QUALITY OF WATER

COLORADO RIVER BASIN

PROGRESS REPORT NO. 11

JANUARY 1983

UNITED STATES
DEPARTMENT OF THE INTERIOR
James G. Watt, Secretary

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Colorado River Basin

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SUMMARY

This report, prepared and updated every 2 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 in the river system. The historical and projected future salinity conditions of the Colorado River Basin are presented in this report.

The historical record was evaluated at Imperial Dam (see Figure VI-2, page 26). Salinity was found to be increasing at a rate of 3.9 mg/L per year over the 1941 to 1981 period of record. This amounts to an increase in salinity at Imperial Dam of approximately 152 mg/L. Statistical analysis of the trend showed the annual salinity varying within the 95 percent confidence interval of $\pm$118 mg/L. The increase in salinity is attributable to many causes but primarily the increase is due to the development of the Colorado River Basin.

The Colorado River Simulation System (CRSS) was used to predict the effect future development will have on salinity at various key stations within the basin (see Table B, page 47 and Figure VII-1, page 43). CRSS was also used to predict the salinity within the basin assuming the water quality improvement program shown in Figure VIII-1, page 50, is implemented. The salinity at Imperial Dam is predicted to increase from 816 mg/L in 1981 to 1,089 mg/L in 2010 without salinity control. Salinity control would reduce the 2010 predicted salinity to 894 mg/L (see Figure VIII-2, page 51, for comparison). The annual damages to lower basin water users is estimated to be $513,300 in 1982 dollars for each 1 mg/L increase at Imperial Dam when concentrations are within the range of 875 mg/L to 1,225 mg/L.

Salinity should remain within the salinity standards over the next 5 years unless several years of low flows occur. Should several years of extremely high flows occur, spills will be required and TDS would drop significantly, based on 1980 conditions. Large spills could reduce TDS by more than 100 mg/L.

Future salinity projections using CRSS are dependent on scheduled depletions actually occurring. In the past the predicted depletions associated with energy development have not occurred, and therefore salinity projections were also high. Verification of some of the hydro-salinity mechanisms used to predict future salinity conditions will require observation of an actual period of prolonged reservoir drawdown.

During the filling of the Colorado River reservoir system, higher TDS water was stored while lower TDS water was passed downstream. With the reservoir system at near capacity, the possibility of high flows requiring spills through the reservoir outlet works may flush higher TDS water from the reservoirs. This would not be necessarily detrimental if

the excessive water dilutes the TDS. It would also provide better quality water in the reservoirs during low flows water years for downstream users.

A major portion of the report is dedicated to the Colorado River Salinity Control Program and describing the individual salinity control projects. Figure VIII-1 on page 50 summarizes the schedule for investigation and construction for these projects. Table F on page 87 lists the 2010 Salinity Control Unit Effects. The effects were calculated using the equations in Part VII-C and will provide a consistent basis for evaluating the impacts of projects.

Many of the salinity studies, including salt load reductions and benefits downstream are still preliminary; this document is therefore a progress report. Specific water and salt budget tables will be revised and final numbers presented in specific water quality improvement project planning reports and environmental impact statements.

Studies of eutrophication, nutrient and salt routing problems, and basic reservoir interactions are needed to improve water quality management options in the future.

Given full development of the States' water allocations, water quality improvement projects will be necessary to maintain TDS near the standards.

PART I. INTRODUCTION

A. Authorization for Report

This is the Eleventh Biennial Progress Report on Quality of Water in the Colorado River Basin. The directive for preparing this report is contained in four separate public laws culminating in the Colorado River Basin Salinity Control Act, Public Law 93-320, Title II, Section 206, which states:

> "Commencing on January 1, 1975, and every 2 years thereafter, the Secretary shall submit, simultaneously, to the President, the Congress, and the Advisory Council created in Section 204(a) of this Title, a report on the Colorado River Salinity Control Program authorized by this title 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 this title, 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. Said report may be included in the biennial report on the quality of water of the Colorado River Basin prepared by the Secretary pursuant to section 15 of the Colorado River Storage Project Act (70 Stat. 111; 43 U.S.C. 602n), section 15 of the Navajo Indian Irrigation Project, and the initial stage of the San Juan-Chama Project Act (76 Stat. 102), and section 6 of the Fryingpan-Arkansas Project Act (76 Stat. 393)."

Public Law 87-483 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."

Nothing in this report is intended to interpret the provision 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 and Cooperating Agencies

A series of 10 reports starting with the 1963 edition have been prepared prior to this report. Each succeeding report updated the previous report.

This report was prepared by the Bureau of Reclamation and utilizes basic data provided primarily by the Geological Survey. A continuing cooperation program between Reclamation (Bureau of Reclamation) and USGS (Geological Survey), in effect for a number of years, provides for the collection of streamflow data at stations other than basic data stations maintained by USGS in order to obtain additional information 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 USGS and other agencies. Along the mainstem below Lees Ferry, data are obtained on a regular basis at stations that include essentially all significant diversions, surface return flows, and major river points. 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 include representatives from the USGS, International Boundary and Water Commission, and EPA (Environmental Protection Agency).

Since this is a progress report with a due date fixed by law, a number of the projects are ongoing. In fact, more salinity studies are now in progress than at any previous time. In this regard this report is not very timely since final plan formulation is in the final stages on several projects. The water and salt budgets for salinity projects presented in this report are, therefore, subject to change as the plan formulation documents are finalized.

C. Legal Aspects

1. Water Quantity

Apportionment of Colorado River water has been accomplished by (1) the Colorado River Compact of 1922, (2) the Mexican Treaty of 1944, (3) the Upper Colorado River Basin Compact of 1948, and (4) the U.S. Supreme Court (State of Arizona vs. California et al., 1964).

The first of these, the Colorado River Compact, divided the Colorado River between the Upper and Lower Basins at Lee Ferry (just below the confluence of the Paria River), and apportioned to each basin 7.5 MAF (million acre-feet) annually, and contains provisions governing

exportation and obligations to Indian Tribes. Further, the Mexican Treaty of 1944 obligates the United States to deliver to Mexico 1.5 MAF of Colorado River water annually.

The Upper Colorado River Basin Compact of 1948 further apportioned Colorado River water, allocating to Arizona 50,000 acre-feet annually, with the remaining water allocated to Upper Basin States as follows: Colorado, 51.75 percent; New Mexico, 11.25 percent; Utah, 23 percent; Wyoming, 14 percent. The compact permitted the authorization of Federal projects above Lee Ferry. States of the Lower Basin, however, did not agree to a compact for the apportionment of waters in the Lower Colorado River Basin; accordingly, a Supreme Court decree (Arizona vs. California et al.) in 1964 allocated use of the main stream of the river below Lee Ferry among California, Nevada, and Arizona, and of the Gila River between the States of Arizona and New Mexico. The decree also permitted Federal water projects and the development of Indian tribal lands to proceed.

2. Water Quality

Although a number of water quality-related legislative actions have been taken on the State and Federal levels, four Federal acts are of special significance to the Colorado River Basin: (1) The Water Quality Act of 1965 and related amendments, (2) the Federal Water Pollution Control Act Amendments of 1972 (Public Law 92-500), (3) the Colorado River Basin Salinity Control Act of 1974, and (4) the Clean Water Act of 1977. Also central to water quality issues are agreements with Mexico on Colorado River system waters entering that country.

The first of these, the Water Quality Act of 1965 (Public Law 89-234), amended the Federal Water Pollution Control Act and established a Federal Water Pollution Control Administration (now EPA). Among other provisions, it required states to adopt water quality criteria for interstate waters inside their boundaries. The seven basin states initially developed water quality standards which did not include numeric salinity criteria for the Colorado River primarily because of technical constraints. In 1972, the states agreed to a policy which called for the maintenance of salinity concentrations in the Lower Colorado River system at or below existing levels while the Upper Basin states continued to develop their compact apportioned waters. The states suggested that the Bureau of Reclamation should have primary responsibility for investigating, planning, and implementing the proposed Colorado River Basin Salinity Control Program with the assistance of the Federal Office of Saline Water and EPA.

Enactment of the Federal Water Pollution Control Act Amendments of 1972 affected salinity control in that the legislation was interpreted by EPA to require numerical standards for salinity in the Colorado River. In response, the basin states founded the Colorado River Basin Salinity Control Forum to develop numeric salinity criteria and a basinwide plan of implementation for salinity control. The Basin States held public meetings on the proposed standards as required by the enacting

legislation. The Forum recommended that the individual Basin States adopt the Proposed Water Quality Standards for Salinity Including Numeric Criteria and Plan of Implementation for Salinity Control, Colorado River System. The proposed water quality standard called for maintenance of flow-weighted average TDS concentrations of 723 mg/L below Hoover Dam, 747 mg/L below Parker Dam, and 879 mg/L below Imperial. Included in the plan of implementation were four salinity control units and possibly additional units, the application of effluent limitations, and use of saline water whenever practicable and for future studies. The standards are to be reviewed at 3-year intervals. All of the Basin States adopted the 1975 Forum-recommended standards.

The Colorado River Basin Salinity Control Act of 1974 (Public Law 93-320) provided the means to comply with United States obligations to Mexico which included as a major feature a desalting plant and brine discharge canal. These facilities will enable the United States to deliver to Mexico water having an average salinity no greater than 115 ppm $\pm$ 30 ppm (Mexican count) over the annual average salinity of Colorado River waters at Imperial Dam. The act also authorized construction of four salinity control units and the expedited planning of 12 other salinity control projects above Imperial Dam as part of the basin-wide salinity control plan.

In 1978, the Forum reviewed the salinity standards which were adopted by all of the seven basin states, and recommended: The construction of 3 of the 4 salinity control units and 10 of the 12 projects identified in the 1974 Act,the placing of effluent limitations on industrial and municipal discharges, and the reduction of the salt loading effects of irrigation return flows. The plan also called for the inclusion of Water Quality Management Plans to comply with Section 208 provisions after the plans' adoption by the states and approval of EPA. It also contemplated the use of saline water for industrial purposes and future salinity use/control methods.

PART II. DESCRIPTION OF BASIN

A. Climate

Extremes of temperature in the Colorado River Basin range from -50° F to 130° F. 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. Much of the Intermountain area consists of high basins or valleys with cold winters and hot dry summers. The southern desert portion of the basin has long, hot summers, practically continuous sunshine, and almost complete absence of freezing temperatures. Rainfall averages 2.5 inches in the southern end of the basin while total precipitation in the mountains reaches 40 to 60 inches annually.

B. Geography

The Colorado River begins where peaks rise more than 14,000 feet in the northwest portion of Colorado's Rocky Mountain National Park, 70 miles northwest of Denver. It meanders southwest for 640 miles through the Upper Basin to Lee Ferry (Figure II-1).

The Green River, the Colorado River's major tributary, rises in western Wyoming and discharges into the river in southeastern Utah--730 river miles south of its origin and 220 miles 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 Colorado River in the Upper Basin.

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 Wayne N. Aspinall Unit Dams. Glen Canyon Dam is the only major dam on the mainstem of the Colorado above Lee Ferry, but it will permit control of almost all flows leaving the Upper Basin.

The natural drainage area of the Colorado River below Lee Ferry and above Imperial Dam is about 75,100 square miles. 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.

Lake Mead, formed by Hoover Dam, provides most of the storage and regulation in the Lower Colorado River Basin, providing for irrigation, M&I (municipal and industrial) uses, power generation, flood control, recreation, and other beneficial uses.

Lake Mohave, the reservoir formed by Davis Dam, backs water at high stages about 67 miles upstream to the tailrace of Hoover Powerplant. Storage in Lake Mohave is used for some reregulation of releases from

LEGEND

STATION

1 Green River near Green River, Wyo.
2 Green River near Greendale, Utah
3 Yampa River near Maybell, Colo.
4 Duchesne River near Randlett, Utah
5 White River near Watson, Utah
6 Green River at Green River, Utah
7 San Rafael River near Green River, Utah
8 Colorado River near Glenwood Springs, Colo.
9 Colorado River near Cameo, Colo.
10 Gunnison River near Grand Junction, Colo.
11 Dolores River near Cisco, Utah
12 Colorado River near Cisco, Utah
13 San Juan River near Archuleta, New Mex.
14 San Juan River near Bluff, Utah
15 Colorado River at Lees Ferry, Ariz.
16 Colorado River near Grand Canyon, Ariz.
17 Virgin River at Littlefield, Ariz.
18 Colorado River below Hoover Dam, Ariz.-Nev.
19 Colorado River below Parker Dam, Ariz.-Calif.
20 Colorado River at Imperial Dam, Ariz.-Calif.

● Quality of water measurement stations 1/

★ Authorized water development projects 2/

▲ Authorized for construction water quality improvement project, Title II

△ Water quality improvement project under investigation, Title II

■ Water quality improvement project, Title I

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.

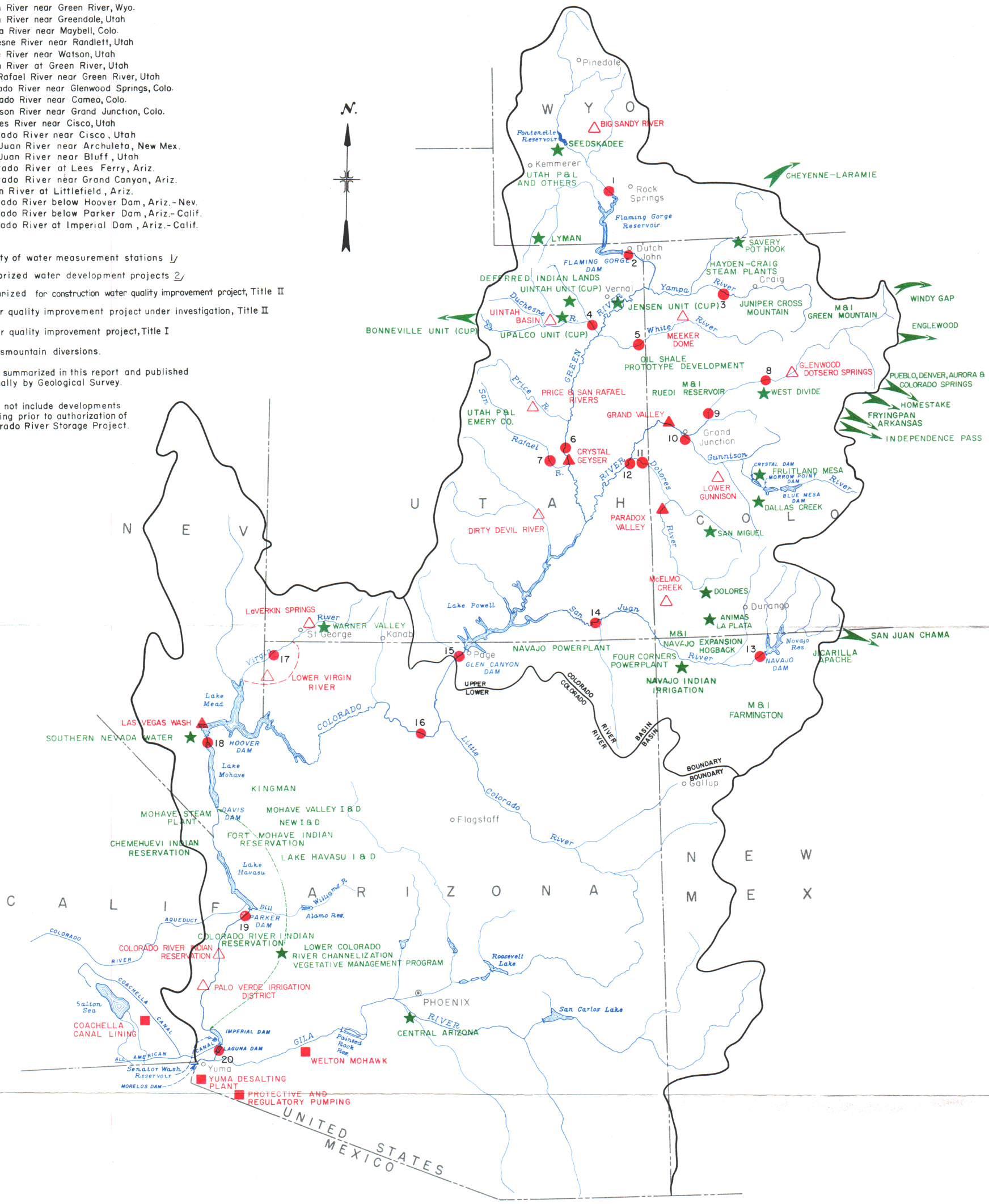


FIGURE II-1

UNITED STATES
DEPARTMENT OF THE INTERIOR
WATER AND POWER RESOURCES SERVICE

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 OCTOBER 1980

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 below Davis Dam at which point the river enters the broad Mohave Valley 33 miles above the upper end of Lake Havasu.

Lake Havasu backs up behind Parker Dam for about 45 miles and covers about 25,000 acres, serving as a forebay from which the Metropolitan Water District of Southern California pumps water into the Colorado River Aqueduct. Lake Havasu will also serve as forebay for the Central Arizona Project pumping plants and aqueducts, Lake Havasu and Alamo Dam and Reservoir, on the Bill Williams River, 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 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, an offstream reservoir, 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.

The Morelos Dam is the last dam on the Colorado River. This small diversion dam diverts water for the Alamo Canal which delivers water to northern Mexico, located just below the Northern International Boundary.

C. Hydrology

The Colorado River Basin, technically divided into an Upper and Lower Basin, has a total area of approximately 244,000 square miles, carrying an average annual virgin flow of 13 to 15 MAF at Lee Ferry. Of this flow, more than 5 MAF per year is exported to the Arkansas, Missouri, the Great Basins, to Southern California, and to the Rio Grande.

Wet and dry cycles have played a significant role in bringing about the development of the Colorado River/Reservoir complex. In the past, the annual flow of the river has varied from less than 6 MAF to over 20 MAF per year. The reservoir system allows storage of sufficient water to maintain the flows of the river to meet downstream needs during dry periods.

The construction and filling of the mainstem reservoirs of the Colorado River Basin have brought about significant changes in the flow

patterns of the river. In addition to the major reservoirs, numerous smaller reservoirs have been built on many of the tributaries. Since major storage began with Lake Mead in 1935, and concluded with the filling of Lake Powell in 1980, the Colorado River Basin reservoirs now have a combined storage capacity equal to approximately four times the total average annual virgin (undepleted) flow of the entire Colorado River.

The Colorado River Basin is an arid or semiarid basin compared to others, such as the Columbia Basin, which drains approximately the same area but carries a comparatively larger flow, as shown in the following table. While the Colorado River is one of the major drainage basins in the continental United States, its runoff is about equal to that of the Delaware, which drains a much smaller area.

Comparison of river basins

River basin	Drainage area (1,000 square miles)	Runoff (MAF/year)	Runoff per unit area (inches/years)
Colorado	244	15	1.15
Mississippi	1,234	440	6.7
Columbia	258	180	13.1
Delaware	12	14	20.9

Silting and salinity problems are more pronounced in the Colorado Basin than elsewhere, as are irregularities in flow.

The flow at various points in the Colorado River Basin for the 1941-80 period is given in Tables 1 through 20 at the end of this report. The records of flow depict characteristic wide fluctuations month-to-month and considerable variation year-to-year. The storage reservoirs now level out some of the fluctuations in the reaches below the major dams.

D. Geology and Soils

Rocks of all ages--from those of the oldest known geological period to the recent alluvial deposits, including igneous, sedimentary, and metamorphic types--are found in the Colorado River Basin.

Many of the sedimentary formations in the basin were deposited in marine or brackish water environments, and therefore they frequently contain salts of sodium chloride (halite) and calcium sulfate (gypsum). The high salt content, low precipitation, and the concentrating effects of evaporation contribute to the high salinity found in the Colorado River and its tributaties.

The soils of the Colorado River Basin closely resemble the geologic formations of their origin, since only in limited areas at higher elevations has the precipitation been sufficient to leach the soil mass of its soluble constituents (salts). Over much of the area both residual and transported soils are alkaline and display "alkali" accumulation.

Residual soils are usually shallow in depth over shale and sandstone of various ages. Many of the shales are saline but contain gypsum as well as other chloride, sulfate, and bicarbonate salts. Much of the salt pickup occurs in areas where the natural runoff contacts the saline shales before entering the streams. Very few residual soil areas are suitable for irrigation development.

Alluvial materials vary, ranging from alluvial fans, terraces, and outwash plains to lake sediments. Some soils are composed of material transported only short distances, while other soils have been transported and mixed well. Since most of the agricultural areas are on these well mixed alluviums, cultivated soils vary in composition.

Extensive areas of Eolian deposits (wind arranged, such as sand dunes) occur in part of the basin. The uniformly textured soils are reddish-brown in color and resemble either the underlying formations or adjacent areas. These are excellent agricultural soils, but in many areas topography makes farming difficult.

E. Vegetation

Areas of higher elevation are covered with forests of pine, fir, spruce, and aspens, broken by small glades and mountain meadows. Pinyon and juniper trees, interspersed with scrub oak, mountain mahogany, rabbitbrush, 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 sagebrush-related vegetation, while many of the streams are bordered by cottonwood, willows, and salt cedar. Scattered cottonwoods and chokecherries grow in the canyons with cliff rose, redbud, and blue columbine, while wildflowers carpet many mountain parks. At lower elevations large areas have a low density of plant cover with scattered desert shrubs, Joshua trees, other yucca plants, and saguaro cacti, some of which reach 40 feet 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 so overrun with tamarisk (salt-cedar) that a large volume of water is being consumed by the phreatophyte vegetation.

PART III. HISTORY OF WATER RESOURCE DEVELOPMENT

A. Irrigation Development

Irrigation development in the Upper Basin took place gradually from the beginning of settlement in about 1860 but was hastened by the purchase of land from the Indians in 1873. About 800,000 acres were being irrigated by 1905. Between 1905 and 1920 the development of irrigated land continued at a rapid pace, and by 1920 nearly 1.4 million acres were being irrigated. The development then leveled off, and increase since that time has been slow because of physical and economic limitations on the availablility of water.

Irrigation development began in the Lower Basin at about the same time as in the Upper Basin but was slowed by 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 have provided the means for a continued expansion of the irrigated area. In 1970, an additional 21,800 acres were irrigated by private pumping either directly from the Colorado River or from wells in the flood plain. In 1974, nearly 849,000 acres were irrigated from Colorado River diversions below Hoover Dam. About 25,500 acres of Lower Basin lands in Utah are now under irrigation.

B. Streamflow Depletions

Development and utilization of the basin's water resources result in depletions of streamflows, particularly the consumptive use of water by irrigated crops and exports to other basins. Reservoir evaporation and consumptive use of water for M&I purposes also produce significant depletions.

The 1980 estimated consumptive use of water by all users in the Upper Basin was approximately 3.5 MAF.

Water exported from the Upper Basin during the period 1941-72 averaged about 360,000 acre-feet per year. Completion of such large projects as the Colorado-Big Thompson, Duchesne Tunnel, and Roberts Tunnel, and more recent projects such as the San Juan-Chama, Fryingpan-Arkansas, and Homestake, resulted in increased exports to about 726,000 acre-feet per year for 1976-80, with a peak in 1978 of 852,000 acre-feet.

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.

Previous reports have identified some of the natural sources of salinity; however, a basinwide field review has not been made in the recent past. The need for a review has been identified in the Problems and Needs section, Part X, and will be addressed in future reports.

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. 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 amount which occurs as a result of irrigation and should not include the amount resulting from natural sources.

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.

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 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.

Development of oil and gas, oil shale, and mineral resources in the basin also has the potential to increase salt loading. Many saline ground water aquifers are static (very little water movement) until they are disturbed by drilling or mining activities. An example of where this has happened is the Meeker Dome Salinity Control Unit described in Part VIII which came about as the result of deep ground water, high in dissolved salts, flowing back to the surface through abandoned oil wells.

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. In-basin Depletons

Consumptive use of water for irrigation within the basin is responsible for the largest depletions while municipal and industrial uses account 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. Transbasin Depletions

The major part of the transbasin depletions is made at higher elevations where the salinity concentrations are very low. This removal of high quality water results in the remaining flows downstream becoming more concentrated even though some salts are removed by the water delivered to another basin. Many transbasin diversions have been made over the years and an additional number will divert in the future.

PART V. COLORADO RIVER WATER QUALITY ASSESSMENT

A. State Inventory

An important objective of this water quality investigation is to assess the suitability of Colorado River water for various beneficial uses. The following section discusses the physical and economic effects of salinity and other pollutants on water uses.

Each State's water quality office or Department of Health was asked to submit an inventory of water pollution problems and/or priorities for users of the Colorado River water within their State.

1. Wyoming

Wyoming submitted a draft report, Statewide Water Quality Assessment Fiscal Year 1982,[1] prepared by the Water Quality Division, Department of Environmental Quality. In this report a rating system was used to prioritize water quality problems by stream reach within the State. The Green River Basin received priorities 1, 4, 22, 28, 30, and 31, as follows:

> Priority 1.--Flaming Gorge Reservoir inflow area. Problem: Eutrophication, blue-green algae, low dissolved oxygen, high nutrients, aesthetics. Impacts: Primary and secondary body contact recreation and cold water sport fishery.
>
> Priority 4.--Big Sandy River from its mouth to Big Sandy Reservoir. Problem: High salinity from seeps and irrigation return flows. Impacts: Primarily from salinity to the Lower Basin.1/
>
> Priority 22.--Big Sandy Reservoir. Problem: High turbidity from erosion - Big Sandy Reservoir has low TDS water. There is no relationship between the erosion problem, Priority 22, and the salinity problem, Priority 4. Impacts: Cold water sport fishery.
>
> Priority 28.--Bitter Creek from its mouth upstream to Point of Rocks. Problem: Improper sewage treatment at Rock Springs and the many satellite facilities in the area. Impacts: Fecal coliform, public health, and moderate secondary recreation; possibly contributes to Priority 1 eutrophication in Flaming Gorge Reservoir.

1/ The Southwestern Wyoming Clean Water Report, 1978,[2] documents TDS impacts to M&I water users seasonally due to high levels of sulfates. This impact was particularly severe during the low flows in the Green River during the 1977 drought.

Priority 30.--Green River. Problem: Stream channel alteration. Impacts: Erosion, recreation, cold water fishery.

Priority 31.--Little Snake River. Problem: Irrigation diversions and improperly treated sewage discharge from the community of Baggs cause low flows and low dissolved oxygen. Impacts: Recreation, cold water fishery.

At this time, Statewide planning and detailed designs have been initiated on sewage treatment projects, with a construction cost of approximately $110,000,000. If adequate funds were available, the Wyoming Department of Environmental Quality estimates construction could begin on all these projects within 3 years, but such funds are not available. Additional sources are necessary to augment funding under the Clean Water Act; if these funds are not forthcoming, most of the projects currently under design will not be built. This would result in a degradation of water quality within the State, including the Green River, tributary to the Colorado River.

A municipal wastewater construction grant program funded by the State of Wyoming is being prepared for submission to the 1983 Wyoming Legislature.

Ground water represents 22 percent of Wyoming's water use. Because ground water pollution is now recognized as a potential area of water quality concern, Wyoming has enacted ground water protection laws. One of the potential sources of ground water pollution is the trona mining in the Green River Basin.

Water from the Green River, used for domestic supply in Green River and Rock Springs, Wyoming, exceeded EPA's secondary drinking water criteria for TDS and sulfates during much of the 1976-77 drought. During winter baseflow periods in dry years, this is a recurring problem. Industrial water uses for trona processing and steam power generation also have high water treatment costs during these high TDS, low-flow periods. These costs are not part of costs per mg/L assessed at Imperial Dam, but some local benefits could occur in Wyoming with successful implementation of the Big Sandy River Unit of the Colorado River Water Quality Improvement Program.

2. Utah

Utah's 305(b)[3] report indicates that of the 21 priority stream segments in Utah, seven are within the Colorado River Basin. These include: Price River and tributaries from the confluence with Green River to headwaters, the Duchesne River and tributaries from Myton to headwaters, Cottonwood Creek and tributaries from highway U-57 to headwaters, Fremont River through Capitol Reef National Park to headwaters, Virgin River and tributaries from Utah-Arizona State line to headwaters and San Rafael River from confluence with Green River to confluence with Ferron Creek.

The water quality data for the upper segment of the Price River, from Price City to headwaters, indicate an impairment to cold water fisheries due to phenols and phosphorus. The data used to determine this impairment however, come from only a single sample point on Pleasant Valley Creek which may not adequately represent water quality in this upper segment of the Price River. The lower segment of the Price River, from its confluence with the Green River to Price City, shows impairment to irrigation use. The problem parameters are sodium and total dissolved solids, which result from natural conditions, mining activities and agriculture.

The Duchesne River from Myton to its headwaters shows impairments to cold water fisheries because of turbidity and temperature. The probable causes of these impairments are natural conditions, irrigation return flow, and municipal point sources. There is also minor imapirment for public water supply due to TDS, manganese, and nickel.

Cottonwood Creek and tributaries from highway U-57 to headwaters are impaired for cold water fisheries because of high levels of phenols. The high phenols result from natural sources and mining activities. Relatively high manganese concentrations are of concern for public water supply.

The Fremont River through Capitol Reef National Park to headwaters is impaired for public water supply and cold water fisheries because of moderate concentrations of manganese, nickel, nitrogen, and phosphorus. These result from natural sources, fish hatcheries, and agricultural activities.

The San Rafael River from its confluence with Green River to the confluence with Ferron Creek is impaired to irrigation because of high levels of total dissolved solids and sodium. They result from natural sources, mining and irrigation.

The Virgin River and tributaries from the Utah-Arizona stateline to headwaters are impaired for irrigation use because of total dissolved solids, sodium and boron. These parameters result primarily from natural conditions and to a limited extent from man-made conditions.

There are also water quality problems in several reservoirs in the Colorado Basin, primarily related to eutrophication. This problem has sometimes resulted in the total depletion of dissolved oxygen at the bottom of some reservoirs during the period of algal blooms, but particularly in the die-off period during the fall cooling. Fish kills have been reported at Scofield, Strawberry, Soldier Creek, and other small reservoirs.

In the past, the blue-green algae in Utah's reservoirs have largely been in irrigation water supplies, and therefore only fishery and recreation water uses have been impaired; however, continued growth has required that more reservoir water be supplied for municipal use. As a result, the potential taste and odor problems associated with

waters containing blue-green algae will increase in the future unless corrected.

Providing adequate sewage treatment facilities to keep up with growth is usually a problem in small communities affected by the energy development boom. Such communities typically receive growth impacts during construction and development, and before the production and establishment of a tax base, a problem intensified by the reduction of Clean Water Act 201 construction grant funds.

3. Colorado[4]

The most significant water quality problem in the basin in Colorado is to maintain the existing high quality waters that are threatened by wastewater from growing communities. Ammonia, in the un-ionized form, is found in municipal wastewater and is toxic to aquatic life. Increasing population in the basin brought about by growth in the recreation and energy sectors of the economy is placing a burden on several threatened tributaries as well as increasing waste discharges in the Roaring Fork, Eagle, Fraser, East, and San Miguel Rivers. Tributaties that have shown a low degree of impairment owing to ammonia from municipal or industrial wastewater include the Crystal River, Gore Creek, Dolores River and lower Colorado River within the State.

Headwater streams in the basin that are located in the Colorado mineral belt frequently are contaminated with heavy metals. Drainage from inactive mine tunnels, mill wastes, and tailings piles are responsible for much of the contamination. The major streams that are impacted within the basin include headwaters of the Eagle, Animas, and Uncompahgre Rivers. Improvements in wastewater treatment from mining operations that discharge to the Dolores River, Slate River, and Tenmile Creek has resulted in corresponding improvement to the quality of those streams.

Two new reservoirs now under construction--Ridgway in the Gunnison drainage and McPhee on the Dolores River--will impound a portion of the heavy metal pollution. The Bureau of Reclamation is monitoring the inflow to these reservoirs, and has agreed to install an aeration system to prevent Ridgway Reservoir from becoming anaerobic, if a condition is found which allows heavy metals and trace elements to re-enter the water in solution.

Depending on the biological availability of the pollutants from the sediments into the food chain, the fisheries--or at least the edibility of the fish flesh--may be impaired in Ridgway Reservoir and, to a lesser extent, possibly in McPhee Reservoir. If these reservoirs act as permanent traps for heavy metals, downstream water quality could benefit.

M&I water from the Dallas Creek Project's Ridgway Reservoir will be provided by exchange from irrigation for a higher quality source to reduce the impacts from metal pollutants.

Heavy metals, trace elements, and organics (phenyls) have also been found in drainages associated with oil shale deposits. The Colorado and White Rivers could be impacted by future oil shale development. There are several major sources of salt loading to the Colorado River that are found within Colorado. They include saline springs that naturally discharge to the Dolores River in the Paradox Valley and Glenwood-Dotsero Springs that discharge to the mainstem. Irrigation of saline Mancos Shale soils in the Grand Valley, McElmo Creek, and lower Gunnison areas also contribute substantially to the salt loading.

4. Arizona[5]

Water quality along the Colorado River is protected for agriculture, aquatic life, drinking water supply, fishing, full body contact recreation, and wildlife uses by Arizona water quality standards. Documented water quality problems along the river and in nearby ground water include elevated bacteria counts and the presence of some agricultural chemicals. Eutrophication has long been suspected in Arizona, and the EPA has promulgated ambient nutrient standards on the Colorado River mainstem under Section 303(c) of the Federal Clean Water Act.

Chlorination of eutrophic surface waters for drinking water systems frequently produces trihalomethanes. Federal standards have been promulgated for total trihalomethanes in public drinking water systems and these substances could become a public health concern for water systems supplied with Colorado River water. There is concern related to unquantified health impacts of several secondary drinking water quality criteria other than salinity, including alkalinity, chloride, hardness, sodium, and sulfate. Though the role of these constituents is not fully understood at this time, some are suspected to have positive or negative impacts on public health.

5. Nevada[6]

The level of organic precursors in Las Vegas raw water intake from Lake Mead is increasing so that after chlorination there is the potential of creating trihalomethanes. This may be connected to a local eutrophication problem in Las Vegas Bay of Lake Mead due to the inflow of Las Vegas wastewater.

Sulfates make up about 300 mg/L of the TDS in Lake Mead, which exceeds the secondary drinking water criteria. Nevada would like to see Federal emphasis on sulfate removal in salinity control programs.

6. California[7]

Present Colorado River salinity levels are marginally suitable for such key beneficial uses as agriculture and domestic water supply. Most of the saline concentrations in the Colorado River derive from sources upstream from California, but, to a lesser degree, there are local influences in the Palo Verde Valley Region.

The Colorado River area contiguous to California serves a large influx of recreationists almost year round, but many of these people camp indiscriminately on public lands along the river's edge. Sanitary facilities, though previously limited, are now improving, an important factor for the protection of public health.

The Colorado River is highly regulated and its waters are intensively used and reused. Water in the California reach of the Colorado River is sodium-calcium sulfate in character and is very hard. The threshold value of chlorides, reported by the University of California Agriculture Extension Service in Guidelines for the Interpretation of Water Quality for Agriculture, February 8, 1974,[8] is 142 mg/L. Prior to 1971, the average chloride concentration at Topock was about 90 mg/L, and just north of the International Boundary it was 240 mg/L. This increasing downstream salinity can be attributed primarily to irrigation return flows coupled with the reduced flow in the Colorado River resulting from diversions between Parker and Imperial Dams.

Although chlorides are a definite water quality problem, the specific conductance data for the past decade have shown a minor but steady improvement. During water year 1980, a slight improvement in electrical conductivity was recorded at both stations. While conductivity increased again in water year 1981, the mean values are generally below those of the last decade. Turbidity at the International Boundary station increased markedly in March 1980 but declined later in the year. Minimum dissolved oxygen values at this station violated the minimum standard (6.0 mg/L) in summer 1980, and equalled the standard in 1981. In water year 1980, DDT was detected at 0.02 ug/L (micrograms per liter), violating the EPA standard of 0.001 mg/L.

During water year 1980, PCB's (polychlorinated byphenyls) were found at a concentration of 0.05 mg/L, a value in excess of the EPA standard of 0.001 mg/L.

Fish tissue analyses have disclosed repeated moderate levels (110-175 ppb) of DDT in fish from the Colorado River from 1978 to 1980. In 1981, the DDT level dropped to 22 ppb (parts per billion). Trace amounts of Dacthal were detected in 1979.

The TDS concentration of the Salton Sea is currently about 38,000 mg/L and is rising at a rate of about 400 mg/L per year. When the salinity reaches 40,000 mg/L, it is expected that this concentration will be unsuitable for the important sport fishery as well as water-oriented recreation and wildlife habitation.

There has been a lack of suitable sites within the basin for disposal of large volumes of waste materials generated by geothermal and agricultural pesticide operations. Because the geothermal industry in the Imperial Valley is developing rapidly, disposal of the brine wastes is creating growing problems; however, a major disposal site was opened in 1981 in the Imperial Valley.

The upper Coachella Valley area is experiencing rapid growth, and its ground waters are being overdrafted. Depths to ground water have fallen over 75 feet.

The Ocotillo-Coyote Wells area is 30 miles west of the city of El Centro in Imperial County. The quality of ground water in the area has been suitable for domestic use, but there is concern now that overpumpage for commercial transport could create a saline intrusion.

The Regional Board and others have petitioned Federal agencies to seek corrections through Mexican officials of the problems on the New River. Through strong insistence, there has been some recent improvement in the New River's water quality at the border crossing. Following discussions between the United States and Mexican Presidents, additions were made to the United States-Mexican Water Treaty that call for prompt corrections to the remaining waste problems. The city of Mexicali brought its waste treatment systems back into operation.

Earlier engineering investigations show that the Salton Sea salinity can be held at present levels, but the physical works to achieve this would be quite expensive.

Southern California is almost entirely dependent upon imported water, with the Colorado supply being one of the three important sources.

The dollar cost to California of increased salinity has been documented elsewhere. Examples of uses which are affected and some of the results of increased salinity follow.

Agriculture in the Coachella, Imperial, Palo Verde, and Bard Valleys is very important to the National market because of the winter growing season. The heavily urbanized areas along the coast rely upon the Colorado for municipal supplies.

Present Colorado River salinity levels are marginally suitable for the key beneficial uses. The water can be softened (for domestic use) by additional treatment, but that process aggravates the salt balance problems in the long run. Blending with other imported supplies of lower salinity is practiced, but increased demand on those other supplies for additional blending to offset Colorado salinity increases would have serious adverse effects.

Most of the salinity in the Colorado derives from sources upstream from California, but there are local contributions in the Palo Verde Region. The Colorado River Basin Salinity Control Forum has developed a plan for salinity control of the Colorado River. The California Regional Water Quality Control Board (Region 7), which borders the river, closely monitors any developments which might impose additional salt loads on the river. Working with the Palo Verde Irrigation District, the Colorado River Board of California, and the USGS, the Regional Board has investigated possible sources of nonpoint salt loadings in the area.

A significant water quality problem in much of Southern California is the adverse salt balance. More tons of salts are imported in water supplies, feed, fertilizers, and other sources, than are exported. In addition, reclamation, recycling, and reuse of the water supply increase the concentration of dissolved minerals in the water.

California's primary need in this instance is to ensure that the situation does not worsen; i.e., that the salinity objectives of the Forum are met. It is, therefore, essential that the fiscal and institutional problems be solved so that water quality improvement projects adequate to maintain the standards are brought on line.

7. New Mexico

New Mexico's 305(b)[9] report did not specifically identify any problems within the Colorado River Basin. Data from 64 monitoring stations throughout New Mexico for the period between 1976-1981 indicate that stream water quality was good, in general, when compared to the water quality standards. Water quality is consistent with standards in over 90 percent of the perennial streams in New Mexico. Public Service of New Mexico is violating the total containment policy established by the Colorado River Basin Salinity Control Forum; however, a strict compliance schedule has been established.

B. Effects of Water Quality on Water Users

1. Recreation, Aesthetics, Fisheries

The major instream uses (uses when water is not depleted) in the Colorado River include hydroelectric power, propagation of fish and aquatic life, recreation (including swimming, water skiing, boating, rafting, etc.), and aesthetics. A number of conflicts between water uses have become more prominent issues in recent years. Temperature and the depth of withdrawal are significant with respect to downstream primary body contact sports and cold water sport fisheries versus conditions suitable for warm water endemic or endangered species.[10] In addition, the depth of withdrawal has become a significant issue concerning reservoir eutrophication, nutrient retention, aesthetics, and evaporation.

There can be many trade-offs in water quality, eutrophication, and aesthetics both in the reservoir and downstream, depending on the depth of reservoir withdrawal and the flushing rate.[11] A deep withdrawal is frequently cold and high in nutrients. This can mean ideal cold water sport fisheries downstream, but can also result in both high and low productivity in another downstream reservoir. Several factors, such as the flushing rate of the upstream reservoir, and the proximity and water uses of the downstream reservoir are very significant. Other trade-offs include temperature impacts on endangered species. At present there are some concerns about evaporation and nutrient processes in Fontenelle, Flaming Gorge, Lake Powell, and Lake Mead reservoirs.

Another potential problem is the conflict between the cold water sport fishery in tailwater streams and the warm water requirements of endangered fish further downstream. These are examples of water quality management alternatives which may be beneficial to one user and detrimental to another. At present, the policy is multiple use, and Reclamation has tried to optimize the greatest overall benefits.

2. Economic and Health Impacts

In the Lower Basin, present peak TDS 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. At the present time, TDS concentrations are being maintained below the standards. Complete development of apportioned water by the States will result in increases in TDS that would be more detrimental to agriculture without salinity control measures.

A consortium of water resources centers in the States of Arizona, California, Colorado, and Utah cooperated in a study funded by the Office of Water Research and Technology and the Bureau of Reclamation to assess the economic damages caused by various salt concentrations to agricultural and municipal water users. This study is documented in a report, Salinity Management Options for the Colorado River, Water Resources Planning Series Report P-78-003, June 1978.[12]

Based upon the findings of that report, Reclamation has published a summary working document entitled, Colorado River Salinity--Economic Impacts on Agricultural, Municipal, and Industrial Users.[13] The estimated future annual damages to the Lower Basin water users in 1976 dollars were $343,000[1/] for each 1 mg/L increase at Imperial Dam when concentrations reach the range of 875 mg/L to 1,225 mg/L. This damage figure is approximately $513,300[1/] per mg/L in 1982 dollars. These annual damages were calculated using the 1972 salinity standard of 879 mg/L (approved by EPA in 1975) and a projected full development salinity concentration of 1,225 mg/L at Imperial Dam.

The annual municipal damages are divided as follows: Metropolitan Water District, 54 percent; Central Arizona Project, 8 percent; and Lower Mainstem users, 8 percent. Total agriculture annual damages are 30 percent. Industrial impairments are not separated from municipal cost estimates.

