CENTRAL ARIZONA SALINITY STUDY --- PHASE I

Technical Appendix B

COLORADO, SALT, VERDE and GILA RIVERS

COLORADO RIVER

The Colorado River Basin (Basin) covers an area of 242,000 square miles in the United States and 2,000 square miles in Mexico. The River extends 1,400 miles from the Rocky Mountains to the Gulf of California. The Colorado River supplies water to 4 million people within the United States portion of the Basin, and through export, a full or supplemental water supply to an additional 19 million including 3 million within Central Arizona Project's delivery area.

The in-basin economy is based on irrigated agriculture, livestock grazing, mining, forestry, manufacturing, oil and gas production, recreation and tourism. About 3.5 million acres are irrigated within the Basin and hundreds of thousands of acres by water exported from the Basin. The Colorado River also serves about 1.7 million people and 500,000 irrigated acres in Mexico.

Like most western rivers, the Colorado's salinity increases as it moves downstream in its watershed. Mineral salts in the Basin are indigenous and pervasive. Significant portions of the geologic formations were deposited in ancient saline marine environments. Salts deposited within the sedimentary rocks are easily eroded, dissolved, and transported into the river system. The salinity concentration is highly variable due to large variations in the magnitude of runoff. The United States Geological Survey (USGS) has estimated that the natural salt load of Colorado River at Lees Ferry, Arizona is 5.3 million tons per year. The Bureau of Reclamation (Reclamation) has determined that the salt load currently entering Lake Mead is about 9 million tons annually.

The U.S. Environment Protection Agency (EPA), in 1971, concluded that about half (47 percent) of the salinity concentration arriving at Hoover Dam is from natural sources. Natural sources include contributions from saline springs, groundwater discharge into the river system (excluding irrigation return flows), erosion, and dissolution of sediments, and the concentrating effects of evaporation and transpiration. As identified by EPA, about 53 percent results from human activity. Irrigated agriculture accounts for 37 percent, reservoir evaporation amounts to 12 percent, out-of-basin export 3 percent, and one percent is attributed to in-basin municipal and industrial uses.

Salinity Control on the Colorado River

Sustained attention to water quality problems in the River dates back to 1960 when the Conference in the "Matter of the Pollution of the Interstate Waters of the Colorado River and Its Tributaries" was formed under the provisions of the Federal Water Pollution

Control Act, as amended, PL 84-660. Representatives of each of the Colorado Basin States participated in the Conference sessions. Six sessions of the Conference were held from 1960 through 1967.

The long-range salinity problem was identified early in the deliberations, but the paucity of data cast doubt upon the ability to deal effectively with it until more data were collected and evaluated. The seven states advocated and supported efforts to improve the database. During the series of meetings of the Conferees held in 1966 and 1967, a document (that) was formulated known as "Guidelines for Formulating Water Quality Standards for the Interstate Waters of the Colorado System." These guidelines were adopted in January 1967. The guidelines said in part:

> "*In order to develop practicable and reasonable quality standards for interstate waters in the Colorado River System, full consideration must be given to the numerous factors and variables connected with the control, development, utilization, conservation, and protection of the System's water resources. It is evident that future development and utilization of the System's water resources for expansion of irrigated agriculture, increases in population, and industrial growth will be accompanied by progressive increases in consumptive losses of water and attendant increases in concentration of dissolved solids."*
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> *"The states served by the Colorado River System recognize that answers to important questions regarding total dissolved solids, chlorides, sulfates and sodium are lacking or are based on factors that are not yet well-defined. In respect of this recognition the states agree that pending the development of acceptable answers to enable the setting of criteria for total dissolved solids, chlorides, sulfates and sodium for the Colorado River system, such criteria should be stated in qualitative terms. At the same time it is agreed that all identifiable sources of water pollution will be managed and controlled to the maximum degree practicable with available technology in order to provide water quality suitable for present and potential future uses of the System's interstate waters."*

In 1968, the Secretary of Interior, in testimony before Congress, stated that the Department of the Interior (Interior) would pursue an active program to lay a foundation setting numerical standards that will equitable, workable, and enforceable.

