WATER QUALITY STANDARDS FOR SALINITY
INCLUDING
NUMERIC CRITERIA AND PLAN OF IMPLEMENTATION FOR SALINITY CONTROL

COLORADO RIVER SYSTEM

Prepared by
Colorado River Basin Salinity Control Forum

1978

NOTE – This Review is composed of two parts, namely:

1) Proposed 1978 Revision, *Water Quality Standards for Salinity Including Numeric Criteria and Plan of Implementation for Salinity Control, Colorado River System*, dated August 1978

2) Supplement Including Modifications to *Proposed 1978 Revision, Water Quality Standards for Salinity Including Numeric Criteria and Plan of Implementation for Salinity Control, August 1978, Colorado River System,* dated December 18, 1978

PROPOSED

1978 REVISION

WATER QUALITY STANDARDS FOR SALINITY

INCLUDING

NUMERIC CRITERIA AND PLAN OF IMPLEMENTATION FOR SALINITY CONTROL

COLORADO RIVER SYSTEM

Prepared by
Colorado River Basin Salinity Control Forum

August, 1978

MEMBERS OF COLORADO RIVER BASIN SALINITY CONTROL FORUM

ARIZONA: Dr. Ronald Miller, Chief, Bureau of Water Quality Control

Wesley E. Steiner, Executive Director, Arizona Water Commission

CALIFORNIA: W. Don Maughan, Vice Chairman, State Water Resources Control Board

Myron B. Holburt, Chief Engineer, Colorado River Board

COLORADO: Evan Dildine, Technical Secretary, Colorado Water Quality Control Commission, Colorado State Department of Health

Laren D. Morrill, Deputy Director, Colorado Water Conservation Board

Fitzhugh Scott III, Attorney-at-Law

NEVADA: Ernest G. Gregory, Chief, Division of Environmental Protection

Donald L. Paff, General Manager, Las Vegas Valley Water District

Roland D. Westergard, State Engineer, Division of Water Resources

NEW MEXICO: Stephen E. Reynolds, State Engineer

UTAH: Richard C. Hansen, Associate Deputy Director, Utah State Division of Health

Daniel F. Lawrence, Director, Division of Water Resources

WYOMING: George L. Christopulos, State Engineer

William F. Garland, Administrator, Water Quality Division, Department of Environmental Quality

CHAIRMAN OF FORUM:

Daniel F. Lawrence

SECRETARY OF FORUM:

Ival Goslin, Executive Director, Upper Colorado River Commission

SUMMARY

Section 303 of the Clean Water Act of 1977 requires that water quality standards be reviewed from time to time, but at least once during each three-year period. The seven-state Colorado River Basin Salinity Control Forum has reviewed the existing state-adopted and Environmental Protection Agency (EPA)-approved numeric salinity criteria and plan of implementation for salinity control for the Colorado River system. Changes in hydrologic conditions and water use within the Colorado River Basin have been evaluated and this report presents the recommended revisions which are to be submitted to each of the basin states for adoption.

The Forum finds no reason to recommend changes in the numeric salinity criteria at the three lower main stem stations. Those values are:

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

The revised plan of implementation comprises a number of federal and non-federal measures to maintain the adopted salinity criteria while the basin states continue to develop their compact-apportioned waters. The Forum recommends that the plan of implementation described in this report be carried out. The principal components of the plan are:

1. Prompt construction and operation of three salinity control units authorized by Section 202, Title II, of Public Law 93-320, namely the Paradox Valley, Grand Valley, and Las Vegas Wash Units. Additional planning on Las Vegas Wash will be required before construction will be undertaken.
2. Authorization and construction of the Meeker Dome Unit and 10 of the 12 units listed in Section 203 (a)(1), Title II of Public Law 93-320, or their equivalents after receipt of favorable planning reports.
3. The placing of effluent limitations on industrial and municipal discharges principally under the National Pollutant Discharge Elimination System (NPDES) permit program provided for in Section 402 of the Clean Water Act of 1977. NPDES permits will be consistent with the Forum-adopted and EPA-approved "Policy for Implementation of the Colorado River Salinity Standards Through the NPDES Permit Program".
4. The reformulation of previously authorized, but unconstructed, Federal water projects to reduce the salt loading effect of return flows. This process is essentially completed.
5. Inclusion of the 208 Water Quality Management Plans. The basin states are individually developing water quality management plans to

conform to the requirements of Section 208 of the Clean Water Act. When the plans have been adopted by the states and approved by EPA, those portions of the plans dealing with salinity control will become part of this implementation plan.

The plan also contemplates the use of saline water for industrial purposes whenever practicable, programs by water users to cope with higher salinity water, improvements in irrigation systems and management to reduce salt pickup, studies of means to minimize salinity in municipal discharges, and studies of future possible salinity control programs not now included in the plan.

Many natural and man-made factors affect the river's salinity. Consequently, the actual salinity will vary above and below the recommended numeric criteria.

The state-adopted and EPA-approved standards permit temporary increases above the 1972 levels if control measures are included in the plan. Should water development projects be completed before control measures are brought on line, temporary increases above the criteria could result and these increases will be deemed in conformance with the standards. The plan of implementation contains sufficient salinity control measures which when implemented will offset the increases in salinity caused by the projected 1990 level of development.

Periodic increases above the criteria as a result of unfavorable reservoir conditions or periods of below normal

annual river flows will also be in conformance with the standards provided that, with satisfactory reservoir conditions and when river flows return to normal, concentrations can be expected to be at or below the criteria level.

Salt routing studies for salinity projections were made for the 1975 Forum report using a model developed by the Bureau of Reclamation. This model was also used for projecting future salinities for this standards revision using current information as regards future development. After completion of the routing studies, a preliminary analysis indicated that projected salinity increases are over-estimated. A reanalysis of model inputs indicated that salt loads in relation to flow have significantly decreased since the mid-1960's following development of considerable Upper Basin storage. Incorporation of the new salt load versus flow relationships in the salt routing studies would reduce projected future salinities. It is estimated that to develop the new relationships, re-run the routing studies and allow time for complete review by all parties will be completed by the next standards revision.

A detailed study will be immediately initiated to develop flow versus salt load relationships that reflect present and anticipated future conditions and to prepare new salinity projections.

Salinities at each of the three lower main stem stations for which numeric criteria have been established

have been decreasing almost consistently since 1972. Currently, salinities at these stations are almost 60 mg/l below the numeric criteria. The current and projected rate of basin-wide water development is slower than estimated in the 1975 report. Although progress on the salinity control program has also been slower than anticipated, there is no reason to believe that the standards would be exceeded during the next three-year revision period. Because of the extremely long lead time required to conduct salinity studies, complete feasibility reports, authorize and complete construction, and achieve full impact at lower main stem stations, it is necessary to continue efforts to implement salinity control measures.

COLORADO RIVER BASIN

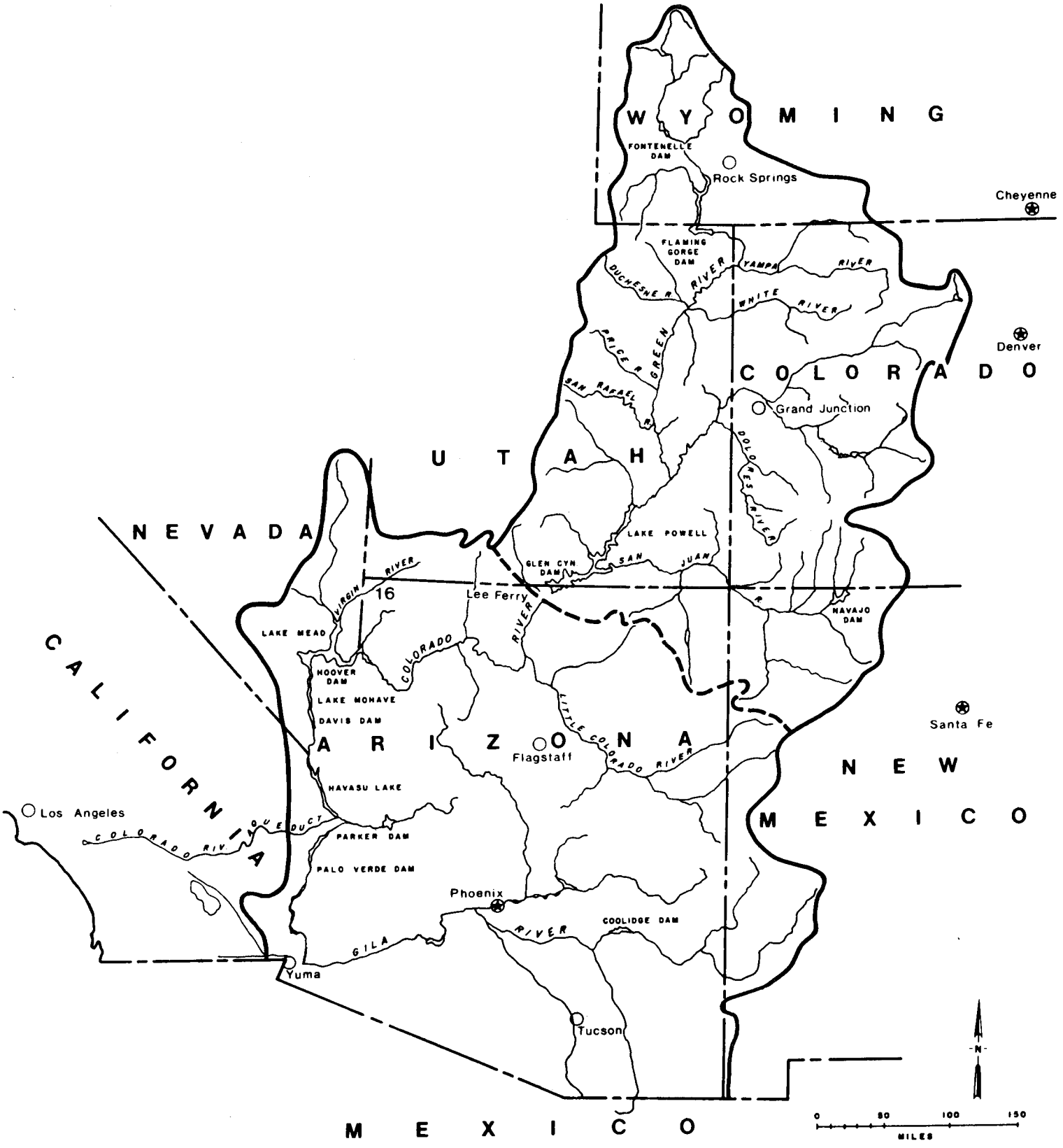


TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

TABLES

FIGURES

APPENDIXES

LIST OF ABBREVIATIONS USED IN REPORT

a.f.	acre-feet
ARS	Agricultural Research Service
BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
cfs	cubic feet per second
CRSP	Colorado River Storage Project
CRWQIP	Colorado River Water Quality Improvement Program
DPR	Definite Plan Report
DRI	Denver Research Institute
EPA	Environmental Protection Agency
IMS	Irrigation Management Services
maf/yr	million acre-feet per year
mg/l	milligrams per liter
NPDES	National Pollutant Discharge Elimination System
SCS	Soil Conservation Service
T/AF	Tons per acre-foot
TDS	Total Dissolved Solids
USBR	Bureau of Reclamation
USU	Utah State University
WSI	Water Systems Improvement

CHAPTER I

INTRODUCTION

This report is in response to Section 303(c) of the Clean Water Act of 1977 (P.L. 92-500 as amended by P.L. 95-217) referred to in this report as the Clean Water Act.

Section 303(c)(1) of the Clean Water Act requires that:

> The governor of a state or the state water pollution control agency of such state shall from time to time (but at least once each three-year period beginning with the date of enactment of the Federal Water Pollution Control Act Amendments of 1972) hold public hearings for the purpose of reviewing applicable water quality standards and, as appropriate, modifying and adopting standards. Results of such review shall be made available to the Administrator.

This report is written as a complete document and replaces the Colorado River Basin Salinity Control Forum's June 1975 report, "Water Quality Standards for Salinity Including Numeric Criteria and Plan of Implementation for Salinity Control, Colorado River System", and the August 26, 1975 supplement thereto (referred to as the 1975 Forum report). For background information regarding historical actions relative to salinity standards, refer to the 1975 Forum report.

The 1975 Forum report was prepared by the Colorado River Basin Salinity Control Forum composed of water resource and water quality representatives from each of the seven Colorado River states of Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming for the purpose of providing the states with the necessary information to meet the Environmental Protection Agency's regulation 40 CFR, Part 120, Water Quality Standards (Colorado River System; Salinity Control Policy and Standards Procedures and Section 303(c) of Public Law 92-500).

This report includes the modifications or revisions to the 1975 Forum report and August 26, 1975 supplement that have become necessary as a result of changing conditions and the availability of better information.