The health impacts of high TDS waters presently are poorly understood and are a subject of some debate. High sulfate waters frequently exceeding 500 mg/L for local domestic supplies are known to cause problems in sensitive people, particularly infants, and to visitors who have not developed a tolerance. High levels of sodium in drinking water supplies may aggravate high blood pressure problems.

1/ The annual damages represent impact to users below Hoover Dam; damages from projects located downstream of Hoover Dam will be less.

PART VI. EVALUATION OF HISTORICAL TRENDS AND PRESENT SALINITY CONDITIONS

The Bureau of Reclamation has embarked on a major analysis of long-term salinity and specific ion trends. The analysis of trends contained in some 70 years of water quality records is possible with the extensive use of computers. Accordingly, the past 6 years have been devoted to digitizing water quality data and developing computer programs to reanalyze the entire record. This computerization, which is still in progress, is essential to understanding the long-term salinity trends throughout the recorded water quality history of the basin. The ongoing studies described in Part IX are largely directed to a better understanding of the relationships between land use, water use, hydrology, chemical and biological mechanisms, and long-term salinity trends.

Although this report provides a 2-year update of observed conditions in the basin, the goal is to understand the long-term trends and to then be able to accurately predict the near- and long-term future salinity at various levels of depletion and development. The CRSS model presented in Part VII predicts future salinity trends given expected depletions and salt loading schedules. Reclamation is also now using the computer extensively for long-term specific ion analysis and reservoir studies to improve these predictions.

A. Quality of Water Records

The evaluations of the historical salinity in the Colorado River Basin are based on streamflow records at selected stations as shown on Figure II-1. The basic data summarized in this report were obtained primarily from the USGS and were funded in part by Reclamation.

Salt loads and concentrations were generally calculated from daily conductivity and flow records. Correlations were used at each station to convert conductivity data to salt concentrations. Where records were not available, missing data were estimated by the use of correlations with other parameters or with other nearby stations.

Historical steamflow, salinity concentrations, and salt load data for the 20 key stations for the 1941-80 period of record are presented in Tables 1 to 20 at the end of this report. The average concentrations and loads were determined on a flow-weighted basis using daily data whenever possible. Some small differences ($\pm$1,000 acre-feet/year) in discharges from USGS records were noted and presumably occurred due to differences in rounding within the computer programs used.

B. Historical Analysis of Salinity

A trend analysis was made for two key stations in the lower basin to determine if, in the past, there have been significant changes in TDS, and what the range of fluctuations in TDS have been. A standard linear

regression, which is the best fit of the data using a straight line, was used to determine the mg/L per year change in TDS. The results of the regressions were then tested to see whether they were a statistical aberration or statistically significant. The data were then analyzed for fluctuations from either a mean, if the regression and significance tests showed no trend (the data could be averaged), or from the regression line. The results of the analysis for fluctuations were the development of confidence intervals. The 95 percent confidence intervals show the range within which the mean annual TDS fluctuates 95 percent of the time or conversely the range which may be exceeded 5 percent of the time.

The limitations of the trend analysis, as described, are based on the inability of the analysis to predict cause and effect relationships. The analysis does not lend itself to predicting future events since there are numerous causes (mechanisms) which combine together to influence the effect (TDS); however, the analysis does allow the simplification of the sometimes confusing variations in the data.

The results of the analysis for the period of 1941 to 1980 (see Figure VI-1) for the station below Hoover Dam indicate TDS increased at an average rate of 0.9 mg/L. Statistical tests showed the regression slope was not significantly different than zero. The average annual TDS concentration was found to be 697 mg/L. The 95 percent confidence interval was 697 mg/L $\pm$ 101 mg/L.

The results of the analysis for the period of 1941-1981 for the station at Imperial Dam indicate TDS increased at an average rate of 3.9 mg/L per year. Statistical tests showed the regression to be significant (see Figure VI-2). The 95 percent confidence interval was approximately $\pm$ 118 mg/L from the regression line.

Salinity concentrations at Imperial Dam (see figure VI-2) have decreased in an apparent steady decline from 1970 to 1979, dropped notably in 1980, and increased sharply in 1981. Generally the data are showing the buffering effect that over 50 million acre-feet of reservoir storage can have on the salinity concentration at Imperial Dam. With the Colorado River Reservoir System at such a high storage level, increased flows due to anticipatory flood control releases in 1980 lowered salinity concentrations at Imperial Dam temporarily. The next section discusses, in more detail, the factors which combine together to produce the fluctuations and trends found in the salinity data.

The 5-year moving averages are used to simplify the interpretation of the historical data, and to show an approximate simulation of the 5 to 7 year hydraulic retention time now present in the reservoir storage system.

C. Factors in Salinity Trend Analysis

Although the data vary within the range of expected values, the recent decline of TDS concentrations at some of the stations on the Colorado River has led to the hypothesis that some mechanism(s) may

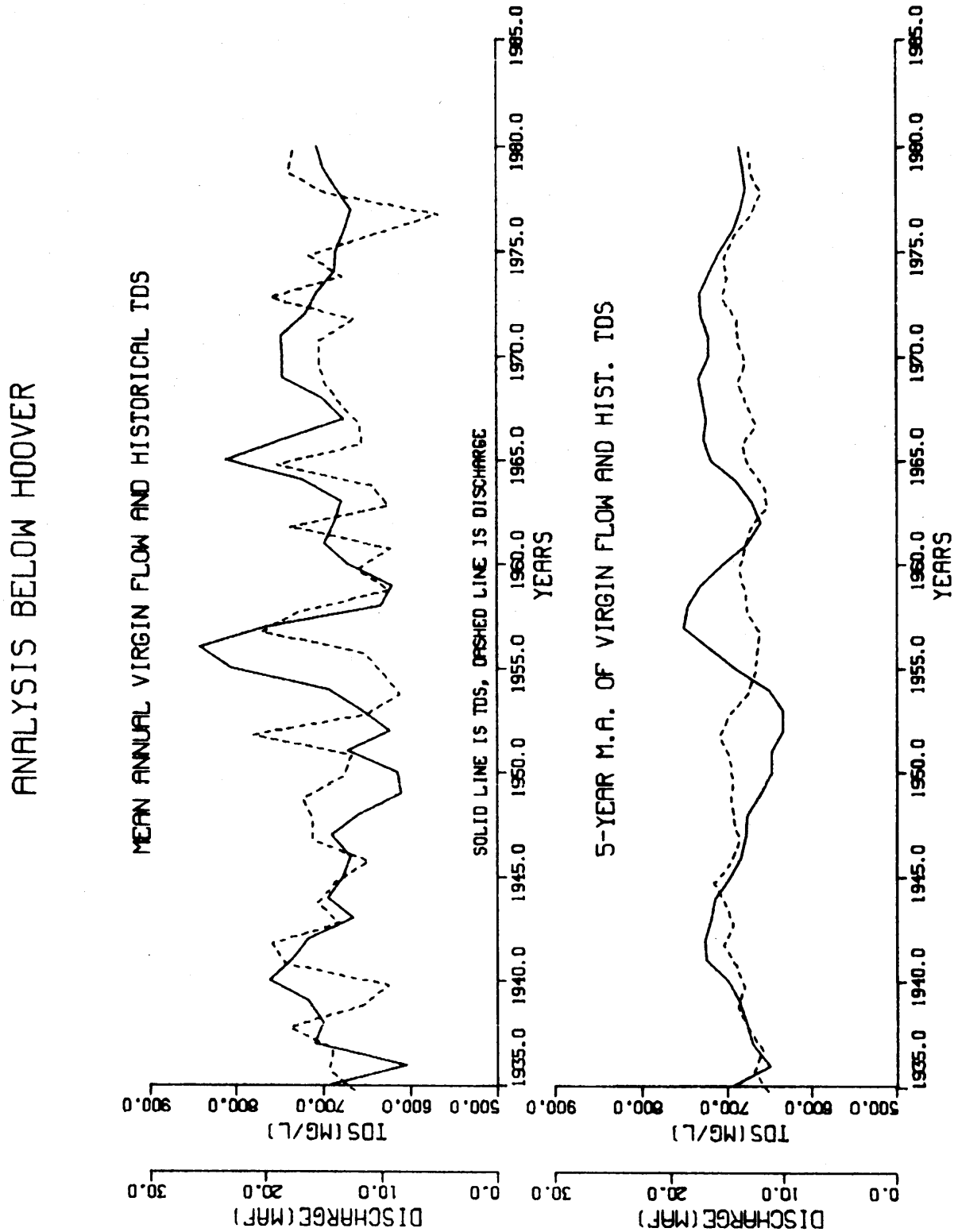


Figure VI-1 TDS Analysis below Hoover

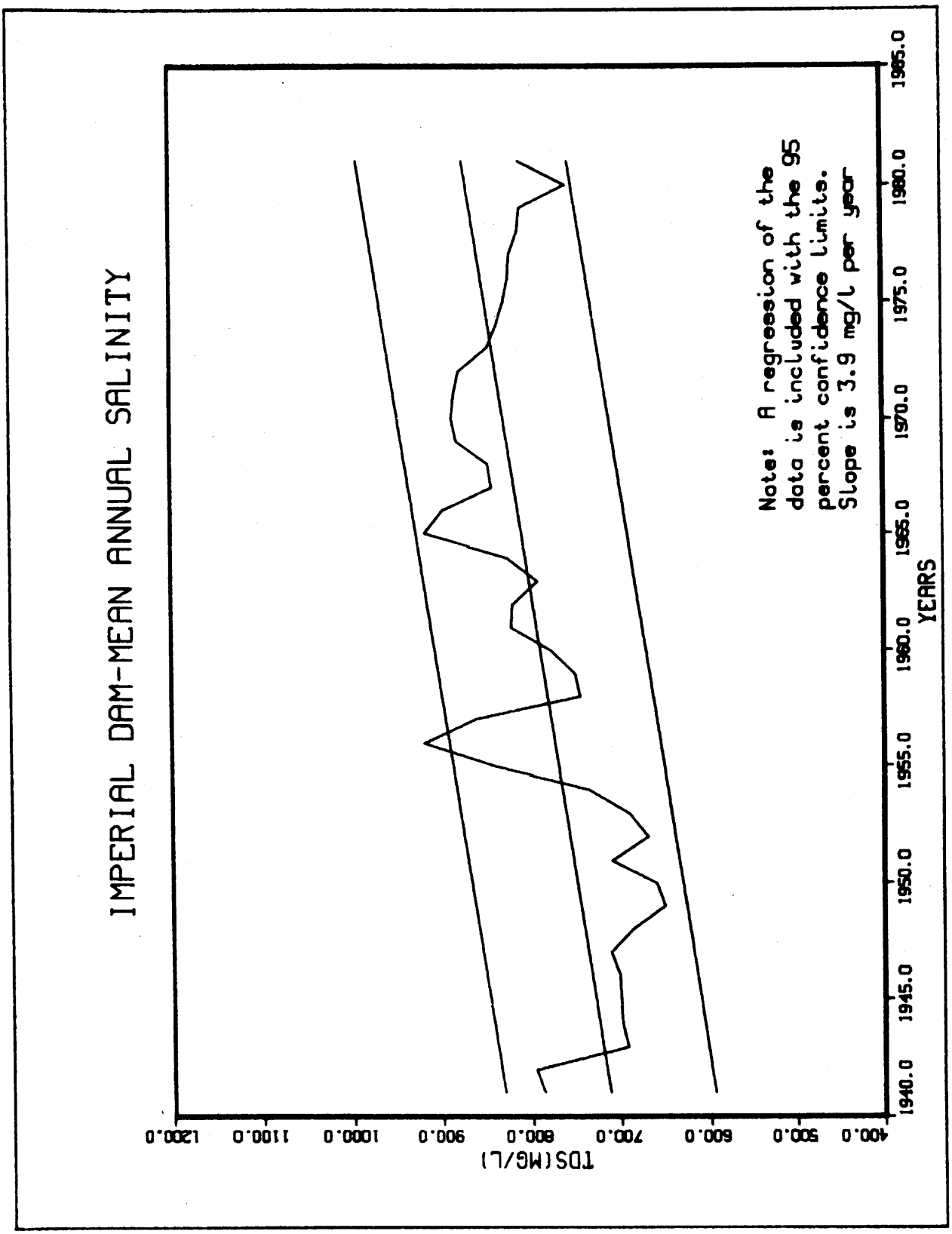


Figure VI-2 TDS Analysis at Imperial Dam

be decreasing the salinity of the Colorado River. However, several factors complicate the analysis of the decline and leveling off of salinity concentrations. The most significant of these are the natural variations in concentrations stemming from variations in runoff and the effects of initial filling and operation of the mainstem reservoirs. These and other factors, which may cause shifts in salinity, are discussed in the following sections.

1. Hydrologic Conditions

The salinity concentration in rivers generally decreases with increased flow on an annual basis. Years of lower flows are characterized by higher TDS concentrations than years of higher flows. Combining this characteristic with the lag time in the reservoir system because of storage suggests the decline of TDS concentrations may have been in part caused by the transition from a relatively drier period (1955 to 1965) with an annual virgin (undepleted) flow of 13.23 MAF at Lees Ferry, to a relatively wetter period (1965 to 1975) with an annual virgin flow of 14.76 MAF. This is an increase in the flow of approximately 10 percent and may be responsible for all or part of the 9 percent decrease in TDS concentration observed at Imperial Dam.

2. Reservoir Effects

The period of 1963-80 represents the most significant period of reservoir storage in the history of water development on the Colorado River. The storage in Flaming Gorge Reservoir, Lake Powell, and Lake Mead increased from less than 20 MAF in 1963 to over 50 MAF by 1980 (Figure VI-3). The spill of Glen Canyon Dam in 1980 ended the initial filling of the major reservoirs on the Colorado River.

During the initial filling, significant leaching of gypsum (calcium sulfate) was documented at Flaming Gorge[14] and Reudi Reservoirs[15] and at Lake Mead,[16] but gypsum leaching at Lake Mead and Reudi Reservoir has diminished. Final documentation of the long-term salt leaching at Flaming Gorge and Lake Powell is part of the ongoing ion constituency and reservoir studies described in Part IX.

The reservoir system, having completed its initial filling, is approaching a dynamic hydrologic equilibrium but chemical equilibrium has yet to be documented. The long-term implications of this dynamic equilibrium will require a very detailed analysis of reservoir water quality conditions for at least the 1975 to 1985 period.

In addition to salt leaching, the reservoirs may play an important part in other major factors which influence TDS. There is strong evidence that Flaming Gorge and Lake Powell have stored higher TDS water and routed the lower TDS spring runoff downstream from 1965 through 1980. There is a question as to whether this situation will continue after the reservoirs reach a more stable or equilibrium condition. Flaming Gorge is presently undergoing significant chemical changes as

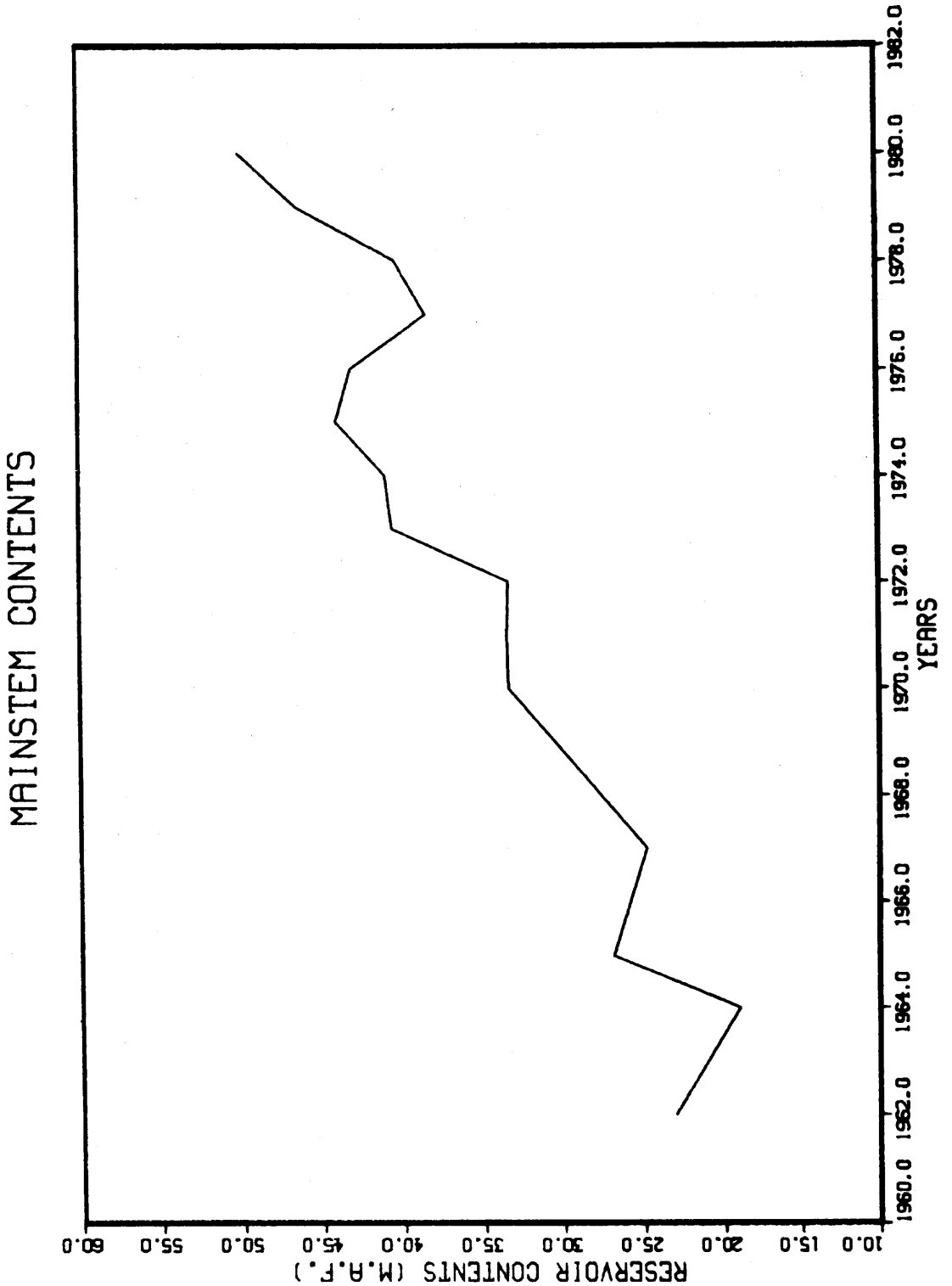


Figure VI-3 Storage at Flaming Gorge, Lake Powell, and Lake Mead

discussed in Part IX. The selective salinity routing observed in Flaming Gorge and Lake Powell in the 1970's may not be representative of future conditions.

When higher TDS waters remain in the reservoirs, they are subject to bank storage, chemical precipitation, ion exchange, oxidation reduction, and various biological activities.

In addition, it is possible that the sedimentation processes in the reservoirs may influence both TDS and the ratio of dissolved ions. Suspended sediment which is subject to mechanical degradation in a river environment may continue to release salts and exchange ions (sodium exchanged for calcium); however, once settled out in the reservoir these salts and ion exchange capabilities may be isolated. Sediment stored in reservoirs may contain salts which would have been released with continued mechanical breakdown in a riverine environment. Reservoir studies are discussed in detail in Part IX.

3. Irrigation and Increased Depletions

Most of the irrigation projects that deplete water and increase salt pickup to the river were largely in place before 1965. Moreover, like the newly inundated soils in reservoirs, the irrigated lands are also subject to a leach-out period. In cases where lands with poor drainage stored salt, these areas were taken out of production. In addition, irrigation practices changed significantly during the 1960-80 period, with canal and lateral lining, sprinkling systems, gated pipe, and trickle systems being introduced. These changes should result in reduced return flows and salt pickup.

Projected water depletions through the 1965-80 period were largely unrealized; total depletions increased by approximately 12 percent.

Average annual depletions by basin
(1,000 acre-feet)

	Upper Basin	Lower Basin
1970-1979	3,565	6,136 1/
1960-1969	2,538	6,119 1/ 2/
1950-1959	2,043	4,757 2/
1940-1949	1,894	3,776
1930-1939	1,712	3,676
1920-1929	1,998	3,662
1910-1919	1,656	3,643
1900-1909	1,001	3,373 2/

1/ Estimated from best available data.
2/ Lacking some years of data.

Previous Reclamation salinity projections have been too high, largely because the depletion projections were also too high. Transbasin diversions and increased reservoir evaporation account for the majority

of the increased depletions from 1960-1980; however, no additonal salt pickup or loading occurred with these depletions.

The large quantities of water expected to be depleted for steam power generation, coal gasification, oil shale, and mineral development have not been realized in the past decade. Even where new coal-fired powerplants have been constructed, some of the water has been obtained from existing agricultural rights. While water uses have often changed, the total depletions have increased only slightly.

In cases where powerplant water was obtained from existing agricultural supplies, salt pickup may have been reduced, since irrigated lands in areas of coal deposits are often saline soils of Mancos Shale origin.

Powerplants and new industries are no longer allowed to discharge saline cooling tower blowdown waters back to the river. This total containment policy resulted in some decreased salt loading during the 1970's. Leakage from evaporation ponds and other disposal methods may eventually allow some of these salts to reenter the river.

4. Reduced Flood Plains

The reservoirs have also significantly reduced the peak (flood) flows downstream (Figure IX-1). The consequent reductions in the downstream flood plains result in decreased bank storage and possibly reduced salt flushing. At least temporarily the area between the old and new flood plains may act as a salt sink, but the long-term salinity effects of the changes in the flood plains are not known.

5. Potential New Sources of Salt Loading

Many of the geologic formations of the Colorado River Basin were deposited in marine (salt water) or brackish water environments. Sulfates and sodium chloride are prevalent salts in most of these formations. Many of the sediments deposited in drier periods are capable of transmitting water, but these aquifers are frequently sandwiched between hundreds or even thousands of feet of impermeable shales (aquicludes). Therefore, these aquifers are static (no ground water movement) and often saline. Many static and saline aquifers are present in the Colorado River Basin. Drilling and mining activities can disrupt aquicludes and mobilize these saline static aquifers. When a path of flow is provided by drilling or mining, these aquifers are mobilized, and brackish or saline waters flow back to the surface.

Some states have enacted drilling and ground water laws to protect water quality. In the Colorado River Basin, ground water laws and strict enforcement are essential to prevent further saline aquifer movement and salt loading. Many small saline ground water springs and/or flowing wells that probably are linked to drilling activities have been identified in the basin and listed in previous progress reports.

Seismograph drilling activities may be particularly disruptive to shallow ground water systems and stricter regulation and enforcement should be considered.

The Meeker Dome Salinity Project described in Part VIII is one area where Reclamation has plugged abandoned oil exploration drilling holes anticipating that the aquifers are static and the saline water would not find another path back to the surface.

6. Switching the Reporting of TDS from Evaporation Residue at 180° C to Sum of the Constituents

It has been found that waters high in calcium sulfate salts retain water at 180° C, and thus yield high TDS results. Between 1968 and 1970, TDS was changed from a measurement of 180°C residue to sum of ionic constituents for all the USGS records used in this report. Since the Colorado River waters are high in sulfates, this may have produced a slight downward shift in the TDS data.

7. Salinity Control Projects

The actual implementation of salinity control units is described in Part VIII. Meeker Dome, Grand Valley Stage I, and possibly research pumping for the Paradox Unit have prevented some salts from reaching the river in the 1980-82 period. While the local impacts of these projects are still being evaluated, no effects are likely to have occurred as yet below Lake Mead because of the 5- to 7-year actual flow hydraulic detention time of the reservoirs.

8. Erosion

Several research projects have shown that steeply sloping saline shales yield high dissolved solids concentrations during runoff events. These and previous studies have primarily focused on conditions caused by summer and fall thundershowers. The total salt contributions from these events have been estimated to constitute less than 10 percent of the total salt budget of the studied tributaries. Lower elevation snowmelt events, particularly associated with saline marine formations, may contribute a greater portion of the salinity budgets. Analyses of the Green River near Green River station indicate that electrical conductivity remains high or may increase with flow peaks associated with snowmelt runoff events in January through April.

During the McElmo Creek salinity studies (described in Part VIII), it was found that approximately 32 percent of the total salt load could be related to such runoff events. Since some of these salts had previously been assigned to agricultural return flows, the project salinity benefits had to be revised. Similarly, recent Price River salinity studies showed 21 percent, and San Rafael 14 percent of the salt budget related to natural runoff.

A literature search and conversations with salinity erosion researchers reveal that practically no previous effort has been made to isolate January through April salt loads related to erosion and snowmelt runoff on lower elevation lands.

BLM salinity/erosion studies in the Price River basin show that at least one drainage yielded significantly reduced salt loads where experimental contour plowing and gully plugs were used for erosion control. The feasibility of erosion control as a mechanism to control salinity (including snowmelt runoff events) needs further investigation based on the BLM Price River studies.

The extreme annual and seasonal variation in the runoff events could also result in wide fluctuations in salt loading.

9. Shifts in Ion Constituents

Reductions in calcium and bicarbonate and increases in sodium and sulfate have been documented at Flaming Gorge Reservoir. Similar calcium bicarbonate reductions are hypothesized at Lake Powell. Precipitation of calcium carbonate from biological/chemical influences in the reservoirs has been hypothesized to limit salinity. Calcium reductions can result from precipitation, cation exchange (calcium exchanged for sodium), biological uptake, or chemical reaction between sodium bicarbonate and calcium sulfate. A number of mechanisms exist by which calcium and carbonate may be reduced. There is also evidence that in anoxic conditions, sulfates may be reduced to hydrogen sulfide gas and be released to the atmosphere. For the most part, once sodium, chloride, and sulfate are in solution, they tend to remain.

The overall significance of these mechanisms needs to be defined in terms of total salt reduction and economic benefits. Since calcium and bicarbonate are more readily treated by water softening methods than sodium, chlorides, or sulfate, the overall economic benefits of ion constituency shifts need careful future consideration.

D. Conclusions

Salinity concentrations at Lees Ferry and at Hoover, Parker, and Imperial Dams should remain, for at least the next few years, within the salinity standards. Unless an extended drought of several years or some unforeseen salt loading occurs, salinity should remain fairly stable, with small annual changes downstream from Hoover Dam in the next several years. Given good water conditions, salinity is likely to remain in the lower range of the predictions shown in Figures VII-1 and VII-2.

The Colorado River Reservoir System is currently at a high storage level (Figure VI-3). If above-average runoff occurs in 1983, additional flood control releases may be required, and any increases in flow are expected to decrease salinity levels downstream due to dilution.

Therefore, given average or greater water conditions, salinity concentrations appear favorable over the next 5 years. However as the Upper Basin States continue to develop their apportioned water, salinity levels are expected to rise (see CRSS salinity projections, Part VII).

It would be fortunate if future salinity conditions were partially alleviated by some natural salinity control mechanisms as has been hypothesized, since it is unlikely that all of the presently proposed salinity projects will yield feasible control methods. However, it is also highly unlikely that hypothesized natural salinity control mechanisms, primarily associated with calcium precipitation, can be depended upon to maintain salinity below the standards under future depletion conditions. Therefore, in order for the States to fully develop their apportioned water rights without exceeding the salinity standards, it is essential that major salinity control measures be implemented.

The downward fluctuation of salinity at Imperial Dam during the 1970's is within the expected range (95 percent confidence interval), and therefore cannot be judged as a significant long-term trend. In addition, should the Colorado River Basin experience extremely wet conditions for the next several years, salinity will continue to decline with new flood control releases. Extremely wet conditions for several years, say 1982-84, would result in spills from the Colorado River Reservoir System for the first time in many years.

Ironically, should such a wet period occur, the spill-induced lower salinity levels would occur simultaneously with the greatest effort to authorize and implement salinity control units. However, future dry cycles with major reservoir drawdown are just as likely to increase salinity levels. Therefore, the long-range predictions for salinity increases shown in the next chapter need to take precedence, particularly if a wet cycle should occur.

PART VII. ANTICIPATED EFFECTS OF ADDITIONAL DEVELOPMENT

An evaluation of the probable effects of developments on the flows and water quality of the Colorado River Basin was made using a computer model. The model, Colorado River Simulation System (CRSS), estimates the impacts of depletions and salt pickups caused by development at selected stations within the basin. Table A lists the project depletions and salt pickups used by CRSS to predict the results tabulated in Tables B anc C for zero level (virgin), 1980, 1990, 2000, and 2010 developments for both Federal and non-Federal projects.

A. Depletions and Salt Pickups (Table A)

Table A presents a summary of the estimated present and projected future depletion of water through the year 2010 for both the Upper and Lower Basins of the Colorado River. The projections for the years 1980 through 2010 represent Reclamation's best estimate of how water use will be developed over the next 30 years. The projections were made after consultation with individual States within the Colorado Basin; however, the projections adopted by Reclamation for planning purposes are not necessarily concurred with by the States. Table A was extracted from the latest data available as of July 1982.[1/]

Table A lists the salt pickups used by the CRSS model for the calculation of salinities in the upper basin. The lower basin salinities are calculated on a reach-by-reach basis using cumulative depletions and pickups, instead of on a project-by-project basis as in the upper basin, and are not listed. The salt pickups listed are the actual figures used in the model to calculate the salinity changes projeted by CRSS. Irrigation and transbasin diversions show salt gains and losses respectively; other uses (municipal, industrial, evaporation, mineral, etc.), with the exception of the Las Vegas Wash, show no gains in loading due to salt pickup.

1. Upper Basin Depletions

The present use depletions were developed starting with the depletions reported in the Upper Colorado Region Comprehensive Framework Study for a 1965 level of development, with the further addition to these values of depletions resulting from water projects completed in the subsequent 15 years. The other line items shown in the table are projects under construction in 1980 or anticipated for construction before 2010.

1/ It should be noted that Reclamation's projections assume that water development projects will come on line as planned. Experience has shown that actual water use has increased at a slower rate than projected.

2. Lower Basin Depletions

Estimates of future consumptive use by Lower Basin States of mainstem Colorado River water are derived from quantities recommended by the Supreme Court Decree in Arizona vs. California and lists of present perfected rights filed with the court and furnished to the Secretary of the Interior. Rates of development have been estimated in those cases where a particular use is presently either partially or fully undeveloped. Certain other existing uses are presumed to be curtailed when the Central Arizona Project becomes fully operational (assumed to be in 1986).

Table A
CRSS Project Depletions and Salt Pickup
1980-2010[4]

Sheet 1 of 5

	Type of use[1]	Depletions (1,000 acre-feet/year)				TDS pickup (1,000 tons/year)			
		1980	1990	2000	2010	1980	1990	2000	2010
WYOMING									
Present[2]	-	333	333	333	333	429.1	429.1	429.1	429.1
Lyman Project	Ir, Mu	8	10	10	10	11.5	14.4	14.4	14.4
Little Snake Diversion	Ex	8	15	20	50	-1.1	-2.0	-2.7	-6.8
Seedskadee	En, In, Mi	31	50	100	150	0.0	0.0	0.0	0.0
Private industry	Mi	0	50	57	57	0.0	0.0	0.0	.0.0
Total		380	458	520	600	439.5	441.5	440.8	436.7
COLORADO									
Present[2]	-	1,814	1,814	1,814	1,814	2,413.8	2,413.8	2,413.8	2,413.8
Fryingpan-Arkansas	Ex	56	69	69	69	-2.8	-3.5	-3.5	-3.5
Ruedi contracts	In, Mi	0	16	32	48	0.0	0.0	0.0	0.0
Blue Mesa Contracts	In, Mi	0	10	10	10	0.0	0.0	0.0	0.0
Animas-La Plata Project	Ir, Mu	0	3	119	120	0.0	2.3	94.2	95.4
Dallas Creek Project	Ir, Mu	0	12	17	17	0.0	6.7	10.0	10.0
Dolores Project	Ir, Mu	0	78	80	81	0.0	1.4	1.4	1.4
Denver expansion	Ex	60	110	160	216	-3.0	-5.5	-8.1	-10.9
Colorado Springs expansion	Ex	0	0	5	5	0.0	0.0	-0.3	-0.3
Homestake expansion	Ex	0	15	31	31	0.0	-0.8	-1.6	-1.6
Rangely Reservoir	In, Mu	0	5	12	18	0.0	0.0	0.0	0.0
Hayden-Craig	En	10	20	20	20	0.0	0.0	0.0	0.0
Windy Gap	Ex	0	30	54	54	0.0	-1.5	-2.7	-2.7
Oil Shale	Mi	0	30	75	100	0.0	0.0	0.0	0.0
Hydroelectric	Ev	0	0	30	30	0.0	0.0	0.0	0.0
Colorado Ute	En	0	12	12	12	0.0	0.0	0.0	0.0
Total		1,940	2,224	2,540	2,645	2,408.0	2,412.9	2,503.2	2,501.6

Table A (Continued)
CRSS Project Depletions and Salt Pickup
1980-2010[4/]

Sheet 2 of 5

	Type of use[1/]	Depletions (1,000 acre-feet/year)				TDS pickup (1,000 tons/year)			
		1980	1990	2000	2010	1980	1990	2000	2010
UTAH									
Present[2/]	-	668	668	668	668	2,353.8	2,353.8	2,353.8	2,353.8
Bonneville Unit - CUP	Ir, Mu, Ex	43	136	166	166	3.7	-15.5	-21.6	-21.6
Upalco Unit - CUP	Ir,Mu	0	12	12	12	0.0	6.2	6.2	6.2
Jensen Unit - CUP	Ir, Mu	11	15	15	15	24.3	33.2	33.2	33.2
Uintah Unit - CUP	Ir	0	3	28	28	0.0	1.6	14.5	14.5
Utah DWR Projects	Ir, Mu	7	12	12	12	7.6	10.6	10.6	10.6
Deferred Indian lands	Ir	0	9	84	84	0.0	4.7	43.4	43.4
Conversion of Irrigation to power	En	-4	-12	-12	-12	3/	3/	3/	3/
Emery County Project	Ir	11	8	8	8	3/	3/	3/	3/
Emery County Powerplants	En	13	39	39	39	0.0	0.0	0.0	0.0
Wellington Powerplants	En	0	0	35	35	0.0	0.0	0.0	0.0
Deseret Generation Co-op	En	0	12	12	12	0.0	0.0	0.0	0.0
White River Dam	Ev	0	6	6	6	0.0	0.0	0.0	0.0
Oil Shale	Mi	0	50	75	75	0.0	0.0	0.0	0.0
Gallup-Navajo Project	Mu	0	1	1	1	0.0	0.0	0.0	0.0
Warner Valley	Mu	0	21	40	40	0.0	0.0	0.0	0.0
Other municipal	Mu	2	3	5	6	0.0	0.0	0.0	0.0
Unidentified	-	0	0	0	8	0.0	0.0	0.0	0.0
Total		750	983	1,194	1,203	2,389.4	2,394.6	2,440.1	2,440.1

Table A (Continued)
CRSS Project Depletions and Salt Pickup
1980-2010[4]

Sheet 3 of 5

	Type of use[1]	Depletions (1,000 acre-feet/year) 1980	1990	2000	2010	TDS pickup (1,000 tons/year) 1980	1990	2000	2010
NEW MEXICO									
Present[2]	-	242	242	242	242	96.5	96.5	96.5	96.5
Animas-La Plata Project	Ir, Mu	0	0	27	34	0.0	0.0	13.8	13.8
Hogback Expansion	Ir	0	10	10	10	0.0	11.5	11.5	11.5
Utah International Inc.	En	22	39	39	39	0.0	0.0	0.0	0.0
Farmington	Mu, In	0	5	5	5	0.0	0.0	0.0	0.0
Navajo Indian Irrigation Project	Ir	100	208	267	267	114.9	239.0	306.8	306.8
Jicarilla Apache	Mu	0	3	3	3	0.0	0.0	0.0	0.0
Navajo contracts	En, Mi, Mu	10	71	75	63	0.0	0.0	0.0	0.0
Total		374	578	668	663	210.4	347.0	428.6	428.6
NEVADA									
Southern Nevada Water Project									
Las Vegas Valley Water District	Mu, In	92	67	90	114				
Henderson City	Mu	4	9	16	22				
Boulder City	Mu	4	8	12	15				
North Las Vegas City	Mu	7	10	17	22				
Nellis Air Force Base	Mu	2	3	3	3				
Basic Management, Inc. BMI	In,. Rec	9	10	14	18				
Henderson City	Mu	6	5	5	6				
Boulder City	Mu	1	1	1	1		(see footnote 5)		
Lake Mead Recreation	Rec	1	2	2	2				
Small Industry	In	0	1	1	1				
Harry Allen Powerplant	En	0	28	28	28				
Las Vegas Wash	Rec	-43	0	0	0				
Southern California Edison	En	10	18	23	23				
Total		93	162	212	255				

Table A (Continued)
CRSS Project Depletions and Salt Pickup
1980-2010[4]

Sheet 4 of 5

	Type of use[1]	Depletions (1,000 acre-feet/year)				TDS pickup (1,000 tons/year)			
		1980	1990	2000	2010	1980	1990	2000	2010
ARIZONA									
Present[2]	-	13	13	13	13	12.1	12.1	12.1	12.1
Navajo Powerplant	En	21	34	34	34				
Page Expansion	Mu	0	3	3	3				
Havasu Refuge	Rec	40	37	37	37				
Ft. Mohave Indians	Ir	13	60	60	60				
Kingman	Mu	0	0	9	18				
Mohave Valley I & DD	Ir	27	30	41	41				
Lake Havasu I & DD	Ir	9	14	14	14				
Central Arizona Project	Ir, Mu, In	0	1,515	1,488	1,464				
Colorado River Indians	Ir	349	383	398	398		(see footnote 5)		
Imperial Refuge	Rec	0	13	13	13				
Cibola Refuge	Rec	16	17	17	17				
Gila Project	Ir	401	450	450	450				
Yuma City	Mu	9	13	18	23				
Yuma County and Unit B	Ir	236	212	212	212				
Cocopah Indians	Ir	1	2	2	2				
Other uses	Ir, Mu, Rec, In	71	54	42	52				
		1,206	2,850	2,850	2,850				

Table A (Continued)
CRSS Project Depletions and Salt Pickup
1980-2010[4/]

Sheet 5 of 5

	Type of use[1/]	Depletions (1,000 acre-feet/year) 1980	1990	2000	2010	TDS pickup (1,000 tons/year) 1980	1990	2000	2010
CALIFORNIA									
Needles City	Mu, In	6	7	12	17				
Metro. Water District	Mu, In, Ex	817	550	550	550				
Ft. Mohave Indians	Ir	12	9	9	9				
Ft. Chemeheuvi Indians	Ir	0	5	8	8				
Colorado River Indians	Mu Ir	12	15	33	33				
Palo Verde District	Ir	418	423	423	423				
Blythe City	Mu	4	4	4	4				
Yuma Project	-	-	-	-	-				
Indian Unit	Ir	42	34	34	34				
Bard Unit	Ir	48	40	40	40		(see footnote 5)		
Reservation Division	Re	-28	-20	-20	-20				
Imperial Irrigation District	Ir	2,846	2,979	2,953	2,948				
Coachella Water District	Ir	532	485	485	485				
Imperial and Coachella	Re	0	-18	-18	-18				
Other uses	Ir, Mu, I	21	19	19	19				
Coachella Canal Lining	-	0	-132	-132	-132				
Total		4,370	4,400	4,400	4,400				

1/ En = Energy, Ev = Evaporation, Ex = Export, In = Industrial, Ir = Irrigation, Mi = Minerals, Mu = Municipal, Re = Return Flow, Rec = Recreation.

2/ Represents sum of projects completely developed in the Upper Colorado River Basin as of 1980.

3/ Being evaluated.

4/ See disclaimer, Part I, section A.

5/ Lower Colorado River Basin CRSS model does not consider each project separately. TDS pickup is not broken out by project. It is input on a reach by reach (cumulative) basis.

B. Colorado River Simulation System--Water Quality Projections

1. Introduction

The CRSS is a package of computer programs and data bases developed by the Bureau of Reclamation as a tool to be used by water resource managers dealing with water related issues and problems in the Colorado River Basin. The CRSM (Colorado River Simulation Model), the central feature to the CRSS, is a computer program which simulates the flow of salt and water through the system and the operations of the hydroelectric powerplants. The CRSM is a deterministic model and operates on a monthly time frame. Salts and water are routed through the system by a simple mass balance accounting procedure in which TDS is modeled as a conservative parameter. No calculations are included for the chemical equilibrium or precipitation of salts.

Among the assumptions used in CRSS salinity projections is that in routing salt through a given reservoir there is complete mixing each month. This assumption is not presently valid for some of the larger reservoirs, but is used as an approximation for lack of a better routing method. Lake Powell and Flaming Gorge Reservoirs do not currently conform to this assumption, but they are relatively new reservoirs and have not yet reached chemical equilibrium. The two-dimensional reservoir study detailed in the Special Study Section is designed to determine if a better reservoir salt routing method, using an adjustment for calcium carbonate precipitation, can be developed which could improve CRSS projections in the future.

An ion constituency study has been designed to check the assumption that historical conditions can be used to predict future conditions. If salinity trends or shifts in ion constituents can be defined, CRSS could be modified to reflect these TDS trends to improve predictive capabilities.

The development and use of CRSS is an ongoing (learning) process; however, results from the model have been favorably compared against the 1968-78 historical conditions, and Reclamation believes that in its present form CRSS is the best predictive tool available.

2. Application of Model

Hydrology information used in the data base includes natural flow and salt records from 1906 to 1978. This information was developed from historical streamflow records, cropped acreages, evaporation, bank storage calculations for the reservoirs, and recorded diversions and return flows. Assumptions underlying the data base are:

a. Recorded flows are accurate;

b. Diversions and irrigated acreages are recorded or can be estimated within reasonable limits;

c. Consumptive use and reservoir evaporation are computable within reasonable limits;

d. Return flows may be lagged, routed, and attenuated;

e. The remaining residuals can be explained by other hydrologic parameters such as precipitation, bank storage, or ground water inflows which can be either calculated or otherwise accounted for by the historical hydrologic records correlations.

This explanation is a simplified description of the CRSS. Withdrawals and depletion of water from the river are included in the data reflecting the approximate physical location by reach of the various water demands on the river, including withdrawals for a given user at a demand point; depletions and return flows; lag time in months for return flows; year of withdrawal and depletion; salt pickup; location of withdrawal, and location of return flow. A more detailed explanation is found in the Colorado River Simulation System, An Executive Summary, October 1981. The CRSS is now felt to constitute a reasonably accurate tool for predicting the future effects of additional water depletions, related salt loading and return flows, and river operation changes for flow and salinity conditions.

The range of projected salinities at Imperial Dam, based on the depletion schedule shown in Table A with and without the effects of the Water Quality Improvement Projects, is shown in Figures VII-1 and VII-2.