The Colorado River Board of California in 1970 released its report, which presented an appraisal of salinity sources; probable future increases in salinity, impacts of such increases on California users.

The EPA, in December 1971, released the results of its eight-year study of Colorado River salinity. The report recommended the adoption and enforcement of salinity criteria to hold the maximum mean monthly concentration of total dissolved solids at Imperial Dam at 1,000 mg/l—approximately the maximum mean monthly concentration then of record.

The 1971 EPA report was the major subject of the Seventh Session of the Conference in the "Matter of Pollution of the Interstate Waters of the Colorado River". At the February 17, 1972 Reconvened Seventh Session, the State Conferees unanimously adopted a resolution regarding Colorado River salinity standards. The significant part of that resolution states:

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

Enactment of Federal Water Pollution Control Act Amendment (PL 92-500) in 1972 introduced a new factor into the salinity problem. The legislation was interpreted by EPA as requiring that numerical criteria be set for salinity on the Colorado River. In the fall of 1973, EPA submitted to the Colorado River Basin States proposed regulations for water quality standards for salinity and procedures for salinity control in the Colorado River Basin, including the establishment of an interstate organization to develop a salinity control plan.

In response to EPA's proposed regulations, representatives of water quality and water resource interests from the seven Basin states met on November 8 and 9, 1973 to consider EPA's submittals and to establish a mechanism for interstate cooperation. During the meeting the representatives formed the "Colorado River Basin Salinity Control Forum," and adopted the "Seven Colorado River Basin States Accord" which expressed the consensus of the States with respect to the proposed EPA regulations.

The Forum is comprised of two to three representatives from each state, appointed by the Governor, with representation from both water resources and water quality interests. The Forum operates by consensus with each state having only one vote in developing the consensus.

On November 26, 1973 in a letter from Lynn M. Thatcher, chairman of the newly created Forum to Paul DeFalco, Jr., Director, Region IX, the Environmental Protection Agency, Mr. Thatcher advised of the creation of the Forum and submitted the statement "Seven Colorado River Basin States Accord." The key elements of the statement were:

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

"(b) The final statement on proposed water quality standards and plan of implementation for salinity control should be consistent for all seven States of the Colorado River Basin; and

"(c) Opportunity should be provided for further direct discussion between representatives of the Environmental Protection Agency and the Forum before the proposed regulations are published in the Federal Register."

Water Quality Standards for Salinity

In response to the EPA draft regulations, the Forum released its proposed salinity standards in June 1975. Following public meetings and receipt of comments, the Forum adopted the numeric criteria and plan of implementation and recommended its adoption to each of the Basin states. The numeric criteria and plan of implementation were set forth in the document "Proposed Water Quality Standards for Salinity Including Numeric Criteria and Plan of Implementation for Salinity Control." Eventually, each state adopted the Forum recommended standards as its state standards for the Colorado River. Subsequently, EPA approved the standards.

Federal regulations, Section 303 of the Clean Water Act, require that the standards be reviewed at least once during each three-year period. The 1999 Review, the eighth triennial review, has been completed and adopted by the Forum. Each review has been documented in a report. This Review is consistent with the EPA approved 1975 standards and deals only with that portion of the Colorado River Basin above Imperial Dam.

The numeric criteria were established at three lower main stem locations at the points where the Lower Basin states divert Colorado River water. The numeric criteria correspond to the flow-weighted average annual concentrations in the lower main stem of the Colorado River during the calendar year 1972. The numeric criteria are:

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

Below Imperial Dam, the river's salinity is to be controlled by agreement with Mexico on salinity as set forth in Minute 242 of the International Boundary and Water Commission. The agreement calls for measures to be taken to assure that the waters delivered to Mexico upstream of Morelos Dam will have a salinity of no more than 115 mg/l +/- 30

mg/l greater than the average annual salinity of Colorado River arriving at Imperial Dam. The implementation plan for compliance with Minute 242 is a federal responsibility and separates from the Forum's basin-wide implementation program.

