic units 2 to 4 (exposures too small to be shown in figure 7) generally are composed of the same rock material and yield water in the same salinity range as do the respective units which they overlie.

GEOHYDROLOGIC UNITS IN THE UPPER COLORADO RIVER BASIN
AND DOMINANT SALINITY OF NATURAL RUNOFF FROM THOSE UNITS



Note: This highly generalized map is intended for regional planning only; accurate determination of rock type in any given part of the area can be made only on the basis of detailed investigation using detailed geologic maps.

Figure 7

The Paradox Member of the Hermosa Formation of Pennsylvanian age underlies a large area in western Colorado and eastern Utah. The few surface exposures of the Paradox are grouped with other rocks in geohydrologic unit 2, which consists of rocks that generally yield nonsaline to slightly saline runoff. However, the Paradox, where buried beneath younger rocks, contains large accumulations of salt. Locally, some of the salt is dissolved by ground water, carried in solution to shallower aquifers, and eventually discharged into streams. The most notable example is where the Dolores River crosses the Paradox Valley to western Colorado (Figure 7). Data compiled by the U.S. Bureau of Reclamation (1975) indicate that the annual salt pickup of the Dolores River in the Paradox Valley is approximately 200,000 tons (181,000 t).[4]

2. Geologic Structure

Nearly all the rocks in the Upper Colorado River Basin have undergone some structural deformation since their emplacement or deposition. In the mountainous areas, many of the rocks have been complexly folded and faulted; whereas, those in the Green River, Washakie, Uinta, Piceance, and San Juan Basins have been folded into broad synclinal troughs with some associated faulting and secondary folding. Even the relatively flat-lying rocks in the Canyonlands have been tilted, folded, or faulted to some extent. Because of the small map scale, Figure 7 shows only a small fraction of the faults that are known to exist in the basin.

Geologic structues has significant influence on diffused sources and point sources of salinity in the basin. For example, faults associated with the formation of salt domes and the collapse of leached-out areas in the Paradox Member of the Hermosa Formation are the principal conduits along which saline ground water flows upward and eventually discharges to streams in and around the Paradox Valley.

Some thermal springs are significant point sources of salinity. Water moves downward deep into the earth along fractures and bedding planes. The temperature of the water increases with depth, significantly increasing its ability to dissolve mineral constituents. These thermal waters return to the surface along faults and discharge large amounts of salt into streams at various points in the Colorado River Basin. Hagen and others (1971, p. 70) estimated that the annual salt discharge of the major thermal springs in the basin exceeds 500,000 tons (454,000 t) and that the salt discharge of Glenwood Springs alone is nearly 214,000 tons (194,000 t).[5]

In the Green River, Washakie, Uinta, Piceance, and San Juan Basins, much of the ground water is under artesian presure. In the Piceance Basin, for example, highly saline water from a deep confined aquifer in the Green River Formation moves upward under artesian pressure into shallow aquifers and eventually into Piceance and Yellow Creeks (Weeks and others, 1974, Figure 18).[6]

B. Flaming Gorge Reservoir

Since 1966, the U.S. Geological Survey has been carrying out a series of studies on the water quality of Flaming Gorge Reservoir as part of a continuing program to assess the water quality of the Colorado River Basin. The results of the latest of these studies are given in Bolke (1978).[7]

This study found that circulation of water in Flaming Gorge Reservoir was due chiefly to insolation, inflow-outflow relationships, and wind. Thermal stratification of the reservoir occurs from mid-spring to late autumn. This has generally resulted in a well-mixed isothermal and oxygenated epilimnion; a moderately mixed metalimnion marked by a thermal transition and decreased dissolved-oxygen concentrations; and an unmixed isothermal and oxygen-depleted hypolimnion. Oxygen depletion generally first occurs in the upper part of the reservoir near the confluence of the Blacks Fork and Green River arms. Since the dissolved-oxygen depletion usually develops simultaneously in both arms, it was concluded that this is a function of reservoir stratification.

The decomposition of organic matter, which is deposited in the bottom sediment in this area of the reservoir at the former confluence of the Blacks Fork and Green River arms, a metalimnetic oxygen minimum was noted. This was most apparent in July. Since neither chemical nor seston analyses could explain this anomaly, it is attributed to the flow characteristics of the reservoir.

In September 1975, excessive algal production was observed in an area extending from approximately 7 miles (11 km) below the confluence of the Blacks Fork and Green River arms to 9 miles (14 km) up the Blacks Fork arm and 12 miles (19 km) up the Green River arm. This algal bloom turned the reservoir a "pea green" color and extended from bank to bank. Vertical sampling indicated that the bloom extended to a depth of from 26 feet (8 m) to approximately 49 feet (15 m). The 49-foot (15 m) limit corresponds to the depth of the euphotic zone. (See Bolke, 1976.)[7] During October 1975, no extensive algal production was observed in the reservoir.

Excessive algal production in the reservoir could result in a large oxygen demand when the algae dies and bacterial decomposition occurs. This could significantly reduce the dissolved-oxygen content of the reservoir making areas unsuitable for fish and other aquatic organisms. The development of near-anaerobic conditions also could result in the mobilization of nutrients and potentially toxic trace metals from the reservoir sediment. Large-scale blooms have seldom occurred in the past in Flaming Gorge Reservoir because of the relatively low level of nutrient loading and the large storage capacity of the reservoir. This, coupled with the reservoir's relatively high flow-through capacity, discourages the accumulation and concentration of nutrients. However, if nutrient loading should increase significantly due to changes in conditions upstream, algal blooms could greatly increase, especially during droughts when inflow is low. This could result in a degraded water quality severely limiting the reservoir's value for recreational use.

C. Lake Powell

A network of six sampling stations was established in Lake Powell in 1965 and sampling at these sites had continued on a quarterly basis until the fall of 1971. In addition, samples were taken at the mouth of Wahweap Creek and below the Glen Canyon Dam on a monthly basis. The purpose of this program was to observe chemical changes in the reservoir with time. In the fall of 1971 the quarterly sampling program was increased to a monthly program to obtain sufficient data for a mathematical model of the Colorado River system. The seven sites in the reservoir are: (1) Wahweap, (2) Crossing of the Fathers, (3) Oak Creek, (4) Cha Canyon, (5) Escalante River, (6) Bullfrog, and (7) Hite Basin. The samples are taken at 50-foot (15 m) intervals to the bottom of the lake and analyzed for dissolved solids, common ions, specific conductance, pH, temperature, and dissolved oxygen. Figure 8 shows the change in salinity concentration with depth for the period of record at the Wahweap station. It appears that the concentration had stabilized since about 1972 but had risen with the drought of 1977. The impact of this rise might be felt in about two years at Imperial Dam.

From 1971 to March 1978 a research project entitled "Lake Powell Research Project" was conducted by a consortium of university groups funded by the Division of Advanced Environmental Research and Technology and RANN (Research Applied to National Needs) in the National Science Foundation. The researchers in the consortium sought to bring a wide range of expertise in natural and social sciences to bear on the general problems of the effects and ramifications of water resource management in the Lake Powell region. Their findings are presented in a series of project bulletins. The titles of those bulletins related to water quality and water quantity topics are shown as References 8 to 18 in the Bibliography.

D. Lake Mead

The Bureau of Reclamation conducted an extensive sampling program of Lake Mead from 1964 through 1968. The data collected from the sampling program were published by the Bureau of Reclamation in Report No. CHE-70, Water Quality Study of Lake Mead, 1970.

SALINITY CHANGES IN LAKE POWELL AT WAHWEAP SITE

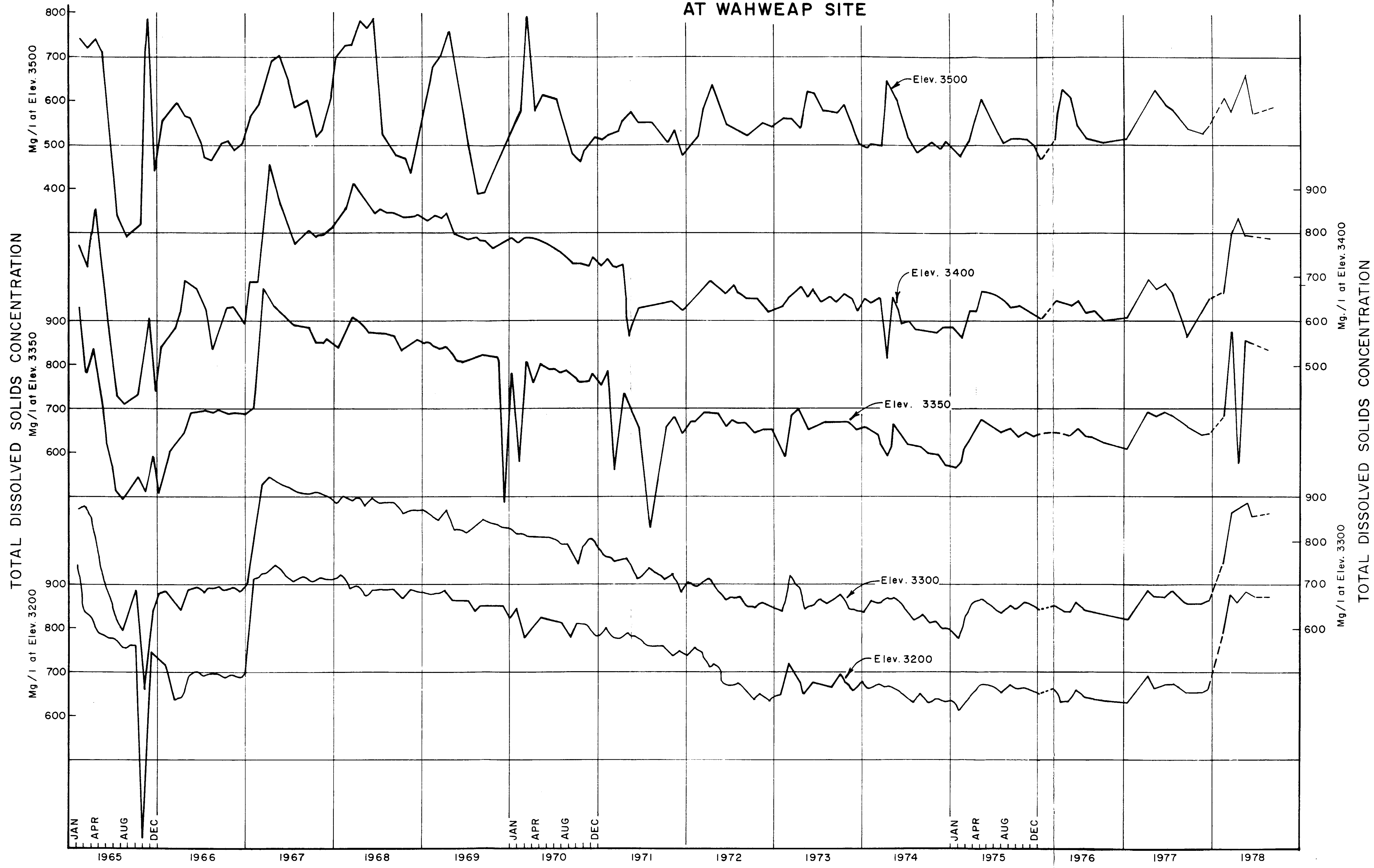


Figure 8

A more recent report funded by the Bureau of Reclamation entitled "A Mathematical Model of Primary Productivity and Limnological Patterns in Lake Mead, Technical Report No. 13." September 1972 analyzes the biological and chemical properties of Lake Mead based on eight sampling stations. This report indicates the sources of water pollution and the time of highest pollution potential. It also presents a method of quantifying eutrophication trends in Lake Mead.

Another report entitled "Final Report on Interrelationships between Chemial, Physical, and Biological Conditions of the Waters at Las Vegas Bay at Lake Mead" by Dr. James Deacon, University of Nevada, Las Vegas, May 1973, describes the effects of Las Vegas Wash, an enriched stream on Lake Mead.

The Biology Department of the University of Nevada, Las Vegas, conducted a special study called the "Lake Mead Water Quality Monitoring Program." A report on this program was issued in April 1975.

Complete chemical and nutrient analyses are made for water samples taken by the Bureau of Reclamation quarterly at three stations in Lake Mead: Hoover Dam Intake Towers, Saddle Island Station, and Station 10.

The California Department of Fish and Game just completed a limnological study of the Lower Colorado River from Needles California to the Northerly International Boundary. The report was completed in 1978.

The University of Nevada at Las Vegas will be completing a two-year limnological study on Lake Mead in December of 1978. The report includes information on the nutrient problems which will probably be associated with the Hoover Modification program. The report will be available in early 1979.

E. Upper Colorado River Salinity Investigations

Water quality samples are being collected daily, monthly, or quarterly from approximately 100 sites on the rivers, canals, drains, and sloughs by the Bureau of Reclamation and by the Geological Survey for the Bureau of Reclamation in the Upper Colorado River Basin. This program is in addition to the regular Geological Survey network. Samples are collected at various locations for the purpose of evaluating effects of future water resource projects on the river system, identifying sources of salinity for water quality improvement projects, obtaining basic data for research projects, and acquiring long-term records to determine trends and observe overall changes in the salinity of the river system. This monitoring system will be especially valuable in providing data for the "Colorado River Water Quality Improvement Program" in the basin.

F. Lower Colorado River Salinity Investigations

In February of 1970, the Bureau of Reclamation began a trial program to analyze the source and makeup of the salt load arriving at Imperial Dam on a daily basis. Conductivity measurements were made each day at 10 stations between Parker Dam and Imperial Dam. The network included essentially all significant diversions, surface return flows, and major river stations.

An intensive program was carried on for one year. After one year of operation, the frequency of sampling was reduced. During the fall of 1971, an experimental program of automatic salinity monitoring was started. Conductivity probes were installed at nine stations on the lower river and the data transmitted by telemetry to the Boulder City and Imperial Dam offices. The nine stations are as follows:

1. Colorado River below Hoover Dam.
2. CRIR Main Canal near Parker.
3. Poston Wasteway near Poston.
4. Palo Verde Canal near Blythe.
5. Colorado River at Taylor Ferry near Cibola.
6. Colorado River below Cibola Valley.
7. Yuma Mesa Drain near Yuma.
8. Main Outlet Drain Extension Bifurcation for MODES 2 and 3.
9. Colorado River at the Northerly International Boundary above Morelos Dam.

Recently the Intensive Salinity Surveillance Program was changed. The water quality telemetering program was discontinued but weekly samples are taken at the nine previously mentioned stations. Daily conductivity measurements are taken at Imperial Dam in conjunction with the requirements of meeting Minute 242. The USGS is now responsible for the continuous water quality monitoring probes at Imperial Dam and on the Main Outlet Drain Extension for both continued research and data gathering. There are plans to install continuous monitoring probes at Hoover and Parker Dams and at Needles. The installation at Needles will test three different probe systems to determine which best suits the needs of that and future sites.

In addition to the nine formerly telemetered stations, water quality samples are collected from five other stations. Individual samples are analyzed for conductivity. The U.S. Geological Survey Laboratory makes weekly analyses for total dissolved solids (residue at 180° C) and monthly analyses of the chemical constituents.

Sampling frequencies for all stations were selected from an analysis of past records so that samples would represent the actual salt load with an error of less than 5 percent, 95 percent of the time. The five other stations and the selected frequencies are shown in the following tabulation:

	Samples/Week
Colorado River below Parker Dam	1
CRIR Levee Drain near Parker	1
CRIR Lower Main Drain near Parker	1
Palo Verde Outfall Drain near Palo Verde	1
Colorado River at Imperial Dam	7

Data from the Intensive Salinity Surveillance Program have been valuable in analyzing salt loads from the Palo Verde Irrigation District and the Colorado River Indian Reservation for the Water Quality Improvement Program, part of the Colorado River Basin Salinity Control Project - Title II.

G. Irrigated Areas

Studies have been made in several areas to determine irrigation effects on water quality.

1. Prediction of Mineral Quality of Irrigation Return Flow

A cooperative study initiated in 1969 entitled "Predictions of Mineral Quality of Irrigation Return Flows" was conducted by the Bureau of Reclamation and Environmental Protection Agency to develop a technique for predicting the mineral quality of irrigation return flow. The means for accomplishing this is through the use of mathematical models and high speed computers. The mathematical model is primarily a mathematical formula or expression attempting to describe conditions encountered on an irrigation project. The study utilizes data from existing irrigation projects in order to verify the technique.

The objective of the study was to use the model as a tool in predicting changes in capacity and the associated water quality distribution of the aquifer and also the quality distribution of the water as surface effluents from the system. The prediction of the system responses was compared with the historical data, both quantity and quality distributions as a measure of the reliability of the model. Data from the Vernal Unit of the Central Utah Project have been used for designing and testing the model. Tests were also made using data from the Grand Valley area in Colorado and the Cedar Bluff Unit in Kansas.

A detailed return flow quality model was also developed under contract with the University of Arizona, and by the Bureau of Reclamation personnel over a period of about 5 years. This model provides a highly sophisticated and detailed simulation of salt and nutrient movement from the soil surface to a tile or open channel drainage system. This model can be interfaced with the conjunctive use model mentioned above to provide basin wide simulation capabilities. Information concerning these models are included in final reports dated August 1977, (EPA-60012-77-179c and 179e).

With these models the implication for water resource projects is that farm operation could be designed to use the least amount of water and return the smallest amount of salt to the river while permitting the farmer to obtain the greatest possible return from his farm. The salt load reductions expected from irrigation scheduling and management could also be verified on the Vernal Unit in the Uinta Basin.

2. Florida Project Area Study

Flow and quality data were collected at several points in the Florida Project area beginning in 1958 before the project was constructed. A study of these data for the period 1958-63 show the effect of irrigation of these lands on the quality of return flows leaving the area.

Results show that there has been a very small amount of pickup measured in the river downstream from the irrigated area. The concentration of total dissolved solids in the inflowing water ranges from 0.14 to 0.17 ton per acre-foot (103 to 125 mg/l), and that of the outflowing water ranges from 0.17 to 0.30 ton per acre-foot (125 to 221 mg/l). About 13,720 acres (5,550 ha) were irrigated at the time the measurements were made.

Other areas in the Colorado River Basin with similar type soils and underlying aquifers would yield only minor amounts of salt.

3. Grand Valley Area A.R.S.

The Agricultural Research Service is doing a research study in the Grand Valley with regards to irrigation efficiencies. This is further covered in Part VIII.

4. Montezuma Valley

The Soil Conservation Service has conducted a study of on farm improvements in the Montezuma Valley in Colorado.

5. Other Studies

Considerable variation in the effects of irrigation return flow on water quality is to be expected. Differences arise due to the size of the irrigated areas, the number of times the return flow is reused, properties of the soils and drainage area, number of years land has been irrigated, nature of aquifers, rainfall, dilution, temperature, irrigation methods, storage reservoirs, vegetation, and type of return flow channels.

Consumptive use, return flow, salinity, and pollution studies are continually being made by Universities such as Utah State and Colorado State and by Federal agencies in cooperation with State and local agencies. Some of the study areas are purposely held small to achieve better control, but they will be as representative as possible of existing projects. The results pertaining to the quantity of return flow will be very helpful in estimating effects on water quality of return flows from larger areas where measurement of inflow and outflow is not always possible or practical. Studies of local areas are also conducted under the Section 208 program (P.L. 92-500) or by private organizations under contract with the government. These Section 208 studies include the investigations of all sources of salinity as well as, bacteriological, biological, heavy metals and all other types of pollution.

Special studies in areas of the basin will continue to be made from time to time to determine water quality conditions, and studies of projects, such as Florida, Grand Valley, and Vernal Areas should be repeated or continued in order to evaluate changes with time.

H. Environmental Protection Agency Report

A special 1971 report by the Environmental Protection Agency entitled "The Mineral Quality Problem in the Colorado River Basin" presents results and recommendations obtained from a comprehensive salinity control study. This report includes a presentation of natural and manmade conditions affecting mineral quality, the physical and economic impacts, and salinity control and management aspects.[20]

I. Model Studies

1. Colorado River Storage Project Model (CRSP)

This mathematical model was developed by the Bureau of Reclamation for the Colorado River Reservoir Long Range operating criteria (Public Law 90-537) and includes monthly water supply data for the period 1906-74. It does not project future quality conditions at any station above Lee's Ferry. Water quality data were added to the model to obtain salt loadings. Since water quality records are not available for the years prior to about 1941, the records back to 1906 were obtained by correlations.

This model was used in the sizing study for the Yuma Desalting Plant which has been authorized for construction under Title 1 of Public Law 93-320. The study shows the magnitude, duration and frequency of extreme salinities in the lower reaches of the Colorado River.

2. Interim Water Quality Simulation Model for the Colorado River

This model was developed by the Bureau of Reclamation in 1973, and nominally duplicated the hand computed model shown in Table 18 of the January 1973 "Quality of Water Colorado River Basin Progress Report" No. 6, as it included the 1941-70 period of record. The model ("Application of a River Network Model to Water Quality Investigations for the Colorado River," September 1973 by R.W. Ribbens and R.F. Wilson) however, was different in that it simulated reservoir operations, was computed on a monthly, year by year instead of an average annual basis and was developed for the reach from Lake Powell to Imperial Dam instead of including all the Upper Basin stations as well as the Lower Basin stations. Results were comparable to the Biennial Report study. This was the model used by the work group for the "Colorado River Basin Salinity Control Forum" to make projection studies in developing numeric criteria and a plan of implementation of control measures to meet the criteria.

3. Colorado River Simulation Model (CRSM)

This comprehensive mathematical model of the Colorado River was developed by the Bureau of Reclamation during the years 1972 to 1974. It was developed so it could be adapted to other basins as well as the Colorado River Basin, simulating both water quality and quantity. The model was first applied to the West Wide studies using a stochastic hydrologic data base.

A natural flow data base has recently been developed for both water quality and quantity. It is based on recorded data adjusted for known changes in the hydrologic regime such as consumptive use for in-basin agriculture, reservoir changes of content, evaporation, bank storage, municipal and industrial uses, and transbasin diversions. Periods of missing records have been filled in by statistical correlations.

The most recent application of CRSM and the natural flow data base to the Colorado River Emerging Energy Technology (CREET) study done in 1978 for the State of Colorado in cooperation with the Water Resources Council. The CREET study is a summary of 23 hydrologic traces applied to high, medium, and low demand schedules for with emerging energy requirements. This study is, perhaps, the most rigorous basin-wide water quantity and quality examination of reservoir and stream conditions performed on the Colorado River Basin. It is expected the model will be used to obtain results for this report in the future.

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(20) Environmental Protection Agency, 1971, Mineral Quality Problem in the Colorado River Basin.

Table I

Colorado River Basin

Historical Flow and Quality of Water Data

Green River near Green River, Wyoming

Year	Month	Flow 1000 (A.F.)	Concentration (T./A.F.)	T.D.S. 1000 (Tons)
	Jan.	22	0.73	16
	Feb.	19	.74	14
	Mar.	45	.60	31
	Apr.	95	.54	51
	May	174	.52	90
	June	342	.34	116
1941	July	137	.37	51
	Aug.	81	.46	37
	Sept.	48	.54	26
	Oct.	67	.60	40
	Nov.	53	.64	34
	Dec.	26	.81	21
	Total	1,109	.48	527
	Jan.	24	.79	19
	Feb.	23	.83	19
	Mar.	43	.70	30
	Apr.	200	.41	82
	May	151	.50	75
	June	337	.34	114
1942	July	205	.32	66
	Aug.	58	.52	30
	Sept.	32	.62	20
	Oct.	29	.76	22
	Nov.	26	.81	21
	Dec.	26	.77	20
	Total	1,154	.45	518
	Jan.	28	.78	22
	Feb.	29	.76	22
	Mar.	59	.63	37
	Apr.	200	.41	82
	May	237	.39	92
	June	476	.29	138
1943	July	359	.25	90
	Aug.	121	.39	47
	Sept.	50	.54	27
	Oct.	48	.67	32
	Nov.	43	.67	29
	Dec.	30	.77	23
	Total	1,680	.38	641
	Jan.	25	.80	20
	Feb.	25	.80	20
	Mar.	31	.77	24
	Apr.	267	.37	99
	May	155	.46	71
	June	351	.33	116
1944	July	230	.30	69
	Aug.	60	.50	30
	Sept.	31	.65	20
	Oct.	38	.71	27
	Nov.	31	.74	23
	Dec.	21	.81	17
	Total	1,265	.42	536
	Jan.	24	.70	19
	Feb.	27	.74	20
	Mar.	41	.68	28
	Apr.	78	.58	45
	May	111	.52	58
	June	245	.38	93
1945	July	284	.28	80
	Aug.	125	.39	49
	Sept.	76	.45	34
	Oct.	64	.62	40
	Nov.	42	.69	29
	Dec.	33	.73	24
	Total	1,150	.45	519
	Jan.	32	.75	24
	Feb.	26	.77	20
	Mar.	65	.62	40
	Apr.	131	.48	63
	May	212	.41	87
	June	320	.34	109
1946	July	153	.35	54
	Aug.	74	.47	35
	Sept.	52	.52	27
	Oct.	58	.64	37
	Nov.	52	.67	34
	Dec.	51	.67	34
	Total	1,225	.46	564
	Jan.	26	0.81	21
	Feb.	30	.73	22
	Mar.	141	.47	66
	Apr.	75	.57	43
	May	368	.33	121
	June	501	.29	145
1947	July	327	.26	85
	Aug.	199	.32	64
	Sept.	81	.44	36
	Oct.	75	.59	44
	Nov.	59	.63	37
	Dec.	44	.68	30
	Total	1,926	.37	714
	Jan.	38	.71	27
	Feb.	33	.73	24
	Mar.	64	.62	40
	Apr.	95	.54	51
	May	187	.43	80
	June	396	.31	123
1948	July	121	.39	47
	Aug.	56	.52	29
	Sept.	32	.62	20
	Oct.	36	.72	26
	Nov.	29	.76	22
	Dec.	26	.81	21
	Total	1,113	.46	510
	Jan.	27	.78	21
	Feb.	24	.79	19
	Mar.	45	.69	31
	Apr.	104	.52	54
	May	211	.41	86
	June	372	.32	119
1949	July	179	.36	64
	Aug.	65	.48	31
	Sept.	38	.58	22
	Oct.	52	.65	34
	Nov.	54	.65	35
	Dec.	34	.74	25
	Total	1,205	.45	541
	Jan.	29	.79	23
	Feb.	33	.73	24
	Mar.	102	.53	54
	Apr.	251	.38	95
	May	270	.37	100
	June	582	.34	198
1950	July	427	.23	98
	Aug.	140	.37	52
	Sept.	76	.45	34
	Oct.	66	.61	40
	Nov.	71	.59	42
	Dec.	40	.65	32
	Total	2,096	.38	792
	Jan.	34	.74	25
	Feb.	47	.66	31
	Mar.	70	.59	41
	Apr.	154	.45	69
	May	317	.35	111
	June	528	.28	148
1951	July	349	.25	87
	Aug.	208	.28	58
	Sept.	91	.43	39
	Oct.	81	.53	43
	Nov.	50	.68	34
	Dec.	43	.70	30
	Total	1,972	.36	716
	Jan.	41	.63	26
	Feb.	42	.62	26
	Mar.	52	.63	33
	Apr.	190	.52	99
	May	348	.32	111
	June	399	.27	108
1952	July	171	.33	56
	Aug.	99	.38	38
	Sept.	57	.51	29
	Oct.	42	.64	27
	Nov.	28	.82	23
	Dec.	27	.78	21
	Total	1,496	.40	597
	Jan.	32	0.69	22
	Feb.	33	.70	23
	Mar.	44	.68	30
	Apr.	77	.58	45
	May	74	.57	42
	June	381	.28	107
1953	July	206	.29	60
	Aug.	104	.39	41
	Sept.	39	.56	22
	Oct.	34	.74	25
	Nov.	36	.75	27
	Dec.	24	.88	21
	Total	1,084	.43	465
	Jan.	26	.81	21
	Feb.	27	.74	20
	Mar.	48	.67	32
	Apr.	88	.55	48
	May	282	.28	79
	June	232	.30	70
1954	July	250	.25	62
	Aug.	86	.40	34
	Sept.	47	.55	26
	Oct.	40	.68	27
	Nov.	39	.69	27
	Dec.	18	.89	16
	Total	1,183	.39	462
	Jan.	20	.80	16
	Feb.	20	.80	16
	Mar.	33	.76	25
	Apr.	74	.59	44
	May	127	.39	50
	June	245	.27	66
1955	July	116	.36	42
	Aug.	68	.41	28
	Sept.	35	.57	20
	Oct.	33	.70	23
	Nov.	28	.79	22
	Dec.	39	.74	29
	Total	838	.45	381
	Jan.	42	.69	29
	Feb.	29	.66	19
	Mar.	91	.56	51
	Apr.	158	.45	71
	May	310	.37	115
	June	555	.25	139
1956	July	197	.31	61
	Aug.	98	.38	37
	Sept.	41	.56	23
	Oct.	39	.59	23
	Nov.	35	.69	24
	Dec.	26	.77	20
	Total	1,621	.38	612
	Jan.	22	.77	17
	Feb.	37	.70	26
	Mar.	57	.68	39
	Apr.	60	.62	37
	May	176	.46	81
	June	476	.27	129
1957	July	380	.25	95
	Aug.	117	.35	41
	Sept.	68	.47	32
	Oct.	66	.55	36
	Nov.	48	.67	32
	Dec.	41	.71	29
	Total	1,548	.38	594
	Jan.	33	.76	25
	Feb.	47	.66	31
	Mar.	51	.63	32
	Apr.	99	.56	55
	May	291	.31	90
	June	266	.31	82
1958	July	76	.45	34
	Aug.	51	.53	27
	Sept.	36	.64	23
	Oct.	33	.79	26
	Nov.	32	.78	25
	Dec.	31	.74	23
	Total	1,046	.45	[illegible]

Table I

Colorado River Basin

Historical Flow and Quality of Water Data

Green River near Green River, Wyoming

Year	Month	Flow 1000 (A.F.)	Concentration (T./A.F.)	T.D.S. 1000 (Tons)
	Jan.	24	0.71	17
	Feb.	25	.72	18
	Mar.	49	.65	32
	Apr.	73	.64	47
	May	79	.51	40
	June	322	.26	84
1959	July	140	.34	48
	Aug.	79	.40	32
	Sept.	42	.55	23
	Oct.	51	.57	29
	Nov.	42	.60	25
	Dec.	27	.74	20
	Total	953	.44	415
	Jan.	27	.74	20
	Feb.	23	.78	18
	Mar.	75	.53	40
	Apr.	84	.49	41
	May	66	.48	32
	June	173	.30	52
1960	July	68	.43	29
	Aug.	38	.45	17
	Sept.	28	.54	15
	Oct.	42	.57	24
	Nov.	47	.49	23
	Dec.	27	.69	19
	Total	698	.47	330
	Jan.	20	.60	12
	Feb.	19	.58	11
	Mar.	30	.57	17
	Apr.	50	.60	30
	May	60	.43	26
	June	162	.27	44
1961	July	47	.43	20
	Aug.	35	.43	15
	Sept.	39	.46	18
	Oct.	41	.51	21
	Nov.	29	.52	15
	Dec.	27	.52	14
	Total	559	.43	243
	Jan.	32	.47	15
	Feb.	48	.48	23
	Mar.	77	.51	38
	Apr.	203	.43	87
	May	256	.36	92
	June	355	.27	96
1962	July	250	.27	68
	Aug.	94	.37	35
	Sept.	38	.58	22
	Oct.	38	.63	24
	Nov.	35	.66	23
	Dec.	25	.88	22
	Total	1,451	.38	545
	Jan.	18	.72	13
	Feb.	18	.72	13
	Mar.	42	.67	28
	Apr.	51	.63	32
	May	100	.45	45
	June	337	.26	88
1963	July	143	.32	46
	Aug.	76	.47	36
	Sept.	77	.43	33
	Oct.	58	.50	29
	Nov.	52	.60	31
	Dec.	30	.60	18
	Total	1,002	.41	412
	Jan.	23	.56	13
	Feb.	22	.59	13
	Mar.	29	.59	17
	Apr.	68	.56	38
	May	138	.32	44
	June	323	.38	123
1964	July	335	.26	87
	Aug.	87	.39	34
	Sept.	37	.65	24
	Oct.	24	.92	22
	Nov.	25	.88	22
	Dec.	25	.84	21
	Total	1,136	.40	458
	Jan.	28	0.79	22
	Feb.	30	.70	21
	Mar.	38	.74	28
	Apr.	44	.86	38
	May	94	.60	56
	June	429	.38	163
1965	July	466	.30	140
	Aug.	184	.36	66
	Sept.	461	.41	189
	Oct.	86	.73	63
	Nov.	75	.65	49
	Dec.	29	.90	26
	Total	1,964	.44	861
	Jan.	37	.76	28
	Feb.	35	.77	27
	Mar.	88	.72	63
	Apr.	138	.50	69
	May	160	.39	62
	June	171	.31	53
1966	July	91	.43	39
	Aug.	56	.52	29
	Sept.	45	.60	27
	Oct.	35	.77	27
	Nov.	30	.83	25
	Dec.	25	.96	24
	Total	911	.52	473
	Jan.	19	1.01	19
	Feb.	19	1.04	20
	Mar.	33	.87	29
	Apr.	129	.54	70
	May	138	.48	66
	June	456	.28	128
1967	July	448	.25	112
	Aug.	88	.39	34
	Sept.	65	.50	32
	Oct.	62	.56	35
	Nov.	49	.64	31
	Dec.	17	1.07	18
	Total	1,523	.39	594
	Jan.	17	1.03	18
	Feb.	16	1.03	16
	Mar.	33	.86	28
	Apr.	31	.93	29
	May	56	.68	38
	June	271	.40	108
1968	July	88	.41	36
	Aug.	136	.40	54
	Sept.	126	.37	47
	Oct.	117	.44	51
	Nov.	54	.58	31
	Dec.	30	.85	26
	Total	975	.49	482
	Jan.	51	.61	31
	Feb.	89	.46	41
	Mar.	80	.56	45
	Apr.	141	.46	65
	May	207	.36	75
	June	302	.28	86
1969	July	154	.34	52
	Aug.	97	.47	46
	Sept.	68	.51	35
	Oct.	81	.49	40
	Nov.	50	.60	30
	Dec.	42	.69	29
	Total	1,362	.42	575
	Jan.	38	.74	28
	Feb.	33	.76	25
	Mar.	58	.60	35
	Apr.	75	.69	52
	May	84	.58	49
	June	204	.37	75
1970	July	127	.36	46
	Aug.	86	.43	37
	Sept.	75	.45	34
	Oct.	62	.55	34
	Nov.	49	.67	33
	Dec.	43	.70	30
	Total	934	.51	478
	Jan.	42	.71	30
	Feb.	47	.62	29
	Mar.	76	.60	45
	Apr.	107	.53	57
	May	280	.41	116
	June	480	.30	143
1971	July	291	.28	81
	Aug.	126	.37	47
	Sept.	77	.46	35
	Oct.	72	.49	35
	Nov.	63	.54	34
	Dec.	87	.51	44
	Total	1,748	.40	696
	Jan.	85	.54	46
	Feb.	77	.56	43
	Mar.	106	.58	62
	Apr.	154	.48	73
	May	294	.40	118
	June	625	.27	169
1972	July	255	.30	78
	Aug.	122	.39	48
	Sept.	75	.48	36
	Oct.	79	.53	42
	Nov.	85	.51	43
	Dec.	51	.61	31
	Total	2,008	.39	789
	Jan.	73	.58	42
	Feb.	95	.48	46
	Mar.	92	.53	49
	Apr.	110	.60	66
	May	171	.46	78
	June	162	.36	58
1973	July	127	.40	51
	Aug.	107	.44	47
	Sept.	75	.53	40
	Oct.	67	.57	38
	Nov.	61	.62	38
	Dec.	53	.62	33
	Total	1,193	.49	586
	Jan.	78	.56	44
	Feb.	110	.49	54
	Mar.	114	.57	65
	Apr.	104	.58	60
	May	207	.43	89
	June	346	.31	106
1974	July	210	.31	65
	Aug.	102	.42	43
	Sept.	53	.60	32
	Oct.	57	.61	35
	Nov.	54	.65	35
	Dec.	59	.63	37
	Total	1,494	.45	665
	Jan.	62	.61	38
	Feb.	57	.60	34
	Mar.	62	.66	41
	Apr.	70	.67	47
	May	125	.54	67
	June	296	.36	108
1975	July	329	.32	105
	Aug.	133	.38	50
	Sept.	60	.57	34
	Oct.	57	.60	34
	Nov.	60	.58	35
	Dec.	74	.55	41
	Total	1,385	.46	634
	Jan.	71	.58	41
	Feb.	65	.55	36
	Mar.	99	.54	53
	Apr.	106	.54	57
	May	296	.40	117
	June	292	.30	88
1976	July	177	.34	60
	Aug.	141	.39	55
	Sept.	65	.51	33
	Oct.	58	.55	32
	Nov.	56	.54	30
	Dec.	60	.53	32
	Total	1,486	.43	634

To obtain mg/l multiply T/AF by 735

Table I

Colorado River Basin

Historical Flow and Quality of Water Data

Green River near Green River, Wyoming

(Annual Summary)

Calendar Year	Flow 1,000 (A.F.)	T./A.F.	T.D.S. 1000 Ton	Flow 1,000,000 (m^3)	mg/l	T.D.S. 1,000 Tonne
1941	1109	.48	527	1368	349	478
1942	1154	.45	518	1423	330	470
1943	1680	.38	641	2072	281	582
1944	1265	.42	536	1560	312	486
1945	1150	.45	519	1419	332	471
1946	1225	.46	564	1511	339	512
1947	1926	.37	714	2376	273	648
1948	1113	.46	510	1373	337	463
1949	1205	.45	541	1486	330	491
1950	2096	.38	792	2585	278	719
1951	1972	.36	716	2432	267	650
1952	1496	.40	597	1845	294	542
1953	1084	.43	465	1337	316	422
1954	1183	.39	462	1459	287	419
1955	838	.45	381	1034	335	346
1956	1621	.38	612	1999	278	555
1957	1548	.38	594	1909	282	539
1958	1046	.45	473	1290	333	429
1959	953	.44	415	1176	320	376
1960	698	.47	330	861	347	299
1961	559	.43	243	690	319	220
1962	1451	.38	545	1790	276	494
1963	1002	.41	412	1236	303	374
1964	1136	.40	458	1401	296	415
1965	1964	.44	861	2423	322	781
1966	911	.52	473	1124	382	429
1967	1523	.39	594	1879	287	539
1968	975	.49	482	1203	363	437
1969	1362	.42	575	1680	311	522
1970	934	.51	478	1152	377	434

Table I
Colorado River Basin
Historical Flow and Quality of Water Data
Green River near Green River, Wyoming

(Annual Summary)

Calendar Year	Flow 1,000 (A.F.)	T./A.F.	T.D.S. 1000 Ton	Flow 1,000,000 (m^3)	mg/l	T.D.S. 1,000 Tonne
1971	1748	.40	696	2156	293	631
1972	2008	.39	789	2477	289	716
1973	1193	.49	586	1472	361	532
1974	1494	.45	665	1843	327	603
1975	1385	.46	634	1708	337	575
1976	1486	.43	634	1833	314	575
Total	47,493		20,032	58,582		18,174
Average	1,319	.42	556	1,627	310	505

Table 2

Colorado River Basin

Historical Flow and Quality of Water Data

Green River near Greendale, Utah

Year	Month	Flow 1000 (A.F.)	Concentration (T./A.F.)	T.D.S. 1000 (Tons)
	Jan.	27	0.93	25
	Feb.	25	1.16	29
	Mar.	72	.94	68
	Apr.	131	.56	74
	May	276	.58	160
	June	441	.40	175
-1941	July	171	.55	94
	Aug.	110	.73	80
	Sept.	67	.78	52
	Oct.	94	.97	91
	Nov.	71	.93	66
	Dec.	36	1.19	43
	Total	1,521	.63	957
	Jan.	30	1.00	30
	Feb.	31	1.00	31
	Mar.	69	1.07	74
	Apr.	261	.65	170
	May	235	.76	180
	June	434	.44	193
-1942	July	239	.40	97
	Aug.	73	.57	42
	Sept.	40	.72	29
	Oct.	36	1.00	36
	Nov.	35	1.17	41
	Dec.	34	1.06	36
	Total	1,517	.63	959
	Jan.	33	1.09	36
	Feb.	37	.97	36
	Mar.	96	.74	71
	Apr.	262	.48	125
	May	338	.38	130
	June	552	.33	182
-1943	July	393	.29	115
	Aug.	163	.47	76
	Sept.	64	.56	36
	Oct.	60	.72	43
	Nov.	54	.83	45
	Dec.	37	.89	33
	Total	2,089	.44	928
	Jan.	30	.93	28
	Feb.	32	1.00	32
	Mar.	48	1.48	71
	Apr.	345	.55	190
	May	245	.58	142
	June	469	.37	174
-1944	July	278	.39	109
	Aug.	76	.49	37
	Sept.	36	.61	22
	Oct.	47	.83	39
	Nov.	39	.92	36
	Dec.	27	.85	23
	Total	1,672	.54	903
	Jan.	29	.97	28
	Feb.	34	.94	32
	Mar.	65	.88	57
	Apr.	113	.70	79
	May	176	.60	105
	June	310	.46	144
-1945	July	325	.37	120
	Aug.	174	.47	82
	Sept.	103	.43	44
	Oct.	74	.74	55
	Nov.	52	.88	46
	Dec.	42	.81	34
	Total	1,497	.55	826
	Jan.	39	.90	35
	Feb.	33	.85	28
	Mar.	88	.67	59
	Apr.	237	.48	115
	May	298	.44	130
	June	354	.37	133
-1946	July	162	.40	64
	Aug.	81	.57	46
	Sept.	62	.60	37
	Oct.	68	.76	52
	Nov.	63	.82	52
	Dec.	62	.77	48
	Total	1,547	.52	799
	Jan.	32	0.81	26
	Feb.	37	.89	33
	Mar.	195	.62	120
	Apr.	136	.62	84
	May	521	.40	210
	June	628	.36	225
-1947	July	372	.35	131
	Aug.	218	.45	99
	Sept.	91	.53	48
	Oct.	90	.70	63
	Nov.	71	.77	55
	Dec.	56	.87	49
	Total	2,447	.47	1,143
	Jan.	47	.91	43
	Feb.	40	.88	35
	Mar.	102	.79	81
	Apr.	157	.70	110
	May	336	.38	126
	June	454	.36	162
-1948	July	126	.50	63
	Aug.	59	.56	33
	Sept.	33	.76	25
	Oct.	39	.77	30
	Nov.	34	.85	29
	Dec.	31	1.00	31
	Total	1,458	.53	768
	Jan.	31	.90	28
	Feb.	29	.93	27
	Mar.	73	.89	65
	Apr.	152	.69	105
	May	310	.53	165
	June	493	.47	230
-1949	July	205	.52	106
	Aug.	72	.61	44
	Sept.	42	.74	31
	Oct.	70	.93	65
	Nov.	66	.97	64
	Dec.	40	.97	39
	Total	1,583	.61	969
	Jan.	36	1.19	43
	Feb.	45	.95	43
	Mar.	150	.61	92
	Apr.	323	.46	150
	May	416	.46	190
	June	741	.37	275
-1950	July	458	.34	154
	Aug.	153	.51	78
	Sept.	86	.62	53
	Oct.	76	.72	55
	Nov.	80	.75	60
	Dec.	61	.84	51
	Total	2,625	.47	1,244
	Jan.	45	.80	36
	Feb.	61	.82	50
	Mar.	93	.78	73
	Apr.	212	.47	100
	May	395	.45	177
	June	626	.36	225
-1951	July	366	.36	132
	Aug.	228	.44	101
	Sept.	98	.56	55
	Oct.	99	.71	70
	Nov.	57	.91	52
	Dec.	54	.87	47
	Total	2,334	.48	1,118
	Jan.	49	.82	40
	Feb.	52	.81	42
	Mar.	63	.75	47
	Apr.	318	.62	198
	May	600	.39	235
	June	554	.36	201
-1952	July	205	.56	114
	Aug.	121	.60	72
	Sept.	67	.67	45
	Oct.	49	.86	42
	Nov.	37	1.11	41
	Dec.	34	1.18	40
	Total	2,149	.52	[illegible],117
	Jan.	48	0.81	39
	Feb.	48	.85	41
	Mar.	73	.86	63
	Apr.	96	.76	73
	May	110	.64	70
	June	452	.39	175
-1953	July	198	.39	77
	Aug.	105	.54	57
	Sept.	43	.63	27
	Oct.	35	.89	31
	Nov.	42	.98	41
	Dec.	32	.97	31
	Total	1,282	.57	725
	Jan.	28	1.11	31
	Feb.	39	.87	34
	Mar.	62	.81	50
	Apr.	101	.65	66
	May	302	.31	94
	June	223	.36	81
-1954	July	265	.28	73
	Aug.	81	.43	35
	Sept.	45	.69	31
	Oct.	42	.95	40
	Nov.	41	.85	35
	Dec.	20	1.05	21
	Total	1,249	.47	591
	Jan.	24	.75	18
	Feb.	24	.71	17
	Mar.	44	1.11	49
	Apr.	106	.64	68
	May	168	.52	88
	June	288	.33	95
-1955	July	130	.38	49
	Aug.	80	.52	42
	Sept.	38	.58	22
	Oct.	38	.68	26
	Nov.	36	.75	27
	Dec.	45	.82	37
	Total	1,021	.53	538
	Jan.	50	.86	43
	Feb.	38	.76	29
	Mar.	150	.47	70
	Apr.	203	.43	87
	May	368	.39	144
	June	615	.29	178
-1956	July	207	.33	69
	Aug.	104	.42	44
	Sept.	48	.44	21
	Oct.	46	.74	34
	Nov.	39	.82	32
	Dec.	26	.88	23
	Total	1,894	.41	774
	Jan.	28	.86	24
	Feb.	43	.79	34
	Mar.	66	.91	60
	Apr.	86	.67	58
	May	275	.54	148
	June	685	.37	251
-1957	July	433	.36	155
	Aug.	142	.57	81
	Sept.	82	.58	48
	Oct.	77	.69	53
	Nov.	57	1.00	57
	Dec.	46	.91	42
	Total	2,020	.50	1,011
	Jan.	43	.77	33
	Feb.	55	.80	44
	Mar.	66	.71	47
	Apr.	134	.67	90
	May	386	.39	151
	June	335	.38	127
-1958	July	87	.50	44
	Aug.	57	.56	[illegible]
	Sept.	39	.69	[illegible]
	Oct.	36	.72	[illegible]
	Nov.	34	.70	24
	Dec.	38	.84	32
	Total	[illegible]	[illegible]	[illegible]

To obtain mg/l multiply T/AF by 735.