For the purpose of the study, 15 estimates of the 1980 to 2010 conditions were run simulating 15 sets of possible hydrologic conditions per year. The initial year (1980) was started with the 1908 hydrologic conditions in the period of study. The base hydrologic condition was then incremented by 5 years, such that the 1980 to 2010 period utilized the 1913 to 1943 hydrology. In this way, incrementing the natural flow data base 5 years each time, 15 estimates per year of the 1980 to 2010 predictions were developed, permitting a range of conditions to be displayed and considered. The process was followed twice, once without water quality improvement projects in place and once with all the same projects on line according to the present schedule shown in Figure VIII-1. Since the water quality improvement projects are still in various stages of planning, the salt reduction figures will be periodically revised as more detailed information becomes available.

The projected minimum represents the average of the 3 lowest salinities out of the 15 hydrologic variations conducted for each year; the mean is the average salinity of the 15 variations; the median is the salinity that was exceeded 50 percent of the time; and the projected maximum is the average of the highest 3 of the 15 salinity conditions for each year.

Mean flow and flow-weighted salinities at 22 stations throughout the basin for the years 1990, 2000, and 2010 are shown in Table B.

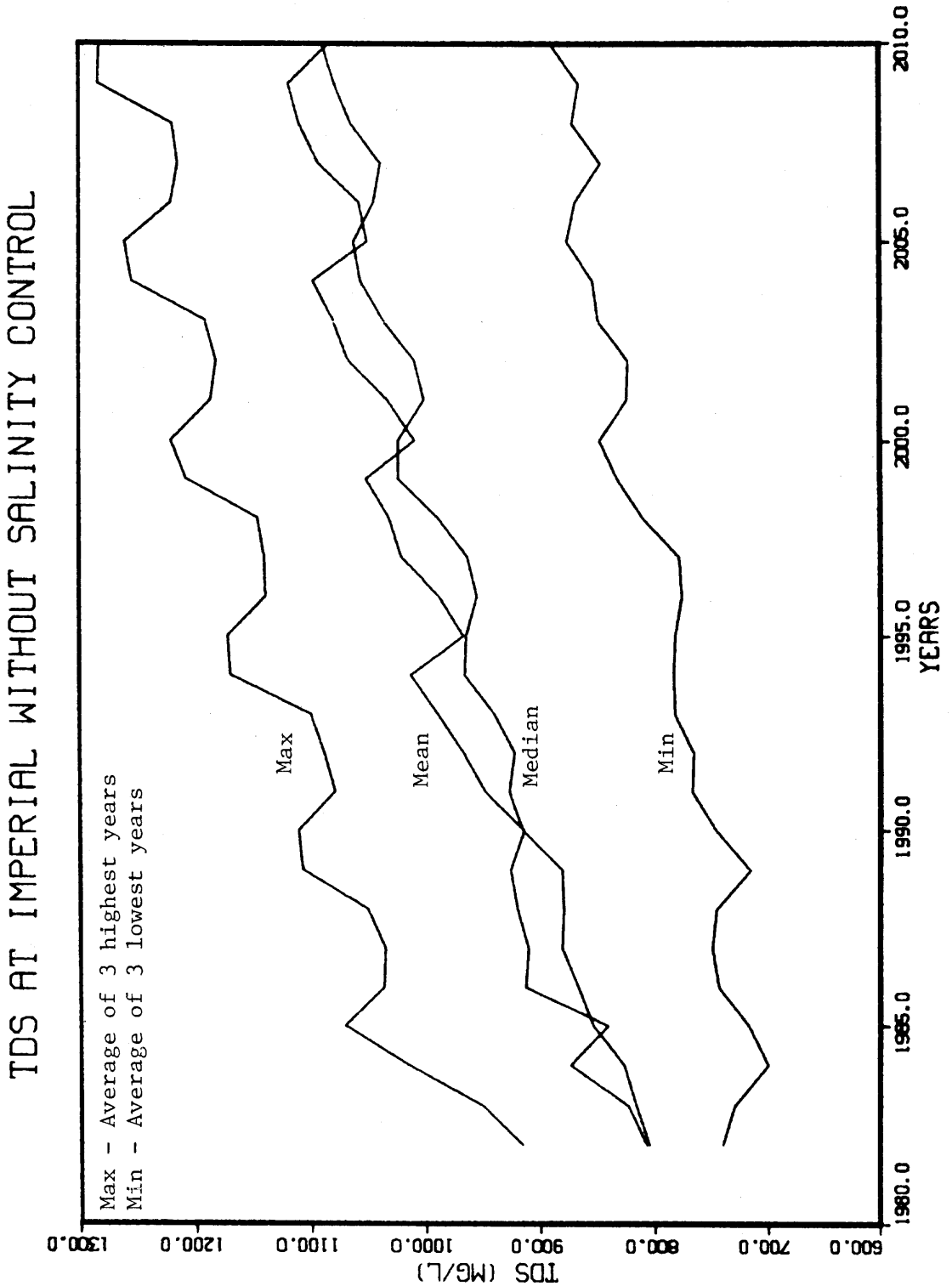


Figure VII-1 CRSS Projections (without Water Quality Improvement Program)

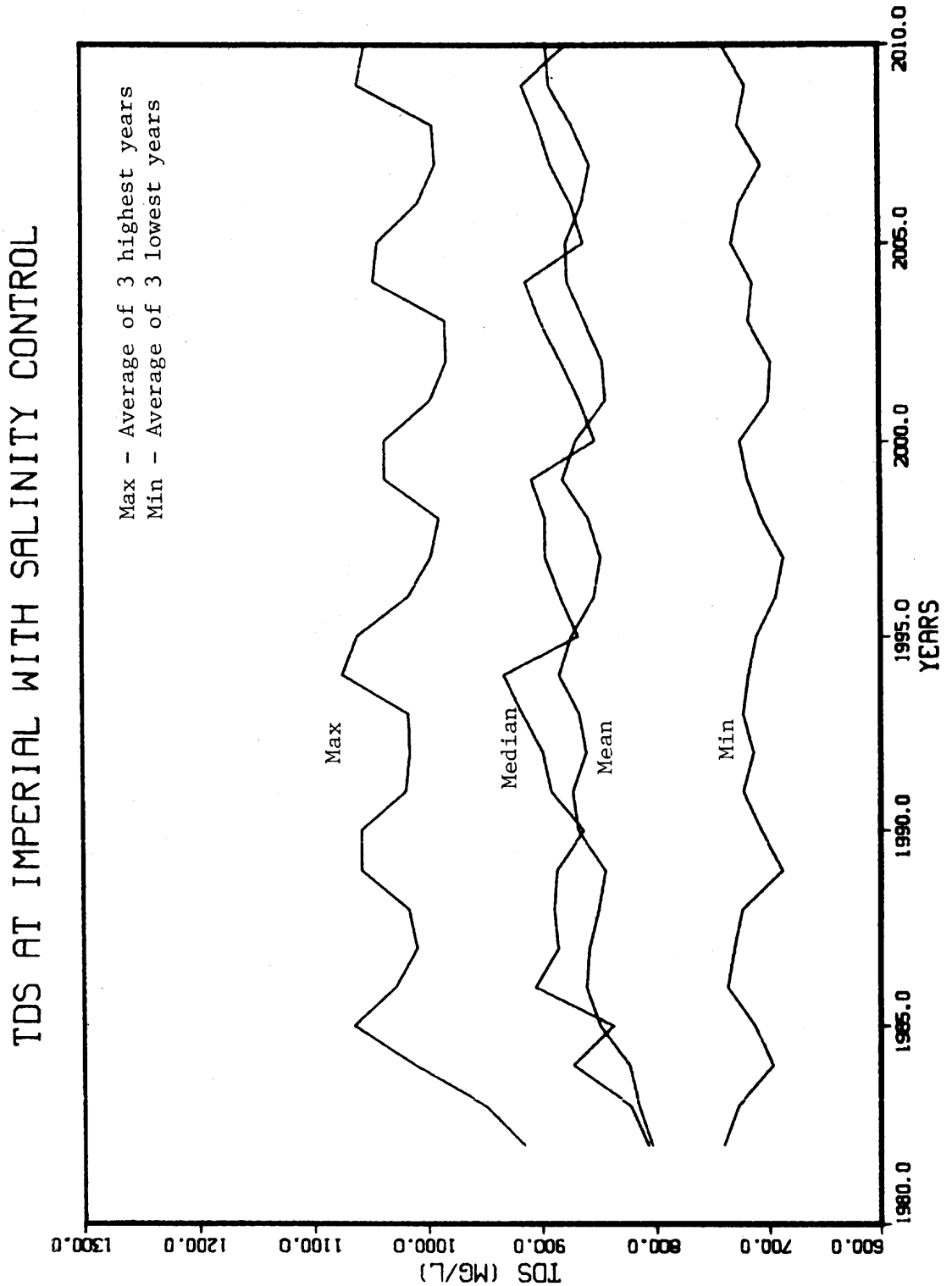


Figure VII-2 CRSS Projections (with Water Quality Improvement Program)

The effects of the salinity control projects are shown in Table C. It should be noted that these estimates differ from those presented in the past for three main reasons.

a. CRSS utilizes the 1906-78 period of record rather than 1941-78, resulting in an average 1 MAF per year more water;

b. The reservoir levels are allowed to rise and fall over their entire permissible range, resulting in different evaporation rates and greater water availability during low flow years;

c. The effects of development in the Upper Basin are buffered as the river passes through Lakes Powell and Mead, resulting in a hydraulic detention timeline of 5 to 7 years depending on actual storage before the impacts are perceived at Imperial Dam.

C. Future Effects Equation

The CRSS model was used to develop equations to predict the change in salinity concentration at Imperial Dam. The equations are recommended for use in evaluating alternative projects on a comparable basis. While the CRSS model may be used in more detailed studies, the major benefit of the model, predicting baseline 2010 conditions, has then been factored into the future effects equations, as described below.

The future effects equations are based on the conditions listed in Table B for 2010 conditions. Use of the 2010[1/] future effects equations in all studies on projects within the Colorado River Basin will provide consistency in the assessments of the impacts on salinity at Imperial Dam. The 2010 future effect at Imperial Dam is calculated from the salt loading relationship for projects above and below Parker Dam as follows:

10,000 tons above Parker Dam = 1.01 mg/L at Imperial[2/]

10,000 tons below Parker Dam = 1.28 mg/L at Imperial[2/]

These two equations do not assess the impact of water use (depletions) or water savings (due to water quality improvement projects). When calculating the impact of a water quality improvement project, water saved may be redeveloped within the states' apportioned water right.

1/ The 1990 and 2000 level equations are available (USBR).

2/ Although the impacts for projects below Parker Dam are calculated as being higher for TDS concentration, the economic impacts are 70 percent less due to the economic impacts to water users above Parker Dam.

Thus the redevelopment of this water will mitigate the TDS impact of the water savings.

In some special cases when depletions need to be considered, the expanded 2010 future effects equation may be used to calculate the combined or individual effects of salt loading and flow from projects located above Parker Dam as follows:

$$C = \left(\left[6782 \frac{(10606 + X)}{(8617.5 + Y)}\right] - 8347\right) \frac{735.29}{5726}$$

where

C = Change in TDS (mg/L) at Imperial
X = Change in salt load due to project in 1,000 tons
Y = Change in flow due to project in 1,000 acre-feet
735.29 = Conversion from tons/acre-feet to mg/L

The expanded 2010 future effects equation for projects below Parker Dam is:

$$C = \left(\left[5726 \frac{(8480 + X)}{(5726 + Y)}\right] - 8480\right) \frac{735.29}{5726}$$

The assumption behind these equations is that any project impact will be passed unchanged to Parker Dam. At Parker Dam, a relatively constant annual flow is passed downstream to Imperial Dam, with the remainder being sent to the Metropolitan Water District and the Central Arizona Project. Project impacts below Parker Dam are passed unaltered to Imperial Dam.

The future effects equations will be updated with new CRSS data and projections in each successive progress report or as needed. The equation will be moved forward 10 years each decade so that in 1990 the future effects equation will be changed from 2010 to 2020. This will continue until full development of the basin has been reached.

Table B
Summary of Mean Annual Discharge and TDS Conditions by Depletion Level
Without Water Quality Improvement Program[2/]

	Flow by Depletion Level (1,000 AF/Yr)					TDS Concentration by Depletion Level (mg/L)					TDS Load by Depletion Level (1,000 Tons/Yr)				
	Virgin	1980	1990	2000	2010	Virgin	1980	1990	2000	2010	Virgin	1980	1990	2000	2010
Green River near Green River, WY	1,441	1,157[1/]	1,101	1,010	946	90	386	403	440	469	177	607[1/]	603	604	603
Green River near Greendale, UT	1,967	405[1/]	1,362	1,204	1,219	227	497	504	549	585	606	274[1/]	934	899	970
Yampa River near Maybell, CO	1,219	1,117	1,105	1,066	1,028	119	152	153	158	161	197	231	230	229	225
Duchesne River near Randlett, UT	776	362	263	194	185	165	851	1,152	1,645	1,711	174	419	412	434	430
White River near Watson, UT	562	525	490	443	392	218	488	480	465	467	167	348	321	280	249
Green River at Green River, UT	5,420	3,109[1/]	3,423	3,423	3,279	248	533	548	591	618	1,828	2,254[1/]	2,836	2,751	2,756
San Rafael River near Green River, UT	180	106	100	96	94	470	1,363	1,230	1,212	1,240	115	196	167	158	159
Colorado River at Glenwood Springs, CO	2,127	1,574	1,492	1,348	1,226	188	315	331	362	393	544	674	672	664	655
Colorado River near Cameo, CO	3,538	2,700	2,599	2,420	2,263	261	448	464	495	525	1,254	1,645	1,640	1,629	1,616
Gunnison River near Grand Junction, CO	2,321	1,773[1/]	1,822	1,830	1,765	188	674	685	685	704	592	1,625[1/]	1,697	1,705	1,690
Dolores River near Cisco, UT	812	749	674	727	751	330	480	459	435	426	364	489	421	430	435
Colorado River near Cisco, UT	6,758	5,085[1/]	4,983	4,888	4,698	256	643	657	670	694	2,349	4,447[1/]	4,452	4,454	4,434
San Juan River near Archuleta, NM	1,203	503[1/]	607	555	439	91	139	167	163	163	149	95[1/]	138	123	97
San Juan River near Bluff, UT	2,157	1,267[1/]	1,394	1,307	1,201	240	619	663	807	871	703	1,067[1/]	1,257	1,434	1,423
Colorado River at Lees Ferry, CO	14,980	9,770[1/]	10,418	9,537	8,954	270	529	635	701	737	5,508	7,029[1/]	8,997	9,092	8,975
Colorado River near Grand Canyon, AZ	-	10,125	10,774	9,895	9,322	-	564	664	730	766	-	7,766	9,729	9,824	9,711
Virgin River at Littlefield, AZ	-	175	167	142	151	-	1,309	1,111	1,056	1,028	-	312	252	204	211
Colorado River below Hoover Dam, AZ-NV	-	12,628	10,440	9,608	9,268	-	685	745	816	858	-	11,764	10,578	10,663	10,815
Colorado River above Parker Dam, AZ-NV	-	12,320	10,085	9,228	8,862	-	695	758	833	880	-	11,645	10,396	10,454	10,606
Colorado River below Parker Dam, AZ-CA	-	11,202	7,240	6,903	6,782	-	704	773	854	905	-	10,725	7,611	8,017	8,347
Colorado River at Imperial Dam, AZ-CA	-	10,231	6,218	5,848	5,726	-	781	915	1,024	1,089	-	10,867	7,738	8,144	8,535

1/ The 1980 depletion level conditions were based on the 1979 end-of-year reservoir conditions. The low flow conditions at some of the stations resulted from the filling of reservoirs previously drawn down to meet power generation commitments in the upper region.

2/ From CRSS projections as of November 5, 1982.

Table C
Summary of Mean Annual Discharge and TDS Conditions by Depletion Level
With Water Quality Improvement Program[2/]

	Flow by Depletion Level (1,000 AF/Yr)					TDS Concentration by Depletion Level (mg/L)					TDS Load by Depletion Level (1,000 Tons/Yr)				
	Virgin	1980[2/] 1	1990	2000	2010	Virgin	1980	1990	2000	2010	Virgin	1980[2/]	1990	2000	2010
Green River near Green River, WY	1,441	1,157[1/]	1,101	996	931	90	386	403	388	414	177	607[1/]	603	526	519
Green River near Greendale, UT	1,967	405[1/]	1,362	1,205	1,130	227	497	504	515	545	606	274[1/]	934	844	838
Yampa River near Maybell, CO	1,219	1,117	1,105	1,066	1,028	119	152	153	158	161	197	231	230	229	225
Duchesne River near Randlett, UT	776	362	262	193	185	165	851	945	1,161	1,206	174	419	337	305	303
White River near Watson, UT	562	525	490	441	390	218	488	403	392	392	167	348	269	235	208
Green River at Green River, UT	5,420	3,109[1/]	3,806	3,391	3,158	248	533	526	528	552	1,828	2,254[1/]	2,723	2,435	2,371
San Rafael River near Green River, UT	180	106	100	84	82	470	1,363	1,230	988	962	115	196	167	113	107
Colorado River at Glenwood Springs, CO	2,127	1,574	1,492	1,348	1,226	188	315	331	362	393	544	674	672	664	655
Colorado River near Cameo, CO	3,538	2,700	2,599	2,404	2,247	261	448	464	402	426	1,254	1,645	1,640	1,314	1,302
Gunnison River near Grand Junction, CO	2,321	1,773[1/]	1,821	1,829	1,764	188	674	647	494	506	592	1,625[1/]	1,602	1,229	1,214
Dolores River near Cisco, UT	812	749	673	727	750	330	480	260	248	245	364	489	238	245	250
Colorado River near Cisco, UT	6,758	5,085[1/]	4,980	4,869	4,679	256	643	563	464	479	2,349	4,447[1/]	3,813	3,073	3,048
San Juan River near Archuleta, NM	1,203	503[1/]	607	555	439	91	139	167	163	163	149	95[1/]	138	123	97
San Juan River near Bluff, UT	2,157	1,267[1/]	1,393	1,306	1,200	240	619	647	776	837	703	1,067[1/]	1,226	1,378	1,366
Colorado River at Lees Ferry, CO	14,980	9,770[1/]	10,412	9,395	8,810	270	529	598	578	599	5,508	7,029[1/]	8,468	7,385	7,177
Colorado River near Grand Canyon, AZ	-	10,125	10,768	9,752	9,178	-	564	628	612	635	-	7,766	9,197	8,117	7,926
Virgin River at Littlefield, AZ	-	175	179	152	161	-	1,309	883	778	760	-	312	215	161	166
Colorado River below Hoover Dam, AZ-NV	-	12,628	10,467	9,587	9,243	-	685	714	697	708	-	11,764	10,164	9,088	8,900
Colorado River above Parker Dam, AZ-CA	-	12,320	10,112	9,206	8,838	-	695	727	712	727	-	11,645	9,998	8,914	8,738
Colorado River below Parker Dam, AZ-CA	-	11,202	7,267	6,881	6,794	-	704	742	731	748	-	10,725	7,333	6,841	6,911
Colorado River at Imperial Dam, AZ-CA	-	10,231	6,245	5,826	5,738	-	781	869	870	894	-	10,867	7,381	6,893	6,977

1/ The 1980 depletion level conditions were based on the 1979 end-of-year reservoir conditions. The low flow conditions at some of the stations resulted from the filling of reservoirs previously drawn down to meet power generation commitments in the upper region.

2/ From CRSS projections as of November 5, 1982.

PART VIII. COLORADO RIVER BASIN 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 2 previous fiscal years. The report is to include the effectiveness of the units, anticipated work to be accomplished 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, Colo.; the Grand Valley Unit, Colo.; and the Las Vegas Wash Unit, Nev. The schedule of planning reports for projects authorized for construction is shown on Figure VIII-1. This section of the report presents a brief description and summary of the status of investigations for each of the projects authorized for construction. (A fourth unit, Crystal Geyser, was also authorized, but this unit is now inactive due to low cost effectiveness.)

1. Paradox Valley Unit

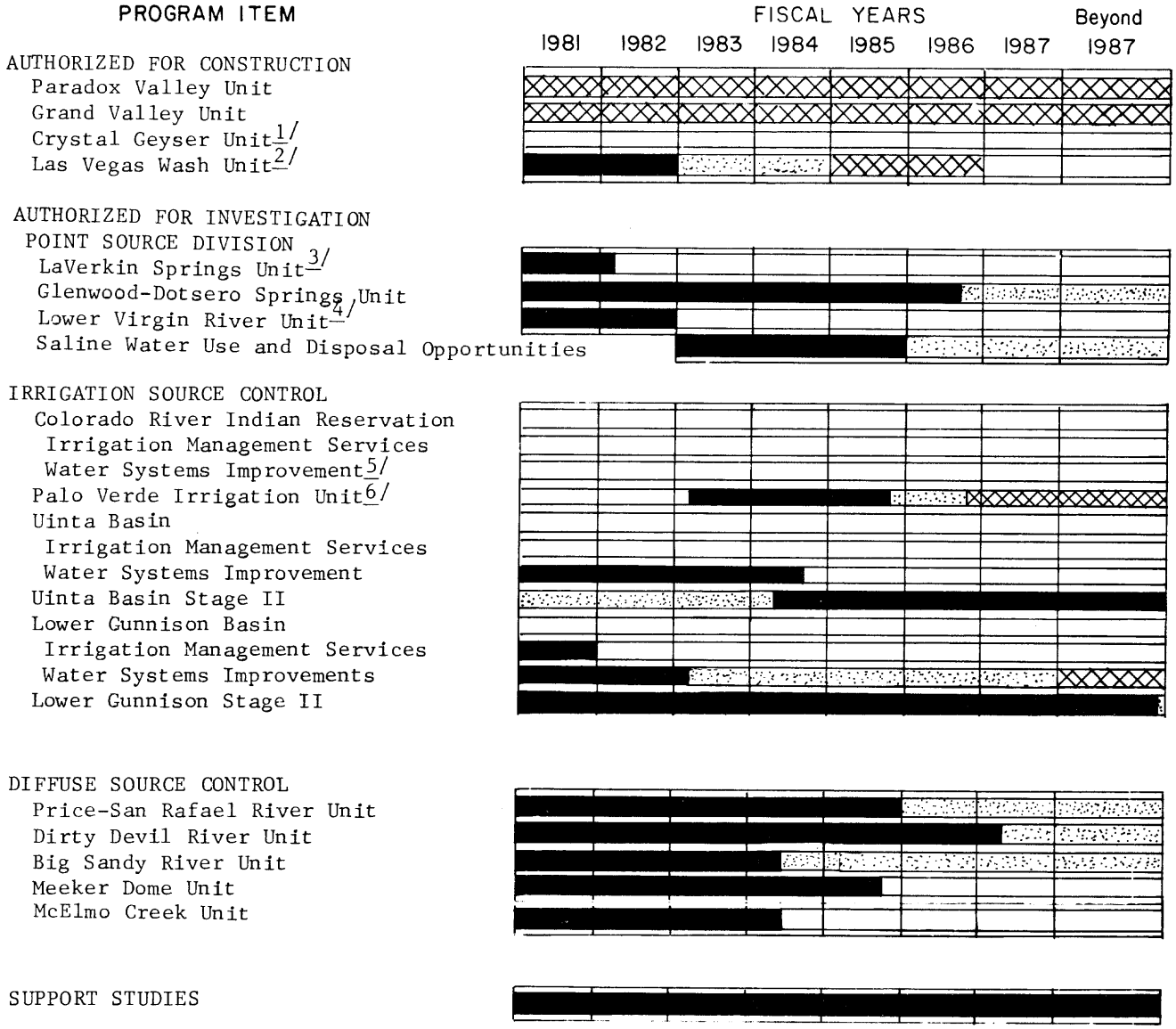
Paradox Valley, a collapsed salt anticline, is a northwest-southeast trending valley 3 to 5 miles wide in southwestern Colorado.

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 long. Paradox Valley lies along the axis of one of these salt anticlines and was formed from erosion of faulted and uplifted sandstone and shale formations from above a residual gypsum cap overlying about 14,000 feet of pure salt and salt-rich shale. The Dolores River remained in its ancient streambed as the uplift and erosion of the valley developed. West Paradox Creek heads in the La Sal Mountains and flows southeast through the northwestern half of the 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.

Ground water comes into contact with the top of the salt formation where it becomes nearly saturated and surfaces in the Dolores River channel in Paradox Valley. Studies conducted by Reclamation have

INVESTIGATION AND CONSTRUCTION SCHEDULE

COLORADO RIVER WATER QUALITY IMPROVEMENT PROGRAM



1/ Construction not scheduled.
2/ Las Vegas Wash Unit construction is contingent on local consensus.
3/ Concluding Report prepared December 1981.
4/ Concluding Report prepared March 1982.
5/ Concluding Report prepared October 1979-BIA will improve the canals and laterals.
6/ Status Report prepared March 1980; Special Report prepared July 1981.

INVESTIGATION
PRECONSTRUCTION INVESTIGATION
CONSTRUCTION

Fig. VIII - 1

indicated that the river picks up over 205,000 tons of salt annually as it passes through the valley.

In its Definite Plan Report, Reclamation recommended that a series of wells be drilled on both sides of the river into the brine zone to pump the saline ground water, lowering the interface between the fresh ground water and the underlying brine. The brine would then be stripped of hydrogen sulfide gas and pumped to a terminal evaporation pond in Dry Creek Basin.

Before installing permanent facilities, a verification pumping program was initiated to determine, among other things, what pumping rate is required to reduce the brine inflow. This program has shown that by pumping at a rate of 1.2 ft^3/s (cubic feet per second), approximately 60 percent of the brine inflow can be controlled. It is projected that by installing five more pumping wells in strategic locations and pumping at 2 ft^3/s, 180,000 tons of salt per year can be removed. Initially, a 5 ft^3/s pumping rate was estimated to be necessary to control brine inflow.

The projected lower pumping rate changed the criteria for evaluating disposal methods, showing that deep well injection as a method of brine disposal would be more attractive from technical, economic, and environmental standpoints. Accordingly, the new plan consists of disposing of the brine in a permeable limestone formation deep under Paradox Valley.

Williams Brothers Engineering Company, a consulting firm experienced in deep well waste disposal, was hired to determine feasibility and to design facilities and prepare technical specifications for construction of a deep well injection facility. They concluded that deep well brine disposal is applicable to Paradox Valley and that an existing "wildcat" oil well could be rehabilitated and tested. Test results will determine if an additional well is needed to handle the 2 ft^3/s. After completion and testing of all required injection wells, and if injection proves feasible, the Definite Plan Report will be amended and an Environmental Assessment prepared to reflect the brine disposal change. Design and construction of permanent surface facilities will follow approval of the reports. The project should be in operation by 1988.

Conditional water rights have been obtained from the State of Colorado and application will be made for a permanent water right permit for the 19 wells presently being pumped. A portion of the releases from McPhee Reservoir will be utilized as augmentation for the diverted brine flows. Lands downstream which presently irrigate with water containing the saline flows will benefit from the better quality augmented flows. Thus, the diversion-augmentation plan may be recognized by the State of Colorado as a beneficial use.

2. Grand Valley Unit

The Grand Valley is located in the saline Mancos Formation in western Mesa County, Colo. Within the valley the irrigated lands have been developed on areas with a few feet of residual soil, on alluvial plains and pediments with deeper soil, and on some terraces, all overlying Mancos Shale.

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.

A total of about 67,000 acres is served by these irrigation entities, with approximately 31,000 acres under the Federal project. Major crops produced in the valley are corn, small grain, alfalfa, pasture, and various orchard crops.

The Grand Valley is estimated to contribute an average of about 580,000 tons of salt annually to the Colorado River, based on a long-term water and salt budget study conducted by the Bureau of Reclamation, Grand Junction Projects Office. This is a revision from 780,000 tons/year. The new estimate was made by combining several methods used in the 1976 USGS report, "Salt Load Computations-Colorado River, Cameo, Colorado to Cisco, Utah." Most of these salts are leached from the soil and underlying Mancos Shale by deep percolation and seepage from water delivery systems and are carried into the river by ground water inflow.

The Mancos Formation is a thick sequence of gray fissile shale varying locally from 4,000 to 5,000 feet thick. Many white patches of salt are visible on the nonirrigated surfaces, and some patches are also visible on the irrigated lands where drainage is poor. The salts present in the 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.

Below the soil, the near-surface weathered zone of Mancos Shale transmits water along joints, fractures, and open bedding planes. Percolating water from irrigation and conveyance system seepage dissolves salts present in the weathered shale zone. As most of the soils forming the irrigated lands have been derived from Mancos Shale, they are also a source of salt.

The purpose of the Grand Valley Unit is to reduce the salt loading to the Colorado River by reducing the seepage from the water delivery systems and implementing on-farm improvements. The combination of these programs would reduce the amount of ground water percolating into the saline soils and underlying Mancos Shale. Systems improvement studies are being conducted by Reclamation of the Department of the

Interior while on-farm improvement studies are being conducted by the SCS (Soil Conservation Service) of the Department of Agriculture.

Reclamation's studies of the Grand Valley Unit are being conducted in stages. Stage One is under construction in a portion of the valley where plans and designs are complete, where sufficient data are available to assess the impacts of the initial development, and where environmental impacts will not be significant. Concurrently, investigations and plan formulation activities are being conducted on Stage Two.

As part of the plan of development for Stage One, 6.8 miles of the Government Highline Canal were concrete lined and cross-drainage facilities were completed for the 1981 irrigation season. Construction work began in October 1981 to consolidate 13 open channel laterals presently serving the area under the newly lined portion of the Government Highline Canal into 12 pipe laterals. Construction on the lateral system is scheduled for 1981-82, and should be completed for the 1983 irrigation system.

To test the effectiveness of Stage One, a water quality monitoring program is underway in this area, known as the Reed Wash Study Area, a hydrologically closed basin within the Stage One area. The results of the water quality monitoring will be used to assess the effectiveness of Stage One development in reducing salt loading. The findings will form the basis for recommendations to Congress concerning construction on the rest of the unit.

Hydrosalinity data collected during 1981 in the Stage One study area indicate that canal lining and SCS on-farm management have reduced salt loading to the Colorado River by about 9,000 tons. Some saline wetlands with surface salt efflorescence (salt formed on the surface as emerging canal seepage evaporated) adjacent to the canals have now dried out and farmers are furrowing and irrigating these areas. In addition the SCS land leveling program has removed soils and exposed shales on high areas which previously remained above the wetted portion of the irrigated field. Some of these changes should cause temporary increases in salt leaching. The Stage One construction activities are scheduled for completion by the 1983 irrigation season; 3 to 5 years' monitoring may be required to properly evaluate long-term salt reduction. The 1981 monitoring showed that the canal lining effectively reduced water losses and reduced ground water levels and that the total SCS/Reclamation program reduced salt loading. The 1982-84 monitoring program should yield more conclusive and quantifiable evidence of long-term salt reductions from canal and lateral lining and from SCS on-farm irrigation improvements and management. These results are presented in a report entitled 1981 Progress Report on Grand Valley Stage One and Hydrosalinity Monitoring.

Stage Two investigations are to include evaluation of various lining and system combining alternatives, and because nonlining options were only marginally evaluated before authorization, salinity control measures other than lining are being developed and evaluated. Salinity

control measures under study include plans which involve lining portions of the irrigation systems with various types of material, and consolidating conveyance systems, as well as collecting, or intercepting, and transporting and disposing of saline water. Several alternatives under consideration involve opportunities for industrial use of saline water by private entities.

General data gathering is continuing to determine the nature and extent of the salt loading to the Colorado River. Such data include the following: (1) flow measurements and samples from all major washes and drains; (2) samples and water levels from existing observation wells in the Reed Wash Study Area; (3) samples and water levels from an extensive network of wells valleywide; and (4) computation of water and salt budgets for the Grand Valley and for the Reed Wash Study Area.

Detailed information on surface and ground water inflows and outflows to selected basins within the unit is currently being collected and is being used to develop water and salt budgets to evaluate alternative methods of salinity control. In addition, an intensive drilling and aquifer testing program is underway in both the areas underlain by cobble deposits and in the weathered Mancos Shale areas. The purpose of this program is to determine aquifer characteristics such as hydraulic conductivity, as well as to identify quality and direction of ground water flow.

Selection of a best plan and preparation of a plan formulation working document are scheduled for mid-calendar year 1983, and the completion of the Regional Director's Planning Report and Draft Environmental Statement is scheduled for 1984.

3. Las Vegas Wash Unit

Las Vegas Wash is a natural drainage channel providing the only surface water outlet for the entire 2,193 square miles of Las Vegas Valley. A drainage area of 1,586 square miles directly contributes to the Wash which conveys stream runoff and wastewater to Las Vegas Bay, an arm of Lake Mead. Located in Clark County in southern Nevada, the Las Vegas Valley contains the largest population center in the State. Three cites (North Las Vegas, Las Vegas, and Henderson) and other communities are drained by tributaries to Las Vegas Wash. Studies evaluating salinity contributed by the wash are concerned mainly with the 10-mile reach upstream of Las Vegas Bay. The wash flood plain and adjacent area support about 1,800 acres of halophyte, hydrophyte, and phreatophyte vegetation.

Before water development in the valley, Las Vegas Wash had been a generally barren and sandy channel with contained discharge only during brief periods of major storm runoff. The growth of the communities in the valley contributed increasing amounts of wastewater discharge to the wash until the flow became perennial. Return flows to the wash are from secondary treated sewage plant effluent, industrial cooling water, and urban irrigation and agricultural drainage. The water from some of these

sources contains nutrients, salts, and other solutes; however, all of the wastewater leaches additional salts from the soil as it flows into and through the Las Vegas Wash.

Past investigations associated with plan development have been described in previous progress reports. Construction according to a Draft Definite Plan Report was begun in 1977, but it was delayed in 1978 to allow time to reevaluate the changing ground water conditions in the Lower Las Vegas Valley.

One potential approach would be to proceed with environmental investigations and design data collection for a Bypass Channel. The channel would convey wastewater and minor storm runoff parallel to Las Vegas Wash for about 4 miles, circumventing salt deposits and saline water in the wash alluvium. The Bypass Channel has been viewed by some local entities as being in conflict with nutrient control and wildlife habitat improvement objectives. A planning group representing various local entities was established to coordinate several different wastewater management activities into a comprehensive plan.

Preparation of a definite plan for the Las Vegas Wash Unit was delayed to complete nutrient control planning by local entities. The schedule for the nutrient control planning has since been abandoned, but the Nevada Environmental Quality Commission is attempting to set effluent limitations and water quality standards.

During the time the State endeavors to set new limitations and standards, Reclamation will seek a consensus among the local wastewater entities concerning Reclamation's role in future salinity control measures for Las Vegas Wash.

A continuing ground water monitoring program in the Lower Las Vegas Valley has been augmented by the addition of about 50 new wells in the Pittman area. These wells are being used to verify expected changes in ground water levels and quality before and after the abandonment of unlined wastewater ditches in the area. The wastewater is expected to be diverted to a Pittman Bypass Pipeline by October 1983. The curtailment of seepage from the unlined ditches is expected to cause a rapid drop in ground water levels in the Pittman area, resulting in reduced saline ground water inflow to Las Vegas Wash. The monitoring of the resulting ground water changes is expected to continue through fiscal year 1984, at which time an assessment would be made of the results of the Pittman Verification Program.

A study of the amount of salt stored in soils above the water table was completed in April 1982 by Desert Research Institute. The study showed significant quantities of salt stored in the unsaturated soil throughout the Lower Las Vegas Valley. Soil salt concentrations were found to be highest in close proximity to the Muddy Creek formation and very low in the coarse alluvial fan material south of Las Vegas Wash.

Thus, relatively little salt was found in the abandoned tailing ponds area, but salt concentrations exceeding 10 percent of the soil weight were common elsewhere.

One location in the tailings pond area did show high soil salt concentrations within a few feet of the top of the Muddy Creek formation. Other sample holes in the tailings pond area did not reach the Muddy Creek formation and possible saline soils since they stopped upon contact with the ground water table. Examination of well logs and other auger hole boring has shown extensive gypsum deposits throughout the Lower Las Vegas Valley below the ground water table, as well as the unsaturated zone. Thus, the presence of a nearly inexhaustible supply of native salt in the lower valley is subject to leaching by wastewater disposed of in unlined ditches or ponds.

Proposed measures to control potentially hazardous wastes in the Pittman area ground water are being considered by the Nevada Department of Environmental Protection. Such measures are expected to be coordinated with the Pittman Verification Program activities.

Although no problems are foreseen that would impede the Pittman Verification Program, the initiation of advance planning for the Bypass Channel is dependent upon resolving local nutrient control and wildlife habitat issues.

4. Yuma Desalting Plant

The Yuma Desalting Plant is being built on a 60-acre tract of land 4 miles west of Yuma, Arizona. This site allows easy access to the Main Outlet Drain Extension, which will carry the saline water to be treated to the plant, and it is also near the Colorado River, where the treated water will be delivered.

The primary purpose of the plant is to upgrade the quality of drainage waters from the Wellton-Mohawk Irrigation and Drainage District to enable the United States to meet its obligations under the Minute 242 agreement with Mexico. In part, Minute 242 states that approximately 1,360,000 acre-feet delivered to Mexico upstream to Morelos Dam, have an annual average salinity of no more than 115 mg/L plus or minus 30 mg/L (115 $\pm$ 30) over the annual average salinity of Colorado River waters which arrive at Imperial Dam. Imperial Dam is located approximately 20 miles upstream from the delivery point at Morelos Dam.

Presently, the plant is planned to produce about 73 million gallons of desalinated or product water per day. This would result in a delivery of about 67,000 acre-feet of product water per year. The product water will be blended with about 12,600 acre-feet of partially treated water and sufficient untreated water to make up an estimated return flow of about 79,600 acre-feet each year. The plant is expected to save about 74 percent of the total drainage flow from the Wellton-Mohawk Irrigation and Drainage District.

Public Law 93-320, which was enacted on June 24, 1974, specifies a daily treatment capacity of approximately 129 million gallons with not less than a 70-percent product water recovery ratio and not less than a 90-percent reduction of the dissolved solids in the feed water. The water quality differential requirement stipulated in Minute No. 242 is a factor which will be met through the operational capability of the equipment selected for use at this plant.

It was determined, using the operational design parameters set up for the plant, that units using a membrane process were technically and economically suitable for the Yuma Desalting Plant operation. The size of the desalting plant was computed using a salt balance formula. The factors included in this formula are: (1) the volume of the water delivered to Mexico, (2) the salinity differential required by Minute No. 242 of the International Boundary and Water Commission, United States and Mexico, (3) the salinity of the Colorado River at Imperial Dam, (4) the volume of drain water treated, (5) the salinity of the drain, (6) a number of other factors related to the diffuse return flows below Imperial Dam, and (7) plant operational factors. The items which will affect the required size of the plant the most are the salinity at Imperial Dam and the volume and salinity of drain flow if the other factors are assumed constant. The original size of the desalting plant was 96 Mgal/d capacity which could treat 167,000 acre-feet of drain flow as long as the salinity of the Colorado River at Imperial Dam is above 949 mg/L. If the salinity is below 949, some drainage water would have to be bypassed.

A study done by The Advisory Committee on Irrigation Efficiency - Wellton-Mohawk Irrigation and Drainage District, in 1978, recommended expansion of the onfarm measures which will result in an irrigation drain flow of 108,000 acre-feet/year. In addition, the Colorado River Salinity Control Forum has established a maximum salinity level at Imperial Dam of 879 mg/L. Using the salt balance formula, and assuming an irrigation drain flow of 108,000 acre-feet and a salinity of the Colorado River water at Imperial Dam of 838 mg/L, a plant size of 73 Mgal/d would be required to treat the irrigation flow portion of the total drainage flow.

B. 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) and directs the Secretary to undertake research on additional methods of accomplishing the objective of this title (Title II of Public Law 93-320).

The three categories of projects listed under Section 203 are irrigation source control, point source control, and diffuse source

control. The schedule of reports for projects authorized for investigation is shown on Figure VIII-1. The investigative program for each project is reviewed 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 (Colorado River Water Quality Improvement Program) major program emphasis for control of irrigation sources is placed on improved irrigation management through an IMS (Irrigation Management Services) Program and improved control of water flow in canals, laterals, and drainage systems through a WSI (Water Systems Improvements) 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. This practice is expected to spread to some 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 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 becomes concentrated with salt, thus lowering the quality. In some cases, particularly after repeated use, the return flow water becomes undesirable for irrigation or M&I use without treatment. A few specialized industries, however, can use water of poor quality for cooling purposes. With the increased need for electric generating the use of flows has assumed new drainage 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.

a. Colorado River Indian Reservation Unit, Ariz.

The Colorado River Indian Reservation has a total of 268,850 acres located in the lower Colorado River Basin below Parker Dam in northern Yuma County, Ariz., and the eastern part of the San Bernardino and Riverside Counties, Calif.

The United States Supreme Court allocated water to irrigate 107,588 acres, of which 99,374 acres are in Arizona and 8,213 acres are in California. The court's allocation also provided for a maximum

diversion of 717,148 acre-feet. In 1978, 75,405 acres were irrigated with Colorado River water diverted at Headgate Rock Dam. About 200 miles of canals and laterals delivered water to irrigate this acreage. Irrigation return flows are collected in a 100-mile drainage system and are 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. An analysis of the diversions to and drainage from the reservation indicated that the reservation did not make a net salt contribution to the river. Consequently the investigation was terminated, and a Concluding Report was released in October 1979 to present the studies performed.

b. Palo Verde Irrigation District Unit, Calif.

The Palo Verde Irrigation District is a privately developed district located in Riverside and Imperial Counties, Calif. Water for irrigation is diverted from the Colorado River at the Palo Verde Diversion Dam and is conveyed through 295 miles of main canals and laterals to serve approximately 91,400 acres of irrigated land within the district. The irrigation return flows are collected in a 153-mile drainage system and returned to the Colorado River; however, the return flows are located below many of the salinity drainage areas and would not have the full benefits of an upstream project.

An analysis based on 1974 operational data indicated that the 914,000 acre-feet diverted contained 945,000 tons of salt, and that 467,000 acre-feet of return flows to the river contained 1,097,000 tons of salt. The difference of 152,000 tons 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. Two of the subareas 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. 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 of salt, which is expected to be flushed out gradually by deep percolation of irrigation water.

The rate of salt discharged 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 seepage to the ground water system.