Implementation Plan for Salinity Control

The implementation plan is designed to maintain the salinity of the River at or below the numeric criteria of the three lower main stem stations while the Basin states continue to develop their compact apportioned waters. This is accomplished mainly by reducing the salt contributions from existing natural and existing human caused sources and minimizing future increases in salt loading by human activity.

The Federal agencies have a significant role in implementing the salinity control program. Reclamation is implementing a number of specifics units to reduce salt loading to the River system. The units authorized for construction by Congress are Grand Valley, Lower Gunnison, Dolores, Paradox Valley, and Las Vegas Wash in Colorado and Nevada.

The 1974 Salinity Control Act legislation was a unit-specific approach to control with unit authorization and funding requiring congressional approval. This constraint limited the effectiveness of the implementation plan, causing delays in completion and the ability to select the most cost – effective units from an array of potential measures.

The Colorado River Basin Salinity Control Act was amended in 1984 by P.L. 98-569 to authorize two additional units for construction by Reclamation. The amendments directed the Secretary of the Interior and the Secretary of Agriculture to give preference to the salinity control units with the least cost per unit of salinity reduction. The Act was also amended to establish a voluntary on-farm salinity control program to be implemented by the Department of Agriculture and provided for voluntary replacement of incidental fish and wildlife values foregone on account of the on-farm measures. Many cost-effective salt-load reducing activities were accomplished in the decade following that authorization. P.L. 98-569 also directed the Bureau of Land Management (BLM) to implement salinity controls.

The Department of Agriculture's basin-wide on-farm voluntary cost-share program was authorized in the 1984 Amendments to the Salinity Control Act. Currently, control measures are being implemented to reduce salt loading from agricultural activities in Grand Valley, Lower Gunnison and McElmo Creek in Colorado; Uinta Basin in Utah, and Big Sandy River in Wyoming

The Bureau of Land Management's program provides for watershed improvement and rangeland management for watershed improvement in Colorado, Utah, and Wyoming.

The U.S. Geological Survey, U.S. Fish and Wildlife Service, and the Environmental Protection Agency all have an active role in salinity control activities.

Reclamation and the Forum, in 1994, concluded that the existing Act, as amended, with its unit-specific approach and authorization ceiling, was limiting salinity control opportunities. In 1995, the Act was amended by P.L. 104-20 – Amendments to the Colorado River Basin Salinity Control Act to authorize an entirely new way of implementing salinity control. Reclamation's new basin-wide Salinity Control Program opens the program to competition through a public process and has greatly reduced the cost of salinity control. An additional $75 Million of expenditures by Reclamation were authorized by P.L. 104-20. In 2000, P.L. 106-459, an amendment to the Colorado River Basin Salinity Control Act both increased the authorization ceiling for the Basin wide Salinity Control Program from $75 million to $175 million and authorized additional measures to carry out the control of salinity upstream of Imperial Dam in a cost-effective manner.

The 1995 amendments resolved the problem by authorizing Reclamation to implement a Basin-wide approach with an additional $75 million for expenditures. This change permits Reclamation to select the most effective means of control.

The Federal Agriculture Improvement and Reform (FAIRA) of 1996 – P.L 104-127 – further amended the U.S. Department of Agriculture's (USDA) role in salinity control by creating a new conservation program known as the Environmental Quality Incentives Program (EQIP) which combined four conservation programs, including USDA's Colorado River Basin salinity control program. FAIRA provided authority for funding the nationwide EQIP through the year 2002. USDA has created rules and regulations concerning how EQIP funds are to be allocated. The past authority for the states to cost-share from the Basin funds was retained in the new EQIP program with linkage to Reclamation's authority to distribute Basin funds for cost sharing. The Forum's experience has been that the enacted rules and regulations for EQIP do not consider the significant benefits in downstream states, thus creating a situation which disadvantages salinity control efforts when compared to other local initiatives. The past authority for the states to cost-share from the Basin funds was retained in the new EQIP with linkage to Reclamation's authority to distribute Basin funds for cost sharing.