Table 2

Colorado River Basin

Historical Flow and Quality of Water Data

Green River near Greendale, Utah

Year	Month	Flow 1000 (A.F.)	Concen-tration (T./A.F.)	T.D.S. 1000 (Tons)
	Jan.	29	0.86	25
	Feb.	32	.91	29
	Mar.	65	.92	60
	Apr.	98	.71	70
	May	115	.57	66
	June	368	.36	132
-1959	July	176	.51	90
	Aug.	93	.47	44
	Sept.	58	.79	46
	Oct.	68	.72	49
	Nov.	51	.76	39
	Dec.	37	.99	37
	Total	1,190	.58	687
	Jan.	26	.81	21
	Feb.	29	.86	25
	Mar.	149	.70	104
	Apr.	140	.55	77
	May	127	.58	74
	June	216	.43	93
-1960	July	78	.49	38
	Aug.	43	.47	20
	Sept.	35	.56	20
	Oct.	49	.65	32
	Nov.	54	.67	36
	Dec.	27	.84	23
	Total	973	.58	563
	Jan.	27	.73	20
	Feb.	27	.77	21
	Mar.	64	.86	55
	Apr.	76	.69	52
	May	79	.59	47
	June	192	.32	61
-1961	July	56	.44	25
	Aug.	43	.58	25
	Sept.	55	.68	37
	Oct.	64	.70	45
	Nov.	54	.70	38
	Dec.	44	.78	34
	Total	781	.59	460
	Jan.	43	.65	28
	Feb.	83	.81	67
	Mar.	150	.84	126
	Apr.	374	.55	206
	May	394	.41	162
	June	456	.40	182
-1962	July	297	.39	116
	Aug.	109	.48	52
	Sept.	44	.64	28
	Oct.	48	.79	38
	Nov.	5	.80	4
	Dec.	16	.94	15
	Total	2,019	.51	1,024
	Jan.	23	.91	21
	Feb.	26	.92	24
	Mar.	6	.83	5
	Apr.	8	.87	7
	May	8	.87	7
	June	7	.86	6
-1963	July	6	.83	5
	Aug.	6	.83	5
	Sept.	7	.86	6
	Oct.	8	.87	7
	Nov.	19	.58	11
	Dec.	46	.63	29
	Total	170	.78	133
	Jan.	58	.57	33
	Feb.	56	.57	32
	Mar.	37	.59	22
	Apr.	35	.63	22
	May	91	.64	58
	June	86	.60	52
-1964	July	150	.61	92
	Aug.	122	.61	74
	Sept.	131	.61	80
	Oct.	159	.64	102
	Nov.	139	.60	83
	Dec.	194	.62	120
	Total	1,258	.61	770
	Jan.	216	0.63	136
	Feb.	213	.70	149
	Mar.	233	1.05	245
	Apr.	204	.83	169
	May	66	.80	53
	June	86	.86	74
-1965	July	29	.86	25
	Aug.	31	.87	27
	Sept.	44	.89	39
	Oct.	79	.79	62
	Nov.	120	.73	88
	Dec.	116	.65	75
	Total	1,437	.79	1,14[illegible]
	Jan.	72	0.64	46
	Feb.	72	.65	47
	Mar.	71	.76	54
	Apr.	130	.79	103
	May	83	.78	65
	June	95	.76	72
-1966	July	104	.75	78
	Aug.	118	.72	85
	Sept.	124	.73	91
	Oct.	124	.77	95
	Nov.	[illegible]	.81	69
	Dec.	[illegible]	.76	84
	Total	1,189	.75	889
	Jan.	142	.74	105
	Feb.	96	.75	72
	Mar.	67	.77	52
	Apr.	85	.81	69
	May	122	.83	101
	June	195	.83	162
-1967	July	171	.85	145
	Aug.	188	.86	162
	Sept.	180	.82	148
	Oct.	188	.87	164
	Nov.	173	.85	147
	Dec.	197	.72	142
	Total	1804	.81	1469
	Jan.	187	.70	131
	Feb.	123	.72	89
	Mar.	76	.83	63
	Apr.	96	.88	84
	May	119	.81	96
	June	97	.77	75
-1968	July	198	.75	148
	Aug.	200	.75	150
	Sept.	181	.75	136
	Oct.	140	.73	102
	Nov.	137	.68	93
	Dec.	137	.68	93
	Total	1691	.75	1260
	Jan.	183	.70	128
	Feb.	219	.73	160
	Mar.	166	.74	123
	Apr.	150	.78	117
	May	191	.78	149
	June	108	.74	80
	July	158	.74	117
-1969	Aug.	194	.72	140
	Sept.	165	.72	119
	Oct.	129	.69	89
	Nov.	129	.63	81
	Dec.	196	.62	122
	Total	1,988	.72	1,425
	Jan.	101	.62	63
	Feb.	78	.62	48
	Mar.	81	.64	52
	Apr.	109	.66	72
	May	64	.67	43
	June	87	.67	58
-1970	July	119	.65	77
	Aug.	127	.68	86
	Sept.	117	.70	82
	Oct.	59	.71	42
	Nov.	66	.68	45
	Dec.	80	.63	50
	Total	1,088	.66	718
	Jan.	55	.61	34
	Feb.	43	.62	26
	Mar.	48	.63	30
	Apr.	81	.63	51
	May	90	.66	59
	June	100	.66	66
1971	July	117	.64	75
	Aug.	151	.65	99
	Sept.	136	.67	91
	Oct.	117	.69	81
	Nov.	171	.66	114
	Dec.	200	.61	123
	Total	1,309	.65	849
	Jan.	170	.59	100
	Feb.	168	.62	104
	Mar.	102	.63	65
	Apr.	140	.65	90
	May	244	.64	156
	June	190	.63	119
1972	July	181	.62	113
	Aug.	161	.64	104
	Sept.	93	.66	62
	Oct.	195	.67	131
	Nov.	216	.67	144
	Dec.	223	.63	[illegible]
	Total	2,083	.64	1,328
	Jan.	220	.63	138
	Feb.	203	.65	131
	Mar.	113	.69	78
	Apr.	62	.76	47
	May	160	.71	114
	June	188	.72	136
1973	July	166	.68	113
	Aug.	211	.65	137
	Sept.	150	.65	98
	Oct.	148	.66	98
	Nov.	154	.66	102
	Dec.	156	.63	98
	Total	1,931	.67	1,290
	Jan.	127	.64	81
	Feb.	45	.67	30
	Mar.	51	.71	36
	Apr.	60	.73	44
	May	183	.71	130
	June	132	.67	89
1974	July	87	.68	59
	Aug.	137	.69	95
	Sept.	141	.70	98
	Oct.	180	.73	131
	Nov.	147	.71	105
	Dec.	148	.68	101
	Total	1,438	.69	999
	Jan.	154	.71	109
	Feb.	163	.72	117
	Mar.	98	.71	70
	Apr.	62	.73	45
	May	89	.75	67
	June	206	.76	155
1975	July	266	.73	195
	Aug.	198	.70	139
	Sept.	94	.70	66
	Oct.	86	.74	64
	Nov.	126	.71	89
	Dec.	212	.68	145
	Total	1,754	.72	1,261
	Jan.	179	.67	119
	Feb.	111	.66	73
	Mar.	108	.69	75
	Apr.	138	.84	116
	May	259	.72	187
	June	212	.72	152
1976	July	172	.70	120
	Aug.	162	.71	115
	Sept.	160	.64	103
	Oct.	167	.66	111
	Nov.	168	.72	121
	Dec.	192	.65	124
	Total	2,028	.70	1,416

To obtain mg/l multiply T/AF by 735.

Table 2
Colorado River Basin
Historical Flow and Quality of Water Data
Green River near Greendale, Utah

(Annual Summary)

Calendar Year	Flow 1,000 (A.F.)	T./A.F.	T.D.S. 1000 Ton	Flow 1,000,000 (m^3)	mg/l	T.D.S. 1,000 Tonne
1941	1,521	.63	957	1,876	463	868
1942	1,517	.63	959	1,871	465	870
1943	2,089	.44	928	2,577	327	842
1944	1,672	.54	903	2,062	397	819
1945	1,497	.55	826	1,847	406	749
1946	1,547	.52	799	1,908	380	725
1947	2,447	.47	1,143	3,018	344	1,037
1948	1,458	.53	768	1,798	388	697
1949	1,583	.61	969	1,953	450	879
1950	2,625	.47	1,244	3,238	349	1,129
1951	2,334	.48	1,118	2,879	352	1,014
1952	2,149	.52	1,117	2,651	382	1,013
1953	1,282	.57	725	1,581	416	658
1954	1,249	.47	591	1,541	348	536
1955	1,021	.53	538	1,259	388	488
1956	1,894	.41	774	2,336	301	702
1957	2,020	.50	1,011	2,492	368	917
1958	1,310	.52	677	1,616	380	614
1959	1,190	.58	687	1,468	424	623
1960	973	.58	563	1,200	426	511
1961	781	.59	460	963	433	417
1962	2,019	.51	1,024	2,490	373	929
1963	170	.78	133	210	576	121
1964	1,258	.61	770	1,552	450	699
1965	1,437	.79	1,142	1,773	584	1,036
1966	1,189	.75	889	1,467	550	807
1967	1,804	.81	1,469	2,225	599	1,333
1968	1,691	.75	1,260	2,086	548	1,143
1969	1,988	.72	1,425	2,452	527	1,293
1970	1,088	.66	718	1,342	485	651

Table 2

Colorado River Basin

Historical Flow and Quality of Water Data

Green River near Greendale, Utah

(Annual Summary)

Calendar Year	Flow 1,000 (A.F.)	T./A.F.	T.D.S. 1000 Ton	Flow 1,000,000 (m^3)	mg/l	T.D.S. 1,000 Tonne
1971	1,309	.65	849	1,615	477	770
1972	2,083	.64	1,328	2,569	469	1,205
1973	1,931	.67	1,290	2,382	491	1,170
1974	1,438	.69	999	1,774	511	906
1975	1,754	.72	1,261	2,164	529	1,144
1976	2,028	.70	1,416	2,502	514	1,285
Total	57,346		33,730	70,737		30,600
Average	1,593	.59	937	1,965	433	850

Table 3
Colorado River Basin
Historical Flow and Quality of Water Data

Yampa River near Maybell, Colorado

Year	Month	Flow 1,000 (A.F.)	Concentration (T./A.F.)	T.D.S. 1,000 (Tons)
	Jan.	14	.43	6
	Feb.	17	.41	7
	Mar.	39	.36	14
	Apr.	92	.23	21
	May	451	.15	69
	June	240	.18	43
1941	July	50	.28	14
	Aug.	21	.33	7
	Sept.	11	.45	5
	Oct.	40	.35	14
	Nov.	28	.39	11
	Dec.	24	.42	10
	Total	1,027	.22	221
	Jan.	21	.38	8
	Feb.	19	.42	8
	Mar.	50	.34	17
	Apr.	239	.18	43
	May	361	.16	59
	June	329	.17	55
1942	July	58	.26	15
	Aug.	14	.36	5
	Sept.	5	.60	3
	Oct.	10	.50	5
	Nov.	15	.47	7
	Dec.	13	.46	6
	Total	1,134	.20	231
	Jan.	12	.42	5
	Feb.	13	.46	6
	Mar.	46	.35	16
	Apr.	190	.19	37
	May	237	.18	43
	June	270	.17	47
1943	July	70	.26	18
	Aug.	20	.35	7
	Sept.	9	.44	4
	Oct.	10	.50	5
	Nov.	14	.43	6
	Dec.	12	.42	5
	Total	903	.22	199
	Jan.	10	.50	5
	Feb.	10	.50	5
	Mar.	18	.44	8
	Apr.	44	.27	12
	May	311	.17	53
	June	347	.16	57
1944	July	64	.25	16
	Aug.	8	.50	4
	Sept.	2	.50	1
	Oct.	9	.44	4
	Nov.	16	.44	7
	Dec.	13	.46	6
	Total	852	.21	178
	Jan.	12	.42	5
	Feb.	10	.50	5
	Mar.	24	.38	9
	Apr.	89	.24	21
	May	439	.15	68
	June	393	.16	62
1945	July	163	.20	33
	Aug.	56	.27	15
	Sept.	20	.35	7
	Oct.	17	.41	7
	Nov.	19	.42	8
	Dec.	16	.44	7
	Total	1,258	.20	247
	Jan.	14	.43	6
	Feb.	18	.44	8
	Mar.	40	.35	14
	Apr.	215	.19	40
	May	220	.19	41
	June	228	.18	42
1946	July	43	.28	12
	Aug.	16	.38	6
	Sept.	9	.44	4
	Oct.	20	.40	8
	Nov.	25	.40	10
	Dec.	20	.40	8
	Total	868	.23	199
	Jan.	14	.43	6
	Feb.	15	.47	7
	Mar.	76	.37	24
	Apr.	164	.20	33
	May	492	.15	74
	June	317	.17	53
1947	July	119	.22	26
	Aug.	32	.31	10
	Sept.	17	.35	6
	Oct.	22	.41	9
	Nov.	26	.38	10
	Dec.	38	.37	14
	Total	1,332	.20	272
	Jan.	37	.35	13
	Feb.	37	.35	13
	Mar.	57	.33	19
	Apr.	195	.19	37
	May	453	.15	69
	June	240	.18	43
1948	July	51	.27	14
	Aug.	20	.35	7
	Sept.	6	.50	3
	Oct.	16	.44	7
	Nov.	17	.41	7
	Dec.	16	.44	7
	Total	1,145	.21	239
	Jan.	15	.47	7
	Feb.	16	.44	7
	Mar.	44	.34	15
	Apr.	192	.19	37
	May	422	.16	66
	June	433	.15	67
1949	July	120	.22	26
	Aug.	20	.35	7
	Sept.	11	.45	5
	Oct.	24	.38	9
	Nov.	20	.40	8
	Dec.	15	.47	7
	Total	1,332	.20	261
	Jan.	15	.47	7
	Feb.	15	.47	7
	Mar.	28	.39	11
	Apr.	133	.21	28
	May	271	.17	47
	June	327	.17	55
1950	July	78	.24	19
	Aug.	14	.36	5
	Sept.	11	.45	5
	Oct.	16	.44	7
	Nov.	17	.41	7
	Dec.	17	.38	6
	Total	942	.22	204
	Jan.	14	.39	5
	Feb.	15	.47	7
	Mar.	33	.40	13
	Apr.	110	.31	34
	May	329	.15	49
	June	315	.11	35
1951	July	108	.14	15
	Aug.	29	.26	7
	Sept.	13	.36	5
	Oct.	21	.31	6
	Nov.	16	.36	6
	Dec.	13	.40	5
	Total	1,016	.18	187
	Jan.	14	.40	6
	Feb.	15	.39	6
	Mar.	19	.41	8
	Apr.	240	.30	72
	May	516	.17	88
	June	474	.13	62
1952	July	73	.21	15
	Aug.	33	.29	9
	Sept.	14	.37	5
	Oct.	12	.46	5
	Nov.	12	.48	6
	Dec.	14	.48	7
	Total	1,436	.20	289
	Jan.	15	.44	7
	Feb.	12	.46	6
	Mar.	25	.43	11
	Apr.	72	.34	24
	May	221	.20	44
	June	364	.12	44
1953	July	52	.22	11
	Aug.	24	.34	8
	Sept.	6	.54	3
	Oct.	9	.52	5
	Nov.	16	.41	6
	Dec.	12	.48	6
	Total	828	.21	175
	Jan.	15	.43	6
	Feb.	15	.44	7
	Mar.	23	.44	10
	Apr.	103	.25	26
	May	209	.14	29
	June	85	.16	14
1954	July	17	.34	6
	Aug.	8	.44	3
	Sept.	11	.45	5
	Oct.	23	.29	7
	Nov.	16	.36	6
	Dec.	13	.44	6
	Total	538	.23	125
	Jan.	12	.40	5
	Feb.	11	.40	4
	Mar.	28	.43	12
	Apr.	119	.30	36
	May	300	.15	45
	June	200	.12	24
1955	July	31	.23	7
	Aug.	15	.34	5
	Sept.	4	.56	2
	Oct.	8	.49	4
	Nov.	16	.41	7
	Dec.	20	.40	8
	Total	764	.21	159
	Jan.	17	.43	7
	Feb.	14	.44	6
	Mar.	30	.42	13
	Apr.	214	.27	28
	May	401	.15	60
	June	259	.12	31
1956	July	33	.24	8
	Aug.	17	.37	6
	Sept.	4	.59	2
	Oct.	8	.52	4
	Nov.	13	.45	6
	Dec.	12	.44	5
	Total	1,022	.20	206
	Jan.	12	.43	5
	Feb.	13	.42	5
	Mar.	29	.49	14
	Apr.	125	.39	49
	May	440	.22	97
	June	680	.17	115
1957	July	358	.13	47
	Aug.	64	.25	16
	Sept.	27	.33	9
	Oct.	29	.36	10
	Nov.	29	.41	12
	Dec.	25	.44	11
	Total	1,831	.21	390
	Jan.	20	.41	8
	Feb.	28	.45	13
	Mar.	41	.50	21
	Apr.	162	.40	65
	May	549	.18	99
	June	330	.12	40
1958	July	35	.27	9
	Aug.	11	.46	5
	Sept.	10	.50	5
	Oct.	13	.42	5
	Nov.	15	.46	7
	Dec.	13	.47	6
	Total	1,227	.23	283

Years 1941-50, October 1973-September 1975 correlated.

Table 3
Colorado River Basin
Historical Flow and Quality of Water Data

Yampa River near Maybell, Colorado

Year	Month	Flow 1,000 (A.F.)	Concen-tration (T./A.F.)	T.D.S. 1,000 (Tons)
	Jan.	13	.46	6
	Feb.	14	.48	7
	Mar.	21	.46	10
	Apr.	89	.38	34
	May	265	.16	42
	June	287	.11	31
1959	July	48	.21	10
	Aug.	22	.33	7
	Sept.	12	.43	5
	Oct.	41	.28	11
	Nov.	32	.29	9
	Dec.	23	.37	8
	Total	867	.21	180
	Jan.	14	.42	6
	Feb.	13	.39	5
	Mar.	41	.41	17
	Apr.	240	.23	55
	May	287	.16	46
	June	268	.12	32
1960	July	36	.26	9
	Aug.	10	.51	5
	Sept.	6	.59	3
	Oct.	12	.43	5
	Nov.	15	.46	7
	Dec.	13	.48	6
	Total	955	.20	196
	Jan.	12	.46	6
	Feb.	12	.43	5
	Mar.	19	.44	8
	Apr.	56	.38	21
	May	233	.17	40
	June	195	.12	23
1961	July	22	.28	6
	Aug.	8	.45	4
	Sept.	32	.31	10
	Oct.	61	.23	14
	Nov.	34	.31	10
	Dec.	22	.37	8
	Total	706	.22	154
	Jan.	20	.37	7
	Feb.	41	.45	18
	Mar.	45	.47	21
	Apr.	387	.28	108
	May	439	.17	75
	June	305	.24	73
1962	July	113	.16	18
	Aug.	18	.35	6
	Sept.	7	.62	4
	Oct.	18	.45	8
	Nov.	17	.45	8
	Dec.	13	.52	7
	Total	1,423	.25	353
	Jan.	13	.53	7
	Feb.	22	.49	11
	Mar.	29	.46	13
	Apr.	79	.30	24
	May	251	.14	35
	June	147	.14	20
1963	July	17	.35	6
	Aug.	13	.50	7
	Sept.	12	.43	5
	Oct.	7	.55	4
	Nov.	12	.53	6
	Dec.	8	.58	5
	Total	610	.23	143
	Jan.	8	.45	4
	Feb.	9	.43	4
	Mar.	14	.43	6
	Apr.	67	.39	26
	May	334	.17	57
	June	292	.11	32
1964	July	83	.23	19
	Aug.	19	.34	6
	Sept.	11	.40	4
	Oct.	11	.43	5
	Nov.	14	.48	7
	Dec.	17	.49	8
	Total	879	.20	178
	Jan.	17	.44	7
	Feb.	15	.49	7
	Mar.	18	.51	9
	Apr.	156	.27	42
	May	386	.14	54
	June	455	.11	50
1965	July	150	.15	22
	Aug.	46	.26	12
	Sept.	30	.26	8
	Oct.	37	.35	13
	Nov.	25	.46	12
	Dec.	20	.39	8
	Total	1,355	.18	244
	Jan.	21	.43	9
	Feb.	15	.46	7
	Mar.	88	.22	19
	Apr.	122	.16	20
	May	237	.32	75
	June	110	.48	53
1966	July	17	.58	10
	Aug.	8	.53	4
	Sept.	3	.49	1
	Oct.	16	.45	7
	Nov.	13	.46	6
	Dec.	13	.46	6
	Total	663	.33	217
	Jan.	12	.50	6
	Feb.	12	.50	6
	Mar.	42	.52	22
	Apr.	88	.27	24
	May	250	.19	48
	June	316	.16	49
1967	July	109	.22	24
	Aug.	21	.42	9
	Sept.	14	.37	5
	Oct.	17	.41	7
	Nov.	15	.47	7
	Dec.	12	.42	5
	Total	908	.23	212
	Jan.	14	.43	6
	Feb.	14	.43	6
	Mar.	28	.50	14
	Apr.	89	.30	27
	May	343	.16	56
	June	466	.24	110
1968	July	94	.39	36
	Aug.	37	.43	15
	Sept.	15	.40	6
	Oct.	22	.45	10
	Nov.	19	.53	10
	Dec.	17	.53	9
	Total	1,158	.26	305
	Jan.	17	.53	9
	Feb.	16	.50	8
	Mar.	26	.38	10
	Apr.	248	.15	36
	May	400	.17	68
	June	222	.17	37
1969	July	75	.32	24
	Aug.	21	.38	8
	Sept.	20	.35	7
	Oct.	28	.43	12
	Nov.	25	.48	12
	Dec.	22	.45	10
	Total	1,120	.22	241
	Jan.	22	.45	10
	Feb.	22	.59	13
	Mar.	30	.63	19
	Apr.	82	.52	43
	May	510	.16	81
	June	443	.16	69
1960	July	123	.28	35
	Aug.	27	.37	10
	Sept.	17	.35	6
	Oct.	29	.45	13
	Nov.	26	.50	13
	Dec.	21	.52	11
	Total	1,352	.24	323
	Jan.	23	.57	13
	Feb.	21	.48	10
	Mar.	66	.27	18
	Apr.	277	.20	55
	May	393	.16	62
	June	462	.15	70
1971	July	117	.23	27
	Aug.	20	.45	9
	Sept.	15	.47	7
	Oct.	19	.42	8
	Nov.	21	.62	13
	Dec.	19	.47	9
	Total	1,453	.21	301
	Jan.	21	.48	10
	Feb.	25	.52	13
	Mar.	72	.38	27
	Apr.	126	.22	28
	May	261	.16	43
	June	290	.13	38
1972	July	33	.27	9
	Aug.	9	.44	4
	Sept.	12	.50	6
	Oct.	25	.32	8
	Nov.	23	.30	7
	Dec.	22	.32	7
	Total	919	.22	200
	Jan.	19	.37	7
	Feb.	16	.38	6
	Mar.	26	.38	10
	Apr.	97	.18	17
	May	473	.17	82
	June	358	.16	58
1973	July	131	.21	28
	Aug.	32	.31	10
	Sept.	12	.42	5
	Oct.	15	.47	7
	Nov.	20	.40	8
	Dec.	22	.41	9
	Total	1,221	.20	247
	Jan.	19	.42	8
	Feb.	15	.47	7
	Mar.	35	.37	13
	Apr.	225	.18	41
	May	596	.14	85
	June	369	.16	60
1974	July	76	.25	19
	Aug.	19	.37	7
	Sept.	5	.60	3
	Oct.	13	.46	6
	Nov.	17	.41	7
	Dec.	9	.44	4
	Total	1,398	.19	260
	Jan.	14	.43	6
	Feb.	17	.41	7
	Mar.	28	.39	11
	Apr.	93	.24	22
	May	334	.16	55
	June	433	.15	67
1975	July	208	.19	39
	Aug.	31	.32	10
	Sept.	11	.45	5
	Oct.	15	.40	6
	Nov.	18	.44	8
	Dec.	17	.47	8
	Total	1,219	.20	244
	Jan.	15	.40	6
	Feb.	20	.50	10
	Mar.	33	.61	20
	Apr.	87	.41	36
	May	308	.16	50
	June	221	.14	30
1976	July	61	.21	13
	Aug.	22	.32	7
	Sept.	10	.50	5
	Oct.	13	.54	7
	Nov.	11	.45	5
	Dec.	9	.56	5
	Total	810	.24	194

Table 3
Colorado River Basin
Historical Flow and Quality of Water Data
Yampa River near Maybell, Colorado

(Annual Summary)

Calendar Year	Flow 1,000 (A.F.)	T./A.F.	T.D.S. 1000 Ton	Flow 1,000,000 (m^3)	mg/l	T.D.S. 1,000 Tonne
1941	1,027	.22	221	1,267	158	200
1942	1,134	.20	231	1,399	150	210
1943	903	.22	199	1,114	162	181
1944	852	.21	178	1,051	153	161
1945	1,258	.20	247	1,552	144	224
1946	868	.23	199	1,071	169	181
1947	1,332	.20	272	1,643	150	247
1948	1,145	.21	239	1,412	154	217
1949	1,332	.20	261	1,643	144	237
1950	942	.22	204	1,162	159	185
1951	1,016	.18	187	1,253	136	170
1952	1,436	.20	289	1,771	148	262
1953	828	.21	175	1,021	156	159
1954	538	.23	125	664	170	113
1955	764	.21	159	942	153	144
1956	1,022	.20	206	1,261	148	187
1957	1,831	.21	390	2,259	157	354
1958	1,227	.23	283	1,514	170	257
1959	867	.21	180	1,069	152	163
1960	955	.20	196	1,178	151	178
1961	706	.22	154	871	161	140
1962	1,423	.25	353	1,755	182	320
1963	610	.23	143	752	173	130
1964	879	.20	178	1,084	149	161
1965	1,355	.18	244	1,671	132	221
1966	663	.33	217	818	241	197
1967	908	.23	212	1,120	171	192
1968	1,158	.26	305	1,428	194	277
1969	1,120	.22	241	1,382	158	219
1970	1,352	.24	323	1,668	176	293

Table 3
Colorado River Basin
Historical Flow and Quality of Water Data
Yampa River near Maybell, Colorado

(Annual Summary)

Calendar Year	Flow 1,000 (A.F.)	T./A.F.	T.D.S. 1000 Ton	Flow 1,000,000 (m^3)	mg/l	T.D.S. 1,000 Tonne
1971	1,453	.21	301	1,792	152	273
1972	919	.22	200	1,134	160	181
1973	1,221	.20	247	1,506	149	224
1974	1,398	.19	260	1,724	137	236
1975	1,219	.20	244	1,504	147	221
1976	810	.24	194	999	176	176
Total	38,471		8,257	47,454		7,491
Average	1,069	.21	229	1,318	158	208

Table 4
Colorado River Basin
Historical Flow and Quality of Water Data
Duchesne River near Randlett, Utah

Year	Month	Flow 1000 (A.F.)	Concen-tration (T./A.F.)	T.D.S. 1000 (Tons)
	Jan.	25	1.12	28
	Feb.	24	1.29	31
	Mar.	21	1.71	36
	Apr.	20	1.50	30
	May	152	.50	76
	June	230	.38	88
1941	July	35	1.11	39
	Aug.	18	1.50	27
	Sept.	15	1.60	24
	Oct.	54	.93	50
	Nov.	51	.90	46
	Dec.	44	1.04	46
	Total	694	.75	523
	Jan.	40	.90	36
	Feb.	39	1.00	39
	Mar.	39	1.23	48
	Apr.	50	.90	45
	May	83	.72	60
	June	171	.46	79
1942	July	23	1.43	33
	Aug.	8	2.12	17
	Sept.	5	2.40	12
	Oct.	18	1.50	27
	Nov.	22	1.41	31
	Dec.	28	1.28	36
	Total	526	.88	463
	Jan.	26	1.12	29
	Feb.	29	1.17	34
	Mar.	29	1.51	44
	Apr.	43	1.00	43
	May	100	.64	64
	June	103	.62	64
1943	July	28	1.21	34
	Aug.	23	1.39	32
	Sept.	8	2.00	16
	Oct.	22	1.40	31
	Nov.	24	1.29	31
	Dec.	25	1.28	32
	Total	460	.99	454
	Jan.	23	1.08	25
	Feb.	26	1.31	34
	Mar.	43	1.20	52
	Apr.	48	.94	45
	May	128	.57	73
	June	255	.37	94
1944	July	82	.72	59
	Aug.	8	2.00	16
	Sept.	7	2.14	15
	Oct.	24	1.37	33
	Nov.	26	1.30	34
	Dec.	28	1.32	37
	Total	698	.74	517
	Jan.	30	1.00	30
	Feb.	27	1.18	32
	Mar.	32	1.40	45
	Apr.	24	1.29	31
	May	59	.86	51
	June	91	.67	61
1945	July	30	1.23	37
	Aug.	21	1.29	27
	Sept.	12	1.75	21
	Oct.	21	1.38	29
	Nov.	26	1.27	33
	Dec.	24	1.37	33
	Total	407	1.08	440
	Jan.	22	1.13	26
	Feb.	21	1.38	29
	Mar.	29	1.41	41
	Apr.	40	1.00	40
	May	70	.78	55
	June	47	.95	45
1946	July	5	2.60	13
	Aug.	6	2.33	14
	Sept.	4	2.75	11
	Oct.	17	1.53	26
	Nov.	32	1.22	39
	Dec.	30	1.20	36
	Total	324	1.16	375
	Jan.	26	1.07	28
	Feb.	36	1.08	39
	Mar.	36	1.27	46
	Apr.	23	1.30	30
	May	143	.53	76
	June	158	.49	78
1947	July	33	1.18	39
	Aug.	25	1.28	32
	Sept.	12	1.75	21
	Oct.	17	1.65	28
	Nov.	29	1.21	35
	Dec.	31	1.19	37
	Total	569	.76	429
	Jan.	29	1.00	29
	Feb.	26	1.31	34
	Mar.	40	1.20	48
	Apr.	31	1.23	38
	May	70	.79	55
	June	52	.92	47
1948	July	3	3.00	9
	Aug.	2	3.50	7
	Sept.	1	3.00	3
	Oct.	5	2.40	12
	Nov.	14	1.71	24
	Dec.	26	1.27	33
	Total	298	1.14	339
	Jan.	24	1.08	26
	Feb.	23	1.30	30
	Mar.	44	1.20	53
	Apr.	46	.98	45
	May	127	.56	71
	June	230	.39	90
1949	July	50	.94	47
	Aug.	7	2.14	15
	Sept.	8	2.13	17
	Oct.	25	1.28	32
	Nov.	29	1.21	35
	Dec.	28	1.29	36
	Total	641	.78	497
	Jan.	31	1.00	31
	Feb.	26	1.23	32
	Mar.	40	1.30	52
	Apr.	44	1.00	44
	May	97	.67	65
	June	193	.43	83
1950	July	45	1.00	45
	Aug.	9	2.00	18
	Sept.	13	1.77	23
	Oct.	16	1.56	25
	Nov.	27	1.26	34
	Dec.	33	1.36	45
	Total	574	.87	497
	Jan.	26	1.00	26
	Feb.	26	1.31	34
	Mar.	23	1.56	36
	Apr.	14	1.71	24
	May	79	.75	59
	June	124	.73	91
1951	July	31	1.29	40
	Aug.	26	1.46	38
	Sept.	10	1.90	19
	Oct.	25	1.28	32
	Nov.	30	1.22	30
	Dec.	32	1.22	39
	Total	448	1.06	477
	Jan.	28	1.07	30
	Feb.	26	1.31	34
	Mar.	31	1.42	44
	Apr.	111	.60	67
	May	304	.34	103
	June	302	.33	100
1952	July	70	.79	55
	Aug.	49	.94	46
	Sept.	30	1.20	36
	Oct.	21	1.38	29
	Nov.	26	1.31	34
	Dec.	37	1.11	41
	Total	1,035	.60	619
	Jan.	39	0.90	35
	Feb.	33	1.12	37
	Mar.	34	1.41	48
	Apr.	13	1.77	23
	May	15	1.60	24
	June	107	.60	64
1953	July	13	1.77	23
	Aug.	12	1.75	21
	Sept.	5	2.20	11
	Oct.	9	2.00	18
	Nov.	20	1.40	28
	Dec.	26	1.31	34
	Total	326	1.12	366
	Jan.	27	1.11	30
	Feb.	25	1.28	32
	Mar.	20	1.80	36
	Apr.	13	1.77	23
	May	36	1.11	40
	June	5	2.40	12
1954	July	2	3.00	6
	Aug.	1	4.00	4
	Sept.	6	2.33	14
	Oct.	17	1.59	27
	Nov.	18	1.50	27
	Dec.	18	1.50	27
	Total	188	1.48	278
	Jan.	25	1.08	27
	Feb.	21	1.43	30
	Mar.	34	1.38	47
	Apr.	22	1.41	31
	May	45	1.00	45
	June	34	1.09	37
1955	July	2	3.00	6
	Aug.	8	2.25	17
	Sept.	4	2.50	10
	Oct.	6	2.33	14
	Nov.	15	1.60	24
	Dec.	29	1.21	35
	Total	245	1.32	323
	Jan.	27	1.00	27
	Feb.	23	1.35	31
	Mar.	25	1.60	40
	Apr.	17	1.59	27
	May	74	.76	56
	June	90	.68	61
1956	July	4	2.75	11
	Aug.	2	4.00	8
	Sept.	1	5.00	5
	Oct.	4	2.25	9
	Nov.	17	1.59	27
	Dec.	19	1.21	23
	Total	303	1.07	325
	Jan.	21	1.05	22
	Feb.	20	1.05	21
	Mar.	22	1.54	34
	Apr.	12	1.83	22
	May	39	1.23	48
	June	184	.41	75
1957	July	35	.91	32
	Aug.	18	1.61	29
	Sept.	15	1.47	22
	Oct.	19	1.74	33
	Nov.	41	1.41	58
	Dec.	30	1.07	32
	Total	456	.94	428
	Jan.	29	.83	24
	Feb.	31	1.00	31
	Mar.	35	1.37	48
	Apr.	29	1.07	31
	May	141	.46	65
	June	103	.42	43
1958	July	4	2.50	10
	Aug.	1	4.00	4
	Sept.	3	2.33	7
	Oct.	5	2.60	13
	Nov.	14	1.93	27
	Dec.	21	1.24	26
	Total	416	.79	329

Table 4

Colorado River Basin

Historical Flow and Quality of Water Data

Duchesne River near Randlett, Utah

Year	Month	Flow 1000 (A.F.)	Concentration (T./A.F.)	T.D.S. 1000 (Tons)
1959	Jan.	22	1.14	25
	Feb.	24	1.04	25
	Mar.	17	1.29	22
	Apr.	5	2.00	10
	May	4	2.75	11
	June	34	.85	29
	July	6	2.00	12
	Aug.	4	2.75	11
	Sept.	4	2.50	10
	Oct.	11	1.54	17
	Nov.	13	1.54	20
	Dec.	22	1.32	29
	Total	166	1.33	221
1960	Jan.	23	.87	20
	Feb.	23	.83	19
	Mar.	27	1.15	31
	Apr.	8	1.62	13
	May	18	1.17	21
	June	23	.91	21
	July	1	4.00	4
	Aug.	1	4.00	4
	Sept.	1	4.00	4
	Oct.	5	2.40	12
	Nov.	12	1.58	19
	Dec.	18	1.33	24
	Total	160	1.20	192
1961	Jan.	21	1.19	25
	Feb.	19	1.47	28
	Mar.	10	1.50	15
	Apr.	2	3.50	7
	May	3	2.33	7
	June	3	2.67	8
	July	1	4.00	4
	Aug.	1	3.00	3
	Sept.	13	1.15	15
	Oct.	19	1.47	28
	Nov.	27	1.11	30
	Dec.	26	1.00	26
	Total	145	1.35	196
1962	Jan.	21	.81	17
	Feb.	43	.93	40
	Mar.	49	1.04	51
	Apr.	70	.69	48
	May	88	.64	56
	June	146	.47	69
	July	27	1.04	28
	Aug.	4	2.75	11
	Sept.	4	2.50	10
	Oct.	15	1.73	26
	Nov.	15	1.60	24
	Dec.	23	1.26	29
	Total	505	.81	409
1963	Jan.	18	1.17	21
	Feb.	29	1.14	33
	Mar.	10	1.90	19
	Apr.	5	3.20	16
	May	31	.97	30
	June	50	.76	38
	July	3	2.67	8
	Aug.	5	2.40	12
	Sept.	14	1.64	23
	Oct.	7	2.43	17
	Nov.	16	1.62	26
	Dec.	22	1.14	25
	Total	210	1.28	268
1964	Jan.	18	1.00	18
	Feb.	18	.94	17
	Mar.	23	1.04	24
	Apr.	14	1.57	22
	May	72	.68	49
	June	122	.66	81
	July	29	.97	28
	Aug.	6	2.17	13
	Sept.	4	2.75	11
	Oct.	5	2.80	14
	Nov.	18	1.67	30
	Dec.	27	1.26	34
	Total	356	.96	341
1965	Jan.	27	1.00	27
	Feb.	21	1.38	29
	Mar.	26	1.54	40
	Apr.	32	1.16	37
	May	71	1.11	79
	June	302	.49	148
	July	175	.51	90
	Aug.	57	.96	55
	Sept.	58	1.09	63
	Oct.	47	1.15	54
	Nov.	47	1.13	53
	Dec.	42	1.12	47
	Total	905	.80	721
1966	Jan.	39	.90	35
	Feb.	38	.74	28
	Mar.	47	1.02	48
	Apr.	35	1.20	42
	May	58	1.07	62
	June	16	1.81	29
	July	3	3.00	9
	Aug.	3	3.00	9
	Sept.	6	2.50	15
	Oct.	11	2.36	26
	Nov.	19	1.79	34
	Dec.	31	1.35	42
	Total	306	1.24	379
1967	Jan.	33	1.01	33
	Feb.	30	.98	29
	Mar.	41	1.44	59
	Apr.	19	1.71	32
	May	56	.82	46
	June	253	.45	114
	July	76	.70	53
	Aug.	11	1.89	21
	Sept.	10	2.05	20
	Oct.	12	2.17	26
	Nov.	18	1.74	31
	Dec.	32	1.02	33
	Total	591	.84	497
1968	Jan.	34	.85	29
	Feb.	34	1.12	38
	Mar.	40	1.49	60
	Apr.	31	1.61	50
	May	45	1.14	51
	June	250	.40	100
	July	24	1.23	30
	Aug.	26	1.40	36
	Sept.	13	1.91	25
	Oct.	20	1.77	35
	Nov.	27	1.45	39
	Dec.	38	1.03	39
	Total	582	.91	532
1969	Jan.	42	.88	37
	Feb.	37	.93	34
	Mar.	52	1.16	60
	Apr.	69	.89	61
	May	183	.43	79
	June	139	.75	104
	July	17	1.60	27
	Aug.	9	2.26	20
	Sept.	10	2.27	23
	Oct.	20	1.65	33
	Nov.	22	1.45	32
	Dec.	20	1.05	21
	Total	620	.86	531
1970	Jan.	14	1.07	15
	Feb.	17	1.12	19
	Mar.	10	1.60	16
	Apr.	3	2.67	8
	May	17	1.24	21
	June	58	1.29	75
	July	9	1.67	15
	Aug.	3	2.33	7
	Sept.	5	2.20	11
	Oct.	9	2.22	20
	Nov.	11	1.82	20
	Dec.	7	2.14	15
	Total	163	1.48	242
1971	Jan.	23	1.04	24
	Feb.	31	1.09	34
	Mar.	20	1.04	21
	Apr.	12	1.62	19
	May	28	1.16	32
	June	140	.49	68
	July	19	1.27	25
	Aug.	4	2.30	8
	Sept.	9	1.92	16
	Oct.	20	1.76	36
	Nov.	28	1.66	47
	Dec.	26	1.24	32
	Total	360	1.01	362
1972	Jan.	24	.97	24
	Feb.	35	.91	32
	Mar.	37	1.10	41
	Apr.	13	1.54	19
	May	37	.87	32
	June	116	.51	60
	July	6	1.83	11
	Aug.	3	2.49	8
	Sept.	5	2.54	12
	Oct.	22	1.70	38
	Nov.	31	1.31	41
	Dec.	37	.92	34
	Total	366	.96	352
1973	Jan.	32	.97	31
	Feb.	29	1.00	29
	Mar.	58	1.22	71
	Apr.	49	1.24	61
	May	126	.57	72
	June	138	.49	67
	July	31	1.19	37
	Aug.	13	1.62	21
	Sept.	17	1.47	25
	Oct.	20	1.45	29
	Nov.	25	1.28	32
	Dec.	28	.89	25
	Total	566	.88	500
1974	Jan.	28	.82	23
	Feb.	28	.75	21
	Mar.	41	1.02	42
	Apr.	19	1.16	22
	May	61	.66	40
	June	55	.56	31
	July	13	1.46	19
	Aug.	13	1.46	19
	Sept.	5	2.00	10
	Oct.	6	2.33	14
	Nov.	7	2.57	18
	Dec.	8	1.25	10
	Total	284	.95	269
1975	Jan.	11	1.18	13
	Feb.	10	1.30	13
	Mar.	7	2.00	14
	Apr.	5	1.80	9
	May	17	1.59	27
	June	160	.34	55
	July	163	.48	79
	Aug.	15	1.40	21
	Sept.	9	2.00	18
	Oct.	11	1.73	19
	Nov.	17	1.59	27
	Dec.	21	1.00	21
	Total	446	.71	316
1976	Jan.	20	.75	15
	Feb.	27	1.00	27
	Mar.	38	1.16	44
	Apr.	15	2.26	34
	May	31	.90	28
	June	29	2.10	61
	July	3	2.33	7
	Aug.	4	2.25	9
	Sept.	6	2.00	12
	Oct.	7	1.86	13
	Nov.	8	2.00	16
	Dec.	8	1.12	9
	Total	196	1.40	275

To obtain mg/l multiply T/AF by 735

Table 4
Colorado River Basin
Historical Flow and Quality of Water Data
Duchesne River near Randlett, Utah

(Annual Summary)

Calendar Year	Flow 1,000 (A.F.)	T./A.F.	T.D.S. 1000 Ton	Flow 1,000,000 (m^3)	mg/l	T.D.S. 1,000 Tonne
1941	694	.75	523	856	554	474
1942	526	.88	463	649	647	420
1943	460	.99	454	567	726	412
1944	698	.74	517	861	545	469
1945	407	1.08	440	502	795	399
1946	324	1.16	375	400	850	340
1947	569	.86	489	702	632	444
1948	298	1.14	339	368	837	308
1949	641	.78	497	791	570	451
1950	574	.87	497	708	637	451
1951	448	1.06	477	553	783	433
1952	1,035	.60	619	1,277	440	562
1953	326	1.12	366	402	826	332
1954	188	1.48	278	232	1,086	252
1955	245	1.32	323	302	970	293
1956	303	1.07	325	374	789	295
1957	456	.94	428	562	690	388
1958	416	.79	329	513	581	298
1959	166	1.33	221	205	976	200
1960	160	1.20	192	197	883	174
1961	145	1.35	196	179	994	178
1962	505	.81	409	623	596	371
1963	210	1.28	268	259	938	243
1964	356	.96	341	439	704	309
1965	905	.80	721	1,116	586	654
1966	306	1.24	379	377	912	344
1967	591	.84	497	729	619	451
1968	582	.91	532	718	673	483
1969	620	.86	531	765	630	482
1970	163	1.48	242	201	1,095	220

Table 4
Colorado River Basin
Historical Flow and Quality of Water Data
Duchesne River near Randlett, Utah
(Annual Summary)

Calendar Year	Flow 1,000 (A.F.)	T./A.F.	T.D.S. 1000 Ton	Flow 1,000,000 (m^3)	mg/l	T.D.S. 1,000 Tonne
1971	360	1.01	362	444	739	328
1972	366	.96	352	451	707	319
1973	566	.88	500	698	650	454
1974	284	.95	269	350	697	244
1975	446	.71	316	550	522	287
1976	196	1.40	275	242	1,029	249
Total	15,535		14,342	19,162		13,011
Average	432	.92	398	533	677	361

Table 5
Colorado River Basin
Historical Flow and Quality of Water Data

White River near Watson, Utah

Year	Month	Flow 1,000 (A.F.)	Concen-tration (T./A.F.)	T.D.S. 1,000 (Tons)
	Jan.	18	.89	16
	Feb.	22	.77	17
	Mar.	31	.71	22
	Apr.	34	.68	23
	May	156	.38	60
	June	118	.42	50
1941	July	40	.65	26
	Aug.	33	.70	23
	Sept.	29	.72	21
	Oct.	44	.61	27
	Nov.	29	.72	21
	Dec.	24	.79	19
	Total	578	.56	325
	Jan.	23	.78	18
	Feb.	22	.77	17
	Mar.	43	.63	27
	Apr.	107	.44	47
	May	158	.38	60
	June	144	.40	57
1942	July	44	.61	27
	Aug.	27	.74	20
	Sept.	23	.78	18
	Oct.	29	.72	21
	Nov.	27	.74	20
	Dec.	23	.78	18
	Total	670	.52	350
	Jan.	21	.81	17
	Feb.	24	.79	19
	Mar.	33	.70	23
	Apr.	40	.65	26
	May	56	.57	32
	June	87	.48	42
1943	July	31	.71	22
	Aug.	44	.61	27
	Sept.	20	.80	16
	Oct.	21	.81	17
	Nov.	23	.78	18
	Dec.	22	.77	17
	Total	422	.65	276
	Jan.	19	.84	16
	Feb.	21	.81	17
	Mar.	32	.69	22
	Apr.	29	.72	21
	May	94	.47	44
	June	112	.44	49
1944	July	40	.65	26
	Aug.	18	.89	16
	Sept.	15	.93	14
	Oct.	19	.84	16
	Nov.	20	.80	16
	Dec.	20	.80	16
	Total	439	.62	273
	Jan.	25	.76	19
	Feb.	26	.77	20
	Mar.	28	.71	20
	Apr.	30	.70	21
	May	108	.44	48
	June	105	.45	47
1945	July	57	.56	32
	Aug.	37	.68	25
	Sept.	23	.78	18
	Oct.	25	.76	19
	Nov.	27	.74	20
	Dec.	21	.81	17
	Total	512	.60	306
	Jan.	22	.77	17
	Feb.	21	.81	17
	Mar.	30	.70	21
	Apr.	43	.63	27
	May	68	.53	36
	June	67	.52	35
1946	July	21	.81	17
	Aug.	29	.72	21
	Sept.	21	.81	17
	Oct.	28	.71	20
	Nov.	24	.79	19
	Dec.	23	.78	18
	Total	397	.67	265

Year	Month	Flow 1,000 (A.F.)	Concen-tration (T./A.F.)	T.D.S. 1,000 (Tons)
	Jan.	17	.88	15
	Feb.	19	.84	16
	Mar.	43	.63	27
	Apr.	35	.69	24
	May	140	.40	56
	June	116	.43	50
1947	July	61	.56	34
	Aug.	37	.68	25
	Sept.	26	.77	20
	Oct.	34	.68	23
	Nov.	28	.71	20
	Dec.	27	.74	20
	Total	583	.57	330
	Jan.	24	.79	19
	Feb.	21	.81	17
	Mar.	38	.66	25
	Apr.	59	.56	33
	May	128	.41	53
	June	92	.47	43
1948	July	31	.71	22
	Aug.	28	.71	20
	Sept.	19	.84	16
	Oct.	24	.79	19
	Nov.	22	.77	17
	Dec.	19	.84	16
	Total	505	.59	300
	Jan.	15	.93	14
	Feb.	14	.93	13
	Mar.	39	.64	25
	Apr.	44	.61	27
	May	106	.44	47
	June	158	.38	60
1949	July	73	.52	38
	Aug.	31	.71	22
	Sept.	28	.71	20
	Oct.	34	.68	23
	Nov.	26	.77	20
	Dec.	21	.81	17
	Total	589	.55	326
	Jan.	20	.80	16
	Feb.	17	.88	15
	Mar.	30	.70	21
	Apr.	33	.70	23
	May	63	.54	34
	June	120	.43	51
1950	July	38	.66	25
	Aug.	20	.80	16
	Sept.	24	.79	20
	Oct.	25	.77	19
	Nov.	24	.77	18
	Dec.	23	.78	18
	Total	437	.63	276
	Jan.	18	.87	16
	Feb.	24	.81	19
	Mar.	27	.82	22
	Apr.	26	.75	20
	May	79	.41	32
	June	112	.34	38
1951	July	51	.53	27
	Aug.	39	.74	29
	Sept.	21	.69	14
	Oct.	25	.73	18
	Nov.	23	.73	17
	Dec.	21	.81	17
	Total	466	.58	269
	Jan.	20	.81	16
	Feb.	19	.80	15
	Mar.	21	.81	17
	Apr.	77	.93	72
	May	149	.52	77
	June	210	.38	80
1952	July	50	.59	30
	Aug.	46	.81	37
	Sept.	33	.71	23
	Oct.	26	.74	19
	Nov.	22	.80	18
	Dec.	26	.86	22
	Total	699	.61	426