Nothing in this report shall be construed to alter, amend, repeal, construe, interpret, modify, or be in conflict with the provisions of the Boulder Canyon Project Act (45 Stat. 1057), the Boulder Canyon Project Adjustment Act (54 Stat. 774), the Colorado River Basin Project Act (82 Stat. 885), the Colorado River Compact, the Upper Colorado River Basin Compact, or the Treaty with the United Mexican States (Treaty Series 994).

This report is consistent with the EPA-approved 1975 Forum report and deals only with the portion of the Colorado River Basin above Imperial Dam. As used in this report, the lower main stem of the Colorado River System is defined as that portion of the main river from Hoover Dam to Imperial Dam.

Below Imperial Dam, the river's salinity will be controlled to meet the terms of the agreement with Mexico on salinity in Minute 242 of the International Boundary and Water Commission, entitled "Permanent and Definitive Solution to the International Problem of the Salinity of the Colorado River." This agreement states that measures will be taken to assure that the waters delivered to Mexico upstream from Morelos Dam will have an annual average salinity of no more than 115 ppm ($\pm$ 30 ppm) total dissolved

solids greater than the annual average salinity of Colorado River water arriving at Imperial Dam. Title I of P.L. 93-320 is the legislation which implements the provisions of Minute 242. Minute 242 and Title I constitute a federal numeric criterion and plan of implementation for the river below Imperial Dam.

CHAPTER II

ACTIONS SINCE 1975 RELATIVE TO THE ESTABLISHMENT OF SALINITY STANDARDS

The 1975 Forum report includes a detailed discussion of the legislation and events leading up to the establishment of salinity standards for the lower main stem of the Colorado River. The standards were adopted by all of the Basin states and subsequently approved by the Environmental Protection Agency by letter dated November 8, 1976, for Colorado, Utah, and Wyoming; November 19, 1976, for California; November 22, 1976, for Arizona and Nevada, and December 3, 1976, for New Mexico.

The plan of implementation, as set forth in the 1975 Forum report, includes effluent limitations for industrial discharges with the objective of no-salt return whenever practicable. In February 1977, the Forum adopted the "Policy for Implementation of Colorado River Salinity Standards through the NPDES Permit Program." The policy provides detailed guidance in the application of salinity standards developed pursuant to Section 303 of the Clean Water Act and through the NPDES permitting authority in the regulation of municipal and industrial sources. The complete policy is presented in Appendix A.

The states of California, Nevada, and Colorado, all of which have been granted permit issuing authority by EPA, have adopted the Forum policy as their guide in issuing permits. The Forum policy has not yet been adopted as regulation by the State of Wyoming, therefore, Wyoming has continued to use the general language (no-salt return wherever practicable) of the 1975

Forum report when issuing or reissuing industrial discharge permits. The Forum policy as presented in Appendix A will be considered for adoption as regulation by Wyoming at the same time as this 1978 revision of the Forum report.

The Environmental Protection Agency retains the permit issuing authority for the states of Arizona, New Mexico and Utah. In June 1977 EPA advised the Forum and the states that EPA Regions VI, VII, and IX will use the Forum policy as guidance in issuing and reissuing NPDES permits in the Colorado River Basin. See Appendix A for EPA letter of approval. The Enforcement Division, EPA Region VIII has approved industrial discharges that are inconsistent with EPA-approved policy. However, in the future, Region VIII intends to follow the Forum-adopted and EPA-approved policy of February 1977.

There have been no legislative or regulatory changes since 1975 that alter the need for or the procedure used to establish standards.

CHAPTER III
SALINITY OF THE RIVER

The Colorado River System drains 244,000 square miles of the western United States and a small portion of northern Mexico. Its waters serve some 2.25 million people within the Basin and through export provide full or supplemental water supply to another 12 million people. The regional economy is based on irrigated agriculture, mining, forestry, manufacturing, oil and gas production and tourism. About 2.5 million acres are irrigated within the Basin and hundreds of thousands of acres are irrigated by waters exported from the Basin. The Colorado River also serves about 1.5 million people and 425,000 irrigated acres in Mexico.

Salinity has long been recognized as one of the major problems of the river. The Colorado, like most western rivers, increases in salinity from its headwaters to its mouth. Increasing salinity is the result of both natural and man-made causes. Natural causes include salt contribution of saline springs and other ground waters, erosion and solution of sediments, and the concentrating effects of evaporation and transpiration. Man-caused increases in salinity result from the diversion, use, and out-of-basin exports of water. The largest man-induced increase in salinity is caused by the concentrating effect and salt loading associated with agriculture.

In addition to the comprehensive studies conducted by the Forum in 1975 and for this revision, evaluations of the salinity of the Colorado River has been made by the Bureau of Reclamation (USBR), Geological Survey (USGS), Environmental

Protection agency (EPA), and the Colorado River Board of California (CRBC).

Water quality and streamflow data are being obtained on a daily, weekly, monthly, or quarterly basis at various points on streams throughout the Basin by the U.S. Geological Survey in cooperation with the states and other federal agencies. Gaging stations in the Upper Basin that are of significance to this report and for which streamflow and water quality records are available are listed on Figure 1. This figure shows the availability of streamflow and quality data for key stations during the period 1941-1977 and the current frequency of sampling as classified by the U.S. Geological survey. Where the water quality information is not complete, the missing data have been estimated by correlation with data from other stations.

Salinity: 1972-1977

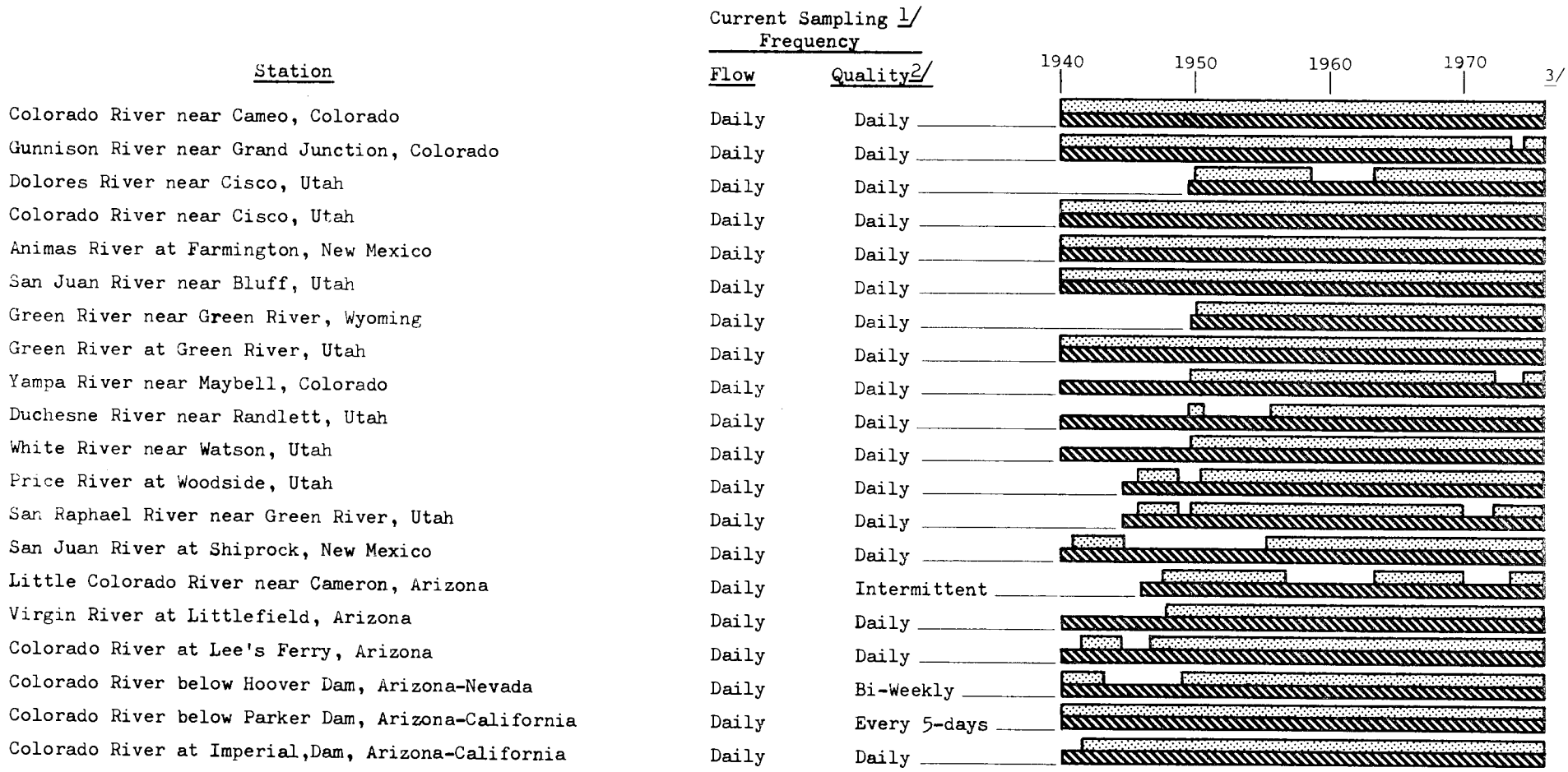
The flow-weighted annual average salinity at the stations for which numeric criteria have been set are shown in the following table:

	Flow Weighted Annual* Average Salinity (milligrams per liter)					
Station	1972 (Numeric Criteria)	1973	1974	1975	1976	1977**
Hoover Dam	723	706	686	686	675	667
Parker Dam	747	726	700	703	689	689
Imperial Dam	879	846	836	829	823	820

* Calendar Year
** Provisional, subject to change

FIGURE 1

COLORADO RIVER BASIN
Flow and Quality of Water Data
1941-77



1/ Sampling frequency as classified by the U.S. Geological Survey, 2/ Electrical conductivity measurements, Frequency of complete chemical analyses varies from station-to-station.

3/ Sampled quality data / Measured flow record

The above table shows a fairly consistent decrease in salinity for the six-year period 1972 through 1977.

Projections of Future Water Use

One of the significant factors affecting salinity is water use. The estimated use of Colorado River water by the Upper Basin states in 1976 was 3,140,000 acre-feet exclusive of main stem reservoir evaporation. A number of water development projects are either now under construction or have been completed and water use is building up to project capacities. Several other projects have been authorized for construction. In addition, studies are being made of numerous in-basin projects that would develop water for irrigated agriculture, coal and oil shale development, thermal-electric generation, and municipal and industrial purposes. Some of the projected future developments will provide for increased transmountain diversions to the eastern slopes of the Rocky Mountains in Colorado, to the Bonneville Basin in Utah, and to the Rio Grande Basin in New Mexico; there also may be new transbasin diversions in Wyoming.

Estimates of both 1976 water use and projected future use through the year 1990 for each of the seven states were furnished by the basin states. Since future water use is subject to many uncertainties, and will be dependent on many variables, three possible future water depletion levels were developed for use in salt routing studies. These were identified as low, moderate, and high. The three projected possible levels of depletion were based on anticipated demand and are independent of physical limitations on water supply.

Projected depletions in the Upper Basin in 1990, exclusive of main stem reservoir evaporation, range from a low of about 3,540,000 acre-feet to a high of 4,986,000 acre-feet. Not included in these figures is the annual main stem reservoir evaporation, estimated by the USBR to average about 520,000 acre-feet per year.

Projected consumptive use 1/ from the main stem in the Lower Basin in 1990 varies in a narrow range from 7,431,000 acre-feet to 7,488,000 acre-feet.

Table 1 presents a summary of the projected water use in the Colorado River Basin. Presented in Appendix B are data on 1976 base conditions and projected future uses listed by state and by specific categories of use. Also presented in the Appendix is a summary table comparing the estimated uses for this standards revision with those used in the 1975 Forum report.

Salt Routing Studies

Extensive salinity projections were made for the 1975 report by conducting salt routing studies using a computer model developed by the Bureau of Reclamation 2/. This model

---

1/ Consumptive use as defined by the U.S. Dupreme Court means diversions from the stream less such return flow thereto as is available for consumptive use in the United States or in satisfaction of the Mexican Treaty obligation.

2/ Detailed information on the model is presented in: "Application of a River Network Model to Water Quality Investigations for the Colorado River", Richard Ribbens and Robert F. Wilson, Bureau of Reclamation, U.S. Department of the Interior, Denver, Colorado (1973).

TABLE 1

SUMMARY OF ESTIMATED WATER USE

IN COLORADO RIVER BASIN[1]

(1,000 acre-feet)

	1976 Base Condition	Assumption as to Level of Use	1980	1985	1990
Upper Basin[2]	3,140	Low	3,134	3,337	3,541
		Moderate	3,473	3,762	4,095
		High	3,741	4,609	4,986
Lower Basin[3]	5,812	Low	5,857	5,935	7,431
		Moderate	6,102	6,777	7,448
		High	6,615	7,362	7,488
TOTAL	8,952	Low	8,991	9,272	10,972
		Moderate	9,575	10,539	11,543
		High	10,356	11,971	12,474

1/ Does not include deliveries to Mexico.