The Farm Security and Rural Investment Act (FSRIA) of 2002 (P.L. 107-171) reauthorized EQIP from 2002 through 2007 at significantly increased funding levels. If the percentage of EQIP funds dedicated to the Colorado River Salinity Control Programs continues at the previous rate, more than $10 million would available in 2002 and would rise to a high of $33 million in 2007, the final year of FSRIA. Final rules have not been published and the full input of FSRIA on salinity control have not been analyzed.

The Basin states' role in the program involves the control of total dissolved solids through the National Pollutant Discharge Elimination System Permit (NPDES) program and non-point source water quality management plans as well as implementation of the Forum's recommended and adopted polices. The policies include:

1. "Policy for Implementation of Colorado River Salinity Standards Through the NPDES Permit Programs";

2. "Policy for Use of Brackish and/or Saline Waters for Industrial Purpose";

3. "Policy for implementation of the Colorado River Salinity Standards Through the NPDES Permit Program for Intercepted Ground Water'; and

4. "Policy for Implementation of the Colorado River Salinity Standards Through the NPDES Permit Program for Fish Hatcheries."

Mexican Salinity Issues

The salinity of waters delivered to Mexico increased markedly in the winter of 1961-62, increasing from less than 1,000 mg/l in prior years to 2,600 mg/l. Mexico protested the increase. In 1962, the Presidents of the United States and Mexico agreed to find a mutually satisfactory solution to this problem.

The increase in salinity was attributed to two major factors. The Wellton-Mohawk Project began receiving irrigation water from the Colorado River in 1952. By 1960, a drainage system was implemented returning about 300 cubic feet per second (cfs) (217,000 AF/yr) of highly saline drainage water to the Colorado River above the Mexican diversion point, Morelos Dam. This, combined with the completion of Glen Canyon Dam and the filling of Lake Powell, greatly reduced flows at the international boundary.

Temporary measures were implemented through a number of Minutes to the 1944 Mexican Water Treaty. In 1965, the U.S. with the agreement of the seven Basin state governors executed Minute 218 of the International Boundary and Water Commission. Under this agreement the U.S. constructed and extension to bypass Wellton-Mohawk drainage beyond Morelos Dam and delivered about 50,000 AF/yr of additional Colorado River water to Mexico to substitute for bypassed drainage water.

In 1972, President Nixon and Mexico' President Echeverra met to discuss matters of mutual concern. High on the list was the salinity of the water being delivered to Mexico. They agreed to find a "permanent, definitive and just" solution to the salinity problem. As part of the agreement, Minute 248 replaced Minute 218. The new Minute increased the amount of Colorado River water that would be substituted for Wellton-Mohawk drainage water from 50,000 AF/yr to 118,000 AF/yr. The remaining drainage was also bypassed around Morelos Dam at Mexico's request but was deducted from the required 1.5 million acre-feet of annual deliveries to Mexico.

A presidential representative, former Attorney General Herbert Brownell, worked closely with a federal task force and the Committee of Fourteen, which is the seven-state advisory body to the U.S. Department of State on the Mexican Water Treaty. An agreement was reached and approved by the two Presidents in August 1973. The agreement was formalized as Minute 242. Minute 242 terminated Minute 241.

The key provision of Minute 242 was a commitment by the United States to adopt measures to ensure that the water delivered to Mexico upstream of Morelos Dam would have an average annual salinity of not more than 115 mg/l plus or minus 30 mg/l over the average annual salinity. The guarantee on the salinity of deliveries was to become effective upon authorization by Congress of funds required to construct the necessary works.

While Minute 242 was considered a permanent solution, it was understood by Mexico and recognized by the U.S. that control of salinity upstream of Imperial Dam was critical to the resolution of the salinity problems with Mexico. Herbert Brownell stated "…that unless the U.S. does control this threatened and almost certain increase in salinity above Imperial Dam, the water we deliver to Mexico may become unacceptable, and we shall in the future, have a new salinity problem with that country." Similar expressions of concern over future salinity in the River were expressed by Mexico's Foreign Secretary Rabasa.