Year	Month	Flow 1,000 (A.F.)	Concen-tration (T./A.F.)	T.D.S. 1,000 (Tons)
	Jan.	25	.79	20
	Feb.	23	.77	18
	Mar.	36	.87	31
	Apr.	30	.84	25
	May	70	.57	40
	June	135	.42	57
1953	July	33	.80	26
	Aug.	34	1.00	34
	Sept.	17	.86	15
	Oct.	21	.82	17
	Nov.	24	.83	20
	Dec.	21	.88	18
	Total	469	.66	321
	Jan.	23	.80	18
	Feb.	26	.83	22
	Mar.	24	.97	23
	Apr.	35	.70	25
	May	69	.59	41
	June	32	.70	22
1954	July	18	1.13	20
	Aug.	13	1.03	13
	Sept.	35	.88	31
	Oct.	26	.83	22
	Nov.	20	.86	17
	Dec.	18	.96	17
	Total	339	.80	271
	Jan.	16	.93	15
	Feb.	19	.92	17
	Mar.	47	.80	38
	Apr.	31	.87	27
	May	87	.43	37
	June	76	.81	62
1955	July	15	.91	14
	Aug.	21	1.16	24
	Sept.	12	.96	12
	Oct.	20	.83	17
	Nov.	22	.87	19
	Dec.	21	.85	18
	Total	387	.78	300
	Jan.	20	.88	18
	Feb.	19	.95	18
	Mar.	44	.89	39
	Apr.	33	.69	23
	May	99	.40	40
	June	85	.36	31
1956	July	22	.77	17
	Aug.	21	.89	19
	Sept.	13	.87	11
	Oct.	19	.87	17
	Nov.	21	.87	18
	Dec.	18	.91	16
	Total	414	.64	267
	Jan.	22	.88	19
	Feb.	22	.82	18
	Mar.	31	.99	31
	Apr.	29	.91	26
	May	76	.61	46
	June	218	.44	96
1952	July	169	.42	71
	Aug.	67	.75	50
	Sept.	36	.65	23
	Oct.	33	.75	25
	Nov.	33	.80	26
	Dec.	28	.79	22
	Total	764	.59	453
	Jan.	24	.78	19
	Feb.	35	.76	27
	Mar.	35	.84	29
	Apr.	45	.90	40
	May	148	.47	70
	June	132	.47	62
1958	July	34	.69	23
	Aug.	22	.78	17
	Sept.	25	.80	20
	Oct.	27	.73	20
	Nov.	25	.75	19
	Dec.	22	.78	17
	Total	574	.63	363

January 1941 to September 1950 T.D.S. Correlated

Table 5

Colorado River Basin

Historical Flow and Quality of Water Data

White River near Watson, Utah

Year	Month	Flow 1,000 (A.F.)	Concen-tration (T./A.F.)	T.D.S. 1,000 (Tons)
	Jan.	24	.84	20
	Feb.	21	.78	16
	Mar.	24	.84	20
	Apr.	30	.74	22
	May	64	.43	28
	June	96	.35	34
1959	July	30	.63	19
	Aug.	29	.89	26
	Sept.	24	.79	19
	Oct.	28	.69	19
	Nov.	23	.72	17
	Dec.	20	.79	16
	Total	413	.62	256
	Jan.	17	.83	14
	Feb.	19	.81	15
	Mar.	35	.83	29
	Apr.	41	.59	24
	May	69	.42	29
	June	95	.36	34
1960	July	21	.74	15
	Aug.	14	.93	13
	Sept.	19	.86	16
	Oct.	21	.74	16
	Nov.	21	.80	17
	Dec.	19	.85	16
	Total	391	.61	238
	Jan.	18	.87	16
	Feb.	19	.81	15
	Mar.	23	.82	19
	Apr.	22	.85	19
	May	65	.43	28
	June	65	.37	24
1961	July	16	.74	12
	Aug.	18	.98	18
	Sept.	38	.82	31
	Oct.	38	.72	27
	Nov.	26	.72	19
	Dec.	23	.83	19
	Total	371	.67	247
	Jan.	21	.76	16
	Feb.	37	.84	31
	Mar.	66	.97	64
	Apr.	85	.69	59
	May	139	.43	60
	June	128	.37	47
1962	July	59	.48	28
	Aug.	25	.76	19
	Sept.	21	.78	16
	Oct.	28	.76	21
	Nov.	25	.76	19
	Dec.	21	.84	18
	Total	655	.61	398
	Jan.	20	.88	18
	Feb.	24	.79	19
	Mar.	24	.82	20
	Apr.	29	.66	19
	May	71	.37	26
	June	31	.57	18
1963	July	12	.96	12
	Aug.	25	1.09	27
	Sept.	27	.99	27
	Oct.	15	.87	13
	Nov.	19	.90	17
	Dec.	15	1.01	15
	Total	312	.74	231
	Jan.	17	.94	16
	Feb.	19	.86	16
	Mar.	26	.83	22
	Apr.	30	.88	26
	May	84	.41	34
	June	99	.34	34
1964	July	30	.65	20
	Aug.	25	.81	20
	Sept.	16	.80	13
	Oct.	20	.74	15
	Nov.	20	.79	16
	Dec.	22	.84	18
	Total	408	.61	250

Year	Month	Flow 1,000 (A.F.)	Concen-tration (T./A.F.)	T.D.S. 1,000 (Tons)
	Jan.	23	.90	21
	Feb.	22	.88	19
	Mar.	33	1.01	33
	Apr.	35	.87	30
	May	98	.47	46
	June	158	.38	60
1965	July	69	.66	46
	Aug.	32	.73	23
	Sept.	33	.70	23
	Oct.	34	.67	23
	Nov.	28	.72	20
	Dec.	27	.81	22
	Total	592	.62	366
	Jan.	24	.86	21
	Feb.	21	.81	17
	Mar.	62	.86	53
	Apr.	32	.66	21
	May	71	.46	33
	June	26	.59	15
1966	July	10	1.13	11
	Aug.	16	1.05	17
	Sept.	14	1.00	14
	Oct.	23	.91	21
	Nov.	18	.85	15
	Dec.	19	.86	16
	Total	336	.76	254
	Jan.	18	.87	16
	Feb.	18	.83	15
	Mar.	29	.92	27
	Apr.	24	.80	19
	May	69	.49	34
	June	102	.42	43
1967	July	31	.64	20
	Aug.	17	.89	15
	Sept.	19	.84	16
	Oct.	22	.77	17
	Nov.	20	.85	17
	Dec.	18	.96	17
	Total	387	.66	256
	Jan.	18	.91	16
	Feb.	20	.92	18
	Mar.	25	.91	23
	Apr.	29	.92	27
	May	71	.57	40
	June	149	.34	51
1968	July	37	.71	26
	Aug.	43	.91	39
	Sept.	21	.64	13
	Oct.	26	.64	17
	Nov.	24	.66	16
	Dec.	26	.75	19
	Total	489	.62	305
	Jan.	24	.63	15
	Feb.	19	.82	16
	Mar.	33	.83	27
	Apr.	52	.61	32
	May	116	.35	41
	June	75	.46	34
1969	July	33	.60	20
	Aug.	25	.73	18
	Sept.	30	.81	24
	Oct.	33	.71	24
	Nov.	27	.63	17
	Dec.	24	.67	16
	Total	491	.58	284
	Jan.	26	.65	17
	Feb.	25	.68	17
	Mar.	25	.72	18
	Apr.	27	.70	19
	May	123	.34	42
	June	141	.32	45
1970	July	52	.46	24
	Aug.	32	.62	20
	Sept.	29	.59	17
	Oct.	32	.68	22
	Nov.	28	.57	16
	Dec.	26	.62	16
	Total	566	.48	273

Year	Month	Flow 1,000 (A.F.)	Concen-tration (T./A.F.)	T.D.S. 1,000 (Tons)
	Jan.	26	.62	16
	Feb.	22	.64	14
	Mar.	36	.66	24
	Apr.	43	.49	21
	May	86	.33	28
	June	135	.27	37
1971	July	47	.40	19
	Aug.	20	.60	12
	Sept.	29	.58	17
	Oct.	28	.57	16
	Nov.	29	.62	18
	Dec.	24	.67	16
	Total	525	.45	238
	Jan.	24	.75	18
	Feb.	22	.68	15
	Mar.	26	.65	17
	Apr.	30	.53	16
	May	72	.35	25
	June	108	.32	35
1972	July	22	.59	13
	Aug.	16	.69	11
	Sept.	22	.68	15
	Oct.	30	.60	18
	Nov.	26	.65	17
	Dec.	25	.72	18
	Total	423	.52	218
	Jan.	27	.70	19
	Feb.	21	.81	17
	Mar.	33	.85	28
	Apr.	28	.93	26
	May	129	.42	54
	June	137	.39	54
1973	July	56	.68	38
	Aug.	28	.82	23
	Sept.	26	.81	21
	Oct.	29	.72	21
	Nov.	27	.74	20
	Dec.	25	.76	19
	Total	566	.60	340
	Jan.	24	.88	21
	Feb.	19	.79	15
	Mar.	42	.93	39
	Apr.	44	.86	38
	May	128	.34	44
	June	99	.35	35
1974	July	37	.68	25
	Aug.	23	.74	17
	Sept.	18	.89	16
	Oct.	27	.70	19
	Nov.	25	.72	18
	Dec.	19	.79	15
	Total	505	.60	302
	Jan.	21	.76	16
	Feb.	21	.76	16
	Mar.	32	.81	26
	Apr.	29	.83	24
	May	76	.51	39
	June	159	.33	52
1975	July	94	.37	35
	Aug.	30	.63	19
	Sept.	26	.65	17
	Oct.	28	.64	18
	Nov.	25	.28	7
	Dec.	18	.72	13
	Total	559	.50	282
	Jan.	16	.75	12
	Feb.	26	.77	20
	Mar.	34	.76	26
	Apr.	31	.84	26
	May	87	.39	34
	June	72	.39	28
1976	July	22	.73	16
	Aug.	21	.81	17
	Sept.	17	.76	13
	Oct.	24	.58	14
	Nov.	20	.65	13
	Dec.	18	.67	12
	Total	388	.60	231

Table 5
Colorado River Basin
Historical Flow and Quality of Water Data
White River near Watson, Utah
(Annual Summary)

Calendar Year	Flow 1,000 (A.F.)	T./A.F.	T.D.S. 1000 Ton	Flow 1,000,000 (m^3)	mg/l	T.D.S. 1,000 Tonne
1941	578	.56	325	713	414	295
1942	670	.52	350	826	385	318
1943	422	.65	276	521	480	250
1944	439	.62	273	542	458	248
1945	512	.60	306	632	440	278
1946	397	.67	265	490	490	240
1947	583	.57	330	719	416	299
1948	505	.59	300	623	437	272
1949	589	.55	326	727	407	296
1950	437	.63	276	539	464	250
1951	466	.58	269	575	424	244
1952	699	.61	426	862	448	386
1953	469	.68	321	579	503	291
1954	339	.80	271	418	589	246
1955	387	.78	300	477	570	272
1956	414	.64	267	511	474	242
1957	764	.59	453	942	436	411
1958	574	.63	363	708	465	329
1959	413	.62	256	509	456	232
1960	391	.61	238	482	448	216
1961	371	.67	247	458	489	224
1962	655	.61	398	808	447	361
1963	312	.74	231	385	545	210
1964	408	.61	250	503	451	227
1965	592	.62	366	730	455	332
1966	336	.76	254	414	556	230
1967	387	.66	256	477	486	232
1968	489	.62	305	603	459	277
1969	491	.58	284	606	426	258
1970	566	.48	273	698	355	248

Table 5
Colorado River Basin
Historical Flow and Quality of Water Data
White River near Watson, Utah

(Annual Summary)

Calendar Year	Flow 1,000 (A.F.)	T./A.F.	T.D.S. 1000 Ton	Flow 1,000,000 (m^3)	mg/l	T.D.S. 1,000 Tonne
1971	525	.45	238	648	333	216
1972	423	.52	218	522	379	198
1973	566	.60	340	698	441	308
1974	505	.60	302	623	440	274
1975	559	.50	282	690	371	256
1976	388	.60	231	479	438	210
Total	17,621		10,666	21,737		9,676
Average	489	.61	296	604	445	269

Table 6

Colorado River Basin

Historical Flow and Quality of Water Data

Green River at Green River, Utah

Year	Month	Flow 1000 (A.F.)	Concentration (T./A.F.)	T.D.S. 1000 (Tons)
	Jan.	100	1.01	101
	Feb.	126	1.06	134
	Mar.	216	1.01	218
	Apr.	314	.75	235
	May	1,172	.53	621
	June	1,146	.49	562
-1941	July	359	.63	226
	Aug.	267	1.09	291
	Sept.	182	1.01	184
	Oct.	318	1.00	318
	Nov.	240	.90	216
	Dec.	168	.98	165
	Total	4,608	.71	3,271
	Jan.	112	1.04	117
	Feb.	122	.98	120
	Mar.	264	.94	248
	Apr.	858	.65	557
	May	980	.57	558
	June	1,271	.39	495
-1942	July	414	.57	236
	Aug.	152	.85	129
	Sept.	91	1.10	100
	Oct.	118	1.20	142
	Nov.	124	1.18	146
	Dec.	116	1.22	141
	Total	4,622	.65	2,989
	Jan.	112	1.13	127
	Feb.	130	1.02	132
	Mar.	236	.91	215
	Apr.	569	.57	325
	May	763	.39	298
	June	1,074	.40	430
-1943	July	612	.43	263
	Aug.	300	.83	249
	Sept.	116	.98	114
	Oct.	124	1.10	136
	Nov.	146	1.04	152
	Dec.	112	1.11	124
	Total	4,294	.60	2,565
	Jan.	80	1.20	96
	Feb.	111	1.06	118
	Mar.	253	1.07	271
	Apr.	529	.81	428
	May	924	.48	444
	June	1,391	.30	417
-1944	July	591	.44	260
	Aug.	143	.73	104
	Sept.	73	.96	70
	Oct.	115	1.13	130
	Nov.	119	1.14	136
	Dec.	88	1.23	108
	Total	4,417	.58	2,582
	Jan.	109	1.04	113
	Feb.	128	.99	127
	Mar.	185	1.03	191
	Apr.	291	.84	244
	May	909	.44	400
	June	1,016	.39	396
-1945	July	701	.41	287
	Aug.	335	.74	248
	Sept.	163	.77	125
	Oct.	161	.99	159
	Nov.	149	.99	148
	Dec.	113	1.06	120
	Total	4,260	.60	2,558
	Jan.	123	.95	117
	Feb.	117	.91	106
	Mar.	236	.90	212
	Apr.	528	.60	317
	May	775	.41	318
	June	746	.36	269
-1946	July	264	.47	124
	Aug.	152	.84	128
	Sept.	105	.91	96
	Oct.	149	1.00	149
	Nov.	170	.98	167
	Dec.	154	.94	145
	Total	3,519	.61	2,148

Year	Month	Flow 1000 (A.F.)	Concentration (T./A.F.)	T.D.S. 1000 (Tons)
	Jan.	92	1.07	98
	Feb.	151	.86	130
	Mar.	411	.79	325
	Apr.	422	.59	249
	May	1,400	.38	532
	June	1,348	.39	526
-1947	July	656	.40	262
	Aug.	365	.71	259
	Sept.	166	.77	128
	Oct.	181	.91	165
	Nov.	179	.91	163
	Dec.	152	1.01	154
	Total	5,523	.54	2,991
	Jan.	141	.94	132
	Feb.	136	.91	124
	Mar.	313	.86	269
	Apr.	558	.69	385
	May	1,061	.39	414
	June	952	.34	324
-1948	July	268	.54	145
	Aug.	137	.81	111
	Sept.	69	.81	56
	Oct.	92	1.02	94
	Nov.	104	1.05	109
	Dec.	97	1.10	107
	Total	3,928	.58	2,270
	Jan.	100	1.01	101
	Feb.	110	.92	101
	Mar.	276	.92	254
	Apr.	474	.69	327
	May	1,221	.43	525
	June	1,547	.42	650
-1949	July	592	.57	338
	Aug.	172	.77	132
	Sept.	112	.89	100
	Oct.	207	.98	203
	Nov.	190	.90	171
	Dec.	128	1.07	137
	Total	5,129	.59	3,039
	Jan.	141	1.01	142
	Feb.	147	1.01	148
	Mar.	356	.90	321
	Apr.	620	.64	397
	May	1,026	.53	544
	June	1,567	.35	548
-1950	July	734	.49	360
	Aug.	246	.63	155
	Sept.	149	.89	133
	Oct.	153	.96	147
	Nov.	166	.99	164
	Dec.	171	.96	164
	Total	5,476	.59	3,223
	Jan.	113	1.13	128
	Feb.	167	.92	154
	Mar.	204	.93	190
	Apr.	372	.70	260
	May	882	.45	397
	June	1,309	.40	524
-1951	July	627	.43	270
	Aug.	379	.69	261
	Sept.	178	.79	140
	Oct.	211	.99	209
	Nov.	164	1.05	172
	Dec.	132	1.07	142
	Total	4,738	.60	2,847
	Jan.	135	1.01	136
	Feb.	140	.96	134
	Mar.	160	1.05	168
	Apr.	988	.88	869
	May	2,087	.48	1,002
	June	1,809	.36	651
-1952	July	514	.60	309
	Aug.	315	.89	280
	Sept.	184	.96	177
	Oct.	129	1.09	140
	Nov.	122	1.24	151
	Dec.	129	1.20	155
	Total	6,712	.62	4,172

Year	Month	Flow 1000 (A.F.)	Concentration (T./A.F.)	T.D.S. 1000 (Tons)
	Jan.	140	1.05	147
	Feb.	141	1.04	147
	Mar.	217	1.00	217
	Apr.	221	.96	212
	May	454	.55	250
	June	1,167	.37	432
-1953	July	376	.48	181
	Aug.	212	.84	178
	Sept.	87	.99	86
	Oct.	86	1.20	104
	Nov.	126	1.15	145
	Dec.	107	1.18	126
	Total	3,334	.67	2,225
	Jan.	107	1.09	117
	Feb.	138	1.03	142
	Mar.	169	1.03	174
	Apr.	270	.75	202
	May	639	.38	243
	June	376	.45	169
-1954	July	346	.46	159
	Aug.	120	.65	78
	Sept.	134	1.02	137
	Oct.	139	1.14	159
	Nov.	120	1.06	127
	Dec.	80	1.25	100
	Total	2,638	.68	1,807
	Jan.	80	1.06	85
	Feb.	86	.92	79
	Mar.	237	.92	218
	Apr.	311	.77	239
	May	678	.39	264
	June	654	.36	236
-1955	July	223	.46	102
	Aug.	161	.83	134
	Sept.	71	.93	66
	Oct.	77	1.08	83
	Nov.	86	1.13	97
	Dec.	127	1.02	130
	Total	2,791	.62	1,733
	Jan.	155	.91	141
	Feb.	100	1.05	105
	Mar.	314	.81	255
	Apr.	460	.53	244
	May	995	.35	348
	June	1,207	.32	386
-1956	July	294	.49	144
	Aug.	169	.67	113
	Sept.	72	.72	52
	Oct.	77	.94	73
	Nov.	99	1.02	101
	Dec.	79	1.05	83
	Total	4,021	.51	2,045
	Jan.	83	.95	79
	Feb.	100	.94	94
	Mar.	237	.89	210
	Apr.	290	.73	212
	May	913	.48	438
	June	1,871	.34	636
-1957	July	1,164	.34	396
	Aug.	386	.79	305
	Sept.	202	.76	153
	Oct.	185	.94	174
	Nov.	228	.96	219
	Dec.	149	.97	144
	Total	5,808	.53	3,060
	Jan.	128	.93	119
	Feb.	184	.86	158
	Mar.	246	.92	227
	Apr.	432	.71	307
	May	1,311	.41	537
	June	1,174	.35	411
-1958	July	224	.62	139
	Aug.	110	.82	91
	Sept.	96	1.07	103
	Oct.	91	1.01	92
	Nov.	102	1.10	113
	Dec.	114	1.09	124
	Total	[illegible]	.57	[illegible]

To obtain mg/l multiply T/AF by 735.

Table 6
Colorado River Basin
Historical Flow and Quality of Water Data
Green River at Green River, Utah

Year	Month	Flow 1000 (A.F.)	Concentration (T./A.F.)	T.D.S. 1000 (Tons)
-1959	Jan.	97	1.13	110
	Feb.	114	.95	108
	Mar.	146	.94	137
	Apr.	219	.76	166
	May	480	.42	202
	June	763	.34	259
	July	346	.51	176
	Aug.	179	.90	161
	Sept.	104	.92	96
	Oct.	178	.86	153
	Nov.	152	.83	126
	Dec.	106	1.02	108
	Total	2,884	.62	1,802
-1960	Jan.	95	1.05	100
	Feb.	102	.95	97
	Mar.	320	.83	266
	Apr.	534	.51	272
	May	551	.39	215
	June	683	.33	225
	July	170	.52	88
	Aug.	69	.76	52
	Sept.	59	.93	55
	Oct.	96	1.00	96
	Nov.	105	.90	94
	Dec.	80	1.06	85
	Total	2,864	.57	1,645
-1961	Jan.	79	.98	77
	Feb.	94	.87	82
	Mar.	136	.89	121
	Apr.	184	.79	145
	May	342	.41	140
	June	542	.31	168
	July	112	.49	55
	Aug.	80	.91	73
	Sept.	175	.99	173
	Oct.	234	.75	176
	Nov.	161	.80	129
	Dec.	126	.88	111
	Total	2,265	.64	1,450
-1962	Jan.	115	.79	91
	Feb.	403	.72	290
	Mar.	401	.95	381
	Apr.	1,093	.56	612
	May	1,350	.36	486
	June	1,074	.38	408
	July	598	.41	245
	Aug.	177	.61	108
	Sept.	98	.98	96
	Oct.	126	1.37	173
	Nov.	94	1.15	108
	Dec.	72	1.10	79
	Total	5,601	.55	3,077
-1963	Jan.	71	1.04	74
	Feb.	120	.93	112
	Mar.	99	1.00	99
	Apr.	154	.68	105
	May	399	.40	160
	June	310	.42	130
	July	51	.77	39
	Aug.	72	1.77	127
	Sept.	95	1.57	149
	Oct.	47	1.32	62
	Nov.	74	1.26	93
	Dec.	84	1.08	91
	Total	1,576	.79	1,241
-1964	Jan.	109	.76	83
	Feb.	114	.76	87
	Mar.	128	.87	111
	Apr.	190	.89	169
	May	634	.45	285
	June	725	.40	290
	July	344	.54	186
	Aug.	196	.93	182
	Sept.	139	.82	114
	Oct.	196	.78	153
	Nov.	200	.84	168
	Dec.	267	.81	216
	Total	3,242	.63	2,044
-1965	Jan.	300	0.73	219
	Feb.	303	.82	248
	Mar.	361	.88	318
	Apr.	518	.79	409
	May	819	.46	377
	June	1,207	.42	507
	July	546	.52	284
	Aug.	228	.94	214
	Sept.	189	.95	180
	Oct.	253	.85	215
	Nov.	239	.92	220
	Dec.	248	.89	221
	Total	5,211	.65	3,412
-1966	Jan.	181	.86	156
	Feb.	166	.80	133
	Mar.	393	.80	314
	Apr.	390	.66	257
	May	566	.48	272
	June	325	.55	179
	July	147	.85	125
	Aug.	147	.96	141
	Sept.	157	1.01	159
	Oct.	189	1.01	191
	Nov.	159	1.06	169
	Dec.	146	1.12	164
	Total	2,966	.76	2,260
-1967	Jan.	196	.88	172
	Feb.	169	.90	152
	Mar.	256	.95	243
	Apr.	260	.77	200
	May	504	.54	272
	June	1,134	.52	590
	July	508	.63	320
	Aug.	247	.99	245
	Sept.	231	1.06	245
	Oct.	250	1.07	268
	Nov.	243	1.03	250
	Dec.	229	1.31	300
	Total	4,227	.77	3,257
-1968	Jan.	249	.87	217
	Feb.	196	.91	178
	Mar.	241	1.05	253
	Apr.	275	.94	258
	May	708	.58	411
	June	1,248	.35	437
	July	426	.65	277
	Aug.	345	1.02	352
	Sept.	241	.93	224
	Oct.	230	.99	228
	Nov.	221	.93	206
	Dec.	209	.88	184
	Total	4,589	.70	3,225
-1969	Jan.	282	.81	228
	Feb.	313	.82	257
	Mar.	354	.94	333
	Apr.	658	.69	454
	May	1,095	.45	493
	June	684	.54	369
	July	358	.59	211
	Aug.	270	.96	259
	Sept.	246	.97	239
	Oct.	255	.95	242
	Nov.	236	.88	208
	Dec.	271	.83	225
	Total	5,022	.70	3,518
-1970	Jan.	191	.84	160
	Feb.	175	.87	152
	Mar.	194	.89	173
	Apr.	249	.86	214
	May	867	.38	329
	June	1,019	.40	408
	July	420	.52	218
	Aug.	212	.80	170
	Sept.	179	.93	166
	Oct.	174	.94	164
	Nov.	159	1.12	178
	Dec.	145	.95	138
	Total	3,984	.62	2,470
1971	Jan.	154	.84	129
	Feb.	165	.80	132
	Mar.	202	.80	162
	Apr.	479	.54	259
	May	714	.38	272
	June	1,060	.29	311
	July	397	.46	183
	Aug.	197	.82	162
	Sept.	210	.92	193
	Oct.	211	.96	203
	Nov.	263	.92	241
	Dec.	267	.80	214
	Total	4,319	.57	2,461
1972	Jan.	272	.79	215
	Feb.	303	.73	222
	Mar.	323	.72	232
	Apr.	324	.63	204
	May	635	.43	273
	June	834	.35	292
	July	246	.60	148
	Aug.	202	.73	147
	Sept.	123	.92	114
	Oct.	303	.90	274
	Nov.	340	.83	282
	Dec.	277	.81	223
	Total	4,182	.63	2,626
1973	Jan.	264	.77	202
	Feb.	265	.76	201
	Mar.	342	.96	330
	Apr.	303	.95	287
	May	1,168	.42	491
	June	1,069	.39	415
	July	521	.62	323
	Aug.	303	.80	242
	Sept.	233	.91	213
	Oct.	231	.94	217
	Nov.	255	.89	227
	Dec.	239	.85	204
	Total	5,193	.65	3,352
1974	Jan.	231	.84	195
	Feb.	150	.87	131
	Mar.	300	.87	262
	Apr.	357	.83	297
	May	1,179	.34	399
	June	892	.31	275
	July	269	.62	167
	Aug.	192	.83	159
	Sept.	173	.86	149
	Oct.	228	.94	215
	Nov.	233	.98	229
	Dec.	205	.96	196
	Total	4,409	.61	2,674
1975	Jan.	256	.84	216
	Feb.	258	.81	208
	Mar.	249	.91	226
	Apr.	224	.87	196
	May	652	.46	301
	June	1,253	.36	449
	July	899	.44	392
	Aug.	318	.76	242
	Sept.	171	.96	164
	Oct.	160	.96	154
	Nov.	205	.92	189
	Dec.	292	.83	243
	Total	4,937	.60	2,980
1976	Jan.	259	.80	207
	Feb.	249	.72	179
	Mar.	294	.85	250
	Apr.	310	.95	294
	May	765	.48	367
	June	658	.44	289
	July	281	.59	165
	Aug.	206	.81	166
	Sept.	185	.78	144
	Oct.	214	.78	168
	Nov.	219	.80	175
	Dec.	226	.75	169
	Total	3,866	.67	2,573

To obtain mg/l multiply T/AF by 735.

Table 6
Colorado River Basin
Historical Flow and Quality of Water Data
Green River at Green River, Utah

(Annual Summary)

Calendar Year	Flow 1,000 (A.F.)	T./A.F.	T.D.S. 1000 Ton	Flow 1,000,000 (m^3)	mg/l	T.D.S. 1,000 Tonne
1941	4,608	.71	3,271	5,684	522	2,967
1942	4,622	.65	2,989	5,701	476	2,712
1943	4,294	.60	2,565	5,297	439	2,327
1944	4,417	.58	2,582	5,448	430	2,342
1945	4,260	.60	2,558	5,255	442	2,321
1946	3,519	.61	2,148	4,341	449	1,949
1947	5,523	.54	2,991	6,813	398	2,713
1948	3,928	.58	2,270	4,845	425	2,059
1949	5,129	.59	3,039	6,327	436	2,757
1950	5,476	.59	3,223	6,755	433	2,924
1951	4,738	.60	2,847	5,844	442	2,583
1952	6,712	.62	4,172	8,279	457	3,785
1953	3,334	.67	2,225	4,112	491	2,019
1954	2,638	.68	1,807	3,254	504	1,639
1955	2,791	.62	1,733	3,443	457	1,572
1956	4,021	.51	2,045	4,960	374	1,855
1957	5,808	.53	3,060	7,164	387	2,776
1958	4,212	.57	2,421	5,196	423	2,196
1959	2,884	.62	1,802	3,557	460	1,635
1960	2,864	.57	1,645	3,533	422	1,492
1961	2,265	.64	1,450	2,794	471	1,315
1962	5,601	.55	3,077	6,909	404	2,791
1963	1,576	.79	1,241	1,944	579	1,126
1964	3,242	.63	2,044	3,999	464	1,854
1965	5,211	.65	3,412	6,428	481	3,095
1966	2,966	.76	2,260	3,659	560	2,050
1967	4,227	.77	3,257	5,214	567	2,955
1968	4,589	.70	3,225	5,661	517	2,926
1969	5,022	.70	3,518	6,195	515	3,192
1970	3,984	.62	2,470	4,914	456	2,241

Table 6
Colorado River Basin
Historical Flow and Quality of Water Data
Green River at Green River, Utah

(Annual Summary)

Calendar Year	Flow 1,000 (A.F.)	T./A.F.	T.D.S. 1000 Ton	Flow 1,000,000 (m^3)	mg/l	T.D.S. 1,000 Tonne
1971	4,319	.57	2,461	5,327	419	2,233
1972	4,182	.63	2,626	5,158	462	2,382
1973	5,193	.65	3,352	6,406	475	3,041
1974	4,409	.61	2,674	5,439	446	2,426
1975	4,937	.60	2,980	6,090	444	2,703
1976	3,866	.67	2,573	4,769	489	2,334
Total	151,367		94,013	186,684		85,287
Average	4,205	.62	2,611	5,186	457	2,369

Table 7
Colorado River Basin
Historical Flow and Quality of Water Data
San Rafael River near Green River, Utah

Year	Month	Flow 1000 (A.F.)	Concentration (T./A.F.)	T.D.S. 1000 (Tons)
-1941	Jan.	2	4.0	8
	Feb.	2	4.0	8
	Mar.	6	3.5	21
	Apr.	1	4.0	4
	May	50	1.2	62
	June	49	1.2	59
	July	7	2.9	20
	Aug.	6	3.3	20
	Sept.	2	4.5	9
	Oct.	5	4.0	20
	Nov.	5	4.2	21
	Dec.	4	4.0	16
	Total	139	1.9	268
-1942	Jan.	6	2.8	17
	Feb.	5	3.6	18
	Mar.	6	3.7	22
	Apr.	14	2.8	39
	May	34	1.4	49
	June	51	1.2	61
	July	6	3.0	18
	Aug.	6	3.2	19
	Sept.	1	5.0	5
	Oct.	2	5.0	10
	Nov.	3	4.7	14
	Dec.	3	4.7	14
	Total	137	2.1	286
-1943	Jan.	4	3.0	12
	Feb.	5	3.4	17
	Mar.	6	3.8	23
	Apr.	15	2.9	44
	May	13	2.1	27
	June	14	2.0	28
	July	2	3.5	7
	Aug.	6	3.2	19
	Sept.	1	5.0	5
	Oct.	2	5.0	10
	Nov.	2	5.0	10
	Dec.	3	3.7	11
	Total	73	2.9	213
-1944	Jan.	2	3.5	7
	Feb.	3	3.0	9
	Mar.	6	3.5	21
	Apr.	1	5.0	5
	May	40	1.3	53
	June	72	1.1	78
	July	9	2.9	26
	Aug.	7	3.1	22
	Sept.	1	5.0	5
	Oct.	2	5.0	10
	Nov.	3	4.7	14
	Dec.	3	4.3	13
	Total	149	1.8	263
-1945	Jan.	3	3.3	10
	Feb.	3	4.0	12
	Mar.	6	3.5	21
	Apr.	1	6.0	6
	May	22	1.6	35
	June	27	1.5	41
	July	6	3.2	19
	Aug.	7	3.4	24
	Sept.	2	4.0	8
	Oct.	3	5.0	15
	Nov.	3	4.7	14
	Dec.	2	4.5	9
	Total	85	2.5	214
-1946	Jan.	2	4.0	8
	Feb.	4	3.3	13
	Mar.	6	3.7	22
	Apr.	11	3.2	35
	May	20	1.8	36
	June	8	2.4	19
	July	1	4.0	4
	Aug.	7	5.4	38
	Sept.	0	0	0
	Oct.	2	5.0	10
	Nov.	5	3.8	19
	Dec.	3	4.3	13
	Total	69	3.1	217
-1947	Jan.	2	4.5	9
	Feb.	5	3.0	15
	Mar.	4	3.8	15
	Apr.	3	4.3	13
	May	33	1.4	46
	June	26	1.8	47
	July	5	3.6	18
	Aug.	20	3.4	68
	Sept.	3	5.0	15
	Oct.	2	6.0	12
	Nov.	4	3.8	15
	Dec.	4	3.5	14
	Total	111	2.6	287
-1948	Jan.	3	3.7	11
	Feb.	6	3.0	18
	Mar.	7	3.6	25
	Apr.	4	3.5	14
	May	16	1.4	23
	June	13	2.2	29
	July	2	4.0	8
	Aug.	6	2.2	13
	Sept.	0	0	0
	Oct.	1	5.0	5
	Nov.	2	5.0	10
	Dec.	2	4.5	9
	Total	62	2.7	165
-1949	Jan.	2	4.0	8
	Feb.	2	4.0	8
	Mar.	9	3.3	30
	Apr.	10	2.2	22
	May	30	1.3	38
	June	52	1.2	64
	July	14	2.7	38
	Aug.	5	3.0	15
	Sept.	3	4.7	14
	Oct.	3	4.7	14
	Nov.	3	4.7	14
	Dec.	2	4.5	9
	Total	135	2.0	274
-1950	Jan.	2	4.5	9
	Feb.	6	3.3	20
	Mar.	5	4.0	20
	Apr.	3	4.7	14
	May	9	2.2	20
	June	11	2.2	24
	July	9	2.9	26
	Aug.	1	3.0	3
	Sept.	1	5.0	5
	Oct.	1	6.0	6
	Nov.	2	5.5	11
	Dec.	3	4.3	13
	Total	53	3.2	171
-1951	Jan.	2	5.0	10
	Feb.	3	3.7	11
	Mar.	2	5.0	10
	Apr.	1	6.0	6
	May	15	1.9	29
	June	23	1.7	40
	July	3	3.7	11
	Aug.	12	2.2	27
	Sept.	1	5.0	5
	Oct.	6	4.0	24
	Nov.	4	4.5	18
	Dec.	3	5.0	15
	Total	75	2.7	206
-1952	Jan.	3	3.7	11
	Feb.	5	3.6	18
	Mar.	14	3.1	44
	Apr.	24	2.4	58
	May	93	.8	78
	June	128	.9	114
	July	19	1.9	36
	Aug.	12	3.3	40
	Sept.	5	3.8	19
	Oct.	3	4.7	14
	Nov.	4	4.5	18
	Dec.	4	4.0	16
	Total	314	1.5	466
-1953	Jan.	6	2.8	17
	Feb.	7	3.1	22
	Mar.	6	3.2	19
	Apr.	3	4.3	13
	May	2	5.5	11
	June	31	1.5	47
	July	5	3.8	19
	Aug.	9	3.7	33
	Sept.	1	5.0	5
	Oct.	4	4.3	17
	Nov.	4	4.5	18
	Dec.	3	4.8	14
	Total	81	2.9	235
-1954	Jan.	3	4.0	12
	Feb.	5	3.8	19
	Mar.	4	3.8	15
	Apr.	3	4.3	13
	May	8	2.9	23
	June	1	5.0	5
	July	1	5.0	5
	Aug.	1	3.0	3
	Sept.	4	4.0	16
	Oct.	2	4.0	8
	Nov.	2	4.5	9
	Dec.	2	4.5	9
	Total	36	3.8	137
-1955	Jan.	2	4.0	8
	Feb.	2	3.5	7
	Mar.	6	3.5	21
	Apr.	3	3.7	11
	May	4	3.0	12
	June	6	2.8	17
	July	0	0	0
	Aug.	3	3.7	11
	Sept.	0	0	0
	Oct.	0	0	0
	Nov.	1	5.0	5
	Dec.	2	4.5	9
	Total	29	3.5	101
-1956	Jan.	3	3.7	11
	Feb.	3	3.3	10
	Mar.	3	3.3	10
	Apr.	1	5.0	5
	May	11	1.6	18
	June	8	2.0	16
	July	1	4.0	4
	Aug.	1	3.0	3
	Sept.	0	0	0
	Oct.	0	0	0
	Nov.	1	5.0	5
	Dec.	1	5.0	5
	Total	33	2.6	87
-1957	Jan.	2	3.0	6
	Feb.	4	3.0	12
	Mar.	2	5.0	10
	Apr.	1	5.0	5
	May	9	3.1	28
	June	94	.8	79
	July	24	1.5	37
	Aug.	13	2.8	36
	Sept.	4	3.5	14
	Oct.	10	3.3	33
	Nov.	21	2.5	53
	Dec.	5	3.4	17
	Total	189	1.7	330
-1958	Jan.	5	2.6	13
	Feb.	8	2.8	22
	Mar.	6	3.3	20
	Apr.	13	1.6	21
	May	66	.9	60
	June	57	.8	47
	July	2	4.0	8
	Aug.	4	4.5	18
	Sept.	4	4.3	17
	Oct.	1	5.0	5
	Nov.	2	4.0	8
	Dec.	4	3.3	13
	Total	172	1.5	252

To obtain mg/l multiply T/AF by 735.

Table 7

Colorado River Basin

Historical Flow and Quality of Water Data

San Rafael River near Green River, Utah

Year	Month	Flow 1000 (A.F.)	Concentration (T./A.F.)	T.D.S. 1000 (Tons)
	Jan.	3	3.3	10
	Feb.	4	3.0	12
	Mar.	3	4.0	12
	Apr.	2	3.5	7
	May	1	5.0	5
	June	2	4.0	8
-1959	July	0	0	0
	Aug.	1	3.0	3
	Sept.	1	5.0	5
	Oct.	1	4.0	4
	Nov.	2	4.0	8
	Dec.	1	7.0	7
	Total	21	3.9	81
	Jan.	1	6.0	6
	Feb.	2	3.5	7
	Mar.	8	2.8	22
	Apr.	3	3.3	10
	May	8	1.9	15
	June	11	1.5	17
-1960	July	0	0	0
	Aug.	0	0	0
	Sept.	1	4.0	4
	Oct.	8	2.5	20
	Nov.	2	4.5	9
	Dec.	2	4.0	8
	Total	46	2.6	118
	Jan.	2	3.5	7
	Feb.	3	2.7	8
	Mar.	2	5.5	11
	Apr.	2	4.0	8
	May	3	3.0	9
	June	2	2.5	5
-1961	July	0	0	0
	Aug.	7	2.9	20
	Sept.	18	2.9	53
	Oct.	3	4.0	12
	Nov.	4	3.5	14
	Dec.	2	4.5	9
	Total	48	3.3	156
	Jan.	2	4.0	8
	Feb.	8	2.5	20
	Mar.	6	2.8	17
	Apr.	11	1.3	14
	May	29	1.1	31
	June	37	1.0	37
-1962	July	7	2.6	18
	Aug.	1	4.0	4
	Sept.	3	3.0	9
	Oct.	4	4.5	18
	Nov.	2	5.5	11
	Dec.	2	5.5	11
	Total	112	1.8	198
	Jan.	2	5.5	11
	Feb.	4	3.2	13
	Mar.	2	5.5	11
	Apr.	1	6.0	6
	May	6	2.3	14
	June	10	2.2	22
-1963	July	1	2.0	2
	Aug.	9	3.8	34
	Sept.	6	4.3	26
	Oct.	1	6.0	6
	Nov.	2	4.5	9
	Dec.	2	4.5	9
	Total	46	3.5	163
	Jan.	1	6.0	6
	Feb.	2	4.0	8
	Mar.	3	3.7	11
	Apr.	1	8.0	8
	May	15	1.9	29
	June	20	1.6	33
-1964	July	4	3.8	15
	Aug.	6	3.7	22
	Sept.	1	4.0	4
	Oct.	0	0	0
	Nov.	1	7.0	7
	Dec.	3	4.7	14
	Total	57	2.7	157
	Jan.	4	3.5	14
	Feb.	3	3.7	11
	Mar.	3	4.0	12
	Apr.	6	2.7	16
	May	18	1.6	28
	June	77	.9	70
-1965	July	38	1.6	60
	Aug.	16	2.5	40
	Sept.	5	4.0	20
	Oct.	4	4.5	18
	Nov.	5	4.8	24
	Dec.	5	3.2	16
	Total	184	1.8	329
	Jan.	3	3.7	11
	Feb.	3	3.7	11
	Mar.	8	3.5	28
	Apr.	4	3.0	12
	May	4	4.5	18
	June	2	4.0	8
-1966	July	2	4.5	9
	Aug.	1	3.0	3
	Sept.	2	5.0	10
	Oct.	1	8.0	8
	Nov.	1	5.0	5
	Dec.	2	5.0	10
	Total	33	4.0	133
	Jan.	1	4.8	5
	Feb.	2	3.8	8
	Mar.	2	4.6	9
	Apr.	1	5.8	6
	May	5	3.2	16
	June	22	2.0	44
-1967	July	7	2.9	21
	Aug.	3	3.3	10
	Sept.	5	3.6	18
	Oct.	2	4.6	9
	Nov.	2	4.5	9
	Dec.	2	5.0	10
	Total	54	3.1	165
	Jan.	2	5.0	10
	Feb.	3	4.1	12
	Mar.	3	5.2	16
	Apr.	2	4.8	10
	May	6	3.8	23
	June	25	1.3	33
-1968	July	6	3.6	21
	Aug.	11	3.3	36
	Sept.	4	3.9	16
	Oct.	5	4.3	21
	Nov.	3	4.1	12
	Dec.	2	4.7	9
	Total	72	3.0	219
	Jan.	3	4.0	12
	Feb.	3	3.3	10
	Mar.	9	3.6	32
	Apr.	13	1.8	23
	May	38	1.0	39
	June	32	1.4	44
-1969	July	8	2.4	19
	Aug.	9	3.3	30
	Sept.	6	3.8	23
	Oct.	4	4.2	17
	Nov.	4	3.0	12
	Dec.	4	3.3	13
	Total	133	2.1	274
	Jan.	2	4.0	8
	Feb.	4	3.5	14
	Mar.	2	6.0	12
	Apr.	2	4.5	9
	May	14	1.5	21
	June	48	1.2	59
-1970	July	9	2.9	26
	Aug.	4	4.0	16
	Sept.	4	4.0	16
	Oct.	3	5.0	15
	Nov.	3	4.7	14
	Dec.	3	4.7	14
	Total	98	2.3	224
	Jan.	2	3.0	6
	Feb.	2	4.0	8
	Mar.	3	4.1	13
	Apr.	3	3.3	10
	May	4	4.0	16
	June	5	2.6	13
1971	July	6	3.2	19
	Aug.	4	4.0	16
	Sept.	2	5.0	10
	Oct.	5	5.3	28
	Nov.	4	4.5	18
	Dec.	2	4.5	9
	Total	42	4.0	166
	Jan.	2	4.5	9
	Feb.	3	4.0	12
	Mar.	3	4.0	12
	Apr.	2	4.0	8
	May	2	5.0	10
	June	3	4.7	14
1972	July	1	6.0	6
	Aug.	1	5.0	5
	Sept.	1	4.0	4
	Oct.	9	3.0	27
	Nov.	4	5.0	20
	Dec.	1	7.0	7
	Total	32	4.2	134
	Jan.	2	3.50	7
	Feb.	2	4.00	8
	Mar.	18	3.61	65
	Apr.	4	4.25	17
	May	29	1.00	29
	June	51	1.18	60
1973	July	10	3.00	30
	Aug.	4	4.00	16
	Sept.	4	3.75	15
	Oct.	5	3.40	17
	Nov.	3	5.33	16
	Dec.	3	4.00	12
	Total	135	2.16	292
	Jan.	2	5.00	10
	Feb.	2	4.00	8
	Mar.	3	5.33	16
	Apr.	2	5.00	10
	May	3	5.00	15
	June	4	3.75	15
1974	July	5	4.00	20
	Aug.	3	3.33	10
	Sept.	2	4.50	9
	Oct.	5	4.40	22
	Nov.	4	5.75	23
	Dec.	2	5.00	10
	Total	37	4.54	168
	Jan.	2	4.0	8
	Feb.	2	5.0	10
	Mar.	3	5.0	15
	Apr.	2	3.0	6
	May	3	4.3	13
	June	31	1.5	46
1975	July	28	1.4	38
	Aug.	5	2.8	14
	Sept.	5	3.2	16
	Oct.	4	3.2	13
	Nov.	3	4.6	14
	Dec.	2	4.5	9
	Total	90	2.2	202
	Jan.	1	6.0	6
	Feb.	3	4.0	12
	Mar.	2	3.5	7
	Apr.	1	5.0	5
	May	2	6.0	12
	June	2	4.5	9
1976	July	2	4.0	8
	Aug.	1	6.0	6
	Sept.	2	4.0	8
	Oct.	2	4.5	9
	Nov.	2	4.0	8
	Dec.	1	6.0	6
	Total	21	4.8	96

To obtain mg/l multiply T/AF by 735.