Preliminary studies indicated that increasing the on-farm irrigation efficiency to 60 percent would cause an estimated reduction in salt discharges of 67,400 tons at present, but the reduction would decline gradually in the future. On-farm efficiency would be improved both by on-farm improvements to facilitate more efficient irrigation and better irrigation water management. Salt discharge could be further reduced by lining irrigation canals. More detailed studies are needed to verify these conclusions and to implement a salinity control project. A Status Report was issued in March 1980.

The district has subsequently requested Reclamation to investigate the feasiblity of lining the entire distribution system. Costs allocated to salinity control would be nonreimbursable; the district would repay costs not allocated to salinity control. A Special Report was issued in July 1981 which summarized the Status Report and discusses lining the entire system.

The possibility of using the temporarily surplus flows in the Colorado River to speed up the flushing of saline ground water from the southern part of the district was investigated by spreading water on 320 acres of fallow farmland. This cooperative test indicated that ground water flushing was not a viable means of salinity control. A Geological Survey Open File Report is being prepared on the flushing program.

c. Uinta Basin Unit

The Uinta Basin lies between the Uinta Mountains on the north and the Tavaputs Plateau on the south in northeastern Utah. Irrigated lands in the Uinta Basin totaling 170,000 acres are located primarily on alluvial materials adjacent to rivers and on benches and mesas. The mountain front streams supplying the irrigated lands produce high-quality water (30 to 350 mg/L TDS). Water quality in the basin deteriorates as return flows enter the Duschesne River and its tributaries with average TDS levels of 200 to 4,000 mg/L. The Uinta and Ashley Valleys contribute about 450,000 tons of salt.

Irrigation Management Services.--Since 1980 there has been no irrigation scheduling in the Uinta Basin in which Reclamation has been involved because of lack of interest by the irrigators.

Water Systems Improvement Program.--Systems improvement possibilities consist principally of improving irrigation conveyance systems such as lining canals and laterals, use of pipe systems, and upgrading diversion and flow measuring structures.

Seepage loss studies have been completed on canal systems presently proposed for rehabilitation. Studies were conducted by the Bureau of Reclamation, Soil Conservation Service, and Geological Survey, and by contract with a consulting engineering firm. Infrared photography, soils data, observation well data, canal company interviews, and

results of geological studies were used in addition to seepage measurements to determine reaches of the canal to be photographed and mapped for feasibility designs.

Contracts for topography and cross sections on 132 miles of canal have been completed. Cross drainage, sizing, and preliminary design and cost estimate studies have been completed. These data will be used for feasibility designs in the recommended plan. The canals will be sized to existing capacities unless sizing studies show larger capacities are needed to remove restrictions in certain reaches.

The detailed mass balance analyses for 17 subareas of the Uinta Basin Unit have been completed and are included in the Hydrosalinity Appendix. Based on these analyses, a recommended plan has been selected which involves systems improvement for 59.0 miles of canals and laterals in 7 subareas.

Since August 1981, the water quality sampling program has been reduced to 25 key surface stations, most of which are sampled monthly. Salt loading appears to result primarily from the dissolution of salts from the subsurface material, with only a minor effect from displacement of saline ground water.

Wildlife habitat and archeological studies have been completed and impact and mitigation plans are being developed. Presently about 750 acres of mitigation lands are needed to replace approximately the same amount of acreage affected by canal seepage. The Agricultural Stabilization and Conservation Service (ASCS) and the SCS have continued to target areas in which on-farm improvements are to be made. The Planning Report is scheduled for completion in March 1983. The recommended plan for systems improvement is estimated to reduce salt loading by about 23,500 tons annually, which will result in a salinity reduction at Imperial Dam of 2.4 mg/L.

d. Lower Gunnison Basin Unit

Present Reclamation studies on the Lower Gunnison Basin Unit are confined to the Uncompahgre Project in west-central Colorado. The North Fork area northeast of the Uncompahgre Valley, centered around the community of Hotchkiss, comprises the remainder of the unit area and will be studied in the future.

The Uncompahgre Valley is mainly an agricultural area relying on irrigation water delivery via a 550-mile system of canals and laterals. The source of irrigation water is the Uncompahgre River, which flows through the middle of the valley, and the Gunnison River, which is partially diverted through a 6-mile tunnel.

Field data indicate that about 360,000 tons of salt are leached from the valley each year, and this salt ultimately finds its way into the Colorado River by way of the Gunnison River and its tributary

the Uncompahgre River. The objective of the Lower Gunnison Basin Unit is to reduce salinity in the Colorado River by controlling seepage from the delivery system and by appropriate on-farm measures.

Feasibility-level investigations were initiated for the Lower Gunnison Basin Unit in 1977. Reclamation is investigating the delivery system salt load contributions, and the SCS is investigating on-farm measures.

The Planning Report and Environmental Statement are being reviewed and processed.

Investigations since 1977 are as follows.

In the fall of 1977, four ponding seepage tests were made, one each on the Selig, East, Garnet, and Ironstone Canals. The Garnet Canal showed the highest seepage rate, about 0.4 foot/day, while the East Canal had the lowest seepage rate, measured at less than 0.1 foot/day. Two additional sites were tested in the fall of 1978, one each on the South and Loutzenhizer Canals. The test results for the Loutzenhizer Canal showed a loss of about 0.4 foot/day for what was considered the normal water surface elevation of the canal and the results for the South Canal showed about 0.17 foot/day seepage loss. Of the six ponding tests, only two are reasonably good--the Ironstone Canal test in 1977 and the Loutzenhizer Canal test in 1978. All other test locations had problems, and the level of confidence varies.

In October 1977, 19 lateral reaches were tested for seepage by current meter measurements of inflow and outflow which showed only 6 with definite losses. In the spring and summer of 1978 an additional 20 inflow-outflow tests were made and only 7 reaches showed a decrease of the outflow over inflow, for about the same percentage as was found in the 1977 testing.

Many interferences appear to be involved in testing for seepage by the inflow-outflow method. Unseen return flows are probably the greatest single factor, while measurement error undoubtedly is also involved. Fluctuations in lateral flows also cause errors and are difficult to control. Accordingly, Parshall flumes were installed on four reaches of laterals in 1978 in the hope that continuous flow recording would take care of the fluctuation problems. Two laterals were not influenced by irrigation return flows and the tests are considered reliable. Loss rates were 0.3 and 0.6 foot/day.

During the summers of 1978 and 1979 canal seepage rates were determined by measuring parameters in Darcy's equation such as permeability and gradient. The program was undertaken to circumvent the problems encountered with ponding tests and inflow-outflow measurements as a means of determining canal seepage. A total of 96 holes drilled along the access roads of canals east of the Uncompahgre River revealed that both an artesian and free water table aquifer were present. The

artesian aquifer is located within the weathered Mancos Shale and the free water table aquifer is shallower in the reworked Mancos Shale soils. A total of 39 aquifer tests (piezometer, auger-hole, and pomona) were made to determine the hydraulic conductivities for the two types of aquifers. The mean seepage rate for the artesian aquifer was found to be 0.264 $ft^3/ft^2/day$ (cubic foot per square foot per day) and the mean seepage rate for the free water table aquifer was found to be 0.202 $ft^3/ft^2/day$.

The planning team for the Lower Gunnison Basin Unit was organized on May 4, 1977, and the first public meeting was held in August 1979 in Olathe, Colo. At this meeting the public was asked to determine which types of alternative solutions they preferred and which types they could not accept and for any recommendations which had not yet been considered. Participants indicated a strong preference for concrete lining and strong disapproval of institutional-type controls such as land retirement and limitations of water delivery. One recommendation from the public was that certain areas may not be suitable for rigid concrete linings and that for such areas flexible lining should be considered.

At the second public meeting in Montrose, Colo., in September 1979, the public considered the amount of lining that would be preferred, and asked that as much of the delivery systems be lined as could be justified under the salinity program. The second preference was the alternative to line only adobe soil areas (which correspond to the higher saline areas). The recommended plan includes lining canals and laterals on the east side of the valley and eliminating winter flows through the entire irrigation delivery system.

The third public meeting was also an environmental scoping meeting and was held in Olathe on April 30, 1980. The purpose of the meeting was to elicit environmental concerns the public might have regarding the recommended plan and any of the more acceptable alternatives. Such concerns were obtained and will be listed in the project's Environmental Impact Statement.

e. McElmo Creek Unit

McElmo Creek Unit was initially designated as a diffuse source unit since salt loading mechanisms in the area were not readily identifiable. Early studies conducted in the area show that salt loading results from both irrigation sources and diffuse sources with irrigation being the main contributor. McElmo Creek Unit is now identified as an irrigation source unit.

The McElmo Creek Basin is located in southwestern Colorado and covers approximately 720 square miles. About 150 square miles of the basin, mostly in the east, are agricultural land.

McElmo Creek flows through the southern half of the basin beginning east of Cortez, Colo., and emptying into the San Juan River near Aneth, Utah. Based upon data from 1953 through 1980 water years at

a gage near the Colorado-Utah State line, flows in McElmo Creek average 36,600 acre-feet per year, carrying an average annual salt load of 116,000 tons.

Ninety-two percent of the salt load in McElmo Creek is measured just downstream of the confluence with Mud Creek, about 5 miles from Cortez. Natural runoff accounts for 33 percent of the total flow in McElmo Creek at this point and contributes 32 percent of the salt load. Between Mud Creek and State line, the remainder of water entering McElmo Creek is natural runoff and ground water inflow.

The soils in the basin can be divided into two types. The Billings (gray) soil, which is alluvial in origin, covers most of the far eastern and southeastern portions of the basin. The Monticello (red) soil, derived from Dakota Sandstone and Eolian in nature, covers the north and western portions of the basin. Areas of intermixed soils exist between areas distinctly red and gray. Irrigated gray soils have the potential of producing five to ten times as much salt as irrigated red soils per deep percolated acre-foot of water.

The MVIC (Montezuma Valley Irrigation Company) diverts water from the Dolores River and serves the McElmo Creek Basin. The diverted water quality averages 160 mg/L TDS, while McElmo Creek water contains about 2,530 mg/L TDS at the Colorado-Utah State line.

Fifteen ponding tests have been run on MVIC canal sections and 115 miles of canals within the basin have been characterized according to soil structure. Results indicate seepage rates for most of the MVIC distribution system are low to moderate except for locations where canal sections have been cut through shale and sandstone and seepage rates are high. More tests are planned to determine seepage rates for other canal sections suspected of higher seepage.

Ground water research in the basin consisted of 125 wells monitored for water table elevation, salinity, and hydraulic conductivity. Information gathered by this monitoring program was used to determine base flow qualities and water table fluctuations, but results were inconclusive.

Computer models used to determine what proportion irrigation, canal seepage, and precipitation contribute to total salt load (subbasin by subbasin) were also inconclusive. Only when results from the four subbasins were combined into a total basin water budget could surface water, ground water, precipitation, and salts associated with water movement be determined; however, use of the basin water budget is limited due to the apparent inaccuracies of base data used to calculate the budget.

Irrigation research was done on seven test farms in the basin representing various soil types, farm sizes, irrigation methods, and farm management. During the irrigation season, water inflow and

outflow from these farms were constantly monitored, and available soil moisture contents measured. Results on gravity-irrigated fields show as much as 25 percent of the farm delivery is lost through deep percolation.

Through a Multiple Objective Planning process and Public Involvement Program, several alternatives were proposed to reduce salinity in this area. These include (1) modification of MVIC canal sections reducing ground water seepage and salt loading, (2) improvement of on-farm irrigation management, (3) selective withdrawal of highly saline lands, (4) evaporation of saline water in small ponds located along small creeks, (5) evaporation of McElmo Creek flows in McElmo Canyon, (6) evaporation of selective flows between November and April, (7) removal of salt from the water through desalting by reverse osmosis or electrodialysis, (8) rerouting Towaoc Canal as proposed by the Dolores Project, (9) use in a coal slurry pipeline, and (10) use as cooling water for a powerplant.

The alternatives found to be the most cost effective and acceptable to people and organizations in the area are modifying MVIC canal sections and improving on-farm irrigation management. The Bureau of Reclamation is involved in modifying MVIC canal sections and the SCS is involved in on-farm irrigation improvements. Reclamations's preferred alternative is to line several sections of MVIC canals and to combine the Rocky Ford Canal with the Highline Canal. The effect of this plan will be to reduce ground water seepage from canals by 4,150 to 6,140 acre-feet a year and reduce the amount of salt returned to McElmo Creek by 17,000 to 25,500 tons per year.

SCS sampled irrigation systems and practices representative of approximately 29,100 acres of irrigated land. This information, used with results of seepage and permeability tests to determine the amount of water lost through the irrigation conveyance systems, shows that about 54,000 tons of salt are attributed to on-farm irrigation agriculture. Improved management of irrigation water has the potential for reducing salinity by as much as 32,000 tons annually.

2. Point Source Control Projects

There are five sources in the following section that have been identified as point contributors of salt to the Colorado River. They are springs that discharge high concentrations of dissolved salts.

a. 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 per year with a flow of about 11.5 ft^3/s that contains TDS averaging 9,650 mg/L. A feasibility report plan for collecting and desalting the springs was forwarded to the Commissioner's Office in December 1974. A reformulation of the LaVerkin Springs Unit under the Water Resources Council Principles and Standards of Water Resources Planning was subsequently conducted.

The favored plan developed during the multiobjective planning study consisted of a desalting plant to desalt the spring water and evaporation ponds to dispose of brine from the plant. Seventy percent of the water would be returned to the Virgin River and 30 percent would be brine. Water rights or a replacement supply would need to be secured for the disposed water. A salt load of 103,000 tons per year would be removed from the stream. The total effect of the LaVerkin Springs Unit may not be immediately apparent and may not ever reach the expected salinity reduction because a part of the discharge appears to contribute to the source of Littlefield Springs which may take many years to surface.

Unfortunately, when the cost estimates were finalized this plan was too expensive to be viable. Additional alternatives examined, including deep well injection of the brine, total evaporation of the spring water, use of the spring water for powerplant cooling, and deep well injection of the entire spring flow, were also not viable. Consequently, the investigation was terminated and a Concluding Report was released in December 1981.

b. Glenwood-Dotsero Springs Unit

The primary area of study lies along a 16-mile reach of the Colorado River in Glenwood Canyon between Glenwood Springs and Dotsero in Garfield and Eagle Counties of western Colorado. In this river reach numerous thermal saline springs and associated ground water inflows comprise the largest point source of dissolved solids in the Upper Colorado River Basin.

In the 16-mile reach about 25,000 acre-feet of water and about 500,000 tons of salt enter the river annually. About half of the water and salts comes from 20 identified springs clustered on both sides of the river near Glenwood Springs and at a point about 2.5 miles downstream from Dotsero. The remainder enters unseen through stream gravels as ground water inflow with a very small amount entering from surface runoff of intermittent tributaries. Twelve of the identified springs are located near Glenwood Springs and eight near Dotsero.

The 20 springs have an estimated combined average flow of about 16 ft^3/s and an average dissolved solids concentration of about 14,420 mg/L. The average surface flow of the 12 springs at Glenwood Springs is approximately 9.5 ft^3/s, while the average salinity concentration is about 18,100 mg/L. The average temperature is about 107° F. At the Dotsero Springs, the combined surface flow of the eight springs is about 6.5 ft^3/s, the average salinity concentration is about 9,300 mg/L, and the average temperature is about 85° F.

Chemical analysis indicates that the composition of TDS from the two spring areas is quite similar. The constituents are approximately 90 percent sodium chloride with the remaining 10 percent made up mostly of calcium, magnesium, potassium, bicarbonate, and sulfate.

The very similar ionic contents of the Glenwood and Dotsero Spring waters indicate common recharge areas or at least recharge areas with the same lithologic characteristics. Probable areas of recharge are in the northeastern and southern portions of the study area. These areas possess structural, topographic, and lithologic attributes which could explain the physical and chemical properties of the Glenwood and Dotsero Springs.

Recharge probably infiltrates downward along deep faults or volcanic necks. Downward migrating water contacts halite and gypsum deposits of the Eagle Valley Evaporite and acquires high concentrations of sodium, chloride, calcium, and sulfate. Water is heated at depth, enters the underlying permeable Leadville Limestone, probably mixes with other water in the Leadville, and migrates toward areas of lower head on the surface where it issues as thermal saline springs at Dotsero and Glenwood Springs.

Some of the springs at Glenwood Springs have been developed commercially. The flows are collected for distribution to swimming pools and the discharge is piped into the Colorado River. No use is made of water from the Dotsero Springs.

The appraisal investigations included use of infrared photography to locate springs not visible, chemical analyses of water samples, and preliminary methods of control.

A monitoring program was conducted in 1972-73 to estimate average flow and TDS issuing from the springs.

A 3-year baseline monitoring program was carried on from 1972 to 1976 in which bimonthly samples were collected and analyzed for common ions. Baseline monitoring is continuing on flow and quality at four stations along the Colorado River and a program to identify the presence of heavy metals and other parameters has been completed. Results of this monitoring are being analyzed.

In January 1980, the Geological Survey started continuous electrical conductivity and temperature recording at four gaging stations along the Colorado River. Weekly samples are collected at each station and analyzed for common ions and general chemistry.

In January 1980, the Notice of Initiation of Investigation was issued. A contract was awarded for the technical investigation of the Glenwood-Dotsero Springs Unit on September 22, 1980, to URS Corporation of Denver, Colo.

Based on public and technical input, 33 alternative solutions were developed. After comparison of these alternatives, a recommended plan was selected in late 1981. The plan consists of capturing 21.4 ft^3/s of brine at Glenwood Springs and Dotsero, piping it to the Colorado-Utah border, and storing and evaporating it in 5,000 acres

of contour ponds. This plan would reduce concentrations at Imperial Dam by 31 mg/L. If at any time a more beneficial user for the brine offers development, the plan for such use would take precedence over the recommended plan provided that there existed technical, economic, and environmental verification.

One potential alternative to disposal of the saline water could be a coal (capsule) pipeline transportation system to the west coast for power generation or shipment to foreign markets. This alternative is under consideration in a separate study which is being conducted jointly by the Bureau of Reclamation and private industry.

In 1982, the contract for technical work was modified to include verification of the major assumptions affecting the cost estimate of the recommended plan. The work will lead to the Draft Planning Report Environmental Statement.

c. Lower Virgin River Unit

This unit encompasses southeast Nevada and northwest Arizona; Clark County, Nev.; and Mohave County, Ariz. The unit includes natural saline springs averaging 2,900 mg/L near Littlefield, Ariz., and the 3,500 acres of irrigated land along the Virgin River between the springs and Lake Mead.

The investigation proceeded through three sequential phases. It began in 1972 as the Littlefield Springs Unit of the CRWQIP. The initial approach was to study the saline Littlefield Springs, with a view to diverting them from the river's edge and treating them or disposing of them in some way; however, such a project was strenuously opposed locally because the springs form the only reliable water supply for downstream irrigation during the summer when surface flows cease in the river.

Consequently, this approach was abandoned and, beginning in 1977, the possibility of extracting saline underflow from the riverbed in the reach downstream from the irrigated areas was studied. Available information on flows and salinity indicated that less salt was leaving the reach in surface flow than was entering it, and it was postulated that salt unaccounted for was leaving the reach as underflow in the alluvial bed of the river. Preliminary calculations indicated that the underflow would contain water with as much as 32,000 mg/L of dissolved salts. An exploration program was conducted which involved installing a line of observation wells across the alluvial valley fill; however, the results showed that the average water quality was only about 3,000 mg/L, far less saline than needed to support a project for its extraction and treatment or disposal.

Finally, a study of the entire Lower Virgin River was made to define the hydrologic and salinity regimes to determine whether any other sources of salt loading exist in that reach (besides Littlefield

Springs). Reclamation contracted with Desert Research Institute to perform a 1-year study to cover the annual flow cycle of the river. Additional shallow observation wells were installed and existing wells were inventoried. The river's flow and quality were monitored at six points. While the data gathering program and the analysis were more intensive than before, various uncertainties still exist about the basic hydrologic processes and, consequently, in the analysis as well. Nonetheless, the results did not provide conclusive evidence of salt loading along the river other than the known discharge from Littlefield Springs.

No satisfactory basis was found to formulate a project to control salinity on the Lower Virgin River by collecting or treating Littlefield Springs flow or ground water, and the investigation was terminated. A Concluding Report was issued in March 1982.

The SCS has formulated a proposal to reduce salt loading by reducing deep percolation from irrigated agriculture by instituting greater on-farm irrigation efficiency and lining irrigation canals. A Planning Report on the proposal was released by the SCS in March 1982.

d. Blue Springs, Arizona

The Blue Springs area is located on the Little Colorado River within the Navajo Indian Reservation in north-central Arizona. The springs contribute an average of 160,000 acre-feet per year which have a collective salinity of 2,500 mg/L and a total salt load of about 550,000 tons per year.

The lower portion of the river flows through a meandering canyon of about 1 mile in width and a 1/2 mile in 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 springflow 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 springflows are clear, salty, slightly acidic, and from 65°F to 70°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.

A full-scale feasibility study of the project is not planned due to the high capital cost of building the project and environmental problems resulting from the significant historical and religious value of the area to the Hopi Indians.

3. Diffuse Source Control Projects.

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

a. Price-San Rafael Rivers Unit

The Price and San Rafael Rivers originate in the mountains of the Wasatch Plateau and provide tributary flows to the Green and Colorado Rivers in east-central Utah. The study areas are principally desert with an arid to semiarid climate.

The geologic formations in these river basins consist primarily of sedimentary rock. About 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. Many of the irrigated lands are located on these salt-producing formations in the upper portions of the drainages.

Salinity concentrations range from 200 to 5,000 mg/L for both rivers with an average of 3,500 mg/L for the Price River and an average of 4,000 mg/L for the San Rafael River.

The estimated TDS contributed by the Price and San Rafael Rivers are 240,000 and 190,000 tons, respectively.

The estimated annual reductions of salt by potential control programs are 100,000 tons on the Price River and 80,000 tons on the San Rafael River.

A professional services contract was awarded to CH2M Hill Central, Inc., in September 1981, to investigate and analyze problems and possible solutions to reduce salt loading. The contractor will develop structural and nonstructural alternative plans utilizing input from public involvement and the Bureau of Reclamation.

The SCS is presently investigating the salinity impacts of on-farm improvements.

The recommended plan for system improvements is scheduled to be selected in October 1983, and the Planning Report/Environmental Statement is scheduled for completion in August 1984.

b. Dirty Devil River Unit

The Dirty Devil River drainage area, containing about 4,300 square miles, originates in the mountains of Wasatch, Fishlake, Awapa, and Aquarius Plateaus and discharges into the Colorado River at the upper end of Lake Powell. About 47 percent of the area is tributary

to the Fremont River, about 37 percent to Muddy Creek, and about 16 percent directly to the Dirty Devil River, which is formed by the confluence of the Fremont River and Muddy Creek. Elevations range from about 3,600 feet above sea level at the mouth of the Dirty Devil River to 11,000 feet in the mountain ranges at the west end of the drainage. The drainage basin is principally desert with annual rainfall averaging 10 inches.

The geologic formations in the drainage basin consist primarily of sedimentary deposits, about 60 percent of which are mudstones, claystones, and shales. The Carmel Formation of Jurassic Age and the Mancos Shale Formations of Cretaceous Age are major contributors of dissolved solids in the basin. Irrigation of alluvial soils derived from shales increases the contribution of dissolved solids to the streams.

The total dissolved solids contributed by the Dirty Devil River is estimated to range between 120,000 and 180,000 tons annually. Potential programs to reduce the salt loading from this river system are being investigated and a Preliminary Findings Report is scheduled for completion in March 1983.

Investigations began in 1974 and were limited to brief field surveys and hydrologic data collection. Streamflow and water quality data are currently being obtained at stations throughout the basin through a cooperative effort of Reclamation, USGS, and the State of Utah. Numerous surveys and studies have been done on the basin and were analyzed by Reclamation, and additional data collections programs have been recently initiated to fill in information not collected by previous studies. These programs consist of irrigation system characterization, phreatophyte quantification, continuous quality and quality measurements of surface waters, and intense water quality sampling instantaneous flow measurement at strategic sites. The purpose of this data collection is to more accurately identify, precisely locate, and quantify the problem. With this data Reclamation will study potential alternatives and ultimately recommend a plan.

The Regional Director's Planning Report and Environmental Statement are scheduled for completion in 1987.

c. 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 where most of the flow is diverted to irrigate Eden Project lands.

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 river's dissolved solids increase to 70-120 mg/L at Big Sandy Reservoir. Below Big Sandy Dam the river picks up irrigation return flows from the Eden Project and saline seeps along the river channel. The Big Sandy River annually discharges approximately 167,000 tons of dissolved solids to the Green River. Salt loading is attributable to a series of seeps and springs along a 26-mile reach of river

below Farson, Wyo. The average annual flow of the seeps and springs is estimated to be 33 cfs at a concentration which varies from 1,000 to 6,000 mg/L.

Drilling investigations have shown that aquifers near the river are the source of the saline seeps, and these confined aquifers extend over a wide area from above Farson to the vicinity of the Gasson Bridge. Quality of the water in the aquifer varies from about 2,000 to 6,500 mg/L; it is estimated that the seeps contribute about 110,000 tons of salt annually.

Pumping test wells indicate that the saline water could be intercepted before seeping into the river. One test well was pumped at a rate of 2,250 to 2,700 gallons per minute for 5 days, with a big reduction in seepage flows occurring within the area of influence.

Feasibility investigations have been ongoing since October 1980 with the issuance of the Notice of Initiation of Investigation. A plan of study and public involvement plan have been prepared presenting the objectives, procedures, and schedule of the study.

A planning team formed early in the investigation developed preliminary alternative solutions to the salinity problem. Reclamation's contractor, Sage Murphy and Associates (SMA), developed a Problem Identification and Quantification Report (PIQ) which details the geohydrology of the project area and theory on the salt loading mechanisms.

Nine alternatives investigated by the contractor were evaluated by the planning team and new alternatives were formulated, one of which, preferred by Wyoming, was selected as the best plan. This plan proposes removing saline water by collection wells in the spring and seep area of the Big Sandy River and pumping the water via a pipeline to a proposed Chevron fertilizer plant near Rock Springs. A potential second pipeline to an industrial area near Green River, Wyo., is also part of the best plan but depends on industry's willingness to participate. To supplement the plan, Wyoming is also studying a dam and reservoir proposal (Unit D of Plains Reservoir) on the Lower Big Sandy River to store the saline flows. This water could then be diverted to an industrial user who could utilize saline water.

The State of Wyoming and Chevron Chemical Corporation have signed a contract which would provide industrial water to Chevron from Fontenelle Reservoir. At the State's option, up to half of the water could be delivered from the Big Sandy River Unit. The saline water appears to be compatible with Chevron's fertilizer processing.

The Bureau of Reclamation and Wyoming have signed a Memorandum of Agreement outlining the responsibilities of each during the remainder of the investigation. Wyoming will study for future construction a dam and reservoir on the Big Sandy River near the seep and spring area in order to provide a firm water yield to Chevron and other

potential users. Wyoming also is providing environmental data which will be used to develop a draft environmental document to be prepared by Reclamation, and which also will provide study information and final plans and specifications on the collector wells, pumping plant, and pipelines. Wyoming and Reclamation will prepare a joint report to be presented to the Wyoming Legislature in January 1983. This report will be used by the Wyoming Legislature to determine whether or not to continue studies and/or fund construction of the project.

The Bureau of Reclamation is currently conducting a verification program to determine if the collector well concept could be used to develop the quantity of water needed to supply industry and, more importantly, remove saline water from the river by drying up seeps and springs which presently recharge the river. SMA is subcontracting the drilling of test wells and, along with Reclamation, will pump test and monitor each well.

The schedule for the remainder of the investigation has changed, partly as a result of Wyoming's efforts to supply saline water to industry. Also, Reclamation's new two-stage planning process will eliminate the second, or feasibility, phase of the investigation and initiate a preconstruction design data gathering stage during the Planning Report/Environmental Impact Statement review period. The agreement with Wyoming calls for an integrated Draft Planning Report/ Environmental Impact Statement in March 1984, with the Final Environmental Impact Statement to be filed in December 1984.

Full analysis of the hydrosalinity mechanisms is not critical, but further verification activities are planned to fully verify whether or not the collector wells will stop the spring and seep flow to the river. Test wells would be upgraded to production wells in 1984 as part of the preconstruction activities.

d. Meeker Dome Unit

The Meeker Dome, site of the Meeker Well and several other abandoned oil and gas exploratory wells, is a local anticlinal uplift in northwestern Colorado, 3 miles 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 the 1920's, 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, it was flowing at a rate of about 3 ft^3/s, and its highly saline water (19,200 mg/L) was increasing the Colorado River's salt load by about 57,000 tons per year.

In February 1969, two abandoned wells 2 miles north of the Meeker Well also were reported to be flowing saline water and were plugged 8 months later. Further seepage appeared in four areas within a 1-mile radius of the plugged Meeker Well in the same year.

Active feasibility investigations were initiated in early 1979 by the organization of a multidisciplinary planning team of interested local, State, and Federal agencies, as well as special interest groups and private citizens. These investigations were designed to gain a better understanding of the quantity, sources, and mechanisms by which saline waters enter the White River, and then to identify alternatives that would eliminate or greatly reduce the salt contribution to the river.

Technical investigations conducted through a professional services contract with CH2M Hill Central, Inc., a Denver-based water resources consultant, indicated that seepage was continuing and that variable loads of salt are being transmitted into the White River and subsequently into the Colorado River. The loading estimate for 1979 approximated 27,000 tons at a flow of about 1.4 ft^3/s and a concentration of 19,000 mg/L.

Problem identification investigations indicated that of the eight oil and gas exploratory wells drilled on the Dome itself, four were adequately plugged. The other four--the Scott Well, the Meeker Well, James Well, and particularly the Marland Well--were believed to be unplugged or inadequately plugged and acting as conduits, allowing saline water from deep geological formations to flow through shallower ground water aquifers and pollute surface waters of the White River. To verify this belief, a problem verification program was initiated to clean, test, and plug the Scott, James, and Marland Wells. Prior to verification efforts on the wells, a network of shallow observation wells and seep measurement stations were installed to monitor the effects of the verification program.

The well bores of the Scott and James Wells were cleaned, tested, and successfully plugged. Because major difficulties were encountered in cleaning the Marland Well bore, an adjacent intercept hole was drilled to 1,360 feet and an attempt was made to plug the well by hydraulically fracturing the formation using pressure cementing from the intercept hole.

Monitoring is continuing to assess the results of the verification program. To date, ground water levels are decreasing as are flows from saline seeps, apparently confirming the hypothesis that the wells act as conduits for saline water.

A preliminary findings report is scheduled for completion in 1983.

C. U.S. Department of Agriculture Contributions

1. Title I - Colorado River Basin Salinity Control Act (Public Law 93-320)

The goal of this aspect of Title I is to decrease the drainage return flows from the Wellton-Mohawk Irrigation and Drainage District

so that the size of the Yuma Desalting Plant could be reduced. The measures identified are: acreage reduction; onfarm measures and technical assistance; research and demonstrations; irrigation management services; and extension education and information. Of these measures, the USDA, through the Soil Conservation Service (SCS), has initiated the onfarm measures and technical assistance program.

The SCS enters into contracts with eligible landowners and operators (cooperators) to install conservation practices that will directly contribute to the objectives of the program. The SCS contract provides for technical assistance and irrigation water management efficiency checks over a 2-year period after installation of the practices.

A cost-share rate of 75 percent Federal and 25 percent cooperator has been established. Funds to cover the contract cost sharing and the SCS technical services are transferred periodically from the Bureau of Reclamation to the SCS under the Title I Memorandum of Agreement.

Since 1974, there have been 306 individual farm applications for assistance covering over 48,900 acres. In 1980 and 1981, 48 new applications were received on 12,900 acres. Irrigation water management and salinity control plans and contracts executed since the inception of the program total 202 farms on 31,052 acres. The 1980-81 contracts cover 74 farms on 12,152 acres.

Major irrigation water management practices completed in 1980 and 1981 include: 106 miles of ditch lining; 16,700 acres of land leveling; 3,030 structures for water control; and 9,836 acres of totally treated irrigated croplands. With the installation of these practices, in combination with onfarm improved irrigation water management, irrigation efficiencies have been improved by 25-30 percent on over 17,000 acres (8,450 acres in 1980-81). This represents a water conservation savings and a reduction in deep percolation. The 1980 and 1981 savings are approximately 22,800 acre-feet and 39,500 acre-feet respectively. These cumulative reductions are having substantial impacts on decreasing the amounts of drainage return flows from the District. Flow records of 1981 indicate drainage return flows have been reduced to 153,000 acre-feet. These return flow values nearly equal the original target goals of 150,000 acre-feet. Current drainage return goals of 108,000 acre-feet should be achieved by the 1986 completion date.

Generally, the irrigation land retirement program and the present USDA onfarm water management programs are having major impacts on improving irrigation efficiencies, reducing deep percolation, and reducing drainage return flows.

2. Title II - USDA Onfarm Program

Since irrigation has been identified as contributing up to 37 percent of the total salt load to the Colorado River in the upper basin, it has been determined that increased effort through USDA is appropriate for addressing the agricultural irrigation problem. Improvements in

onfarm irrigation efficiencies will reduce excess surface runoff, will reduce deep percolation into the highly saline substrata, and will reduce the extent and magnitude of saline drainage return flows to the Colorado River. USDA activities in the onfarm Colorado River Basin Salinity Control Program include: (1) irrigation salt source unit studies, (2) technical and financial assistance on implementation; (3) information and education; (4) research and demonstration; and (5) monitoring and evaluation.

a. Irrigation Salt Source Unit Studies

The USDA carries out detailed salinity surveys and investigations in cooperation with USBR and the EPA. Essentially, the SCS conducts special irrigation salt source area unit studies to: (1) determine extent of salt source loads to the Colorado River from private irrigated, range, and forested lands; and (2) determine extent of onfarm irrigation and land treatment improvements needed to increase irrigation efficiencies, reduce deep percolation losses, and reduce runoff and erosion in lowering total salt loading to the Colorado River. The SCS conducts these studies under authority of Section 6 of Public Law 93-566 using special river basin study funding.

The four studies completed since 1980 include: (1) Moapa Valley, 5,000 acres; (2) Big Sandy, 16,000 acres; (3) Lower Gunnison, 182,000 acres; and (4) Virgin Valley Subevaluation Unit, 4,600 acres.

Four additional studies nearly completed or in draft stages include: McElmo Creek, 29,000 acres; Price-San Rafael Rivers, 68,000 acres; Mancos Valley, 8,000 acres; and Upper Virgin River, 14,000 acres. Completion of these four studies will bring total salinity control irrigation studies to 699,000 acres in the five upper Colorado River basin states.

b. Implementation

Technical and financial assistance for implementation is a second major area of USDA onfarm program inputs. Technical assistance is provided through the Soil Conservation Service with the Agricultural Stabilization and Conservation Service providing financial cost-share assistance through the Agriculture Conservation Program (ACP). While several difficulties exist in using authorities of existing programs, USDA has been able to achieve some reasonable level of accomplishment.

The Grand Valley (Colorado) irrigation salt source area was the first unit implemented under authority of existing USDA onfarm programs. Since initiation, 530 landowners/operators have received technical and financial cost-share assistance with 366 serviced in the last 2 years. Major accomplishments include: over 24 miles of pipeline and concrete laterals, about 24 miles of ported ditch and gated pipeline, and 7 new drip or sprinkler irrigation systems.

The 1982 annual project benefits are estimated to be 17,000 tons/year. This translated into a 1.77 mg/L reduction in salinity concentration at Imperial Dam.

When the Uinta Basin project (Utah) was initiated in 1980, it was determined that a special concentration or focusing of technical assistance to target areas in the project would be most effective. Also, the use of long-term agreements (LTA's) was chosen as the major approach for total onfarm water management and salinity control planning. The use of LTA's and the target area approach have been very successful in providing high visibility for the salinity control projects, for establishing a long-term farmer commitment, and in obligating a high percentage of available funds.

The following shows the annual cost-share and LTA commitments and fund distribution made in 1980 and 1981 from a total of $4 million which was available from ACP:

	Annual	LTA	Total
$ Obligated	$488,574	$3,032,943	$3,521,517
Farmers Assisted	48	106	154

These figures indicate approximately 70 percent of the farmers assisted have LTA's and that about 85 percent of the funds are obligated through these LTA's. A total of 12,028 acres has been affected by the program in a 2-year time frame. Accomplishments to-date on irrigation water management and salinity control practices include: 82 miles of pipeline laterals; 9 miles of sprinkler systems; and 16 miles of gated pipe and wheelline systems.

For 1982, the total salt load reductions from the Uinta Basin have been estimated to be 12,000 tons/yr for a 1.25 mg/L reduction at Imperial Dam. It has been determined actual irrigation on treated land efficiencies have been raised from 35-45 percent up to 65-80 percent. These improved efficiencies conserve water, reduce excessive deep percolation, and contribute to significantly reduced salt loads to the Colorado River. Generally, it assumed that the Uinta Basin project is having similar salt load reduction impacts as the Grand Valley program.

c. Information and Education

Information and educational activities have been vital ingredients to the success of the USDA onfarm program. Numerous tours, field days, and demonstrational projects have been major efforts in the Uinta Basin and Grand Valley projects. Newsletters and radio/newspaper media efforts through the local Cooperative Extension Service offices have complimented the efforts of other USDA agencies.

More recently, Reclamation, working in conjunction with the USDA Extension Service, SCS, and the Colorado Cooperative Extension Service, has entered into a 3-way memorandum of understanding for full-time extension agent assistance in Grand Valley. The full-time extension position will assist USBR and USDA agencies in helping organize local irrigation and drainage groups to further the off-farm and onfarm lateral development program. Additional emphasis is also being given to improved educational activities to promote continued onfarm irrigation water management practices.

d. Research and Demonstration

Agricultural Research Service activities within the Upper Colorado have come about by redirection of inhouse funds. Level basins are being studied as a surface irrigation method that eliminates surface runoff or tailwater, allows close control of deep percolation, and has a low labor requirement. Level basins are less suited to the Grand Valley, with its steeper slopes and shallower soils, than to the Wellton-Mohawk project. However, a survey has shown that about one-third of the Grand Valley may be suitable for level basin systems. Additional research is underway for effective irrigation scheduling and the effect of high saline water tables on irrigation water requirements.

Another research and development component concerns the evaluation of available automation equipment, development and testing of new devices, and working with farmers to integrate these components into an effective management system. Additional work has been funded by ARS at Utah State to develop a system of "surge irrigation" that may help solve the variable infiltration rate problem in Uinta Basin.

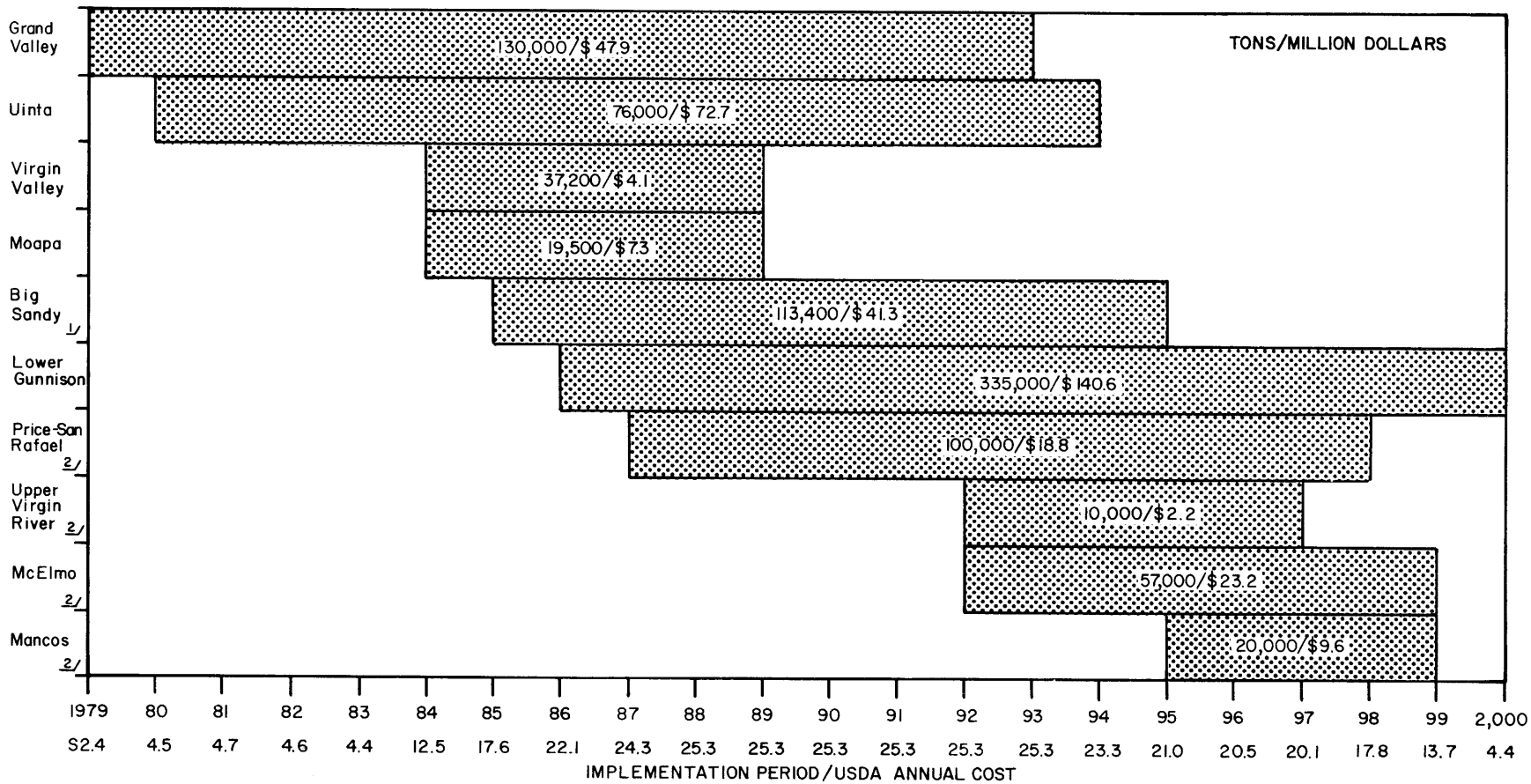
e. Monitoring and Evaluation

Minimal monitoring and evaluation activities have occurred in the last 2 years. Onfarm USDA monitoring includes specific onfarm irrigation water management evaluation for 1980 and 1981 in Grand Valley. This effort covered about 10 farms in 1980 and 15 farms in 1981. The objective of these onfarm evaluations was to measure the water management benefits from improved systems, to evaluate automated equipment, and to improve water management technology.

USBR has continued the instream monitoring and observation wells while USGS and state agencies continue to complement the instream monitoring network of data collection.