Colorado River Basin Salinity Control Act

The Colorado River Basin Salinity Control Act, P.L. 93-320, contains two titles, Title I – Programs Downstream from Imperial Dam and Title II – Measures Upstream from Imperial Dam.

Title I authorizes measures which include:

1. Construction of a desalting complex near Yuma Arizona to reduce the salinity of Wellton-Mohawk drainage water;
2. Construction of a lined bypass facility to the Gulf of California to carry brine reject water from the desalting plant;
3. Improvement of irrigation efficiency in Wellton-Mohawk Irrigation and Drainage District to reduce the amount of drainage water to be desalted;
4. Implementation of protective groundwater pumping in a five-mile wide strip along the Arizona – Sonora border; and
5. Replacement of the first 49 unlined miles of the Coachella Canal with a lined reach to reduce water lost through seepage. The recovered seepage loss can be used by federal government to reduce storage releases until the first year that the Secretary of the Interior delivers an amount less than requested by the California agencies under contract pursuant to the Boulder Canyon Project Act. At that time, California will benefit from the salvaged Coachella Canal water in the less water will be lost to seepage than would have otherwise been the case if the canal were not lined.

The Yuma desalting complex facility has been completed with an ultimate capacity of about 73 million gallons per day of product water of 300 mg/l. The desalted water will be blended with raw drainage water to provide 73,000 AF/yr, which will be returned to the Colorado River upstream of Morelos Dam. Only about one-third of the reverse osmosis membranes are install and the plant is not operating. The River system has, at

this time, adequate water to meet the Basin's demands and bypass the Wellton-Mohawk drainage water to the Santa Clara Slough. Costly operation of desalting can be avoided under these conditions. It is understood that Reclamation is currently negotiating with non-Federal interests to operate the plant at one-third capacity in return for rights to the desalted water for an interim period until the water is needed for meeting Minute 242.

The lined bypass drain from Morelos Dam to Santa Clara Slough in Mexico has been completed. It currently is carrying irrigation return flow from Wellton-Mohawk. At such time that the desalting plant becomes operational, reject brines will be bypassed to Santa Clara Slough.

The goal of the agricultural improvements in the Wellton-Mohawk Irrigation and Drainage District is to reduce the amount of drainage water to be desalted. In order to achieve the goal, 10,000 acres of irrigable lands were fallowed. On-farm irrigation efficiencies have been improved for a time, on-farm canals have been lined, lands have been leveled and more efficient irrigation systems have been installed. The ultimate goal of the overall program is to reduce irrigation drainage pumping to about 110,000 AF/yr.

The cost of the work required by Title I is to be borne by the federal government.

Title II provided for:

1. The Secretary of the Interior (Secretary) to implement the salinity control policy adopted in 1972 for the Colorado River by the seven Basin states in the "Conclusions and Recommendations" published in the Proceedings of the Reconvened Seventh Session of the Conference in the "Matter of Pollution of the Interstate Waters of the Colorado River and Its Tributaries", 1972;
2. The Secretary to expedite the planning and implementation of the program described in Reclamation's report "Colorado River Water Quality Improvement Program", February 1972.
3. The Secretary to expedite completion of planning reports on 12 irrigation, point, and diffuse salt sources identified in Reclamation's 1972 report;
4. Creation of the Colorado River Basin Salinity Control Advisory Council consisting of gubernatorial-appointed state representatives. (The members of the Advisory Council are generally the same individuals who are members of the Forum.)
5. Seventy-five percent of the total cost of construction, operation, maintenance, and replacement to be a federal cost and non-reimbursable. Twenty-five percent of the total costs are allocated between the Upper Colorado River Basin Fund and Lower Colorado River Basin Development Fund. Of the 25 percent reimbursement, a maximum of 15 percent is from the Upper Basin Fund with the remainder, currently 85 percent repaid from the Lower Basin Fund. Repayment of construction, operation and maintenance is over 50 years without interest. (The allocation of 75 percent of the costs to the federal government is because a major portion of the lands within the Basin from

which the dissolved salt originates is in federal ownership and/or from federal projects.)