Table 7
Colorado River Basin
Historical Flow and Quality of Water Data
San Rafael River near Green River, Utah

(Annual Summary)

Calendar Year	Flow 1,000 (A.F.)	T./A.F.	T.D.S. 1000 Ton	Flow 1,000,000 (m^3)	mg/l	T.D.S. 1,000 Tonne
1941	139	1.9	268	171	1,421	243
1942	137	2.1	286	169	1,533	259
1943	73	2.9	213	90	2,144	193
1944	149	1.8	263	184	1,299	239
1945	85	2.5	214	105	1,848	194
1946	69	3.1	217	85	2,318	197
1947	111	2.6	287	137	1,898	260
1948	62	2.7	165	76	1,974	150
1949	135	2.0	274	167	1,491	249
1950	53	3.2	171	65	2,385	155
1951	75	2.7	206	93	2,011	187
1952	314	1.5	466	387	1,093	423
1953	81	2.9	235	100	2,130	213
1954	36	3.8	137	44	2,818	124
1955	29	3.5	101	36	2,556	92
1956	33	2.6	87	41	1,927	79
1957	189	1.7	330	233	1,283	299
1958	172	1.5	252	212	1,080	229
1959	21	3.9	81	26	2,808	73
1960	46	2.6	118	57	1,877	107
1961	48	3.3	156	59	2,407	142
1962	112	1.8	198	138	1,304	180
1963	46	3.5	163	57	2,596	148
1964	57	2.7	157	70	2,029	142
1965	184	1.8	329	227	1,313	298
1966	33	4.0	133	41	2,951	121
1967	54	3.1	165	67	2,239	150
1968	72	3.0	219	89	2,236	199
1969	133	2.1	274	164	1,518	249
1970	98	2.3	224	121	1,678	203

Table 7
Colorado River Basin
Historical Flow and Quality of Water Data
San Rafael River near Green River, Utah

(Annual Summary)

Calendar Year	Flow 1,000 (A.F.)	T./A.F.	T.D.S. 1000 Ton	Flow 1,000,000 (m^3)	mg/l	T.D.S. 1,000 Tonne
1971	42	4.0	166	52	2,904	151
1972	32	4.2	134	39	3,128	122
1973	135	2.2	292	167	1,587	265
1974	37	4.5	168	46	3,304	152
1975	90	2.2	202	111	1,649	183
1976	21	4.8	96	26	3,346	87
Total	3,203		7,447	3,952		6,757
Average	89	2.3	207	110	1,709	188

Table 8

Colorado River Basin

Historical Flow and Quality of Water Data

Colorado River near Glenwood Springs, Colorado

Year	Month	Flow 1000 (A.F.)	Concentration (T./A.F.)	T.D.S. 1000 (Tons)
	Jan.	36	0.75	27
	Feb.	37	.59	22
	Mar.	51	.60	30
	Apr.	85	.47	40
	May	535	.22	118
	June	470	.19	90
- 1941	July	163	.37	60
	Aug.	84	.60	50
	Sept.	67	.60	40
	Oct.	78	.58	45
	Nov.	59	.63	37
	Dec.	48	.67	32
	Total	1,713	.34	591
	Jan.	43	.74	32
	Feb.	41	.68	28
	Mar.	46	.70	32
	Apr.	167	.42	70
	May	389	.24	93
	June	721	.16	116
- 1942	July	230	.27	62
	Aug.	78	.53	41
	Sept.	46	.78	36
	Oct.	53	.75	40
	Nov.	49	.76	37
	Dec.	40	.82	33
	Total	1,903	.33	620
	Jan.	37	.86	32
	Feb.	36	.78	28
	Mar.	48	.75	36
	Apr.	162	.34	55
	May	342	.23	79
	June	582	.18	105
- 1943	July	254	.28	71
	Aug.	109	.45	49
	Sept.	66	.64	42
	Oct.	60	.67	40
	Nov.	67	.54	36
	Dec.	64	.53	34
	Total	1,827	.33	607
	Jan.	37	.76	28
	Feb.	44	.66	29
	Mar.	50	.72	36
	Apr.	85	.51	43
	May	302	.26	78
	June	498	.16	80
- 1944	July	185	.29	54
	Aug.	72	.49	35
	Sept.	45	.71	32
	Oct.	60	.65	39
	Nov.	57	.63	36
	Dec.	59	.56	33
	Total	1,494	.35	523
	Jan.	41	.71	29
	Feb.	37	.68	25
	Mar.	62	.50	31
	Apr.	72	.51	37
	May	347	.22	76
	June	461	.18	83
- 1945	July	268	.26	70
	Aug.	181	.33	60
	Sept.	73	.52	38
	Oct.	78	.49	38
	Nov.	73	.47	34
	Dec.	71	.45	32
	Total	1,764	.31	553
	Jan.	67	.48	32
	Feb.	54	.54	29
	Mar.	64	.55	35
	Apr.	197	.28	55
	May	284	.22	62
	June	362	.22	80
- 1946	July	164	.40	65
	Aug.	83	.51	42
	Sept.	59	.66	39
	Oct.	70	.61	43
	Nov.	61	.59	36
	Dec.	77	.40	31
	Total	1,542	.36	549
	Jan.	52	0.60	31
	Feb.	54	.61	33
	Mar.	68	.53	36
	Apr.	123	.37	46
	May	486	.19	92
	June	606	.17	103
- 1947	July	438	.21	92
	Aug.	147	.38	56
	Sept.	79	.53	42
	Oct.	90	.47	42
	Nov.	80	.49	39
	Dec.	75	.48	36
	Total	2,298	.28	648
	Jan.	76	.45	34
	Feb.	72	.44	32
	Mar.	68	.50	34
	Apr.	162	.37	60
	May	542	.20	108
	June	470	.18	85
- 1948	July	156	.35	55
	Aug.	90	.51	46
	Sept.	57	.67	38
	Oct.	63	.65	41
	Nov.	66	.53	35
	Dec.	59	.61	36
	Total	1,881	.32	604
	Jan.	67	.54	36
	Feb.	56	.57	32
	Mar.	58	.59	34
	Apr.	132	.38	50
	May	364	.23	84
	June	654	.19	124
- 1949	July	356	.24	85
	Aug.	106	.45	48
	Sept.	69	.59	41
	Oct.	61	.70	43
	Nov.	55	.71	39
	Dec.	58	.62	36
	Total	2,036	.32	652
	Jan.	56	.63	35
	Feb.	54	.56	30
	Mar.	80	.44	35
	Apr.	141	.35	49
	May	259	.26	67
	June	429	.20	86
- 1950	July	137	.42	58
	Aug.	79	.50	40
	Sept.	66	.58	38
	Oct.	49	.80	39
	Nov.	53	.70	37
	Dec.	55	.61	34
	Total	1,458	.38	548
	Jan.	59	.56	33
	Feb.	58	.52	30
	Mar.	58	.55	32
	Apr.	104	.40	42
	May	381	.23	88
	June	536	.20	107
- 1951	July	285	.25	71
	Aug.	132	.43	57
	Sept.	77	.58	45
	Oct.	75	.61	46
	Nov.	63	.57	36
	Dec.	63	.51	32
	Total	1,891	.33	619
	Jan.	53	.60	32
	Feb.	47	.62	29
	Mar.	63	.51	32
	Apr.	194	.38	74
	May	597	.23	137
	June	785	.19	149
- 1952	July	245	.34	83
	Aug.	157	.51	80
	Sept.	99	.54	53
	Oct.	77	.58	45
	Nov.	66	.64	42
	Dec.	60	.58	35
	Total	2,443	.32	791
	Jan.	64	0.59	38
	Feb.	53	.57	30
	Mar.	67	.54	37
	Apr.	103	.46	47
	May	229	.32	73
	June	509	.20	102
- 1953	July	171	.41	70
	Aug.	121	.50	60
	Sept.	69	.58	40
	Oct.	64	.63	40
	Nov.	55	.75	41
	Dec.	58	.66	38
	Total	1,563	.39	616
	Jan.	62	.58	36
	Feb.	48	.62	30
	Mar.	62	.58	36
	Apr.	86	.44	38
	May	146	.35	51
	June	89	.52	46
- 1954	July	83	.55	46
	Aug.	74	.58	43
	Sept.	59	.61	36
	Oct.	58	.66	38
	Nov.	48	.71	34
	Dec.	40	.90	36
	Total	855	.55	470
	Jan.	38	.79	30
	Feb.	34	.82	28
	Mar.	43	.79	34
	Apr.	90	.48	43
	May	206	.28	58
	June	217	.31	67
- 1955	July	99	.56	56
	Aug.	86	.66	57
	Sept.	67	.57	38
	Oct.	61	.62	38
	Nov.	55	.69	38
	Dec.	55	.60	33
	Total	1,051	.49	520
	Jan.	52	.60	31
	Feb.	48	.56	27
	Mar.	69	.59	41
	Apr.	120	.44	53
	May	421	.26	110
	June	329	.24	79
- 1956	July	104	.54	56
	Aug.	82	.61	50
	Sept.	73	.55	40
	Oct.	66	.55	36
	Nov.	50	.72	36
	Dec.	41	.78	32
	Total	1,455	.41	591
	Jan.	46	.72	33
	Feb.	44	.68	30
	Mar.	51	.67	34
	Apr.	92	.53	49
	May	350	.32	112
	June	834	.21	175
- 1957	July	571	.22	126
	Aug.	176	.37	65
	Sept.	88	.56	49
	Oct.	75	.60	45
	Nov.	72	.58	42
	Dec.	63	.59	[illegible]
	Total	2,462	.32	[illegible]
	Jan.	62	.55	34
	Feb.	58	.50	29
	Mar.	73	.52	38
	Apr.	102	.45	46
	May	546	.22	120
	June	439	.21	92
- 1958	July	104	.51	53
	Aug.	67	.59	40
	Sept.	62	.58	36
	Oct.	59	.63	37
	Nov.	54	.68	37
	Dec.	54	.63	34
	Total	1,680	.35	596

To obtain mg/l multiply T/AF by 735.

Table 8
Colorado River Basin
Historical Flow and Quality of Water Data
Colorado River near Glenwood Springs, Colorado

Year	Month	Flow 1000 (A.F.)	Concentration (T./A.F.)	T.D.S. 1000 (Tons)
	Jan.	63	0.54	34
	Feb.	54	.52	28
	Mar.	49	.65	32
	Apr.	81	.54	44
	May	252	.29	73
	June	342	.25	85
- 1959	July	126	.48	61
	Aug.	89	.61	54
	Sept.	73	.56	41
	Oct.	84	.55	46
	Nov.	69	.55	38
	Dec.	59	.53	31
	Total	1,341	.42	567
	Jan.	67	.49	33
	Feb.	55	.50	28
	Mar.	93	.47	44
	Apr.	166	.32	53
	May	288	.25	72
	June	357	.25	89
- 1960	July	122	.49	60
	Aug.	73	.60	44
	Sept.	67	.60	40
	Oct.	61	.62	38
	Nov.	56	.61	34
	Dec.	61	.54	33
	Total	1,466	.39	568
	Jan.	65	.52	34
	Feb.	56	.53	30
	Mar.	55	.59	32
	Apr.	66	.54	36
	May	207	.29	60
	June	203	.28	57
- 1961	July	82	.60	49
	Aug.	80	.59	47
	Sept.	109	.50	54
	Oct.	128	.43	55
	Nov.	81	.50	40
	Dec.	77	.47	36
	Total	1,209	.44	530
	Jan.	80	.44	35
	Feb.	91	.42	38
	Mar.	122	.39	48
	Apr.	347	.32	111
	May	539	.23	125
	June	455	.23	105
- 1962	July	288	.29	84
	Aug.	110	.50	55
	Sept.	74	.58	43
	Oct.	127	.42	53
	Nov.	102	.47	48
	Dec.	72	.57	41
	Total	2,407	.33	786
	Jan.	55	.67	37
	Feb.	53	.63	33
	Mar.	62	.58	36
	Apr.	81	.48	39
	May	175	.31	54
	June	122	.45	55
- 1963	July	66	.66	44
	Aug.	77	.60	46
	Sept.	76	.57	43
	Oct.	63	.61	38
	Nov.	54	.66	36
	Dec.	38	.82	31
	Total	922	.53	492
	Jan.	36	.80	29
	Feb.	33	.78	26
	Mar.	39	.71	28
	Apr.	64	.61	39
	May	210	.32	67
	June	215	.31	67
- 1964	July	99	.63	62
	Aug.	87	.61	53
	Sept.	72	.60	43
	Oct.	65	.64	42
	Nov.	50	.72	36
	Dec.	51	.73	37
	Total	1,021	.52	529
	Jan.	51	0.70	36
	Feb.	44	.72	32
	Mar.	49	.69	34
	Apr.	104	.50	52
	May	263	.30	79
	June	446	.26	116
- 1965	July	271	.31	84
	Aug.	172	.39	67
	Sept.	95	.50	48
	Oct.	95	.44	42
	Nov.	86	.46	39
	Dec.	88	.47	41
	Total	1,764	.[illegible]8	670
	Jan.	78	0.48	37
	Feb.	70	.45	32
	Mar.	91	.46	42
	Apr.	84	.47	39
	May	186	.30	56
	June	110	.45	50
- 1966	July	89	.51	45
	Aug.	77	.46	35
	Sept.	68	.51	35
	Oct.	72	.60	43
	Nov.	55	.66	36
	Dec.	44	.75	33
	Total	1,024	.47	483
	Jan.	49	.65	32
	Feb.	45	.62	28
	Mar.	67	.59	40
	Apr.	96	.45	43
	May	185	.31	57
	June	250	.28	70
- 1967	July	139	.47	65
	Aug.	90	.57	51
	Sept.	83	.59	49
	Oct.	78	.59	46
	Nov.	69	.57	39
	Dec.	59	.59	35
	Total	1,210	.46	555
	Jan.	53	.61	32
	Feb.	53	.55	29
	Mar.	62	.55	34
	Apr.	95	.46	44
	May	171	.36	62
	June	369	.25	92
- 1968	July	133	.46	61
	Aug.	125	.48	60
	Sept.	79	.53	42
	Oct.	77	.55	42
	Nov.	68	.54	37
	Dec.	65	.59	38
	Total	1,350	.42	573
	Jan.	66	.55	36
	Feb.	56	.57	32
	Mar.	63	.56	35
	Apr.	131	.41	54
	May	283	.28	51
	June	260	.31	81
- 1969	July	174	.38	66
	Aug.	93	.49	46
	Sept.	78	.53	41
	Oct.	94	.55	52
	Nov.	79	.53	42
	Dec.	71	.52	37
	Total	1,448	.40	573
	Jan.	62	.55	34
	Feb.	65	.52	34
	Mar.	72	.51	37
	Apr.	95	.43	41
	May	488	.20	99
	June	471	.21	99
- 1970	July	194	.35	68
	Aug.	109	.46	50
	Sept.	101	.50	50
	Oct.	108	.48	52
	Nov.	92	.50	46
	Dec.	68	.51	35
	Total	1,925	.34	645
	Jan.	72	.49	35
	Feb.	71	.49	35
	Mar.	105	.45	47
	Apr.	174	.32	55
	May	348	.22	77
	June	519	.19	99
1971	July	271	.31	84
	Aug.	121	.44	53
	Sept.	109	.48	52
	Oct.	90	.50	45
	Nov.	86	.47	41
	Dec.	72	.52	37
	Total	2,038	.32	660
	Jan.	67	.52	35
	Feb.	62	.50	31
	Mar.	94	.45	42
	Apr.	116	.36	42
1972	May	255	.24	62
	June	355	.22	79
	July	128	.40	51
	Aug.	97	.44	42
	Sept.	96	.46	44
	Oct.	92	.45	42
	Nov.	88	.42	37
	Dec.	74	.45	33
	Total	1,524	.35	540
	Jan.	68	.47	32
	Feb.	60	.45	27
	Mar.	73	.45	33
	Apr.	86	.45	39
	May	352	.21	73
	June	448	.19	83
1973	July	315	.23	74
	Aug.	138	.37	51
	Sept.	89	.44	39
	Oct.	97	.42	41
	Nov.	90	.42	38
	Dec.	69	.51	35
	Total	1,885	.30	565
	Jan.	67	.52	35
	Feb.	63	.51	32
	Mar.	93	.45	42
	Apr.	123	.37	46
	May	486	.17	84
	June	427	.20	84
1974	July	199	.36	72
	Aug.	113	.45	51
	Sept.	97	.45	44
	Oct.	91	.48	44
	Nov.	78	.51	40
	Dec.	64	.53	34
	Total	1,901	.32	608
	Jan.	64	.55	35
	Feb.	62	.53	33
	Mar.	74	.54	40
	Apr.	100	.44	44
	May	213	.27	58
	June	375	.22	83
1975	July	283	.27	75
	Aug.	121	.43	52
	Sept.	84	.48	40
	Oct.	78	.50	39
	Nov.	73	.48	35
	Dec.	63	.55	35
	Total	1,580	.36	56[illegible]
	Jan.	62	.53	33
	Feb.	65	.52	34
	Mar.	84	.45	38
	Apr.	98	.45	44
	May	227	.26	59
	June	235	.26	61
1976	July	116	.47	55
	Aug.	93	.45	42
	Sept.	85	.43	37
	Oct.	74	.46	34
	Nov.	59	.49	29
	Dec.	52	.52	27
	Total	1,250	.39	493

To obtain mg/l multiply T/AF by 735.

Table 8
Colorado River Basin
Historical Flow and Quality of Water Data
Colorado River near Glenwood Springs, Colorado

(Annual Summary)

Calendar Year	Flow 1,000 (A.F.)	T./A.F.	T.D.S. 1000 Ton	Flow 1,000,000 (m^3)	mg/l	T.D.S. 1,000 Tonne
1941	1,713	.34	591	2,113	254	536
1942	1,093	.33	620	2,347	239	562
1943	1,827	.33	607	2,254	244	551
1944	1,494	.35	523	1,843	257	474
1945	1,764	.31	553	2,176	231	502
1946	1,542	.36	549	1,902	262	498
1947	2,298	.28	648	2,835	207	588
1948	1,881	.32	604	2,320	236	548
1949	2,036	.32	652	2,511	235	591
1950	1,458	.38	548	1,798	276	497
1951	1,891	.33	619	2,333	241	562
1952	2,443	.32	791	3,013	238	718
1953	1,563	.39	616	1,928	290	559
1954	855	.55	470	1,055	404	426
1955	1,051	.49	520	1,296	364	472
1956	1,455	.41	591	1,795	299	536
1957	2,462	.32	797	3,037	238	723
1958	1,680	.35	596	2,072	261	541
1959	1,341	.42	567	1,654	311	514
1960	1,466	.39	568	1,808	285	515
1961	1,209	.44	530	1,491	323	481
1962	2,407	.33	786	2,969	240	713
1963	922	.53	492	1,137	392	446
1964	1,021	.52	529	1,259	381	480
1965	1,764	.38	670	2,176	279	608
1966	1,024	.47	483	1,263	347	438
1967	1,210	.46	555	1,493	337	503
1968	1,350	.42	573	1,665	312	520
1969	1,448	.40	573	1,786	291	520
1970	1,925	.34	645	2,374	246	585

Table 8

Colorado River Basin

Historical Flow and Quality of Water Data

Colorado River near Glenwood Springs, Colorado

(Annual Summary)

Calendar Year	Flow 1,000 (A.F.)	T./A.F.	T.D.S. 1000 Ton	Flow 1,000,000 (m^3)	mg/l	T.D.S. 1,000 Tonne
1971	2,038	.32	660	2,514	238	599
1972	1,524	.35	540	1,880	261	490
1973	1,885	.30	565	2,325	221	513
1974	1,901	.32	608	2,345	235	552
1975	1,580	.36	569	1,949	265	516
1976	1,250	.39	493	1,542	290	447
Total	58,581		21,301	72,258		19,324
Average	1,627	.36	592	2,007	268	537

Table 9

Colorado River Basin

Historical Flow and Quality of Water Data

Colorado River near Cameo, Colorado

Year	Month	Flow 1000 (A.F.)	Concentration (T./A.F.)	T.D.S. 1000 (Tons)
	Jan.	65	1.23	80
	Feb.	67	1.15	77
	Mar.	82	1.11	91
	Apr.	133	.83	110
	May	948	.34	322
	June	803	.28	225
-1941	July	315	.47	148
	Aug.	144	.91	131
	Sept.	122	.97	118
	Oct.	166	.88	146
	Nov.	124	.96	119
	Dec.	103	1.11	114
	Total	3,072	.55	1,681
	Jan.	90	1.24	112
	Feb.	86	1.19	102
	Mar.	103	1.13	116
	Apr.	334	.62	207
	May	757	.41	310
	June	1,215	.24	292
-1942	July	406	.44	179
	Aug.	139	.85	118
	Sept.	86	1.15	99
	Oct.	94	1.18	111
	Nov.	94	1.24	117
	Dec.	84	1.26	106
	Total	3,488	.54	1,869
	Jan.	77	1.30	100
	Feb.	74	1.26	93
	Mar.	89	1.22	109
	Apr.	237	.56	133
	May	509	.32	163
	June	931	.23	214
-1943	July	387	.39	151
	Aug.	192	.73	140
	Sept.	117	.89	104
	Oct.	111	1.00	111
	Nov.	115	.90	103
	Dec.	107	.93	100
	Total	2,946	.52	1,521
	Jan.	74	1.24	92
	Feb.	76	1.11	84
	Mar.	81	1.11	90
	Apr.	118	.85	100
	May	564	.36	203
	June	890	.24	214
-1944	July	378	.38	143
	Aug.	123	.80	98
	Sept.	78	1.09	85
	Oct.	99	1.05	104
	Nov.	100	1.01	101
	Dec.	99	1.02	101
	Total	2,680	.53	1,415
	Jan.	78	1.15	90
	Feb.	72	1.18	85
	Mar.	95	.99	94
	Apr.	115	.90	104
	May	601	.36	216
	June	794	.27	214
-1945	July	499	.33	165
	Aug.	287	.52	149
	Sept.	118	.83	98
	Oct.	126	.79	100
	Nov.	125	.81	101
	Dec.	117	.89	104
	Total	3,027	.50	1,520
	Jan.	109	.90	98
	Feb.	91	.97	88
	Mar.	99	.94	93
	Apr.	285	.45	128
	May	449	.32	144
	June	689	.28	193
-1946	July	267	.51	136
	Aug.	126	.85	107
	Sept.	92	1.01	93
	Oct.	122	.89	109
	Nov.	104	.92	96
	Dec.	121	.82	99
	Total	2,554	.54	1,384
	Jan.	82	1.04	85
	Feb.	82	.99	81
	Mar.	107	.96	103
	Apr.	178	.63	112
	May	809	.28	227
	June	1,027	.25	257
-1947	July	732	.27	198
	Aug.	240	.58	139
	Sept.	143	.78	111
	Oct.	153	.80	122
	Nov.	135	.77	104
	Dec.	118	.86	102
	Total	3,806	.43	1,641
	Jan.	116	.84	97
	Feb.	111	.81	90
	Mar.	115	.90	104
	Apr.	253	.59	149
	May	920	.30	276
	June	844	.26	219
-1948	July	312	.47	146
	Aug.	161	.77	124
	Sept.	88	1.03	91
	Oct.	109	1.02	111
	Nov.	107	.96	103
	Dec.	90	1.04	94
	Total	3,226	.50	1,604
	Jan.	99	.96	95
	Feb.	84	.92	77
	Mar.	98	.98	96
	Apr.	201	.65	131
	May	572	.36	206
	June	1,080	.26	281
-1949	July	594	.34	202
	Aug.	184	.69	127
	Sept.	122	.93	113
	Oct.	125	.98	123
	Nov.	108	1.01	109
	Dec.	101	1.05	106
	Total	3,368	.49	1,666
	Jan.	91	1.04	95
	Feb.	88	.95	84
	Mar.	118	.87	103
	Apr.	212	.59	125
	May	418	.40	167
	June	787	.27	212
-1950	July	273	.54	147
	Aug.	125	.87	109
	Sept.	111	.97	108
	Oct.	97	1.19	115
	Nov.	98	1.14	112
	Dec.	98	1.07	105
	Total	2,516	.59	1,482
	Jan.	96	1.01	97
	Feb.	88	.95	84
	Mar.	99	1.01	100
	Apr.	151	.70	106
	May	537	.34	183
	June	858	.27	232
-1951	July	471	.36	170
	Aug.	207	.68	141
	Sept.	111	.90	100
	Oct.	120	.92	110
	Nov.	104	.97	101
	Dec.	106	.96	102
	Total	2,948	.52	1,526
	Jan.	96	1.01	97
	Feb.	84	1.06	89
	Mar.	113	.99	112
	Apr.	313	.60	188
	May	978	.36	352
	June	1,320	.26	343
-1952	July	449	.44	197
	Aug.	276	.70	193
	Sept.	171	.78	133
	Oct.	123	.97	119
	Nov.	112	1.04	117
	Dec.	99	1.12	111
	Total	4,134	.50	2,051
	Jan.	99	1.03	102
	Feb.	80	1.06	85
	Mar.	102	.96	98
	Apr.	136	.78	106
	May	346	.44	152
	June	887	.27	239
-1953	July	294	.52	153
	Aug.	194	.72	140
	Sept.	101	.99	100
	Oct.	101	1.06	107
	Nov.	99	1.13	112
	Dec.	92	1.17	108
	Total	2,531	.59	1,502
	Jan.	95	1.00	95
	Feb.	81	1.05	85
	Mar.	94	1.01	95
	Apr.	136	.78	106
	May	296	.48	142
	June	204	.60	123
-1954	July	146	.81	118
	Aug.	105	.97	102
	Sept.	103	1.07	110
	Oct.	125	.97	121
	Nov.	98	1.07	105
	Dec.	82	1.23	101
	Total	1,565	.83	1,303
	Jan.	74	1.23	91
	Feb.	67	1.25	84
	Mar.	86	1.13	97
	Apr.	142	.77	110
	May	384	.42	161
	June	448	.37	166
-1955	July	214	.61	130
	Aug.	157	.87	137
	Sept.	100	.94	94
	Oct.	91	1.02	93
	Nov.	94	1.06	100
	Dec.	89	1.07	95
	Total	1,946	.70	1,358
	Jan.	81	1.07	87
	Feb.	75	1.11	83
	Mar.	104	.98	102
	Apr.	184	.66	122
	May	685	.34	233
	June	637	.31	197
-1956	July	173	.70	121
	Aug.	115	.95	109
	Sept.	88	.90	79
	Oct.	93	.95	88
	Nov.	83	1.07	89
	Dec.	73	1.21	88
	Total	2,391	.59	1,398
	Jan.	80	1.10	88
	Feb.	77	1.10	85
	Mar.	83	1.16	96
	Apr.	151	.83	125
	May	591	.47	278
	June	1,415	.27	382
-1957	July	1,072	.27	289
	Aug.	339	.50	170
	Sept.	157	.78	122
	Oct.	136	.89	121
	Nov.	123	.91	112
	Dec.	102	.96	98
	Total	4,326	.45	1,966
	Jan.	92	.93	86
	Feb.	95	.93	88
	Mar.	123	.89	110
	Apr.	171	.76	130
	May	847	.31	263
	June	808	.27	218
-1958	July	193	.67	129
	Aug.	109	.97	106
	Sept.	103	1.03	106
	Oct.	99	1.09	108
	Nov.	94	1.09	102
	Dec.	86	1.12	96
	Total	2,820	.55	1,542

To obtain mg/l multiply T/AF by 735

Table 9

Colorado River Basin

Historical Flow and Quality of Water Data

Colorado River near Cameo, Colorado

Year	Month	Flow 1000 (A.F.)	Concentration (T./A.F.)	T.D.S. 1000 (Tons)
	Jan.	94	1.02	96
	Feb.	86	1.01	87
	Mar.	83	1.09	90
	Apr.	118	.83	98
	May	392	.40	157
	June	684	.29	198
-1959	July	215	.59	127
	Aug.	131	.87	114
	Sept.	105	.98	103
	Oct.	138	.81	112
	Nov.	116	.87	101
	Dec.	100	.98	98
	Total	2,262	.61	1,381
	Jan.	100	.89	89
	Feb.	91	.95	86
	Mar.	135	.78	105
	Apr.	246	.51	125
	May	432	.37	160
	June	668	.30	200
-1960	July	217	.60	130
	Aug.	117	.89	104
	Sept.	102	.95	97
	Oct.	106	1.00	106
	Nov.	99	1.05	104
	Dec.	100	1.01	101
	Total	2,413	.58	1,407
	Jan.	99	.97	96
	Feb.	85	.94	80
	Mar.	86	1.06	91
	Apr.	103	.91	94
	May	354	.40	142
	June	426	.34	145
-1961	July	138	.81	112
	Aug.	115	.89	102
	Sept.	175	.73	128
	Oct.	200	.59	118
	Nov.	131	.73	96
	Dec.	121	.78	94
	Total	2,033	.64	1,298
	Jan.	115	.78	90
	Feb.	135	.74	100
	Mar.	160	.69	110
	Apr.	513	.40	205
	May	892	.31	277
	June	882	.27	238
-1962	July	545	.37	202
	Aug.	186	.72	134
	Sept.	121	.95	115
	Oct.	173	.74	128
	Nov.	148	.79	117
	Dec.	115	.99	114
	Total	3,985	.46	1,830
	Jan.	95	1.11	105
	Feb.	87	.98	85
	Mar.	98	1.02	100
	Apr.	127	.79	100
	May	323	.40	129
	June	246	.53	130
-1963	July	111	.91	101
	Aug.	115	.92	106
	Sept.	112	.89	100
	Oct.	96	.99	95
	Nov.	90	1.09	98
	Dec.	71	1.32	94
	Total	1,571	.79	1,243
	Jan.	58	1.29	75
	Feb.	55	1.19	65
	Mar.	67	1.13	76
	Apr.	105	.92	97
	May	403	.41	165
	June	465	.35	163
-1964	July	223	.62	138
	Aug.	153	.81	124
	Sept.	116	.86	100
	Oct.	104	1.01	105
	Nov.	94	1.11	104
	Dec.	91	1.08	98
	Total	1,934	.68	1,310
	Jan.	92	1.10	101
	Feb.	78	1.09	85
	Mar.	85	1.15	98
	Apr.	161	.69	111
	May	477	.39	186
	June	920	.28	258
-1965	July	605	.34	206
	Aug.	273	.56	153
	Sept.	172	.75	129
	Oct.	167	.75	125
	Nov.	137	.75	103
	Dec.	138	.75	103
	Total	3,305	.50	1,658
	Jan.	114	.82	93
	Feb.	99	.81	80
	Mar.	133	.77	102
	Apr.	141	.66	93
	May	373	.40	149
	June	277	.48	133
-1966	July	157	.73	115
	Aug.	119	.87	104
	Sept.	101	.94	95
	Oct.	108	.98	106
	Nov.	93	1.05	98
	Dec.	85	1.22	104
	Total	1,800	.71	1,272
	Jan.	86	1.11	95
	Feb.	74	1.06	78
	Mar.	106	.93	99
	Apr.	137	.72	99
	May	328	.43	141
	June	543	.31	168
-1967	July	289	.53	153
	Aug.	137	.83	114
	Sept.	125	.90	112
	Oct.	115	.92	106
	Nov.	104	.95	99
	Dec.	100	1.00	100
	Total	2,144	.64	1,364
	Jan.	89	1.12	100
	Feb.	87	.98	85
	Mar.	96	1.01	97
	Apr.	133	.77	102
	May	326	.43	140
	June	757	.27	204
-1968	July	257	.57	146
	Aug.	224	.67	150
	Sept.	125	.86	108
	Oct.	128	.91	116
	Nov.	113	.95	107
	Dec.	104	.99	103
	Total	2,439	.60	1,458
	Jan.	106	.94	100
	Feb.	86	.99	85
	Mar.	96	.95	91
	Apr.	241	.58	140
	May	561	.34	191
	June	502	.40	201
-1969	July	355	.52	185
	Aug.	152	.79	120
	Sept.	131	.88	115
	Oct.	173	.79	137
	Nov.	131	.85	112
	Dec.	121	1.05	127
	Total	2,655	.60	1,604
	Jan.	105	.96	101
	Feb.	95	.92	87
	Mar.	116	.84	97
	Apr.	154	.64	99
	May	850	.26	224
	June	834	.27	222
-1970	July	363	.45	165
	Aug.	167	.77	128
	Sept.	182	.74	134
	Oct.	171	.78	133
	Nov.	155	.79	122
	Dec.	140	.86	120
	Total	3,332	.49	1,632
	Jan.	138	.82	113
	Feb.	112	.84	94
	Mar.	149	.74	110
	Apr.	293	.48	140
	May	521	.32	165
	June	885	.24	215
1971	July	451	.41	184
	Aug.	179	.72	129
	Sept.	170	.76	130
	Oct.	150	.78	118
	Nov.	137	.78	108
	Dec.	129	.79	102
	Total	3,314	.49	1,608
	Jan.	127	.79	100
	Feb.	119	.87	104
	Mar.	151	.81	122
	Apr.	175	.66	115
	May	394	.39	155
	June	664	.29	192
1972	July	219	.60	132
	Aug.	143	.85	122
	Sept.	150	.81	121
	Oct.	164	.77	126
	Nov.	152	.74	113
	Dec.	128	.81	103
	Total	2,586	.58	1,505
	Jan.	116	.86	100
	Feb.	105	.82	86
	Mar.	125	.82	103
	Apr.	121	.82	99
	May	592	.32	189
	June	829	.27	222
1973	July	565	.31	174
	Aug.	207	.61	126
	Sept.	143	.81	116
	Oct.	149	.81	120
	Nov.	141	.80	113
	Dec.	126	.87	110
	Total	3,219	.48	1,558
	Jan.	122	.80	97
	Feb.	109	.83	91
	Mar.	152	.79	120
	Apr.	185	.66	122
	May	709	.25	176
	June	658	.28	184
1974	July	286	.53	151
	Aug.	161	.73	118
	Sept.	128	.84	107
	Oct.	136	.85	116
	Nov.	127	.87	111
	Dec.	115	.97	111
	Total	2,888	.52	1,504
	Jan.	109	.89	97
	Feb.	98	.88	86
	Mar.	124	.92	114
	Apr.	154	.77	118
	May	389	.43	168
	June	739	.28	208
1975	July	561	.35	198
	Aug.	199	.63	126
	Sept.	141	.80	113
	Oct.	141	.83	117
	Nov.	133	.80	106
	Dec.	120	.83	100
	Total	2,908	.53	1,551
	Jan.	115	.82	94
	Feb.	114	.82	95
	Mar.	139	.85	118
	Apr.	161	.70	112
	May	401	.40	161
	June	450	.33	149
1976	July	213	.58	123
	Aug.	149	.83	123
	Sept.	136	.82	112
	Oct.	139	.83	115
	Nov.	116	.88	102
	Dec.	112	1.10	122
	Total	2,245	.64	1,426

To obtain mg/l multiply T/AF by 735.

Table 9

Colorado River Basin

Historical Flow and Quality of Water Data

Colorado River near Cameo, Colorado

(Annual Summary)

Calendar Year	Flow 1,000 (A.F.)	T./A.F.	T.D.S. 1000 Ton	Flow 1,000,000 (m^3)	mg/l	T.D.S. 1,000 Tonne
1941	3,072	.55	1,681	3,789	402	1,525
1942	3,488	.54	1,869	4,302	394	1,696
1943	2,946	.52	1,521	3,634	380	1,380
1944	2,680	.53	1,415	3,306	388	1,284
1945	3,027	.50	1,520	3,734	369	1,379
1946	2,554	.54	1,384	3,150	399	1,256
1947	3,806	.43	1,641	4,695	317	1,489
1948	3,226	.50	1,604	3,979	366	1,455
1949	3,368	.49	1,666	4,154	364	1,511
1950	2,516	.59	1,482	3,103	433	1,344
1951	2,948	.52	1,526	3,636	381	1,384
1952	4,134	.50	2,051	5,099	365	1,861
1953	2,531	.59	1,502	3,122	437	1,363
1954	1,565	.83	1,303	1,930	612	1,182
1955	1,946	.70	1,358	2,400	513	1,232
1956	2,391	.59	1,398	2,949	430	1,268
1957	4,326	.45	1,966	5,336	334	1,784
1958	2,820	.55	1,542	3,478	402	1,399
1959	2,262	.61	1,381	2,790	449	1,253
1960	2,413	.58	1,407	2,976	429	1,276
1961	2,033	.64	1,298	2,508	470	1,178
1962	3,985	.46	1,830	4,915	338	1,660
1963	1,571	.79	1,243	1,938	582	1,128
1964	1,934	.68	1,310	2,386	498	1,188
1965	3,305	.55	1,658	4,077	369	1,504
1966	1,800	.71	1,272	2,220	520	1,154
1967	2,144	.64	1,364	2,645	468	1,237
1968	2,439	.60	1,458	3,009	440	1,323
1969	2,655	.60	1,604	3,275	444	1,455
1970	3,332	.49	1,632	4,110	360	1,481

Table 9

Colorado River Basin

Historical Flow and Quality of Water Data

Colorado River near Cameo, Colorado

(Annual Summary)

Calendar Year	Flow 1,000 (A.F.)	T./A.F.	T.D.S. 1000 Ton	Flow 1,000,000 (m^3)	mg/l	T.D.S. 1,000 Tonne
1971	3,314	.49	1,608	4,088	357	1,459
1972	2,586	.58	1,505	3,190	428	1,365
1973	3,219	.48	1,558	3,971	356	1,413
1974	2,888	.52	1,504	3,562	383	1,364
1975	2,908	.53	1,551	3,587	392	1,407
1976	2,245	.64	1,426	2,769	467	1,294
Total	100,377		55,038	123,812		49,931
Average	2,788	.55	1,529	3,439	403	1,387

Table 10

Colorado River Basin

Historical Flow and Quality of Water Data

Gunnison River near Grand Junction, Colorado

Year	Month	Flow 1000 (A.F.)	Concentration (T./A.F.)	T.D.S. 1000 (Tons)
1941	Jan.	51	1.90	97
	Feb.	52	1.82	93
	Mar.	63	1.67	105
	Apr.	123	1.00	123
	May	871	.40	349
	June	563	.46	259
	July	192	.94	180
	Aug.	95	1.41	134
	Sept.	81	2.11	171
	Oct.	198	1.35	267
	Nov.	121	1.33	161
	Dec.	84	1.58	133
	Total	2,493	.83	2,072
1942	Jan.	71	1.59	113
	Feb.	62	1.66	103
	Mar.	76	1.64	125
	Apr.	546	.52	284
	May	760	.47	357
	June	688	.38	261
	July	167	.93	156
	Aug.	68	2.18	148
	Sept.	56	2.36	132
	Oct.	57	2.58	147
	Nov.	65	1.92	125
	Dec.	58	1.83	106
	Total	2,674	.77	2,057
1943	Jan.	57	1.72	98
	Feb.	48	1.60	77
	Mar.	56	1.55	87
	Apr.	279	.44	123
	May	389	.48	187
	June	397	.46	183
	July	113	1.08	122
	Aug.	153	1.43	219
	Sept.	87	1.59	138
	Oct.	69	1.84	127
	Nov.	75	1.59	119
	Dec.	61	1.57	96
	Total	1,784	.88	1,576
1944	Jan.	51	1.65	84
	Feb.	48	1.44	69
	Mar.	53	1.42	75
	Apr.	102	.97	99
	May	758	.32	242
	June	694	.33	229
	July	230	.69	159
	Aug.	51	1.94	99
	Sept.	45	2.44	110
	Oct.	58	2.31	134
	Nov.	71	1.86	132
	Dec.	64	1.73	111
	Total	2,225	.69	1,543
1945	Jan.	55	1.58	87
	Feb.	47	1.62	76
	Mar.	52	1.48	77
	Apr.	91	1.00	91
	May	628	.35	220
	June	407	.46	187
	July	163	.85	139
	Aug.	122	1.22	149
	Sept.	46	2.39	110
	Oct.	76	2.00	152
	Nov.	73	1.63	119
	Dec.	58	1.59	92
	Total	1,819	.82	1,499
1946	Jan.	58	1.55	90
	Feb.	48	1.44	69
	Mar.	58	1.28	74
	Apr.	182	.59	108
	May	228	.59	135
	June	321	.52	167
	July	64	1.62	104
	Aug.	56	2.16	121
	Sept.	54	2.31	125
	Oct.	69	2.06	142
	Nov.	67	1.70	114
	Dec.	56	1.55	87
	Total	1,261	1.06	1,336
1947	Jan.	45	1.67	75
	Feb.	47	1.49	70
	Mar.	55	1.27	70
	Apr.	96	.82	79
	May	455	.39	177
	June	502	.46	231
	July	242	.64	155
	Aug.	120	1.50	180
	Sept.	95	1.63	155
	Oct.	114	1.60	183
	Nov.	96	1.35	130
	Dec.	70	1.41	99
	Total	1,938	.83	1,605
1948	Jan.	58	1.38	80
	Feb.	65	1.43	93
	Mar.	76	1.38	105
	Apr.	324	.51	165
	May	835	.30	251
	June	546	.40	218
	July	141	.92	129
	Aug.	71	1.84	131
	Sept.	48	2.25	108
	Oct.	57	2.09	119
	Nov.	70	1.84	129
	Dec.	70	1.64	115
	Total	2,361	.70	1,643
1949	Jan.	51	1.49	76
	Feb.	52	1.48	77
	Mar.	69	1.42	98
	Apr.	235	.57	134
	May	481	.38	183
	June	651	.42	273
	July	265	.65	172
	Aug.	65	1.80	117
	Sept.	53	2.15	114
	Oct.	70	2.09	146
	Nov.	74	1.58	117
	Dec.	54	1.74	94
	Total	2,121	.76	1,601
1950	Jan.	54	1.57	85
	Feb.	57	2.00	114
	Mar.	60	1.33	80
	Apr.	219	.50	110
	May	309	.45	139
	June	319	.50	160
	July	88	1.43	126
	Aug.	37	2.16	80
	Sept.	46	2.61	120
	Oct.	37	2.65	98
	Nov.	49	2.12	104
	Dec.	60	1.73	104
	Total	1,335	.99	1,328
1951	Jan.	47	1.64	77
	Feb.	46	1.59	73
	Mar.	55	1.27	70
	Apr.	62	.97	60
	May	265	.51	135
	June	323	.52	168
	July	93	1.06	99
	Aug.	53	1.72	91
	Sept.	37	2.30	85
	Oct.	49	2.41	118
	Nov.	60	1.88	113
	Dec.	46	1.65	76
	Total	1,136	1.03	1,165
1952	Jan.	53	1.53	81
	Feb.	47	1.48	70
	Mar.	53	1.41	75
	Apr.	342	.46	157
	May	818	.33	270
	June	759	.35	266
	July	200	.79	158
	Aug.	121	1.54	187
	Sept.	76	1.86	141
	Oct.	67	1.90	127
	Nov.	64	2.00	128
	Dec.	72	1.68	121
	Total	2,672	.67	1,781
1953	Jan.	65	1.51	98
	Feb.	50	1.48	74
	Mar.	61	1.26	77
	Apr.	86	1.01	87
	May	230	.57	131
	June	437	.43	188
	July	86	1.13	97
	Aug.	67	1.75	117
	Sept.	46	2.28	105
	Oct.	58	2.40	139
	Nov.	74	1.78	132
	Dec.	52	1.83	95
	Total	1,312	1.02	1,340
1954	Jan.	49	1.75	86
	Feb.	45	1.58	71
	Mar.	45	1.49	67
	Apr.	70	.84	59
	May	110	.85	93
	June	39	1.92	75
	July	40	2.10	84
	Aug.	31	2.64	82
	Sept.	52	2.50	130
	Oct.	64	1.94	124
	Nov.	51	1.92	98
	Dec.	49	1.90	93
	Total	645	1.68	1,068
1955	Jan.	46	1.70	78
	Feb.	40	1.67	67
	Mar.	59	1.47	87
	Apr.	108	.74	80
	May	262	.52	136
	June	219	.63	138
	July	46	1.74	80
	Aug.	52	1.86	97
	Sept.	36	2.48	89
	Oct.	38	2.47	94
	Nov.	54	2.08	112
	Dec.	57	1.65	94
	Total 1017	1,017	1.13	1,152
1956	Jan.	50	1.64	82
	Feb.	44	1.59	70
	Mar.	56	1.30	73
	Apr.	142	.60	85
	May	324	.45	146
	June	262	.53	139
	July	37	1.92	71
	Aug.	29	2.07	60
	Sept.	20	3.15	63
	Oct.	35	2.94	103
	Nov.	55	1.95	107
	Dec.	47	1.87	88
	Total	1,101	.99	1,087
1957	Jan.	52	1.73	90
	Feb.	55	1.69	93
	Mar.	56	1.36	76
	Apr.	135	.67	91
	May	554	.44	244
	June	1,168	.32	374
	July	719	.39	281
	Aug.	224	.83	186
	Sept.	108	1.47	159
	Oct.	106	1.92	204
	Nov.	111	1.33	148
	Dec.	92	1.26	116
	Total	3,381	.61	2,062
1958	Jan.	66	1.40	92
	Feb.	70	1.50	105
	Mar.	82	1.24	102
	Apr.	254	.57	145
	May	873	.32	279
	June	570	.42	239
	July	65	1.52	99
	Aug.	43	1.74	75
	Sept.	51	2.31	118
	Oct.	52	2.42	126
	Nov.	71	1.82	129
	Dec.	65	1.60	[illegible]
	Total	2,262	.71	

To obtain mg/l multiply T/AF by 735.

Table 10

Colorado River Basin

Historical Flow and Quality of Water Data

Gunnison River near Grand Junction, Colorado

Year	Month	Flow 1000 (A.F.)	Concentration (T./A.F.)	T.D.S. 1000 (Tons)
	Jan.	57	1.58	90
	Feb.	50	1.51	75
	Mar.	52	1.34	70
	Apr.	55	1.10	61
	May	167	.75	125
	June	256	.66	169
-1959	July	34	2.39	81
	Aug.	51	2.01	103
	Sept.	41	2.46	101
	Oct.	96	1.45	139
	Nov.	72	1.39	100
	Dec.	50	1.54	77
	Total	981	1.21	1,191
	Jan.	49	1.46	72
	Feb.	41	1.48	61
	Mar.	87	1.26	110
	Apr.	270	.45	122
	May	259	.45	117
	June	336	.46	155
-1960	July	58	1.33	77
	Aug.	34	2.08	71
	Sept.	38	2.22	84
	Oct.	51	2.34	119
	Nov.	58	1.69	98
	Dec.	51	1.59	81
	Total	1,332	.88	1,167
	Jan.	41	1.65	[illegible]
	Feb.	40	1.55	62
	Mar.	55	1.29	71
	Apr.	67	1.05	70
	May	266	.50	133
	June	209	.62	130
-1961	July	34	2.09	71
	Aug.	44	2.07	91
	Sept.	100	1.66	166
	Oct.	107	1.20	128
	Nov.	86	1.20	103
	Dec.	57	1.37	78
	Total	1,106	1.06	1,171
	Jan.	52	1.37	71
	Feb.	58	1.35	78
	Mar.	53	1.22	65
	Apr.	395	.37	146
	May	574	.32	184
	June	477	.37	176
-1962	July	219	.67	147
	Aug.	52	1.72	89
	Sept.	63	1.97	124
	Oct.	70	1.84	129
	Nov.	68	1.62	110
	Dec.	54	1.70	92
	Total	2,135	.66	1,411
	Jan.	48	[illegible]	80
	Feb.	70	1.51	105
	Mar.	82	1.11	91
	Apr.	102	.72	73
	May	188	.53	100
	June	92	1.02	94
-1963	July	37	2.11	78
	Aug.	52	1.99	104
	Sept.	51	2.28	116
	Oct.	55	2.52	139
	Nov.	66	1.70	112
	Dec.	49	1.69	83
	Total	892	1.32	1,176
	Jan.	43	1.58	68
	Feb.	45	1.51	68
	Mar.	43	1.52	65
	Apr.	78	1.00	78
	May	418	.41	171
	June	316	.50	158
-1964	July	83	1.20	100
	Aug.	93	1.61	150
	Sept.	59	1.99	117
	Oct.	53	2.20	117
	Nov.	65	1.85	120
	Dec.	59	1.46	86
	Total	1,355	.96	1,298
	Jan.	55	1.37	75
	Feb.	45	1.28	58
	Mar.	52	1.33	69
	Apr.	228	.52	119
	May	582	.36	210
	June	681	.37	252
-1965	July	472	.47	222
	Aug.	158	.98	155
	Sept.	161	1.29	208
	Oct.	116	1.35	157
	Nov.	63	1.93	122
	Dec.	60	1.58	95
	Total	2,673	.65	1,742
	Jan.	52	1.67	87
	Feb.	37	1.86	69
	Mar.	68	1.30	88
	Apr.	166	.65	108
	May	211	.67	141
	June	125	1.03	129
-1966	July	51	1.75	89
	Aug.	38	2.09	79
	Sept.	58	1.99	115
	Oct.	65	2.03	132
	Nov.	45	2.34	105
	Dec.	55	1.76	97
	Total	971	1.28	1,239
	Jan.	47	1.63	77
	Feb.	42	1.62	68
	Mar.	62	1.16	72
	Apr.	86	.73	63
	May	143	.81	116
	June	152	1.03	157
-1967	July	60	1.78	107
	Aug.	59	1.93	114
	Sept.	70	1.88	132
	Oct.	65	1.88	122
	Nov.	106	1.16	123
	Dec.	165	.73	120
	Total	1,057	1.20	1,271
	Jan.	119	.95	113
	Feb.	96	1.03	99
	Mar.	65	1.20	78
	Apr.	68	.97	66
	May	268	.57	153
	June	258	.56	144
-1968	July	59	1.62	96
	Aug.	107	1.56	167
	Sept.	68	1.86	126
	Oct.	87	1.72	150
	Nov.	133	1.08	144
	Dec.	149	.77	115
	Total	1,477	.98	1,451
	Jan.	146	.80	117
	Feb.	75	1.03	77
	Mar.	145	.70	[illegible]
	Apr.	[illegible]	[illegible]	[illegible]
	May	332	.49	162
	June	194	1.03	200
-1969	July	100	1.37	137
	Aug.	91	1.40	128
	Sept.	119	1.43	170
	Oct.	155	1.27	197
	Nov.	143	.98	140
	Dec.	128	.88	113
	Total	1,932	.87	1,673
	Jan.	129	.78	100
	Feb.	122	.70	85
	Mar.	149	.68	101
	Apr.	137	.69	95
	May	404	.42	169
	June	415	.50	208
-1970	July	174	.79	137
	Aug.	101	1.27	128
	Sept.	196	1.07	209
	Oct.	188	1.13	212
	Nov.	170	.78	133
	Dec.	181	.65	[illegible]
	Total	2,366	.72	[illegible]
	Jan.	196	.54	107
	Feb.	201	.45	90
	Mar.	239	.44	106
	Apr.	266	.40	105
	May	209	.66	139
	June	212	.72	152
1971	July	114	1.07	122
	Aug.	114	.95	108
	Sept.	133	1.08	144
	Oct.	120	1.22	146
	Nov.	132	.88	116
	Dec.	144	.76	109
	Total	2,080	.69	1,444
	Jan.	126	.61	77
	Feb.	110	.61	68
	Mar.	109	.65	71
	Apr.	67	.87	58
	May	115	.86	99
	June	118	.91	107
1972	July	36	1.86	66
	Aug.	38	1.73	66
	Sept.	84	1.42	120
	Oct.	104	1.38	143
	Nov.	125	.89	111
	Dec.	157	.61	95
	Total	1,189	.91	1,081
	Jan.	155	.52	80
	Feb.	75	.84	63
	Mar.	83	.93	77
	Apr.	93	.77	72
	May	456	.34	155
	June	414	.46	191
1973	July	164	.82	134
	Aug.	148	.96	142
	Sept.	109	1.07	117
	Oct.	125	.98	122
	Nov.	89	.99	88
	Dec.	170	.68	115
	Total	2,081	.65	1,356
	Jan.	216	.45	97
	Feb.	214	.51	109
	Mar.	204	.83	170
	Apr.	141	.74	105
	May	261	.61	159
	June	121	1.53	185
1974	July	51	2.82	144
	Aug.	42	2.00	84
	Sept.	65	1.94	126
	Oct.	84	1.75	147
	Nov.	117	1.12	131
	Dec.	111	.99	110
	Total	1,627	.96	1,567
	Jan.	114	.82	93
	Feb.	96	.91	87
	Mar.	99	.90	89
	Apr.	158	.67	106
	May	398	.38	151
	June	336	.59	198
1975	July	165	.93	153
	Aug.	63	1.72	108
	Sept.	76	1.53	116
	Oct.	110	1.21	133
	Nov.	141	.87	122
	Dec.	152	.80	121
	Total	1,908	.77	1,477
	Jan.	134	.72	96
	Feb.	95	1.05	100
	Mar.	87	.90	78
	Apr.	83	.83	69
	May	207	1.29	268
	June	128	.92	118
1976	July	54	1.69	91
	Aug.	50	1.80	90
	Sept.	73	1.64	120
	Oct.	91	1.33	121
	Nov.	105	1.09	115
	Dec.	120	.80	[illegible]
	Total	1,227	1.11	[illegible]

To obtain mg/l multiply T/AF by 735.