2/ Depletions at point of use. Does not include CRSP reservoir evaporation estimated by the USBR to average 520,000 acre-feet per year.

3/ Diversions from the main stem less returns. Does not include main stem reservoir evaporation and stream losses estimated by the Forum to average 1,400,000 acre-feet per year.

was also used for projecting future salinities for this standards revision using current information as regards future development. The salt routing studies were conducted to provide estimates of future flow-weighted salinity levels for each year of the 1977 through 1990 study period at selected points in the Basin under differing assumptions as to both the available water supply and future water uses. The studies were designed to provide estimates of salinity under conditions with and without salinity control projects.

To evaluate future possible salinity levels, four water supply conditions were employed - a virgin flow of 12, 13, 14, and 15 million acre-feet per year at Lee Ferry, Arizona[1/]. It is considered that within the time frame of the study this range of flows would most likely encompass the actual future flow. The 1896-1977 average annual virgin flow at Lee Ferry is 14.7 million acre-feet.

It should also be noted that to regulate the erratic flows of the Colorado River, a large-volume reservoir storage system has been constructed. It is currently at about 75 percent capacity. This reservoir system dampens the variation in both the annual flow and salinity in the lower main stem.

1/ The Colorado River Compact defines Lee Ferry as a point on the mainstream of the Colorado River one mile below the mouth of the Paria River.

Using the salt routing model, projections of future salinity levels in the lower main stem were made to determine the impact on salinity in the lower main stem for the full range of assumed water supply conditions and the three projected water use levels under each of the following conditions:

1. No salinity control projects would be undertaken but other salinity control measures would be fully implemented. These measures include no-salt return for industrial development within the basin, as set forth by the Forum-adopted and EPA-approved "Policy for Implementation of the Colorado River Salinity Standards Through the NPDES Permit Program", February 28, 1977, and reformulation of authorized federal water projects to minimize salt contribution;

2. The three authorized salinity control projects described in Chapter V would be constructed in combination with implementation of the other salinity control measures identified in item (1) above; and

3. All fourteen salinity control projects would be constructed in combination with implementation of the other salinity control measures identified in item (1) above.

The salinity control projects consist essentially of those projects described in Title II, P.L. 93-320, with some modifications as described in Chapter V. The initial year of operation of the salinity control projects was determined after considering the time required for planning, authorization, and construction. The individual projects and estimated year of initial operation are described in Chapters V and VI.

The policy set forth in the 1975 Forum report calls for maintenance of salinity in the lower main stem of the river at or below the flow-weighted average value found during 1972 while the Basin states continue to develop their compact-apportioned waters.

Future flow-weighted annual salinity concentrations depend not only upon man's activities, but upon natural phenomena, including periods of high and low annual precipitation, variations in distribution of precipitation over the Basin, variations in the time of year during which precipitation falls, variations in natural evapo-transpiration, etc. Also, within the major storage reservoirs, salts precipitate, dissolve, and are mixed with results largely beyond the control of man. Consequently, future adherence to the 1972 numeric criteria will be affected by factors beyond the control of man as subsequently explained in Chapters IV, V and VIII.

A primary factor influencing the results of the salt routing analyses is the amount of salt entering the modelled portion of the basin under 1976 conditions of development. The model operates by superimposing future changes in salt loading upon the estimated inflow of salt under 1976 conditions. Because the salt load under 1976 conditions is very large when compared with estimated future changes in salt loading resulting from future development, a small percentage error in estimating the 1976 salt load can have a significant impact on the results of the salt loading analyses.

In the model studies conducted for this standards revision, as well as those for the 1975 report, the salt loads under initial conditions of development for the four supply conditions used were estimated from flow versus salt load relationships adjusted to reflect changes in use such as increases in irrigated agriculture and out-of-basin exports. This method has been used by other investigators such as the USBR.

After completion of the model studies, an analysis of the results indicated that the rate of projected salinity increases is overestimated when compared with recent historical salinity trends. This prompted a re-analysis of model input data.

Time limitation precluded a thorough investigation. However, a preliminary investigation of flow versus salt load relationships for the period 1941 to 1977 indicated that a significant change in these relationships occurred after about 1965 for the river system above Lee Ferry and for the river reach Lee Ferry to Hoover Dam. Salt loads in relation to flow for the period after 1965 are significantly lower than for the period prior to 1965.

The salt loads under 1976 conditions used in the model were based on records spanning the entire period since 1941. In addition, it was assumed that the basic flow versus salt load relationships remained unchanged throughout the period and that the only adjustments that needed to be made to the

historical record were reductions in flow and increases in salt loading resulting from increased water use. For these reasons, the values used in the model, when compared with values obtained from the preliminary flow versus salt load relationships based on the period after 1965, appear to be overestimated by about 500 thousand to one million tons per year. An overestimate of 500 thousand tons per year in salt loading is equivalent to an increase in projected 1990 salinities at Imperial Dam of about 50 milligrams per liter.

Because of the significant overestimate in initial salt loading, the results of the salt routing studies are not shown in this report. The report, however, includes two examples of the salt routing studies presented in conjunction with historical salinities.

Historical flow-weighted annual salinities and projected salinities at Imperial Dam for the 14 maf water supply condition and low level of development are shown on Figure 2. The five-year moving mean of historical and projected salinities is shown on Figure 3. The moving mean dampens annual fluctuations and should be a better indication of salinity trends. These two figures have been included in order to compate historical and projected salinity trends. The projection for the low level of development and the 14 maf water supply condition is shown as it approximates the average recent historical rate of development and the average water supply for the period 1941 to 1976. In addition to Figures 2 and

3, Figure 4, showing historical salinities and projected salinities at Imperial Dam for the 14 maf water supply condition and moderate level of development, has been included to show the effect of a higher depletion level. The approximate effects of a 500 thousand ton per year reduction in initial salt load on 1990 salinities are shown on Figures 2 and 4.

Projected salinities shown on Figures 2, 3 and 4, have been carried beyond 1990 to the year 2000. In the salt routing studies, the routing period was extended beyond the 1977 through 1990 study period in order to demonstrate whether or not the salinity control measures incorporated into the plan of implementation are sufficient to offset the impact of projected 1990 levels of development. Due to the dampening effect of reservoir storage, the full impact on salinity of development and of salinity control actions occurring above Hoover Dam is not felt at lower basin main stem stations until several years after such actions are implemented. Because projected future depletions and salt load reductions by salinity control projects increase throughout the 1977-1990 study period, projected 1990 salinities do not reflect the full impact on salinity of future development and of the salinity control projects. In extending the salt routing period, both depletions and salt load reductions by salinity control projects were held constant at projected 1990 levels.