SALT RIVER

The Salt River drains an area of approximately 5,980 miles (5%of the state's land area) and is the largest tributary of the Gila River. The headwaters of the Salt River are the White and Black Rivers which originate at elevations near 11,400 feet above mean sea level in the White Mountains. From the confluence of the White and Black Rivers, the Salt River roughly follows a 140-mile course southwesterly to its confluence with the Gila River at an elevation of about 900 feet above mean sea level.

The Salt River is perennial from its headwaters to Granite Reef Diversion Dam near Mesa, Arizona. The Black and White Rivers originate on the Fort Apache Indian Reservation in the White Mountains and together drain a total of nearly 1,900 square miles.

Numerous streams that start as springs and seeps along the Mogollon Rim and in the White Mountains feed the tributaries of the Salt River. The perennial flows in these areas are primarily a result of geologic barriers discharging groundwater to streams. Volcanic rocks are exposed along the east-central portion of the state in the Central highlands. Water is forced through this volcanic material through joints and fractures and discharges as springs where these fractures intersect the ground surface.

Water Quality

Surface runoff from the Upper Salt River watershed and its headwaters are of relatively good quality and free of dissolved solids. However, significant changes occur in the water quality by the time the Salt River enters Roosevelt Lake. A twenty-mile stretch of springs begins approximately twenty-five miles above the head of Roosevelt Lake, and are responsible for the degradation of water quality. These springs discharge waters which have high concentrations of dissolved solids, particularly sodium and chloride.

Springs occurring in and around the confluence of the White and Black Rivers, the Salt River, and the lower Carrizo Creek are known to discharge waters which have high concentrations of dissolved solids ranging from 1,600 mg/l to 17,600 mg/l. Water containing greater than 10,000 mg/l of dissolved solids is considered very saline, hence the origin of the Salt River's name. Sodium and chloride are the primary components of the dissolved solids. At the Salt Banks on the Salt River the sodium content ranges from 10,000 mg/l to 13,500 mg/l and the chloride content ranges from 15,900 mg/l to 20,800 mg/l resulting in the flow being very similar to that of a solution of common table salt. The springs emerge through Precambrian quartzite, however, the source of the saline water is not readily apparent.

Although the sodium and chloride exceed all other constituents, the Salt Banks and other saline springs along the Salt River have high bicarbonate levels which usually exceed the sulfate levels. Concentrations of bicarbonates and sulfates range from 90 to 600 mg/l and 3 to 590 mg/l respectively. Calcium and magnesium also occur in large amounts. Hardness as calcium and magnesium range from 64 to 1,800 mg/l with most sample3s in the 400 mg/l range which classifies the water as very hard. Boron concentrations are also relatively high where it occurs. High concentrations of boron may be indicative of evaporite deposits and geothermal activity. Large concentrations of boron in irrigation water is harmful to some plants.

By the time the Salt River reaches Roosevelt Lake, mixing of better quality water from surface runoff and tributaries serves to improve the river's quality. Also, good quality water from the Tonto Creek enters the lake. In the lower Tonto Creek basin dissolved solids range 255 to275 mg/l, hardness as calcium carbonate range from 157 to 185 mg/l with the main constituents being calcium and bicarbonate.

Pinal Creek, Miami Wash and Bloody Tanks Wash are reported to have total dissolved solids concentrations over 3,000 mg/l. These high levels of TDS are attributed to the mining operations in the area.

VERDE RIVER

The Verde River drains an area of approximately 6,188 square miles (6% of the state's land area) and traverses a distance of about 140 miles from Sullivan Lake Dam near Paulden, to its confluence with the Salt River. The river drains eastward from Sullivan Lake Dam to Perkinsville, then southeastward to its confluence with Fossil Creek where it continues southward until it joins with the Salt River.

The Verde River is intermittent from Sullivan Lake Dam to the Granite Creek confluence, a distance of about 3 miles; perennial flow is maintained from this confluence to where it joins the Salt River. The major perennial tributaries drain the area north and east of the Verde River and flow in southwesterly direction toward the Verde River. Groundwater discharge maintains perennial flow in these tributaries and in the Verde River.