Table 10
Colorado River Basin
Historical Flow and Quality of Water Data
Gunnison River near Grand Junction, Colorado

(Annual Summary)

Calendar Year	Flow 1,000 (A.F.)	T./A.F.	T.D.S. 1000 Ton	Flow 1,000,000 (m^3)	mg/l	T.D.S. 1,000 Tonne
1941	2,493	.83	2,072	3,075	611	1,880
1942	2,674	.77	2,057	3,298	566	1,866
1943	1,784	.88	1,576	2,201	650	1,430
1944	2,225	.69	1,543	2,745	510	1,400
1945	1,818	.82	1,499	2,243	606	1,360
1946	1,261	1.06	1,336	1,555	779	1,212
1947	1,938	.83	1,605	2,391	609	1,456
1948	2,361	.70	1,643	2,912	512	1,491
1949	2,121	.76	1,601	2,616	555	1,452
1950	1,335	.99	1,320	1,647	727	1,198
1951	1,136	1.03	1,165	1,401	754	1,057
1952	2,672	.67	1,781	3,296	490	1,616
1953	1,312	1.02	1,340	1,618	752	1,216
1954	645	1.65	1,062	796	1,210	963
1955	1,017	1.13	1,152	1,254	833	1,045
1956	1,101	.99	1,087	1,358	726	986
1957	3,381	.61	2,062	4,170	449	1,871
1958	2,262	.71	1,613	2,790	524	1,463
1959	981	1.21	1,191	1,210	893	1,080
1960	1,332	.88	1,167	1,643	645	1,059
1961	1,106	1.06	1,171	1,364	779	1,062
1962	2,135	.66	1,411	2,634	486	1,280
1963	892	1.32	1,176	1,100	970	1,067
1964	1,355	.96	1,298	1,671	705	1,178
1965	2,673	.65	1,742	3,297	479	1,580
1966	971	1.28	1,239	1,198	938	1,124
1967	1,057	1.20	1,271	1,304	884	1,153
1968	1,477	.98	1,451	1,822	722	1,316
1969	1,932	.87	1,673	2,383	637	1,518
1970	2,366	.72	1,694	2,918	527	1,537

Table 10
Colorado River Basin
Historical Flow and Quality of Water Data
Gunnison River near Grand Junction, Colorado

(Annual Summary)

Calendar Year	Flow 1,000 (A.F.)	T./A.F.	T.D.S. 1000 Ton	Flow 1,000,000 (m^3)	mg/l	T.D.S. 1,000 Tonne
1971	2,080	.69	1,444	2,566	511	1,310
1972	1,189	.91	1,081	1,467	669	981
1973	2,081	.65	1,356	2,567	479	1,230
1974	1,627	.96	1,567	2,007	709	1,422
1975	1,908	.77	1,477	2,354	569	1,340
1976	1,227	1.11	1,362	1,513	817	1,236
Total	61,925		52,285	76,384		47,435
Average	1,720	.84	1,452	2,122	621	1,318

Table 11
Colorado River Basin
Historical Flow and Quality of Water Data
Dolores River near Cisco, Utah

Year	Month	Flow 1,000 (A.F.) 1/	Concentration (T./A.F.)	T.D.S. 1,000 (Tons) 2/ 3/
1941	Jan.	14	2.79	39
	Feb.	20	2.35	47
	Mar.	41	1.41	58
	Apr.	175	.46	80
	May	615	.20	125
	June	248	.26	65
	July	98	.59	58
	Aug.	31	1.42	44
	Sept.	32	1.31	42
	Oct.	197	.52	102
	Nov.	61	1.33	81
	Dec.	34	1.82	62
	Total	1566	.51	803
1942	Jan.	26	2.19	57
	Feb.	22	2.23	49
	Mar.	50	1.26	63
	Apr.	516	.25	129
	May	387	.25	98
	June	213	.27	58
	July	46	.89	41
	Aug.	17	1.76	30
	Sept.	8	2.63	21
	Oct.	9	3.00	27
	Nov.	10	3.10	31
	Dec.	12	3.00	36
	Total	1316	.49	640
1943	Jan.	12	3.00	36
	Feb.	14	2.79	39
	Mar.	20	2.20	44
	Apr.	212	.41	87
	May	133	.42	56
	June	98	.45	44
	July	24	1.25	30
	Aug.	34	1.35	46
	Sept.	19	1.68	32
	Oct.	11	2.64	29
	Nov.	9	3.22	29
	Dec.	10	3.20	32
	Total	596	.85	504
1944	Jan.	9	3.33	30
	Feb.	12	3.00	36
	Mar.	17	2.47	42
	Apr.	97	.63	61
	May	463	.23	108
	June	267	.25	67
	July	73	.70	51
	Aug.	14	1.93	27
	Sept.	5	3.40	17
	Oct.	8	3.13	25
	Nov.	12	2.83	34
	Dec.	11	3.09	34
	Total	988	.54	532
1945	Jan.	12	3.00	36
	Feb.	16	2.63	42
	Mar.	14	2.79	39
	Apr.	134	.52	70
	May	296	.29	85
	June	88	.47	41
	July	32	1.06	34
	Aug.	29	1.45	42
	Sept.	6	3.17	19
	Oct.	15	2.20	33
	Nov.	10	3.10	31
	Dec.	9	3.44	31
	Total	661	.76	503
1946	Jan.	11	3.09	34
	Feb.	10	3.30	33
	Mar.	16	2.56	41
	Apr.	72	.74	53
	May	53	.66	35
	June	59	.59	35
	July	16	1.50	24
	Aug.	18	1.78	32
	Sept.	10	2.40	24
	Oct.	9	3.00	27
	Nov.	11	2.91	32
	Dec.	10	3.20	32
	Total	295	1.36	402
1947	Jan.	8	3.50	28
	Feb.	11	3.18	35
	Mar.	15	2.67	40
	Apr.	49	.92	45
	May	172	.38	65
	June	111	.41	46
	July	48	.85	41
	Aug.	37	1.30	48
	Sept.	30	1.33	40
	Oct.	37	1.43	53
	Nov.	19	1.58	30
	Dec.	16	2.19	35
	Total	553	.92	506
1948	Jan.	14	2.79	39
	Feb.	26	2.12	55
	Mar.	26	2.00	52
	Apr.	250	.44	109
	May	271	.31	84
	June	133	.32	43
	July	33	.91	30
	Aug.	18	1.61	29
	Sept.	5	3.80	19
	Oct.	8	3.63	29
	Nov.	8	4.25	34
	Dec.	9	3.89	35
	Total	801	.70	558
1949	Jan.	12	3.17	38
	Feb.	17	2.96	47
	Mar.	24	2.21	53
	Apr.	189	.59	112
	May	233	.32	75
	June	222	.33	73
	July	71	.75	53
	Aug.	20	2.20	44
	Sept.	5	5.40	27
	Oct.	9	3.78	34
	Nov.	10	3.70	37
	Dec.	10	3.80	38
	Total	822	.77	631
1950	Jan.	12	3.08	37
	Feb.	16	2.50	40
	Mar.	18	2.44	44
	Apr.	128	.45	58
	May	78	.45	35
	June	67	.48	32
	July	22	1.32	29
	Aug.	4	3.50	14
	Sept.	5	4.20	21
	Oct.	5	3.60	18
	Nov.	5	4.40	22
	Dec.	6	4.50	27
	Total	366	1.03	377
1951	Jan.	9	3.78	34
	Feb.	9	3.78	34
	Mar.	8	3.50	28
	Apr.	7	3.71	26
	May	38	.92	35
	June	48	.58	28
	July	12	1.58	19
	Aug.	11	1.73	19
	Sept.	4	2.50	10
	Oct.	4	3.75	15
	Nov.	6	3.33	20
	Dec.	7	3.14	22
	Total	163	1.78	290
1952	Jan.	14	2.36	33
	Feb.	10	2.40	24
	Mar.	15	2.33	35
	Apr.	324	.38	123
	May	365	.27	97
	June	243	.26	62
	July	67	.63	42
	Aug.	21	1.48	31
	Sept.	11	2.64	29
	Oct.	8	2.88	23
	Nov.	7	3.57	25
	Dec.	10	3.20	32
	Total	1095	.51	556
1953	Jan.	12	2.83	34
	Feb.	9	3.67	33
	Mar.	12	3.25	39
	Apr.	39	1.00	39
	May	64	.59	38
	June	88	.41	36
	July	18	1.44	26
	Aug.	20	1.75	35
	Sept.	4	3.25	13
	Oct.	16	2.38	38
	Nov.	11	3.00	33
	Dec.	8	3.63	29
	Total	301	1.31	393
1954	Jan.	9	3.44	31
	Feb.	9	3.00	27
	Mar.	10	3.20	32
	Apr.	43	.84	36
	May	53	.58	31
	June	18	1.22	22
	July	10	1.80	18
	Aug.	7	2.14	15
	Sept.	13	2.15	28
	Oct.	20	1.55	31
	Nov.	9	3.00	27
	Dec.	7	4.43	31
	Total	208	1.58	329
1955	Jan.	6	3.50	21
	Feb.	7	2.86	20
	Mar.	32	1.47	47
	Apr.	65	.63	41
	May	116	.42	49
	June	66	.52	34
	July	12	1.83	22
	Aug.	17	2.06	35
	Sept.	3	5.00	15
	Oct.	4	4.50	18
	Nov.	6	4.67	28
	Dec.	9	3.78	34
	Total	343	1.06	364
1956	Jan.	8	4.38	35
	Feb.	9	3.67	33
	Mar.	16	2.25	36
	Apr.	56	.59	33
	May	84	.51	43
	June	63	.51	32
	July	8	2.38	19
	Aug.	7	2.71	19
	Sept.	1	6.00	6
	Oct.	2	8.50	17
	Nov.	6	4.33	26
	Dec.	5	4.60	23
	Total	265	1.22	322
1957	Jan.	6	3.83	23
	Feb.	13	2.62	34
	Mar.	13	2.77	36
	Apr.	114	.60	68
	May	296	.35	103
	June	352	.28	98
	July	157	.43	67
	Aug.	78	.76	59
	Sept.	43	.91	39
	Oct.	31	1.77	55
	Nov.	27	2.33	63
	Dec.	20	2.40	48
	Total	1150	.60	693
1958	Jan.	13	3.38	44
	Feb.	32	1.94	62
	Mar.	35	1.77	62
	Apr.	341	.42	144
	May	368	.27	100
	June	164	.36	59
	July	20	1.75	35
	Aug.	8	3.63	29
	Sept.	9	3.00	27
	Oct.	8	3.75	30
	Nov.	9	3.78	34
	Dec.	9	4.00	36
	Total	1016	.65	662

1/ January 1941 to December 1950 used Dolores River at Gateway for flows.
2/ January 1941 to September 1947 correlated.
3/ October 1947 to December 1951 used Dolores River at Gateway for T.D.S.

Table II
Colorado River Basin
Historical Flow and Quality of Water Data
Dolores River near Cisco, Utah

Year	Month	Flow 1,000 (A.F.)	Concen- tration (T./A.F.)	T.D.S. 1,000 (Tons)
	Jan.	10	3.40	34
	Feb.	10	3.00	30
	Mar.	11	3.27	36
	Apr.	25	1.48	37
	May	33	.94	31
	June	32	.78	25
1959	July	7	1.57	11
	Aug.	13	1.69	22
	Sept.	3	3.67	11
	Oct.	10	2.20	22
	Nov.	9	2.67	24
	Dec.	6	3.33	20
	Total	169	1.79	303
	Jan.	8	2.63	21
	Feb.	9	3.33	30
	Mar.	44	1.48	65
	Apr.	156	.47	73
	May	111	.41	46
	June	104	.37	38
1960	July	20	1.25	25
	Aug.	5	2.60	13
	Sept.	4	3.75	15
	Oct.	5	3.80	19
	Nov.	7	2.86	20
	Dec.	7	3.14	22
	Total	480	.81	387
	Jan.	6	4.17	25
	Feb.	7	4.14	29
	Mar.	12	2.83	34
	Apr.	58	.72	42
	May	131	.37	49
	June	70	.44	31
1961	July	11	1.73	19
	Aug.	14	2.36	33
	Sept.	19	1.42	27
	Oct.	18	1.61	29
	Nov.	12	2.63	34
	Dec.	9	3.67	33
	Total	367	1.05	385
	Jan.	8	3.63	29
	Feb.	25	1.32	33
	Mar.	17	2.59	44
	Apr.	190	.37	71
	May	134	.39	52
	June	80	.48	38
1962	July	33	1.00	33
	Aug.	8	2.38	19
	Sept.	6	3.83	23
	Oct.	12	2.50	30
	Nov.	9	3.67	33
	Dec.	8	4.63	37
	Total	530	.83	442
	Jan.	6	3.33	20
	Feb.	17	2.82	48
	Mar.	36	1.56	56
	Apr.	51	.76	39
	May	57	.60	34
	June	18	1.56	28
1963	July	8	2.13	17
	Aug.	15	1.93	29
	Sept.	10	1.70	17
	Oct.	5	3.60	18
	Nov.	8	2.38	19
	Dec.	6	3.17	19
	Total	237	1.45	344
	Jan.	5	4.60	23
	Feb.	6	6.50	39
	Mar.	7	5.00	35
	Apr.	37	1.32	49
	May	117	.43	50
	June	56	.50	28
1964	July	14	1.71	24
	Aug.	28	1.82	51
	Sept.	8	3.00	24
	Oct.	7	3.43	24
	Nov.	6	4.17	25
	Dec.	9	3.22	29
	Total	300	1.34	401
	Jan.	11	3.00	33
	Feb.	9	3.44	31
	Mar.	9	4.00	36
	Apr.	174	.43	74
	May	243	.32	78
	June	165	.34	56
1965	July	96	.57	55
	Aug.	42	1.07	45
	Sept.	27	1.37	37
	Oct.	30	1.63	49
	Nov.	21	2.24	47
	Dec.	22	2.14	47
	Total	849	.69	588
	Jan.	23	2.39	55
	Feb.	14	2.14	30
	Mar.	67	1.00	67
	Apr.	130	.44	57
	May	133	.50	67
	June	44	.82	36
1966	July	14	2.00	28
	Aug.	5	2.00	10
	Sept.	4	3.25	13
	Oct.	6	3.33	20
	Nov.	7	3.57	25
	Dec.	17	2.35	40
	Total	464	.97	448
	Jan.	8	3.38	27
	Feb.	10	3.60	36
	Mar.	20	1.85	37
	Apr.	19	1.58	30
	May	58	.76	44
	June	45	.93	42
1967	July	17	1.82	31
	Aug.	23	1.83	42
	Sept.	9	2.33	21
	Oct.	6	3.00	18
	Nov.	6	3.50	21
	Dec.	7	4.14	29
	Total	228	1.66	378
	Jan.	8	3.00	24
	Feb.	11	3.55	39
	Mar.	10	3.90	39
	Apr.	54	.94	51
	May	168	.40	68
	June	158	.37	58
1968	July	27	1.41	38
	Aug.	40	1.15	46
	Sept.	5	4.00	20
	Oct.	6	5.33	32
	Nov.	8	4.13	33
	Dec.	6	4.67	28
	Total	501	.95	476
	Jan.	11	3.18	35
	Feb.	10	3.90	39
	Mar.	13	2.92	38
	Apr.	213	.42	90
	May	168	.33	56
	June	75	.56	42
1969	July	39	1.05	41
	Aug.	13	2.15	28
	Sept.	14	2.36	33
	Oct.	15	2.06	30
	Nov.	14	1.96	29
	Dec.	14	2.24	32
	Total	599	.82	493
	Jan.	13	2.99	38
	Feb.	11	2.41	27
	Mar.	11	3.32	37
	Apr.	51	.97	50
	May	229	.31	71
	June	89	.48	42
1970	July	28	1.24	35
	Aug.	18	1.63	29
	Sept.	64	.88	56
	Oct.	16	2.10	34
	Nov.	15	2.16	32
	Dec.	15	2.40	36
	Total	560	.87	487
	Jan.	16	2.22	36
	Feb.	15	2.20	33
	Mar.	42	1.13	48
	Apr.	81	.49	40
	May	109	.47	51
	June	104	.39	40
1971	July	25	1.09	27
	Aug.	17	2.68	46
	Sept.	8	2.23	18
	Oct.	16	2.28	37
	Nov.	10	3.12	31
	Dec.	14	2.10	29
	Total	457	.95	436
	Jan.	13	3.19	42
	Feb.	12	3.33	40
	Mar.	34	1.19	40
	Apr.	28	1.26	35
	May	39	1.00	39
	June	47	.65	31
1972	July	7	2.21	16
	Aug.	2	4.48	9
	Sept.	6	3.07	18
	Oct.	40	1.16	46
	Nov.	23	1.68	39
	Dec.	18	2.25	41
	Total	269	1.47	396
	Jan.	18	1.94	35
	Feb.	18	1.83	33
	Mar.	33	1.71	56
	Apr.	194	.50	97
	May	546	.30	164
	June	321	.32	103
1973	July	109	.67	73
	Aug.	13	2.62	34
	Sept.	8	3.70	29
	Oct.	8	4.31	35
	Nov.	8	4.17	33
	Dec.	13	3.97	51
	Total	1289	.58	743
	Jan.	10	3.50	35
	Feb.	10	2.50	25
	Mar.	24	2.14	51
	Apr.	77	.87	67
	May	130	.38	49
	June	37	.93	34
1974	July	15	1.90	28
	Aug.	4	2.61	10
	Sept.	1	6.19	6
	Oct.	5	4.65	23
	Nov.	8	3.47	28
	Dec.	7	4.44	31
	Total	328	1.18	387
	Jan.	7	4.27	30
	Feb.	9	3.60	32
	Mar.	13	3.19	42
	Apr.	150	.95	140
	May	315	.27	86
	June	218	.28	60
1975	July	130	.43	56
	Aug.	16	2.05	33
	Sept.	9	3.43	30
	Oct.	8	4.36	35
	Nov.	8	4.70	37
	Dec.	8	4.37	35
	Total	891	.69	616
	Jan.	10	3.95	39
	Feb.	13	3.75	49
	Mar.	13	3.82	49
	Apr.	80	.56	45
	May	132	.40	53
	June	76	.54	41
1976	July	15	1.98	30
	Aug.	8	2.54	20
	Sept.	8	2.12	17
	Oct.	8	3.13	25
	Nov.	6	5.00	30
	Dec.	4	6.50	26
	Total	373	1.14	424

Table II
Colorado River Basin
Historical Flow and Quality of Water Data
Dolores River near Cisco, Utah

(Annual Summary)

Calendar Year	Flow 1,000 (A.F.)	T./A.F.	T.D.S. 1000 Ton	Flow 1,000,000 (m^3)	mg/l	T.D.S. 1,000 Tonne
1941	1,566	.51	803	1,932	377	728
1942	1,316	.49	640	1,623	358	581
1943	596	.85	504	735	622	457
1944	988	.54	532	1,219	396	483
1945	661	.76	503	815	560	456
1946	295	1.36	402	364	1,003	365
1947	553	.92	506	682	673	459
1948	801	.70	558	988	512	506
1949	822	.77	631	1,014	564	572
1950	366	1.03	377	451	758	342
1951	163	1.78	290	201	1,308	263
1952	1,095	.51	556	1,351	373	504
1953	301	1.31	393	371	962	357
1954	208	1.58	329	257	1,160	298
1955	343	1.06	364	423	780	330
1956	265	1.22	322	327	893	292
1957	1,150	.60	693	1,419	443	629
1958	1,016	.65	662	1,253	480	601
1959	169	1.79	303	208	1,322	275
1960	480	.81	387	592	593	351
1961	367	1.05	385	453	770	349
1962	530	.83	442	654	613	401
1963	237	1.45	344	292	1,068	312
1964	300	1.34	401	370	984	364
1965	849	.69	588	1,047	509	533
1966	464	.97	448	572	710	406
1967	228	1.66	378	281	1,221	343
1968	501	.95	476	618	699	432
1969	599	.82	493	739	605	447
1970	560	.87	487	691	640	442

Table II
Colorado River Basin
Historical Flow and Quality of Water Data
Dolores River near Cisco, Utah

(Annual Summary)

Calendar Year	Flow 1,000 (A.F.)	T./A.F.	T.D.S. 1000 Ton	Flow 1,000,000 (m^3)	mg/l	T.D.S. 1,000 Tonne
1971	457	.95	436	564	702	396
1972	269	1.47	396	332	1,081	359
1973	1,289	.58	743	1,590	424	674
1974	328	1.18	387	405	867	351
1975	891	.69	616	1,099	509	559
1976	373	1.14	424	460	837	385
Total	21,396		17,199	26,392		15,602
Average	594	.80	478	733	591	433

Table 12
Colorado River Basin
Historical Flow and Quality of Water Data
Colorado River near Cisco, Utah

Year	Month	Flow 1000 (A.F.)	Concentration (T./A.F.)	T.D.S. 1000 (Tons)
	Jan.	139	1.86	259
	Feb.	153	1.78	272
	Mar.	207	1.64	339
	Apr.	445	1.00	445
	May	2,355	.42	989
	June	1,582	.46	728
- 1941	July	579	.73	423
	Aug.	251	1.67	419
	Sept.	237	1.81	429
	Oct.	579	1.10	637
	Nov.	311	1.18	367
	Dec.	229	1.51	346
	Total	7,067	.80	5,653
	Jan.	181	1.67	302
	Feb.	165	1.73	285
	Mar.	228	1.52	347
	Apr.	1,344	.61	820
	May	1,809	.45	814
	June	1,961	.37	725
- 1942	July	579	.78	451
	Aug.	185	1.84	340
	Sept.	134	2.46	329
	Oct.	162	2.33	378
	Nov.	186	1.99	370
	Dec.	164	1.96	322
	Total	7,098	.77	5,483
	Jan.	153	1.90	291
	Feb.	146	1.85	270
	Mar.	174	1.77	308
	Apr.	709	.64	454
	May	996	.46	458
	June	1,365	.38	518
- 1943	July	502	.78	392
	Aug.	368	1.26	463
	Sept.	212	1.85	392
	Oct.	184	1.84	339
	Nov.	215	1.47	317
	Dec.	190	1.56	296
	Total	5,214	.86	4,498
	Jan.	140	1.77	248
	Feb.	152	1.56	237
	Mar.	166	1.51	251
	Apr.	304	1.09	331
	May	1,784	.41	732
	June	1,843	.35	645
- 1944	July	677	.61	413
	Aug.	149	1.62	241
	Sept.	99	2.54	252
	Oct.	159	2.18	347
	Nov.	196	1.78	348
	Dec.	171	1.70	291
	Total	5,840	.74	4,336
	Jan.	149	1.73	258
	Feb.	151	1.74	263
	Mar.	178	1.56	277
	Apr.	328	.88	289
	May	1,495	.36	538
	June	1,311	.37	485
- 1945	July	676	.67	453
	Aug.	446	1.01	451
	Sept.	146	1.85	270
	Oct.	217	1.75	380
	Nov.	224	1.41	316
	Dec.	183	1.26	230
	Total	5,504	.76	4,210
	Jan.	174	1.37	239
	Feb.	155	1.27	197
	Mar.	191	1.24	236
	Apr.	525	.61	320
	May	726	.49	356
	June	1,027	.42	432
- 1946	July	309	.98	303
	Aug.	196	1.66	325
	Sept.	135	2.10	283
	Oct.	206	1.85	382
	Nov.	206	1.56	322
	Dec.	208	1.37	285
	Total	4,058	.91	3,680

Year	Month	Flow 1000 (A.F.)	Concentration (T./A.F.)	T.D.S. 10 00 (Tons)
	Jan.	145	1.58	229
	Feb.	150	1.44	216
	Mar.	189	1.39	263
	Apr.	316	.85	268
	May	1,423	.40	569
	June	1,594	.39	621
- 1947	July	985	.47	463
	Aug.	369	1.21	447
	Sept.	259	1.44	373
	Oct.	328	1.47	483
	Nov.	277	1.24	343
	Dec.	223	1.40	312
	Total	6,258	.73	4,587
	Jan.	191	1.34	256
	Feb.	210	1.33	280
	Mar.	245	1.36	333
	Apr.	830	.64	531
	May	1,959	.36	705
	June	1,499	.39	585
- 1948	July	446	.86	384
	Aug.	225	1.52	342
	Sept.	121	1.88	228
	Oct.	175	1.96	343
	Nov.	204	1.67	341
	Dec.	186	1.66	308
	Total	6,291	.74	4,636
	Jan.	188	1.54	289
	Feb.	187	1.35	253
	Mar.	243	1.40	340
	Apr.	615	.67	412
	May	1,289	.41	529
	June	1,910	.37	707
- 1949	July	908	.55	499
	Aug.	224	1.58	354
	Sept.	158	2.08	328
	Oct.	226	1.83	414
	Nov.	210	1.71	359
	Dec.	180	1.66	299
	Total	6,338	.75	4,783
	Jan.	199	1.52	302
	Feb.	201	1.44	289
	Mar.	209	1.31	274
	Apr.	541	.61	330
	May	764	.51	389
	June	1,113	.42	467
- 1950	July	347	1.03	357
	Aug.	109	2.02	220
	Sept.	138	2.12	292
	Oct.	125	2.35	294
	Nov.	161	1.96	316
	Dec.	167	1.75	293
	Total	4,074	.94	3,823
	Jan.	153	1.69	258
	Feb.	151	1.51	228
	Mar.	161	1.46	236
	Apr.	173	1.21	209
	May	758	.54	409
	June	1,173	.43	505
- 1951	July	529	.68	360
	Aug.	238	1.47	350
	Sept.	131	2.06	270
	Oct.	169	1.99	336
	Nov.	178	1.74	310
	Dec.	172	1.67	287
	Total	3,986	.94	3,758
	Jan.	191	1.59	303
	Feb.	155	1.65	256
	Mar.	194	1.48	287
	Apr.	969	.53	514
	May	2,152	.35	753
	June	2,314	.33	764
- 1952	July	641	.72	462
	Aug.	358	1.18	422
	Sept.	213	1.58	337
	Oct.	166	1.92	318
	Nov.	177	1.89	334
	Dec.	188	1.66	313
	Total	7,718	.66	5,0[illegible]

Year	Month	Flow 1000 (A.F.)	Concentration (T./A.F.)	T.D.S. 1000 (Tons)
	Jan.	185	1.65	306
	Feb.	14[illegible]	1.63	23[illegible]
	Mar.	187	1.52	284
	Apr.	250	1.00	250
	May	606	.60	364
	June	1,399	.41	574
- 1953	July	353	.95	335
	Aug.	256	1.23	315
	Sept.	128	2.22	284
	Oct.	177	1.89	334
	Nov.	207	1.77	366
	Dec.	171	1.75	299
	Total	4,06[illegible]	.97	3,944
	Jan.	177	1.76	312
	Feb.	143	1.65	236
	Mar.	161	1.46	235
	Apr.	221	.98	217
	May	436	.74	323
	June	217	1.17	254
- 1954	July	150	1.69	253
	Aug.	98	2.30	225
	Sept.	171	2.09	358
	Oct.	215	1.59	342
	Nov.	164	1.70	278
	Dec.	140	1.90	266
	Total	2,293	1.44	3,[illegible]
	Jan.	134	1.84	247
	Feb.	121	1.78	215
	Mar.	198	1.33	263
	Apr.	320	.82	262
	May	752	.50	376
	June	689	.55	379
- 1955	July	214	1.21	259
	Aug.	185	1.66	307
	Sept.	108	2.16	233
	Oct.	119	2.19	261
	Nov.	169	1.89	319
	Dec.	176	1.70	299
	Total	3,185	1.07	3,42[illegible]
	Jan.	155	1.69	262
	Feb.	141	1.70	239
	Mar.	187	1.50	281
	Apr.	356	.72	256
	May	1,005	.45	452
	June	924	.44	406
- 1956	July	172	1.47	253
	Aug.	119	1.97	234
	Sept.	81	2.38	193
	Oct.	121	2.22	269
	Nov.	165	1.87	308
	Dec.	142	1.94	275
	Total	3,568	.96	3,428
	Jan.	164	1.80	296
	Feb.	168	1.55	260
	Mar.	167	1.56	260
	Apr.	398	.86	342
	May	1,375	.44	605
	June	2,859	.29	829
- 1957	July	1,952	.37	722
	Aug.	661	.83	549
	Sept.	314	1.21	380
	Oct.	292	1.78	520
	Nov.	299	1.44	431
	Dec.	239	1.71	408
	Total	8,888	.63	5,602
	Jan.	200	1.52	304
	Feb.	225	1.34	302
	Mar.	254	1.29	328
	Apr.	756	.53	401
	May	2,032	.31	630
	June	1,560	.40	624
- 1958	July	234	1.22	285
	Aug.	109	2.17	236
	Sept.	153	2.14	328
	Oct.	155	1.99	308
	Nov.	19[illegible]	1.66	31[illegible]
	Dec.	176	1.63	287
	Total	[illegible]	.72	4,349

To obtain mg/l multiply T/AF by 735.

Table 12

Colorado River Basin

Historical Flow and Quality of Water Data

Colorado River near Cisco, Utah

Year	Month	Flow 1000 (A.F.)	Concentration (T./A.F.)	T.D.S. 1000 (Tons)
	Jan.	168	1.71	287
	Feb.	153	1.41	216
	Mar.	150	1.60	240
	Apr.	163	1.39	227
	May	535	.65	348
	June	924	.50	462
1959	July	214	1.15	246
	Aug.	160	1.91	306
	Sept.	124	2.14	265
	Oct.	250	1.43	358
	Nov.	210	1.31	275
	Dec.	163	1.54	251
	Total	3,214	1.08	3,481
	Jan.	164	1.51	248
	Feb.	143	1.51	216
	Mar.	273	1.22	333
	Apr.	629	.51	321
	May	758	.49	371
	June	1,068	.42	448
1960	July	25[illegible]	1.04	260
	Aug.	105	1.96	206
	Sept.	117	2.16	253
	Oct.	153	1.94	297
	Nov.	177	1.67	296
	Dec.	165	1.48	244
	Total	4,002	.87	3,493
	Jan.	156	1.43	223
	Feb.	140	1.52	213
	Mar.	162	1.44	233
	Apr.	206	1.14	235
	May	677	.57	386
	June	664	.51	339
1961	July	130	1.62	211
	Aug.	138	2.01	277
	Sept.	316	1.49	471
	Oct.	357	1.07	382
	Nov.	252	1.23	310
	Dec.	197	1.40	276
	Total	3,395	1.05	3,556
	Jan.	182	1.29	235
	Feb.	261	1.12	292
	Mar.	246	1.05	258
	Apr.	1,054	.44	464
	May	1,603	.38	609
	June	1,400	.38	532
1962	July	765	.58	444
	Aug.	206	1.42	293
	Sept.	173	1.99	344
	Oct.	26[illegible]	1.43	376
	Nov.	243	1.31	318
	Dec.	180	1.77	319
	Total	6,576	.68	4,4[illegible]3
	Jan.	163	1.52	248
	Feb.	193	1.51	292
	Mar.	219	1.30	285
	Apr.	245	.91	223
	May	517	.62	320
	June	332	.93	309
1963	July	114	1.94	221
	Aug.	168	1.94	326
	Sept.	183	1.80	329
	Oct.	134	2.14	287
	Nov.	179	1.62	290
	Dec.	138	1.84	254
	Total	2,585	1.31	3,384
	Jan.	132	1.85	244
	Feb.	121	1.79	217
	Mar.	128	1.87	239
	Apr.	214	1.11	238
	May	861	.50	430
	June	780	.50	390
1964	July	276	1.07	295
	Aug.	241	1.51	364
	Sept.	153	1.88	288
	Oct.	164	1.93	317
	Nov.	182	1.81	329
	Dec.	181	1.59	288
	Total	3,433	1.06	3,639
	Jan.	162	1.55	251
	Feb.	140	1.63	228
	Mar.	154	1.59	245
	Apr.	562	.68	382
	May	1,272	.39	496
	June	1,654	.38	629
1965	July	1,116	.52	580
	Aug.	447	.94	420
	Sept.	369	1.21	446
	Oct.	360	1.32	475
	Nov.	249	1.65	411
	Dec.	237	1.39	329
	Total	6,722	.73	4,892
	Jan.	200	1.38	276
	Feb.	169	1.34	226
	Mar.	278	.96	267
	Apr.	438	.61	267
	May	697	.53	369
	June	429	.83	356
1966	July	185	1.50	278
	Aug.	120	1.89	227
	Sept.	145	2.01	291
	Oct.	175	1.87	327
	Nov.	153	1.89	289
	Dec.	174	1.71	298
	Total	3,163	1.10	3,471
	Jan.	146	1.77	25[illegible]
	Feb.	136	1.71	233
	Mar.	185	1.30	240
	Apr.	198	1.31	259
	May	462	.76	351
	June	713	.65	463
1967	July	327	1.09	356
	Aug.	175	1.76	30[illegible]
	Sept.	178	1.77	315
	Oct.	174	1.39	242
	Nov.	211	1.39	293
	Dec.	241	1.18	284
	Total	3,146	1.14	3,602
	Jan.	205	1.18	242
	Feb.	193	1.20	232
	Mar.	171	1.41	241
	Apr.	230	.99	228
	May	667	.60	400
	June	1,171	.44	515
1968	July	306	1.08	330
	Aug.	365	1.23	449
	Sept.	159	1.72	273
	Oct.	213	1.63	347
	Nov.	257	1.28	329
	Dec.	248	1.14	283
	Total	4,185	.92	3,869
	Jan.	259	1.04	270
	Feb.	189	1.19	224
	Mar.	250	.97	242
	Apr.	714	.56	400
	May	987	.24	239
	June	731	.60	439
1969	July	472	.82	387
	Aug.	199	1.44	287
	Sept.	240	1.47	353
	Oct.	324	1.12	364
	Nov.	289	1.06	305
	Dec.	252	1.06	267
	Total	4,906	.77	3,777
	Jan.	236	1.06	251
	Feb.	220	.95	208
	Mar.	277	.87	241
	Apr.	327	.82	267
	May	1,384	.37	518
	June	1,339	.39	518
1970	July	537	.68	366
	Aug.	245	1.20	294
	Sept.	407	1.06	432
	Oct.	360	.99	357
	Nov.	338	.90	305
	Dec.	317	.87	275
	Total	5,987	.67	4,032
	Jan.	332	.78	258
	Feb.	321	.68	216
	Mar.	413	.63	262
	Apr.	580	.50	288
	May	768	.52	398
	June	1,141	.40	457
1971	July	535	.65	349
	Aug.	246	1.16	286
	Sept.	282	1.13	320
	Oct.	280	1.28	357
	Nov.	276	1.12	308
	Dec.	284	1.06	302
	Total	5,458	.70	3,801
	Jan.	267	1.02	273
	Feb.	227	1.03	233
	Mar.	279	1.07	299
	Apr.	202	.98	198
	May	453	.71	320
	June	759	.50	377
1972	July	192	1.19	229
	Aug.	119	1.66	198
	Sept.	201	1.54	309
	Oct.	302	1.13	342
	Nov.	281	1.13	317
	Dec.	267	.98	263
	Total	3,549	.95	3,358
	Jan.	283	.96	273
	Feb.	211	1.15	242
	Mar.	240	1.23	295
	Apr.	388	.96	372
	May	1,557	.43	670
	June	1,557	.41	640
1973	July	799	.60	480
	Aug.	331	1.04	344
	Sept.	220	1.37	302
	Oct.	251	1.34	337
	Nov.	247	1.23	305
	Dec.	290	.93	271
	Total	6,374	.71	4,531
	Jan.	312	.86	267
	Feb.	294	.81	237
	Mar.	363	.84	304
	Apr.	361	.81	291
	May	1,016	.39	400
	June	747	.50	373
1974	July	313	1.01	315
	Aug.	161	1.48	238
	Sept.	158	1.66	263
	Oct.	206	1.58	326
	Nov.	259	1.27	329
	Dec.	232	1.20	279
	Total	4,422	.82	3,622
	Jan.	236	1.11	263
	Feb.	207	1.08	223
	Mar.	241	1.09	263
	Apr.	377	.85	319
	May	1,007	.47	472
	June	1,243	.42	524
1975	July	807	.53	425
	Aug.	226	1.20	272
	Sept.	185	1.50	278
	Oct.	233	1.44	336
	Nov.	279	1.16	324
	Dec.	262	1.08	283
	Total	5,303	.75	3,982
	Jan.	230	1.07	247
	Feb.	206	1.18	244
	Mar.	220	1.11	244
	Apr.	277	1.15	319
	May	639	.61	390
	June	592	.63	371
1976	July	231	1.20	278
	Aug.	150	1.58	237
	Sept.	176	1.46	257
	Oct.	219	1.28	280
	Nov.	220	1.20	264
	Dec.	219	1.04	229
	Total	3,379	.99	3,360

To obtain mg/l multiply T/AF by 735.

Table 12
Colorado River Basin
Historical Flow and Quality of Water Data
Colorado River near Cisco, Utah
(Annual Summary)

Calendar Year	Flow 1,000 (A.F.)	T./A.F.	T.D.S. 1000 Ton	Flow 1,000,000 (m^3)	mg/l	T.D.S. 1,000 Tonne
1941	7,067	.80	5,653	8,717	588	5,128
1942	7,098	.77	5,483	8,755	568	4,974
1943	5,214	.86	4,498	6,431	635	4,081
1944	5,840	.74	4,336	7,204	546	3,934
1945	5,504	.76	4,210	6,789	563	3,819
1946	4,058	.91	3,680	5,006	667	3,338
1947	6,258	.73	4,587	7,719	539	4,161
1948	6,291	.74	4,636	7,760	542	4,206
1949	6,338	.75	4,783	7,818	555	4,339
1950	4,074	.94	3,823	5,025	690	3,468
1951	3,986	.94	3,758	4,917	693	3,409
1952	7,718	.66	5,063	9,520	482	4,593
1953	4,062	.97	3,944	5,010	714	3,578
1954	2,293	1.44	3,299	2,828	1,058	2,993
1955	3,185	1.07	3,420	3,929	790	3,103
1956	3,568	.96	3,428	4,401	707	3,110
1957	8,888	.63	5,602	10,963	464	5,082
1958	6,044	.72	4,348	7,455	529	3,945
1959	3,214	1.08	3,481	3,964	797	3,158
1960	4,002	.87	3,493	4,936	642	3,169
1961	3,395	1.05	3,556	4,188	770	3,226
1962	6,576	.68	4,484	8,111	502	4,068
1963	2,585	1.31	3,384	3,189	963	3,070
1964	3,433	1.06	3,639	4,235	779	3,301
1965	6,722	.73	4,892	8,292	535	4,438
1966	3,163	1.10	3,471	3,902	807	3,149
1967	3,146	1.14	3,602	3,881	842	3,268
1968	4,185	.92	3,869	5,162	680	3,510
1969	4,906	.77	3,777	6,052	566	3,426
1970	5,987	.67	4,032	7,385	495	3,658

Table 12
Colorado River Basin
Historical Flow and Quality of Water Data
Colorado River near Cisco, Utah

(Annual Summary)

Calendar Year	Flow 1,000 (A.F.)	T./A.F.	T.D.S. 1000 Ton	Flow 1,000,000 (m^3)	mg/l	T.D.S. 1,000 Tonne
1971	5,458	.70	3,801	6,732	512	3,448
1972	3,549	.95	3,358	4,378	696	3,046
1973	6,374	.71	4,531	7,862	523	4,111
1974	4,422	.82	3,622	5,452	602	3,286
1975	5,303	.75	3,982	6,541	552	3,612
1976	3,379	.99	3,360	4,168	731	3,048
Total	177,285		146,885	218,677		133,253
Average	4,925	.83	4,080	6,074	609	3,701

Table 13

Colorado River Basin

Historical Flow and Quality of Water Data

San Juan River near Archuleta, New Mexico

Year	Month	Flow 1000 (A.F.)	Concentration (T./A.F.)	T.D.S. 1000 (Tons)
	Jan.	22	0.41	9
	Feb.	46	.35	16
	Mar.	98	.38	37
	Apr.	251	.21	53
	May	709	.16	110
	June	560	.12	68
- 1941	July	324	.14	46
	Aug.	84	.19	16
	Sept.	68	.24	16
	Oct.	273	.12	33
	Nov.	87	.17	15
	Dec.	52	.21	11
	Total	2,574	.17	430
	Jan.	45	.33	15
	Feb.	48	.25	12
	Mar.	54	.42	23
	Apr.	383	.21	82
	May	320	.15	48
	June	310	.12	38
- 1942	July	76	.18	14
	Aug.	41	.22	9
	Sept.	28	.25	7
	Oct.	23	.26	6
	Nov.	22	.27	6
	Dec.	16	.38	6
	Total	1,366	.19	266
	Jan.	16	.44	7
	Feb.	26	.35	9
	Mar.	55	.38	21
	Apr.	198	.19	37
	May	184	.16	30
	June	134	.15	20
- 1943	July	51	.24	12
	Aug.	48	.21	10
	Sept.	28	.25	7
	Oct.	35	.20	7
	Nov.	24	.29	7
	Dec.	19	.32	6
	Total	818	.21	173
	Jan.	16	.38	6
	Feb.	19	.32	6
	Mar.	34	.47	16
	Apr.	131	.21	27
	May	371	.16	61
	June	382	.13	49
- 1944	July	134	.16	22
	Aug.	45	.20	9
	Sept.	43	.23	10
	Oct.	41	.22	9
	Nov.	21	.29	6
	Dec.	14	.43	6
	Total	1,251	.18	227
	Jan.	14	.43	6
	Feb.	22	.45	10
	Mar.	35	.49	17
	Apr.	143	.20	28
	May	278	.16	44
	June	209	.13	28
- 1945	July	68	.21	14
	Aug.	40	.22	9
	Sept.	21	.24	5
	Oct.	30	.37	11
	Nov.	19	.37	7
	Dec.	12	.50	6
	Total	891	.21	185
	Jan.	14	.43	6
	Feb.	17	.47	8
	Mar.	22	.50	11
	Apr.	66	.23	15
	May	73	.18	13
	June	87	.18	16
- 1946	July	27	.33	9
	Aug.	40	.35	14
	Sept.	29	.31	9
	Oct.	36	.31	11
	Nov.	26	.35	9
	Dec.	19	.32	6
	Total	456	.28	127
	Jan.	15	0.40	6
	Feb.	24	.38	9
	Mar.	32	.34	11
	Apr.	50	.24	12
	May	186	.17	32
	June	140	.13	18
- 1947	July	43	.28	12
	Aug.	73	.30	22
	Sept.	56	.23	13
	Oct.	77	.21	16
	Nov.	37	.22	8
	Dec.	27	.26	7
	Total	760	.22	166
	Jan.	27	.26	7
	Feb.	39	.33	13
	Mar.	43	.35	15
	Apr.	246	.20	49
	May	306	.14	43
	June	338	.12	40
- 1948	July	79	.16	13
	Aug.	49	.24	12
	Sept.	22	.32	7
	Oct.	23	.35	8
	Nov.	18	.39	7
	Dec.	13	.46	6
	Total	1,203	.18	220
	Jan.	16	.44	7
	Feb.	25	.36	9
	Mar.	73	.37	27
	Apr.	228	.24	55
	May	318	.15	48
	June	406	.13	53
- 1949	July	199	.15	30
	Aug.	57	.24	14
	Sept.	33	.27	9
	Oct.	30	.30	9
	Nov.	21	.38	8
	Dec.	14	.50	7
	Total	1,420	.19	276
	Jan.	16	.37	6
	Feb.	29	.41	12
	Mar.	31	.42	13
	Apr.	116	.19	22
	May	126	.15	19
	June	112	.16	18
- 1950	July	44	.27	12
	Aug.	20	.35	7
	Sept.	24	.38	9
	Oct.	20	.35	7
	Nov.	14	.50	7
	Dec.	12	.50	6
	Total	564	.24	138
	Jan.	10	.50	5
	Feb.	11	.45	5
	Mar.	20	.45	9
	Apr.	35	.29	10
	May	117	.18	21
	June	94	.17	16
- 1951	July	21	.38	8
	Aug.	33	.36	12
	Sept.	22	.36	8
	Oct.	17	.47	8
	Nov.	15	.47	7
	Dec.	18	.44	8
	Total	413	.28	117
	Jan.	19	.53	10
	Feb.	19	.53	10
	Mar.	47	.49	23
	Apr.	326	.26	85
	May	396	.16	63
	June	454	.13	59
- 1952	July	136	.18	24
	Aug.	66	.26	17
	Sept.	33	.27	9
	Oct.	22	.32	7
	Nov.	16	.44	7
	Dec.	18	.39	7
	Total	1,552	.21	321
	Jan.	18	0.39	7
	Feb.	18	.39	7
	Mar.	37	.41	15
	Apr.	75	.24	18
	May	117	.19	22
	June	148	.15	22
- 1953	July	41	.32	13
	Aug.	33	.33	11
	Sept.	16	.44	7
	Oct.	23	.43	10
	Nov.	23	.43	10
	Dec.	14	.50	7
	Total	563	.26	149
	Jan.	11	.45	5
	Feb.	21	.48	10
	Mar.	28	.46	13
	Apr.	90	.21	19
	May	143	.18	26
	June	67	.19	13
- 1954	July	37	.41	15
	Aug.	45	.29	13
	Sept.	30	.43	13
	Oct.	42	.24	10
	Nov.	18	.39	7
	Dec.	13	.46	6
	Total	545	.28	150
	Jan.	12	.42	5
	Feb.	13	.31	4
	Mar.	27	.37	10
	Apr.	45	.24	11
	May	132	.18	24
	June	119	.16	19
- 1955	July	42	.29	12
	Aug.	67	.28	19
	Sept.	28	.29	8
	Oct.	20	.30	6
	Nov.	17	.35	6
	Dec.	15	.40	6
	Total	537	.24	130
	Jan.	16	.38	6
	Feb.	15	.40	6
	Mar.	48	.33	16
	Apr.	79	.20	16
	May	173	.14	24
	June	117	.15	18
- 1956	July	25	.32	8
	Aug.	23	.35	8
	Sept.	11	.36	4
	Oct.	12	.42	5
	Nov.	11	.45	5
	Dec.	9	.44	4
	Total	539	.22	120
	Jan.	13	.46	6
	Feb.	30	.47	14
	Mar.	46	.43	20
	Apr.	120	.28	34
	May	222	.19	42
	June	480	.13	62
- 1957	July	326	.16	52
	Aug.	164	.22	36
	Sept.	67	.19	13
	Oct.	67	.30	20
	Nov.	68	.26	18
	Dec.	44	.30	13
	Total	1,647	.20	330
	Jan.	22	.36	8
	Feb.	51	.43	22
	Mar.	77	.42	32
	Apr.	279	.30	84
	May	460	.17	78
	June	270	.13	35
- 1958	July	42	.26	11
	Aug.	35	.31	11
	Sept.	40	.30	12
	Oct.	25	.36	9
	Nov.	17	.41	7
	Dec.	14	.43	6
	Total	1,332	.24	315

To obtain mg/l multiply T/AF by 735.