HISTORICAL AND PROJECTED
FLOW-WEIGHTED ANNUAL SALINITY AT IMPERIAL DAM

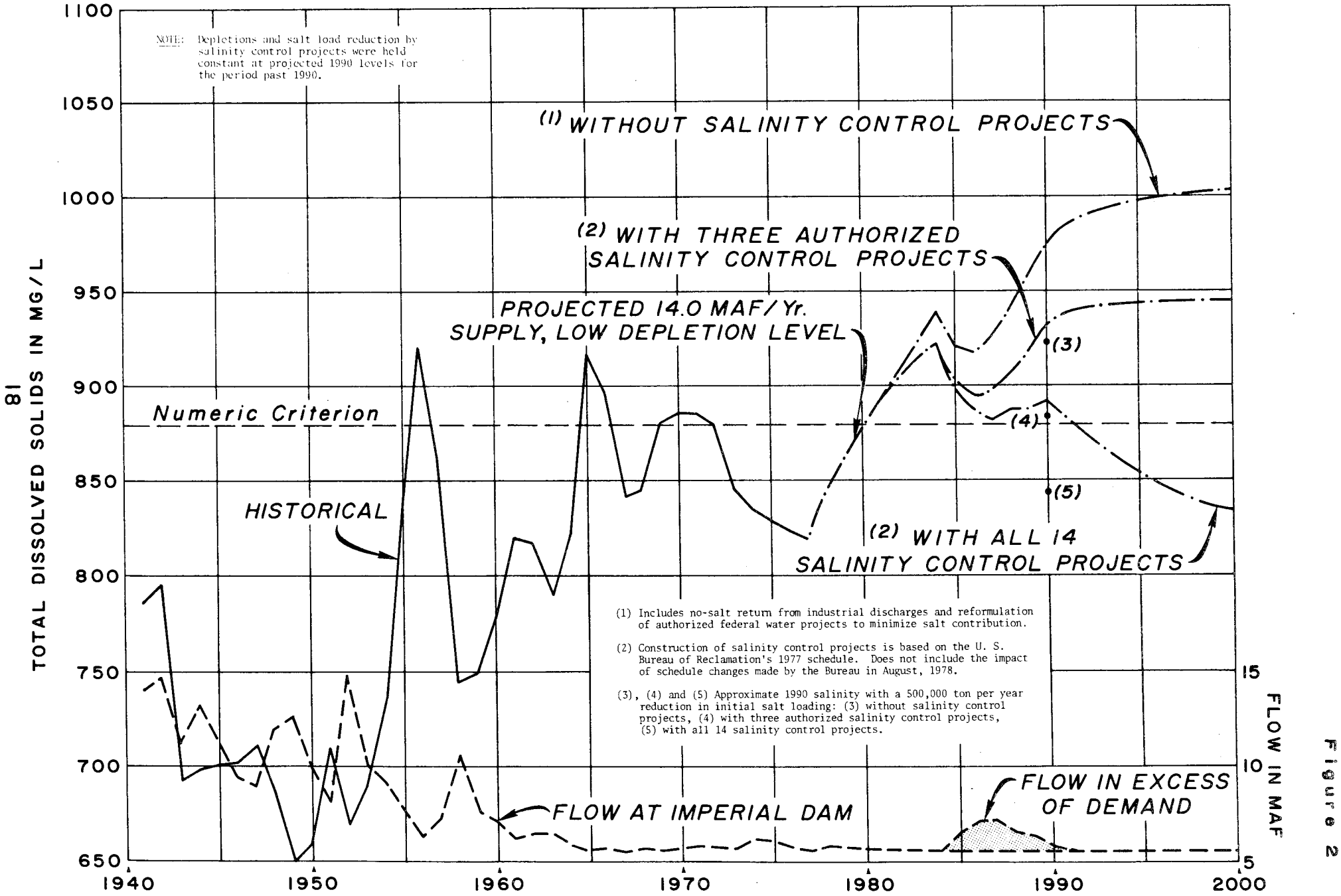


Figure 2

FIVE-YEAR MOVING MEAN OF HISTORICAL AND PROJECTED FLOW-WEIGHTED ANNUAL SALINITY AT IMPERIAL DAM

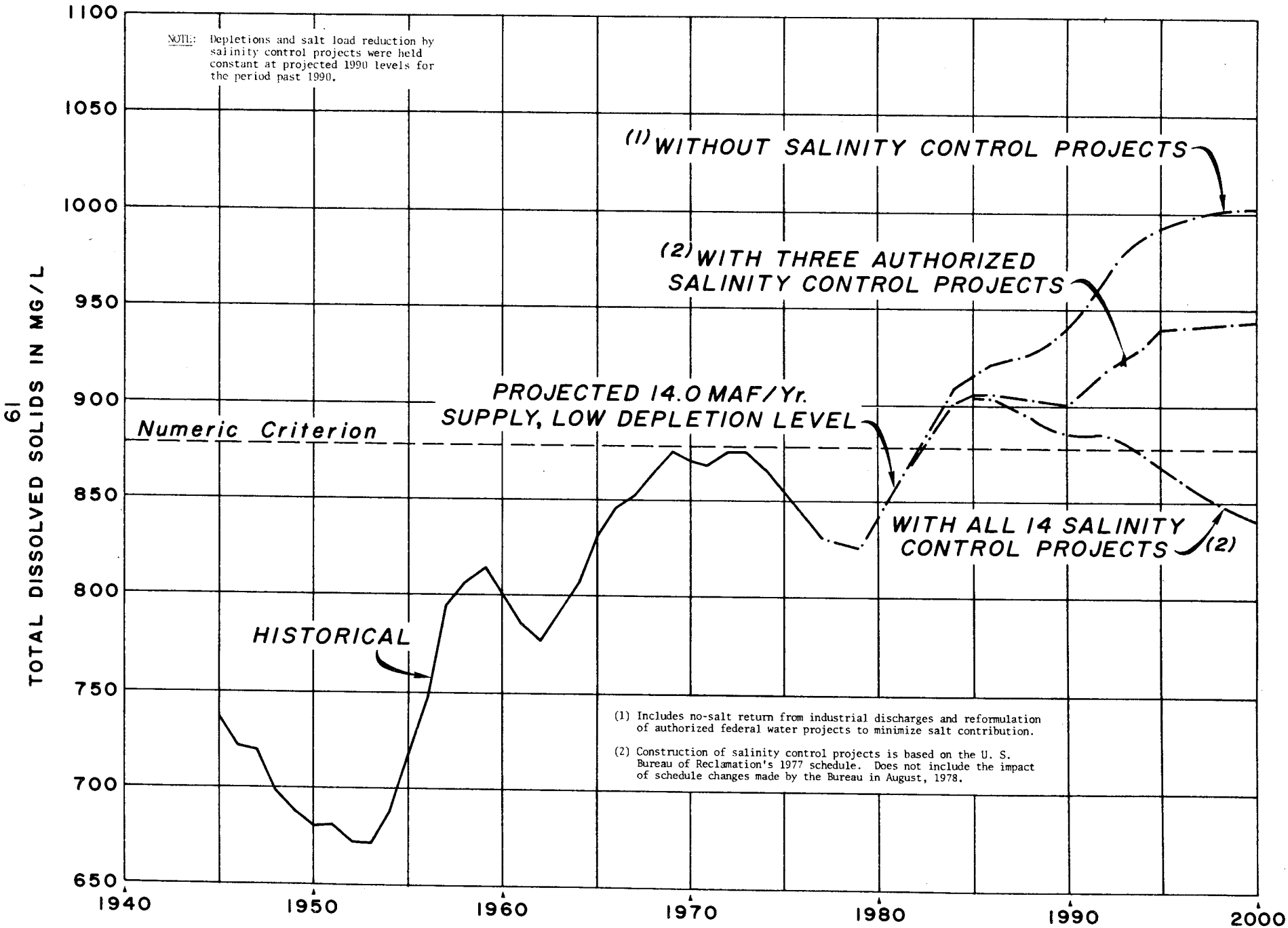


Figure 3

HISTORICAL AND PROJECTED FLOW-WEIGHTED ANNUAL SALINITY AT IMPERIAL DAM

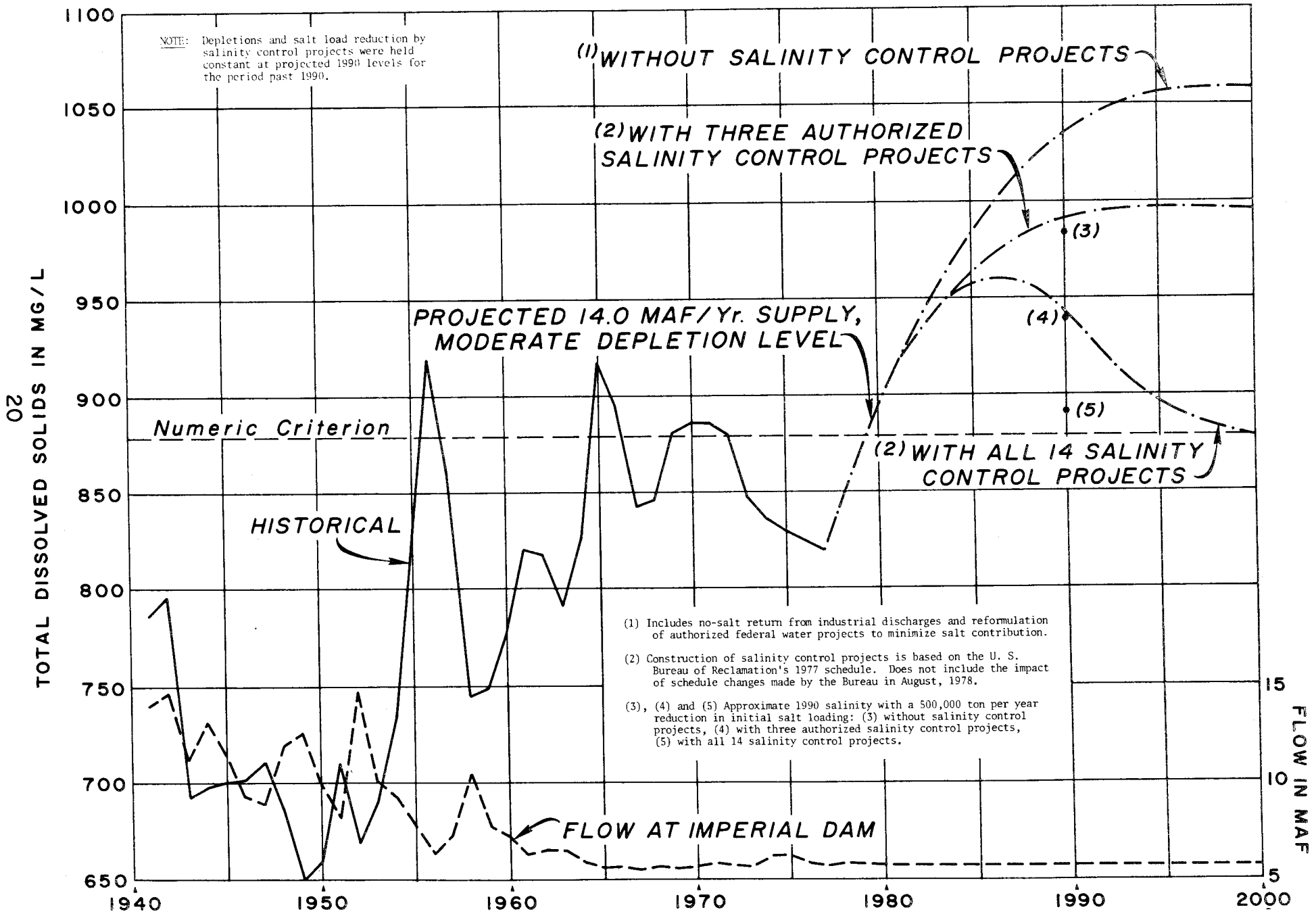


Figure 4

The trend of projected salinities shown on Figures 2 and 3 follows the general historical trend. This is because the projected salinities are based on flow versus salt load relationships which are strongly influenced by the period prior to 1965. If the projections were based on relationships reflecting the period after 1965, the rate of projected salinity increase would be considerably less. See points 3, 4 and 5 on Figures 2 and 4.

The apparent change in the flow versus salt load relationships could be due to various factors. It appears, however, that the major factor is construction of the Colorado River Storage Project reservoirs, including Lake Powell, the completion date of which approximately coincides with the change in relationships. There is evidence suggesting that construction of these reservoirs has reduced the salt load of the Colorado River System in the following ways:

1. The inundated areas of the reservoirs reduced the amount of overland flow and the accompanying salt loads. In addition, the inundated areas, particularly in Lake Powell, reduced the length of stream channels from which flowing water picked up salt.

2. The reservoirs caused significnat changes in stream regimen and made possible the control of the widely fluctuating flows of most of the streams and tributaries below the major reservoirs. This reduced areas that periodically

flooded during periods of high flows thus reducing the dissolution of salts and the erosion of saline sediments entering the river system.

3. Saline sediments containing undissolved particles of salt previously flowed through the river system and released their salt load as they moved downstream. Much of these sediments are now trapped by the various reservoirs before releasing all of their salt load, settle to the bottom, become covered by other sediments and retain at least part of the salt load that would have otherwise been released.

4. Precipitation of dissolved salts in the reservoirs, particularly in Lake Powell.

The results of the preliminary analysis of the flow versus salt load relationships used in the salt routing model indicate that the inflow of salts to the river system under initial conditions is overestimated. Therefore, a detailed study will be immediately initiated to develop flow versus salt load relationships that would more accurately reflect present and future conditions. After completion of this study, the salt routing analyses will be re-run using the new information.

The schedule for the proposed study and new salt routing analyses is as follows. Each activity of the schedule includes a period for review by federal agencies and approval by the Forum.

Activity	Man Months Required	Estimated Completion Date
Problem evaluation and selection of scope and method of study	2	March 1979
Data collection, analyses & evaluation	3	June 1979
Development of flow versus salt load relationships	6	Nov. 1979
Development of input for model re-analysis	3	March 1980
Conduct model runs	2	June 1980
Evaluation of results	2	Oct. 1980
Preparation of report	3	May 1981

Salinities at each of the stations with established salinity criteria have been decreasing almost consistently since 1972. As a result of this decrease, salinities at these stations are almost 60 milligrams per liter below the criteria. Thus, it is extremely unlikely that the criteria would be exceeded within the next three-year period. This will allow sufficient time for the completion of the proposed study and to conduct new salt routing studies.

CHAPTER IV

WATER QUALITY STANDARDS FOR ALINITY

The Forum developed and adopted water quality standards for salinity, including numeric criteria and a plan of implementation for salinity control in 1975 (1975 Forum Report). Each of the basin states adopted the 1975 Forum report as its standard for salinity. The state standards were subsequently approved by EPA.

In compliance with Section 303(c) of the Clean Water Act of 1977 the Forum has reviewed the numeric criteria for salinity and determined that the 1975 values are still appropriate for the lower main stem of the Colorado River. They are as follows:

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

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

Periodic increases above the criteria as a result of unfavorable reservoir conditions or periods of below norman annual river flows also will be in conformance with the standards, provided that, with satisfactory reservoir conditions and when

river flows return to normal, concentrations are expected to be at or below the criteria level.

Salinity Monitoring Points

The salinity control program includes a water quality monitoring and analyses program that will provide information on a basinwide basis for plan evaluation. This system is essential to establish a data base for future studies, support state and regional planning activities, and evaluate the effectiveness of salinity control measures. The monitoring points are not locations at which numeric criteria are now set or contemplated, except for those located below Hoover and Parker Dams, and at Imperial Dam.

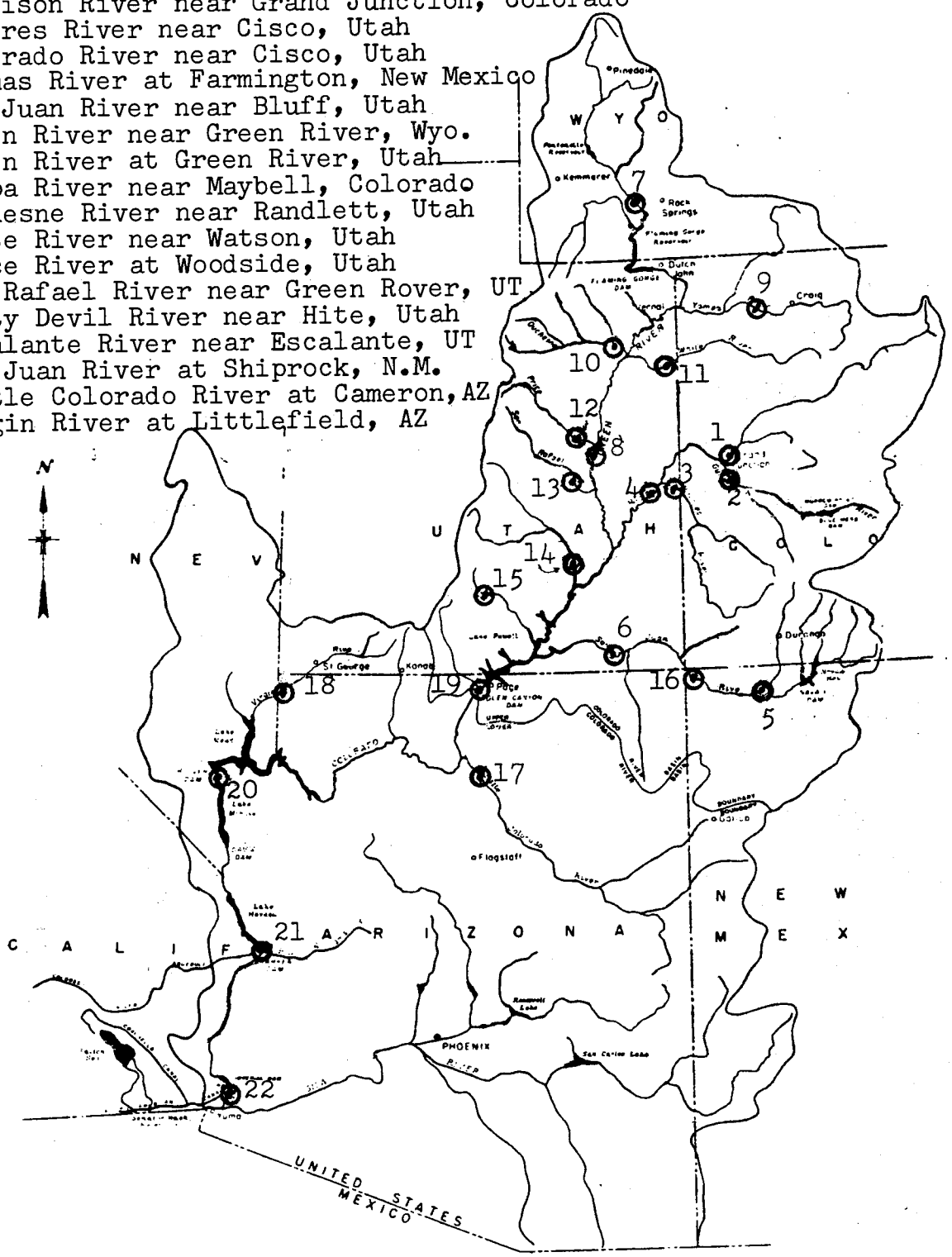
Salinity monitoring is being conducted by the Geological Survey and USBR at the stations listed and shown on Figure 5. Reliable equipment for continuous measurement has generally not become available, so measurements are made on a periodic basis.