Surface water in the Verde Valley is used for irrigation purposes. The water quality generally is well suited for this use. During low flows, the dissolved solids concentrations generally increase in the downstream direction because of the increased levels in groundwater from the Verde Formation. This is especially evident in the southern part of the Verde Valley. High sodium levels occur in the Verde River downstream from Camp Verde. During medium and high flows, the dissolved solids concentration is diluted by snowmelt or surface runoff that have a lower dissolved solids concentration.

GILA RIVER

The Gila River is divided into the upper, middle and lower watersheds. The upper Gila River watershed is located in southwestern New Mexico and in southeastern Arizona above Coolidge Dam at San Carlos Reservoir. The watershed drains approximately 12,890 square miles. The river originates in the Mogollon Mountains in western New Mexico. Flows in the upper Gila River are intermittent but does maintain a 35 mile perennial stretch beginning about 20 miles into Arizona.

Agriculture is the major use of surface water in the upper watershed. Irrigation water is obtained from the Gila River at several diversions and from wells pumping groundwater. Diversions from the river above Coolidge Dam are regulated by the Gila Decree since 1936.

The middle Gila River watershed encompasses the area from below Coolidge Dam to Gillespie Dam southwest of Phoenix. The San Pedro River drainage encompasses the vast majority of this watershed. The middle Gila River watershed is approximately 5,425 square miles and of that the San Pedro drains approximately 4,485 square miles. Flow in the Gila River between Coolidge dam and Ashurst-Hayden Dam can be attributed to releases from the San Carlos Reservoir and natural flow in the river.

Irrigated agriculture, grazing and mining are the main water uses in the middle watershed. Water released from the San Carlos Reservoir is stored and regulated by the Gila Decree of 1936.

The water quality of the middle watershed is poor. The Arizona Department of Environmental Quality has reported exceedance of water quality standards for turbidity, metals, bacteria, total dissolved solids, and nutrients along the Gila River from San Carlos Reservoir to the Phoenix area. As an example the total dissolved solids in the Gila River at Kelvin had an annual average concentration of 929 mg/l (Earthinfo, Inc., 1991)

The lower Gila River watershed extends from Gillespie Dam to the confluence of the Colorado River a distance of approximately 150 miles. The lower Gila River is ephemeral and flows only in response to precipitation and releases from Coolidge Dam.

STATE PROGRAMS

A major element of the state programs is the ability of the Basin states to cost-share in the Reclamation and the USDA programs. This allows, for additional funds to be made available from the Basin states' fund through up-front cost sharing to move the salinity control effort ahead. At current federal funding levels, the Basin states contribute about $8 million each year. Basin states' funds are available to cost-share in a larger program if federal dollars were to be increased.

The states' portion of the plan of implementation also includes effluent limitations on industrial point source discharges with the objective of no-salt return whenever practicable, as well as a program which parallels USBR and USDA efforts and which is funded from the Basin states' funds.

In 1977, the Forum adopted it "Policy for Implementation of Colorado River Salinity Standards Through the National Pollution Discharge Elimination System (NPDES) Permit Program." This policy provides guidance for the regulation of municipal and industrial point source discharges of saline water. In 1980, the Forum adopted a policy to encourage the use of brackish and/or saline waters for industrial purposes where it is environmentally sound, and economically feasible. A third policy dealing with intercepted ground water was adopted by the Forum in 1982. In 1988, the Forum adopted a fourth policy which addresses the salinity of water discharges from fish hatcheries.

Important components of the plan of implementation for salinity control are the Basin states' activities associated with the control of total dissolved solids through the NPDES Permit program, and the water quality management plans. The Forum considers, from time to time, needed changes to its NPDES policies. The original policy allowed for a waiver to be granted by the permitting agency if the proposed discharge of water contained less than a ton of salt per day.