Table 13

Colorado River Basin

Historical Flow and Quality of Water Data

San Juan River near Archuleta, New Mexico

Year	Month	Flow 1000 (A.F.)	Concen-tration (T./A.F.)	T.D.S. 1000 (Tons)
1959	Jan.	11	0.46	5
	Feb.	14	.44	6
	Mar.	18	.42	8
	Apr.	37	.30	11
	May	87	.18	16
	June	84	.16	13
	July	18	.32	6
	Aug.	34	.33	11
	Sept.	15	.34	5
	Oct.	60	.30	18
	Nov.	39	.30	12
	Dec.	19	.37	7
	Total	436	.27	118
1960	Jan.	14	.43	6
	Feb.	16	.42	7
	Mar.	175	.34	60
	Apr.	240	.19	46
	May	193	.17	33
	June	232	.13	30
	July	55	.23	13
	Aug.	25	.29	7
	Sept.	23	.31	7
	Oct.	26	.37	10
	Nov.	16	.42	7
	Dec.	14	.54	7
	Total	1,029	.23	233
1961	Jan.	12	.45	5
	Feb.	16	.43	7
	Mar.	43	.44	19
	Apr.	113	.26	29
	May	192	.15	29
	June	122	.16	19
	July	38	.28	11
	Aug.	52	.28	15
	Sept.	58	.25	15
	Oct.	52	.24	12
	Nov.	34	.28	10
	Dec.	18	.31	6
	Total	750	.24	177
1962	Jan.	15	.37	6
	Feb.	42	.38	16
	Mar.	51	.38	20
	Apr.	242	.20	48
	May	228	.14	32
	June	165	.14	23
	July	39	.19	7
	Aug.	29	.25	7
	Sept.	19	.25	5
	Oct.	18	.31	6
	Nov.	14	.33	5
	Dec.	10	.37	4
	Total	872	.21	179
1963	Jan.	7	.39	3
	Feb.	8	.43	4
	Mar.	15	.39	6
	Apr.	31	.38	12
	May	19	.26	5
	June	19	.19	4
	July	20	.18	4
	Aug.	21	.19	4
	Sept.	20	.20	4
	Oct.	24	.23	6
	Nov.	24	.24	6
	Dec.	24	.28	7
	Total	232	.28	65
1964	Jan.	17	.32	6
	Feb.	13	.31	4
	Mar.	13	.32	4
	Apr.	15	.32	5
	May	34	.31	10
	June	82	.28	23
	July	108	.25	27
	Aug.	48	.23	11
	Sept.	26	.22	6
	Oct.	28	.23	6
	Nov.	21	.27	6
	Dec.	32	.28	9
	Total	437	.27	117
1965	Jan.	90	0.29	26
	Feb.	92	.30	28
	Mar.	52	.36	19
	Apr.	85	.35	30
	May	138	.29	40
	June	215	.20	43
	July	102	.18	18
	Aug.	136	.17	23
	Sept.	112	.17	19
	Oct.	131	.13	17
	Nov.	180	.16	29
	Dec.	178	.18	32
	Total	1,511	.21	324
1966	Jan.	168	.21	35
	Feb.	94	.26	24
	Mar.	114	.29	33
	Apr.	181	.28	51
	May	130	.26	34
	June	27	.22	6
	July	28	.17	5
	Aug.	29	.18	5
	Sept.	27	.17	5
	Oct.	91	.18	16
	Nov.	47	.20	9
	Dec.	25	.24	6
	Total	961	.24	229
1967	Jan.	25	.26	6
	Feb.	45	.26	12
	Mar.	70	.26	18
	Apr.	23	.27	6
	May	17	.31	5
	June	18	.35	6
	July	20	.34	7
	Aug.	62	.29	18
	Sept.	59	.26	15
	Oct.	21	.23	5
	Nov.	21	.26	5
	Dec.	21	.28	6
	Total	402	.27	109
1968	Jan.	19	.29	6
	Feb.	20	.26	5
	Mar.	18	.29	5
	Apr.	60	.27	16
	May	49	.26	13
	June	28	.26	7
	July	30	.28	8
	Aug.	39	.27	11
	Sept.	47	.25	12
	Oct.	35	.25	9
	Nov.	23	.24	6
	Dec.	24	.23	6
	Total	392	.27	104
1969	Jan.	40	.22	9
	Feb.	110	.23	25
	Mar.	94	.20	19
	Apr.	110	.25	27
	May	117	.22	26
	June	118	.22	26
	July	98	.22	22
	Aug.	72	.21	15
	Sept.	76	.21	16
	Oct.	96	.20	19
	Nov.	81	.21	17
	Dec.	90	.21	19
	Total	1,102	.22	240
1970	Jan.	51	.22	11
	Feb.	110	.19	21
	Mar.	91	.20	18
	Apr.	26	.23	6
	May	29	.24	7
	June	30	.23	7
	July	31	.19	[illegible]
	Aug.	39	.18	7
	Sept.	78	.19	15
	Oct.	110	.22	24
	Nov.	104	.22	23
	Dec.	120	.22	26
	Total	819	.21	171
1971	Jan.	141	.23	32
	Feb.	120	.24	29
	Mar.	68	.22	15
	Apr.	30	.23	7
	May	31	.22	7
	June	29	.24	7
	July	31	.22	7
	Aug.	30	.21	6
	Sept.	30	.22	7
	Oct.	25	.26	6
	Nov.	18	.29	5
	Dec.	65	.21	14
	Total	618	.23	142
1972	Jan.	93	.22	20
	Feb.	84	.26	22
	Mar.	93	.28	26
	Apr.	49	.28	14
	May	31	.24	7
	June	30	.28	9
	July	31	.30	9
	Aug.	38	.24	9
	Sept.	37	.27	10
	Oct.	32	.29	9
	Nov.	30	.27	8
	Dec.	62	.27	17
	Total	610	.26	160
1973	Jan.	71	.27	19
	Feb.	97	.26	25
	Mar.	29	.31	9
	Apr.	30	.30	9
	May	133	.31	41
	June	182	.28	51
	July	266	.28	75
	Aug.	216	.22	47
	Sept.	159	.22	35
	Oct.	120	.20	24
	Nov.	117	.21	24
	Dec.	120	.21	25
	Total	1,540	.25	384
1974	Jan.	103	.20	21
	Feb.	65	.23	15
	Mar.	63	.22	14
	Apr.	59	.25	15
	May	57	.25	14
	June	38	.24	9
	July	36	.25	9
	Aug.	43	.26	11
	Sept.	42	.24	10
	Oct.	32	.28	9
	Nov.	28	.29	8
	Dec.	30	.30	9
	Total	596	.24	144
1975	Jan.	32	.28	9
	Feb.	27	.27	7
	Mar.	31	.29	9
	Apr.	82	.27	22
	May	148	.27	40
	June	144	.27	39
	July	151	.26	39
	Aug.	113	.26	29
	Sept.	92	.25	23
	Oct.	90	.24	21
	Nov.	85	.23	20
	Dec.	96	.22	21
	Total	1,091	.26	279
1976	Jan.	77	.22	17
	Feb.	54	.22	12
	Mar.	56	.21	12
	Apr.	42	.24	10
	May	88	.23	20
	June	82	.23	19
	July	33	.24	8
	Aug.	37	.24	9
	Sept.	40	.23	9
	Oct.	29	.24	7
	Nov.	28	.26	[illegible]
	Dec.	73	.23	17
	Total	639	.23	147

To obtain mg/l multiply T/AF by 735.

Table 13
Colorado River Basin
Historical Flow and Quality of Water Data
San Juan River near Archuleta, New Mexico
(Annual Summary)

Calendar Year	Flow 1,000 (A.F.)	T./A.F.	T.D.S. 1000 Ton	Flow 1,000,000 (m^3)	mg/l	T.D.S. 1,000 Tonne
1941	2,574	.17	430	3,175	123	390
1942	1,366	.19	266	1,685	143	241
1943	818	.21	173	1,009	156	157
1944	1,251	.18	227	1,543	134	206
1945	891	.21	185	1,099	153	168
1946	456	.28	127	562	205	115
1947	760	.22	166	937	161	151
1948	1,203	.18	220	1,484	135	200
1949	1,420	.19	276	1,752	143	250
1950	564	.24	138	696	180	125
1951	413	.28	117	509	208	106
1952	1,552	.21	321	1,914	152	291
1953	563	.26	149	694	195	135
1954	545	.28	150	672	202	136
1955	537	.24	130	662	178	118
1956	539	.22	120	665	164	109
1957	1,647	.20	330	2,032	147	299
1958	1,332	.24	315	1,643	174	286
1959	436	.27	118	538	199	107
1960	1,029	.23	233	1,269	166	211
1961	750	.24	177	925	174	161
1962	872	.21	179	1,076	151	162
1963	232	.28	65	286	206	59
1964	437	.27	117	539	197	106
1965	1,511	.21	324	1,864	158	294
1966	961	.24	229	1,185	176	208
1967	402	.27	109	496	200	99
1968	392	.27	104	484	194	94
1969	1,102	.22	240	1,359	160	218
1970	819	.21	171	1,010	153	155

Table 13
Colorado River Basin
Historical Flow and Quality of Water Data
San Juan River near Archuleta, New Mexico
(Annual Summary)

Calendar Year	Flow 1,000 (A.F.)	T./A.F.	T.D.S. 1000 Ton	Flow 1,000,000 (m^3)	mg/l	T.D.S. 1,000 Tonne
1971	618	.23	142	762	169	129
1972	610	.26	160	752	193	145
1973	1,540	.25	384	1,900	183	348
1974	596	.24	144	735	178	131
1975	1,091	.26	279	1,346	188	253
1976	639	.23	147	788	169	133
Total	32,468		7,162	40,047		6,496
Average	902	.22	199	1,112	162	180

Table 14

Colorado River Basin

Historical Flow and Quality of Water Data

San Juan River near Bluff, Utah

Year	Month	Flow 1000 (A.F.)	Concentration (T./A.F.)	T.D.S. 1000 (Tons)
1941	Jan.	78	1.01	79
	Feb.	127	.98	124
	Mar.	211	.78	165
	Apr.	392	.62	243
	May	1,323	.50	662
	June	915	.30	275
	July	526	.30	158
	Aug.	174	.70	122
	Sept.	202	.87	176
	Oct.	655	.64	419
	Nov.	191	.61	117
	Dec.	105	.81	85
	Total	4,899	.54	2,625
1942	Jan.	81	.93	75
	Feb.	68	.93	63
	Mar.	126	.95	120
	Apr.	602	.51	307
	May	479	.38	182
	June	533	.26	139
	July	150	.48	72
	Aug.	51	.82	42
	Sept.	38	1.00	38
	Oct.	37	1.22	45
	Nov.	39	1.23	48
	Dec.	43	1.26	54
	Total	2,247	.53	1,185
1943	Jan.	43	1.26	54
	Feb.	49	1.18	58
	Mar.	95	1.09	104
	Apr.	294	.47	138
	May	332	.39	129
	June	254	.38	96
	July	106	.57	60
	Aug.	91	1.01	92
	Sept.	62	.90	56
	Oct.	58	1.00	58
	Nov.	59	.97	57
	Dec.	51	1.12	57
	Total	1,494	.64	959
1944	Jan.	37	1.16	43
	Feb.	49	1.14	56
	Mar.	76	1.06	81
	Apr.	204	.62	126
	May	640	.36	230
	June	705	.25	176
	July	283	.35	99
	Aug.	61	.85	52
	Sept.	66	.92	61
	Oct.	75	.91	68
	Nov.	52	1.12	58
	Dec.	43	1.19	51
	Total	2,291	.48	1,101
1945	Jan.	41	1.22	50
	Feb.	63	1.13	71
	Mar.	72	1.03	74
	Apr.	196	.61	120
	May	456	.35	160
	June	377	.29	109
	July	128	.50	64
	Aug.	96	1.13	108
	Sept.	21	1.18	25
	Oct.	62	1.10	68
	Nov.	46	1.04	48
	Dec.	30	1.27	38
	Total	1,588	.59	935
1946	Jan.	37	1.14	42
	Feb.	36	1.19	43
	Mar.	47	1.04	49
	Apr.	95	.66	63
	May	125	.49	61
	June	204	.40	82
	July	63	.86	54
	Aug.	75	1.12	84
	Sept.	44	.93	41
	Oct.	55	.98	54
	Nov.	60	1.02	61
	Dec.	46	1.02	47
	Total	887	.77	681
1947	Jan.	31	1.13	35
	Feb.	45	1.07	48
	Mar.	51	.90	46
	Apr.	68	.63	43
	May	329	.38	125
	June	276	.30	83
	July	110	.41	45
	Aug.	294	1.01	296
	Sept.	124	.73	91
	Oct.	207	.79	163
	Nov.	77	.73	56
	Dec.	65	.86	56
	Total	1,6[illegible]7	.65	1,087
1948	Jan.	52	.83	43
	Feb.	79	.84	66
	Mar.	89	.83	74
	Apr.	358	.37	133
	May	519	.27	140
	June	603	.28	169
	July	147	.41	60
	Aug.	86	.78	67
	Sept.	36	1.11	40
	Oct.	75	1.05	79
	Nov.	55	1.07	59
	Dec.	41	1.12	46
	Total	2,140	.46	976
1949	Jan.	63	1.11	70
	Feb.	74	.99	73
	Mar.	152	.81	123
	Apr.	338	.45	152
	May	503	.31	156
	June	748	.31	232
	July	342	.33	113
	Aug.	90	.66	59
	Sept.	41	1.05	43
	Oct.	56	1.00	56
	Nov.	45	1.07	48
	Dec.	35	1.23	43
	Total	2,487	.47	1,168
1950	Jan.	41	1.12	46
	Feb.	49	1.08	53
	Mar.	56	.93	52
	Apr.	136	.46	62
	May	169	.40	68
	June	191	.38	73
	July	68	.72	49
	Aug.	15	1.13	17
	Sept.	42	1.14	48
	Oct.	30	1.07	32
	Nov.	25	1.44	36
	Dec.	32	1.34	43
	Total	854	.68	579
1951	Jan.	30	1.30	39
	Feb.	29	1.41	41
	Mar.	34	1.15	39
	Apr.	34	.85	29
	May	142	.51	72
	June	188	.36	68
	July	30	.80	24
	Aug.	49	1.06	52
	Sept.	45	1.07	48
	Oct.	35	1.23	43
	Nov.	39	1.10	43
	Dec.	36	1.28	46
	Total	691	.79	544
1952	Jan.	88	1.16	102
	Feb.	40	1.20	48
	Mar.	87	1.03	90
	Apr.	453	.42	190
	May	618	.30	185
	June	769	.24	185
	July	238	.42	100
	Aug.	83	.69	57
	Sept.	56	.93	52
	Oct.	38	1.05	40
	Nov.	41	1.29	53
	Dec.	43	1.26	54
	Total	2,554	.45	1.156
1953	Jan.	42	1.24	52
	Feb.	36	1.17	42
	Mar.	56	1.02	57
	Apr.	107	.64	68
	May	156	.44	69
	June	267	.27	72
	July	77	.84	65
	Aug.	71	1.15	82
	Sept.	12	1.50	18
	Oct.	54	1.28	69
	Nov.	55	1.13	62
	Dec.	34	1.31	45
	Total	967	.73	701
1954	Jan.	32	1.34	43
	Feb.	36	1.17	42
	Mar.	48	1.02	49
	Apr.	113	.53	60
	May	218	.39	85
	June	120	.48	58
	July	120	1.03	123
	Aug.	66	.86	57
	Sept.	89	1.19	106
	Oct.	95	.75	71
	Nov.	39	1.05	41
	Dec.	35	1.26	44
	Total	1,011	.77	779
1955	Jan.	31	1.26	39
	Feb.	34	1.12	38
	Mar.	63	1.00	63
	Apr.	62	.74	46
	May	186	.38	71
	June	208	.32	67
	July	65	.88	57
	Aug.	142	1.07	152
	Sept.	28	.82	23
	Oct.	25	1.00	25
	Nov.	31	1.26	39
	Dec.	35	1.34	47
	Total	910	.73	667
1956	Jan.	40	1.22	49
	Feb.	34	1.29	44
	Mar.	74	.83	61
	Apr.	107	.50	54
	May	241	.35	84
	June	203	.31	63
	July	31	1.10	34
	Aug.	36	1.33	48
	Sept.	4	1.50	6
	Oct.	13	1.54	20
	Nov.	30	1.23	37
	Dec.	25	1.40	35
	Total	838	.64	535
1957	Jan.	38	1.26	48
	Feb.	64	1.05	67
	Mar.	71	.97	69
	Apr.	171	.55	94
	May	327	.48	157
	June	787	.28	220
	July	566	.38	215
	Aug.	364	.63	229
	Sept.	142	.68	97
	Oct.	150	.86	129
	Nov.	141	.72	102
	Dec.	88	.81	71
	Total	2,909	.51	1,498
1958	Jan.	53	1.02	54
	Feb.	119	.92	109
	Mar.	159	.87	139
	Apr.	413	.48	198
	May	743	.26	193
	June	507	.25	126
	July	74	.65	48
	Aug.	43	1.02	[illegible]
	Sept.	61	.95	58
	Oct.	47	1.04	49
	Nov.	43	1.23	53
	Dec.	36	1.28	46
	Total	[illegible]	.49	1,116

To obtain mg/l multiply T/AF by 735.

Table 14

Colorado River Basin

Historical Flow and Quality of Water Data

San Juan River near Bluff, Utah

Year	Month	Flow 1000 (A.F.)	Concentration (T./A.F.)	T.D.S. 1000 (Tons)
-1959	Jan.	30	1.39	42
	Feb.	31	1.36	42
	Mar.	32	1.27	41
	Apr.	39	.94	37
	May	111	.52	58
	June	156	.39	61
	July	18	.81	15
	Aug.	64	1.13	72
	Sept.	11	1.53	17
	Oct.	92	.86	79
	Nov.	82	.82	67
	Dec.	46	1.02	47
	Total	712	.81	578
-1960	Jan.	37	1.26	47
	Feb.	43	1.09	47
	Mar.	260	.73	190
	Apr.	336	.32	108
	May	285	.34	97
	June	382	.27	103
	July	92	.53	49
	Aug.	18	1.11	20
	Sept.	17	1.24	21
	Oct.	58	1.13	66
	Nov.	39	1.22	48
	Dec.	40	1.27	51
	Total	1,607	.53	847
-1961	Jan.	35	1.33	47
	Feb.	41	1.31	54
	Mar.	66	1.02	67
	Apr.	157	.56	88
	May	285	.32	91
	June	227	.31	70
	July	43	.83	36
	Aug.	87	1.05	91
	Sept.	109	.88	96
	Oct.	98	.77	75
	Nov.	72	.93	67
	Dec.	44	1.22	54
	Total	1,264	.66	836
-1962	Jan.	36	1.24	45
	Feb.	94	.95	89
	Mar.	73	.99	72
	Apr.	315	.37	117
	May	346	.30	104
	June	297	.32	95
	July	88	.59	52
	Aug.	23	1.02	23
	Sept.	26	1.41	37
	Oct.	104	1.32	137
	Nov.	45	1.34	60
	Dec.	33	1.40	46
	Total	1,480	.59	877
-1963	Jan.	25	1.66	42
	Feb.	39	1.44	56
	Mar.	40	1.25	50
	Apr.	64	.78	50
	May	95	.72	68
	June	47	.82	39
	July	15	1.60	24
	Aug.	48	1.57	75
	Sept.	70	1.09	76
	Oct.	41	1.32	54
	Nov.	47	1.10	52
	Dec.	48	1.03	49
	Total	579	1.10	635
-1964	Jan.	44	1.14	50
	Feb.	30	1.27	38
	Mar.	28	1.46	41
	Apr.	30	1.40	42
	May	103	.57	59
	June	121	.58	70
	July	113	.76	86
	Aug.	131	1.07	140
	Sept.	56	1.36	76
	Oct.	37	1.26	47
	Nov.	42	1.43	60
	Dec.	60	1.20	72
	Total	795	.98	781
-1965	Jan.	122	0.77	94
	Feb.	120	.70	84
	Mar.	85	.93	79
	Apr.	165	.62	102
	May	288	.45	130
	June	419	.38	159
	July	295	.45	133
	Aug.	218	.65	142
	Sept.	177	.56	99
	Oct.	190	.60	114
	Nov.	232	.50	116
	Dec.	235	.54	127
	Total	2,546	.54	1,379
-1966	Jan.	198	0.54	107
	Feb.	129	.65	84
	Mar.	199	.68	135
	Apr.	252	.48	121
	May	267	.42	112
	June	127	.56	71
	July	54	1.01	55
	Aug.	44	1.30	57
	Sept.	42	1.25	52
	Oct.	94	.66	62
	Nov.	70	.86	60
	Dec.	72	1.11	80
	Total	1,548	.64	996
-1967	Jan.	58	1.07	62
	Feb.	64	.92	59
	Mar.	79	.71	56
	Apr.	31	1.15	36
	May	78	.76	59
	June	89	.91	81
	July	39	1.35	53
	Aug.	151	1.29	195
	Sept.	94	.96	90
	Oct.	31	1.46	45
	Nov.	38	1.26	48
	Dec.	39	1.20	47
	Total	791	1.05	831
-1968	Jan.	36	1.22	44
	Feb.	54	1.29	70
	Mar.	50	1.25	62
	Apr.	83	.75	62
	May	148	.54	80
	June	240	.37	89
	July	82	.93	76
	Aug.	176	1.04	183
	Sept.	41	1.00	41
	Oct.	56	1.09	61
	Nov.	49	1.18	58
	Dec.	45	1.07	48
	Total	1,060	.82	874
-1969	Jan.	83	1.04	86
	Feb.	131	.61	80
	Mar.	143	.73	104
	Apr.	216	.54	117
	May	271	.40	108
	June	238	.45	107
	July	202	.57	115
	Aug.	101	.88	89
	Sept.	118	.76	90
	Oct.	208	.83	173
	Nov.	118	.64	75
	Dec.	109	.65	71
	Total	1,938	.63	1,215
-1970	Jan.	75	.77	58
	Feb.	130	.49	64
	Mar.	116	.57	66
	Apr.	49	.96	47
	May	140	.45	[illegible]
	June	138	.49	67
	July	74	.73	54
	Aug.	66	1.09	72
	Sept.	308	[illegible]	[illegible]
	Oct.	[illegible]	[illegible]	[illegible]
	Nov.	[illegible]	[illegible]	[illegible]
	Dec.	149	.54	[illegible]
	Total	1,524	.63	954
1971	Jan.	164	.48	79
	Feb.	144	.48	69
	Mar.	101	.57	57
	Apr.	69	.74	51
	May	86	.77	67
	June	123	.49	61
	July	66	.83	54
	Aug.	108	1.36	146
	Sept.	52	1.12	58
	Oct.	100	1.14	113
	Nov.	59	1.12	66
	Dec.	110	.77	85
	Total	1,182	.77	906
1972	Jan.	119	.61	72
	Feb.	109	.61	67
	Mar.	119	.54	64
	Apr.	65	.69	44
	May	81	.69	56
	June	118	.61	72
	July	17	1.14	19
	Aug.	31	1.44	44
	Sept.	56	.99	56
	Oct.	339	1.03	349
	Nov.	96	.98	94
	Dec.	100	.79	79
	Total	1,250	.81	1,016
1973	Jan.	109	.76	83
	Feb.	178	.75	134
	Mar.	177	1.16	205
	Apr.	260	.95	248
	May	486	.49	237
	June	464	.40	187
	July	398	.41	162
	Aug.	222	.49	108
	Sept.	195	.54	106
	Oct.	133	.59	79
	Nov.	134	.59	79
	Dec.	141	.57	81
	Total	2,897	.59	1,709
1974	Jan.	133	.59	78
	Feb.	92	.72	66
	Mar.	103	.98	101
	Apr.	65	.78	51
	May	106	.57	60
	June	69	.64	44
	July	39	1.13	44
	Aug.	25	1.12	28
	Sept.	25	1.08	27
	Oct.	73	.99	72
	Nov.	71	1.11	79
	Dec.	55	1.04	57
	Total	856	.83	707
1975	Jan.	59	.88	52
	Feb.	50	1.08	54
	Mar.	112	1.11	124
	Apr.	159	.67	107
	May	295	.42	124
	June	397	.31	123
	July	361	.35	125
	Aug.	147	.52	76
	Sept.	129	.60	78
	Oct.	107	.59	63
	Nov.	102	.58	59
	Dec.	116	.57	66
	Total	2,034	.52	1,051
1976	Jan.	97	.71	69
	Feb.	81	.75	61
	Mar.	79	.84	66
	Apr.	53	.75	40
	May	179	.45	81
	June	180	.54	98
	July	52	.77	40
	Aug.	48	.77	37
	Sept.	66	.86	57
	Oct.	51	.94	48
	Nov.	47	1.06	50
	Dec.	82	.76	62
	Total	1,015	.70	709

To obtain mg/l multiply T/AF by 735.

Table 14
Colorado River Basin
Historical Flow and Quality of Water Data
San Juan River near Bluff, Utah
(Annual Summary)

Calendar Year	Flow 1,000 (A.F.)	T./A.F.	T.D.S. 1000 Ton	Flow 1,000,000 (m^3)	mg/l	T.D.S. 1,000 Tonne
1941	4,899	.54	2,625	6,043	394	2,381
1942	2,247	.53	1,185	2,772	388	1,075
1943	1,494	.64	959	1,843	472	870
1944	2,291	.48	1,101	2,826	354	999
1945	1,588	.59	935	1,959	433	848
1946	887	.77	681	1,094	565	618
1947	1,677	.65	1,087	2,069	477	986
1948	2,140	.46	976	2,640	335	885
1949	2,487	.47	1,168	3,068	346	1,060
1950	854	.68	579	1,053	499	525
1951	691	.79	544	852	580	494
1952	2,554	.45	1,156	3,150	333	1,049
1953	967	.73	701	1,193	533	636
1954	1,011	.77	779	1,247	567	707
1955	910	.73	667	1,122	539	605
1956	838	.64	535	1,034	469	485
1957	2,909	.51	1,498	3,588	379	1,359
1958	2,298	.49	1,116	2,835	357	1,012
1959	712	.81	578	878	597	524
1960	1,607	.53	847	1,982	387	768
1961	1,264	.66	836	1,559	486	758
1962	1,480	.59	877	1,826	436	796
1963	579	1.10	635	714	807	576
1964	795	.98	781	981	723	709
1965	2,546	.54	1,379	3,140	398	1,251
1966	1,548	.64	996	1,909	474	904
1967	791	1.05	831	976	773	754
1968	1,060	.82	874	1,308	606	793
1969	1,938	.63	1,215	2,391	461	1,102
1970	1,524	.63	954	1,880	460	865

Table 14
Colorado River Basin
Historical Flow and Quality of Water Data
San Juan River near Bluff, Utah
(Annual Summary)

Calendar Year	Flow 1,000 (A.F.)	T./A.F.	T.D.S. 1000 Ton	Flow 1,000,000 (m^3)	mg/l	T.D.S. 1,000 Tonne
1971	1,182	.77	906	1,458	564	822
1972	1,250	.81	1,016	1,542	598	922
1973	2,897	.59	1,709	3,573	434	1,550
1974	856	.83	707	1,056	607	641
1975	2,034	.52	1,051	2,509	380	953
1976	1,015	.70	709	1,252	514	643
Total	57,820		35,193	71,322		31,925
Average	1,606	.61	978	1,981	448	887

Table 15

Colorado River Basin

Historical Flow and Quality of Water Data

Colorado River at Lees Ferry, Arizona

Year	Month	Flow 1000 (A.F.)	Concentration (T./A.F.)	T.D.S. 1000 (Tons)
	Jan.	348	1.36	474
	Feb.	425	1.29	546
	Mar.	669	1.12	749
	Apr.	1,091	.79	862
	May	4,974	.45	2,239
	June	4,004	.38	1,522
-1941	July	1,666	.51	850
	Aug.	798	1.16	925
	Sept.	608	1.35	821
	Oct.	1,797	1.09	1,959
	Nov.	903	.94	849
	Dec.	576	1.19	685
	Total	17,857	.70	12,481
	Jan.	407	1.34	545
	Feb.	396	1.28	507
	Mar.	630	1.16	731
	Apr.	2,844	.55	1,564
	May	3,209	.46	1,476
	June	4,202	.29	1,219
-1942	July	1,317	.57	751
	Aug.	454	1.08	490
	Sept.	275	1.59	438
	Oct.	334	1.58	528
	Nov.	368	1.58	582
	Dec.	357	1.54	550
	Total	14,793	.63	9,381
	Jan.	330	1.50	494
	Feb.	332	1.41	469
	Mar.	516	1.19	614
	Apr.	1,450	.67	971
	May	2,158	.43	928
	June	2,729	.40	1,092
-1943	July	1,429	.47	672
	Aug.	793	1.09	864
	Sept.	447	1.15	514
	Oct.	378	1.60	604
	Nov.	456	1.35	616
	Dec.	395	1.36	537
	Total	11,413	.73	8,375
	Jan.	278	1.50	418
	Feb.	344	1.32	454
	Mar.	509	1.31	668
	Apr.	1,027	.89	914
	May	3,251	.47	1,528
	June	4,136	.32	1,323
-1944	July	1,782	.45	802
	Aug.	417	1.07	446
	Sept.	229	1.50	343
	Oct.	342	1.66	567
	Nov.	384	1.51	579
	Dec.	320	1.51	483
	Total	13,519	.65	8,525
	Jan.	325	1.48	481
	Feb.	352	1.39	489
	Mar.	437	1.28	559
	Apr.	755	.99	748
	May	2,805	.44	1,234
	June	2,761	.37	1,021
-1945	July	1,668	.47	784
	Aug.	1,011	.89	900
	Sept.	370	1.28	474
	Oct.	505	1.51	763
	Nov.	443	1.34	594
	Dec.	337	1.35	454
	Total	11,769	.72	8,501
	Jan.	366	1.28	468
	Feb.	319	1.24	396
	Mar.	496	1.15	570
	Apr.	1,013	.83	841
	May	1,732	.47	814
	June	1,393	.43	857
	July	730	.73	533
-1946	Aug.	478	1.28	612
	Sept.	310	1.62	502
	Oct.	403	1.50	604
	Nov.	466	1.30	607
	Dec.	445	1.22	542
	Total	8,751	.84	7,346

Year	Month	Flow 1000 (A.F.)	Concentration (T./A.F.)	T.D.S. 1000 (Tons)
	Jan.	277	1.40	388
	Feb.	357	1.29	462
	Mar.	654	1.09	713
	Apr.	780	.78	608
	May	3,121	.39	1,217
	June	3,275	.40	1,310
-1947	July	1,926	.43	828
	Aug.	1,203	.98	1,179
	Sept.	584	1.13	660
	Oct.	818	1.17	958
	Nov.	585	1.07	626
	Dec.	466	1.21	564
	Total	14,046	.68	9,513
	Jan.	406	1.18	479
	Feb.	458	1.14	522
	Mar.	645	1.14	735
	Apr.	1,703	.64	1,090
	May	3,507	.38	1,333
	June	3,339	.34	1,135
-1948	July	980	.65	637
	Aug.	531	1.23	653
	Sept.	230	1.40	322
	Oct.	331	1.65	545
	Nov.	408	1.46	595
	Dec.	347	1.40	485
	Total	12,885	.66	8,531
	Jan.	337	1.39	469
	Feb.	361	1.25	451
	Mar.	706	1.18	834
	Apr.	1,307	.78	1,020
	May	3,098	.43	1,332
	June	4,419	.41	1,812
-1949	July	2,137	.52	1,111
	Aug.	576	1.00	576
	Sept.	313	1.51	473
	Oct.	509	1.48	753
	Nov.	473	1.31	619
	Dec.	368	1.37	504
	Total	14,604	.68	9,954
	Jan.	350	1.41	493
	Feb.	399	1.23	490
	Mar.	650	1.11	721
	Apr.	1,217	.74	900
	May	1,971	.49	966
	June	2,979	.37	1,102
-1950	July	1,377	.67	923
	Aug.	422	1.02	430
	Sept.	330	1.47	485
	Oct.	342	1.47	502
	Nov.	350	1.55	542
	Dec.	415	1.31	544
	Total	10,802	.75	8,098
	Jan.	315	1.43	451
	Feb.	361	1.25	451
	Mar.	418	1.19	497
	Apr.	531	1.00	531
	May	1,645	.57	938
	June	2,886	.41	1,184
-1951	July	1,357	.48	651
	Aug.	787	1.11	874
	Sept.	411	1.32	542
	Oct.	412	1.47	606
	Nov.	445	1.41	628
	Dec.	333	1.44	480
	Total	9,901	.79	7,833
	Jan.	476	1.23	586
	Feb.	379	1.26	478
	Mar.	440	1.31	576
	Apr.	2,267	.74	1,677
	May	5,081	.41	2,083
	June	5,192	.36	1,869
-1952	July	1,573	.55	865
	Aug.	821	1.06	870
	Sept.	542	1.31	710
	Oct.	368	1.43	527
	Nov.	386	1.55	599
	Dec.	378	1.47	556
	Total	17,903	.64	11,396

Year	Month	Flow 1000 (A.F.)	Concentration (T./A.F.)	T.D.S. 1000 (Tons)
	Jan.	393	1.36	534
	Feb.	365	1.30	475
	Mar.	458	1.22	558
	Apr.	529	1.07	566
	May	1,047	.69	723
	June	2,992	.38	1,137
-1953	July	950	.64	608
	Aug.	661	1.19	787
	Sept.	258	1.59	410
	Oct.	321	1.77	568
	Nov.	414	1.50	621
	Dec.	341	1.46	498
	Total	8,729	.86	7,485
	Jan.	319	1.46	466
	Feb.	342	1.30	444
	Mar.	393	1.24	487
	Apr.	546	1.00	546
	May	1,277	.56	715
	June	792	.63	499
-1954	July	647	.87	563
	Aug.	321	1.19	382
	Sept.	389	1.66	645
	Oct.	512	1.43	733
	Nov.	349	1.39	485
	Dec.	278	1.51	421
	Total	6,165	1.04	6,386
	Jan.	244	1.58	386
	Feb.	243	1.39	338
	Mar.	580	1.29	748
	Apr.	617	1.05	649
	May	1,570	.56	879
	June	1,586	.49	777
-1955	July	571	.70	399
	Aug.	510	1.40	713
	Sept.	230	1.60	368
	Oct.	214	1.70	363
	Nov.	275	1.67	458
	Dec.	326	1.44	470
	Total	6,966	.94	6,548
	Jan.	373	1.28	477
	Feb.	280	1.39	390
	Mar.	511	1.16	592
	Apr.	898	.75	673
	May	2,190	.48	1,051
	June	2,594	.39	1,012
-1956	July	557	.75	418
	Aug.	356	1.33	473
	Sept.	166	1.48	246
	Oct.	186	1.74	324
	Nov.	300	1.58	474
	Dec.	247	1.55	383
	Total	8,658	.75	6,513
	Jan.	284	1.46	415
	Feb.	323	1.34	433
	Mar.	498	1.23	613
	Apr.	828	.90	745
	May	2,569	.56	1,439
	June	5,645	.39	2,201
-1957	July	4,015	.43	1,727
	Aug.	1,604	.78	1,251
	Sept.	822	1.03	847
	Oct.	748	1.54	1,150
	Nov.	848	1.39	1,179
	Dec.	516	1.25	646
	Total	18,700	.68	12,646
	Jan.	397	1.27	504
	Feb.	536	1.18	632
	Mar.	696	1.10	766
	Apr.	1,574	.64	1,007
	May	3,992	.46	1,836
	June	3,678	.40	1,471
-1958	July	628	.74	465
	Aug.	286	1.43	409
	Sept.	319	1.69	540
	Oct.	310	1.63	505
	Nov.	357	1.65	589
	Dec.	366	1.52	556
	Total	13,139	.71	9,280

To obtain mg/l multiply T/AF by 735.

Table 15

Colorado River Basin

Historical Flow and Quality of Water Data

Colorado River at Lees Ferry, Arizona

Year	Month	Flow 1000 (A.F.)	Concentration (T./A.F.)	T.D.S. 1000 (Tons)
	Jan.	315	1.48	466
	Feb.	315	1.36	428
	Mar.	344	1.37	471
	Apr.	420	1.16	487
	May	1,025	.70	718
	June	1,836	.48	881
-1959	July	782	.63	493
	Aug.	425	1.43	608
	Sept.	246	1.68	413
	Oct.	502	1.41	708
	Nov.	499	1.21	604
	Dec.	352	1.39	489
	Total	7,061	.96	6,766
	Jan.	305	1.54	470
	Feb.	318	1.34	426
	Mar.	745	1.18	879
	Apr.	1,610	.62	998
	May	1,564	.51	798
	June	2,239	.43	963
-1960	July	647	.69	446
	Aug.	208	1.38	287
	Sept.	193	1.90	367
	Oct.	341	1.67	569
	Nov.	345	1.47	507
	Dec.	275	1.39	382
	Total	8,790	.81	7,092
	Jan.	266	1.48	394
	Feb.	331	1.34	444
	Mar.	362	1.34	485
	Apr.	567	1.02	578
	May	1,153	.59	680
	June	1,588	.45	715
-1961	July	369	.89	328
	Aug.	336	1.65	554
	Sept.	710	1.61	1,143
	Oct.	725	1.01	732
	Nov.	527	1.04	548
	Dec.	380	1.22	464
	Total	7,314	.97	7,065
	Jan.	349	1.24	433
	Feb.	791	1.03	815
	Mar.	598	1.13	676
	Apr.	2,391	.71	1,698
	May	3,633	.44	1,599
	June	2,876	.45	1,294
-1962	July	1,717	.57	979
	Aug.	469	1.02	478
	Sept.	315	1.61	507
	Oct.	539	1.52	819
	Nov.	428	1.28	548
	Dec.	333	1.42	473
	Total	14,439	.71	10,319
	Jan.	169	1.69	286
	Feb.	369	1.35	498
	Mar.	188	1.35	254
	Apr.	60	1.44	86
	May	62	1.30	81
	June	140	1.13	158
-1963	July	90	.95	86
	Aug.	62	.96	60
	Sept.	60	.90	54
	Oct.	61	.88	54
	Nov.	60	.95	57
	Dec.	63	1.34	84
	Total	1,384	1.27	1,758
	Jan.	71	1.33	94
	Feb.	231	1.33	307
	Mar.	388	1.29	500
	Apr.	771	1.24	956
	May	319	1.22	389
	June	60	1.24	74
	July	60	1.25	75
-1964	Aug.	174	1.24	216
	Sept.	156	.69	108
	Oct.	268	.63	169
	Nov.	347	.84	292
	Dec.	398	1.00	398
	Total	3,243	1.10	3,578
	Jan.	558	0.98	547
	Feb.	515	1.02	525
	Mar.	556	1.01	562
	Apr.	1,222	1.03	1,259
	May	2,284	.95	2,170
	June	2,323	.88	2,044
-1965	July	727	.48	349
	Aug.	871	.41	357
	Sept.	750	.40	300
	Oct.	659	.43	283
	Nov.	589	.47	277
	Dec.	531	.63	335
	Total	11,535	.78	9,008
	Jan.	451	0.73	329
	Feb.	483	.76	367
	Mar.	622	.76	473
	Apr.	825	.77	635
	May	978	.72	704
	June	754	.71	535
-1966	July	658	.66	434
	Aug.	682	.65	443
	Sept.	622	.66	411
	Oct.	551	.65	358
	Nov.	584	.66	385
	Dec.	529	.69	365
	Total	7,739	.70	5,439
	Jan.	614	.76	467
	Feb.	534	.79	422
	Mar.	690	.89	614
	Apr.	788	1.03	812
	May	879	.93	817
	June	698	.99	691
-1967	July	641	.81	519
	Aug.	693	.71	492
	Sept.	596	.75	447
	Oct.	415	.73	303
	Nov.	460	.76	350
	Dec.	552	.82	453
	Total	7,560	.84	6,387
	Jan.	633	.93	589
	Feb.	464	.97	450
	Mar.	858	1.02	875
	Apr.	968	1.02	987
	May	943	1.05	990
	June	894	1.00	894
-1968	July	827	.81	670
	Aug.	685	.70	480
	Sept.	635	.70	444
	Oct.	620	.69	428
	Nov.	616	.67	413
	Dec.	639	.79	505
	Total	8,782	.88	7,725
	Jan.	570	.92	524
	Feb.	461	.94	434
	Mar.	708	.99	698
	Apr.	871	1.06	920
	May	763	.98	744
	June	875	.91	798
-1969	July	956	.88	837
	Aug.	930	.76	710
	Sept.	794	.72	570
	Oct.	630	.77	487
	Nov.	706	.80	562
	Dec.	814	.77	623
	Total	9,078	.87	7,907
	Jan.	706	.84	593
	Feb.	445	.90	401
	Mar.	486	.96	466
	Apr.	942	.94	888
	May	900	.92	824
	June	800	.86	690
-1970	July	769	.86	658
	Aug.	773	.79	608
	Sept.	701	.77	542
	Oct.	498	.76	380
	Nov.	459	.80	365
	Dec.	670	.81	545
	Total	8,149	.85	6,960
	Jan.	492	.75	369
	Feb.	416	.85	354
	Mar.	640	.91	581
	Apr.	1,011	.90	908
	May	926	.87	803
	June	894	.79	705
1971	July	943	.77	724
	Aug.	876	.75	660
	Sept.	776	.68	525
	Oct.	584	.71	415
	Nov.	764	.71	539
	Dec.	937	.71	662
	Total	9,259	.78	7,245
	Jan.	806	.74	594
	Feb.	444	.74	331
	Mar.	378	.85	321
	Apr.	782	.88	686
	May	902	.82	741
	June	863	.78	676
1972	July	915	.75	684
	Aug.	1,005	.75	755
	Sept.	931	.71	663
	Oct.	631	.73	459
	Nov.	671	.74	499
	Dec.	1,017	.79	799
	Total	9,345	.77	7,208
	Jan.	1,207	.73	887
	Feb.	764	.75	572
	Mar.	1,095	.83	912
	Apr.	1,678	.86	1,443
	May	648	.86	558
	June	751	.83	624
1973	July	656	.84	552
	Aug.	566	.78	444
	Sept.	424	.79	334
	Oct.	510	.76	387
	Nov.	412	.76	314
	Dec.	333	.69	230
	Total	9,044	.80	7,257
	Jan.	846	.69	585
	Feb.	299	.68	203
	Mar.	389	.80	313
	Apr.	495	.84	418
	May	804	.81	653
	June	914	.77	702
1974	July	1,226	.75	921
	Aug.	1,213	.74	897
	Sept.	826	.72	597
	Oct.	602	.71	425
	Nov.	710	.70	495
	Dec.	564	.68	381
	Total	8,888	.74	6,590
	Jan.	768	.70	539
	Feb.	556	.73	406
	Mar.	508	.79	402
	Apr.	459	.81	373
	May	892	.83	740
	June	987	.78	771
1975	July	1,221	.76	934
	Aug.	1,022	.73	751
	Sept.	966	.74	717
	Oct.	637	.70	449
	Nov.	425	.73	311
	Dec.	520	.71	369
	Total	8,961	.75	6,762
	Jan.	692	.70	485
	Feb.	742	.78	581
	Mar.	676	.84	570
	Apr.	660	.84	557
	May	1,046	.81	843
	June	756	.77	585
1976	July	766	.75	572
	Aug.	720	.72	524
	Sept.	842	.72	610
	Oct.	792	.70	556
	Nov.	898	.73	655
	Dec.	811	.71	577
	Total	9,401	.76	7,115

To obtain mg/l multiply T/AF by 735.