USDA recently developed a comprehensive monitoring and evaluation plan for the Uinta Basin and Grand Valley projects. SCS is currently pursuing funding options in order to more adequately assess the impacts of the USDA onfarm program.

USDA
COLORADO RIVER BASIN SALINITY CONTROL PROGRAM
Cost, Implementation Schedule, and Salt Reduction Upon Completion



Total Salt Reduction = 898,000 Tons Per Year
Total Cost = $369.7 Million (Includes $ 2.0 Million for Basin Studies
Total Economic Benefit = $529.8 Million Per Year

1/ Final alternative not yet selected.

2/ Estimated, USDA report are not yet published.

Figure VIII-2 USDA Program Schedule

f. General Prospectus

The USDA onfarm program has been identified as a very cost effective approach to improved salinity control in the Colorado River Basin. USDA reports that efforts will be continued to further strengthen, refine, and expedite the implementation of salinity projects. As program improvements and authorities are developed and as funding levels increase, more emphasis will be given to project implementation.

Special attention will be directed towards overcoming and resolving cost-share difficulties which restrict annual cost-share payments to a maximum of $3,500 per farmer. Likewise, the inability to provide cost-share assistance to special irrigation districts or companies needs to be changed. As these program modifications and improvements occur, USDA is hopeful that the onfarm program will continue to make substantial salt load reduction contributions to the Colorado River Salinity Control Program. The "modified" USDA implementation schedule in Figure VIII-2 illustrates a proposed onfarm salinity control program which will ultimately reduce total salt loads an estimated 898,000 tons per year. This proposed schedule presents modest increases in USDA funding and a more realistic commitment to the onfarm program.

In many instances, the USDA onfarm program and the USBR off-farm lateral and canal delivery system improvements are necessary for total salinity control in major irrigation salt source unit areas. The Department of the Interior and the Bureau of Reclamation continue to support and endorse the cost-effective USDA onfarm water management and salinity control activities.

D. Saline Water Use and Disposal Opportunities Unit, Basinwide

This Bureau of Reclamation appraisal-level effort was initiated in May 1980 to study the opportunities of collecting saline waters in the Colorado River Basin for use in energy production. Conceptual study descriptions were widely distributed for public comment. Public participation meetings were held with representatives from the Basin States, Federal agencies, energy development interests, and environmental groups.

The appraisal study has two thrusts: One is the investigation of using saline water for energy development. Second is the feasibility of a pipeline collection and disposal system for saline water and other collected wastewaters such as wastewater from powerplants and oil shale development.

Sixteen saline water sources, shown in Table D, were evaluated in a recent study in various collection configurations for local use or export. The total water volume considered as a potential source for use or disposal is 610,000 acre-feet of saline water, averaging about 3,200 mg/L of TDS and carrying 2.6 million tons of salt per year.

Table D
Saline water sources

	Annual average discharge		
	acre-ft/yr	TDS mg/L	Salt 1,000 tons
Big Sandy River	19,900	5,015	110
Meeker Dome	1,090	19,300	29
Glenwood-Dotsero Springs	25,000	14,200	500
Grand Valley*	43,500	3,300	195
Lower Gunnison*	17,200	2,900	68
Paradox Valley	568	265,000	205
McElmo Creek	32,500	2,700	119
Uinta Basin	13,600	4,500	83
Price River	24,900	4,000	136
San Rafael River	22,200	3,600	109
Crystal Geyser	150	14,000	3
Dirty Devil River	68,800	1,703	159
LaVerkin Springs	8,300	10,000	109
Lower Virgin	7,200	2,800	27
Las Vegas Wash	72,000	2,000	196
Palo Verde Irrigation District	253,000	1,700	585
Totals	609,908	3,173	2,633

* Remaining flow after implementation of irrigation systems and onfarm improvements.

Water is essential to all energy development operations, including mining, land reclamation, onsite processing, transportation, powerplant cooling, refining, and fuel conversion processes.

Some of the anticipated water requirements inherently require high quality (low TDS) water for boiler feed water or process steam. However, about 70 percent of typical plant water needs relate to cooling processes, and when accompanied by proper treatment, these processes can use water of degraded quality. Because of total containment or zero discharge policies for industrial effluent or blowdown in the Colorado River Basin, recycling and reuse of degraded quality water is a proven practice.

Coal transport pipelines present a viable future alternative to rail transportation of western coal as demonstrated by the 273-mile Black Mesa pipeline now supplying the Mohave Powerplant in Arizona. The pipeline has a capacity of 5 million tons per year and requires about 3,300 acre-feet of water per year. Several slurry pipelines are under planning study to move coal from the Rocky Mountain Region to the West Coast.

While the West Coast, primarily California, is not currently a major market for Colorado/Utah coal, it offers significant potential for long-term utilization of these reserves. In addition to new power and gasification plant construction, conversion of California's current oil and natural gas-fired electrical generation capacity to coal would require more than 50 million tons per year of coal. The same logistical factors which make Utah and Colorado coals attractive for the West Coast also reinforce the potential export of coal to the Orient, particularly Japan. Exports of steam coal from the United States have grown by a substantial 63 percent in the past year. Steam coal consumption in Japan is projected to increase from 1 million tons per year today to about 50 million tons per year by 1990.

Table E summarizes the net cost-effectiveness estimates for the major study alternatives which considered coal transport and local use options. Costs reflect net Federal costs after adjustments for savings or added costs resulting from beneficial use of saline water. In order to show relative cost-effectiveness and total salt removal potential, comparative estimates are also provided for the base case and long distance pipeline transport alternatives. On this relative cost-effectiveness basis, the local use and coal slurry pipeline alternatives appear very attractive. On the other hand, the long distance transport alternative costs stretch beyond the present range of acceptable cost-effectiveness. It is readily acknowledged that not all additional costs and/or benefits of joint use could be identified or quantified at this time. As such, the net Federal cost-effectiveness estimates are very preliminary and subject to changing, site-sensitive cost conditions. However, the ranges of costs, even allowing for considerable error in estimates, do give encouragement for more specific study of the local use and coal slurry transport cases.

Of special concern in this study are legal and institutional, environmental, and cost-sharing issues. To assure that these issues are

Table E
Saline Water Uses
Cost-Effectiveness Estimates[1/]

Alternative	Potential salt removal (1,000 tons)	TDS reduction at Imperial Dam (mg/L)	Net Federal cost-effectiveness in $ per mg/L per year
Base case (desalting and evaporation ponds)	1,600	160	1,244,000-1,836,000
Long Distance transport	768-1,975	77-198	1,850,000-5,130,000
Local use			
Total potential for 10 sites	878	84	(representative range as shown below)
LaVerkin Springs	103	8	795,000
McElmo Creek	60	6	880,000
Big Sandy River	98	8	519,000
Coal slurry pipeline			
100 million tons of coal	531	50	260,000
50 million tons of coal	183	15	518,000

1/ The local use options represent examples of the direct Federal costs for completing a saline water supply system (collection, storage, treatment, etc.,) as well as net reimbursable costs that would be paid to industry after appropriate credits for providing a firm water supply. For coal slurry pipeline cases, total non-Federal pipeline system capital costs, Federal water supply costs, and credits for the sale of water determined the general cost-sharing potential.

addressed early, special steps are being taken. A series of legal, institutional, and financial options have been discussed with the forum's work group. Those options are designed to be compatible with the existing law of the river and normal Federal cost-sharing procedures. To assure that environmental issues are identified and addressed, the study will include an environmental assessment of the alternatives that appear to hold the most promise. Public involvement activities are being conducted throughout the study.

A special report describing the results of the appraisal investigation was completed in September 1981. Any followup feasibility study will depend on congressional authorization. Work is expected to continue in cooperation with other agencies such as Department of Energy, as well as with private concerns, in developing saline water cooling towers and other new technology dedicated to the reduction of freshwater use for energy development.

1. Future Projects

A new bill to amend the 1974 Colorado River Salinity Act (Public Law 93-320) has been introduced recently which may have far-reaching implications for saline water use. The proposed bill would permit the Department of the Interior to enter into joint ventures with industrial water users to use saline water for industrial purposes. Another key provision would allow for demonstration of saline water use technology. Moreover, the bill would put saline water use planning studies on a "fast-track" basis in order to mesh with the planning horizon of most utilities.

Along with the impetus of pending legislation, Reclamation and the Basin States are actively exploring saline water use in three specific areas: (1) powerplant cooling demonstration, (2) industrial processes, and (3) coal transport systems.

Under (1) powerplant cooling demonstration, the Bureau is working with several utilities in evaluating specific sites for installation of a demonstration saline water-cooling tower as a retrofit or original equipment. Other studies are looking at the potential of softening processes to increase water use cycles on conventional wet-cooling towers in order to permit use of blended water supplies from fresh and saline sources.

In the category of industry processes (2), the Bureau and the State of Wyoming are working closely in formulating alternative plans for the use of saline water available from the Big Sandy River in southwest Wyoming. One of the most promising plans involves pipeline delivery of untreated saline water directly to a phosphate fertilizer plant for use and disposal.

Finally, a cooperative study involving Federal, State, and private interests is anticipated which will address new opportunities in coal transport systems(3). The Bureau completed arrangements with the

Jet Propulsion Laboratory in Pasadena, California, to proceed with a systems analysis study of coal transport and multipurpose systems. The study will focus on technological constraints and evaluate economic incentives for joint ventures in multiuse systems.

2. Aquatrain

The aquatrain proposal by W. R. Grace & Company evolved during the study of the Saline Water Use and Disposal Opportunities. Aquatrain would be a saline water pipeline carrying plastic capsules of dry, clean coal to the West Coast and is a cooperative program among Federal, State, and industrial interests.

Reclamation will take the lead Department of the Interior role for a feasibility study and will work with the Bureau of Land Management, Interior's legal staff, and with other Federal, State, and industrial interests. Reclamation and W. R. Grace & Company will contact utilities, transportation companies, and other coal development interests to develop a broader joint venture.

The initial phase includes development of a plan of study and Federal/ non-Federal financial arrangements for feasibility and environmental analyses.

W. R. Grace & Company will assume the lead role for developing the innovative coal transport technology and formation of a consortium of private interests for financing the non-Federal share. The Colorado River Basin Salinity Control Forum will address water rights issues and other related concepts that are a matter of State rather than Federal jurisdiction.

As proposed by W. R. Grace & Company, the aquatrain would consist of a 36-inch pipeline stretching from near Axial, Colorado, to the California Coast, about 1,000 miles in distance. Up to 15 million tons of coal annually mined in Colorado and Utah could be packaged in capsules to supply the proposed pipeline. The plastic capsules, 30 inches by 15 feet in size, would carry between 3 and 4 tons of coal each.

About 12,000 acre-feet of freshwater per year, presently owned by W. R. Grace & Company, could be used to transport part of the coal from Axial to a point near Rifle, Colorado, where it would be exchanged for water containing up to 14,000 mg/L of total dissolved solids, from Glenwood/Dotsero Springs for transport to the Pacific Ocean.

The pipeline would differ from a coal slurry pipeline. The coal would be crushed, cleaned, and dried at the mine. It would then be placed in plastic capsules. The capsules would have a specific gravity equal to the saline water which would transport them to the West Coast. Since the coal is cleaned, crushed, and dried before shipment, a more uniform and higher grade coal could be delivered direct to the powerplant than through existing transportation means. Moisture, sulfur, and ash content would be reduced prior to encapsulation, and the coal would be

stabilized in the capsule so that spontaneous combustion could not occur during transport and storage. The problems of the saline water leaching undesirable minerals out of the coal during transport (and thus adding to a water disposal problem) and saline materials being added to the coal (which cannot be entirely removed before burning, thus causing corrosion, slagging, and fouling during the combustion process) are resolved with this process.

E. Projection of Salinity Reduction of Salinity Control Units

Table F has been included to show each salinity control unit's effect on salinity reduction using the future effect equations developed from CRSS. Concentration reductions were determined for each unit using approximate 2010 flow and salt load conditions. This provides a consistency of river conditions that allow the units to be compared upon their individual contribution to reducing the salinity concentration at Imperial Dam.

The values shown in Table F for tons removed and concentration reduction are based on the maximum feasible salt removal at the time of printing and are subject to change. The concentration reductions at Imperial Dam were calculated using only the estimated salt removal due to a project. Water savings, due to improved systems, may be developed within each States' apportionment and is not expected to increase the flow at Imperial under full development conditions in the basin.

Table F
2010 Salinity Control Unit Effects

Unit		Salt removed per year[1/] tons	Concentration reduction at Imperial Dam (mg/L)[2/]
Paradox Valley		180,000	18
Grand Valley	USBR	[4/]280,000	28
	SCS	130,000	13
Crystal Geyser		3,000	0.3
Las Vegas Wash		55,000	6
Lower Gunnsion Basin	USBR	141,000	14
	SCS	335,000	34
Uinta Basin WSI	USBR	24,000	2
	SCS	76,000	8
McElmo Creek	USBR	16,000-24,000	2
	SCS	32,000	3
Palo Verde Irrigation District		78,000	10
Moapa Valley	SCS	19,000	2
LaVerkin Springs		103,000	10
Lower Virgin River	SCS	95,000	10
Glenwood-Dotsero Springs		314,000	31
Sinbad Valley	BLM	7,000	0.7
Big Sandy River		75,000	8
Price-San Rafael Rivers		[3/]180,000	18
Dirty Devil River		[3/]50,000	5
Meeker Dome		57,000	6

1/ Figures shown for salt removal are as currently planned and are subject to change as more detailed investigations are made.

2/ All concentration reductions were calculated using the 2010 equations in Part VII, except Palo Verde Irrigation District.

3/ Provisional estimate.

4/ Salt removal estimate is expected to be reduced by approximately 100,000 tons per year.

PART IX. SPECIAL STUDIES

A. Salinity Routing through the Colorado River/Reservoir System

The Bureau of Reclamation in cooperation with other agencies, universities, and consultants has ongoing monitoring and computer modeling studies to determine the long-term effects of reservoirs on salinity.

The development of the reservoir system and the subsequent upstream storage of more than 5 years' annual releases from Hoover Dam have considerably reduced annual and long-term salinity fluctuations in the Lower Basin.

Prior to storage in Lake Mead with the closure of Hoover Dam in 1935, the flow of the Colorado River was largely unregulated. The high runoff peaks and low baseflow periods caused considerable seasonal fluctuation in TDS. The TDS typically varied from 300 to 700 mg/L May through August, but the September through April baseflow TDS ranged from 700 to 1,300 mg/L which typically exceeded today's salinity standard of 879 mg/L at Imperial Dam approximately 6 months per year. Since winter water use potential in the Lower Basin was very high, salinity was recognized as a significant problem very early in the development of the Colorado River. Today the reservoir storage in the Colorado River has changed salinity fluctuations below Hoover Dam from 300 to 1,300 mg/L annually to less than 600 to 800 mg/L over the past decade. The annual variation of TDS at Hoover Dam today is typically less than 50 mg/L (see Figure VI-1).

During initial filling and active shoreline wave action, high levels of salt leaching occur in the new reservoirs similar to that experienced by newly irrigated soils. Sediment deposition in the reservoir soon covers salt bearing strata, and after several years salt leaching is greatly reduced.

At Reudi Reservoir[15] in the headwaters of the Colorado River (Figure II-1), Reclamation studies indicate that gypsum leaching has been decreasing and has been trending toward a preimpoundment condition since 1976.

A similar trend has been shown at Flaming Gorge Reservoir and at Lake Mead. In addition, other reservoir studies indicate that chemical and biological mechanisms may be reducing calcium, bicarbonate, and sulfate concentration in several major reservoirs on the Colorado River.

1. Salinity in Flaming Gorge Reservoir

Flaming Gorge Reservoir inundated two distinct geochemical regions. The upper half contains large quantities of sodium bicarbonate (trona) in the Green River Formations, while the lower half contains calcium sulfate (gypsum). Sodium bicarbonate ($NaHCO_3$) and calcium

sulfate ($CaSO_4$) in solution combine resulting in precipitation of calcium carbonate ($CaCO_3$) and solution of sodium sulfate (Na_2SO_4).[17] The USGS studies[14] on Flaming Gorge Reservoir concluded that calcium and bicarbonate loads decreased from 1969-75, while sodium and sulfate increased. The net result was a substantial increase in TDS from 1969-75 which USGS predicted would decline with time.

The USGS studies[14] also found that a wedge of high TDS water below the outlet elevation (approximately 200 feet deep) caused a chemocline. The sharp increase in TDS and lack of turbulence below the outlet resulted in a long-term storage of high TDS water (850 to 1,100 mg/L) from 1969 to 1975. The density barrier across this chemocline prevented mixing with the lower TDS overlying water during fall and spring turnover. This stagnant wedge of water (monimolimnion) remained largely anaerobic until the fall and spring turnovers in 1981-82.

The outlet works at Flaming Gorge Reservoir were modified from a depth of over 150 feet to a selective withdrawal varying up to 45 feet below the surface in 1978 to provide warmer temperatures suitable for a trout fishery downstream.

Data indicate that the high TDS concentration in the deep water was steadily declining from 1975 to 1978, and turnover had already partially eroded the chemocline prior to operation of the selective withdrawal.[18] This may have been an indication that salt leaching into the deep reservoir storage had indeed declined as USGS predicted. The addition of the selective withdrawal may have hastened complete mixing.

Existing records indicate that Flaming Gorge Reservoir selectively retained higher TDS water and routed lower TDS water through the 70's. It is not yet known if this condition will be repeated in the future.

Flaming Gorge should continue to mix in the future, as neither a mechanism in inflowing saline density current nor internal salt leaching appears to be present to re-establish the chemocline at this time. A trend from predominant chemical statification to nearly complete mixing seems to be an indication that Flaming Gorge Reservoir is approaching a dynamic chemical equilibrium.

Long-term TDS and specific ion budgets will be calculated with future studies on Flaming Gorge. The new internal circulation and salinity routing characteristics of the reservoir should be monitored and modeled for the next 2 to 5 years. Should complete mixing continue to occur, Flaming Gorge's ability to route less saline waters and store higher TDS water should diminish in the future. The next 2 years' data are essential to determining the long-term salt leaching and TDS routing characteristics of Flaming Gorge Reservoir under conditions approaching dynamic chemical equilibrium. Flow and TDS fluctuation before and after operation of Flaming Gorge Dam are shown in Figure IX-1.

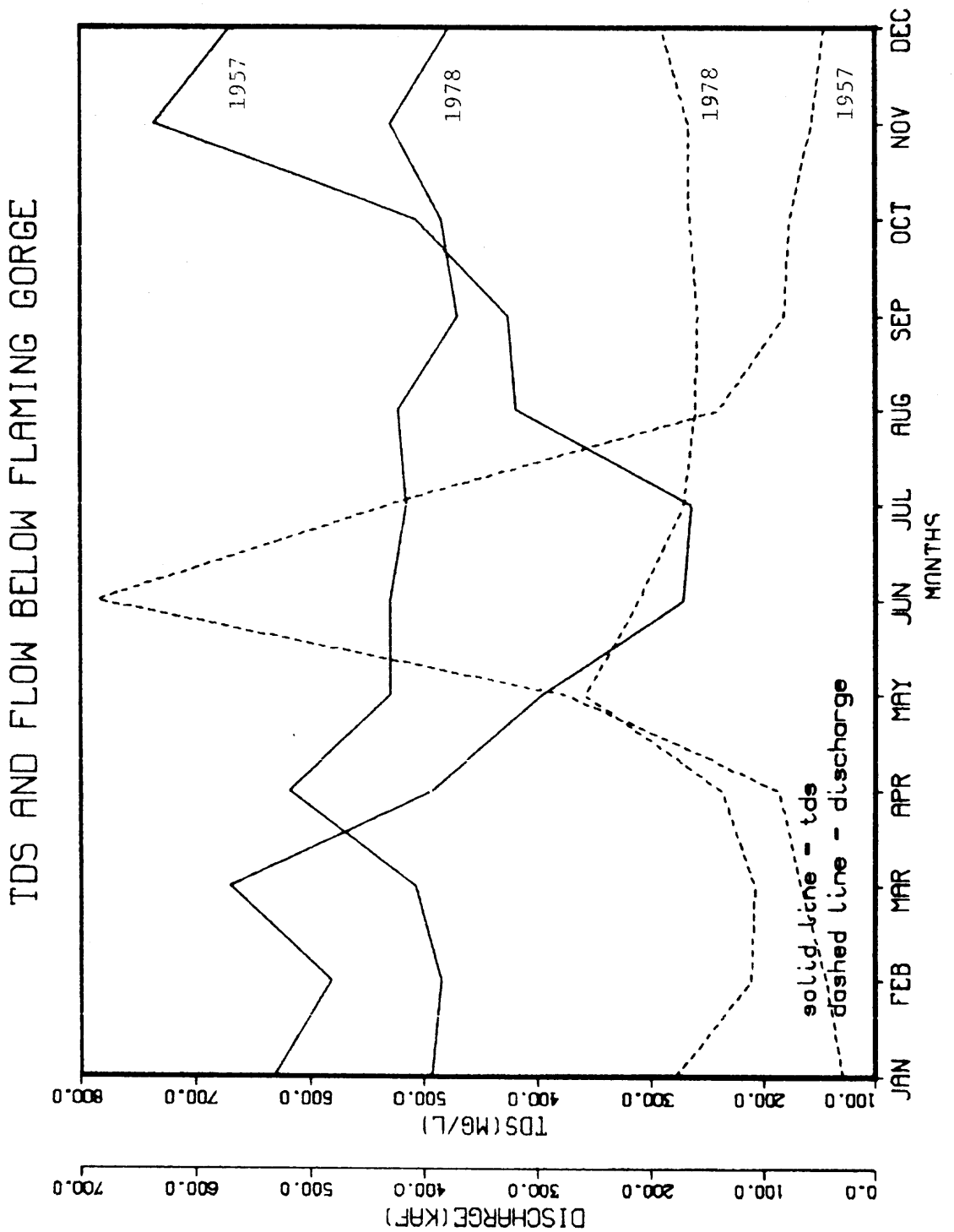


Figure IX-1 TDS and Flow Patterns below Flaming Gorge Pre and Post Impoundment

2. Salinity in Lake Powell

Storage in Lake Powell developed another 2 to 3 years' hydraulic detention time in the Colorado River; initial filling was completed in June 1980. The inflow area to Lake Powell lies on the boundary of Canyonlands National Park, where access and water quality monitoring are limited to boats.

The inflow salt budgets to Lake Powell are computed from the gages on the Green River at Green River (Table 6), Colorado River near Cisco (Table 11), San Rafael River near Green River (Table 7), and the San Juan River near Bluff (Table 14). The distance of these stations from the inflows to Lake Powell and their quality make the derivation of an exact salt budget extremely difficult.

Since Lake Powell will probably be the most significant factor in determining downstream salinity, Reclamation established six quarterly sampling stations at 50-foot intervals in 1965. In the fall of 1971 the quarterly sampling was increased to a monthly program to obtain sufficient data for a mathematical model of the system. The samples are taken at 50-foot intervals to the bottom and analyzed for TDS, common ions, specific conductance, pH, temperature, and dissolved oxygen.

Lake Powell has shown an ability to store the higher density winter inflows which sink to the bottom and route the less saline warmer runoff which moves down the reservoir as an overflow density current. During the drought of 1976-77 the higher TDS inflows were retained in the bottom (see Figures IX-2 and IX-3[19]).

Lake Powell was the last major reservoir to complete initial filling (1980), and the long-term continuation of full season chemical stratification and selective TDS routing is still an unknown. If Lake Powell follows the same trends as Flaming Gorge and Lake Mead, the chemical stratification and lack of seasonal complete mixing may diminish with time. However, the fluctuation of seasonal temperature and TDS in the inflow will continue to vary widely at Lake Powell, and it is quite likely to stratify and selectively retain higher TDS winter inflows.

In the future, Reclamation will attempt to collect 2-hour time interval, temperature, and electrical conductivity data of the Colorado River inflows to Lake Powell with newly developed solid-state memory submersible meters. Monthly common ion, TDS, and nutrient data will be collected when possible. Ice, logs, and debris occasionally make the headwaters of Lake Powell (Cataract Canyon) inaccessible by boat.

The 5-7 years' hydraulic retention, due to storage in the Colorado River, will continue to moderate the fluctuation of TDS. In order to predict future TDS conditions, the reservoir effects must be accurately depicted. Since Lake Powell completed initial filling in 1980, and Flaming Gorge Reservoir is still undergoing chemical and

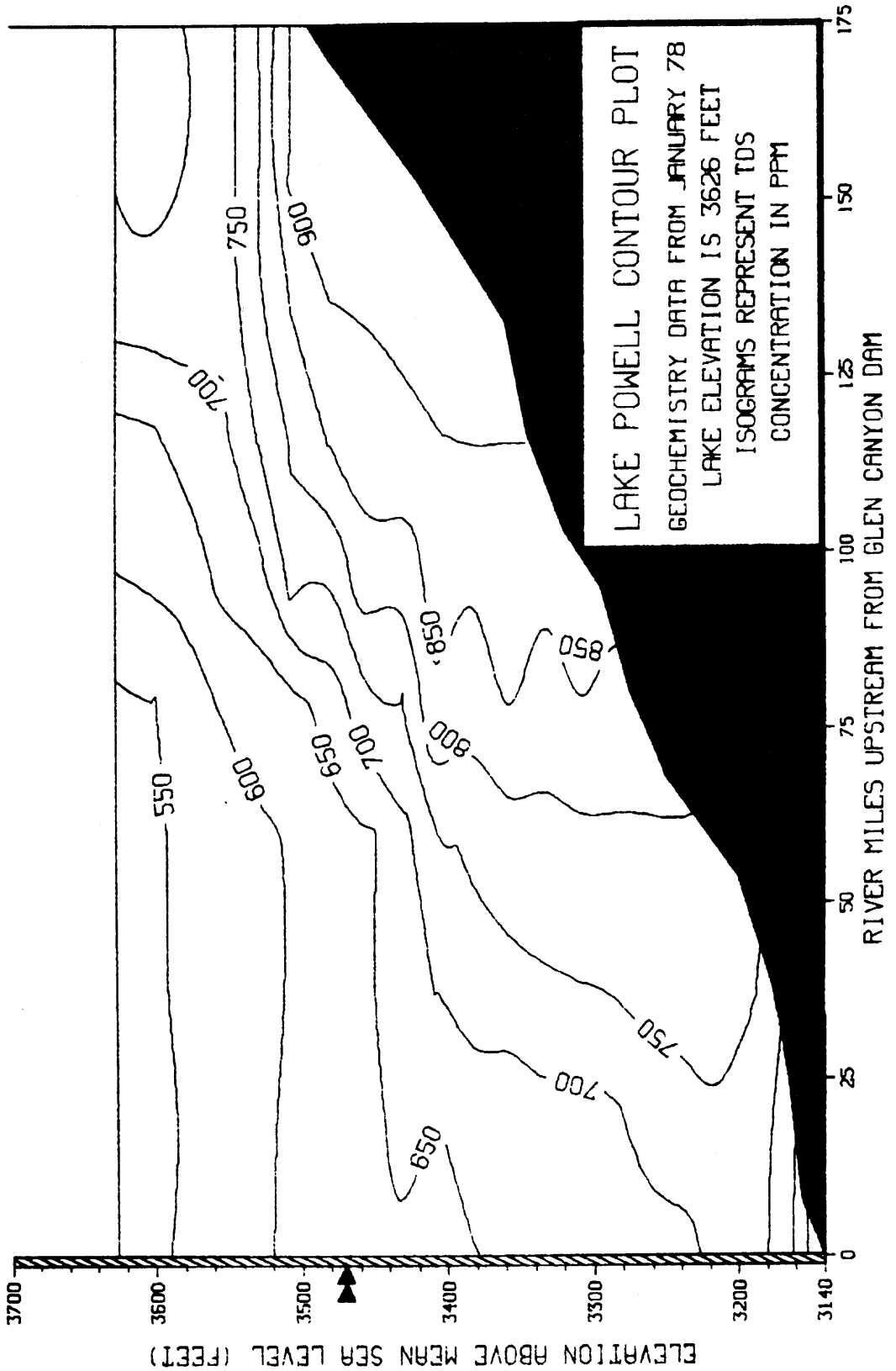


Figure IX-2 Winter TDS Isograph of Lake Powell

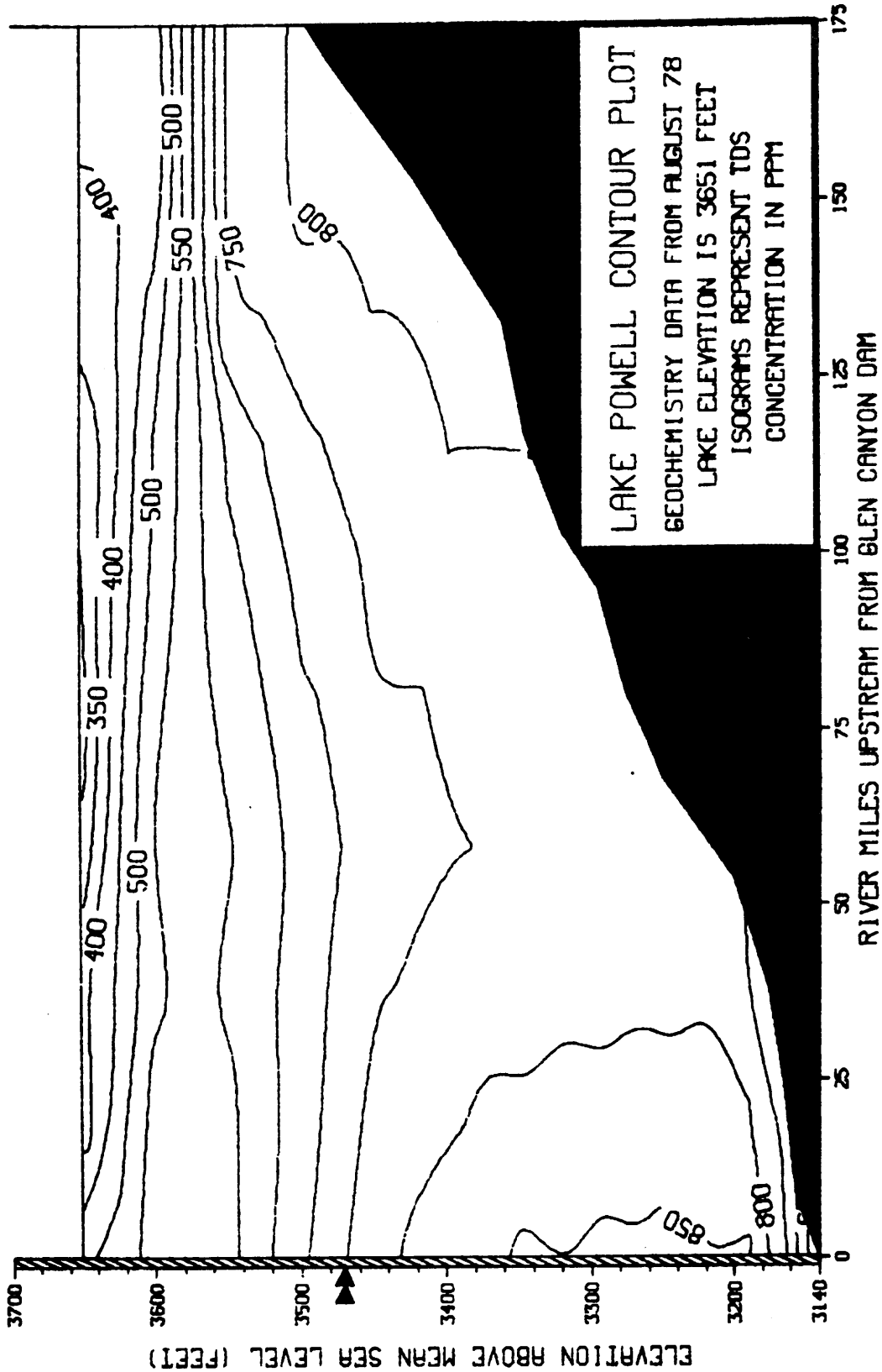


Figure IX-3 Summer TDS Isograph of Lake Powell

internal circulation adjustments, the data collected over the next 2 to 5 years should be the most significant in the history of the Colorado River reservoir system.

B. Two-Dimensional Reservoir Model

The Bureau of Reclamation contracted J. E. Edinger Associates, Inc., with a subcontract to Ford, Thornton, and Norton to develop a two-dimensional chemical and thermal circulation processes model of Lake Mead and Lake Powell. The study began in October 1981, and is scheduled for completion after 2 years. The study will be accomplished in five phases:

1. All the existing water quality and meteorological data on Lake Mead and Lake Powell have been evaluated with respect to the requirements of the various two-dimensional reservoir thermal hydrodynamic models presently in existence. The contractor has completed this phase and a model has been agreed upon for the rest of the study.

2. A chemical subroutine has been developed to be appended to the main model to simulate reservoir chemistry and will include pH, alkalinity, sodium, potassium, calcium, magnesium, sulfate, and chloride.

3. Using split data base techniques, the model will be calibrated and verified for Lake Powell and for Lake Mead if the data base is determined adequate.

4. Model simulations will be conducted to determine the impact that current (1978-81) reservoir operations have on the annual salt load of the Colorado River immediately downstream.

5. The model will then be set up on the Reclamation computer system and, in conjunction with the contractor, tested for its capability to simulate different operating scenarios on each reservoir. These scenarios could include but would not be limited to:

    a. Simulation of modifications of the intake and release structures at Glen Canyon and Hoover Dams to selectively withdraw water from different reservoir elevations than can be tapped under current operation;

    b. Simulation of several reservoir operation levels;

    c. Simulation of monthly, weekly, daily, or hourly release patterns within general annual operation and demand constraints.

The options tested will be evaluated in view of impacts on salinity and evaporation in both the releasing and receiving reservoirs. Impacts on the aquatic ecology of a changed temperature regime will also be evaluated.

The Bureau of Reclamation will use the two-dimensional reservoir model to evaluate potential peaking power alternatives, selective withdrawal methods to control reservoir and downstream water quality, and evaporation conditions. In addition, the study will be used to determine whether a better long-term salinity routing method can be used to improve the TDS projections.

C. Colorado River Solute Trend Study

The need has been shown to define chemical and biological mechanisms which may have altered the ion constituent ratios and/or changed TDS/flow relationships in the Colorado River. The CRSS projections of future salinity are based upon historical salt-flow relationships, under the assumption that such correlations are relatively constant over the period of record. If, however, physical, chemical, or biological changes to the system have changed salt loads relative to discharge volume, predictions of future salinity using the CRSS model will be inadequate.

Several potential new sources of salt loading and salt reduction have been indicated. A systematic change may manifest itself in a shift in the individual solute concentration-streamflow relationships, in the values of monthly solute loads, or mass fractions of individual ionic constituents.

In order to evaluate the possibility of such a systematic change, this study will address the following issues:

1. What is the most accurate model for describing the relationship between solute concentrations and streamflow?

2. What, if any, significant long-term trends exist in solute loads, concentration, relative composition of TDS, or estimated parameter values of the concentration-streamflow relationships?

3. What are the causes of any identified trends?

The study will include development of a data base of monthly flows and solute loads for the major gaging stations in the Upper Basin. Statistical analysis of the time series of various solute-flow relationships will be developed.

The purpose of the study is to determine whether the average historical conditions are representative of expected future salinity or whether trends are present to logically modify future projections.

The development of the solute-flow data base and statistical analysis will also provide an important tool to reanalyze TDS impacts with greater emphasis on specific ions: sodium, calcium, magnesium, chloride, sulfate, and bicarbonate. If improvements to the existing salinity projection methods presently used in CRSS can be identified, CRSS could be modified to incorporate these improvements.

D. Erosion and Sedimentation Processes

The relationship between erosion and salt pickup has been analyzed by several researchers. However, salt pickup during the months of January through April, particularly on lower elevation saline soils and badlands in the Upper Basin such as the Mancos Shale, have not been studied. These snowmelt events may yield a much higher salt pickup than was previously identified. A lack of data collection during the December through April runoff is a problem. Further, some sediments may undergo mechanical and chemical change in the turbulent riverine environment. The interaction of suspended sediment and dissolved pollutants may include adsorption, cation exchange, and biological availablility of nutrients. The sediments now trapped in Lake Powell contain many pollutants including heavy metals of lead, mercury, cadmium, zinc, pesticides, nutrients, and possibly salts.

These sediments might have produced dissolved salts or cation exchange (sodium for calcium) had they remained in a riverine environment with mechanical degradation. The Bureau of Reclamation will initiate at least a preliminary analysis of Lake Powell sediment/salt relationships if money and manpower can be provided in the next 2 years.

E. Nutrients, Eutrophication, Evaporation

The Bureau of Reclamation is also participating in or conducting reservoir studies for nutrients, eutrophication/blue-green algae, outlet elevation/downstream temperature regimes, fisheries, and heavy metals. While not all of this research is in the Colorado River Basin, much of the expertise and technology has been used to solve problems in the basin in the past several years. These projects include:

1. Flaming Gorge Reservoir.--The study of water quality problems included inflow area eutrophication/blue-green algae, dissolved oxygen, and fishery pathology, as well as downstream temperature regimes and other water quality factors that impact the cold water fishery.

2. Upper Basin water quality.--Cooperative studies were conducted with the Fish and Wildlife Service in the area of endangered species recovery.

3. Chemical and biological interaction between reservoirs.--This study particularly concerns the depth of withdrawal, flushing rate, and nutrient routing. It has two parts: (1) the interaction between Lakes Powell and Mead and (2) between Fontenelle and Flaming Gorge Reservoirs in Wyoming.

4. Ridgway Reservoir, Dallas Creek Project, Colo.--This study concerns heavy metals, outlet alternatives, and aeration.

5. Hoover Dam.--Potential outlet elevation alternatives are being studied as a possible mechanism to reduce evaporation and manipulate nutrients and primary productivity in Lake Mead.

These studies involve several State offices, the Lake Mead Limnological Research Center at the University of Nevada, Las Vegas, and the Fish and Wildlife Service. Many of the studies are interrelated or are being conducted in connection with the previously described salinity studies.

Program objectives involve optimization of multiple-use benefits and peaking power studies and a reduction of impacts associated with blue-green algae. The biological productivity of reservoirs and potential dissolved salt reduction mechanisms will also be considered. Since these studies are still ongoing, only a few aspects will be discussed below.

Many reservoirs in the basin are experiencing blooms (excesses) of noxious and potentially toxin-producing forms of blue-green algae. These blue-green algae blooms may be impacting fisheries, aesthetics, or domestic water supplies. Because many Upper Basin reservoirs seem to be trapping large portions of their inflowing nutrient supply, they are experiencing algae blooms locally, particularly in shallow inflow areas.

Fontenelle Resrvoir in Wyoming has a high flushing rate and a deep outlet. Following a period of summer stagnation, the reservoir tends to release high levels of biologically available phosphorus, usually during July, August, and September. The shallow inflow area of Flaming Gorge Reservoir downstream from Fontenelle Reservoir begins to experience fall turnover and blue-green algae blooms in September and October. There is a possible connection between the nutrient releases at Fontenelle and the downstream algae blooms in Flaming Gorge. Reclamation is attempting to assist Wyoming Fisheries Management and water quality agencies with these problems in conjunction with the Flaming Gorge Reservoir salinity studies. In particular, Reclamation hopes to provide these agencies with the in-reservoir limnological processes information to assist in making good management decisions. In addition, it is possible that these biological processes may be associated with calcium carbonate or sulfate reductions in reservoirs.

Nutrient routing below Glen Canyon Dam is a totally different problem than between Fontenelle and Flaming Gorge. The Lake Powell-Lake Mead studies have been combined in a cooperative effort with the Lake Mead Limnological Research Center, which also has grant assistance from the Office of Water Research and Technology and State and local agencies in Nevada. These nutrient and biological studies have been combined with Reclamation's Lake Powell/Mead salinity surveys, resulting in increased levels of research at lower cost.

Lake Powell's great length and depth provide an extremely efficient nutrient and sediment trap. More than 80 percent of the inflow phosphorus and nitrogen is retained in Lake Powell, resulting in a significant reduction of these nutrients in the inflow to Lake Mead. The Lake Mead Limnological Research Center has documented a significant overall decrease in primary productivity and subsequently in the fishery in much of Lake Mead because of nutrient entrapment in Lake Powell.

At the same time that Lake Powell was reducing nutrient inflow to Lake Mead, Las Vegas wastewater was significantly increasing and a local blue-green algae bloom problem developed in the Las Vegas Bay area. Considerable controversy has developed over the need for nutrient control with tertiary treatment of Las Vegas wastewater. This controversy is presently the object of litigation in Nevada.

Reclamation's future ability to continue studying blue-green algae bloom problems in reservoirs appears to be limited by funds at this time; nevertheless, every effort will be made to provide such assistance in conjunction with other studies whenever possible. Separate reports will be published on the results of these special water quality studies as they are completed, and a summary of significant findings will be listed in future editions of this progress report.

PART X. COLORADO RIVER WATER QUALITY PROBLEMS AND NEEDS SURVEY

Many water quality problems have been identified previously in this report, and solutions to most of them have also been outlined; therefore, only the most significant problems, and those for which a potential solution has not been identified, will be mentioned.

A. Monitoring

The vast area of the Colorado River Basin (244,000 square miles), combined with its remoteness and lack of access to many key areas such as the inflow to Lake Powell, makes it difficult to monitor water quality on a continuing basis. In addition, much of the runoff moves in large and quick bursts, making the timing of sampling critical.

Historically, much of the monitoring in the Colorado River mainstem has been handled by the USGS with fiscal assistance from the Bureau of Reclamation and other Federal and State agencies by cooperative agreement; however, in the last 2 years cutbacks in sources of funds available to the USGS and other cooperating agencies have resulted in a reduction in monitoring at several key locations in the basin, particularly in relation to the salinity program in energy impacted areas. Reclamation has tried to assist the USGS by supporting the continuation of at least those monitoring stations that are considered essential to the monitoring program. Otherwise, any further cutbacks in USGS's monitoring stations could result in the loss of future records for important water quality monitoring sites in the Colorado River basin.

While many of the historical monitoring sites need to be re-equipped with modern, continuous recording devices for salinity, cutbacks have resulted in discontinuing existing programs. In several cases, daily electrical conductivity records have been lost for periods of 6 months up to 2 years.

The Bureau of Reclamation and USGS need to analyze and prioritize the monitoring system in the Colorado River Basin to make it as efficient as possible. Those river gages and reservoir stations where data are critical should be equipped and maintained sufficiently to provide continuous flow, electrical conductivity (an indirect measure of salinity), and TDS data to provide a continuation of historical data. Sufficient funding and labor need to be provided to insure the continuation and updating of equipment for this program.