In conformance with Section 106 of the Clean Water Act of 1977, each state has submitted to EPA a report on general water quality monitoring strategy. Status reports on implementation are submitted annually.

In addition to cooperative programs with the USGS, some states maintain individual networks of salinity monitoring stations. As an example, the Utah Bureau of Water Pollution Control monitors 28 sites in the Colorado River Basin. These sites are sampled bimonthly and samples are analyzed for chemical constituents, nutrients, 5-day biochemical oxygen demand, suspended solids, dissolved solids, and coliform. In addition to

FIGURE 5

1. Colorado River near Cameo, Colorado
2. Gunnison River near Grand Junction, Colorado
3. Dolores River near Cisco, Utah
4. Colorado River near Cisco, Utah
5. Animas River at Farmington, New Mexico
6. San Juan River near Bluff, Utah
7. Green River near Green River, Wyo.
8. Green River at Green River, Utah
9. Yampa River near Maybell, Colorado
10. Duchesne River near Randlett, Utah
11. White River near Watson, Utah
12. Price River at Woodside, Utah
13. San Rafael River near Green Rover, UT
14. Dirty Devil River near Hite, Utah
15. Escalante River near Escalante, UT
16. San Juan River at Shiprock, N.M.
17. Little Colorado River at Cameron, AZ
18. Virgin River at Littlefield, AZ



19. Lee Ferry, Arizona
20. Below Hoover Dam, Arizona-Nevada
21. Below Parker Dam, Arizona-California
22. Imperial Dam, Arizona-California

MONITORING POINTS

routine samples collected at these stations, continuous recordings of temperature and specific conductivity are taken at four stations.

In general, there has not been a sufficient accumulation of data, nor have water-related activities changed to the extent that the adequacy of the monitoring system can be measured. The 1976-1977 drought should provide valuable information on the effects of low flows on salinity.

Baseline Values

The 1975 Forum report developed the concept of "baseline values" and called for development of baseline salinity values for monitoring points on the main stem and major tributaries as part of the process of identifying and evaluating salinity control.

There is no intent to turn baseline values into standards nor are they to be considered or interpreted as standards for salinity. Rather, a monitoring site and baseline value are for the analysis of system changes that may occur upstream of the monitoring site.

Because salinity at a given point is influenced by a number of factors, such as river flow, duration, intensity and distribution of storms, rate of snow-melt, reservoir storage and upstream development, baseline values will represent a salinity range rather than a single salinity value. The baseline value will be represented by a broad band superimposed on a best-fit curve representing the relationship between salinity and flow at a particular station. The best-fit curve will represent the average relationship between salinity and flow. The band will represent the deviations from the average relationship arising from all of the other factors that influence salinity.

The Forum is developing flow/salinity curves for the twelve monitoring points listed below:

Colorado River near Cameo, Colorado

Gunnison River near Grand Junction, Colorado

Colorado River near Cisco, Utah

San Juan River near Archuleta, New Mexico

San Juan River near Bluff, Utah

Colorado River at Lee Ferry, Arizona

Green River near Green River, Wyoming

Duchesne River near Randlett, Utah

Green River at Green River, Utah

San Rafael River near Green River, Utah

Dolores River at Cisco, Utah

White River at Watson, Utah

Virgin River at Littlefield, Arizona

The curves are based on 1941-1972 historical flow and salinity data, adjusted to the 1972 level of development. Statistical tests are being applied to the data for each station to verify consistency. One and two standard deviation bands will be drawn about the best-fit curve.

Each year, the new flow/salinity data will be plotted on the appropriate graph, and compared against the one and two standard deviation bands. Projected flow/salinity impacts from upstream developments and salinity control projects will be calculated as they occur, and tentative adjustments made to the baseline values.

A preliminary baseline curve for the Colorado River near Cisco is shown on Figure 6. Initial baseline values for all stations will be complete by January 1979. (Curves for Stations with consistency problems in the data may be delayed.)

PRESENT MODIFIED SALT LOAD vs. FLOW
COLORADO RIVER NEAR CISCO, UTAH

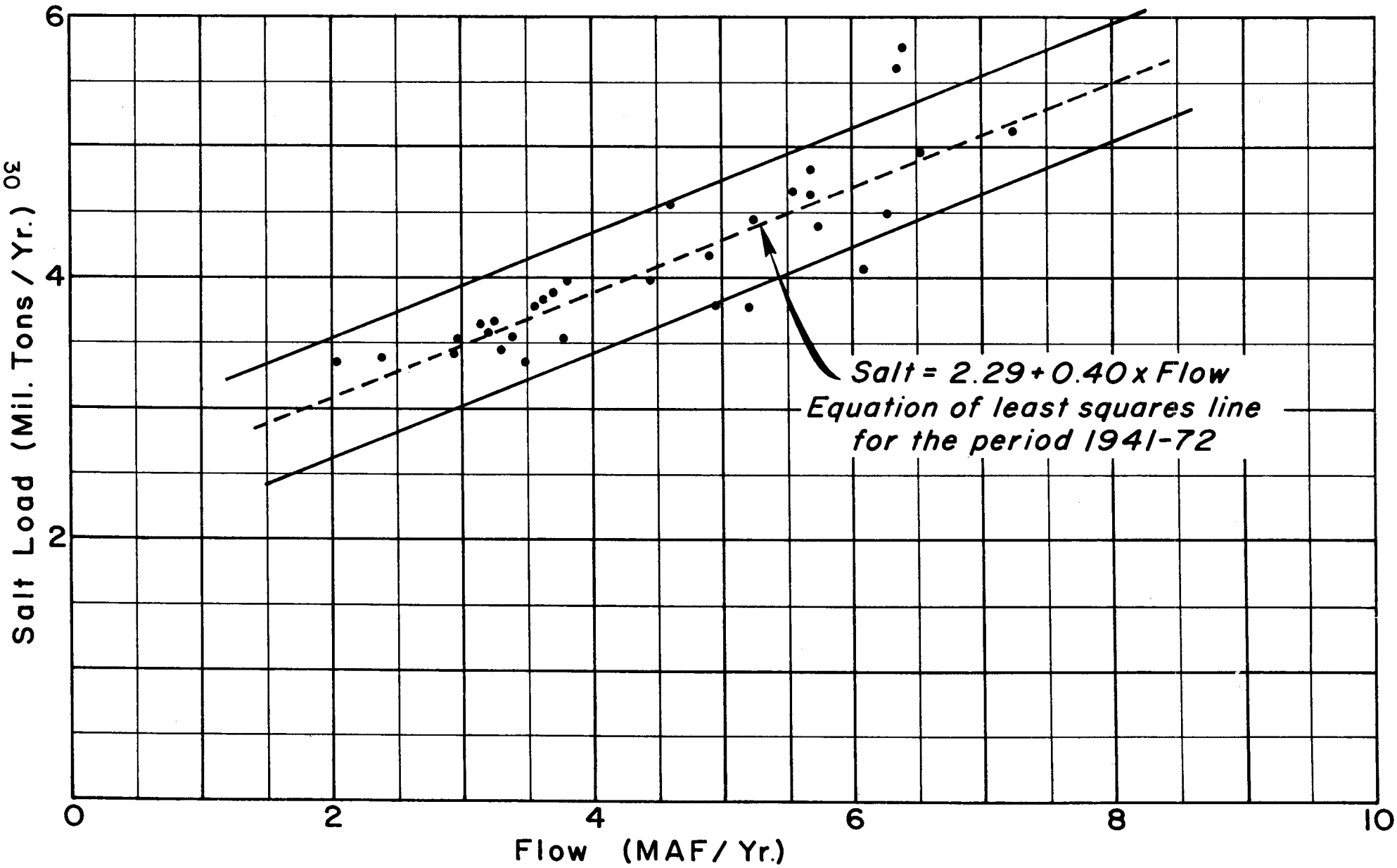


Figure 6

CHAPTER V

PLAN OF IMPLEMENTATION

The plan of implementation is designed to maintain the salinity concentration of the river below numeric criteria by reducing the salt contribution to the river from existing sources and to minimize future increases in salt load by the most cost effective means (economically, environmentally, and socially) at a rate commensurate with the expected increase in future basin water use. It also includes measures that water users have adopted or will adopt to cope with the use of relatively saline water, such as water softening and installation of tile drains.

The principal components of the plan are listed below:

1. Prompt construction and operation of three salinity control units authorized by Section 202, Title II, of Public Law 93-320, namely the Paradox Valley, Grand Valley, and Las Vegas Wash Units. Additional planning will be required for Las Vegas Wash before construction will be undertaken. The Crystal Geyser Unit which was also authorized has been deferred because of low cost effectiveness.
2. Expeditious authorization and construction of 10 of the 12 units listed in Section 203(a)(1), Title II of Public Law 93-320, and the Meeker Dome Unit, or their equivalents after receipt of favorable planning reports.

3. The placing of effluent limitations, principally under the National Pollutant Discharge Elimination System (NPDES) permit program provided for in Section 402 of the Clean Water Act of 1977, on industrial and municipal discharges.

4. The reformulation of previously authorized, but unconstructed, Federal water projects to reduce salt load. This process is essentially completed.

5. Inclusion of the 208 Water Quality Management Plans. The basin states are individually developing water quality management plans to conform to the requirements of Section 208 of the Clean Water Act. However, at this time those plans which will include consideration of salinity, have not been fully developed. When the plans have been adopted by the states and approved by EPA, those portions of the plans dealing with salinity control will be a part of this implementation plan.

The plan also contemplates the use of saline water for industrial purposes whenever practicable, programs by water users to cope with higher salinity water, improvements in irrigation systems and irrigation management to reduce salt pickup, studies of means to minimize salinity in municipal discharges, and studies of future possible salinity control programs.

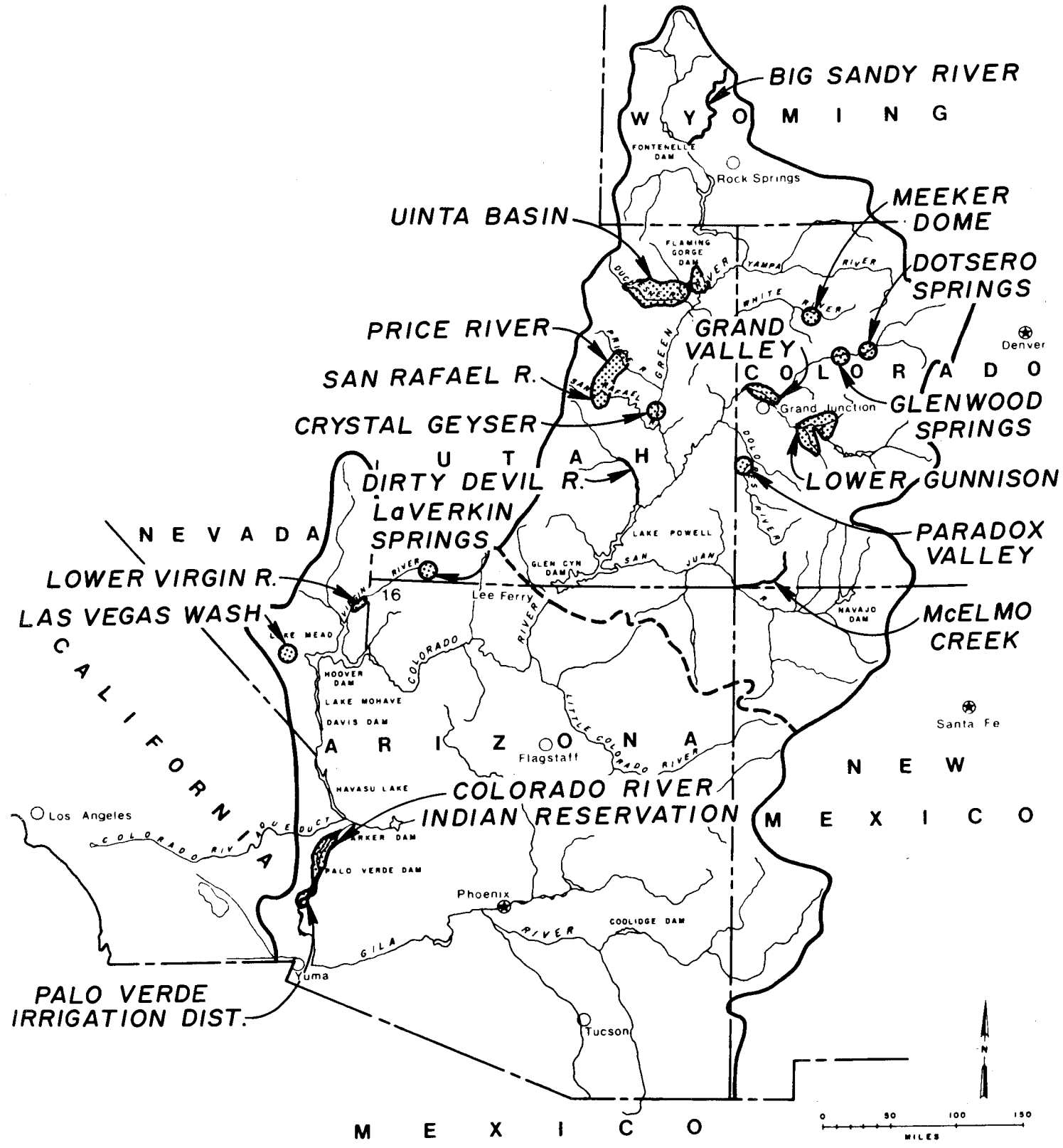
Federal Programs

In the authorizing legislation for the Colorado River

Storage Project (Public Law 84-485), the San Juan-Chama and Navajo Indian Irrigation Projects (Public Law 87-483) and the Fryingpan-Arkansas Project (Public Law 87-590), Congress directed the Secretary of the Interior to study the quality of water of the Colorado River system and to investigate all possible means of improving the quality of such waters. The USBR has published eight reports on a biennial basis which summarize the existing water quality conditions in the basin and include projections of future conditions. The comprehensive Colorado River Water Quality Improvement Program (CRWQIP) was initiated in 1971 based on the authorization contained in these acts. The intent of the program is to evaluate the means by which salinity control goals can be most efficiently attained from the standpoint of cost effectiveness and time.