Table 15
Colorado River Basin
Historical Flow and Quality of Water Data
Colorado River at Lees Ferry, Arizona

(Annual Summary)

Calendar Year	Flow 1,000 (A.F.)	T./A.F.	T.D.S. 1000 Ton	Flow 1,000,000 (m^3)	mg/l	T.D.S. 1,000 Tonne
1941	17,857	.70	12,481	22,027	514	11,323
1942	14,793	.63	9,381	18,247	466	8,510
1943	11,413	.73	8,375	14,078	540	7,598
1944	13,019	.65	8,525	16,059	482	7,734
1945	11,769	.72	8,501	14,517	531	7,712
1946	8,751	.84	7,346	10,794	617	6,664
1947	14,046	.68	9,513	17,326	498	8,630
1948	12,885	.66	8,531	15,894	487	7,739
1949	14,604	.68	9,954	18,014	501	9,030
1950	10,802	.75	8,098	13,324	551	7,347
1951	9,901	.79	7,833	12,213	582	7,106
1952	17,903	.64	11,396	22,083	468	10,338
1953	8,729	.86	7,485	10,767	631	6,790
1954	6,165	1.04	6,386	7,604	762	5,793
1955	6,966	.94	6,548	8,593	691	5,940
1956	8,658	.75	6,513	10,680	553	5,909
1957	18,700	.68	12,646	23,066	497	11,472
1958	13,139	.71	9,280	16,207	519	8,419
1959	7,061	.96	6,766	8,710	705	6,138
1960	8,790	.81	7,092	10,842	593	6,434
1961	7,314	.97	7,065	9,022	710	6,409
1962	14,439	.71	10,319	17,811	526	9,361
1963	1,384	1.27	1,758	1,707	934	1,595
1964	3,243	1.10	3,578	4,000	812	3,246
1965	11,585	.78	9,008	14,290	572	8,172
1966	7,739	.70	5,439	9,546	517	4,934
1967	7,560	.84	6,387	9,325	621	5,794
1968	8,803	.88	7,738	10,859	646	7,020
1969	9,078	.87	7,907	11,198	641	7,173
1970	8,139	.85	6,954	10,039	628	6,309

Table 15
Colorado River Basin
Historical Flow and Quality of Water Data
Colorado River at Lees Ferry, Arizona
(Annual Summary)

Calendar Year	Flow 1,000 (A.F.)	T./A.F.	T.D.S. 1000 Ton	Flow 1,000,000 (m^3)	mg/l	T.D.S. 1,000 Tonne
1971	9,259	.78	7,245	11,421	576	6,573
1972	9,345	.77	7,208	11,527	567	6,539
1973	9,044	.80	7,257	11,156	590	6,584
1974	8,888	.74	6,590	10,963	545	5,978
1975	8,961	.75	6,762	11,053	555	6,134
1976	9,401	.76	7,115	11,596	557	6,455
Total	370,133		280,980	456,558		254,902
Average	10,281	.76	7,805	12,682	558	7,081

Table 16

Colorado River Basin

Historical Flow and Quality of Water Data

Colorado River near Grand Canyon, Arizona

Year	Month	Flow 1000 (A.F.)	Concentration (T./A.F.)	T.D.S. 1000 (Tons)
	Jan.	434	1.42	616
	Feb.	515	1.31	675
	Mar.	838	1.17	980
	Apr.	1,209	.87	1,052
	May	4,976	.50	2,488
	June	4,100	.45	1,845
-1941	July	1,753	.55	964
	Aug.	861	1.29	1,111
	Sept.	659	1.43	942
	Oct.	1,904	1.14	2,171
	Nov.	953	.98	934
	Dec.	594	1.22	725
	Total	13,796	.77	14,503
	Jan.	430	1.40	602
	Feb.	435	1.33	579
	Mar.	653	1.25	816
	Apr.	2,763	.60	1,658
	May	3,163	.49	1,550
	June	4,241	.32	1,357
-1942	July	1,345	.59	794
	Aug.	486	1.15	559
	Sept.	294	1.67	491
	Oct.	356	1.67	575
	Nov.	386	1.67	645
	Dec.	373	1/ 1.50	560
	Total	14,925	.68	10,186
	Jan.	347	1/ 1.49	517
	Feb.	351	1/ 1.48	519
	Mar.	580	1/ 1.26	731
	Apr.	1,417	1/ .83	1,176
	May	2,161	1/ .57	1,232
	June	2,676	1/ .49	1,311
-1943	July	1,459	1/ .60	875
	Aug.	834	1/ 1.17	976
	Sept.	494	1/ 1.40	692
	Oct.	408	1.69	690
	Nov.	477	1.47	701
	Dec.	420	1.46	613
	Total	11,624	.86	10,033
	Jan.	298	1.61	480
	Feb.	363	1.23	446
	Mar.	551	1.41	777
	Apr.	1,099	.95	1,044
	May	3,206	.55	1,763
	June	4,144	.41	1,699
-1944	July	1,854	.52	964
	Aug.	456	1.14	520
	Sept.	251	1.61	404
	Oct.	362	1.78	644
	Nov.	401	1.64	658
	Dec.	345	1.59	549
	Total	13,330	.75	9,948
	Jan.	356	1.55	552
	Feb.	381	1.48	564
	Mar.	472	1.41	666
	Apr.	804	1.01	812
	May	2,803	.52	1,458
	June	2,754	.48	1,322
-1945	July	1,732	.56	970
	Aug.	1,071	1.05	1,125
	Sept.	394	1.38	544
	Oct.	524	1.63	854
	Nov.	465	1.51	702
	Dec.	359	1.47	528
	Total	12,115	.83	10,097
	Jan.	384	1.41	541
	Feb.	333	1.38	460
	Mar.	514	1.29	663
	Apr.	1,016	.94	955
	May	1,775	.53	941
	June	1,995	.54	1,077
-1946	July	784	.82	643
	Aug.	567	1.50	850
	Sept.	372	1.71	636
	Oct.	419	1.62	679
	Nov.	492	1.36	684
	Dec.	468	1.31	613
	Total	9,119	.96	8,742

Year	Month	Flow 1000 (A.F.)	Concentration (T./A.F.)	T.D.S. 1000 (Tons)
	Jan.	303	1.50	455
	Feb.	371	1.38	512
	Mar.	653	1.18	771
	Apr.	785	.92	722
	May	3,088	.48	1,482
	June	3,233	.48	1,552
-1947	July	1,953	.50	976
	Aug.	1,329	1.17	1,555
	Sept.	640	1.26	806
	Oct.	894	1.28	1,144
	Nov.	608	1.14	693
	Dec.	490	1.28	627
	Total	14,347	.79	11,295
	Jan.	427	1.27	542
	Feb.	458	1.28	586
	Mar.	669	1.25	836
	Apr.	1,732	.74	1,282
	May	3,392	.45	1,526
	June	3,358	.40	1,343
-1948	July	1,009	.73	737
	Aug.	587	1.33	781
	Sept.	242	1.65	399
	Oct.	336	1.82	612
	Nov.	434	1.61	699
	Dec.	365	1.25	456
	Total	13,009	.75	9,799
	Jan.	363	1.51	548
	Feb.	374	1.36	509
	Mar.	796	1.20	955
	Apr.	1,337	.92	1,230
	May	2,959	.48	1,420
	June	4,303	.48	2,065
-1949	July	2,128	.58	1,234
	Aug.	632	1.12	708
	Sept.	340	1.65	561
	Oct.	521	1.58	823
	Nov.	488	1.36	664
	Dec.	381	1.41	537
	Total	14,622	.77	11,254
	Jan.	358	1.56	558
	Feb.	414	1.35	559
	Mar.	670	1.21	811
	Apr.	1,192	.88	1,049
	May	1,941	.59	1,145
	June	2,925	.47	1,375
-1950	July	1,401	.76	1,065
	Aug.	444	1.13	502
	Sept.	343	1.56	535
	Oct.	359	1.67	600
	Nov.	355	1.75	621
	Dec.	434	1.48	642
	Total	10,836	.87	9,462
	Jan.	326	1.59	518
	Feb.	366	1.45	531
	Mar.	429	1.35	579
	Apr.	535	1.17	626
	May	1,552	.67	1,040
	June	2,800	.49	1,372
-1951	July	1,397	.57	796
	Aug.	833	1.18	983
	Sept.	452	1.46	660
	Oct.	425	1.67	710
	Nov.	466	1.61	750
	Dec.	353	1.61	568
	Total	9,934	.92	9,133
	Jan.	593	1.28	759
	Feb.	396	1.42	562
	Mar.	435	1.46	635
	Apr.	2,209	.84	1,855
	May	5,062	.52	2,632
	June	5,203	.46	2,393
-1952	July	1,590	.65	1,033
	Aug.	833	1.18	983
	Sept.	596	1.43	852
	Oct.	393	1.52	597
	Nov.	396	1.64	649
	Dec.	400	1.58	632
	Total	13,106	.75	13,582

Year	Month	Flow 1000 (A.F.)	Concentration (T./A.F.)	T.D.S. 1000 (Tons)
	Jan.	408	1.46	596
	Feb.	378	1.42	537
	Mar.	478	1.35	645
	Apr.	533	1.21	645
	May	989	.87	860
	June	2,932	.47	1,378
-1953	July	980	.76	745
	Aug.	703	1.30	914
	Sept.	290	1.73	502
	Oct.	325	1.88	611
	Nov.	428	1.63	698
	Dec.	360	1.56	562
	Total	8,804	.99	8,693
	Jan.	333	1.58	526
	Feb.	353	1.40	494
	Mar.	424	1.34	568
	Apr.	566	1.11	628
	May	1,211	.68	823
	June	798	.68	543
-1954	July	669	.95	636
	Aug.	349	1.32	461
	Sept.	415	1.67	693
	Oct.	526	1.52	800
	Nov.	360	1.47	529
	Dec.	296	1.60	474
	Total	6,300	1.14	7,175
	Jan.	261	1.70	444
	Feb.	269	1.50	404
	Mar.	586	1.35	791
	Apr.	621	1.15	714
	May	1,515	.59	894
	June	1,596	.55	878
-1955	July	618	.77	476
	Aug.	668	1.39	929
	Sept.	265	1.63	432
	Oct.	236	1.84	434
	Nov.	298	1/ 1.88	560
	Dec.	354	1/ 1.52	538
	Total	7,287	1.03	7,494
	Jan.	398	1/ 1.42	565
	Feb.	310	1.30	403
	Mar.	511	1.21	618
	Apr.	878	.82	720
	May	2,125	.49	1,041
	June	2,584	.45	1,163
-1956	July	598	.82	490
	Aug.	383	1.31	502
	Sept.	185	1.58	292
	Oct.	202	1.86	376
	Nov.	325	1.69	549
	Dec.	274	1.66	455
	Total	8,773	.82	7,174
	Jan.	343	1.45	497
	Feb.	370	1.37	507
	Mar.	541	1.26	682
	Apr.	812	.93	755
	May	2,501	.57	1,426
	June	5,541	.40	2,216
-1957	July	4,033	.40	1,613
	Aug.	1,672	.88	1,471
	Sept.	884	1.13	999
	Oct.	784	1.46	1,144
	Nov.	892	1.42	1,266
	Dec.	537	1.28	687
	Total	18,910	.70	13,263
	Jan.	415	1.31	544
	Feb.	536	1.24	[illegible]
	Mar.	749	1.13	846
	Apr.	1,580	.77	1,220
	May	3,900	.45	1,755
	June	3,763	.41	1,542
-1958	July	683	.91	622
	Aug.	337	1/ 1.31	440
	Sept.	379	1/ 1.32	500
	Oct.	346	1/ 1.53	530
	Nov.	385	1/ 1.53	590
	Dec.	338	1/ 1.55	600
	Total	[illegible]	.73	[illegible]

To obtain mg/l multiply T/AF by 735.

1/ Correlated.

Table 16
Colorado River Basin
Historical Flow and Quality of Water Data
Colorado River near Grand Canyon, Arizona

Year	Month	Flow 1000 (A.F.)	Concen-tration (T./A.F.)	T.D.S. 1000 (Tons)
	Jan.	334	1/1.56	520
	Feb.	326	1/1.53	500
	Mar.	365	1/1.53	560
-1959	Apr.	423	1.27	537
	May	1,011	.78	789
	June	1,804	.53	956
	July	795	.69	549
	Aug.	488	1.50	731
	Sept.	271	1.82	493
	Oct.	528	1.47	777
	Nov.	569	1.25	712
	Dec.	394	1.33	524
	Total	7,308	1.05	7,648
	Jan.	348	1.41	490
	Feb.	353	1.40	495
	Mar.	820	1.15	942
-1960	Apr.	1,650	.63	1,036
	May	1,580	.55	870
	June	2,212	.46	1,011
	July	678	.73	497
	Aug.	233	1.42	331
	Sept.	218	1.92	418
	Oct.	382	1.81	692
	Nov.	380	1.59	603
	Dec.	300	1.49	448
	Total	9,154	.86	7,833
	Jan.	291	1.58	460
	Feb.	353	1.39	490
	Mar.	379	1.40	530
-1961	Apr.	587	1.04	608
	May	1,147	.66	760
	June	1,692	.47	788
	July	417	.98	409
	Aug.	374	1.76	658
	Sept.	748	1.82	1,360
	Oct.	772	1.23	949
	Nov.	570	1.23	701
	Dec.	409	1.32	539
	Total	7,739	1.07	8,252
	Jan.	369	1.35	498
	Feb.	832	1.02	847
	Mar.	610	1.19	726
-1962	Apr.	2,467	.70	1,730
	May	3,716	.45	1,654
	June	2,850	.46	1,318
	July	1,821	.57	1,031
	Aug.	512	1.03	526
	Sept.	318	1.58	502
	Oct.	557	1.57	877
	Nov.	443	1.34	592
	Dec.	344	1.50	516
	Total	14,839	.73	10,817
	Jan.	182	1.84	334
	Feb.	374	1.33	496
	Mar.	203	1.37	279
-1963	Apr.	72	1.56	112
	May	79	1.49	118
	June	148	1.09	162
	July	108	1.14	123
	Aug.	112	1.29	145
	Sept.	122	1.43	175
	Oct.	77	1.39	107
	Nov.	76	1.39	106
	Dec.	77	1.74	134
	Total	1,630	1.41	2,291
	Jan.	79	1.75	138
	Feb.	245	1.52	373
	Mar.	382	1.47	562
-1964	Apr.	796	1.33	1,058
	May	356	1.36	485
	June	77	1.65	127
	July	84	1.75	147
	Aug.	287	1.31	376
	Sept.	191	1.05	200
	Oct.	298	.77	230
	Nov.	371	.87	323
	Dec.	416	1.04	431
	Total	3,582	1.24	4,450

Year	Month	Flow 1000 (A.F.)	Concen-tration (T./A.F.)	T.D.S. 1000 (Tons)
	Jan.	608	1.06	644
	Feb.	539	1.09	588
	Mar.	568	1.09	619
	Apr.	1,251	1.04	1,301
	May	2,282	1.03	2,350
	June	2,282	.89	2,038
-1965	July	724	.59	427
	Aug.	879	.86	755
	Sept.	767	.51	391
	Oct.	675	.51	344
	Nov.	612	.53	322
	Dec.	586	.69	406
	Total	11,773	.86	10,185
	Jan.	529	0.79	418
	Feb.	524	.87	45[illegible]
	Mar.	718	.81	582
	Apr.	865	.81	700
	May	1,011	.79	799
	June	789	.77	609
-1966	July	698	.75	523
	Aug.	694	.68	471
	Sept.	623	.75	468
	Oct.	567	.74	419
	Nov.	589	.71	418
	Dec.	620	.76	471
	Total	8,227	.77	6,333
	Jan.	648	.84	544
	Feb.	564	.86	485
	Mar.	704	.97	683
	Apr.	801	1.09	873
	May	861	1.00	861
	June	711	1.02	725
-1967	July	693	.92	638
	Aug.	786	.82	644
	Sept.	713	.90	642
	Oct.	459	.86	395
	Nov.	495	.83	411
	Dec.	597	.90	537
	Total	8,032	.93	7,438
	Jan.	658	1.01	664
	Feb.	534	1.04	555
	Mar.	900	1.03	927
	Apr.	1,078	1.02	1,100
	May	976	1.11	1,083
	June	925	1.03	953
-1968	July	865	.93	804
	Aug.	775	.81	628
	Sept.	675	.80	540
	Oct.	647	.79	511
	Nov.	675	.80	540
	Dec.	665	.77	512
	Total	9,373	.94	8,817
	Jan.	628	.99	621
	Feb.	509	1.10	560
	Mar.	727	1.05	763
	Apr.	927	1.05	973
	May	799	1.03	822
-1969	June	870	.98	853
	July	994	.95	944
	Aug.	1,002	.83	832
	Sept.	842	.82	691
	Oct.	662	.80	527
	Nov.	751	.80	601
	Dec.	832	.81	674
	Total	9,543	.93	8,861
	Jan.	768	.88	676
	Feb.	494	.96	474
	Mar.	510	1.00	510
	Apr.	969	.94	911
	May	946	.96	908
-1970	June	821	.90	739
	July	815	.88	717
	Aug.	798	.87	691
	Sept.	756	.85	641
	Oct.	542	.84	455
	Nov.	483	.82	396
	Dec.	700	.79	553
	Total	8,602	.89	7,671

Year	Month	Flow 1000 (A.F.)	Concen-tration (T./A.F.)	T.D.S. 1000 (Tons)
	Jan.	544	.77	418
	Feb.	430	.85	364
	Mar.	645	1.08	693
	Apr.	1,000	1.07	1,075
	May	933	.90	810
	June	896	.80	721
1971	July	933	.81	753
	Aug.	932	.87	809
	Sept.	801	.81	652
	Oct.	675	.85	573
	Nov.	786	.85	665
	Dec.	994	.77	762
	Total	9,569	.87	8,295
	Jan.	840	.76	640
	Feb.	471	.83	393
	Mar.	364	.94	343
	Apr.	793	.92	731
	May	912	.84	765
	June	890	.81	724
1972	July	872	.80	698
	Aug.	996	.80	798
	Sept.	945	.81	765
	Oct.	917	1.00	898
	Nov.	730	.82	582
	Dec.	1,070	.78	839
	Total	9,800	.84	8,176
	Jan.	1,231	.73	903
	Feb.	839	.81	683
	Mar.	1,204	.86	1,031
	Apr.	1,916	.82	1,566
	May	846	.81	689
	June	771	.85	655
1973	July	671	.85	567
	Aug.	586	.85	499
	Sept.	449	.87	390
	Oct.	516	.86	443
	Nov.	445	.85	378
	Dec.	354	.97	343
	Total	9,828	.83	8,147
	Jan.	877	.70	611
	Feb.	326	.83	271
	Mar.	434	.86	372
	Apr.	507	.86	438
	May	816	.87	714
	June	932	.83	775
1974	July	1,235	.78	961
	Aug.	1,229	.74	914
	Sept.	828	.75	623
	Oct.	609	.78	477
	Nov.	740	.78	579
	Dec.	582	.76	442
	Total	9,115	.79	7,177
	Jan.	803	.74	598
	Feb.	565	.79	445
	Mar.	548	.80	437
	Apr.	504	.92	464
	May	914	.88	805
	June	995	.83	830
1975	July	1,246	.89	1,108
	Aug.	1,029	.80	821
	Sept.	992	.78	772
	Oct.	649	.77	500
	Nov.	441	.86	381
	Dec.	524	.81	427
	Total	9,211	.82	7,588
	Jan.	718	.70	506
	Feb.	767	.75	573
	Mar.	712	.82	584
	Apr.	694	.85	590
	May	1,079	.87	944
	June	760	.85	643
1976	July	807	.80	648
	Aug.	722	.82	595
	Sept.	862	.80	692
	Oct.	819	.68	561
	Nov.	903	.68	614
	Dec.	829	.67	557
	Total	9,672	.78	7,506

To obtain mg/l multiply T/AF by 735.

Table 16

Colorado River Basin

Historical Flow and Quality of Water Data

Colorado River near Grand Canyon, Arizona

(Annual Summary)

Calendar Year	Flow 1,000 (A.F.)	T./A.F.	T.D.S. 1000 Ton	Flow 1,000,000 (m^3)	mg/l	T.D.S. 1,000 Tonne
1941	18,796	.77	14,503	23,185	567	13,157
1942	14,925	.68	10,186	18,410	502	9,241
1943	11,624	.86	10,033	14,338	635	9,102
1944	13,330	.75	9,948	16,443	549	9,025
1945	12,115	.83	10,097	14,944	613	9,160
1946	9,119	.96	8,742	11,248	705	7,931
1947	14,347	.79	11,295	17,697	579	10,247
1948	13,009	.75	9,799	16,047	554	8,890
1949	14,622	.77	11,254	18,036	566	10,210
1950	10,836	.87	9,462	13,366	642	8,584
1951	9,934	.92	9,133	12,254	676	8,285
1952	18,106	.75	13,582	22,334	552	12,322
1953	8,804	.99	8,693	10,860	726	7,886
1954	6,300	1.14	7,175	7,771	838	6,509
1955	7,287	1.03	7,494	8,989	756	6,799
1956	8,773	.82	7,174	10,821	601	6,508
1957	18,910	.70	13,263	23,325	516	12,032
1958	13,461	.73	9,854	16,604	538	8,940
1959	7,308	1.05	7,648	9,014	770	6,938
1960	9,154	.86	7,833	11,291	629	7,106
1961	7,739	1.07	8,252	9,546	784	7,486
1962	14,839	.73	10,817	18,304	536	9,813
1963	1,630	1.41	2,291	2,011	1,033	2,078
1964	3,582	1.24	4,450	4,418	914	4,037
1965	11,773	.86	10,185	14,522	636	9,239
1966	8,227	.77	6,333	10,148	566	5,745
1967	8,032	.93	7,438	9,907	681	6,748
1968	9,373	.94	8,817	11,562	692	7,999
1969	9,543	.93	8,861	11,771	683	8,039
1970	8,602	.89	7,671	10,611	656	6,959

Table 16
Colorado River Basin
Historical Flow and Quality of Water Data
Colorado River near Grand Canyon, Arizona

(Annual Summary)

Calendar Year	Flow 1,000 (A.F.)	T./A.F.	T.D.S. 1000 Ton	Flow 1,000,000 (m^3)	mg/l	T.D.S. 1,000 Tonne
1971	9,569	.87	8,295	11,803	638	7,525
1972	9,800	.84	8,176	12,088	614	7,417
1973	9,828	.83	8,147	12,123	610	7,391
1974	9,115	.79	7,177	11,243	579	6,511
1975	9,211	.82	7,588	11,362	606	6,884
1976	9,672	.78	7,506	11,930	571	6,809
Total	381,295		319,172	470,326		289,552
Average	10,592	.84	8,866	13,065	615	8,043

Table 17
Colorado River Basin
Historical Flow and Quality of Water Data
Virgin River at Littlefield, Arizona

Year	Month	Flow 1000 (A.F.)	Concentration (T./A.F.)	T.D.S. 1000 (Tons)
	Jan.	15	2.39	35
	Feb.	31	1.97	61
	Mar.	62	.82	51
	Apr.	62	.84	52
	May	131	.46	60
	June	19	1.75	34
-1941	July	22	2.45	54
	Aug.	20	3.02	62
	Sept.	6	3.29	18
	Oct.	23	3.22	74
	Nov.	19	2.26	43
	Dec.	17	2.28	39
	Total	427	1.37	583
	Jan.	20	2.25	44
	Feb.	16	2.28	35
	Mar.	20	1.88	38
	Apr.	50	1.01	51
	May	28	1.56	44
	June	5	3.15	16
-1942	July	4	3.31	14
	Aug.	9	3.29	29
	Sept.	4	3.31	13
	Oct.	9	3.41	31
	Nov.	10	2.78	29
	Dec.	11	2.72	31
	Total	186	2.01	375
	Jan.	18	2.32	42
	Feb.	21	2.14	45
	Mar.	36	1.28	47
	Apr.	34	1.36	46
	May	11	2.27	26
	June	4	3.35	13
-1943	July	4	3.31	14
	Aug.	13	3.35	42
	Sept.	6	3.46	20
	Oct.	9	3.40	30
	Nov.	10	2.79	28
	Dec.	13	2.51	32
	Total	179	2.15	385
	Jan.	13	2.47	33
	Feb.	15	2.31	35
	Mar.	26	1.64	42
	Apr.	25	1.66	42
	May	49	1.05	51
	June	11	2.32	25
-1944	July	4	3.32	13
	Aug.	4	3.31	13
	Sept.	4	3.31	14
	Oct.	5	3.30	16
	Nov.	13	2.48	32
	Dec.	12	2.65	31
	Total	181	1.92	347
	Jan.	11	2.68	30
	Feb.	17	2.15	38
	Mar.	20	1.87	38
	Apr.	20	1.83	36
	May	25	1.55	39
	June	5	3.22	15
-1945	July	5	3.31	15
	Aug.	26	3.06	79
	Sept.	8	3.19	25
	Oct.	20	3.14	62
	Nov.	10	2.75	29
	Dec.	14	2.47	35
	Total	181	2.43	441
	Jan.	13	2.48	32
	Feb.	10	2.74	27
	Mar.	10	2.63	28
	Apr.	12	2.49	29
	May	5	3.31	15
	June	4	3.32	13
-1946	July	6	3.40	21
	Aug.	13	3.17	42
	Sept.	4	3.31	13
	Oct.	37	2.18	81
	Nov.	33	1.85	61
	Dec.	22	2.12	47
	Total	169	2.42	409
	Jan.	15	2.34	35
	Feb.	12	2.46	30
	Mar.	13	2.32	31
	Apr.	16	2.17	34
	May	17	1.98	33
	June	4	3.31	14
-1947	July	5	3.30	16
	Aug.	14	2.97	41
	Sept.	4	3.31	14
	Oct.	8	3.34	27
	Nov.	9	2.89	27
	Dec.	14	2.46	34
	Total	131	2.56	336
	Jan.	11	2.78	29
	Feb.	12	2.47	30
	Mar.	13	2.42	31
	Apr.	20	1.87	37
	May	10	2.47	25
	June	4	3.32	14
-1948	July	4	3.31	14
	Aug.	5	3.31	18
	Sept.	6	3.39	20
	Oct.	6	3.34	20
	Nov.	10	2.87	27
	Dec.	10	2.85	29
	Total	111	2.65	294
	Jan.	13	2.52	32
	Feb.	14	2.42	35
	Mar.	18	2.07	36
	Apr.	30	1.43	44
	May	28	1.53	43
	June	12	2.11	25
-1949	July	4	3.19	14
	Aug.	4	3.20	13
	Sept.	7	3.27	23
	Oct.	9	3.07	26
	Nov.	11	2.68	29
	Dec.	13	2.51	34
	Total	163	2.17	354
	Jan.	15	2.20	33
	Feb.	16	2.00	32
	Mar.	14	2.26	31
	Apr.	15	2.05	31
	May	6	2.87	19
	June	4	3.28	13
-1950	July	12	3.38	40
	Aug.	6	3.43	19
	Sept.	6	3.35	20
	Oct.	5	3.40	17
	Nov.	9	3.14	28
	Dec.	10	2.91	30
	Total	118	2.65	313
	Jan.	11	2.77	30
	Feb.	8	2.84	22
	Mar.	8	2.83	23
	Apr.	7	3.17	22
	May	10	2.74	27
	June	4	3.37	12
-1951	July	6	3.34	20
	Aug.	16	3.27	55
	Sept.	6	3.20	20
	Oct.	7	3.24	22
	Nov.	9	2.94	26
	Dec.	20	2.42	49
	Total	112	2.93	328
	Jan.	21	2.34	49
	Feb.	11	2.52	28
	Mar.	27	1.74	48
	Apr.	80	.76	60
	May	71	.68	49
	June	12	1.75	21
-1952	July	4	3.27	14
	Aug.	5	3.43	18
	Sept.	6	3.34	20
	Oct.	6	3.40	20
	Nov.	10	2.84	29
	Dec.	14	2.53	34
	Total	267	1.46	390
	Jan.	14	2.36	32
	Feb.	9	2.70	24
	Mar.	7	2.98	21
	Apr.	6	3.27	20
	May	5	3.27	16
	June	4	3.34	14
-1953	July	8	3.46	28
	Aug.	13	3.04	40
	Sept.	4	3.38	13
	Oct.	7	3.31	24
	Nov.	10	3.07	29
	Dec.	11	2.83	31
	Total	98	3.00	292
	Jan.	15	2.49	37
	Feb.	12	2.36	29
	Mar.	17	1.98	33
	Apr.	23	1.64	38
	May	10	2.35	23
	June	5	3.36	18
-1954	July	8	3.42	26
	Aug.	10	3.44	34
	Sept.	9	3.56	32
	Oct.	9	3.48	30
	Nov.	9	3.13	29
	Dec.	13	2.71	36
	Total	140	2.61	365
	Jan.	12	2.60	31
	Feb.	12	2.51	30
	Mar.	11	2.53	27
	Apr.	6	3.14	19
	May	5	3.18	16
	June	4	3.39	13
-1955	July	10	3.61	37
	Aug.	40	3.69	149
	Sept.	5	3.26	15
	Oct.	5	3.51	19
	Nov.	10	3.05	31
	Dec.	13	2.60	34
	Total	133	3.16	421
	Jan.	15	2.53	38
	Feb.	11	2.59	29
	Mar.	8	2.87	22
	Apr.	6	3.13	18
	May	4	3.23	15
	June	4	3.34	15
-1956	July	8	3.53	27
	Aug.	4	3.35	13
	Sept.	4	3.35	12
	Oct.	4	3.39	14
	Nov.	6	3.50	21
	Dec.	8	3.29	25
	Total	82	3.05	249
	Jan.	12	2.77	33
	Feb.	14	2.32	32
	Mar.	10	2.64	26
	Apr.	6	2.99	18
	May	15	2.04	31
	June	9	2.85	25
-1957	July	4	3.31	13
	Aug.	9	3.41	31
	Sept.	4	3.27	12
	Oct.	14	3.02	44
	Nov.	21	2.45	51
	Dec.	15	2.04	31
	Total	133	2.61	347
	Jan.	10	2.49	24
	Feb.	19	1.83	35
	Mar.	41	1.43	59
	Apr.	64	1.02	65
	May	69	1.05	73
	June	7	2.29	16
-1958	July	6	3.17	19
	Aug.	5	3.22	18
	Sept.	22	3.13	70
	Oct.	5	3.16	24
	Nov.	11	2.62	28
	Dec.	10	2.67	26
	Total	272	1.68	457

To obtain mg/l multiply T/AF by 735.

Table 17

Colorado River Basin

Historical Flow and Quality of Water Data

Virgin River at Littlefield, Arizona

Year	Month	Flow 1000 (A.F.)	Concentration (T./A.F.)	T.D.S. 1000 (Tons)
-1959	Jan.	10	2.5[illegible]	27
	Feb.	13	2.30	31
	Mar.	9	2.67	24
	Apr.	4	3.05	13
	May	4	3.07	13
	June	4	3.24	12
	July	4	3.32	13
	Aug.	12	3.35	40
	Sept.	4	3.20	13
	Oct.	5	3.30	15
	Nov.	13	2.90	36
	Dec.	9	2.69	23
	Total	91	2.87	260
-1960	Jan.	11	2.48	28
	Feb.	10	2.38	24
	Mar.	10	2.45	24
	Apr.	6	2.91	17
	May	5	3.03	14
	June	3	3.16	10
	July	4	3.18	12
	Aug.	3	3.20	11
	Sept.	6	3.51	20
	Oct.	6	3.05	19
	Nov.	12	2.80	35
	Dec.	8	2.71	22
	Total	84	2.79	236
-1961	Jan.	8	2.76	21
	Feb.	7	2.80	20
	Mar.	8	2.84	23
	Apr.	4	3.11	14
	May	4	3.14	12
	June	4	3.14	12
	July	8	3.22	27
	Aug.	17	3.58	60
	Sept.	22	3.36	73
	Oct.	5	3.41	19
	Nov.	8	3.07	23
	Dec.	13	2.69	34
	Total	108	3.14	338
-1962	Jan.	10	2.73	28
	Feb.	30	1.65	50
	Mar.	17	2.09	35
	Apr.	33	1.21	40
	May	9	2.24	19
	June	4	3.32	12
	July	4	3.29	13
	Aug.	3	3.46	11
	Sept.	7	3.28	24
	Oct.	7	3.32	21
	Nov.	6	3.18	20
	Dec.	7	2.75	20
	Total	137	2.14	293
-1963	Jan.	9	2.54	23
	Feb.	9	2.56	23
	Mar.	6	3.14	19
	Apr.	4	3.43	15
	May	4	3.41	13
	June	3	3.44	11
	July	3	3.48	12
	Aug.	11	3.33	36
	Sept.	14	3.54	48
	Oct.	5	3.32	18
	Nov.	10	3.00	28
	Dec.	7	2.96	20
	Total	85	3.14	266
-1964	Jan.	7	2.96	20
	Feb.	7	2.88	21
	Mar.	7	2.99	20
	Apr.	13	2.22	28
	May	11	2.22	24
	June	3	3.50	10
	July	4	3.63	14
	Aug.	14	3.81	53
	Sept.	3	3.63	11
	Oct.	3	3.58	12
	Nov.	6	3.32	22
	Dec.	9	2.98	26
	Total	87	3.01	261
-1965	Jan.	9	2.78	25
	Feb.	8	2.75	22
	Mar.	8	2.62	21
	Apr.	30	2.00	60
	May	23	1.52	35
	June	9	2.11	19
	July	3	3.67	11
	Aug.	5	3.40	17
	Sept.	6	3.00	18
	Oct.	6	3.00	18
	Nov.	21	1.90	40
	Dec.	26	1.58	41
	Total	154	2.12	327
-1966	Jan.	13	2.31	30
	Feb.	11	2.45	27
	Mar.	14	1.50	29
	Apr.	17	1.70	29
	May	6	3.00	18
	June	3	4.00	12
	July	3	4.00	12
	Aug.	3	3.67	11
	Sept.	4	3.50	14
	Oct.	6	3.33	20
	Nov.	9	2.78	25
	Dec.	73	1.99	145
	Total	162	2.30	372
-1967	Jan.	13	2.66	34
	Feb.	9	2.67	25
	Mar.	10	2.76	29
	Apr.	11	2.63	30
	May	20	1.88	37
	June	7	2.80	19
	July	4	3.57	14
	Aug.	7	3.32	25
	Sept.	14	3.41	46
	Oct.	7	3.13	21
	Nov.	9	2.71	25
	Dec.	13	2.49	32
	Total	124	2.72	337
-1968	Jan.	13	2.60	33
	Feb.	15	2.19	32
	Mar.	12	2.16	27
	Apr.	15	2.03	30
	May	17	1.80	30
	June	5	2.81	13
	July	6	3.52	20
	Aug.	14	3.09	45
	Sept.	3	3.60	12
	Oct.	6	3.41	20
	Nov.	7	3.05	22
	Dec.	11	2.79	30
	Total	124	2.53	314
-1969	Jan.	48	1.52	73
	Feb.	34	1.82	62
	Mar.	39	1.49	58
	Apr.	82	.87	71
	May	83	.71	59
	June	14	1.86	26
	July	6	3.17	19
	Aug.	4	3.75	15
	Sept.	9	3.56	32
	Oct.	8	3.13	25
	Nov.	12	2.75	33
	Dec.	12	2.42	29
	Total	351	1.43	502
-1970	Jan.	13	2.08	27
	Feb.	9	2.44	22
	Mar.	12	2.83	34
	Apr.	4	3.50	14
	May	5	3.20	16
	June	4	3.25	13
	July	6	3.33	20
	Aug.	8	3.12	25
	Sept.	5	3.60	18
	Oct.	5	3.40	17
	Nov.	10	3.20	32
	Dec.	11	2.45	27
	Total	92	2.88	265
1971	Jan.	10	2.45	26
	Feb.	9	2.48	23
	Mar.	9	2.74	24
	Apr.	5	3.17	16
	May	9	2.49	22
	June	4	3.29	12
	July	4	3.32	13
	Aug.	19	3.08	58
	Sept.	5	3.35	17
	Oct.	9	2.94	28
	Nov.	10	2.75	27
	Dec.	21	1.96	41
	Total	114	2.69	307
1972	Jan.	11	2.66	28
	Feb.	9	2.70	24
	Mar.	6	3.08	17
	Apr.	4	3.32	13
	May	4	3.41	12
	June	15	3.21	48
	July	4	3.52	14
	Aug.	11	3.22	36
	Sept.	24	3.45	82
	Oct.	17	2.73	48
	Nov.	12	2.35	29
	Dec.	12	2.62	30
	Total	129	2.96	381
1973	Jan.	11	2.49	28
	Feb.	14	2.36	34
	Mar.	34	1.82	61
	Apr.	67	1.24	83
	May	117	.82	96
	June	23	1.24	29
	July	5	2.96	14
	Aug.	5	3.29	16
	Sept.	3	3.30	11
	Oct.	5	3.32	17
	Nov.	11	2.68	29
	Dec.	11	2.44	27
	Total	306	1.45	445
1974	Jan.	14	2.33	33
	Feb.	9	2.98	27
	Mar.	10	2.51	25
	Apr.	6	2.94	16
	May	4	3.17	13
	June	4	3.22	12
	July	5	3.30	15
	Aug.	5	3.45	17
	Sept.	7	3.31	25
	Oct.	9	3.24	29
	Nov.	11	3.15	36
	Dec.	9	3.00	27
	Total	93	2.96	275
1975	Jan.	9	2.70	23
	Feb.	9	2.62	23
	Mar.	13	2.40	31
	Apr.	7	2.72	20
	May	15	2.17	32
	June	5	3.01	16
	July	9	2.81	24
	Aug.	11	3.26	37
	Sept.	4	3.48	14
	Oct.	6	3.44	20
	Nov.	7	3.15	21
	Dec.	8	2.55	21
	Total	103	2.76	282
1976	Jan.	10	2.61	25
	Feb.	17	2.30	40
	Mar.	7	2.61	18
	Apr.	8	2.47	19
	May	9	2.34	21
	June	4	3.62	14
	July	5	3.64	18
	Aug.	5	3.59	17
	Sept.	7	3.36	22
	Oct.	13	3.03	39
	Nov.	7	3.12	21
	Dec.	7	3.00	21
	Total	99	2.78	275

To obtain mg/l multiply T/AF by 735.

Table 17
Colorado River Basin
Historical Flow and Quality of Water Data
Virgin River at Littlefield, Arizona

(Annual Summary)

Calendar Year	Flow 1,000 (A.F.)	T./A.F.	T.D.S. 1000 Ton	Flow 1,000,000 (m^3)	mg/l	T.D.S. 1,000 Tonne
1941	427	1.37	583	527	1,004	529
1942	186	2.01	375	229	1,485	340
1943	179	2.15	385	221	1,579	349
1944	181	1.92	347	223	1,413	315
1945	181	2.43	441	223	1,794	400
1946	169	2.42	409	208	1,784	371
1947	131	2.56	336	162	1,883	305
1948	111	2.65	294	137	1,949	267
1949	163	2.17	354	201	1,597	321
1950	118	2.65	313	146	1,945	284
1951	112	2.93	328	138	2,159	298
1952	267	1.46	390	329	1,076	354
1953	98	3.00	292	120	2,208	265
1954	140	2.61	365	173	1,913	331
1955	133	3.16	421	164	2,329	382
1956	82	3.05	249	101	2,238	226
1957	133	2.61	347	164	1,921	315
1958	272	1.68	457	336	1,235	415
1959	91	2.87	260	112	2,107	236
1960	84	2.79	236	104	2,058	214
1961	108	3.14	338	133	2,308	307
1962	137	2.14	293	169	1,574	266
1963	85	3.14	266	105	2,295	241
1964	87	3.01	261	107	2,215	237
1965	154	2.12	327	190	1,563	297
1966	162	2.30	372	200	1,685	337
1967	124	2.72	337	153	2,000	306
1968	124	2.53	314	153	1,856	284
1969	351	1.43	502	433	1,051	455
1970	92	2.88	265	113	2,124	240

Table 17
Colorado River Basin
Historical Flow and Quality of Water Data
Virgin River at Littlefield, Arizona

(Annual Summary)

Calendar Year	Flow 1,000 (A.F.)	T./A.F.	T.D.S. 1000 Ton	Flow 1,000,000 (m^3)	mg/l	T.D.S. 1,000 Tonne
1971	114	2.69	307	141	1,979	279
1972	129	2.96	381	159	2,176	346
1973	306	1.45	445	377	1,072	404
1974	93	2.96	275	115	2,165	249
1975	103	2.76	282	127	2,016	256
1976	99	2.78	275	122	1,885	249
Total	5,526		12,422	6,815		11,270
Average	153	2.25	345	189	1,658	313

Table 18

Colorado River Basin

Historical Flow and Quality of Water Data

Colorado River below Hoover Dam, Arizona-Nevada

Year	Month	Flow 1000 (A.F.)	Concen-tration (T./A.F.)	T.D.S. 1000 (Tons)
	Jan.	589	1.08	636
	Feb.	500	1.11	555
	Mar.	552	1.10	607
	Apr.	518	1.08	560
	May	1,435	1.08	1,550
	June	1,810	1.07	1,935
-1941	July	951	1.06	1,007
	Aug.	1,429	.97	1,386
	Sept.	1,576	.94	1,481
	Oct.	1,641	.94	1,543
	Nov.	1,817	.93	1,690
	Dec.	2,071	.94	1,947
	Total	14,889	1.00	14,897
	Jan.	2,011	1.00	2,011
	Feb.	1,550	.99	1,535
	Mar.	1,425	1.00	1,425
	Apr.	1,301	1.00	1,301
	May	1,343	1.00	1,343
	June	1,561	1.01	1,577
-1942	July	1,285	.99	1,272
	Aug.	846	.99	838
	Sept.	1,025	.98	1,005
	Oct.	1,163	.95	1,105
	Nov.	1,095	.90	986
	Dec.	1,157	.85	983
	Total	15,762	.98	15,381
	Jan.	1,109	.87	965
	Feb.	823	.89	732
	Mar.	971	.94	913
	Apr.	915	.95	869
	May	1,029	.94	967
	June	1,040	.93	967
-1943	July	1,109	.91	1,009
	Aug.	1,042	.92	959
	Sept.	1,042	.91	948
	Oct.	1,179	.90	1,061
	Nov.	1,179	.86	1,014
	Dec.	1,277	.86	1,098
	Total	12,715	.90	11,502
	Jan.	1,303	.88	1,147
	Feb.	1,269	.97	1,231
	Mar.	1,307	.96	1,254
	Apr.	1,170	.97	1,135
	May	1,216	.98	1,192
	June	1,097	.95	1,042
-1944	July	1,111	.93	1,033
	Aug.	1,211	.92	1,113
	Sept.	1,132	.89	1,007
	Oct.	1,226	1/.94	1,152
	Nov.	1,186	1/.99	1,174
	Dec.	1,199	.94	1,127
	Total	14,427	.94	13,607
	Jan.	1,239	.93	1,152
	Feb.	1,100	1/.96	1,056
	Mar.	1,250	2/.96	1,200
	Apr.	1,042	1/.95	990
	May	1,068	1/.90	961
	June	1,014	2/.91	923
-1945	July	861	.92	792
	Aug.	885	1/.93	823
	Sept.	869	1/.90	782
	Oct.	1,080	1/.88	950
	Nov.	1,042	1/.90	938
	Dec.	1,062	1/.89	945
	Total	12,512	.92	11,512
	Jan.	1,116	.87	971
	Feb.	1,047	1/.95	994
	Mar.	1,004	.88	884
	Apr.	*872	.89	*776
	May	903	1/.96	867
	June	817	1/.92	752
-1946	July	838	.90	754
	Aug.	751	1/.91	683
	Sept.	759	2/.91	691
	Oct.	857	1/.92	788
	Nov.	762	2/.91	693
	Dec.	859	1/.90	773
	Total	*10,585	.91	*9,626

Year	Month	Flow 1000 (A.F.)	Concen-tration (T./A.F.)	T.D.S. 1000 (Tons)
	Jan.	984	0.90	886
	Feb.	886	.91	806
	Mar.	956	.92	879
	Apr.	859	1/.99	850
	May	951	1/1.03	979
	June	919	1/.95	873
-1947	July	925	.96	888
	Aug.	865	1/.92	796
	Sept.	843	2/.92	776
	Oct.	828	1/.92	762
	Nov.	880	2/.92	810
	Dec.	1,063	1/.92	978
	Total	10,959	.94	10,283
	Jan.	1,169	2/.93	1,087
	Feb.	1,138	1/.93	1,058
	Mar.	1,150	1/.93	1,070
	Apr.	1,202	1/.97	1,166
	May	1,142	1/.93	1,062
	June	1,076	1/.88	947
-1948	July	1,156	1/.86	994
	Aug.	968	2/.86	833
	Sept.	981	1/.85	834
	Oct.	917	1/.80	734
	Nov.	1,028	.38	905
	Dec.	1,124	1/.91	1,023
	Total	13,051	.90	11,713
	Jan.	1,212	.83	1,006
	Feb.	1,214	1/.84	1,020
	Mar.	1,291	1/.85	1,097
	Apr.	1,178	1/.86	1,013
	May	1,026	1/.83	852
	June	986	.87	858
-1949	July	1,020	.84	857
	Aug.	1,062	.80	850
	Sept.	1,141	.78	890
	Oct.	1,176	.75	882
	Nov.	1,022	1/.83	848
	Dec.	1,238	.87	1,077
	Total	13,566	.83	11,250
	Jan.	1,277	.83	1,060
	Feb.	1,132	.81	917
	Mar.	1,246	.35	1,059
	Apr.	1,089	.85	926
	May	1,120	1/.84	941
	June	960	1/.83	797
-1950	July	982	.79	776
	Aug.	872	1/.82	715
	Sept.	824	1/.79	651
	Oct.	848	.89	755
	Nov.	815	.88	717
	Dec.	851	.86	732
	Total	12,016	.84	10,046
	Jan.	928	.87	807
	Feb.	756	.87	658
	Mar.	860	.91	783
	Apr.	796	.93	740
	May	898	.92	826
	June	691	.91	629
-1951	July	783	.92	720
	Aug.	907	.93	844
	Sept.	848	.92	780
	Oct.	756	.93	703
	Nov.	818	.93	761
	Dec.	829	.91	754
	Total	9,870	.91	9,005
	Jan.	1,070	.90	963
	Feb.	1,212	.93	1,127
	Mar.	1,371	.94	1,289
	Apr.	1,385	.94	1,302
	May	1,532	.94	1,440
	June	1,432	.91	1,303
-1952	July	1,304	.83	1,082
	Aug.	1,307	.79	1,033
	Sept.	1,359	.73	992
	Oct.	1,291	.69	891
	Nov.	1,215	.66	802
	Dec.	1,338	.88	1,177
	Total	15.316	.85	13,401

Year	Month	Flow 1000 (A.F.)	Concen-tration (T./A.F.)	T.D.S. 1000 (Tons)
	Jan.	1,227	0.93	1,141
	Feb.	1,043	.91	949
	Mar.	1,046	.93	973
	Apr.	971	.94	913
	May	998	.91	908
	June	819	.89	729
-1953	July	897	.87	780
	Aug.	968	.87	842
	Sept.	968	.86	832
	Oct.	802	.86	690
	Nov.	749	.86	644
	Dec.	814	.85	692
	Total	11,302	.89	10,093
	Jan.	836	.88	736
	Feb.	721	.94	678
	Mar.	911	.95	865
	Apr.	975	.94	916
	May	1,101	.93	1,024
	June	929	.94	873
-1954	July	1,027	.94	965
	Aug.	888	.97	861
	Sept.	933	.97	905
	Oct.	776	.94	729
	Nov.	676	.95	642
	Dec.	741	.97	719
	Total	10,514	.94	9,913
	Jan.	725	.99	718
	Feb.	705	1.04	733
	Mar.	906	1.08	978
	Apr.	882	1.11	979
	May	928	1.12	1,039
	June	680	1.12	762
-1955	July	847	1.11	940
	Aug.	789	1.12	884
	Sept.	622	1.11	690
	Oct.	526	1.12	589
	Nov.	487	1.12	545
	Dec.	492	1.09	536
	Total	8,589	1.09	9,393
	Jan.	583	1.09	635
	Feb.	499	1.10	549
	Mar.	769	1.12	861
	Apr.	840	1.14	958
	May	748	1.15	860
	June	784	1.17	917
-1956	July	782	1.19	931
	Aug.	696	1.17	814
	Sept.	610	1.15	702
	Oct.	490	1.16	568
	Nov.	554	1.12	620
	Dec.	457	1.10	503
	Total	7,812	1.14	8,918
	Jan.	534	1.07	571
	Feb.	470	1.08	508
	Mar.	739	1.11	820
	Apr.	890	1.09	970
	May	769	1.07	823
	June	828	1.06	878
-1957	July	786	1.05	825
	Aug.	786	1.03	810
	Sept.	785	1.02	801
	Oct.	697	1.02	711
	Nov.	958	.99	948
	Dec.	1,081	.94	1,016
	Total	9,323	1.04	9,681
	Jan.	1,245	.90	1,120
	Feb.	846	.94	795
	Mar.	1,435	.90	1,292
	Apr.	1,473	.88	1,296
	May	1,115	.84	937
	June	819	.85	696
-1958	July	894	.85	760
	Aug.	911	.83	756
	Sept.	792	.83	657
	Oct.	728	.82	597
	Nov.	746	.82	612
	Dec.	873	.83	725
	Total	11,877	.86	10,243

To obtain mg/l multiply T/AF by 735.
*Revised
1/ Estimated or partially estimated.
2/ Average of adjacent values.