The NPDES Program is currently administered by the EPA in Arizona, however, the Arizona Department of Environmental Quality has submitted a program primacy package to EPA Region IX and anticipates receiving the program delegation on July 1, 2002. Until full program delegation, the permitting workload is shared between the two agencies, each drafting permits which are then issued by EPA. EPA is responsible for issuance of all permits on tribal lands, including the Navajo Nation, who like the State, assist EPA in drafting permits. The State and EPA follow Forum policy in the administration of the NPDES Program.

There are currently 56 NPDES permits in the Colorado River Basin portion of the state. Nineteen of the facilities are on tribal lands: 17 are municipal wastewater discharges or water treatment plants; 3 are major facilities. The two industrial discharges, Peabody Coal Company and Energy Fuels, are both on the Navajo Nation lands and are "major" facilities with numerous outfalls. There are 37 non-tribal facilities in the basin: 8 industrial (1 major); one national fish hatchery and 28 municipal systems, of which 5 are majors. Many of the facilities discharge to ephemeral drainages many miles from the river.

The Northern Arizona Council of Governments (NACOG) is the designated planning agency for the Colorado River and its tributaries in the northeast and north-central portions of the state. Along the lower main stem of the river, Mohave, La Paz, and Yuma counties, have each been delegated the planning responsibilities for their areas. NACOG and the three counties along the main stem of the river are experiencing tremendous residential growth and have also been targeted for development. With the delegation,

each county must prepare and maintain a water quality management plan that addresses both point and non-point sources of pollution. The plans encourage local control and the voluntary use of Best Management Practices to reduce non-point source pollution. As the plans are updated, the State is encouraging inclusion of salinity control issues and the importance of working cooperatively with the Salinity Control Forum in implementing its policies.

To support both the Forum goals for a basin wide approach to salinity control and to ensure compliance with the numeric criteria set for the river through the NPDES Program, in the 2002 Review of its surface water quality standards, Arizona has adopted the Forum's plan of implementation contained in the "1999 Review of Water Quality Standards." Another key change in Arizona's water quality standards is the proposed repeal of the turbidity standard in favor of Suspended Sediment Concentration (SSC) standard coupled with a narrative bottom deposit standard. The State's research has shown that the existing turbidity standard is not a good predictor of impacts to aquatic life in southwest arid environments and has proposed to replace that standard with a numeric standard for SSC and the narrative standard which includes implementation procedures.

Over half of the waters on the State's 1998 303(d) list are listed for turbidity and coliform bacteria. Nearly all of the watersheds on non-tribal lands within the Colorado River Basin have been assessed as Category 1 watersheds under the Clean Water Action Plan, Unified Watershed Assessment (UWA). The goal of the State's Non-point Source Management Program, developed pursuant to Section 319 of the Clean Water Act, is to develop and implement a program which will reduce human-induced pollutants from non-point sources from entering surface and groundwater. Arizona's program has been in place for over a decade and steady progress is being made in identifying, controlling and abating Non-point Source (NPS) pollution from various activities. In support of the program, the State has entered into cooperative agreements with other state and federal land and resource management agencies to carry out portion of the NPS plan on their lands. The State will update its NPS Management Plan in FY 03.

Section 319 also provides federal grants for demonstration projects which are reviewed by ADEQ for consistency with the NPS Plan. The State has recently revamped the Water Quality Improvement Grant Program to facilitate the funding of section 319 eligible projects to improve water quality including projects such as well-plugging, salinity control impoundments, and rangeland management.

Arizona continues to support a basin wide approach to salinity control through its participation in the Colorado River Salinity Control Forum and the Advisory Council. In addition to the Water Quality Improvement Grant Program, the State has recently amended the State Revolving Fund rules to allow use of funds for NPS projects consistent with the State's NPS Plan, including salinity control projects.

ADEQ has taken a lead role in the Colorado River Source Water Assessment Project which involves the seven Basin states developing and implementing an interstate source

water plan to protect and sustain safe drinking water quality for the border states along the River. The primary goal of the project is to provide a common approach to delineate the watershed along the Colorado River and define the process for determining those land use activities that may impact the river. A secondary goal is to provide a forum for these states to meet, discuss issues and exchange information related to source water assessment and protection.

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