Public Law 93-320, Title II, directed the Secretary of the Interior, by reference to the recommendations of the 1972 Seventh Session of the Conference in the Matter of Pollution of the Interstate Waters of the Colorado River and Its Tributaries, to expedite the investigation, planning, and implementation of the salinity control program defined by the CRWQIP. The location of the salinity control program units are shown on Figure 7. The Act established the program objective of treating salinity as a basinwide problem to be solved in order to maintain salinity concentrations at or below 1972 levels in the lower main stem of the river while the basin states continue to develop their compact apportioned waters. Specifically,

LOCATION OF PROPOSED SALINITY CONTROL PROJECTS - COLORADO RIVER BASIN



the Act authorized the construction, operation, and maintenance of four salinity control projects: the Paradox Valley Unit, the Grand Valley Unit, the Las Vegas Wash Unit, and the Crystal Geyser Unit, and the expeditious completion of planning reports on 12 other projects:

Irrigation Source Control:

- Lower Gunnison Basin Unit
- Uinta Basin Unit
- Colorado River Indian Reservation Unit
- Palo Verde Irrigation District Unit

Point Source Control:

- LaVerkin Springs Unit
- Lower Virgin River Unit (replaces Littlefield Springs Unit)
- Glenwood-Dotsero Unit

Diffuse Source Control:

- Price River Unit
- San Rafael River Unit
- Dirty Devil River Unit
- McElmo Creek Unit
- Big Sandy River Unit

The Secretary of the Interior, Secretary of Agriculture, and Administrator of the Environmental Protection Agency were directed to cooperate and coordinate their activities to meet the program objective.

The Soil Conservation Service is actively involved in the planning process on those units having an irrigation source

control component and the Bureau of Land Management is involved in the study of diffuse sources on National Resource Lands in the watershed.

Status of Colorado River Basin Salinity Control Project - Title II, P. L. 93-320

Paradox Valley Unit - The Paradox Valley is a collapsed salt anticline in southwestern Colorado. Several brine seeps enter the Dolores River along a 1.2-mile reach within the valley. The brine is highly concentrated (250,000 mg/l) and contributes about 200,000 tons of salt to the river system each year.

The proposal for salinity control involves lowering the freshwater-brine interface below the river channel by ground water pumping. The brine would be pumped to an evaporation pond, Radium Reservoir, some 20 miles distant, for solar evaporation. About 180,000 tons of salt would be removed annually by this project.

Ground water pumping tests were conducted in FY 1974 and FY 1977. Based on these tests, a system of 18 wells was developed in the upper aquifer. Pump tests conducted during development of the well field indicate that the combined output of the 18 wells could exceed 5 cfs, the maximum discharge believed necessary to lower the brine surface initially. However, should the results of the testing show that the well production required to control the brine flow is two cubic feet per second or less, deep well injection of the brine may be a viable

alternative to solar evaporation.

A 2-stage construction program is proposed: a well field capable of lowering and maintaining the brine surface, followed by construction of the evaporation pond and brine disposal pipeline.

A draft environmental impact statement has been released for public review and a draft Definite Plan Report (DPR) has been prepared. Release of the DPR and final EIS is scheduled for late 1978.

Grand Valley Unit - The Grand Valley Unit calls for increasing the efficiency of irrigation in the Grand Valley area of western Colorado by improving distribution systems and management techniques.

Approximately 60,000 acres are irrigated in the area, mostly from unlined canals and laterals. The Grand Valley area contributes between 650,000 and 850,000 tons of salt per year to the Colorado River. These salts are derived from deep percolation and irrigation system seepage coming in contact with the weathered marine shales underlying the region. Water and salt budgets indicate that this project can prevent 410,000 tons of salt from entering the river system.

Investigations in this area have included canal and lateral seepage measurements, ground water and drain water quantity and quality measurements, and demonstration of improved irrigation techniques. It is now proposed to proceed with a State I construction program in the Reed Wash area in the west end of the

valley which includes lining a reach of the Government Highline Canal (6.7 miles) and constructing 12 pipeline laterals (29.7 miles). The 12 pipeline laterals will replace 14 existing open ditches totaling 34.2 miles.

The DPR for Stage I is scheduled for completion in late 1978. Based on the environmental assesment prepared in 1977, a negative determination of environmental impact was filed on July 4, 1978 for Stage I. It is proposed that during the construction of Stage I, the DPR for the remainder of the project will be prepared with an accompanying environmental impact statement. The effects of the Stage I program will be intensively monitored to provide input to the implementation of the remainder of the project.

The Soil Conservation Service (SCS) has completed a planning report for on-farm improvements in the Grand Valley. They propose lining or piping of head ditches including installation of measuring and control devices, land leveling, replacing open drains with subsurface drains, and converting to drip or sprinkler irrigation methods where applicable. The SCS proposed to concentrate its efforts in the Stage I area during the construction of distribution system improvements in that area.

Several complications have arisen in implementing this salinity control project. The authorizing legislation for this project requires that the Secretary of the Interior, "...shall enter into contracts through which the agencies owning, operating and maintaining the water distribution systems in Grand Valley

singly or in concert, will assume all obligations relating to the continued operation and maintenance of the unit's facilities to the end that the maximum reduction of salinity inflow to the Colorado River will be achieved." The Bureau of Reclamation has entered into negotiations with the Grand Valley Water Users Association for an O&M contract on the Government Highline Canal system. Some difficulty has occurred in resolving the issues of acreage limitation, per acre water service limitation, and provisions for an irrigation scheduling service. However, progress is being made in resolving the problems and construction of Stage I facilities could begin following the 1978 irrigation season if the contract has been signed by that time.

Extensive wildlife mitigation has been recommended by the Fish and Wildlife Service and the Colorado Division of Wildlife. They have recommended that 4,000 acres be purchased and managed to replace the habitat now provided by vegetation along canal, lateral, and farm ditch banks. Because the authorizing legislation is silent on this matter, the Bureau of Reclamation has asked the appropriate Congressional committees for authority to provide the mitigation. The initial request is for the purchase of 2,800 acres with the remaining 1,200 acres to be provided if the voluntary SCS on-farm wildlife mitigation program proves unsatisfactory.

Las Vegas Wash Unit - The Las Vegas Wash is a natural drainage channel which transverses the Las Vegas Valley. The

lower portion is now a perennial stream as a result of secondary wastewater effluent and ground water discharges. Flow in the Wash has increased steadily in recent years due primarily to increased sewage discharges caused by a rapidly growing population. The annual flow measured at the USGS gaging station near North Shore Road was 62,800 acre-feet during the 1976 calendar year. It has been estimated that the Wash contributed about 280,000 tons of salt to the Colorado River System in 1976.

The purpose of the Las Vegas Wash Unit is to assist in the control of saline water discharged from Las Vegas Wash to Lake Mead. The plan of development calls for staged construction. The first stage consists of a sub-surface barrier to intercept highly saline ground water flow, a collection facility, a bypass pipeline from Clark County Advanced Wastewater Treatment (AWT) Plant, a pumping plant and pipeline and evaporation ponds. The second stage provides for the construction of a desalting complex at such time that the water lost to evaporation is needed by the State of Nevada. It has been estimated that construction of this unit will eliminate 41,000 tons of salt per year from entering the Colorado River System when its first stage is completed and an additional 42,000 tons of salt per year when its second stage is put in operation.

Operation of the salinity control facilities will be coordinated with operations of Clark County's AWT plant. This plant, which is now under construction, will process secondary effluent from existing sewage treatment plants in the valley.

The bulk of the discharges from the AWT plant will be placed in a pipeline, bypass the Wash, and be released downstream of the barrier dam. Some treated effluent may be released to the Wash for the purpose of maintaining vegetation.

The original proposal called for control of salinity from both the BMI mounds and regional ground water. It was contemplated that the BMI mounds would slowly dissapate and the regional ground water flow would increase as the Las Vegas Valley developed.

The Definite Plan Report (DPR) was scheduled for completion in November 1978, however, while preparing the DPR it became evident to the Bureau of Reclamation that the salinity of ground water mounds under the Basic Management Incorporated (BMI) tailings ponds were dissipating at a rate faster than anticipated in previous studies. The wastewater formerly discharged to these ponds is now being retained in lined evaporation ponds as a result of effluent limitations placed on industrial dischargers. The operation of Stage I was not scheduled to being until 1981 at which time much of the salinity of ground water from the mounds would have dissipated. Consequently, according to the Bureau of Reclamation the net salt removal during the operational life of Stage I would be significantly less than first predicted.

A new cost estimate using 1978 prices was prepared for Stage I facilities which indicate an additional capital cost of $12.6 million, primarily for evaporation ponds, as compared to the 1976 estimate. The resulting cost of salinity reduction at Imperial Dam is estimated to be $750,000 per mg/l.

The cities of Las Vegas and North Las Vegas have filed suit naming Clark County, the State of Nevada, and EPA as defendants, challenging the necessity for the AWT plant and the water quality standards established for Las Vegas Bay of Lake Mead. If the suit is decided in favor of the plaintiffs, it could result in halting the construction of the AWT plant. Should the AWT plant not be constructed and the existing wastewater treatment facilities continue to discharge to the Wash, the currently proposed salinity control project would no longer be viable without modifications.

In view of the uncertainties concerning the regional ground water and the pending litigation, the Bureau of Reclamation has proposed and the Forum has concurred, that construction of Las Vegas Wash be deferred until the total basin wide hydrosalinity system is restudied. At that time a salinity control project will be reformulated.

Crystal Geyser Unit - A DPR for the Crystal Geyser Unit was completed in 1976. The report, which was not released, concluded that 3,000 tons of salt could be removed annually at a cost of $234,000 ($780,000 per mg/l improvement at Imperial Dam). Because of the relatively poor cost effectiveness and small impact on the system, the construction of this unit has been deferred indefinitely.

Colorado River Water Quality Improvement Program

In addition to the investigation of specific salinity control projects named in Section 203 of Public Law 93-320,

the Colorado River Water Quality Improvement Program (CRWQIP) includes supporting studies of economic evaluation of salinity damages, return flow and hydrologic modeling, and research into salinity control techniques. The investigations of the individual units are at a feasibility level and are discussed below in the approximate order in which the feasibility reports are scheduled for completion. Subsequent to the passage of Public Law 93-320, the Meeker Dome Unit was added to the program and is also discussed below.

LaVerkin Springs Unit - The LaVerkin Springs are located in a canyon reach of the Virgin River in southwest Utah. The springs discharge about 8,300 acre-feet of 10,000 mg/l water per year. The control plan under consideration would bypass normal river flows around the reach of the river to which the springs discharge. The flow of the springs would then be captured at a diversion structure and pumped to a desalting plant. Product water would be returned to the river and brine would be pumped to a lined solar evaporation pond. Replacement water for the brine stream would come from water stored during high flow periods in an off-stream reservoir for release during the irrigation season, or by purchasing an existing irrigation right.

The proposed project would remove 103,000 tons of salt per year. Designation of the Lower Virgin River as critical habitat of the endangered woundfin may inhibit the development of this project.

Lower Gunnison Basin Unit - The Lower Gunnison Basin Unit encompasses those irrigated areas of the Gunnison River drainage below the Black Canyon. There are approximately 160,000 acres of irrigated land included in the study area, contributing an estimated 1,100,000 tons of salt annually.