In the Upper Basin, USGS and Reclamation have tentatively agreed to hold an annual workshop to better facilitate coordination of Colorado River water quality monitoring. In the Lower Basin a similar program has been in existence for several years.

It is now apparent that a reservoir monitoring system is nearly as essential as the river gaging system for predicting future salinity conditions. The existing streamflow data base indicates changes in flows and salinity; however, salt budgets in the major reservoirs have been largely missing. Since the reservoir storage now represents more than 4 years' total annual virgin flow of the river, this is a significant data gap.

The present monitoring system was established over a long period of time. It has been largely based on areas of best access, but program needs may not be best served by stations monitored because of convenient access to these sites. The increased ability to monitor with new technology needs to be combined with overall program needs to evaluate and modify the water quality monitoring system. Such sites as the major inflows to Lake Powell should be given top priority.

In addition, the 2-year lag time from collection to completion of data handling has made it impossible to modify annual programs based on analysis of the previous year's data. The monitoring program needs to be updated based on analysis of data. The use of computer storage and analysis systems is making this an attainable goal. Reclamation is currently working with USGS and EPA to help resolve this problem.

B. Basinwide Salinity Reconnaissance

An intensive basinwide field review and water quality reconnaissance is needed to compare historical records of the tributaries, springs, and flowing wells. This information is needed to properly evaluate any ion constituency shifts or trends found in the Colorado Solute Trend Study described in Part IX. This should provide specific information showing where and why ion constituency trends developed. In addition, if any new flowing drill holes or other salt loading mechanisms have developed in the past decade, they can be inventoried and problems addressed. New areas may be identified for potential salinity control.

C. Eutrophication

The reservoir eutrophication problem is in many ways unique when considered in the context of historical research, which has primarily been applied to natural lakes. The application of this lake technology to reservoirs may be inappropriate and has led to a great deal of controversy and conflict, as shown in litigation concerning the need for phosphorus removal from Las Vegas wastewater. Inasmuch as the increase of water quality impairment associated with blue-green algae seems to be spreading throughout the basin, major new emphasis needs to be placed on this problem not only in the Colorado River Basin but in reservoirs in general.

Major research is needed to identify the unique reservoir limnology and blue-green algae bloom characteristics in the Colorado River Basin. The focus should be placed on blue-green algae dominance, rather than eutrophication in general. The emphasis should be placed on reducing--or, preferably, preventing--blue green algae domination. Healthy aquatic ecology systems should be the goal in the Colorado River Basin, optimizing multiple use benefits.

Moreover, recreational development or urbanization around reservoirs has long been known to increase the rate of the aging or eutrophication process. Therefore, planning and implementation of preventive measures should be developed before eutrophication becomes a crisis. Experience has long proven that once a water body develops anoxic conditions and large algae blooms, internal nutrient recycling becomes nearly self-sufficient. Eutrophication problems require prevention because they are not easily cured.

It is now obvious that each decision in the design and operation of dams implies many trade-offs among various water users. To the extent possible, the trade-offs should be identified and presented to the public. Decisions should continue to be made based on optimizing multi-purpose benefits, but such decisions should be made conscientiously. Where possible, mitigation should be provided in connection with uses of water which are not compatible with these decisions.

Definitions of Terms

Acre-foot (A.F., acre-foot) is the quantity of water required to cover 1 acre to a depth of 1 foot and is equivalent to 43,560 cubic feet or about 326,000 gallons or 1,233 cubic meters.

C.f.s.-day is the volume of water represented by flow of 1 cubic foot per second for 24 hours. It is equivalent to 86,400 cubic feet, approximately 1.9835 acre-feet, about 646,000 gallons or 2,447 cubic meters.

Concentration is the flow-weighted average concentration of total dissolved solids (salt) measured in mg/L or tons/acre-foot.

Consumptive Use is the total amount of water taken up by vegetation for transpiration and evaporation.

Cubic feet per second (c.f.s.) is the rate of discharge representing a volume of 1 cubic foot passing a given point during 1 second and is equivalent to approximately 7.48 gallons per second or 448.8 gallons per minute.

Depletion is the total loss of water from the river system due to consumptive uses, evaporation, seepage, evapotranspiration and transmountain diversion.

Discharge is the volume of water plus suspended sediment that passes a given point within a given period of time.

Diversion is the total amount of water diverted. Diverted water may or may not return to the river.

Drainage Basin is a part of the surface of the earth that is occupied by a drainage system, which consists of a surface stream or a body of impounded surface water together with all tributary surface streams and bodies of impounded surface water.

Estimated Flow is the flow that is estimated for periods of time in which no records of flow are available. The flow may be estimated by correlation or other accepted methods.

Gaging Station is a particular site on a stream, canal, lake, or reservoir where systematic observations of hydrologic data are obtained.

Historical Flow is the flow actually experienced at the gaging station or point of measurement. It is the total runoff of a drainage area above the point of measurement as influenced by nature and the activities of man. It may be recorded or estimated.

Instantaneous Discharge is the discharge at a particular instant of time.

Mean Discharge is the arithmetic mean of individual daily mean discharge during a specific period.

Natural Flow - See definition of virgin flow.

Pickup of salts is the amount of additional salts introduced into the system.

Recorded Flow is the flow passing a specific point on a stream which is measured and a record kept for a period of time.

Return Flow is the amount of water returned to the river system after being diverted for a use.

Salt is a compound derived from an acid by replacing hydrogen with a metal or an electropositive radical. See total dissolved solids.

Salt Pickup - See definition of Pickup of salts.

Sediment is a solid material that originates mostly from disintegrated rocks and is transported by, suspended in, or deposited from water; it includes chemical and biochemical precipitates and decomposed organic material, such as humus.

Specific conductance is a measure of the ability of a water to conduct an electrical current. It is expressed in micromhos per centimeter at 25°C. Specific conductance is related to the type and concentration of ions in water and can be used for approximating the dissolved-solids content of the water.

Stream Flow is the discharge that occurs in a natural channel. Although the term "discharge" can be applied to the flow of a canal, the word "stream flow" uniquely describes the discharge in a surface stream source. The term "stream flow" is more general than "runoff" as stream flow may be applied to discharge whether or not it is affected by diversion or regulation.

Suspended sediment is the sediment that at any given time is maintained in suspension by the upward components of turbulent currents or that exists in suspension as a colloid.

Tons per acre-foot indicates the dry mass of total dissolved solids in 1 acre-foot of water. It is computed by multiplying the concentration in milligrams per liter by 0.00136.

Total Dissolved Solids (TDS) is the total amount of dissolved material, organic and inorganic, contained in water. The actual measure of TDS may be made using numerous methods: evaporation at 104°C, evaporation at 180°C, sum of ionic constituents, or sum of ionic constituents less some portion of the bicarbonate fraction. The method currently used, sum of constituents less approximately half of the bicarbonate fraction, is considered, by the U.S. Geological Survey, to be consistent with measurements made using the 180°C evaporative technique before 1970.

Total Salt Load is the total quantity (weight) of salts passing a given point during a given time. The load is calculated as a function of concentration and discharge.

Transmountain Diversion is the total amount of water diverted out of its original basin.

Virgin Flow is the historical flow at the point of measurement corrected for the effects of manmade developments in the drainage basin above the point of measurement.

Water Year is the 12 month period, October 1 through September 30. The water year is designated by the calendar year in which it ends and which includes 9 of the 12 months. Thus, the year ending September 30, 1978, is called the "1978 water year."

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Table 1

Colorado River Basin

Historical Flow and Quality of Water Data

Green River near Green River, Wyoming

Calendar Year	Month	Flow 1000 (A F)	Concen-tration (T/A F)	T.D.S. 1000 (Tons)
1941	Jan.	22	0.73	16
	Feb.	19	.74	14
	Mar.	45	.69	31
	Apr.	95	.54	51
	May	174	.52	90
	June	342	.34	116
	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
1942	Jan.	24	.79	19
	Feb.	23	.83	19
	Mar.	43	.70	30
	Apr.	200	.41	82
	May	151	.50	75
	June	337	.34	114
	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
1943	Jan.	28	.78	22
	Feb.	29	.76	22
	Mar.	59	.63	37
	Apr.	200	.41	82
	May	237	.39	92
	June	476	.29	138
	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
1944	Jan.	25	.80	20
	Feb.	25	.80	20
	Mar.	31	.77	24
	Apr.	267	.37	99
	May	155	.46	71
	June	351	.33	116
	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
1945	Jan.	24	.79	19
	Feb.	27	.74	20
	Mar.	41	.68	28
	Apr.	78	.58	45
	May	111	.52	58
	June	245	.38	93
	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
1946	Jan.	32	.75	24
	Feb.	26	.77	20
	Mar.	63	.62	40
	Apr.	131	.48	63
	May	212	.41	87
	June	320	.34	109
	July	153	.35	54
	Aug.	74	.47	35
	Sept.	52	.52	27
	Oct.	58	.64	37
	Nov.	51	.67	34
	Dec.	51	.67	34
	TOTAL	1,225	.46	564
1947	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
	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
1948	Jan.	38	.71	27
	Feb.	33	.73	24
	Mar.	64	.62	40
	Apr.	95	.54	51
	May	187	.43	80
	June	396	.31	123
	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
1949	Jan.	27	.78	21
	Feb.	24	.79	19
	Mar.	45	.69	31
	Apr.	104	.52	54
	May	211	.41	86
	June	372	.32	119
	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
1950	Jan.	29	.79	23
	Feb.	33	.73	24
	Mar.	102	.53	54
	Apr.	251	.38	95
	May	270	.37	100
	June	582	.34	198
	July	427	.23	98
	Aug.	140	.37	52
	Sept.	76	.45	34
	Oct.	66	.61	40
	Nov.	71	.59	42
	Dec.	49	.65	32
	TOTAL	2,096	.38	792
1951	Jan.	34	.74	25
	Feb.	47	.66	31
	Mar.	70	.59	41
	Apr.	154	.45	69
	May	317	.35	111
	June	528	.28	148
	July	349	.25	87
	Aug.	298	.28	58
	Sept.	91	.43	39
	Oct.	81	.53	43
	Nov.	50	.68	34
	Dec.	43	.70	30
	TOTAL	1,972	.36	716
1952	Jan.	41	.63	26
	Feb.	42	.62	26
	Mar.	52	.63	33
	Apr.	190	.52	99
	May	348	.32	111
	June	399	.27	108
	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
1953	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
	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
1954	Jan.	26	.81	21
	Feb.	227	.74	20
	Mar.	48	.67	32
	Apr.	88	.55	48
	May	282	.28	79
	June	232	.30	70
	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
1955	Jan.	20	.80	16
	Feb.	20	.80	16
	Mar.	33	.76	25
	Apr.	74	.59	44
	May	127	.39	50
	June	245	.27	66
	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
1956	Jan.	42	.69	29
	Feb.	29	.66	19
	Mar.	91	.56	51
	Apr.	158	.45	71
	May	310	.37	115
	June	555	.25	139
	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
1957	Jan.	22	.77	17
	Feb.	37	.70	26
	Mar.	57	.68	39
	Apr.	60	.62	37
	May	176	.46	81
	June	476	.27	129
	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
1958	Jan.	33	.76	25
	Feb.	47	.66	31
	Mar.	51	.63	32
	Apr.	99	.56	55
	May	291	.31	90
	June	266	.31	82
	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	473
1959	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
	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
1960	Jan.	27	.74	20
	Feb.	23	.78	18
	Mar.	75	.53	40
	Apr.	84	.49	41
	May	66	.48	32
	June	173	.30	52
	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
1961	Jan.	20	.60	12
	Feb.	19	.58	11
	Mar.	30	.57	17
	Apr.	50	.60	30
	May	60	.43	26
	June	162	.27	44
	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
1962	Jan.	32	.47	15
	Feb.	48	.48	23
	Mar.	77	.51	38
	Apr.	203	.43	87
	May	256	.36	92
	June	355	.27	96
	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
1963	Jan.	18	.72	13
	Feb.	18	.72	13
	Mar.	42	.67	28
	Apr.	51	.63	32
	May	100	.45	45
	June	337	.26	88
	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
1964	Jan.	23	.56	13
	Feb.	22	.59	13
	Mar.	29	.59	17
	Apr.	68	.56	38
	May	138	.32	44
	June	323	.38	123
	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
1965	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
	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

To obtain mg/L multiply T/AF by 735.29

Table I

Colorado River Basin

Historical Flow and Quality of Water Data

Green River near Green River, Wyoming

Calendar Year	Month	Flow 1000 (A F)	Concen-tration (T/A F)	T.D.S. 1000 (Tons)
1966	Jan.	37	.76	28
	Feb.	35	.77	27
	Mar.	88	.72	63
	Apr.	138	.50	69
	May	160	.39	62
	June	171	.31	53
	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
1967	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
	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
1968	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
	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
1969	Jan.	51	.61	31
	Feb.	89	.46	41
	Mar.	80	.56	45
	Apr.	141	.46	65
	May	207	.36	75
	June	302	.28	86
	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
1970	Jan.	38	.74	28
	Feb.	33	.76	25
	Mar.	58	.60	35
	Apr.	75	.69	52
	May	84	.58	49
	June	204	.37	75
	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

Calendar Year	Month	Flow 1000 (A F)	Concen-tration (T/A F)	T.D.S. 1000 (Tons)
1971	Jan.	42	.71	30
	Feb.	47	.62	29
	Mar.	76	.60	45
	Apr.	107	.53	57
	May	280	.41	116
	June	480	.30	143
	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
1972	Jan.	85	.54	46
	Feb.	77	.56	43
	Mar.	106	.58	62
	Apr.	154	.48	73
	May	294	.40	118
	June	625	.27	169
	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
1973	Jan.	73	.58	42
	Feb.	95	.48	46
	Mar.	92	.53	49
	Apr.	110	.60	66
	May	171	.46	78
	June	162	.36	58
	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
1974	Jan.	78	.56	44
	Feb.	110	.49	54
	Mar.	114	.57	65
	Apr.	104	.58	60
	May	207	.43	89
	June	346	.31	106
	July	210	.31	65
	Aug.	102	.42	43
	Sept.	53	.60	32
	Oct.	57	.61	35
	Nov.	56	.65	35
	Dec.	59	.63	37
	TOTAL	1,494	.45	655
1975	Jan.	62	.61	38
	Feb.	57	.60	34
	Mar.	62	.66	41
	Apr.	70	.67	47
	May	125	.54	67
	June	296	.36	108
	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

Calendar Year	Month	Flow 1000 (A F)	Concen-tration (T/A F)	T.D.S. 1000 (Tons)
1976	Jan.	71	.58	41
	Feb.	65	.55	36
	Mar.	99	.54	53
	Apr.	106	.54	57
	May	296	.40	117
	June	292	.30	88
	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
1977	Jan.	61	.55	34
	Feb.	55	.57	32
	Mar.	42	.73	30
	Apr.	33	.81	27
	May	30	.76	23
	June	25	.81	20
	July	23	.85	19
	Aug.	23	.88	20
	Sept.	33	.68	22
	Oct.	31	.73	23
	Nov.	32	.73	24
	Dec.	43	.64	27
	TOTAL	431	.70	301
1978	Jan.	64	.51	32
	Feb.	59	.51	30
	Mar.	79	.56	44
	Apr.	104	.49	51
	May	167	.44	74
	June	378	.31	117
	July	302	.25	75
	Aug.	142	.31	43
	Sept.	82	.39	32
	Oct.	46	.56	26
	Nov.	50	.52	26
	Dec.	59	.49	29
	TOTAL	1532	.38	581
1979	Jan.	62	.48	30
	Feb.	61	.48	29
	Mar.	77	.51	39
	Apr.	92	.60	55
	May	123	.44	54
	June	217	.30	65
	July	67	.40	27
	Aug.	63	.45	29
	Sept.	52	.48	25
	Oct.	45	.54	24
	Nov.	47	.51	24
	Dec.	51	.49	30
	TOTAL	957	.45	431
1980	Jan.	45	.57	26
	Feb.	38	.61	23
	Mar.	58	.61	36
	Apr.	142	.53	74
	May	176	.49	86
	June	319	.32	103
	July	237	.30	70
	Aug.	100	.39	39
	Sept.	64	.48	31
	Oct.	48	.60	29
	Nov.	56	.56	31
	Dec.	73	.50	36
	TOTAL	1,338	.43	584

Calendar Year	Month	Flow 1000 (A F)	Concen-tration (T/A F)	T.D.S. 1000 (Tons)
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			

To obtain mg/L multiply T/AF by 735.29

Table 2

Colorado River Basin

Historical Flow and Quality of Water Data

Green River near Greendale, Utah

Calendar Year	Month	Flow 1000 (AF)	Concentration (T/AF)	T.D.S. 1000 (Tons)
1941	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
	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
1942	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
	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
1943	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
	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
1944	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
	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
1945	Jan.	29	.97	28
	Feb.	34	.94	32
	Mar.	65	.88	57
	Apr.	113	.70	79
	May	176	.60	105
	June	310	.46	144
	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

Calendar Year	Month	Flow 1000 (AF)	Concentration (T/AF)	T.D.S. 1000 (Tons)
1946	Jan.	39	.90	35
	Feb.	33	.85	28
	Mar.	88	.67	59
	Apr.	237	.48	115
	May	298	.44	130
	June	354	.37	133
	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
1947	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
	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
1948	Jan.	47	.91	43
	Feb.	40	.88	35
	Mar.	102	.79	81
	Apr.	157	.70	110
	May	336	.38	126
	June	454	.36	162
	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
1949	Jan.	31	.90	28
	Feb.	29	.93	27
	Mar.	73	.89	65
	Apr.	152	.69	105
	May	310	.53	165
	June	493	.47	230
	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
1950	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
	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

Calendar Year	Month	Flow 1000 (AF)	Concentration (T/AF)	T.D.S. 1000 (Tons)
1951	Jan.	45	.80	36
	Feb.	61	.82	50
	Mar.	93	.78	73
	Apr.	212	.47	100
	May	395	.45	177
	June	626	.36	225
	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
1952	Jan.	49	.82	40
	Feb.	52	.81	42
	Mar.	63	.75	47
	Apr.	318	.62	198
	May	600	.39	235
	June	554	.36	201
	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	1,117
1953	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
	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
1954	Jan.	28	1.11	31
	Feb.	39	.87	43
	Mar.	62	.81	50
	Apr.	101	.65	66
	May	302	.31	94
	June	223	.36	81
	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
1955	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
	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

Calendar Year	Month	Flow 1000 (AF)	Concentration (T/AF)	T.D.S. 1000 (Tons)
1956	Jan.	50	.86	43
	Feb.	38	.76	29
	Mar.	150	.47	70
	Apr.	203	.43	87
	May	368	.39	144
	June	615	.29	178
	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
1957	Jan.	28	.86	24
	Feb.	43	.79	34
	Mar.	66	.91	60
	Apr.	86	.67	58
	May	275	.54	148
	June	685	.37	251
	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
1958	Jan.	43	.77	33
	Feb.	55	.80	44
	Mar.	66	.71	47
	Apr.	134	.67	90
	May	386	.39	151
	June	335	.38	127
	July	87	.50	44
	Aug.	57	.56	32
	Sept.	39	.69	27
	Oct.	36	.72	26
	Nov.	34	.70	24
	Dec.	38	.84	32
	TOTAL	1,310	.52	677
1959	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
	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
1960	Jan.	26	.81	21
	Feb.	29	.86	25
	Mar.	149	.70	104
	Apr.	140	.55	77
	May	127	.58	74
	June	216	.43	93
	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

Calendar Year	Month	Flow 1000 (AF)	Concentration (T/AF)	T.D.S. 1000 (Tons)
1961	Jan.	27	.73	20
	Feb.	27	.77	21
	Mar.	64	.86	55
	Apr.	76	.69	52
	May	79	.59	47
	June	192	.32	61
	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
1962	Jan.	43	.65	28
	Feb.	83	.81	67
	Mar.	150	.84	126
	Apr.	374	.55	206
	May	394	.41	162
	June	456	.40	182
	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
1963	Jan.	23	.91	21
	Feb.	26	.92	24
	Mar.	6	.83	5
	Apr.	8	.87	7
	May	8	.87	7
	June	7	.86	6
	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
1964	Jan.	58	.57	33
	Feb.	56	.57	32
	Mar.	37	.59	22
	Apr.	35	.63	22
	May	91	.64	58
	June	86	.60	52
	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
1965	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
	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	1,142

To obtain mg/L multiply T/AF by 735.29

Table 2

Colorado River Basin

Historical Flow and Quality of Water Data

Green River near Greendale, Utah

Calendar Year	Month	Flow 1000 (AF)	Concen-tration (T/AF)	T.D.S. 1000 (Tons)
1966	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
	July	104	.75	78
	Aug.	118	.72	85
	Sept.	124	.73	91
	Oct.	124	.77	95
	Nov.	85	.81	69
	Dec.	111	.76	84
	TOTAL	1,189	.75	889
1967	Jan.	142	.74	105
	Feb.	96	.75	72
	Mar.	67	.77	52
	Apr.	85	.81	69
	May	122	.83	101
	June	195	.83	162
	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	1,804	.81	1,469
1968	Jan.	187	.70	131
	Feb.	123	.72	89
	Mar.	76	.83	63
	Apr.	96	.88	84
	May	119	.81	96
	June	97	.77	75
	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	1,691	.75	1,260
1969	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
	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
1970	Jan.	101	.62	63
	Feb.	78	.62	48
	Mar.	81	.64	52
	Apr.	109	.66	72
	May	64	.67	43
	June	87	.67	58
	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

Calendar Year	Month	Flow 1000 (AF)	Concen-tration (T/AF)	T.D.S. 1000 (Tons)
1971	Jan.	55	.61	34
	Feb.	43	.62	26
	Mar.	48	.63	30
	Apr.	81	.63	51
	May	90	.66	59
	June	100	.66	66
	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
1972	Jan.	170	.59	100
	Feb.	168	.62	104
	Mar.	102	.63	65
	Apr.	140	.65	90
	May	244	.64	156
	June	190	.63	119
	July	181	.62	113
	Aug.	161	.64	104
	Sept.	93	.66	62
	Oct.	195	.67	131
	Nov.	216	.67	144
	Dec.	223	.63	140
	TOTAL	2,083	.64	1,328
1973	Jan.	220	.63	138
	Feb.	203	.65	131
	Mar.	113	.69	78
	Apr.	62	.76	47
	May	160	.71	114
	June	188	.72	136
	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
1974	Jan.	127	.64	81
	Feb.	45	.67	30
	Mar.	51	.71	36
	Apr.	60	.73	44
	May	183	.71	130
	June	132	.67	89
	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
1975	Jan.	154	.71	109
	Feb.	163	.72	117
	Mar.	98	.71	70
	Apr.	62	.73	45
	May	89	.75	67
	June	206	.76	155
	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

Calendar Year	Month	Flow 1000 (AF)	Concen-tration (T/AF)	T.D.S. 1000 (Tons)
1976	Jan.	179	.67	119
	Feb.	111	.66	73
	Mar.	108	.69	75
	Apr.	138	.84	116
	May	259	.72	187
	June	212	.72	152
	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
1977	Jan.	178	.66	118
	Feb.	148	.61	90
	Mar.	235	.62	145
	Apr.	173	.65	113
	May	179	.72	129
	June	145	.66	95
	July	140	.67	93
	Aug.	131	.69	91
	Sept.	107	.69	73
	Oct.	71	.68	48
	Nov.	64	.68	43
	Dec.	64	.67	42
	TOTAL	1,633	.66	1,082
1978	Jan.	76	.72	54
	Feb.	70	.76	53
	Mar.	99	.75	75
	Apr.	74	.79	59
	May	66	.81	54
	June	98	.76	74
	July	125	.70	87
	Aug	105	.73	77
	Sept.	92	.73	67
	Oct.	78	.70	55
	Nov.	97	.72	69
	Dec.	120	.72	86
	TOTAL	1,100	.74	810
1979	Jan.	138	.13	18
	Feb.	157	.13	20
	Mar.	144	.13	18
	Apr.	124	.12	15
	May	90	.10	9
	June	87	.08	7
	July	124	.09	11
	Aug.	95	.11	10
	Sept.	84	.11	9
	Oct.	91	.10	9
	Nov.	114	.10	11
	Dec.	127	.10	13
	TOTAL	1,376	.11	150
1980	Jan.	141	.11	15
	Feb.	131	.11	14
	Mar.	104	.11	11
	Apr.	82	.12	10
	May	64	.11	7
	June	72	.09	7
	July	84	.08	7
	Aug.	99	.08	8
	Sept.	99	.09	9
	Oct.	106	.10	11
	Nov.	86	.11	9
	Dec.	70	.11	8
	TOTAL	1,138	.10	114

Calendar Year	Month	Flow 1000 (AF)	Concen-tration (T/AF)	T.D.S. 1000 (Tons)
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			

To obtain mg/L multiply T/AF by 735.29

Table 3

Colorado River Basin

Historical Flow and Quality of Water Data

Yampa River near Maybell, Colorado

Calendar Year	Month	Flow 1000 (A F)	Concen-tration (T/A F)	T.D.S. 1000 (Tons)
1941	Jan.	14	.43	6
	Feb.	17	.41	7
	Mar.	39	.36	14
	Apr.	92	.23	21
	May	451	.15	69
	June	240	.18	43
	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
1942	Jan.	21	.38	8
	Feb.	19	.42	8
	Mar.	50	.34	17
	Apr.	239	.18	43
	May	361	.16	59
	June	329	.17	55
	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
1943	Jan.	12	.42	5
	Feb.	13	.46	6
	Mar.	46	.35	16
	Apr.	190	.19	37
	May	237	.18	43
	June	270	.17	47
	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
1944	Jan.	10	.50	5
	Feb.	10	.50	5
	Mar.	18	.44	8
	Apr.	44	.27	12
	May	311	.17	53
	June	347	.16	57
	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
1945	Jan.	12	.42	5
	Feb.	10	.50	5
	Mar.	24	.38	9
	Apr.	89	.24	21
	May	439	.15	68
	June	393	.16	62
	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

Calendar Year	Month	Flow 1000 (A F)	Concen-tration (T/A F)	T.D.S. 1000 (Tons)
1946	Jan.	14	.43	6
	Feb.	18	.44	8
	Mar.	40	.35	14
	Apr.	215	.19	40
	May	220	.19	41
	June	228	.18	42
	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
1947	Jan.	14	.43	6
	Feb.	15	.47	7
	Mar.	76	.37	24
	Apr.	164	.20	33
	May	492	.15	74
	June	317	.17	53
	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
1948	Jan.	37	.35	13
	Feb.	37	.35	13
	Mar.	57	.33	19
	Apr.	195	.19	37
	May	453	.15	69
	June	240	.18	43
	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
1949	Jan.	15	.47	7
	Feb.	16	.44	7
	Mar.	44	.34	15
	Apr.	192	.19	37
	May	422	.16	66
	June	433	.15	67
	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
1950	Jan.	15	.47	7
	Feb.	15	.47	7
	Mar.	28	.39	11
	Apr.	133	.21	28
	May	271	.17	47
	June	327	.17	55
	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

Calendar Year	Month	Flow 1000 (A F)	Concen-tration (T/A F)	T.D.S. 1000 (Tons)
1951	Jan.	14	.39	5
	Feb.	15	.47	7
	Mar.	33	.40	13
	Apr.	110	.31	34
	May	329	.15	49
	June	315	.11	35
	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
1952	Jan.	14	.40	6
	Feb.	15	.39	6
	Mar.	19	.41	8
	Apr.	240	.30	72
	May	516	.17	88
	June	474	.13	62
	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
1953	Jan.	15	.44	7
	Feb.	12	.46	6
	Mar.	25	.43	11
	Apr.	72	.34	24
	May	221	.20	44
	June	364	.12	44
	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
1954	Jan.	15	.43	6
	Feb.	15	.44	7
	Mar.	23	.44	10
	Apr.	103	.25	26
	May	209	.14	29
	June	85	.16	14
	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
1955	Jan.	12	.40	5
	Feb.	11	.40	4
	Mar.	28	.43	12
	Apr.	119	.30	36
	May	300	.15	45
	June	200	.12	24
	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

Calendar Year	Month	Flow 1000 (A F)	Concen-tration (T/A F)	T.D.S. 1000 (Tons)
1956	Jan.	17	.43	7
	Feb.	14	.44	6
	Mar.	30	.42	13
	Apr.	214	.27	28
	May	401	.15	60
	June	259	.12	31
	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
1957	Jan.	12	.43	5
	Feb.	13	.42	5
	Mar.	29	.49	14
	Apr.	125	.39	49
	May	440	.22	97
	June	680	.17	115
	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
1958	Jan.	20	.41	8
	Feb.	28	.45	13
	Mar.	41	.50	21
	Apr.	162	.40	65
	May	549	.18	99
	June	330	.12	40
	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
1959	Jan.	13	.46	6
	Feb.	14	.48	7
	Mar.	21	.46	10
	Apr.	89	.38	34
	May	265	.16	42
	June	287	.11	31
	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
1960	Jan.	14	.42	6
	Feb.	13	.39	5
	Mar.	41	.41	17
	Apr.	240	.23	55
	May	287	.16	46
	June	268	.12	32
	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

Calendar Year	Month	Flow 1000 (A F)	Concen-tration (T/A F)	T.D.S. 1000 (Tons)
1961	Jan.	12	.46	6
	Feb.	12	.43	5
	Mar.	19	.44	8
	Apr.	56	.38	21
	May	233	.17	40
	June	195	.12	23
	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
1962	Jan.	20	.37	7
	Feb.	41	.45	18
	Mar.	45	.47	21
	Apr.	387	.28	108
	May	439	.17	75
	June	305	.24	73
	July	113	.16	18
	Aug.	18	.35	5
	Sept.	7	.62	4
	Oct.	18	.45	8
	Nov.	17	.45	8
	Dec.	13	.52	7
	TOTAL	1,423	.25	353
1963	Jan.	13	.53	7
	Feb.	22	.49	11
	Mar.	29	.46	13
	Apr.	79	.30	24
	May	251	.14	35
	June	147	.14	20
	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
1964	Jan.	8	.45	4
	Feb.	9	.43	4
	Mar.	14	.43	6
	Apr.	67	.39	26
	May	334	.17	57
	June	292	.11	32
	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
1965	Jan.	17	.44	7
	Feb.	15	.49	7
	Mar.	18	.51	9
	Apr.	156	.27	42
	May	386	.14	54
	June	455	.11	50
	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

To obtain mg/L multiply T/AF by 735.29

Table 3

Colorado River Basin

Historical Flow and Quality of Water Data

Yampa River near Maybell, Colorado

Calendar Year	Month	Flow 1000 (A F)	Concen-tration (T/A F)	T.D.S. 1000 (Tons)
	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
1970	July	121	.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

Calendar Year	Month	Flow 1000 (A F)	Concen-tration (T/A F)	T.D.S. 1000 (Tons)
	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

Calendar Year	Month	Flow 1000 (A F)	Concen-tration (T/A F)	T.D.S. 1000 (Tons)
	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
	Jan.	8	.48	4
	Feb.	12	.44	5
	Mar.	21	.52	11
	Apr.	52	.37	19
	May	114	.29	33
	June	90	.36	33
1977	July	5	.71	3
	Aug.	5	.67	3
	Sept.	5	.55	3
	Oct.	11	.39	4
	Nov.	12	.37	4
	Dec.	11	.37	4
	TOTAL	345	.37	127
	Jan.	14	.36	5
	Feb.	15	.37	6
	Mar.	34	.46	16
	Apr.	198	.31	61
	May	398	.18	72
	June	531	.12	65
1978	July	184	.12	23
	Aug.	32	.24	8
	Sept.	12	.38	5
	Oct.	12	.39	4
	Nov.	14	.40	6
	Dec.	13	.44	6
	TOTAL	1,456	.19	276
	Jan.	15	.44	6
	Feb.	15	.47	7
	Mar.	31	.57	17
	Apr.	165	.41	68
	May	479	.19	90
	June	414	.13	55
1979	July	122	.15	18
	Aug.	25	.33	8
	Sept.	7	.46	3
	Oct.	11	.49	5
	Nov.	17	.51	9
	Dec.	13	.51	7
	TOTAL	1,313	.23	295
	Jan.	12	.54	7
	Feb.	25	.52	13
	Mar.	32	.64	20
	Apr.	170	.45	77
	May	512	.28	143
	June	380	.21	80
1980	July	81	.28	23
	Aug.	16	.45	7
	Sept.	9	.54	5
	Oct.	13	.55	7
	Nov.	13	.54	7
	Dec.	11	.56	6
	TOTAL	1,276	.31	396

Calendar Year	Month	Flow 1000 (A F)	Concen-tration (T/A F)	T.D.S. 1000 (Tons)
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			

To obtain mg/L multiply T/AF by 735.29

Table 4

Colorado River Basin

Historical Flow and Quality of Water Data

Duchesne River near Randlett, Utah

Calendar Year	Month	Flow 1000 (AF)	Concentration (T/AF)	T.D.S. 1000 (Tons)
1941	Jan.	25	1.12	28
	Feb.	24	1.29	31
	Mar.	21	1.71	36
	Apr.	20	1.50	30
	May	155	.50	78
	June	232	.38	88
	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
1942	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
	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
1943	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
	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
1944	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
	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
1945	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
	July	30	1.23	37
	Aug.	31	1.19	37
	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

Calendar Year	Month	Flow 1000 (AF)	Concentration (T/AF)	T.D.S. 1000 (Tons)
1946	Jan.	23	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
	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
1947	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
	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	.86	489
1948	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	51	.92	47
	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
1949	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
	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
1950	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
	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

Calendar Year	Month	Flow 1000 (AF)	Concentration (T/AF)	T.D.S. 1000 (Tons)
1951	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
	July	31	1.29	40
	Aug.	26	1.46	38
	Sept.	10	1.90	19
	Oct.	25	1.28	32
	Nov.	32	1.22	39
	Dec.	32	1.22	39
	TOTAL	448	1.06	477
1952	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
	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
1953	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
	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
1954	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
	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
1955	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
	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

Calendar Year	Month	Flow 1000 (AF)	Concentration (T/AF)	T.D.S. 1000 (Tons)
1956	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
	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
1957	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
	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
1958	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
	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
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

Calendar Year	Month	Flow 1000 (AF)	Concentration (T/AF)	T.D.S. 1000 (Tons)
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	89
	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

To obtain mg/L multiply T/AF by 735.29

Table 4

Colorado River Basin

Historical Flow and Quality of Water Data

Duchesne River near Randlett, Utah

Calendar Year	Month	Flow 1000 (AF)	Concentration (T/AF)	T.D.S. 1000 (Tons)
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

Calendar Year	Month	Flow 1000 (AF)	Concentration (T/AF)	T.D.S. 1000 (Tons)
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

Calendar Year	Month	Flow 1000 (AF)	Concentration (T/AF)	T.D.S. 1000 (Tons)
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
1977	Jan.	9	1.01	9
	Feb.	10	1.17	12
	Mar.	10	2.61	27
	Apr.	2	2.78	6
	May	3	2.41	7
	June	4	2.61	10
	July	3	2.64	7
	Aug.	2	2.55	6
	Sept.	3	2.27	8
	Oct.	4	2.43	9
	Nov.	5	2.14	10
	Dec.	6	1.85	11
	TOTAL	62	2.00	123
1978	Jan.	11	1.81	19
	Feb.	14	1.73	24
	Mar.	21	1.57	34
	Apr.	25	1.49	37
	May	18	1.58	28
	June	110	.42	46
	July	8	1.71	14
	Aug	3	2.02	6
	Sept.	4	1.98	7
	Oct.	5	1.96	10
	Nov.	16	1.68	27
	Dec.	16	1.71	27
	TOTAL	250	1.12	280
1979	Jan.	15	1.35	21
	Feb.	17	1.23	20
	Mar.	48	1.29	62
	Apr.	57	1.09	62
	May	62	.70	44
	June	36	1.05	38
	July	21	1.27	27
	Aug.	32	1.18	38
	Sept.	29	1.17	33
	Oct.	12	1.99	24
	Nov.	11	1.66	17
	Dec.	89	1.77	15
	TOTAL	349	1.15	402
1980	Jan.	10	1.70	17
	Feb.	15	1.37	21
	Mar.	14	1.74	24
	Apr.	12	1.44	17
	May	32	1.03	33
	June	165	.31	51
	July	23	.96	22
	Aug.	5	1.84	10
	Sept.	15	1.76	26
	Oct.	18	1.44	26
	Nov.	22	1.23	27
	Dec.	32	.92	30
	TOTAL	365	.84	305

Calendar Year	Month	Flow 1000 (AF)	Concentration (T/AF)	T.D.S. 1000 (Tons)
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			

To obtain mg/L multiply T/AF by 735.29

Table 5

Colorado River Basin

Historical Flow and Quality of Water Data

White River near Watson, Utah

Calendar Year	Month	Flow 1000 (AF)	Concentration (T/AF)	T.D.S. 1000 (Tons)
1941	Jan.	18	.89	16
	Feb.	22	.77	17
	Mar.	31	.71	22
	Apr.	34	.68	23
	May	156	.38	60
	June	118	.42	50
	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
1942	Jan.	23	.78	18
	Feb.	22	.77	17
	Mar.	43	.63	27
	Apr.	107	.44	47
	May	158	.38	60
	June	144	.40	57
	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
1943	Jan.	21	.81	17
	Feb.	24	.79	19
	Mar.	33	.70	23
	Apr.	40	.65	26
	May	56	.57	32
	June	87	.48	42
	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
1944	Jan.	19	.84	16
	Feb.	21	.81	17
	Mar.	32	.69	22
	Apr.	29	.72	21
	May	94	.47	44
	June	112	.44	49
	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
1945	Jan.	25	.76	19
	Feb.	26	.77	20
	Mar.	28	.71	20
	Apr.	30	.70	21
	May	108	.44	48
	June	105	.45	47
	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
1946	Jan.	22	.77	17
	Feb.	21	.81	17
	Mar.	30	.70	21
	Apr.	43	.63	27
	May	68	.53	36
	June	67	.52	35
	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
1947	Jan.	17	.88	15
	Feb.	19	.84	16
	Mar.	43	.63	27
	Apr.	35	.69	24
	May	140	.40	56
	June	116	.43	50
	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
1948	Jan.	24	.79	19
	Feb.	21	.81	17
	Mar.	38	.66	25
	Apr.	59	.56	33
	May	128	.41	53
	June	92	.47	43
	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
1949	Jan.	15	.93	14
	Feb.	14	.93	13
	Mar.	39	.64	25
	Apr.	44	.61	27
	May	106	.44	47
	June	158	.38	60
	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
1950	Jan.	20	.80	16
	Feb.	17	.88	15
	Mar.	30	.70	21
	Apr.	33	.70	23
	May	63	.54	34
	June	120	.43	51
	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
1951	Jan.	18	.87	16
	Feb.	24	.81	19
	Mar.	27	.82	22
	Apr.	26	.75	20
	May	79	.41	32
	June	112	.34	38
	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
1952	Jan.	20	.81	16
	Feb.	19	.80	15
	Mar.	21	.81	17
	Apr.	77	.93	72
	May	149	.52	77
	June	210	.38	80
	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
1953	Jan.	25	.79	20
	Feb.	23	.77	18
	Mar.	36	.87	31
	Apr.	30	.84	25
	May	70	.57	40
	June	135	.42	57
	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	.68	321
1954	Jan.	23	.80	18
	Feb.	26	.83	22
	Mar.	24	.97	23
	Apr.	35	.70	25
	May	69	.59	41
	June	32	.70	22
	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
1955	Jan.	16	.93	15
	Feb.	19	.92	17
	Mar.	47	.80	38
	Apr.	31	.87	27
	May	87	.43	37
	June	76	.81	62
	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
1956	Jan.	20	.88	18
	Feb.	19	.95	18
	Mar.	44	.89	39
	Apr.	33	.69	23
	May	99	.40	40
	June	85	.36	31
	July	22	.77	17
	Aug.	21	.89	19
	Sept.	13	.87	11
	Oct.	19	.87	17
	Nov.	21	.87	16
	Dec.	18	.91	16
	TOTAL	414	.64	267
1957	Jan.	22	.88	19
	Feb.	22	.82	18
	Mar.	31	.99	31
	Apr.	29	.91	26
	May	76	.61	46
	June	218	.44	96
	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
1958	Jan.	24	.78	19
	Feb.	35	.76	27
	Mar.	35	.84	29
	Apr.	45	.90	40
	May	148	.47	70
	June	132	.47	62
	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
1959	Jan.	24	.84	20
	Feb.	21	.78	16
	Mar.	24	.84	20
	Apr.	30	.74	22
	May	64	.43	28
	June	96	.35	34
	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
1960	Jan.	17	.83	14
	Feb.	19	.81	15
	Mar.	35	.83	29
	Apr.	41	.59	24
	May	69	.42	29
	June	95	.36	34
	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
1961	Jan.	18	.87	16
	Feb.	19	.81	15
	Mar.	23	.82	19
	Apr.	22	.85	19
	May	65	.43	28
	June	65	.37	24
	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
1962	Jan.	21	.76	16
	Feb.	37	.84	31
	Mar.	66	.97	64
	Apr.	85	.69	59
	May	139	.43	60
	June	128	.37	47
	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
1963	Jan.	20	.88	18
	Feb.	24	.79	19
	Mar.	24	.82	20
	Apr.	29	.66	19
	May	71	.37	26
	June	31	.57	18
	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
1964	Jan.	17	.94	16
	Feb.	19	.86	16
	Mar.	26	.83	22
	Apr.	30	.88	26
	May	84	.41	34
	June	99	.34	34
	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
1965	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
	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

To obtain mg/L multiply T/AF by 735.29

Table 5

Colorado River Basin

Historical Flow and Quality of Water Data

White River near Watson, Utah

Calendar Year	Month	Flow 1000 (A F)	Concen-tration (T/A F)	T.D.S. 1000 (Tons)
	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

Calendar Year	Month	Flow 1000 (A F)	Concen-tration (T/A F)	T.D.S. 1000 (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