Table 18

Colorado River Basin

Historical Flow and Quality of Water Data

Colorado River below Hoover Dam, Arizona-Nevada

Year	Month	Flow 1000 (A.F.)	Concentration (T./A.F.)	T.D.S. 1000 (Tons)
1959	Jan.	795	0.85	676
	Feb.	648	.83	537
	Mar.	827	.88	728
	Apr.	916	.91	834
	May	949	.86	816
	June	760	.85	646
	July	848	.84	713
	Aug.	894	.83	742
	Sept.	773	.81	626
	Oct.	693	.82	568
	Nov.	607	.81	492
	Dec.	572	.81	463
	Total	9,282	.84	7,841
1960	Jan.	629	.86	541
	Feb.	512	.89	456
	Mar.	710	.89	632
	Apr.	909	.93	845
	May	856	.93	796
	June	1,015	.92	934
	July	984	.89	876
	Aug.	959	.93	892
	Sept.	806	.93	749
	Oct.	556	.92	512
	Nov.	489	.92	450
	Dec.	572	.92	526
	Total	8,997	.91	8,209
1961	Jan.	591	.93	549
	Feb.	577	.94	543
	Mar.	936	.95	889
	Apr.	904	.97	877
	May	943	.95	896
	June	842	.94	791
	July	822	.94	772
	Aug.	739	.96	709
	Sept.	690	.96	663
	Oct.	539	.93	502
	Nov.	517	.94	486
	Dec.	486	.95	462
	Total	8,586	.95	8,139
1962	Jan.	482	.93	448
	Feb.	497	1/.94	467
	Mar.	798	1/.94	750
	Apr.	902	1/.95	857
	May	887	1.00	887
	June	799	1/.94	751
	July	824	1/.91	750
	Aug.	857	1/.87	746
	Sept.	716	1.00	716
	Oct.	634	1/.86	545
	Nov.	613	1/.90	552
	Dec.	606	1/.93	564
	Total	8,615	1/.93	8,033
1963	Jan.	482	.99	478
	Feb.	575	1/.97	558
	Mar.	871	1/.95	828
	Apr.	865	1/.94	813
	May	911	.93	847
	June	764	1/.92	702
	July	908	1/.91	826
	Aug.	857	.90	771
	Sept.	724	.89	645
	Oct.	527	.90	475
	Nov.	464	.89	413
	Dec.	585	.90	526
	Total	8,533	1/.92	7,882
1964	Jan.	633	.93	589
	Feb.	583	.94	548
	Mar.	800	.95	760
	Apr.	859	.98	842
	May	844	.98	827
	June	719	.99	712
	July	866	.98	849
	Aug.	731	.99	724
	Sept.	623	.99	616
	Oct.	591	1.01	596
	Nov.	445	1.02	454
	Dec.	469	1.06	497
	Total	8,163	.98	8,014
1965	Jan.	489	1.08	528
	Feb.	498	1.09	543
	Mar.	786	1.15	903
	Apr.	698	1.14	796
	May	872	1.14	994
	June	786	1.08	848
	July	815	1.08	880
	Aug.	817	1.11	907
	Sept.	655	1.12	734
	Oct.	535	1.05	562
	Nov.	418	1.03	430
	Dec.	423	1.06	449
	Total	7,792	1.10	8,574
1966	Jan.	252	1.03	260
	Feb.	436	1.02	445
	Mar.	785	1.05	824
	Apr.	846	1.05	888
	May	887	1.03	914
	June	783	1.06	831
	July	889	1.01	897
	Aug.	839	.98	822
	Sept.	672	1.00	672
	Oct.	467	.96	448
	Nov.	473	.93	440
	Dec.	448	.93	416
	Total	7,777	1.01	7,857
1967	Jan.	500	.94	470
	Feb.	574	.92	528
	Mar.	847	.91	771
	Apr.	771	.90	694
	May	889	.93	827
	June	782	.94	735
	July	832	.90	749
	Aug.	755	.90	679
	Sept.	494	.93	459
	Oct.	576	.93	536
	Nov.	556	.91	506
	Dec.	356	.92	328
	Total	7,932	.92	7,282
1968	Jan.	396	.94	372
	Feb.	496	.92	456
	Mar.	850	.93	791
	Apr.	883	.93	821
	May	853	.95	810
	June	752	.93	699
	July	757	.94	712
	Aug.	693	.97	672
	Sept.	663	.97	643
	Oct.	486	.98	476
	Nov.	457	.99	452
	Dec.	553	1.00	553
	Total	7,839	.95	7,457
1969	Jan.	549	1.02	560
	Feb.	552	1.02	563
	Mar.	825	1.02	841
	Apr.	894	1.02	912
	May	834	1.00	834
	June	753	1.02	768
	July	772	1.01	780
	Aug.	693	1.02	707
	Sept.	618	1.00	618
	Oct.	523	1.00	523
	Nov.	426	1.00	426
	Dec.	453	1.01	458
	Total	7,892	1.01	7,990
1970	Jan.	603	1.04	627
	Feb.	536	1.03	552
	Mar.	753	1.03	776
	Apr.	919	1.02	937
	May	927	.97	899
	June	780	1.00	780
	July	792	.98	776
	Aug.	676	1.00	677
	Sept.	507	.97	492
	Oct.	583	1.01	589
	Nov.	450	1.07	481
	Dec.	497	1.09	542
	Total	8,023	1.01	8,128
1971	Jan.	561	1.07	598
	Feb.	663	1.00	663
	Mar.	860	1.01	872
	Apr.	913	1.04	954
	May	861	1.04	894
	June	741	1.00	741
	July	740	.98	727
	Aug.	741	.99	732
	Sept.	623	1.00	622
	Oct.	503	1.01	509
	Nov.	452	1.02	463
	Dec.	506	1.01	522
	Total	8,164	1.02	8,297
1972	Jan.	568	1.08	612
	Feb.	636	1.02	646
	Mar.	905	.98	887
	Apr.	877	.97	854
	May	866	.97	841
	June	795	.99	790
	July	769	.98	755
	Aug.	756	.96	723
	Sept.	634	.95	602
	Oct.	517	.95	490
	Nov.	397	.98	387
	Dec.	379	.99	375
	Total	8,099	.98	7,962
1973	Jan.	581	.99	577
	Feb.	554	1.01	561
	Mar.	611	.99	603
	Apr.	865	.96	828
	May	1,011	.95	963
	June	683	.95	650
	July	823	.96	788
	Aug.	857	.96	823
	Sept.	659	.95	630
	Oct.	560	.95	530
	Nov.	526	.93	491
	Dec.	571	.92	523
	Total	8,301	.96	7,967
1974	Jan.	436	.94	409
	Feb.	589	.96	563
	Mar.	864	.96	829
	Apr.	951	.95	908
	May	960	.95	909
	June	880	.93	821
	July	847	.93	792
	Aug.	948	.93	885
	Sept.	714	.90	644
	Oct.	614	.90	552
	Nov.	504	.90	455
	Dec.	425	.91	385
	Total	8,732	.93	8,152
1975	Jan.	515	.93	481
	Feb.	617	.91	560
	Mar.	749	.94	701
	Apr.	871	.96	835
	May	969	.92	888
	June	807	.91	734
	July	830	.95	787
	Aug.	805	.95	762
	Sept.	668	.93	662
	Oct.	549	.96	526
	Nov.	486	.93	454
	Dec.	501	.90	449
	Total	8,367	.93	7,839
1976	Jan.	509	.93	473
	Feb.	496	.90	446
	Mar.	910	.90	822
	Apr.	879	.91	797
	May	929	.93	865
	June	716	.91	650
	July	843	.92	775
	Aug.	894	.93	830
	Sept.	609	.92	560
	Oct.	351	.93	328
	Nov.	304	.91	277
	Dec.	487	.92	448
	Total	7,926	.92	7,271

To obtain mg/l multiply T/AF by 735.

1/Estimated or partially estimated.

Table 18

Colorado River Basin

Historical Flow and Quality of Water Data

Colorado River below Hoover Dam, Arizona - Nevada

(Annual Summary)

Calendar Year	Flow 1,000 (A.F.)	T./A.F.	T.D.S. 1000 Ton	Flow 1,000,000 (m^3)	mg/l	T.D.S. 1,000 Tonne
1941	14,889	1.00	14,897	18,366	736	13,515
1942	15,762	.98	15,381	19,442	718	13,954
1943	12,715	.90	11,502	15,684	665	10,435
1944	14,427	.94	13,607	17,796	694	12,344
1945	12,512	.92	11,512	15,434	677	10,444
1946	10,585	.91	9,626	13,057	669	8,733
1947	10,959	.94	10,283	13,518	690	9,329
1948	13,051	.90	11,713	16,098	660	10,626
1949	13,566	.83	11,250	16,734	610	10,206
1950	12,016	.84	10,046	14,822	615	9,114
1951	9,870	.91	9,005	12,175	671	8,169
1952	15,816	.85	13,401	19,509	623	12,157
1953	11,302	.89	10,093	13,941	657	9,156
1954	10,514	.94	9,913	12,969	693	8,993
1955	8,589	1.09	9,393	10,595	804	8,521
1956	7,812	1.14	8,918	9,636	840	8,090
1957	9,323	1.04	9,681	11,500	764	8,783
1958	11,877	.86	10,243	14,650	634	9,292
1959	9,282	.84	7,841	11,449	621	7,113
1960	8,997	.91	8,209	11,098	671	7,447
1961	8,586	.95	8,139	10,591	697	7,384
1962	8,615	.93	8,033	10,627	686	7,288
1963	8,533	.92	7,882	10,525	679	7,151
1964	8,163	.98	8,014	10,069	722	7,270
1965	7,792	1.10	8,574	9,611	809	7,778
1966	7,777	1.01	7,857	9,593	743	7,128
1967	7,932	.92	7,282	9,784	675	6,606
1968	7,839	.95	7,457	9,669	700	6,765
1969	7,892	1.01	7,990	9,735	745	7,249
1970	8,023	1.01	8,128	9,896	745	7,374

Table 18

Colorado River Basin

Historical Flow and Quality of Water Data

Colorado River below Hoover Dam, Arizona - Nevada

(Annual Summary)

Calendar Year	Flow 1,000 (A.F.)	T./A.F.	T.D.S. 1000 Ton	Flow 1,000,000 (m^3)	mg/l	T.D.S. 1,000 Tonne
1971	8,164	1.02	8,297	10,070	747	7,527
1972	8,099	.98	7,962	9,990	720	7,223
1973	8,301	.96	7,967	10,239	706	7,228
1974	8,732	.93	8,152	10,771	686	7,395
1975	8,367	.93	7,799	10,321	689	7,075
1976	7,926	.92	7,271	9,777	675	6,596
Total	364,605		343,318	449,741		311,458
Average	10,128	.94	9,537	12,493	692	8,652

Table 19

Colorado River Basin

Historical Flow and Quality of Water Data

Colorado River below Parker Dam, Arizona – California

Year	Month	Flow 1000 (A.F.)	Concentration (T./A.F.)	T.D.S. 1000 (Tons)
	Jan.	627	1.11	698
	Feb.	561	1.14	642
	Mar.	750	1.14	354
	Apr.	608	1.12	679
	May	1,359	1.12	1,524
	June	1,628	1.11	1,808
-1941	July	998	1.10	1,098
	Aug.	1,332	1.04	1,381
	Sept.	1,528	.98	1,495
	Oct.	1,585	.98	1,550
	Nov.	1,731	.95	1,641
	Dec.	2,042	1.04	2,116
	Total	14,749	1.05	15,486
	Jan.	1,957	1.09	1,963
	Feb.	1,482	1.00	1,480
	Mar.	1,494	.99	1,476
	Apr.	1,136	1.01	1,143
	May	1,588	1.01	1,602
	June	1,536	1.01	1,549
-1942	July	1,226	.98	1,197
	Aug.	880	1.07	939
	Sept.	797	1.00	794
	Oct.	845	.99	833
	Nov.	1,041	.99	1,028
	Dec.	1,213	.89	1,084
	Total	15,195	.99	15,088
	Jan.	1,015	.93	948
	Feb.	746	.88	657
	Mar.	886	.97	863
	Apr.	877	.95	837
	May	957	.97	933
	June	976	.98	961
-1943	July	1,086	.90	981
	Aug.	990	.91	904
	Sept.	1,006	.90	908
	Oct.	1,160	.92	1,062
	Nov.	1,149	.87	1,003
	Dec.	1,231	.87	1,076
	Total	12,079	.92	11,133
	Jan.	1,241	.90	1,121
	Feb.	1,223	.92	1,131
	Mar.	1,297	.96	1,240
	Apr.	1,164	.98	1,136
	May	1,116	.98	1,089
	June	983	.99	969
-1944	July	1,035	.95	988
	Aug.	1,148	.96	1,098
	Sept.	1,114	.89	994
	Oct.	1,178	.88	1,042
	Nov.	1,156	.88	1,023
	Dec.	1,187	.94	1,110
	Total	13,842	.93	12,941
	Jan.	1,186	.94	1,121
	Feb.	1,061	.91	969
	Mar.	1,232	.94	1,152
	Apr.	985	.94	929
	May	970	.94	915
	June	919	.99	914
-1945	July	913	.92	844
	Aug.	770	.90	694
	Sept.	824	.91	751
	Oct.	1,038	.85	884
	Nov.	1,036	.89	924
	Dec.	1,099	.90	992
	Total	12,033	.92	11,089
	Jan.	1,041	.90	939
	Feb.	1,028	.96	991
	Mar.	944	.89	843
	Apr.	830	1.04	867
	May	873	.94	825
	June	754	.92	696
-1946	July	801	.91	731
	Aug.	722	.89	642
	Sept.	730	.91	665
	Oct.	759	.91	691
	Nov.	789	.91	720
	Dec.	870	.91	794
	Total	10,141	.93	9,404
	Jan.	953	.91	870
	Feb.	899	.92	829
	Mar.	940	.94	888
	Apr.	797	.97	777
	May	905	.99	892
	June	860	.98	847
-1947	July	844	.97	822
	Aug.	892	.96	860
	Sept.	819	.98	800
	Oct.	837	.91	765
	Nov.	880	.87	768
	Dec.	1,037	.83	862
	Total	10,663	.94	9,980
	Jan.	1,160	.96	1,109
	Feb.	1,160	.92	1,062
	Mar.	1,107	.91	1,009
	Apr.	1,083	.92	999
	May	1,115	.91	1,016
	June	989	.93	923
-1948	July	1,108	.90	999
	Aug.	986	.89	880
	Sept.	941	.88	831
	Oct.	918	.86	791
	Nov.	978	.81	793
	Dec.	1,106	.92	1,019
	Total	12,651	.90	11,431
	Jan.	1,229	.89	1,099
	Feb.	1,192	.85	1,015
	Mar.	1,236	.84	1,044
	Apr.	1,116	.88	985
	May	983	1.05	866
	June	923	.89	824
-1949	July	952	.89	849
	Aug.	1,013	.84	852
	Sept.	1,099	.83	913
	Oct.	1,148	.80	918
	Nov.	1,011	.77	778
	Dec.	1,158	.74	855
	Total	13,060	.84	10,998
	Jan.	1,080	.86	931
	Feb.	1,036	.85	882
	Mar.	1,209	.84	1,017
	Apr.	998	.88	879
	May	1,066	.88	941
	June	900	.87	785
-1950	July	897	.85	765
	Aug.	833	.84	698
	Sept.	704	.84	590
	Oct.	651	.86	558
	Nov.	542	.87	473
	Dec.	557	.89	494
	Total	10,473	.86	9,013
	Jan.	550	.89	488
	Feb.	501	.89	448
	Mar.	730	.90	657
	Apr.	765	.89	682
	May	675	.90	607
	June	862	.90	779
-1951	July	945	.91	862
	Aug.	945	.89	840
	Sept.	723	.88	636
	Oct.	709	.90	638
	Nov.	560	.90	502
	Dec.	707	.91	642
	Total	8,672	.90	7,781
	Jan.	1,104	.91	1,008
	Feb.	1,134	.89	1,012
	Mar.	1,424	.89	1,273
	Apr.	1,300	.92	1,202
	May	1,443	.95	1,366
	June	1,419	.95	1,341
-1952	July	1,263	.90	1,142
	Aug.	1,296	.85	1,105
	Sept.	1,321	.81	1,074
	Oct.	1,234	.76	935
	Nov.	1,172	.71	829
	Dec.	1,303	.69	895
	Total	15,413	.86	13,182
	Jan.	1,198	.68	813
	Feb.	1,020	.83	848
	Mar.	947	.90	853
	Apr.	808	.93	753
	May	953	.92	880
	June	956	.92	882
-1953	July	1,093	.89	973
	Aug.	1,056	.86	909
	Sept.	823	.85	700
	Oct.	634	.86	544
	Nov.	527	.86	455
	Dec.	634	.87	550
	Total	10,649	.86	9,160
	Jan.	797	.86	685
	Feb.	661	.85	560
	Mar.	782	.86	673
	Apr.	864	.86	746
	May	1,015	.91	927
	June	883	.94	834
-1954	July	1,000	.93	934
	Aug.	982	.93	918
	Sept.	754	.94	706
	Oct.	636	.94	599
	Nov.	638	.94	601
	Dec.	659	.94	618
	Total	9,671	.91	8,801
	Jan.	734	.95	699
	Feb.	598	.96	574
	Mar.	733	.98	722
	Apr.	758	.99	753
	May	792	1.02	804
	June	866	1.06	914
-1955	July	963	1.10	1,060
	Aug.	849	1.09	924
	Sept.	694	1.07	740
	Oct.	499	1.08	540
	Nov.	369	1.10	407
	Dec.	286	1.09	312
	Total	8,141	1.04	8,449
	Jan.	317	1.11	352
	Feb.	365	1.12	407
	Mar.	628	1.13	708
	Apr.	684	1.12	766
	May	671	1.10	735
	June	787	1.12	880
-1956	July	865	1.13	976
	Aug.	823	1.12	920
	Sept.	634	1.15	728
	Oct.	486	1.10	536
	Nov.	321	1.12	359
	Dec.	288	1.15	330
	Total	6,869	1.12	7,697
	Jan.	243	1.15	279
	Feb.	349	1.13	395
	Mar.	589	1.12	657
	Apr.	731	1.09	796
	May	645	1.09	704
	June	783	1.08	845
-1957	July	890	1.06	941
	Aug.	817	1.04	848
	Sept.	661	1.01	670
	Oct.	503	1.02	513
	Nov.	781	1.03	802
	Dec.	1,005	1.04	1,044
	Total	7,997	1.06	8,494
	Jan.	1,285	1.00	1,280
	Feb.	565	.95	536
	Mar.	1,345	.91	1,229
	Apr.	1,333	.89	1,191
	May	1,013	.87	883
	June	854	.86	735
-1958	July	930	.86	803
	Aug.	867	.84	729
	Sept.	714	.83	590
	Oct.	610	.84	510
	Nov.	623	.84	521
	Dec.	753	.85	[illegible]
	Total	10,892	.89	[illegible]

To obtain mg/l multiply T/AF by 735.

Table 19

Colorado River Basin

Historical Flow and Quality of Water Data

Colorado River below Parker Dam, Arizona-California

Year	Month	Flow 1000 (A.F.)	Concentration (T./A.F.)	T.D.S. 1000 (Tons)
	Jan.	677	0.84	566
	Feb.	593	.83	495
	Mar.	690	.84	579
	Apr.	832	.85	707
	May	706	.88	620
	June	797	.89	709
-1959	July	962	.86	829
	Aug.	873	.81	706
	Sept.	682	.82	557
	Oct.	558	.84	471
	Nov.	405	.84	342
	Dec.	411	.83	343
	Total	8,186	.85	6,924
	Jan.	428	.82	352
	Feb.	474	.82	388
	Mar.	760	.83	630
	Apr.	810	.87	705
	May	740	.88	651
	June	879	.90	794
-1960	July	986	.89	880
	Aug.	868	.90	780
	Sept.	640	.89	568
	Oct.	490	.87	428
	Nov.	397	.90	356
	Dec.	322	.91	293
	Total	7,794	.88	6,826
	Jan.	379	.92	347
	Feb.	453	.91	414
	Mar.	742	.92	684
	Apr.	725	.92	669
	May	705	.94	664
	June	822	.94	776
-1961	July	900	.93	841
	Aug.	710	.93	661
	Sept.	606	.92	556
	Oct.	412	.91	374
	Nov.	319	.94	300
	Dec.	202	.92	186
	Total	6,975	.93	6,472
	Jan.	334	.93	310
	Feb.	374	.93	346
	Mar.	692	.94	652
	Apr.	756	1/.96	729
	May	686	1/.97	667
	June	778	1.00	775
-1962	July	882	.97	859
	Aug.	821	.99	816
	Sept.	644	.97	627
	Oct.	471	.98	460
	Nov.	434	.97	423
	Dec.	287	1.00	286
	Total	7,159	.97	6,950
	Jan.	350	1.00	349
	Feb.	467	1.00	466
	Mar.	735	.99	731
	Apr.	690	.99	685
	May	708	.97	687
	June	840	.95	802
-1963	July	933	.92	862
	Aug.	819	.91	747
	Sept.	630	.91	572
	Oct.	438	.88	385
	Nov.	334	.88	294
	Dec.	307	.89	272
	Total	7,251	.94	6,852
	Jan.	363	.91	329
	Feb.	479	.90	432
	Mar.	640	.91	582
	Apr.	652	.91	596
	May	598	.92	552
	June	742	.95	706
	July	864	.95	824
-1964	Aug.	795	.95	754
	Sept.	589	.96	564
	Oct.	409	.96	393
	Nov.	275	.96	264
	Dec.	245	1.00	246
	Total	6,651	.94	6,242
	Jan.	290	1.01	294
	Feb.	423	1.00	424
	Mar.	634	1.03	651
	Apr.	581	1.06	614
	May	604	1.07	645
	June	710	1.11	790
-1965	July	846	1.09	924
	Aug.	867	1.08	940
	Sept.	599	1.08	648
	Oct.	385	1.11	426
	Nov.	220	1.10	243
	Dec.	197	.95	187
	Total	6,356	1.07	6,786
	Jan.	177	.73	129
	Feb.	413	1.04	428
	Mar.	604	1.08	655
	Apr.	729	1.08	785
	May	699	1.10	766
	June	790	1.12	887
-1966	July	901	1.07	966
	Aug.	852	1.04	890
	Sept.	585	1.07	626
	Oct.	357	.96	343
	Nov.	256	1.00	256
	Dec.	320	.97	311
	Total	6,683	1.05	7,042
	Jan.	306	.98	299
	Feb.	431	1.01	434
	Mar.	677	.98	664
	Apr.	608	.98	594
	May	648	.98	635
	June	726	1.01	733
-1967	July	835	.95	794
	Aug.	749	.98	734
	Sept.	490	.97	474
	Oct.	435	.95	413
	Nov.	247	.93	230
	Dec.	170	.96	163
	Total	6,322	.98	6,167
	Jan.	351	.94	330
	Feb.	450	.89	400
	Mar.	680	.93	632
	Apr.	700	.93	652
	May	626	.97	608
	June	722	.95	685
-1968	July	779	.96	745
	Aug.	725	.95	686
	Sept.	585	.98	573
	Oct.	404	.98	394
	Nov.	309	.99	306
	Dec.	312	1.00	312
	Total	6,643	.95	6,323
	Jan.	254	1.01	256
	Feb.	467	1.02	476
	Mar.	740	.95	703
	Apr.	713	1.03	734
	May	640	1.08	692
-1969	June	674	1.05	708
	July	765	1.03	787
	Aug.	733	.99	726
	Sept.	488	.99	483
	Oct.	434	.97	420
	Nov.	220	1.03	227
	Dec.	310	1.02	317
	Total	6,438	1.01	6,529
	Jan.	367	1.03	378
	Feb.	442	1.04	460
	Mar.	654	1.02	667
	Apr.	750	1.04	780
	May	657	1.03	676
-1970	June	706	1.03	727
	July	792	1.00	792
	Aug.	675	1.02	688
	Sept.	530	1.01	535
	Oct.	454	1.03	468
	Nov.	304	1.04	316
	Dec.	328	1.09	358
	Total	6.659	1.03	6,845
	Jan.	339	1.07	363
	Feb.	486	1.03	503
	Mar.	743	1.04	771
	Apr.	746	1.07	796
	May	661	1.05	691
	June	743	1.01	751
1971	July	877	1.02	896
	Aug.	690	1.02	704
	Sept.	565	1.01	570
	Oct.	397	1.04	414
	Nov.	309	1.03	319
	Dec.	355	1.04	371
	Total	6,911	1.03	7,149
	Jan.	346	1.05	362
	Feb.	480	1.07	513
	Mar.	747	1.07	797
	Apr.	766	1.05	806
	May	700	1.02	714
	June	689	1.01	694
1972	July	875	1.00	872
	Aug.	716	.97	694
	Sept.	574	.98	562
	Oct.	224	.99	221
	Nov.	283	.97	274
	Dec.	389	1.00	389
	Total	6,789	1.02	6,898
	Jan.	355	1.01	358
	Feb.	348	1.00	347
	Mar.	642	.95	613
	Apr.	800	.96	770
	May	696	.99	691
	June	673	1.00	673
1973	July	829	1.01	837
	Aug.	726	1.01	731
	Sept.	644	.98	632
	Oct.	484	.98	472
	Nov.	310	.97	302
	Dec.	340	.97	332
	Total	6,847	.99	6,758
	Jan.	245	.98	238
	Feb.	481	.98	472
	Mar.	705	.97	682
	Apr.	864	.97	841
	May	756	.97	730
	June	791	.96	763
1974	July	874	.96	837
	Aug.	825	.92	759
	Sept.	625	.91	567
	Oct.	400	.93	372
	Nov.	281	.92	258
	Dec.	297	.95	282
	Total	7,144	.95	6,801
	Jan.	363	.97	351
	Feb.	447	.98	440
	Mar.	690	.98	675
	Apr.	795	.95	755
	May	770	.96	737
	June	694	.96	667
1975	July	825	.95	786
	Aug.	802	.92	737
	Sept.	650	.93	602
	Oct.	477	.96	457
	Nov.	337	.97	327
	Dec.	360	.97	349
	Total	7,210	.95	6,883
	Jan.	353	.95	337
	Feb.	364	.95	346
	Mar.	805	.96	771
	Apr.	771	.96	738
	May	694	.95	657
	June	717	.97	699
1976	July	790	.95	747
	Aug.	843	.94	796
	Sept.	400	.94	375
	Oct.	355	.92	328
	Nov.	249	.92	230
	Dec.	356	.96	342
	Total	6,697	.95	6,366

To obtain mg/l multiply T/AF by 735.

Table 19

Colorado River Basin

Historical Flow and Quality of Water Data

Colorado River below Parker Dam, Arizona - California

(Annual Summary)

Calendar Year	Flow 1,000 (A.F.)	T./A.F.	T.D.S. 1000 Ton	Flow 1,000,000 (m^3)	mg/l	T.D.S. 1,000 Tonne
1941	14,749	1.05	15,486	18,193	772	14,049
1942	15,195	.99	15,088	18,743	730	13,688
1943	12,079	.92	11,133	14,899	678	10,100
1944	13,842	.93	12,941	17,074	688	11,740
1945	12,033	.92	11,089	14,843	678	10,060
1946	10,141	.93	9,404	12,509	682	8,531
1947	10,663	.94	9,980	13,153	688	9,054
1948	12,651	.90	11,431	15,605	665	10,370
1949	13,060	.84	10,998	16,110	619	9,977
1950	10,473	.86	9,013	12,918	633	8,177
1951	8,672	.90	7,781	10,697	660	7,059
1952	15,413	.86	13,182	19,012	629	11,959
1953	10,649	.86	9,160	13,136	633	8,310
1954	9,671	.91	8,801	11,929	669	7,984
1955	8,141	1.04	8,449	10,042	763	7,665
1956	6,869	1.12	7,697	8,473	824	6,983
1957	7,997	1.06	8,494	9,864	781	7,706
1958	10,892	.89	9,646	13,435	651	8,751
1959	8,186	.85	6,924	10,097	622	6,281
1960	7,794	.88	6,826	9,614	644	6,193
1961	6,975	.93	6,472	8,604	682	5,871
1962	7,159	.97	6,950	8,831	714	6,305
1963	7,251	.94	6,852	8,944	695	6,216
1964	6,651	.94	6,242	8,204	690	5,663
1965	6,356	1.07	6,786	7,840	785	6,156
1966	6,683	1.05	7,042	8,243	775	6,389
1967	6,322	.98	6,167	7,798	717	5,595
1968	6,643	.95	6,323	8,194	700	5,736
1969	6,438	1.01	6,529	7,941	746	5,923
1970	6,659	1.03	6,845	8,214	756	6,210

Table 19
Colorado River Basin
Historical Flow and Quality of Water Data
Colorado River below Parker Dam, Arizona - California

(Annual Summary)

Calendar Year	Flow 1,000 (A.F.)	T./A.F.	T.D.S. 1000 Ton	Flow 1,000,000 (m^3)	mg/l	T.D.S. 1,000 Tonne
1971	6,911	1.03	7,149	8,525	761	6,486
1972	6,789	1.02	6,898	8,374	747	6,258
1973	6,847	.99	6,758	8,446	726	6,131
1974	7,144	.95	6,801	8,812	700	6,170
1975	7,210	.95	6,883	8,894	702	6,244
1976	6,697	.95	6,366	8,261	699	5,775
Total	327,905		310,586	404,471		281,765
Average	9,108	.95	8,627	11,235	696	7,827

Table 20

Colorado River Basin

Historical Flow and Quality of Water Data

Colorado River at Imperial Dam, Arizona - California

Year	Month	Flow 1000 (A.F.)	Concentration (T./A.F.)	T.D.S. 1000 (Tons)
	Jan.	642	1.10	706
	Feb.	535	1.15	615
	Mar.	743	.90	669
	Apr.	562	1.04	584
	May	1,150	1.11	1,277
	June	1,605	1.21	1,942
-1941	July	965	1.17	1,129
	Aug.	1,192	1.09	1,299
	Sept.	1,444	.99	1,430
	Oct.	1,505	1.02	1,535
	Nov.	1,671	1.02	1,704
	Dec.	2,010	1.04	2,090
	Total	14,024	1.07	14,980
	Jan.	1,876	1.08	2,026
	Feb.	1,590	1.09	1,733
	Mar.	1,476	1.09	1,609
	Apr.	1,080	1.11	1,199
	May	1,524	1.10	1,676
	June	1,465	1.11	1,626
-1942	July	1,199	1.11	1,331
	Aug.	844	1.09	920
	Sept.	742	1.11	824
	Oct.	761	1.08	822
	Nov.	981	1.03	1,010
	Dec.	1,176	.97	1,141
	Total	14,714	1.08	15,917
	Jan.	1,011	.94	950
	Feb.	729	.92	671
	Mar.	846	.95	804
	Apr.	802	.96	770
	May	842	.98	825
	June	876	.98	858
-1943	July	972	.95	923
	Aug.	910	.94	855
	Sept.	917	.94	862
	Oct.	1,094	.94	1,028
	Nov.	1,124	.93	1,045
	Dec.	1,222	.89	1,088
	Total	11,345	.94	10,679
	Jan.	1,209	.89	1,076
	Feb.	1,216	.94	1,143
	Mar.	1,289	.97	1,250
	Apr.	1,126	1.00	1,126
	May	1,055	1.01	1,066
	June	900	1.02	918
-1944	July	920	.99	911
	Aug.	1,041	.97	1,010
	Sept.	1,041	.94	979
	Oct.	1,123	.92	1,033
	Nov.	1,142	.89	1,016
	Dec.	1,143	.89	1,017
	Total	13,205	.95	12,545
	Jan.	1,160	.99	1,137
	Feb.	1,047	.97	1,016
	Mar.	1,193	.97	1,157
	Apr.	947	.98	928
	May	905	1.00	905
	June	860	.99	851
-1945	July	817	.96	784
	Aug.	718	.94	675
	Sept.	745	.92	685
	Oct.	912	.88	803
	Nov.	1,011	.89	900
	Dec.	1,075	.93	1,000
	Total	11,390	.95	10,841
	Jan.	1,008	.94	948
	Feb.	1,005	.92	925
	Mar.	927	.94	871
	Apr.	759	.96	729
	May	786	.98	770
	June	658	.99	651
-1946	July	719	.97	697
	Aug.	666	.94	626
	Sept.	639	.95	607
	Oct.	707	.97	686
	Nov.	757	.96	727
	Dec.	855	.94	804
	Total	9,486	.95	9,041

Year	Month	Flow 1000 (A.F.)	Concentration (T./A.F.)	T.D.S. 1000 (Tons)
	Jan.	933	0.95	886
	Feb.	872	.95	828
	Mar.	934	.98	915
	Apr.	737	1.02	752
	May	827	1.01	835
	June	787	1.02	803
-1947	July	743	1.01	750
	Aug.	830	.99	822
	Sept.	733	1.00	733
	Oct.	753	.95	715
	Nov.	851	.90	766
	Dec.	1,041	.87	906
	Total	10,041	.97	9,711
	Jan.	1,106	.97	1,073
	Feb.	1,135	.94	1,067
	Mar.	1,092	.95	1,037
	Apr.	1,007	.94	947
	May	1,051	.95	998
	June	916	.95	870
-1948	July	1,003	.95	953
	Aug.	906	.94	852
	Sept.	871	.91	793
	Oct.	901	.89	802
	Nov.	945	.86	813
	Dec.	1,103	.94	1,037
	Total	12,036	.93	11,242
	Jan.	1,237	.92	1,138
	Feb.	1,183	.88	1,041
	Mar.	1,226	.88	1,079
	Apr.	1,084	.91	986
	May	927	.92	853
	June	871	.93	810
-1949	July	860	.92	791
	Aug.	934	.88	822
	Sept.	996	.86	857
	Oct.	1,103	.83	915
	Nov.	1,000	.93	930
	Dec.	1,146	.77	882
	Total	12,567	.88	11,104
	Jan.	1,088	.89	968
	Feb.	994	.87	865
	Mar.	1,169	.88	1,029
	Apr.	936	.90	842
	May	1,002	.91	912
	June	841	.89	748
-1950	July	822	.89	732
	Aug.	758	.88	667
	Sept.	643	.87	559
	Oct.	603	.94	567
	Nov.	510	.95	485
	Dec.	540	.95	513
	Total	9,906	.90	8,887
	Jan.	558	.95	530
	Feb.	498	.96	478
	Mar.	635	.96	610
	Apr.	744	.96	714
	May	606	.99	600
	June	703	.98	689
-1951	July	820	.98	804
	Aug.	853	.95	810
	Sept.	697	.93	648
	Oct.	682	.96	655
	Nov.	559	.97	542
	Dec.	698	.98	684
	Total	8,053	.96	7,764
	Jan.	1,058	.95	1,005
	Feb.	1,107	.96	1,063
	Mar.	1,424	.92	1,310
	Apr.	1,279	.97	1,241
	May	1,345	1.00	1,345
	June	1,309	.99	1,296
-1952	July	1,182	.97	1,147
	Aug.	1,178	.92	1,084
	Sept.	1,219	.87	1,061
	Oct.	1,240	.84	1,042
	Nov.	1,176	.78	917
	Dec.	1,298	.75	974
	Total	14,815	.91	13,485

Year	Month	Flow 1000 (A.F.)	Concentration (T./A.F.)	T.D.S. 1000 (Tons)
	Jan.	1,216	0.77	936
	Feb.	1,022	.89	910
	Mar.	911	.95	865
	Apr.	756	1.01	764
	May	856	1.01	865
	June	811	1.00	811
-1953	July	980	.96	941
	Aug.	931	.95	884
	Sept.	776	.93	722
	Oct.	644	.96	618
	Nov.	522	.97	506
	Dec.	620	.95	589
	Total	10,045	.94	9,411
	Jan.	783	.94	736
	Feb.	661	.94	621
	Mar.	723	.94	680
	Apr.	773	.94	727
	May	929	1.05	975
	June	804	1.03	828
-1954	July	885	1.01	894
	Aug.	887	1.03	914
	Sept.	719	1.02	733
	Oct.	620	1.03	639
	Nov.	602	1.02	614
	Dec.	644	1.03	663
	Total	9,030	1.00	9,024
	Jan.	739	1.00	739
	Feb.	593	1.03	611
	Mar.	678	1.07	725
	Apr.	716	1.09	780
	May	729	1.13	824
	June	746	1.20	895
-1955	July	882	1.21	1,067
	Aug.	811	1.18	957
	Sept.	638	1.17	746
	Oct.	499	1.20	599
	Nov.	379	1.24	470
	Dec.	298	1.29	384
	Total	7,708	1.14	8,797
	Jan.	298	1.31	390
	Feb.	344	1.24	427
	Mar.	546	1.24	677
	Apr.	646	1.23	795
	May	594	1.26	748
	June	666	1.25	833
-1956	July	753	1.25	941
	Aug.	717	1.22	875
	Sept.	583	1.24	723
	Oct.	479	1.24	594
	Nov.	343	1.28	439
	Dec.	297	1.30	386
	Total	6,266	1.25	7,828
	Jan.	258	1.36	351
	Feb.	314	1.32	414
	Mar.	520	1.23	640
	Apr.	667	1.18	787
	May	581	1.19	691
	June	651	1.19	775
-1957	July	794	1.22	969
	Aug.	759	1.08	820
	Sept.	616	1.12	690
	Oct.	511	1.16	593
	Nov.	695	1.14	792
	Dec.	978	1.10	1,076
	Total	7,344	1.17	8,598
	Jan.	1,299	1.05	1,364
	Feb.	637	1.07	682
	Mar.	1,253	1.06	1,328
	Apr.	1,280	1.02	1,306
	May	1,016	1.00	1,016
	June	769	1.01	777
-1958	July	812	.96	780
	Aug.	802	.97	778
	Sept.	655	.97	635
	Oct.	624	1.01	630
	Nov.	592	1.00	59[illegible]
	Dec.	761	.97	738
	Total	10,500	1.01	10,626

To obtain mg/l multiply T/AF by 735.

Table 20

Colorado River Basin

Historical Flow and Quality of Water Data

Colorado River at Imperial Dam, Arizona - California

Year	Month	Flow 1000 (A.F.)	Concentration (T./A.F.)	T.D.S. 1000 (Tons)
1959	Jan.	674	0.99	667
	Feb.	592	.99	586
	Mar.	618	1.02	630
	Apr.	770	1.01	778
	May	646	1.05	678
	June	679	1.03	699
	July	824	.99	816
	Aug.	821	1.04	854
	Sept.	644	1.04	670
	Oct.	565	1.03	582
	Nov.	421	1.04	438
	Dec.	441	1.01	445
	Total	7,695	1.02	7,843
1960	Jan.	449	1.02	458
	Feb.	436	1.00	436
	Mar.	651	.99	644
	Apr.	762	.99	754
	May	650	1.07	696
	June	736	1.07	788
	July	845	1.07	904
	Aug.	777	1.06	824
	Sept.	606	1.09	661
	Oct.	481	1.10	529
	Nov.	360	1.14	410
	Dec.	354	1.15	407
	Total	7,107	1.06	7,511
1961	Jan.	342	1.18	404
	Feb.	400	1.15	460
	Mar.	648	1.10	713
	Apr.	666	1.08	719
	May	618	1.14	705
	June	691	1.08	746
	July	755	1.09	823
	Aug.	671	1.12	752
	Sept.	541	1.14	617
	Oct.	427	1.10	470
	Nov.	312	1.12	349
	Dec.	222	1.18	262
	Total	6,293	1.12	7,020
1962	Jan.	337	1.11	374
	Feb.	304	1.14	347
	Mar.	597	1.06	633
	Apr.	689	1.06	730
	May	619	1.11	688
	June	648	1.12	725
	July	741	1.11	822
	Aug.	730	1.12	818
	Sept.	593	1.11	658
	Oct.	458	1.15	527
	Nov.	439	1.16	509
	Dec.	303	1.18	358
	Total	6,458	1.11	7,189
1963	Jan.	337	1.14	384
	Feb.	393	1.11	436
	Mar.	615	1.10	676
	Apr.	647	1.09	705
	May	602	1.09	656
	June	691	1.06	733
	July	775	1.04	806
	Aug.	757	1.02	772
	Sept.	595	1.04	619
	Oct.	461	1.08	498
	Nov.	340	1.12	381
	Dec.	309	1.13	350
	Total	6,522	1.08	7,016
1964	Jan.	337	1.12	377
	Feb.	415	1.07	444
	Mar.	562	1.06	595
	Apr.	609	1.07	652
	May	530	1.10	583
	June	576	1.15	663
	July	719	1.09	784
	Aug.	679	1.09	740
	Sept.	539	1.14	615
	Oct.	396	1.22	483
	Nov.	281	1.26	354
	Dec.	257	1.27	326
	Total	5,900	1.12	6,616
1965	Jan.	271	1.26	341
	Feb.	332	1.26	418
	Mar.	548	1.20	658
	Apr.	566	1.15	651
	May	548	1.22	669
	June	558	1.22	680
	July	709	1.26	893
	Aug.	737	1.28	943
	Sept.	540	1.31	708
	Oct.	400	1.29	516
	Nov.	257	1.33	342
	Dec.	237	1.22	290
	Total	5,703	1.25	7,109
1966	Jan.	203	1.13	229
	Feb.	334	1.21	404
	Mar.	517	1.21	626
	Apr.	622	1.22	758
	May	576	1.24	715
	June	637	1.31	835
	July	729	1.20	874
	Aug.	733	1.18	865
	Sept.	532	1.21	643
	Oct.	389	1.23	478
	Nov.	263	1.28	337
	Dec.	314	1.18	369
	Total	5,849	1.22	7,133
1967	Jan.	301	1.21	364
	Feb.	369	1.16	428
	Mar.	593	1.12	664
	Apr.	558	1.15	642
	May	550	1.16	638
	June	595	1.16	690
	July	673	1.08	727
	Aug.	672	1.09	732
	Sept.	450	1.16	522
	Oct.	412	1.12	461
	Nov.	268	1.22	327
	Dec.	174	1.35	235
	Total	5,615	1.15	6,430
1968	Jan.	342	1.18	404
	Feb.	366	1.10	403
	Mar.	566	1.10	623
	Apr.	622	1.09	678
	May	532	1.18	628
	June	580	1.10	638
	July	625	1.14	713
	Aug.	609	1.16	706
	Sept.	494	1.17	578
	Oct.	399	1.21	483
	Nov.	297	1.25	371
	Dec.	309	1.25	386
	Total	5,741	1.15	6,611
1969	Jan.	271	1.30	352
	Feb.	376	1.18	444
	Mar.	601	1.12	675
	Apr.	638	1.20	766
	May	550	1.19	655
	June	553	1.17	647
	July	622	1.16	721
	Aug.	628	1.18	740
	Sept.	443	1.23	544
	Oct.	417	1.22	509
	Nov.	225	1.32	297
	Dec.	292	1.29	376
	Total	5,616	1.20	6,726
1970	Jan.	352	1.20	423
	Feb.	352	1.21	424
	Mar.	558	1.17	653
	Apr.	677	1.16	788
	May	540	1.22	661
	June	549	1.20	658
	July	623	1.19	738
	Aug.	577	1.20	695
	Sept.	440	1.22	535
	Oct.	423	1.24	525
	Nov.	299	1.24	370
	Dec.	315	1.29	407
	Total	5,705	1.21	6,877
1971	Jan.	324	1.32	427
	Feb.	391	1.23	482
	Mar.	612	1.19	728
	Apr.	627	1.20	751
	May	524	1.22	637
	June	579	1.17	679
	July	676	1.14	772
	Aug.	600	1.14	687
	Sept.	472	1.16	550
	Oct.	390	1.23	480
	Nov.	300	1.30	389
	Dec.	334	1.28	428
	Total	5,829	1.20	7,010
1972	Jan.	341	1.28	435
	Feb.	389	1.24	481
	Mar.	618	1.19	735
	Apr.	644	1.17	756
	May	560	1.18	659
	June	559	1.16	648
	July	667	1.15	766
	Aug.	633	1.12	708
	Sept.	484	1.17	567
	Oct.	295	1.38	407
	Nov.	267	1.28	343
	Dec.	340	1.24	424
	Total	5,797	1.20	6,929
1973	Jan.	361	1.20	432
	Feb.	306	1.21	371
	Mar.	532	1.12	594
	Apr.	663	1.09	722
	May	571	1.15	658
	June	524	1.15	601
	July	645	1.11	715
	Aug.	613	1.15	707
	Sept.	539	1.13	610
	Oct.	452	1.16	524
	Nov.	310	1.23	383
	Dec.	331	1.23	407
	Total	5,847	1.15	6,724
1974	Jan.	255	1.28	326
	Feb.	408	1.14	465
	Mar.	571	1.12	642
	Apr.	714	1.11	795
	May	626	1.14	713
	June	624	1.12	696
	July	727	1.10	798
	Aug.	733	1.08	795
	Sept.	558	1.11	621
	Oct.	409	1.17	480
	Nov.	292	1.25	364
	Dec.	301	1.23	370
	Total	6,218	1.14	7,065
1975	Jan.	351	1.17	411
	Feb.	382	1.14	438
	Mar.	559	1.11	622
	Apr.	662	1.10	731
	May	642	1.12	722
	June	555	1.12	623
	July	654	1.09	713
	Aug.	662	1.09	724
	Sept.	561	1.11	622
	Oct.	450	1.16	521
	Nov.	334	1.20	401
	Dec.	349	1.18	413
	Total	6,161	1.13	6,941
1976	Jan.	341	1.18	403
	Feb.	328	1.18	387
	Mar.	658	1.07	707
	Apr.	679	1.09	742
	May	592	1.12	660
	June	557	1.11	618
	July	647	1.08	701
	Aug.	670	1.08	722
	Sept.	450	1.09	492
	Oct.	369	1.16	427
	Nov.	257	1.26	324
	Dec.	355	1.19	422
	Total	5,902	1.12	6,605

To obtain mg/l multiply T/AF by 735.

Table 20

Colorado River Basin

Historical Flow and Quality of Water Data

Colorado River at Imperial Dam, Arizona - California

(Annual Summary)

Calendar Year	Flow 1,000 (A.F.)	T./A.F.	T.D.S. 1000 Ton	Flow 1,000,000 (m^3)	mg/l	T.D.S. 1,000 Tonne
1941	14,024	1.07	14,980	17,299	786	13,590
1942	14,714	1.08	15,917	18,150	796	14,440
1943	11,345	.94	10,679	13,994	692	9,688
1944	13,205	.95	12,545	16,288	699	11,381
1945	11,390	.95	10,841	14,050	700	9,835
1946	9,486	.95	9,041	11,701	701	8,202
1947	10,041	.97	9,711	12,386	711	8,810
1948	12,036	.93	11,242	14,846	687	10,199
1949	12,567	.88	11,104	15,501	650	10,074
1950	9,906	.90	8,887	12,219	660	8,062
1951	8,053	.96	7,764	9,933	709	7,044
1952	14,815	.91	13,485	18,274	669	12,234
1953	10,045	.94	9,411	12,391	689	8,538
1954	9,030	1.00	9,024	11,139	735	8,187
1955	7,708	1.14	8,798	9,508	840	7,982
1956	6,266	1.25	7,828	7,729	919	7,102
1957	7,344	1.17	8,598	9,059	861	7,800
1958	10,500	1.01	10,626	12,952	744	9,640
1959	7,695	1.02	7,843	9,492	750	7,115
1960	7,107	1.06	7,511	8,766	777	6,814
1961	6,293	1.12	7,020	7,762	821	6,369
1962	6,458	1.11	7,189	7,966	819	6,522
1963	6,522	1.08	7,016	8,045	791	6,365
1964	5,900	1.12	6,616	7,278	825	6,002
1965	5,703	1.25	7,109	7,035	917	6,449
1966	5,849	1.22	7,133	7,215	897	6,471
1967	5,615	1.15	6,430	6,926	842	5,833
1968	5,741	1.15	6,611	7,082	847	5,997
1969	5,616	1.20	6,726	6,927	881	6,102
1970	5,705	1.21	6,877	7,037	887	6,239

Table 20
Colorado River Basin
Historical Flow and Quality of Water Data
Colorado River at Imperial Dam, Arizona - California

(Annual Summary)

Calendar Year	Flow 1,000 (A.F.)	T./A.F.	T.D.S. 1000 Ton	Flow 1,000,000 (m^3)	mg/l	T.D.S. 1,000 Tonne
1971	5,829	1.20	7,010	7,190	884	6,359
1972	5,797	1.20	6,929	7,151	879	6,286
1973	5,847	1.15	6,724	7,212	846	6,100
1974	6,218	1.14	7,065	7,670	836	6,409
1975	6,161	1.13	6,941	7,600	829	6,297
1976	5,902	1.12	6,605	7,280	823	5,992
Total	302,433		315,835	373,053		286,529
Average	8,401	1.04	8,773	10,363	768	7,959