It is estimated that implementation of improved distribution systems and improved water management could reduce the loading from this area by 300,000 tons per year. Feasibility investigations by the USBR to date have included mapping of the canal and lateral systems, seepage and inflow-outflow measurements, a hydrogeologic literature search, and extensive water quantity and quality monitoring. The SCS has completed a field irrigation inventory and a sediment and erosion study of the upland watershed. A wetlands evaluation is underway. Investigations on this unit are being conducted using Multiple Objective Planning (MOP) procedures. Presently, about 5,000 acres are included in a pilot irrigation management services (IMS) program.

Uinta Basin Unit - The Uinta Basin contributes about 450,000 tons of salt annually to the Colorado River system through the Duchesne and Green rivers in northeastern Utah. Return flows from 170,000 acres of irrigated land account for much of the salt contribution.

By improving distribution systems, on-farm facilities, and water management techniques, an annual reduction of 100,000 tons in salt loading appears feasible. The Bureau of Reclamation has been evaluating the feasibility of salinity control

with seepage measurements, return flow monitoring, infrared photographic analysis and return flow modeling. Canal sizing and preparation of feasibility designs and estimates are underway. The SCS has completed its field inventories and water and salt budgets. Their report on a plan of implementation has been issued.

McElmo Creek Unit - McElmo Creek drains 350 square miles in southwestern Colorado including the Montezuma Valley where over 40,000 acres are irrigated with diversions from the Dolores River. The creek carries an average annual salt load of 120,000 tons of which 70,000 tons are probably contributed by the irrigated area.

Several alternatives of salinity control are being examined. One possibility would be selective withdrawal of saline water from McElmo Creek during periods of low flow for evaporation or desalting. Another alternative program includes irrigation efficiency improvement in the Montezuma Valley. Some interest has also been shown for industrial use of the water. A combination of the alternatives could be the most effective control scheme. The removal of 40,000 tons per year appears reasonable at this time.

The planning is being done under MOP procedures and the SCS is participating in on-farm improvement evaluations.

Lower Virgin River Unit - This project replaces the Littlefield Springs Unit formerly included in the CRWQIP. It appears

that a more effective salinity control project can be developed at this downstream site without impacting the water supply to the irrigated area downstream of Littlefield Springs. Present estimates indicate a salinity control potential of 80,000 tons per year.

One alternative being examined is the construction of a barrier dam or well field to collect surface and subsurface flows during the May through October period. The water collected would be pumped to solar evaporation ponds for disposal. The feasibility of a barrier dam is dependent upon depth to bedrock which will be determined by a drilling program across the Virgin River channel. This drilling program is the first priority of the feasibility investigation.

Meeker Dome Unit - An oil exploration was drilled into the localized anticlinal structure known as the Meeker Dome in 1915. The well is located near the bank of the White River, 3 miles east of Meeker, Colorado. The well tapped a supply of warm, salty water (19,000 mg/l) and subsequently natural springs in the area dried up. The well was flowing at a rate of 3 cfs when an attempt was made to plug it in 1968. All discernible flow from the well disappeared; however, subsequently several wells and seeps in the area have started discharging.

The present investigations are examining the possibility of redrilling the well or collecting the existing seeps and utilizing or desalting the collected water. A potential exists

for an annual removal of 57,000 tons of salt.

Glenwood-Dotsero Springs Unit - The largest point source of salinity in the Upper Basin is a series of thermal springs located along a reach of the Colorado River between the Eagle River and the Roaring Fork. Approximately 500,000 tons of dissolved solids are added to this reach annually.

An appraisal (reconnaissance) report was prepared on this unit in 1976. The report concluded that a control scheme incorporating a multistage flash distillation desalting process appeared to be the most feasible alternative. Such a desalting plant could remove an estimated 250,000 tons of salt per year from the spring discharges which are controllable.

Price, San Rafael, and Dirty Devil River Units - These three units are comprised of the three river basins draining the Wasatch and Aquarious Plateaus of east-central Utah. The combined salt output of the three rivers is about 630,000 tons per year. The salt is derived from natural surface runoff, ground water, and irrigated agriculture along the streams. Investigations to date have been limited to data collection and research to determine the sources of salinity and potential means of control. Some potential control schemes being evaluated are increased irrigation efficiency, vegetation and watershed management, and selective withdrawal and disposal of poor quality streamflow.

Combinations of the above show potentials for annual salt

reductions of 100,000 tons from the Price River, and 80,000 tons each from the San Rafael and Dirty Devil Rivers.

Big Sandy River Unit - The Big Sandy River discharges 180,000 tons of salt annually from natural seeps, flowing wells, and irrigation return flows. Most of these discharges enter a relatively short reach of the river and total about 35 cfs.

An extensive system of wells has been drilled from the seep area upstream through the Eden Valley Irrigation Project. Most recently the USBR has developed and pump tested three wells in the proximity of some of the major seeps. The 5-day pump tests diminished the flow in the seeps significantly. The SCS is completing an evaluation of the potential of on-farm improvements in reducing salt loading from irrigation return flows.

The large volume of water that must be handled is the major obstacle to a feasible salinity control project. It would appear that diverting the poor quality ground water to some industrial use would be the most desirable alternative.

Colorado River Indian Reservation Unit - The Colorado River Indian Reservation is located along the Colorado River downstream of Parker Dam, Arizona. There is a potential for irrigating 107,588 acres on the Reservation although present development (1976) is about 72,377 acres.

The USBR contracted with Boyle Engineering Corporation to evaluate the potential of irrigation efficiency improvements as a means of salinity control. Based on this evaluation and

other hydrologic data, it has been concluded that the Reservation is acting as a salt sink and the potential for salinity control is extremely limited. Consequently, the USBR will issue a status report which recommends no further investigation of distribution system improvement as a means of salinity control at this time. However, the SCS will conduct a special water conservation and irrigation water management study in this area.

Palo Verde Irrigation District Unit - The Palo Verde Irrigation District is located in California along the Colorado River between Parker and Imperial Dams. About 91,400 acres are irrigated in the District.

The USBR contracted with Bookman-Edmonston Engineering Corporation to analyze the salinity reduction potential on this unit. The contractor concluded that most of the project area was in salt balance, however, the most recently developed area (10,500 irrigated acres) is still adding 150,000 tons per year to the river. Further analysis by USBR will be summarized in a status report which concludes that on-farm improvements in this area plus some lateral lining could significantly reduce this loading. The Bureau will work with the local 208 study to verify the ground water assumptions on which the findings are based. The feasibility investigations will be rescheduled if the data so warrant.

Schedule of Feasibility Reports For
Salinity Control Projects

The 1975 Forum report listed the scheduled dates for completion of feasibility reports provided by the Bureau of Reclamation for the projects included in the Colorado River Water Quality Improvement Program. The salt routing studies used in this report were based on a revised schedule issued by the Bureau in August 1977. In August 1978 the Bureau held its annual program conference which established priorities for its entire program. As a result of this conference, a new schedule was established for completion of the feasibility studies. A comparison of the three schedules is shown on Table 2. Changes in estimated completion dates are shown on Table 3. The delays in the Bureau's program are significant. Between the 1975 schedule and the 1977 schedule the dates for the completion of the reports were delayed from 15 to 64 months. The new August 1978 schedule shows further delays ranging up to 30 months.

The delays in completion of the feasibility reports will result in commensurate lags in the initial year of salt removal as described in Chapter VI. Because of these delays, the projected salinities shown on Figures 2, 3, and 4 involving salinity control projects are not valid, and new salinity projections will be made.

As concerned as the states are with the salinity of the

TABLE 2

COMPARISON OF ESTIMATED COMPLETION DATES OF
FEASIBILITY REPORTS OF USBR SALINITY CONTROL PROJECTS

SALINITY CONTROL PROJECT	FORUM'S 1975 REPORT	USBR 1977 SCHEDULE	USBR 1978 SCHEDULE
LaVerkin Springs Unit	June 1975	Dec. 1978	Apr. 1979
Lower Gunnison Basin Unit	June 1978	Dec. 1979	Dec. 1981
Uinta Basin Unit	June 1978	Dec. 1979	June 1982
McElmo Creek Unit	June 1979	Sept. 1980	Mar. 1982
Lower Virgin River Unit*	June 1976	Oct. 1981	July 1981
Meeker Dome Unit (New Unit)		Dec. 1981	Dec. 1981
Glenwood-Dotsero Springs Unit	June 1979	Oct. 1982	Sept. 1983
Price River Unit	June 1978	Oct. 1982	Mar. 1985
San Rafael River Unit	June 1979	Oct. 1982	Mar. 1985
Dirty Devil River Unit	June 1979	Sept. 1983	Sept. 1985
Big Sandy River Unit	June 1978	Sept. 1983	Dec. 1983

* Replaces the Littlefield Springs Unit

TABLE 3

CHANGE IN ESTIMATED COMPLETION DATES OF FEASIBILITY REPORTS - USBR SALINITY CONTROL PROJECTS

SALINITY CONTROL PROJECT	FORUM'S 1975 REPORT To USBR 1977 SCHEDULE	USBR 1977 SCHEDULE To USBR 1978 SCHEDULE	FORUM'S 1975 REPORT To USBR 1978 SCHEDULE
LaVerkin Springs Unit	Delayed 3 Yrs 6 Mo.	Delayed 4 Mo.	Delayed 3 Yrs 10 Mo.
Lower Gunnison Basin Unit	Delayed 1 Yr 6 Mo.	Delayed 2 Yrs	Delayed 3 Yrs 6 Mo.
Uinta Basin Unit	Delayed 1 Yr 6 Mo.	Delayed 2 Yrs 6 Mo	Delayed 4 Yrs
McElmo Creek Unit	Delayed 1 Yr 3 Mo	Delayed 1 Yr 6 Mo	Delayed 2 Yrs 9 Mo
Lower Virgin River Unit*	Delayed 5 Yrs 4 Mo	Advanced 3 Mo	Delayed 5 Yrs 1 Mo
Meeker Dome Unit	New Unit	No Change	
Glenwood-Dotsero Springs Unit	Delayed 3 Yrs 4 Mo	Delayed 11 Mo	Delayed 4 Yrs 3 Mo
Price River Unit	Delayed 4 Yrs 4 Mo	Delayed 2 Yrs 5 Mo	Delayed 6 Yrs 9 Mo
San Rafael River Unit	Delayed 3 Yrs 4 Mo	Delayed 2 Yrs 5 Mo	Delayed 5 Yrs 9 Mo
Dirty Devil River Unit	Delayed 4 Yrs 3 Mo	Delayed 2 Yrs	Delayed 6 Yrs 3 Mo
Big Sandy River Unit	Delayed 5 Yrs 3 Mo	Delayed 3 Mo	Delayed 5 Yrs 6 Mo

*Replaces the Littlefield Springs Unit

Colorado River, only the federal government is involved in all major basinwide aspects of the salinity problem and a solution is only possible on a basinwide basis. Federal lands including Indian lands are the source of most of the naturally occurring salts in the river. The major component of the salinity control plan is the units identified in Title II of P.L. 93-320, the Colorado River Basin Salinity Control Act. For this reason progress on these units must not be delayed.

The Forum has supported the Bureau's Water Quality Improvement Program and urged its expeditious completion. Each year since 1975, the Forum has presented a statement before the Congressional Appropriations Committees in support of the appropriations for Title II of Public Law 93-320, and the Colorado River Water Quality Improvement Program. In 1977, in a statement before the Agricultural Appropriations Committee, the Forum requested an appropriation of $1.5 million to initiate on-farm salinity control work in the Grand Valley. Again in 1978, the Forum requested the appropriation to initiate the on-farm efforts. Copies of these statements are presented in Appendix C.

Public Law 93-320 called for the creation of an Advisory Council to advise the Secretaries of Interior and Agriculture and the Administrator of the Environmental Protection Agency on all matters relating to efficient and timely planning and execution of the salinity control measures and procedures specified in the Act. Most of the members of the Advisory Council are also members of the Forum. Both the first and second annual

reports (1976 and 1977) recommended prompt completion of authorized salinity control units and the planning reports. Copies of those reports are also presented in Appendix C.

Because of the Forum's concern for prompt action on the salinity control program and the apparent lag that was developing in the Bureau's program schedule, the Forum, in 1975, offered recommendations to the Commissioner of Reclamation regarding management of the salinity program in an effort to expedite the program. In 1977, members of the Forum wrote to the Commissioner concerning the lack of construction progress on the Grand Valley Unit and offered suggestions for offsetting the delays. Again in 1978, a letter from the Chairman of the Forum was sent to Reclamation requesting expeditious completion of the planning reports authorized by P.L. 93-320. Copies of the above correspondence are in Appendix C.

From its inception, the Forum, with the full support of the seven basin states, has urged the Bureau of Reclamation and other federal agencies to expedite the salinity control efforts. Unless the salinity control units are promptly implemented, the salinity objectives will be delayed.