Calendar Year	Month	Flow 1000 (A F)	Concen-tration (T/A F)	T.D.S. 1000 (Tons)
	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
	Jan.	20	.65	13
	Feb.	19	.71	14
	Mar.	24	.61	15
	Apr.	25	.62	15
	May	24	.55	13
	June	16	.66	10
1977	July	9	1.09	9
	Aug.	13	.94	12
	Sept.	13	.89	11
	Oct.	17	.77	13
	Nov.	18	.71	13
	Dec.	17	.72	12
	TOTAL	213	.71	151
	Jan.	18	.70	13
	Feb.	17	.71	12
	Mar.	28	.83	23
	Apr.	36	.63	22
	May	93	.37	34
	June	175	.27	47
1978	July	66	.38	25
	Aug	23	.58	14
	Sept.	23	.67	16
	Oct.	23	.60	14
	Nov.	23	.63	15
	Dec.	24	.61	14
	TOTAL	550	.45	249
	Jan.	20	.76	15
	Feb.	17	.83	14
	Mar.	50	.60	30
	Apr.	47	.89	42
	May	116	.46	54
	June	152	.37	57
1979	July	63	.53	34
	Aug.	27	.68	19
	Sept.	18	.77	14
	Oct.	25	.72	18
	Nov.	24	.75	18
	Dec.	22	.83	18
	TOTAL	582	.57	332
	Jan.	22	.79	17
	Feb.	58	.67	39
	Mar.	38	.70	26
	Apr.	36	.81	29
	May	112	.57	63
	June	124	.39	48
1980	July	40	.58	23
	Aug.	22	.84	18
	Sept.	24	.74	18
	Oct.	28	.77	21
	Nov.	25	.77	20
	Dec.	25	.62	15
	TOTAL	554	.61	338

Calendar Year	Month	Flow 1000 (A F)	Concen-tration (T/A F)	T.D.S. 1000 (Tons)
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			
	Jan.			
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	Mar.			
	Apr.			
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	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			

Calendar Year	Month	Flow 1000 (A F)	Concen-tration (T/A F)	T.D.S. 1000 (Tons)
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			

To obtain mg/L multiply T/AF by 735.29

Table 6

Colorado River Basin

Historical Flow and Quality of Water Data

Green River at Green River, Utah

Calendar Year	Month	Flow 1000 (AF)	Concentration (T/AF)	T.D.S. 1000 (Tons)
1941	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
	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
1942	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
	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
1943	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
	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
1944	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
	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
1945	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
	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

Calendar Year	Month	Flow 1000 (AF)	Concentration (T/AF)	T.D.S. 1000 (Tons)
1946	Jan.	123	0.95	117
	Feb.	117	.91	106
	Mar.	236	.90	212
	Apr.	528	.60	317
	May	775	.41	318
	June	746	.36	269
	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
1947	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
	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
1948	Jan.	141	0.94	132
	Feb.	136	.91	124
	Mar.	313	.86	269
	Apr.	558	.69	385
	May	1,061	.39	414
	June	952	.34	324
	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
1949	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
	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
1950	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
	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

Calendar Year	Month	Flow 1000 (AF)	Concentration (T/AF)	T.D.S. 1000 (Tons)
1951	Jan.	113	1.13	128
	Feb.	167	.92	154
	Mar.	204	.93	190
	Apr.	372	.70	260
	May	882	.45	397
	June	309	.40	524
	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
1952	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
	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
1953	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
	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
1954	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
	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
1955	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
	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

Calendar Year	Month	Flow 1000 (AF)	Concentration (T/AF)	T.D.S. 1000 (Tons)
1956	Jan.	155	0.91	141
	Feb.	100	1.05	105
	Mar.	314	.81	255
	Apr.	460	.53	244
	May	995	.35	348
	June	1,207	.32	386
	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
1957	Jan.	83	0.95	79
	Feb.	100	.94	94
	Mar.	237	.89	210
	Apr.	290	.73	212
	May	913	.48	438
	June	1,871	.34	636
	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
1958	Jan.	128	0.93	119
	Feb.	184	.86	159
	Mar.	246	.92	227
	Apr.	432	.71	307
	May	1,311	.41	537
	June	1,174	.35	411
	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	4,211	.57	2,421
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

Calendar Year	Month	Flow 1000 (AF)	Concentration (T/AF)	T.D.S. 1000 (Tons)
1961	Jan.	79	0.98	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	0.79	91
	Feb.	403	.72	290
	Mar.	401	.95	381
	Apr.	1,093	.56	612
	May	1,350	.36	486
	June	1,974	.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	0.76	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

To obtain mg/L multiply T/AF by 735.29

Table 6

Colorado River Basin

Historical Flow and Quality of Water Data

Green River at Green River, Utah

Calendar Year	Month	Flow 1000 (AF)	Concen-tration (T/AF)	T.D.S. 1000 (Tons)
1966	Jan.	181	0.86	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	0.88	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	0.87	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	0.81	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	0.84	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	0.84	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	0.79	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	0.77	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	0.84	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	0.84	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	0.80	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
1977	Jan.	237	0.75	176
	Feb.	199	.83	166
	Mar.	287	.78	222
	Apr.	266	.70	185
	May	347	.57	197
	June	262	.52	135
	July	183	.89	163
	Aug.	170	.89	151
	Sept.	140	.83	116
	Oct.	117	.90	105
	Nov.	116	.90	104
	Dec.	118	.92	108
	TOTAL	2,443	.75	1,829
1978	Jan.	126	0.84	106
	Feb.	125	.85	106
	Mar.	248	.91	227
	Apr.	374	.64	239
	May	686	.41	282
	June	1,074	.32	341
	July	483	.41	196
	Aug.	173	.66	.115
	Sept.	139	.82	114
	Oct.	141	.84	119
	Nov.	184	.93	172
	Dec.	177	.95	169
	TOTAL	3,930	.56	2,185
1979	Jan.	183	0.82	150
	Feb.	167	.79	132
	Mar.	345	.93	321
	Apr.	518	.85	440
	May	950	.43	404
	June	942	.33	312
	July	402	.48	193
	Aug.	214	.80	171
	Sept.	150	.84	126
	Oct.	151	.91	138
	Nov.	181	.88	158
	Dec.	167	.87	145
	TOTAL	4,369	.62	2,692
1980	Jan.	206	0.83	172
	Feb	305	.80	243
	Mar.	268	.93	248
	Apr.	350	.79	275
	May	1,040	.44	462
	June	312	.35	354
	July	312	.56	175
	Aug.	143	.84	119
	Sept.	183	.96	176
	Oct.	187	.99	184
	Nov.	193	.91	175
	Dec.	174	.87	151
	TOTAL	4,373	.63	2,734
	Jan.			
	Feb.			
	Mar.			
	Apr.			
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	June			
	July			
	Aug.			
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	TOTAL			
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	Oct.			
	Nov.			
	Dec.			
	TOTAL			
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	Mar.			
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	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			

To obtain mg/L multiply T/AF by 735.29

Table 7

Colorado River Basin

Historical Flow and Quality of Water Data

San Rafael River near Green River, Utah

Calendar Year	Month	Flow 1000 (AF)	Concentration (T/AF)	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
1959	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
	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
1960	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
	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
1961	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
	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
1962	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
	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
1963	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
	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
1964	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
	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
1965	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
	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

To obtain mg/L multiply T/AF by 735.29

Table 7

Colorado River Basin

Historical Flow and Quality of Water Data

San Rafael River near Green River, Utah

Calendar Year	Month	Flow 1000 (AF)	Concentration (T/AF)	T.D.S. 1000 (Tons)
	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
1968	May	6	3.8	23
	June	25	1.3	33
	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
1970	May	14	1.5	21
	June	48	1.2	59
	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

Calendar Year	Month	Flow 1000 (AF)	Concentration (T/AF)	T.D.S. 1000 (Tons)
	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

Calendar Year	Month	Flow 1000 (AF)	Concentration (T/AF)	T.D.S. 1000 (Tons)
	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
	Jan.	1	4.61	5
	Feb.	1	4.41	5
	Mar.	2	4.54	7
	Apr.	.4	4.75	2
	May	.2	6.47	1
	June	.1	6.78	.4
1977	July	3	5.21	13
	Aug.	2	3.48	8
	Sept.	1	4.39	4
	Oct.	.3	3.87	1
	Nov.	.3	5.24	2
	Dec.	1	5.83	4
	TOTAL	12	4.61	53
	Jan.	1	4.24	4
	Feb.	1	3.18	4
	Mar.	5	4.55	22
	Apr.	1	5.39	5
	May	1	5.24	7
	June	22	1.09	24
1978	July	8	1.78	15
	Aug	1	3.64	3
	Sept.	.4	4.26	2
	Oct.	5	3.67	18
	Nov.	12	3.13	38
	Dec.	6	4.42	26
	TOTAL	59	2.63	149
	Jan.	1	4.40	5
	Feb.	2	3.20	6
	Mar.	14	2.48	35
	Apr.	5	4.18	23
	May	5	2.50	13
	June	24	1.76	43
1979	July	4	2.71	11
	Aug.	3	3.28	9
	Sept.	1	3.46	5
	Oct.	2	3.56	8
	Nov.	2	3.40	8
	Dec.	2	4.33	8
	TOTAL	67	2.60	175
	Jan.	3	3.35	11
	Feb.	9	2.62	22
	Mar.	6	3.53	20
	Apr.	3	3.38	11
	May	14	2.17	31
	June	71	1.00	71
1980	July	16	2.04	34
	Aug.	5	3.05	15
	Sept.	12	2.13	26
	Oct.	8	2.82	22
	Nov.	5	3.76	18
	Dec.	3	3.46	11
	TOTAL	155	1.88	293

Calendar Year	Month	Flow 1000 (AF)	Concentration (T/AF)	T.D.S. 1000 (Tons)
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			

To obtain mg/L multiply T/AF by 735.29

Table 8

Colorado River Basin

Historical Flow and Quality of Water Data

Colorado River near Glenwood Springs, Colorado

Calendar Year	Month	Flow 1000 (AF)	Concentration (T/AF)	T.D.S. 1000 (Tons)
1941	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
	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
1942	Jan.	43	0.74	32
	Feb.	41	.68	28
	Mar.	46	.70	32
	Apr.	167	.42	70
	May	389	.24	93
	June	721	.16	116
	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
1943	Jan.	37	0.86	32
	Feb.	36	.78	28
	Mar.	48	.75	36
	Apr.	162	.34	55
	May	342	.23	79
	June	582	.18	105
	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
1944	Jan.	37	0.76	28
	Feb.	44	.66	29
	Mar.	50	.72	36
	Apr.	85	.51	43
	May	302	.26	78
	June	498	.16	80
	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
1945	Jan.	41	0.71	29
	Feb.	37	.68	25
	Mar.	62	.50	31
	Apr.	72	.51	37
	May	347	.22	76
	June	461	.18	83
	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
1946	Jan.	67	0.48	32
	Feb.	54	.54	29
	Mar.	64	.55	35
	Apr.	197	.28	55
	May	284	.22	62
	June	362	.22	80
	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
1947	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
	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
1948	Jan.	76	0.45	34
	Feb.	72	.44	32
	Mar.	68	.50	34
	Apr.	162	.37	60
	May	542	.20	108
	June	470	.18	85
	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
1949	Jan.	67	0.54	36
	Feb.	56	.57	32
	Mar.	58	.59	34
	Apr.	132	.38	50
	May	364	.23	84
	June	654	.19	124
	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
1950	Jan.	56	0.63	35
	Feb.	54	.56	30
	Mar.	80	.44	35
	Apr.	141	.35	49
	May	259	.26	67
	June	429	.20	86
	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
1951	Jan.	59	0.56	33
	Feb.	58	.52	30
	Mar.	58	.55	32
	Apr.	104	.40	42
	May	381	.23	88
	June	536	.20	107
	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
1952	Jan.	53	0.60	32
	Feb.	47	.62	29
	Mar.	63	.51	32
	Apr.	194	.38	74
	May	597	.23	137
	June	785	.19	149
	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
1953	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
	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
1954	Jan.	62	0.58	36
	Feb.	48	.62	30
	Mar.	62	.58	36
	Apr.	86	.44	38
	May	146	.35	51
	June	89	.52	46
	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
1955	Jan.	38	0.79	30
	Feb.	34	.82	28
	Mar.	43	.79	34
	Apr.	90	.48	43
	May	206	.28	58
	June	217	.31	67
	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
1956	Jan.	52	0.60	31
	Feb.	48	.56	27
	Mar.	69	.59	41
	Apr.	120	.44	53
	May	421	.26	110
	June	329	.24	79
	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
1957	Jan.	46	0.72	33
	Feb.	44	.68	30
	Mar.	51	.67	34
	Apr.	92	.53	49
	May	350	.32	112
	June	834	.21	175
	July	571	.22	126
	Aug.	176	.37	65
	Sept.	88	.56	49
	Oct.	75	.60	45
	Nov.	72	.58	42
	Dec.	63	.59	37
	TOTAL	2,462	.32	797
1958	Jan.	62	0.55	34
	Feb.	58	.50	29
	Mar.	73	.52	38
	Apr.	102	.45	46
	May	546	.22	120
	June	439	.21	92
	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
1959	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
	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
1960	Jan.	67	0.49	33
	Feb.	55	.50	28
	Mar.	93	.47	44
	Apr.	166	.32	53
	May	288	.25	72
	June	357	.25	89
	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
1961	Jan.	65	0.52	34
	Feb.	56	.53	30
	Mar.	55	.59	32
	Apr.	66	.54	36
	May	207	.29	60
	June	203	.28	57
	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
1962	Jan.	80	0.44	35
	Feb.	91	.42	38
	Mar.	122	.39	48
	Apr.	347	.32	111
	May	539	.23	125
	June	455	.23	105
	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
1963	Jan.	55	0.67	37
	Feb.	53	.63	33
	Mar.	62	.58	36
	Apr.	81	.48	39
	May	175	.31	54
	June	122	.45	55
	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
1964	Jan.	36	0.80	29
	Feb.	33	.78	26
	Mar.	39	.71	28
	Apr.	64	.61	39
	May	210	.32	67
	June	215	.31	67
	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
1965	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
	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	.38	670

To obtain mg/L multiply T/AF by 735.29

Table 8

Colorado River Basin

Historical Flow and Quality of Water Data

Colorado River near Glenwood Springs, Colorado

Calendar Year	Month	Flow 1000 (A F)	Concen-tration (T/A F)	T.D.S. 1000 (Tons)
1966	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
	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
1967	Jan.	49	0.65	32
	Feb.	45	.62	28
	Mar.	67	.59	40
	Apr.	96	.45	43
	May	185	.31	57
	June	250	.28	70
	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
1968	Jan.	53	0.61	32
	Feb.	53	.55	29
	Mar.	62	.55	34
	Apr.	95	.46	44
	May	171	.36	62
	June	369	.25	92
	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
1969	Jan.	66	0.55	36
	Feb.	56	.57	32
	Mar.	63	.56	35
	Apr.	131	.41	54
	May	283	.28	51
	June	260	.31	81
	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
1970	Jan.	62	.55	34
	Feb.	65	.52	34
	Mar.	72	.51	37
	Apr.	95	.43	41
	May	488	.20	99
	June	471	.21	99
	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

Calendar Year	Month	Flow 1000 (A F)	Concen-tration (T/A F)	T.D.S. 1000 (Tons)
1971	Jan.	72	0.49	35
	Feb.	71	.49	35
	Mar.	105	.45	47
	Apr.	174	.32	55
	May	348	.22	77
	June	519	.19	99
	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
1972	Jan.	67	0.52	35
	Feb.	62	.50	31
	Mar.	94	.45	42
	Apr.	116	.36	42
	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
1973	Jan.	68	0.47	32
	Feb.	60	.45	27
	Mar.	73	.45	33
	Apr.	86	.45	39
	May	352	.21	73
	June	448	.19	83
	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
1974	Jan.	67	0.52	35
	Feb.	63	.51	32
	Mar.	93	.45	42
	Apr.	123	.37	46
	May	486	.17	84
	June	427	.20	84
	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
1975	Jan.	64	0.55	35
	Feb.	62	.53	33
	Mar.	74	.54	40
	Apr.	100	.44	44
	May	213	.27	53
	June	375	.22	83
	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	569

Calendar Year	Month	Flow 1000 (A F)	Concen-tration (T/A F)	T.D.S. 1000 (Tons)
1976	Jan.	62	0.53	33
	Feb.	65	.52	34
	Mar.	84	.45	38
	Apr.	98	.45	44
	May	227	.26	59
	June	235	.26	61
	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
1977	Jan.	51	0.55	28
	Feb.	44	.58	25
	Mar.	44	.64	28
	Apr.	73	.45	33
	May	95	.40	38
	June	98	.40	39
	July	82	.46	38
	Aug.	83	.43	36
	Sept.	76	.45	34
	Oct.	62	.56	35
	Nov.	46	.65	30
	Dec.	49	.61	30
	TOTAL	803	.49	394
1978	Jan.	51	0.60	31
	Feb.	48	.58	28
	Mar.	57	.57	32
	Apr.	102	.42	42
	May	264	.25	66
	June	470	.19	90
	July	212	.31	66
	Aug	100	.46	46
	Sept.	89	.46	40
	Oct.	86	.50	44
	Nov.	83	.49	41
	Dec.	64	.57	37
	TOTAL	1,628	.35	563
1979	Jan.	57	0.40	32
	Feb.	54	.40	30
	Mar.	66	.42	38
	Apr.	99	.37	50
	May	319	.17	74
	June	463	.15	91
	July	289	.19	74
	Aug.	119	.33	54
	Sept.	90	.35	43
	Oct.	94	.37	47
	Nov.	78	.40	42
	Dec.	71	.41	39
	TOTAL	1,798	.25	61
1980	Jan.	73	0.41	41
	Feb.	67	.41	37
	Mar.	72	.39	38
	Apr.	104	.31	44
	May	370	.17	86
	June	462	.15	93
	July	173	.27	65
	Aug.	103	.35	49
	Sept.	82	.36	40
	Oct.	69	.41	38
	Nov.	66	.44	39
	Dec.	64	.43	37
	TOTAL	1,706	.26	608

Calendar Year	Month	Flow 1000 (A F)	Concen-tration (T/A F)	T.D.S. 1000 (Tons)
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			

To obtain mg/L multiply T/AF by 735.29

Table 9

Colorado River Basin

Historical Flow and Quality of Water Data

Colorado River near Cameo, Colorado

Calendar Year	Month	Flow 1000 (A F)	Concen-tration (T/A F)	T.D.S. 1000 (Tons)
1941	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
	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
1942	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
	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
1943	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
	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
1944	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
	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
1945	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
	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

Calendar Year	Month	Flow 1000 (A F)	Concen-tration (T/A F)	T.D.S. 1000 (Tons)
1946	Jan.	109	0.90	98
	Feb.	91	.97	88
	Mar.	99	.94	93
	Apr.	285	.45	128
	May	449	.32	144
	June	689	.28	193
	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
1947	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
	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
1948	Jan.	116	0.84	97
	Feb.	111	.81	90
	Mar.	115	.90	104
	Apr.	253	.59	149
	May	920	.30	276
	June	844	.26	219
	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
1949	Jan.	99	0.96	95
	Feb.	84	.92	77
	Mar.	98	.98	96
	Apr.	201	.65	131
	May	572	.36	206
	June	1,080	.26	281
	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
1950	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
	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

Calendar Year	Month	Flow 1000 (A F)	Concen-tration (T/A F)	T.D.S. 1000 (Tons)
1951	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
	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
1952	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
	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
1953	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
	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
1954	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
	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
1955	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
	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

Calendar Year	Month	Flow 1000 (A F)	Concen-tration (T/A F)	T.D.S. 1000 (Tons)
1956	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
	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
1957	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
	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
1958	Jan.	92	0.93	86
	Feb.	95	.93	88
	Mar.	123	.89	110
	Apr.	171	.76	130
	May	847	.31	263
	June	808	.27	218
	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
1959	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
	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
1960	Jan.	100	0.89	89
	Feb.	91	.95	86
	Mar.	135	.78	105
	Apr.	246	.51	125
	May	432	.37	160
	June	668	.30	200
	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

Calendar Year	Month	Flow 1000 (A F)	Concen-tration (T/A F)	T.D.S. 1000 (Tons)
1961	Jan.	99	0.97	96
	Feb.	85	.94	80
	Mar.	86	1.06	91
	Apr.	103	.91	94
	May	354	.40	142
	June	426	.34	145
	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
1962	Jan.	115	0.78	90
	Feb.	135	.74	100
	Mar.	160	.69	110
	Apr.	513	.40	205
	May	892	.31	277
	June	882	.27	238
	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
1963	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
	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
1964	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
	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
1965	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
	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

To obtain mg/L multiply T/AF by 735.29

Table 9

Colorado River Basin

Historical Flow and Quality of Water Data

Colorado River near Cameo, Colorado

Calendar Year	Month	Flow 1000 (A F)	Concen-tration (T/A F)	T.D.S. 1000 (Tons)
1966	Jan.	114	0.82	93
	Feb.	99	.81	80
	Mar.	133	.77	102
	Apr.	141	.66	93
	May	373	.40	149
	June	277	.48	133
	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
1967	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
	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
1968	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
	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
1969	Jan.	106	0.94	100
	Feb.	86	.99	85
	Mar.	96	.95	91
	Apr.	241	.58	140
	May	561	.34	191
	June	502	.40	201
	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
1970	Jan.	105	0.96	101
	Feb.	95	.92	87
	Mar.	116	.84	97
	Apr.	154	.64	99
	May	850	.26	224
	June	834	.27	222
	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

Calendar Year	Month	Flow 1000 (A F)	Concen-tration (T/A F)	T.D.S. 1000 (Tons)
1971	Jan.	138	0.82	113
	Feb.	112	.84	94
	Mar.	149	.74	110
	Apr.	293	.48	140
	May	521	.32	165
	June	885	.24	215
	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
1972	Jan.	127	0.79	100
	Feb.	119	.87	104
	Mar.	151	.81	122
	Apr.	175	.66	115
	May	394	.39	155
	June	664	.29	192
	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
1973	Jan.	116	0.86	100
	Feb.	105	.82	86
	Mar.	125	.82	103
	Apr.	121	.82	99
	May	592	.32	189
	June	829	.27	222
	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
1974	Jan.	122	0.80	97
	Feb.	109	.83	91
	Mar.	152	.79	120
	Apr.	185	.66	122
	May	709	.25	176
	June	658	.28	184
	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
1975	Jan.	109	0.89	97
	Feb.	98	.88	86
	Mar.	124	.92	114
	Apr.	154	.77	118
	May	389	.43	168
	June	739	.28	208
	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

Calendar Year	Month	Flow 1000 (A F)	Concen-tration (T/A F)	T.D.S. 1000 (Tons)
1976	Jan.	115	0.82	94
	Feb.	114	.82	95
	Mar.	139	.85	118
	Apr.	161	.70	112
	May	401	.40	161
	June	450	.33	149
	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
1977	Jan.	105	0.94	99
	Feb.	86	.97	83
	Mar.	80	1.09	87
	Apr.	110	.84	92
	May	156	.64	100
	June	176	.61	107
	July	112	.75	84
	Aug.	108	.79	85
	Sept.	103	.82	85
	Oct.	98	.93	91
	Nov.	83	1.09	90
	Dec.	86	1.01	87
	TOTAL	1,303	.84	1,091
1978	Jan.	80	0.94	75
	Feb.	74	.88	64
	Mar.	96	.88	85
	Apr.	172	.62	107
	May	431	.44	191
	June	846	.27	229
	July	360	.41	146
	Aug	135	.71	96
	Sept.	109	.82	89
	Oct.	108	.83	90
	Nov.	111	.84	93
	Dec.	92	.96	89
	TOTAL	2,615	.52	1,354
1979	Jan.	83	0.55	62
	Feb.	85	.62	71
	Mar.	113	.62	96
	Apr.	172	.45	105
	May	607	.28	227
	June	895	.19	230
	July	517	.24	171
	Aug.	178	.42	102
	Sept.	125	.65	110
	Oct.	132	.60	107
	Nov.	127	.60	103
	Dec.	121	.60	99
	TOTAL	3,154	.35	1,483
1980	Jan.	111	0.60	909
	Feb.	113	.59	901
	Mar.	125	.61	103
	Apr.	189	.47	119
	May	641	.24	212
	June	885	.19	230
	July	330	.32	142
	Aug.	146	.53	106
	Sept.	122	.59	97
	Oct.	137	.62	114
	Nov.	135	.63	116
	Dec.	131	.63	111
	TOTAL	3,363	.37	1,534

Calendar Year	Month	Flow 1000 (A F)	Concen-tration (T/A F)	T.D.S. 1000 (Tons)
1981	Jan.	70	0.73	69
	Feb.	0	.00	0
	Mar.	18	.83	20
	Apr.	38	.55	77
	May	77	.37	38
	June	130	.26	47
	July	42	.52	29
	Aug.	35	.58	27
	Sept.	36	.56	27
	Oct.	0	.00	0
	Nov.	0	.00	0
	Dec.	0	.00	0
	TOTAL	446	.47	287
	Jan.			
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	Oct.			
	Nov.			
	Dec.			
	TOTAL			

Calendar Year	Month	Flow 1000 (A F)	Concen-tration (T/A F)	T.D.S. 1000 (Tons)
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
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	Nov.			
	Dec.			
	TOTAL			

To obtain mg/L multiply T/AF by 735.29

Table 10

Colorado River Basin

Historical Flow and Quality of Water Data

Gunnison River near Grand Junction, Colorado

Calendar Year	Month	Flow 1000 (A F)	Concen-tration (T/A F)	T.D.S. 1000 (Tons)
1941	Jan.	51	1.90	97
	Feb.	51	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.	71	1.68	119
	Dec.	53	1.73	92
	TOTAL	1,818	.82	1,499

Calendar Year	Month	Flow 1000 (A F)	Concen-tration (T/A F)	T.D.S. 1000 (Tons)
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.	96	1.63	155
	Oct.	114	1.60	183
	Nov.	96	1.35	130
	Dec.	70	1.41	99
	TOTAL	1,938	.83	1,695
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.	236	.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	1,320

Calendar Year	Month	Flow 1000 (A F)	Concen-tration (T/A F)	T.D.S. 1000 (Tons)
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	71
	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	1.65	1,062
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	1,017	1.13	1,152

Calendar Year	Month	Flow 1000 (A F)	Concen-tration (T/A F)	T.D.S. 1000 (Tons)
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	.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.	136	.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	104
	TOTAL	2,262	.71	1,613
1959	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
	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
1960	Jan.	49	1.46	72
	Feb.	41	1.48	61
	Mar.	87	1.26	110
	Apr.	270	.45	122
	May	249	.45	117
	June	336	.46	155
	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

Calendar Year	Month	Flow 1000 (A F)	Concen-tration (T/A F)	T.D.S. 1000 (Tons)
1961	Jan.	41	1.65	68
	Feb.	40	1.55	62
	Mar.	55	1.29	71
	Apr.	67	1.05	70
	May	266	.50	133
	June	209	.62	130
	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
1962	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
	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
1963	Jan.	48	1.67	80
	Feb.	70	1.51	106
	Mar.	82	1.11	91
	Apr.	102	.72	73
	May	188	.53	100
	June	92	1.02	94
	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
1964	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
	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
1965	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
	July	472	.47	222
	Aug.	158	.98	155
	Sept.	166	1.29	208
	Oct.	116	1.35	157
	Nov.	63	1.93	122
	Dec.	60	1.58	95
	TOTAL	2,673	.65	1,742

To obtain mg/L multiply T/AF by 735.29

Table 10

Colorado River Basin

Historical Flow and Quality of Water Data

Gunnison River near Grand Junction, Colorado

Calendar Year	Month	Flow 1000 (AF)	Concentration (T/AF)	T.D.S. 1000 (Tons)
1966	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
	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
1967	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
	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
1968	Jan.	119	0.95	113
	Feb.	96	1.03	99
	Mar.	65	1.20	78
	Apr.	68	.97	66
	May	268	.57	153
	June	258	.56	144
	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
1969	Jan.	146	0.80	117
	Feb.	75	1.03	77
	Mar.	145	.70	101
	Apr.	304	.43	131
	May	332	.49	162
	June	194	1.03	200
	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
1970	Jan.	129	0.78	100
	Feb.	122	.70	85
	Mar.	149	.68	101
	Apr.	137	.69	95
	May	404	.42	169
	June	415	.50	208
	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	117
	TOTAL	2,366	.72	1,694
1971	Jan.	196	0.54	107
	Feb.	201	.45	90
	Mar.	239	.44	106
	Apr.	266	.40	105
	May	209	.66	139
	June	212	.72	152
	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
1972	Jan.	126	0.61	77
	Feb.	110	.61	68
	Mar.	109	.65	71
	Apr.	67	.87	58
	May	115	.86	99
	June	118	.91	107
	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
1973	Jan.	155	0.52	80
	Feb.	75	.84	63
	Mar.	83	.93	77
	Apr.	93	.77	72
	May	456	.34	155
	June	414	.46	191
	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
1974	Jan.	216	0.45	97
	Feb.	214	.51	109
	Mar.	204	.83	170
	Apr.	141	.74	105
	May	261	.61	159
	June	121	1.53	185
	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
1975	Jan.	114	0.82	93
	Feb.	96	.91	87
	Mar.	99	.90	89
	Apr.	158	.67	106
	May	398	.38	151
	June	336	.59	198
	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	127
	TOTAL	1,908	.77	1,477
1976	Jan.	134	0.72	96
	Feb.	95	1.05	100
	Mar.	87	.90	78
	Apr.	83	.83	69
	May	207	1.29	268
	June	128	.92	118
	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	96
	TOTAL	1,227	1.11	1,362
1977	Jan.	116	0.93	108
	Feb.	69	1.04	71
	Mar.	48	1.19	57
	Apr.	35	1.30	45
	May	43	1.62	70
	June	37	1.82	67
	July	38	1.93	73
	Aug.	36	1.74	63
	Sept.	36	1.84	66
	Oct.	50	1.71	85
	Nov.	51	1.65	84
	Dec.	43	1.51	65
	TOTAL	600	1.42	853
1978	Jan.	49	1.19	59
	Feb.	46	1.08	49
	Mar.	52	.94	49
	Apr.	133	.69	92
	May	292	.51	148
	June	314	.42	131
	July	143	.83	119
	Aug	59	1.00	58
	Sept.	86	1.08	92
	Oct.	68	1.19	81
	Nov.	86	1.20	103
	Dec.	134	.67	90
	TOTAL	1,461	.73	1,072
1979	Jan.	138	0.40	74
	Feb.	155	.38	81
	Mar.	194	.43	114
	Apr.	279	.29	110
	May	509	.37	254
	June	390	.20	106
	July	180	.51	123
	Aug.	100	.74	100
	Sept.	111	.95	144
	Oct.	107	.91	132
	Nov.	94	.78	101
	Dec.	147	.39	79
	TOTAL	2,402	.43	1,416
1980	Jan.	141	0.51	98
	Feb	134	.42	77
	Mar.	149	.41	83
	Apr.	227	.32	227
	May	560	.20	149
	June	406	.21	115
	July	139	.54	101
	Aug.	70	.77	73
	Sept.	76	.82	84
	Oct.	81	.79	86
	Nov.	144	.51	100
	Dec.	148	.48	96
	TOTAL	2,274	.37	1,159
1981	Jan.	146	.46	90
	Feb.	101	.47	64
	Mar.	70	.52	50
	Apr.	92	.44	56
	May	70	.73	69
	June	40	.93	50
	July	0	.00	0
	Aug.	0	.00	0
	Sept.	0	.00	0
	Oct.	0	.00	0
	Nov.	0	.00	0
	Dec.	0	.00	0
	TOTAL	519	.54	380
	Jan.			
	Feb.			
	Mar.			
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	Dec.			
	TOTAL			
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			

To obtain mg/L multiply T/AF by 735.29

Table II

Colorado River Basin

Historical Flow and Quality of Water Data

Dolores River near Cisco, Utah

Calendar Year	Month	Flow 1000 (AF)	Concentration (T/AF)	T.D.S. 1000 (Tons)
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	1,566	.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	1,316	.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

Calendar Year	Month	Flow 1000 (AF)	Concentration (T/AF)	T.D.S. 1000 (Tons)
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	353	.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

Calendar Year	Month	Flow 1000 (AF)	Concentration (T/AF)	T.D.S. 1000 (Tons)
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	1,095	.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

Calendar Year	Month	Flow 1000 (AF)	Concentration (T/AF)	T.D.S. 1000 (Tons)
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	1,150	.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	1,016	.65	662
1959	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
	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
1960	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
	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

Calendar Year	Month	Flow 1000 (AF)	Concentration (T/AF)	T.D.S. 1000 (Tons)
1961	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
	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
1962	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
	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
1963	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
	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
1964	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
	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
1965	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
	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

To obtain mg/L multiply T/AF by 735.29

Table 11

Colorado River Basin

Historical Flow and Quality of Water Data

Dolores River near Cisco, Utah

Calendar Year	Month	Flow 1000 (A F)	Concen-tration (T/A F)	T.D.S. 1000 (Tons)
	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

Calendar Year	Month	Flow 1000 (A F)	Concen-tration (T/A F)	T.D.S. 1000 (Tons)
	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	1,289	.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

Calendar Year	Month	Flow 1000 (A F)	Concen-tration (T/A F)	T.D.S. 1000 (Tons)
	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
	Jan.	5	6.92	36
	Feb.	7	5.51	41
	Mar.	6	5.81	36
	Apr.	8	2.83	23
	May	6	4.48	26
	June	10	2.32	23
1977	July	19	2.23	43
	Aug.	15	1.70	25
	Sept.	5	2.63	14
	Oct.	10	2.31	24
	Nov.	6	3.25	19
	Dec.	6	4.81	29
	TOTAL	104	3.26	338
	Jan.	9	3.81	32
	Feb.	8	4.04	32
	Mar.	16	2.52	40
	Apr.	236	.34	80
	May	247	.28	68
	June	160	.26	41
1978	July	33	.87	29
	Aug.	5	2.40	12
	Sept.	2	5.15	9
	Oct.	4	5.12	20
	Nov.	10	2.50	25
	Dec.	6	4.10	26
	TOTAL	735	.56	415
	Jan.	8	.92	7
	Feb.	12	2.43	30
	Mar.	31	2.24	69
	Apr.	280	.40	113
	May	389	.32	122
	June	262	.32	85
1979	July	72	.83	59
	Aug.	15	2.65	40
	Sept	4	5.21	20
	Oct.	5	5.59	28
	Nov.	7	4.44	32
	Dec.	8	4.73	37
	TOTAL	1,092	.59	643
	Jan.	13	3.21	41
	Feb.	16	2.71	45
	Mar.	14	2.91	40
	Apr.	217	.45	98
	May	407	.31	127
	June	272	.30	81
1980	July	57	.81	46
	Aug.	11	2.99	33
	Sept	8	3.44	26
	Oct.	8	4.28	33
	Nov.	8	4.12	33
	Dec.	9	4.25	38
	TOTAL	1,039	.61	638

Calendar Year	Month	Flow 1000 (A F)	Concen-tration (T/A F)	T.D.S. 1000 (Tons)
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
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	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			
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	Feb.			
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	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			
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	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			

To obtain mg/L multiply T/AF by 735.29

Table 12

Colorado River Basin

Historical Flow and Quality of Water Data

Colorado River near Cisco, Utah

Calendar Year	Month	Flow 1000 (AF)	Concen-tration (T/AF)	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	723
	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

Calendar Year	Month	Flow 1000 (AF)	Concen-tration (T/AF)	T.D.S. 1000 (Tons)
	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
	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	1.08	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

Calendar Year	Month	Flow 1000 (AF)	Concen-tration (T/AF)	T.D.S. 1000 (Tons)
	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	5,063
	Jan.	185	1.65	306
	Feb.	143	1.63	233
	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	4,062	.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	3,299
	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	3,420

Calendar Year	Month	Flow 1000 (AF)	Concen-tration (T/AF)	T.D.S. 1000 (Tons)
	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.	190	1.66	315
	Dec.	176	1.63	287
	TOTAL	6,044	.72	4,348
	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	250	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

Calendar Year	Month	Flow 1000 (AF)	Concen-tration (T/AF)	T.D.S. 1000 (Tons)
	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.	263	1.43	376
	Nov.	243	1.31	318
	Dec.	180	1.77	319
	TOTAL	6,576	.68	4,483
	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

To obtain mg/L multiply T/AF by 735.29

Table 12

Colorado River Basin

Historical Flow and Quality of Water Data

Colorado River near Cisco, Utah

Calendar Year	Month	Flow 1000 (AF)	Concentration (T/AF)	T.D.S. 1000 (Tons)
1966	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
	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
1967	Jan.	146	1.77	258
	Feb.	136	1.71	233
	Mar.	185	1.30	240
	Apr.	198	1.31	259
	May	462	.76	351
	June	713	.65	463
	July	327	1.09	356
	Aug.	175	1.76	308
	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
1968	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
	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
1969	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
	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
1970	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
	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

Calendar Year	Month	Flow 1000 (AF)	Concentration (T/AF)	T.D.S. 1000 (Tons)
1971	Jan.	332	0.78	258
	Feb.	321	.68	216
	Mar.	413	.63	262
	Apr.	580	.50	288
	May	768	.52	398
	June	1,141	.40	457
	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
1972	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
	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
1973	Jan.	283	0.96	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
	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
1974	Jan.	312	0.86	267
	Feb.	294	.81	237
	Mar.	363	.84	304
	Apr.	361	.81	291
	May	1,016	.39	400
	June	747	.50	373
	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
1975	Jan.	236	1.11	261
	Feb.	207	1.08	223
	Mar.	241	1.09	263
	Apr.	377	.85	319
	May	1,007	.47	472
	June	1,243	.42	524
	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

Calendar Year	Month	Flow 1000 (AF)	Concentration (T/AF)	T.D.S. 1000 (Tons)
1976	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
	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
1977	Jan.	206	1.15	238
	Feb.	146	1.38	201
	Mar.	124	1.56	192
	Apr.	97	1.52	148
	May	143	1.28	183
	June	168	1.23	207
	July	127	1.89	240
	Aug.	109	1.92	209
	Sept.	127	1.68	214
	Oct.	141	1.61	227
	Nov.	142	1.58	225
	Dec.	130	1.46	189
	TOTAL	1,660	1.49	2,472
1978	Jan.	137	1.34	183
	Feb.	138	1.27	176
	Mar.	191	1.19	228
	Apr.	477	.72	343
	May	957	.49	470
	June	1,343	.36	483
	July	535	.62	333
	Aug	159	1.35	215
	Sept.	182	1.36	248
	Oct.	200	1.37	273
	Nov.	249	1.15	287
	Dec.	244	1.06	259
	TOTAL	4,813	.73	3,498
1979	Jan.	239	.70	229
	Feb.	251	.64	217
	Mar	371	.64	322
	Apr.	716	.45	440
	May	1,513	.27	561
	June	1,555	.25	530
	July	755	.37	380
	Aug.	278	.78	297
	Sept.	218	.91	269
	Oct.	225	.92	281
	Nov.	226	.88	270
	Dec.	258	.76	266
	TOTAL	6,607	.45	4,060
1980	Jan.	262	.71	254
	Feb	257	.72	251
	Mar.	273	.72	268
	Apr.	566	.46	351
	May	166	.28	639
	June	158	.23	496
	July	509	.48	334
	Aug.	203	.96	264
	Sept.	206	1.00	280
	Oct.	222	.94	283
	Nov.	264	.75	271
	Dec.	255	.74	258
	TOTAL	6,251	.46	3,948

Calendar Year	Month	Flow 1000 (AF)	Concentration (T/AF)	T.D.S. 1000 (Tons)
1981	Jan.	218	.75	222
	Feb.	175	.84	199
	Mar.	161	.92	201
	Apr.	198	.87	234
	May	235	.69	222
	June	176	.52	123
	July	0	.00	0
	Aug.	0	.00	0
	Sept.	0	.00	0
	Oct.	0	.00	0
	Nov.	0	.00	0
	Dec.	0	.00	0
	TOTAL	1,163	.76	120
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	TOTAL			

Calendar Year	Month	Flow 1000 (AF)	Concentration (T/AF)	T.D.S. 1000 (Tons)
	Jan.			
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	Mar.			
	Apr.			
	May			
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	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			

To obtain mg/L multiply T/AF by 735.29

Table 13

Colorado River Basin

Historical Flow and Quality of Water Data

San Juan River near Archuletta, New Mexico

Calendar Year	Month	Flow 1000 (AF)	Concen-tration (T/AF)	T.D.S. 1000 (Tons)
1941	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
	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
1942	Jan.	45	0.33	15
	Feb.	48	.25	12
	Mar.	54	.42	23
	Apr.	383	.21	82
	May	320	.15	48
	June	310	.12	38
	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
1943	Jan.	16	0.44	7
	Feb.	26	.35	9
	Mar.	55	.38	21
	Apr.	198	.19	37
	May	184	.16	30
	June	134	.15	20
	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
1944	Jan.	16	0.38	6
	Feb.	19	.32	6
	Mar.	34	.47	16
	Apr.	131	.21	27
	May	371	.16	61
	June	382	.13	49
	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
1945	Jan.	14	.43	6
	Feb.	22	.45	10
	Mar.	35	.49	17
	Apr.	143	.20	28
	May	278	.16	44
	June	209	.13	28
	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

Calendar Year	Month	Flow 1000 (AF)	Concen-tration (T/AF)	T.D.S. 1000 (Tons)
1946	Jan.	14	0.43	6
	Feb.	17	.47	8
	Mar.	22	.50	11
	Apr.	66	.23	15
	May	73	.18	13
	June	87	.18	16
	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
1947	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
	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
1948	Jan.	27	0.26	7
	Feb.	39	.33	13
	Mar.	43	.35	15
	Apr.	246	.20	49
	May	306	.14	43
	June	338	.12	40
	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
1949	Jan.	16	0.44	7
	Feb.	25	.36	9
	Mar.	73	.37	27
	Apr.	228	.24	55
	May	318	.15	48
	June	406	.13	53
	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
1950	Jan.	16	.37	6
	Feb.	29	.41	12
	Mar.	31	.42	13
	Apr.	116	.19	22
	May	126	.15	19
	June	112	.16	18
	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

Calendar Year	Month	Flow 1000 (AF)	Concen-tration (T/AF)	T.D.S. 1000 (Tons)
1951	Jan.	10	0.50	5
	Feb.	11	.45	5
	Mar.	20	.45	9
	Apr.	35	.29	10
	May	117	.18	21
	June	94	.17	16
	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
1952	Jan.	19	0.53	10
	Feb.	19	.53	10
	Mar.	47	.49	23
	Apr.	326	.26	85
	May	396	.16	63
	June	454	.13	59
	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
1953	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
	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
1954	Jan.	11	0.45	5
	Feb.	21	.48	10
	Mar.	28	.46	13
	Apr.	90	.21	19
	May	143	.18	26
	June	67	.19	13
	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
1955	Jan	12	0.42	5
	Feb	13	.31	4
	Mar.	27	.37	10
	Apr.	45	.24	11
	May	132	.18	24
	June	119	.16	19
	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

Calendar Year	Month	Flow 1000 (AF)	Concen-tration (T/AF)	T.D.S. 1000 (Tons)
1956	Jan.	16	0.38	6
	Feb.	15	.40	6
	Mar.	48	.33	16
	Apr.	79	.20	16
	May	173	.14	24
	June	117	.15	18
	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
1957	Jan.	13	0.46	6
	Feb.	30	.47	14
	Mar.	46	.43	20
	Apr.	120	.28	34
	May	222	.19	42
	June	480	.13	62
	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
1958	Jan.	22	0.36	8
	Feb.	51	.43	22
	Mar.	77	.42	32
	Apr.	279	.30	84
	May	460	.17	78
	June	270	.13	35
	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
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	0.43	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

Calendar Year	Month	Flow 1000 (AF)	Concen-tration (T/AF)	T.D.S. 1000 (Tons)
1961	Jan.	12	0.45	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	0.37	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	0.39	3
	Feb.	8	.43	4
	Mar.	14	.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	0.32	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	213	.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

To obtain mg/L multiply T/AF by 735.29

Table 13

Colorado River Basin

Historical Flow and Quality of Water Data

San Juan River near Archuletta, New Mexico

Calendar Year	Month	Flow 1000 (AF)	Concen-tration (T/AF)	T.D.S. 1000 (Tons)
1966	Jan.	168	0.21	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	0.26	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	0.29	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	0.22	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	0.22	11
	Feb.	110	.19	21
	Mar.	91	.20	18
	Apr.	26	.23	6
	May	29	.24	7
	June	30	.23	7
	July	31	.19	6
	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	0.23	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	0.22	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	0.27	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	0.20	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	0.28	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	0.22	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	7
	Dec.	73	.23	17
	TOTAL	639	.23	147
1977	Jan.	75	0.23	17
	Feb.	37	.24	9
	Mar.	32	.24	8
	Apr.	31	.25	7
	May	34	.24	8
	June	36	.24	9
	July	34	.24	8
	Aug.	35	.24	8
	Sept.	31	.25	8
	Oct.	33	.25	8
	Nov.	30	.25	8
	Dec.	29	.26	7
	TOTAL	437	.24	105
1978	Jan.	31	0.27	8
	Feb.	29	.26	7
	Mar.	30	.28	8
	Apr.	31	.28	9
	May	32	.28	9
	June	28	.30	8
	July	30	.27	8
	Aug	34	.27	9
	Sept.	38	.27	10
	Oct.	30	.28	8
	Nov.	30	.28	9
	Dec.	31	.28	9
	TOTAL	375	.28	104
1979	Jan.	31	.27	8
	Feb.	32	.26	8
	Mar.	99	.27	26
	Apr.	284	.25	70
	May	305	.25	75
	June	308	.24	74
	July	315	.22	69
	Aug.	114	.20	23
	Sept.	45	.18	8
	Oct.	47	.22	10
	Nov.	33	.20	7
	Dec.	104	.17	17
	TOTAL	1,715	.23	397
1980	Jan.	101	.17	17
	Feb.	99	.18	18
	Mar.	145	.20	28
	Apr.	91	.22	20
	May	120	.21	26
	June	71	.22	15
	July	61	.21	13
	Aug.	79	.20	16
	Sept.	70	.21	14
	Oct.	72	.21	15
	Nov.	84	.20	17
	Dec.	84	.20	17
	TOTAL	1,077	.20	216
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			
	Jan.			
	Feb.			
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	Apr.			
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	Aug.			
	Sept.			
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	Nov.			
	Dec.			
	TOTAL			
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	Oct.			
	Nov.			
	Dec.			
	TOTAL			
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			

To obtain mg/L multiply T/AF by 735.29

Table 14

Colorado River Basin

Historical Flow and Quality of Water Data

San Juan River near Bluff, Utah

Calendar Year	Month	Flow 1000 (A F)	Concen-tration (T/A F)	T.D.S. 1000 (Tons)
	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
1941	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
	Jan.	81	0.93	75
	Feb.	68	.93	63
	Mar.	126	.95	120
	Apr.	602	.51	307
	May	479	.38	182
	June	533	.26	139
1942	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
	Jan.	43	1.26	54
	Feb.	49	1.19	58
	Mar.	95	1.09	104
	Apr.	294	.47	138
	May	332	.39	129
	June	254	.38	96
1943	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
	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
1944	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
	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
1945	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

Calendar Year	Month	Flow 1000 (A F)	Concen-tration (T/A F)	T.D.S. 1000 (Tons)
	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
1946	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
	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
1947	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	1,677	.65	1,087
	Jan.	52	0.83	43
	Feb.	79	.84	66
	Mar.	89	.83	74
	Apr.	358	.37	133
	May	519	.27	140
	June	603	.28	169
1948	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
	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
1949	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
	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
1950	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

Calendar Year	Month	Flow 1000 (A F)	Concen-tration (T/A F)	T.D.S. 1000 (Tons)
	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
1951	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
	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
1952	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
	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
1953	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
	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
1954	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
	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
1955	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

Calendar Year	Month	Flow 1000 (A F)	Concen-tration (T/A F)	T.D.S. 1000 (Tons)
	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
1956	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
	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
1957	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
	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
1958	July	74	.65	48
	Aug.	43	1.02	43
	Sept.	61	.95	58
	Oct.	47	1.04	49
	Nov.	43	1.23	53
	Dec.	36	1.28	46
	TOTAL	2,298	.49	1,116
	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
1959	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
	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
1960	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

Calendar Year	Month	Flow 1000 (A F)	Concen-tration (T/A F)	T.D.S. 1000 (Tons)
	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
1961	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
	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
1962	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
	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
1963	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
	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
1964	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
	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
1965	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

To obtain mg/L multiply T/AF by 735.29

Table 14

Colorado River Basin

Historical Flow and Quality of Water Data

San Juan River near Bluff, Utah

Calendar Year	Month	Flow 1000 (A F)	Concen-tration (T/A F)	T.D.S. 1000 (Tons)
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	0.77	58
	Feb.	130	.49	64
	Mar.	116	.57	66
	Apr.	49	.96	47
	May	140	.45	63
	June	138	.49	67
	July	74	.73	54
	Aug.	66	1.09	72
	Sept.	308	.71	219
	Oct.	142	.59	84
	Nov.	137	.58	80
	Dec.	149	.54	80
	TOTAL	1,524	.63	954

Calendar Year	Month	Flow 1000 (A F)	Concen-tration (T/A F)	T.D.S. 1000 (Tons)
1971	Jan.	164	0.48	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	0.61	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	0.76	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	0.59	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	0.88	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

Calendar Year	Month	Flow 1000 (A F)	Concen-tration (T/A F)	T.D.S. 1000 (Tons)
1976	Jan.	97	0.71	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
1977	Jan.	84	0.72	60
	Feb.	55	.93	51
	Mar.	42	.77	32
	Apr.	24	.95	23
	May	21	1.30	27
	June	33	1.13	37
	July	58	1.50	86
	Aug.	81	1.19	97
	Sept.	33	1.11	37
	Oct.	39	1.12	43
	Nov.	51	1.05	54
	Dec.	49	1.01	49
	TOTAL	569	1.05	597
1978	Jan.	58	1.05	61
	Feb.	61	1.16	71
	Mar.	101	1.22	123
	Apr.	110	.74	81
	May	155	.63	98
	June	203	.40	81
	July	63	.73	46
	Aug.	15	.93	14
	Sept.	30	.95	28
	Oct.	40	.96	39
	Nov.	76	.89	70
	Dec.	75	1.02	77
	TOTAL	991	.80	789
1979	Jan.	93	0.97	90
	Feb.	133	.73	97
	Mar.	226	.92	208
	Apr.	574	.61	350
	May	635	.34	214
	June	615	.28	172
	July	413	.37	151
	Aug.	142	.58	82
	Sept.	39	.62	24
	Oct.	63	.73	46
	Nov.	53	.64	34
	Dec.	126	.58	73
	TOTAL	3,112	.50	1,541
1980	Jan.	149	.55	82
	Feb.	193	.50	96
	Mar.	221	.47	103
	Apr.	285	.46	130
	May	370	.33	121
	June	378	.29	110
	July	123	.47	58
	Aug.	76	.76	58
	Sept.	106	.75	79
	Oct.	84	.61	51
	Nov.	104	.63	65
	Dec.	94	.63	59
	TOTAL	2,183	.46	1,012

Calendar Year	Month	Flow 1000 (A F)	Concen-tration (T/A F)	T.D.S. 1000 (Tons)
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			

Calendar Year	Month	Flow 1000 (A F)	Concen-tration (T/A F)	T.D.S. 1000 (Tons)
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			

To obtain mg/L multiply T/AF by 735.29

Table 15

Colorado River Basin

Historical Flow and Quality of Water Data

Colorado River at Lees Ferry, Arizona

Calendar Year	Month	Flow 1000 (AF)	Concentration (T/AF)	T.D.S. 1000 (Tons)
1941	Jan.	348	1.36	474
	Feb.	423	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
	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
1942	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
	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
1943	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
	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
1944	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
	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	13,019	.65	8,525
1945	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
	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
1946	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	1,993	.43	857
	July	730	.73	533
	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
1947	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
	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
1948	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
	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
1949	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
	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
1950	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
	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
1951	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
	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
1952	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
	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
1953	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
	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
1954	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
	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
1955	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
	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
1956	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
	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
1957	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
	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
1958	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
	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
1959	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
	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
1960	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
	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
1961	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
	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
1962	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
	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
1963	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
	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
1964	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
	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
1965	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
	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	11,585	.78	9,008

To obtain mg/L multiply T/AF by 735.29

Table 15

Colorado River Basin

Historical Flow and Quality of Water Data

Colorado River at Lees Ferry, Arizona

Calendar Year	Month	Flow 1000 (A F)	Concen-tration (T/A F)	T.D.S. 1000 (Tons)
1966	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
	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
1967	Jan.	614	0.76	467
	Feb.	534	.79	422
	Mar.	690	.89	614
	Apr.	788	1.03	812
	May	879	.93	817
	June	698	.99	691
	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
1968	Jan.	633	0.93	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
	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
1969	Jan.	570	0.92	524
	Feb.	461	.94	434
	Mar.	708	.99	698
	Apr.	871	1.06	920
	May	763	.98	744
	June	875	.91	798
	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
1970	Jan.	706	0.84	593
	Feb.	445	.90	401
	Mar.	486	.96	466
	Apr.	942	.94	888
	May	900	.92	824
	June	800	.86	690
	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
1971	Jan.	492	0.75	369
	Feb.	416	.85	354
	Mar.	640	.91	581
	Apr.	1,011	.90	908
	May	926	.87	803
	June	894	.79	705
	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
1972	Jan.	806	0.74	594
	Feb.	444	.74	331
	Mar.	378	.85	321
	Apr.	782	.88	686
	May	902	.82	741
	June	863	.78	676
	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
1973	Jan.	1,207	0.73	887
	Feb.	764	.75	572
	Mar.	1,095	.83	912
	Apr.	1,678	.86	1,443
	May	648	.86	558
	June	751	.83	624
	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
1974	Jan.	846	0.69	585
	Feb.	299	.68	203
	Mar.	389	.80	313
	Apr.	495	.84	418
	May	804	.81	653
	June	914	.77	702
	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
1975	Jan.	768	0.70	539
	Feb.	556	.73	406
	Mar.	508	.79	402
	Apr.	459	.81	373
	May	892	.83	740
	June	987	.78	771
	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
1976	Jan.	692	0.70	485
	Feb.	742	.78	581
	Mar.	676	.84	570
	Apr.	660	.84	557
	May	1,046	.81	843
	June	756	.77	585
	July	766	.75	572
	Aug.	720	.73	524
	Sept.	842	.72	610
	Oct.	792	.70	556
	Nov.	898	.73	655
	Dec.	811	.71	577
	TOTAL	9,401	.76	7,115
1977	Jan.	994	0.74	731
	Feb.	471	.79	372
	Mar.	458	.83	380
	Apr.	164	.82	135
	May	205	.84	172
	June	466	.81	376
	July	847	.80	675
	Aug.	1,178	.81	956
	Sept.	977	.79	774
	Oct.	379	.77	290
	Nov.	390	.77	299
	Dec.	823	.75	617
	TOTAL	7,352	.79	5,777
1978	Jan.	947	0.80	758
	Feb.	601	.80	482
	Mar.	579	.83	482
	Apr.	492	.88	431
	May	647	.90	582
	June	758	.89	675
	July	702	.88	615
	Aug	1,065	.88	936
	Sept.	968	.87	844
	Oct.	681	.84	575
	Nov.	671	.81	546
	Dec.	889	.77	687
	TOTAL	9,001	.85	7,612
1979	Jan.	1,018	0.72	732
	Feb.	746	.74	550
	Mar.	204	.79	161
	Apr.	341	.87	297
	May	517	.84	435
	June	614	.81	496
	July	859	.79	680
	Aug.	1,064	.76	807
	Sept.	686	.77	529
	Oct.	618	.77	476
	Nov.	802	.76	611
	Dec.	637	.71	454
	TOTAL	8,108	.77	6,227
1980	Jan.	537	0.71	383
	Feb	615	.76	469
	Mar.	606	.81	490
	Apr.	863	.81	703
	May	845	.79	669
	June	1,472	.71	1,050
	July	1,585	.69	1,092
	Aug.	1,278	.68	873
	Sept.	981	.69	674
	Oct.	777	.67	522
	Nov.	936	.66	615
	Dec.	747	.63	470
	TOTAL	11,242	.71	8,010

To obtain mg/L multiply T/AF by 735.29

Table 16

Colorado River Basin

Historical Flow and Quality of Water Data

Colorado River near Grand Canyon, Arizona

Calendar Year	Month	Flow 1000 (AF)	Concentration (T/AF)	T.D.S. 1000 (Tons)
1941	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
	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	18,796	.77	14,503
1942	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
	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	1.50	560
	TOTAL	14,925	.68	10,186
1943	Jan.	347	1.49	517
	Feb.	351	1.48	519
	Mar.	580	1.26	731
	Apr.	1,417	.83	1,176
	May	2,161	.57	1,232
	June	2,676	.49	1,311
	July	1,459	.60	875
	Aug.	834	1.17	976
	Sept.	494	1.40	692
	Oct.	408	1.69	690
	Nov.	477	1.47	701
	Dec.	420	1.46	613
	TOTAL	11,624	.86	10,033
1944	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
	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
1945	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
	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

Calendar Year	Month	Flow 1000 (AF)	Concentration (T/AF)	T.D.S. 1000 (Tons)
1946	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
	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
1947	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
	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
1948	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
	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
1949	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
	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
1950	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
	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

Calendar Year	Month	Flow 1000 (AF)	Concentration (T/AF)	T.D.S. 1000 (Tons)
1951	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
	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
1952	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
	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	18,106	.75	13,582
1953	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
	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
1954	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
	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
1955	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
	July	618	.77	476
	Aug.	668	1.39	929
	Sept.	265	1.63	432
	Oct.	236	1.84	434
	Nov.	298	1.88	560
	Dec.	354	1.52	538
	TOTAL	7,287	1.03	7,494

Calendar Year	Month	Flow 1000 (AF)	Concentration (T/AF)	T.D.S. 1000 (Tons)
1956	Jan	398	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
	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
1957	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
	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	.79	13,263
1958	Jan.	415	1.31	544
	Feb.	536	1.24	665
	Mar.	749	1.13	846
	Apr.	1,580	.77	1,220
	May	3,900	.45	1,755
	June	3,763	.41	1,542
	July	683	.91	622
	Aug.	337	1.31	440
	Sept.	379	1.32	500
	Oct.	346	1.53	530
	Nov.	385	1.53	590
	Dec.	388	1.55	600
	TOTAL	13,461	.73	9,854
1959	Jan.	334	1.56	520
	Feb.	326	1.53	500
	Mar.	365	1.53	560
	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
1960	Jan.	348	1.41	490
	Feb.	353	1.40	495
	Mar.	820	1.15	942
	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

Calendar Year	Month	Flow 1000 (AF)	Concentration (T/AF)	T.D.S. 1000 (Tons)
1961	Jan.	291	1.58	460
	Feb.	353	1.39	490
	Mar.	379	1.40	530
	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
1962	Jan.	369	1.35	498
	Feb.	832	1.02	847
	Mar.	610	1.19	726
	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
1963	Jan.	182	1.84	334
	Feb.	374	1.37	496
	Mar.	203	1.37	279
	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
1964	Jan.	79	1.75	138
	Feb.	245	1.52	373
	Mar.	382	1.47	562
	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
1965	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
	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

To obtain mg/L multiply T/AF by 735.29

Table 16

Colorado River Basin

Historical Flow and Quality of Water Data

Colorado River near Grand Canyon, Arizona

Calendar Year	Month	Flow 1000 (A F)	Concen-tration (T/A F)	T.D.S. 1000 (Tons)
	Jan.	529	0.79	418
	Feb.	524	.87	455
	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	0.84	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	0.99	621
	Feb.	509	1.10	560
	Mar.	727	1.05	763
	Apr.	927	1.05	973
	May	799	1.03	822
	June	870	.98	853
1969	July	994	.95	944
	Aug.	1,002	.83	832
	Sept	842	.82	691
	Oct.	662	.80	527
	Nov.	751	.80	601
	Dec.	832	.81	664
	TOTAL	9,543	.93	8,861
	Jan.	768	0.88	676
	Feb.	494	.96	474
	Mar.	510	1.00	510
	Apr.	969	.94	911
	May	946	.96	908
	June	821	.90	739
1970	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

Calendar Year	Month	Flow 1000 (A F)	Concen-tration (T/A F)	T.D.S. 1000 (Tons)
	Jan.	544	0.77	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	0.76	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	0.73	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	0.70	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	0.74	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	9,210	.82	7,588

Calendar Year	Month	Flow 1000 (A F)	Concen-tration (T/A F)	T.D.S. 1000 (Tons)
	Jan.	718	0.70	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	7,507
	Jan.	1,018	.75	765
	Feb.	487	.82	399
	Mar.	492	1.00	490
	Apr.	189	1.14	216
	May	220	1.00	221
	June	472	.91	431
1977	July	888	.83	740
	Aug.	1,245	.85	1,054
	Sept.	976	.86	839
	Oct.	419	.89	373
	Nov.	387	.87	336
	Dec.	804	.85	687
	TOTAL	7,597	.86	6,550
	Jan.	930	0.84	784
	Feb.	592	.85	503
	Mar.	694	.84	582
	Apr.	481	.84	406
	May	581	.89	517
	June	766	.92	706
1978	July	697	.92	643
	Aug	1,092	.93	1,012
	Sept.	1,015	.93	941
	Oct.	707	.93	658
	Nov.	722	.93	672
	Dec.	1,054	.93	982
	TOTAL	9,330	.90	8,405
	Jan.	1,057	0.81	856
	Feb.	831	.83	691
	Mar.	318	.86	273
	Apr.	500	.89	442
	May	602	.90	544
	June	632	.90	569
1979	July	858	.88	756
	Aug.	1,079	.86	830
	Sept.	709	.84	594
	Oct.	619	.82	508
	Nov.	813	.82	667
	Dec.	679	.82	557
	TOTAL	8,696	.85	7,385
	Jan.	600	.78	467
	Feb.	836	.83	694
	Mar.	671	.86	577
	Apr.	965	.86	830
	May	888	.81	721
	June	1,463	.76	1,112
1980	July	1,562	.72	1,116
	Aug.	1,324	.71	941
	Sept.	1,020	.72	732
	Oct.	765	.72	551
	Nov.	925	.71	659
	Dec.	748	.71	529
	TOTAL	11,766	.76	8,929

Calendar Year	Month	Flow 1000 (A F)	Concen-tration (T/A F)	T.D.S. 1000 (Tons)
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			
	Jan.			
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	Mar.			
	Apr.			
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	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			
	Jan.			
	Feb.			
	Mar.			
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	May			
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	Oct.			
	Nov.			
	Dec.			
	TOTAL			
	Jan.			
	Feb.			
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	Apr.			
	May			
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	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			

To obtain mg/L multiply T/AF by 735.29

Table 17

Colorado River Basin

Historical Flow and Quality of Water Data

Virgin River at Littlefield, Arizona

Calendar Year	Month	Flow 1000 (AF)	Concentration (T/AF)	T.D.S. 1000 (Tons)
1941	Jan.	15	2.19	35
	Feb.	31	1.97	61
	Mar.	62	.82	51
	Apr.	62	.84	52
	May	131	.46	60
	June	19	1.75	34
	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
1942	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
	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
1943	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
	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
1944	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
	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
1945	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
	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

Calendar Year	Month	Flow 1000 (AF)	Concentration (T/AF)	T.D.S. 1000 (Tons)
1946	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
	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
1947	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
	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
1948	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
	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
1949	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
	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
1950	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
	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

Calendar Year	Month	Flow 1000 (AF)	Concentration (T/AF)	T.D.S. 1000 (Tons)
1951	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
	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
1952	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
	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
1953	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
	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
1954	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
	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
1955	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
	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

Calendar Year	Month	Flow 1000 (AF)	Concentration (T/AF)	T.D.S. 1000 (Tons)
1956	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
	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
1957	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
	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
1958	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
	July	6	3.17	19
	Aug.	5	3.22	18
	Sept.	22	3.13	70
	Oct.	8	3.16	24
	Nov.	11	2.62	28
	Dec.	10	2.67	26
	TOTAL	272	1.68	457
1959	Jan.	10	2.58	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

Calendar Year	Month	Flow 1000 (AF)	Concentration (T/AF)	T.D.S. 1000 (Tons)
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	2.66	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

To obtain mg/L multiply T/AF by 735.29

Table 17

Colorado River Basin

Historical Flow and Quality of Water Data

Virgin River at Littlefield, Arizona

Calendar Year	Month	Flow 1000 (A F)	Concen-tration (T/A F)	T.D.S. 1000 (Tons)
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

Calendar Year	Month	Flow 1000 (A F)	Concen-tration (T/A F)	T.D.S. 1000 (Tons)
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

Calendar Year	Month	Flow 1000 (A F)	Concen-tration (T/A F)	T.D.S. 1000 (Tons)
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
1977	Jan.	9	2.80	24
	Feb.	7	2.86	19
	Mar.	5	3.22	17
	Apr.	4	3.37	13
	May	6	2.41	15
	June	6	3.21	19
	July	7	3.45	25
	Aug.	7	3.79	26
	Sept.	4	3.52	14
	Oct.	4	3.45	15
	Nov.	6	3.23	20
	Dec.	8	2.95	23
	TOTAL	73	3.15	231
1978	Jan.	15	1.96	30
	Feb.	22	1.88	40
	Mar.	105	1.24	130
	Apr.	50	1.14	57
	May	29	1.05	31
	June	5	2.45	12
	July	4	3.41	14
	Aug.	4	3.53	14
	Sept.	4	3.47	13
	Oct.	4	3.13	14
	Nov.	12	2.26	28
	Dec.	13	2.90	37
	TOTAL	268	1.57	420
1979	Jan.	12	3.02	37
	Feb.	18	2.67	48
	Mar.	37	2.13	79
	Apr.	75	1.58	118
	May	96	1.25	120
	June	23	2.28	53
	July	4	3.90	17
	Aug.	8	3.52	27
	Sept.	4	3.90	15
	Oct.	6	3.85	22
	Nov.	10	3.39	35
	Dec.	12	3.26	39
	TOTAL	305	2.00	609
1980	Jan.	37	1.95	72
	Feb.	134	1.70	227
	Mar.	43	2.17	93
	Apr.	56	1.64	92
	May	91	1.30	119
	June	27	1.98	54
	July	9	3.15	27
	Aug.	7	3.43	22
	Sept.	19	3.54	67
	Oct.	14	3.22	45
	Nov.	16	3.01	49
	Dec.	17	2.83	47
	TOTAL	469	1.95	914

Calendar Year	Month	Flow 1000 (A F)	Concen-tration (T/A F)	T.D.S. 1000 (Tons)
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			

Calendar Year	Month	Flow 1000 (A F)	Concen-tration (T/A F)	T.D.S. 1000 (Tons)
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			

To obtain mg/L multiply T/AF by 735.29

Table 18

Colorado River Basin

Historical Flow and Quality of Water Data

Colorado River below Hoover Dam, Arizona — Nevada

Calendar Year	Month	Flow 1000 (AF)	Concentration (T/AF)	T.D.S. 1000 (Tons)
1941	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
	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
1942	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
	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
1943	Jan.	1,109	0.87	965
	Feb.	823	.89	732
	Mar.	971	.94	913
	Apr.	915	.95	869
	May	1,029	.94	967
	June	1,040	.93	967
	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
1944	Jan.	1,303	0.88	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
	July	1,111	.93	1,033
	Aug.	1,211	.92	1,113
	Sept	1,132	.89	1,007
	Oct.	1,226	.94	1,152
	Nov.	1,186	.99	1,174
	Dec.	1,199	.94	1,127
	TOTAL	14,427	.94	13,607
1945	Jan.	1,239	0.93	1,152
	Feb.	1,100	.96	1,056
	Mar.	1,250	.96	1,200
	Apr.	1,042	.95	990
	May	1,068	.90	961
	June	1,014	.91	923
	July	861	.92	792
	Aug.	885	.93	823
	Sept.	869	.90	782
	Oct.	1,080	.88	950
	Nov.	1,042	.90	938
	Dec.	1,062	.89	945
	TOTAL	12,512	.92	11,512

Calendar Year	Month	Flow 1000 (AF)	Concentration (T/AF)	T.D.S. 1000 (Tons)
1946	Jan.	1,116	0.[illegible]	971
	Feb.	1,047	.95	994
	Mar.	1,004	.88	884
	Apr.	872	.89	776
	May	903	.96	867
	June	817	.92	752
	July	838	.90	754
	Aug.	751	.91	683
	Sept.	759	.91	691
	Oct.	857	.92	788
	Nov.	762	.91	693
	Dec.	859	.90	773
	TOTAL	10,585	.91	9,626
1947	Jan.	984	0.90	886
	Feb.	886	.91	806
	Mar.	956	.92	879
	Apr.	859	.99	850
	May	951	1.03	979
	June	919	.95	873
	July	925	.96	888
	Aug.	865	.92	796
	Sept.	843	.92	776
	Oct.	828	.92	762
	Nov.	880	.92	810
	Dec.	1,063	.92	978
	TOTAL	10,959	.94	10,283
1948	Jan.	1,169	0.93	1,087
	Feb.	1,138	.93	1,058
	Mar.	1,150	.93	1,070
	Apr.	1,202	.97	1,166
	May	1,142	.93	1,062
	June	1,076	.88	947
	July	1,156	.86	994
	Aug.	968	.86	833
	Sept.	981	.85	834
	Oct.	917	.80	734
	Nov.	1,028	.88	905
	Dec.	1,124	.91	1,023
	TOTAL	13,051	.90	11,713
1949	Jan.	1,212	0.83	1,006
	Feb.	1,214	.84	1,020
	Mar.	1,291	.85	1,097
	Apr.	1,178	.86	1,013
	May	1,026	.83	852
	June	986	.87	858
	July	1,020	.84	857
	Aug.	1,062	.80	850
	Sept.	1,141	.78	890
	Oct.	1,176	.75	882
	Nov.	1,022	.83	848
	Dec.	1,238	.87	1,077
	TOTAL	13,566	.83	11,250
1950	Jan.	1,277	0.83	1,060
	Feb.	1,132	.81	917
	Mar.	1,246	.85	1,059
	Apr.	1,089	.85	926
	May	1,120	.84	941
	June	960	.83	797
	July	982	.79	776
	Aug.	872	.82	715
	Sept.	824	.79	651
	Oct.	848	.89	755
	Nov.	815	.88	717
	Dec.	851	.86	732
	TOTAL	12,016	.84	10,046

Calendar Year	Month	Flow 1000 (AF)	Concentration (T/AF)	T.D.S. 1000 (Tons)
1951	Jan.	928	0.87	807
	Feb.	756	.87	658
	Mar.	860	.91	783
	Apr.	796	.93	740
	May	898	.92	826
	June	691	.91	629
	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
1952	Jan.	1,070	0.90	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
	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	15,816	.85	13,401
1953	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
	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
1954	Jan.	836	0.88	736
	Feb.	721	.94	678
	Mar.	911	.95	865
	Apr.	975	.94	916
	May	1,101	.93	1,024
	June	929	.94	873
	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	9,911
1955	Jan.	725	0.99	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
	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

Calendar Year	Month	Flow 1000 (AF)	Concentration (T/AF)	T.D.S. 1000 (Tons)
1956	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
	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
1957	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
	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
1958	Jan.	1,245	0.90	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
	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
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	0.86	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

Calendar Year	Month	Flow 1000 (AF)	Concentration (T/AF)	T.D.S. 1000 (Tons)
1961	Jan.	591	0.93	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	0.93	448
	Feb.	497	.94	467
	Mar.	798	.94	750
	Apr.	902	.95	857
	May	887	1.00	887
	June	799	.94	751
	July	824	.91	750
	Aug.	857	.87	746
	Sept.	716	1.00	716
	Oct.	634	.86	545
	Nov.	613	.90	552
	Dec.	606	.93	564
	TOTAL	8,615	.93	8,033
1963	Jan.	482	0.99	478
	Feb.	575	.97	558
	Mar.	871	.95	828
	Apr.	865	.94	813
	May	911	.93	847
	June	764	.92	702
	July	908	.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	.92	7,882
1964	Jan.	633	0.93	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

To obtain mg/L multiply T/AF by 735.29

Table 18

Colorado River Basin

Historical Flow and Quality of Water Data

Colorado River below Hoover Dam, Arizona — Nevada

Calendar Year	Month	Flow 1000 (A F)	Concen-tration (T/A F)	T.D.S. 1000 (Tons)
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	0.94	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	0.94	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

Calendar Year	Month	Flow 1000 (A F)	Concen-tration (T/A F)	T.D.S. 1000 (Tons)
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	0.99	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	0.94	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	0.93	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

Calendar Year	Month	Flow 1000 (A F)	Concen-tration (T/A F)	T.D.S. 1000 (Tons)
1976	Jan.	509	0.93	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
1977	Jan.	250	0.96	241
	Feb.	608	.92	562
	Mar.	854	.90	773
	Apr.	988	.89	878
	May	761	.90	681
	June	720	.90	651
	July	892	.91	816
	Aug.	876	.92	807
	Sept.	469	.90	423
	Oct.	428	.90	384
	Nov.	463	.90	415
	Dec.	563	.91	514
	TOTAL	7,873	.91	7,144
1978	Jan.	235	0.91	213
	Feb.	429	.92	393
	Mar.	740	.93	691
	Apr.	902	.92	832
	May	860	.93	798
	June	654	.95	623
	July	831	.93	771
	Aug.	892	.93	832
	Sept.	688	.93	642
	Oct.	502	.93	469
	Nov.	375	.95	356
	Dec.	368	.97	356
	TOTAL	7,477	.93	6,976
1979	Jan.	218	0.94	204
	Feb.	291	.95	275
	Mar.	618	.93	577
	Apr.	703	.93	654
	May	1,010	.93	942
	June	865	.93	808
	July	856	.93	796
	Aug.	876	.93	814
	Sept.	703	.93	653
	Oct.	530	.92	488
	Nov.	543	.94	510
	Dec.	505	.93	472
	TOTAL	7,720	.93	7,194
1980	Jan.	471	0.93	440
	Feb.	268	.94	251
	Mar.	929	.94	873
	Apr.	1,129	.94	1,065
	May	1,260	.95	1,193
	June	1,057	.95	1,000
	July	1,190	.94	1,118
	Aug.	1,194	.94	1,120
	Sept.	879	.93	821
	Oct.	987	.94	922
	Nov.	837	.94	785
	Dec.	885	.94	832
	TOTAL	11,086	.94	10,420

Calendar Year	Month	Flow 1000 (A F)	Concen-tration (T/A F)	T.D.S. 1000 (Tons)
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			

To obtain mg/L multiply T/AF by 735.29

Table 19

Colorado River Basin

Historical Flow and Quality of Water Data

Colorado River below Parker Dam, Arizona – California

Calendar Year	Month	Flow 1000 (AF)	Concentration (T/AF)	T.D.S. 1000 (Tons)
1941	Jan.	627	1.11	698
	Feb.	561	1.14	642
	Mar.	750	1.14	854
	Apr.	608	1.12	679
	May	1,359	1.12	1,524
	June	1,628	1.11	1,808
	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
1942	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
	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
1943	Jan.	1,015	0.93	948
	Feb.	746	.88	657
	Mar.	886	.97	863
	Apr.	877	.95	837
	May	957	.97	933
	June	976	.98	961
	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
1944	Jan.	1,241	0.90	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
	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
1945	Jan.	1,186	0.94	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
	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
1946	Jan.	1,041	0.90	939
	Feb.	1,028	.96	991
	Mar.	944	.89	843
	Apr.	830	1.04	867
	May	873	.94	825
	June	754	.92	696
	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
1947	Jan.	953	0.91	870
	Feb.	899	.92	829
	Mar.	940	.94	888
	Apr.	797	.97	777
	May	905	.99	892
	June	860	.98	847
	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
1948	Jan.	1,160	0.96	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
	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
1949	Jan.	1,229	0.89	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
	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
1950	Jan.	1,080	0.86	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
	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
1951	Jan.	550	0.89	488
	Feb.	501	.89	448
	Mar.	730	.90	657
	Apr.	765	.89	682
	May	675	.90	607
	June	862	.90	779
	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
1952	Jan.	1,104	0.91	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
	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
1953	Jan.	1,198	0.68	813
	Feb.	1,020	.83	848
	Mar.	947	.90	853
	Apr.	808	.93	753
	May	953	.92	880
	June	956	.92	882
	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
1954	Jan.	797	0.86	685
	Feb.	661	.85	560
	Mar	782	.86	673
	Apr.	864	.86	746
	May	1,015	.91	927
	June	883	.94	834
	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
1955	Jan.	734	0.95	699
	Feb.	598	.96	574
	Mar.	733	.98	722
	Apr.	758	.99	753
	May	792	1.02	804
	June	866	1.06	914
	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
1956	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
	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
1957	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
	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
1958	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
	July	930	.86	803
	Aug.	867	.84	729
	Sept.	714	.83	590
	Oct.	610	.84	510
	Nov.	623	.84	521
	Dec.	753	.85	639
	TOTAL	10,892	.89	9,646
1959	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
	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
1960	Jan.	428	0.82	353
	Feb.	474	.82	388
	Mar.	760	.83	630
	Apr.	810	.87	705
	May	740	.88	651
	June	879	.90	794
	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
1961	Jan.	379	0.92	347
	Feb.	453	.91	414
	Mar.	742	.92	684
	Apr.	725	.92	669
	May	705	.94	664
	June	822	.94	776
	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
1962	Jan.	334	0.93	310
	Feb.	374	.93	346
	Mar.	692	.94	652
	Apr.	756	.96	729
	May	686	.97	667
	June	778	1.00	775
	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
1963	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
	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
1964	Jan.	363	0.91	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
	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
1965	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
	July	846	1.09	924
	Aug.	867	1.08	940
	Sept.	599	1.08	646
	Oct.	385	1.11	426
	Nov.	220	1.10	243
	Dec.	197	.95	187
	TOTAL	6,356	1.07	6,786

To obtain mg/L multiply T/AF by 735.29

Table 19

Colorado River Basin

Historical Flow and Quality of Water Data

Colorado River below Parker Dam, Arizona – California

Calendar Year	Month	Flow 1000 (AF)	Concentration (T/AF)	T.D.S. 1000 (Tons)
	Jan.	177	0.73	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	0.98	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	0.94	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
	June	674	1.05	708
1969	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
	June	706	1.03	727
1970	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

Calendar Year	Month	Flow 1000 (AF)	Concentration (T/AF)	T.D.S. 1000 (Tons)
	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	0.98	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	0.97	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.	447	.96	457
	Nov.	337	.97	327
	Dec.	360	.97	349
	TOTAL	7,210	.95	6,883

Calendar Year	Month	Flow 1000 (AF)	Concentration (T/AF)	T.D.S. 1000 (Tons)
	Jan.	353	0.95	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
	Jan.	258	0.94	242
	Feb.	498	.94	470
	Mar.	683	.94	640
	Apr.	812	.94	764
	May	652	.93	606
	June	760	.92	701
1977	July	956	.92	877
	Aug.	688	.87	598
	Sept.	460	.92	422
	Oct.	348	.93	324
	Nov.	288	.94	270
	Dec.	308	.99	304
	TOTAL	6,711	.93	6,216
	Jan.	137	0.96	131
	Feb.	398	.94	372
	Mar.	692	.92	637
	Apr.	849	.93	792
	May	679	.93	629
	June	763	.92	699
1978	July	906	.92	832
	Aug	791	.91	719
	Sept.	573	.93	533
	Oct.	360	.92	332
	Nov.	267	.93	250
	Dec.	270	.97	263
	TOTAL	6,685	.93	6,188
	Jan.	152	.98	149
	Feb.	337	.94	315
	Mar.	576	.92	531
	Apr.	776	.93	720
	May	783	.94	734
	June	850	.95	803
1979	July	961	.96	926
	Aug.	830	.95	787
	Sept	709	.97	690
	Oct.	505	.95	482
	Nov.	368	.96	353
	Dec.	349	.86	301
	TOTAL	7,195	.94	6,791
	Jan.	304	.92	281
	Feb.	386	.93	360
	Mar.	1,056	.83	871
	Apr.	1,121	.90	1,011
	May	964	.90	870
	June	1,145	.96	1,094
1980	July	1,247	.94	1,167
	Aug.	1,164	.95	1,110
	Sept.	982	.97	950
	Oct.	879	.98	862
	Nov.	760	.98	744
	Dec.	715	.97	691
	TOTAL	10,723	.93	10,010

Calendar Year	Month	Flow 1000 (AF)	Concentration (T/AF)	T.D.S. 1000 (Tons)
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			

Calendar Year	Month	Flow 1000 (AF)	Concentration (T/AF)	T.D.S. 1000 (Tons)
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			

To obtain mg/L multiply T/AF by 735.29

Table 20

Colorado River Basin

Historical Flow and Quality of Water Data

Colorado River at Imperial Dam, Arizona-California

Calendar Year	Month	Flow 1000 (A F)	Concen-tration (T/A F)	T.D.S. 1000 (Tons)
1941	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
	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
1942	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
	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
1943	Jan.	1,011	0.94	950
	Feb.	729	.92	671
	Mar.	846	.95	804
	Apr.	802	.96	770
	May	842	.98	825
	June	876	.98	858
	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
1944	Jan.	1,209	0.89	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
	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
1945	Jan.	1,160	0.99	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
	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
1946	Jan.	1,008	0.94	948
	Feb	1,005	.92	925
	Mar.	927	.94	871
	Apr.	759	.96	729
	May	786	.98	770
	June	658	.99	651
	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
1947	Jan.	932	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
	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
1948	Jan.	1,106	0.97	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
	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
1949	Jan.	1,237	0.92	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
	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
1950	Jan.	1,088	0.89	968
	Feb.	994	.97	865
	Mar.	1,169	.88	1,029
	Apr.	936	.90	842
	May	1,002	.91	912
	June	841	.89	748
	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
1951	Jan.	558	0.95	530
	Feb.	498	.96	478
	Mar.	635	.96	610
	Apr.	744	.96	714
	May	606	.99	600
	June	703	.98	689
	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
1952	Jan.	1,058	0.95	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
	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
1953	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
	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
1954	Jan.	783	0.94	736
	Feb.	661	.94	621
	Mar.	723	.94	680
	Apr.	773	.94	727
	May	929	1.05	975
	June	804	1.03	828
	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
1955	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
	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
1956	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
	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
1957	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
	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
1958	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
	July	812	.96	780
	Aug.	802	.97	778
	Sept.	655	.97	635
	Oct.	624	1.01	630
	Nov.	592	1.00	592
	Dec.	761	.97	738
	TOTAL	10,500	1.01	10,626
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

To obtain mg/L multiply T/AF by 735.29

Table 20

Colorado River Basin

Historical Flow and Quality of Water Data

Colorado River at Imperial Dam, Arizona-California

Calendar Year	Month	Flow 1000 (AF)	Concentration (T/AF)	T.D.S. 1000 (Tons)
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

Calendar Year	Month	Flow 1000 (AF)	Concentration (T/AF)	T.D.S. 1000 (Tons)
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

Calendar Year	Month	Flow 1000 (AF)	Concentration (T/AF)	T.D.S. 1000 (Tons)
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
1977	Jan.	264	1.24	326
	Feb.	389	1.12	438
	Mar.	569	1.10	627
	Apr.	681	1.09	740
	May	534	1.12	598
	June	586	1.09	640
	July	734	1.06	779
	Aug.	603	1.10	661
	Sept.	433	1.13	489
	Oct.	325	1.17	381
	Nov.	277	1.18	329
	Dec.	310	1.16	359
	TOTAL	5,705	1.12	6,367
1978	Jan.	171	1.34	229
	Feb.	340	1.10	375
	Mar.	550	1.05	578
	Apr.	697	1.05	732
	May	563	1.10	617
	June	589	1.09	640
	July	708	1.08	764
	Aug	664	1.09	722
	Sept.	501	1.11	555
	Oct.	357	1.15	411
	Nov.	274	1.21	332
	Dec.	285	1.21	345
	TOTAL	5,700	1.11	6,299
1979	Jan.	184	1.29	238
	Feb.	265	1.16	308
	Mar.	447	1.09	487
	Apr.	613	1.08	661
	May	644	1.11	714
	June	661	1.09	723
	July	762	1.08	819
	Aug.	723	1.07	776
	Sept.	624	1.06	663
	Oct.	500	1.07	537
	Nov.	368	1.15	422
	Dec.	339	1.15	392
	TOTAL	6,129	1.10	6,740
1980	Jan.	317	1.14	360
	Feb.	343	1.10	376
	Mar.	857	.92	792
	Apr.	979	1.01	991
	May	861	1.03	887
	June	921	1.06	978
	July	1,065	1.03	1,092
	Aug.	986	1.02	1,003
	Sept.	864	1.02	881
	Oct.	817	1.03	845
	Nov.	727	1.06	772
	Dec.	697	1.06	741
	TOTAL	9,434	1.03	9.717

Calendar Year	Month	Flow 1000 (AF)	Concentration (T/AF)	T.D.S. 1000 (Tons)
1981	Jan.	504	1.10	557
	Feb.	368	1.13	417
	Mar.	602	1.08	650
	Apr.	735	1.07	783
	May	579	1.10	637
	June	624	1.09	679
	July	744	1.06	788
	Aug.	725	1.10	795
	Sept.	505	1.17	589
	Oct.	345	1.21	419
	Nov.	257	1.24	319
	Dec.	277	1.20	334
	TOTAL	6,267	1.11	6,966
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			
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	Oct.			
	Nov.			
	Dec.			
	TOTAL			
	Jan.			
	Feb.			
	Mar.			
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	Oct.			
	Nov.			
	Dec.			
	TOTAL			
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	Mar.			
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	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			
	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	TOTAL			

To obtain mg/L multiply T/AF by 735.29