Department of Agriculture Program

In addition to the work discussed under the individual units of the Colorado River Water Quality Improvement Program, the Soil Conservation Service has scheduled investigations of the potential for salinity control in the following drainages: Virgin River, Roaring Fork, San Juan, Lyman, and Henry's Fork-Manila.

The Department of Agriculture will administer the Rural Clean Water Program as described in this chapter under the discussion on the 208 program.

The Agricultural Research Service participated with the Bureau of Reclamation on a 4-year study of means by which salinity could be reduced in irrigation return flows in the Grand Valley. The results of these efforts have been summarized in a final report on the project. The Science and Education Administration (formerly ARS) is now evaluating the application of dead level basins for irrigation in the Grand Valley.

The U. S. Salinity Laboratory evaluated whether calcium carbonate ($CaCO_3$) is precipitating in the lower main stem as a result of drainage flows contributing sufficient $CaCO_3$ to supersaturate the river. They found no evidence of precipitation occurring and concluded that any reduction in salt loading would directly affect the total concentration of the river.

Bureau of Land Management Program

The Bureau of Land Management has been evaluating the sources of salinity from National Resource Lands in the Colorado River Basin beginning in 1974. An interim report of their investigations was published in 1977, and a status report on the effects of surface disturbance on salinity was published in 1978. These reports identified several measures which have promise for salinity control such as constructing detention dams, contour furrowing, and grazing modifications.

The BLM is now pursuing site specific control measures within the Upper Basin. They are cooperating with the SCS and USBR on those units of CRWQIP containing National Resource Lands.

Environmental Protection Agency Program

The Clean Water Act of 1977 (P.L. 92-500 as amended by P.L. 95-217) strengthens the shared responsibilities between the Environmental Protection Agency and individual states for implementation of numerous provisions of the Act. Congressional intent for a significant delegation of responsibilities to states is clearly expressed. Therefore, many provisions of the Clean Water Act of 1977 are discussed in greater detail under State Programs in the succeeding section. Table 4 lists the regulations in the Clean Water Act of 1977 which are particularly relevant to the salinity control effort.

Primary responsibility for implementation of Sections 106 (Grants for state pollution control programs), 208 (Areawide water quality management planning), 303 (Water quality standards and implementation plans) rests with the states. The states of California, Colorado, Nevada, and Wyoming also have primary responsibility for Section 402 (National Pollut Discharge Elimination System, NPDES). EPA retains permit issuing authority for the other basin states. However, EPA has review and approval authority with regard to the programs. Sections 304(k) (Federal agency assistance for implementation of 208 plans), and 313 (Federal compliance with all federal, state, interstate and local pollution control and abatement require-

TABLE 4

Major Regulations Bearing on Salinity Control Activities
Clean Water Act of 1977

Section of the Act	Topic
101(e)	Public Participation in Water Pollution Control
101(g)	State Jurisdiction shall not be Impaired
102(d)	Analysis of Relationship Between Water Quality and Water Quantity Programs
106(a)	Grants for State Pollution Control Programs
106(e)(1)	Water Quality Monitoring and Reporting
201	Grants for Construction of Treatment Works
208	Areawide Waste Treatment Management
208(j)	Agricultural Cost Sharing
301	Effluent Limitations
303	Water Quality Standards and Implementation Plans
304(k)	Interagency agreements for implementation of 208 plans
305	Water Quality Inventory
309	Federal Enforcement
310	International Pollution Abatement
313	Federal Compliance with All Federal, State, Interstate and Local Pollution Control and Abatement Requirements.
402	National Pollutant Discharge Elimination System
404	Permits for Dredged or Fill Material

ments), provide the possibility for increased opportunity to coordinate and cooperate with Federal agencies involved in the implementation of salinity control efforts.

The major thrust of EPA's water and waste management programs will focus on the following activities: improved program integration (integration of monitoring programs, implementation of comprehensive five-year water quality management programs), resource management (conservation and wise use of limited or irreplaceable resources), emphasis of nonpoint source control development, and application of best management practices.

Public involvement and public participation in water quality management programs is a requirement of the Clean Water Act (Section 101(e)) for EPA and state activities. Regulations specifying minimum guidelines for this requirement were promulgated on August 23, 1973 as 40 CFR 105. These guidelines are presently being revised and draft material indicates a significant strengthening of the public participation requirements.

The Environmental Protection Agency has an extensive research and development program which has provided information related to salinity control efforts in the Colorado River Basin. Examples include "Best Management Practices for Salinity Control in Grand Valley" (Environmental Protection Technology Series, in press, Robert S. Kerr, Environmental Research Laboratory), "State and Local Management Actions to Reduce Colorado River Salinity" (EPA 908/3-77-002) and "Proceedings, National Conference on Irrigation Return Flow Quality Management" (Office

of University Communication, Colorado State University, 1977).

State Programs - Effluent Limitations

A principal component of the plan of implementation is the control of effluent discharge. To facilitate this operation, the Forum developed a "Policy for Implementation of the Colorado River Salinity Standards through the NPDES Permit Program", which was approved by the EPA and adopted by all basin states except Wyoming as a guide for the issuance of NPDES permits. The types of discharge which are subject to control are industrial and municipal. During the period 1975-1977, the status of implementation was as follows:

Industrial Discharges

Arizona - Authority for issuing permits has not been granted to the state and is under the administration of EPA, Region IX. Arizona is currently implementing an interim permit program where Arizona is performing all the permit program except final permit issuance and enforcement. As Arizona completes the necessary statute amendments and regulation development, delegation of full permit authority is anticipated.

There are three industrial dischargers in the Colorado River main stem and their impact is considered to be very small. One source discharges to a dry wash, one is a U. S. Fish Hatchery, and one is a small Sanitary District located on the river. According to permit provisions, those dischargers who discharge salt mainly to ground water, are developing information concerning the salinity of their water supply and effluent

to evaluate the salt loads that these discharges may contribute to the Colorado River System.

The State, in preparation of the permits is presently following the NPDES policy of the Forum. Re-using of water is to be encouraged except where it would have additional adverse impacts on Colorado River quality.

California - The State Water Resources Control Board has been granted the authority for the NPDES permit program. The Regional Water Quality Control Board - Colorado River Region, issues the NPDES permits and waste discharge requirements within the Colorado River drainage portion of the state. No NPDES permits were applied for or issued for the period.

Colorado - The State will give the Colorado River Basin Salinity Control Program a high priority. The Water Quality Control Program will focus mainly on two functions: (1) point source control through the NPDES program and, (2) non-point source control through the 208 areawide waste management plans.

The major portion of salt loading decreases in the plan for salinity control in the Colorado River are to be accomplished through Federal programs, therefore coordination and support through the key Federal agencies, such as the Bureau of Reclamation, the Soil Conservation Service and the EPA will be essential to approach the goals contained in the standards and implementation program.

The Colorado Water Quality Control Division has been delegated responsibility by EPA for state administration of the

NPDES (permit) program. Colorado has a total of 99 industrial permits issued for point source discharges in the Colorado River Basin. Most of these permits were issued for existing discharges and will be evaluated under the "no-salt return where practicable" requirement when the permits are reissued. New industrial discharges will be required to comply with the Forum and State implementation policy. Municipal discharge permits also will be reissued as they expire to comply with the Forum policy and the State adopted regulations. Letters are being issued to all industrial permit holders in the Basin, advising that the necessary steps to accomplish the "no-salt return" requirement will be initiated as soon as practicable. When the discharger's permit is reissued, the return of salt will be stopped or other appropriate measures will have been taken. Where time constraints will not allow an immediate cessation of salt return to be accomplished, an appropriate implementation schedule will be included in the reissued permit.

The following companies are proposing no discharge from potential Oil Shale development:

Occidental Oil Company

Standard Gulf Oil Company

Union Oil Company

The Anschutz Coal Company has had a discharge permit in the past and is working toward stopping their discharging under a reissued permit.

New Mexico - Authority for issuing permits has not been granted to the State and the program is being administered by EPA, Region VI. EPA is following the Forum policy in the administration of the permit program. In the Colorado River basin within the state the following permits have been issued: Electric Power - 2; Coal Mines - 1; Uranium Mines - 8, 6 major and 2 minor; and Gravel Plants - 4.

EPA has determined that discharges covered by the uranium mine permits will contribute less than 350 tons of salt per year to the nearest perennial stream segment of the Colorado River. The electric power permits are for the Four Corners plant (operated by Arizona Public Service Company for a consortium) and the City of Farmington Plant. The State of New Mexico, relying on the EPA-approved Colorado River salinity standards and plan of implementation, sought a condition in the NPDES permit for the 2175 MW Four Corners Power Plant requiring the elimination of the discharge of fly ash sluicing water to the San Juan River by 1981. APS has recently initiated construction to eliminate this discharge. With the plant operating, as it has in recent years, at a load factor of 0.60, this condition will result in a reduction of about 7,500 tons per year of salt discharge to the Colorado River system.

Nevada - The NPDES Permit program was delegated to the state by EPA in September 1975. Prior to program delegation EPA issued permits in compliance with the EPA Region IX policy

and the 1975 Forum report. The State has reissued most of the EPA-issued permits and they are consistent with the Forum policy.

All industrial discharges from Basic Management Industries (BMI) have been eliminated with the exception of industrial cooling water discharged to the Colorado River via Las Vegas Wash by two companies, Titanium Metals and Kerr-McGee, within BMI. Nevada Power Company is currently discharging salt from both Clark and Sunrise Generating Stations to the Colorado River via the Las Vegas Wash in violation of the NPDES permit effluent limitations. Nevada Power Company proposes to discharge cooling water blowdown from both generating stations to the evaporation ponds of the proposed USBR Las Vegas Salinity Control Unit. In the event that this is not feasible, Nevada Power Company has submitted a contingency plan which when implemented must result in compliance by 1982. The NPDES permits for each generating station sets daily maximum TDS concentrations and daily mass emission rates.

Utah - Industrial and Municipal dischargers in Utah are required to obtain an NPDES permit from EPA and a construction permit from the Utah Water Pollution Committee. The discharger must submit information on the proposed installation, chemical concentrations, and possible alternatives to discharge as required in the February 1977 Forum Policy. The proposal is then evaluated for its impact on the lower main stem of the Colorado River and the practicability of achieving no discharge. The Bureau of Water Pollution Control cooperates with EPA in the

NPDES program by drafting most permits and certifying that the permits conform with State regulations including salinity requirements. The final authority and issuance of the NPDES permits in Utah rests with EPA.

A total of 37 NPDES industrial permits have been issued in the Colorado River Basin in Utah. There have been seven industries, including two power plants, which have achieved no discharge status since 1972. Three other companies have totally contained their most highly polluted wastewaters and two proposed uranium mills will be required to totally contain.

Twenty-six industrial permits have been issued during 1977-78. Six dischargers have been required to submit additional salinity information as required by the Forum Policy. The other discharges were determined to contribute less than 1 ton per day or it was determined that total containment was not practical.

Wyoming- The Wyoming Department of Environmental Quality, Water Quality Division, has been granted authority by EPA for State administration of the NPDES permit program. The Forum Policy has not yet been adopted as regulation by the State of Wyoming, therefore, Wyoming has continued to use the general language (no-salt return wherever practicable) of the 1975 Forum report when issuing or reissuing industrial discharge permits. The Forum policy as presented in Appendix A will be considered for adoption as regulation by Wyoming at the same time as this 1978 Revision of the Forum Report.

The trona processing industry is the only major salt

producing industry in the Wyoming portion of the Colorado River Basin. This industry is completely containing all of its wastewaters without discharge. There are a total of fifteen other industrial facilities in the Wyoming portion of the Colorado River drainage which do discharge. During 1977, these fifteen discharges contributed a total salt load of only 14.3 tons per day.

Municipal Discharges

Arizona - Several small municipal dischargers have ceased discharging to the Colorado; however, their salt loadings were less than one ton per day and thus were exempt from the incremental increase in salinity as set forth by the policy.

The Parker (Colorado River Joint Venture) discharge has a TDS loading of about 2.8 ton/day and has an average incremental increase in TDS of slightly over 400 mg/l. All other discharges directly to the main stream are less than one ton per day and are exempt from the incremented increase.

Many other discharges in the Colorado main stem and the Little Colorado River do not impact the main stem as these discharges are to dry washes. Nonetheless, the Forum guidelines are followed and all permits require that TDS influent and effluent be monitored and reported.

California - A permit was issued for the City of Needles in 1975. The requirements for incremental increases in salinity are more stringent than specified by the Forum policy. Compliance actions are underway but complete compliance has not

been achieved.

Colorado - A total of 170 municipal permits for point source discharges to the Colorado River have been issued. As these permits expire and are reissued they will comply with the Forum policy as well as state-adopted regulations.

Municipal permit holders will be advised of the Salinity Control Program and will be required to monitor for incremental increases of salinity in their discharges and each discharger will be reviewed on a case by case basis to implement the control program.

New Mexico - Permits have been issued for three major and 2 minor sewage treatment plants, 2 water treatment plants, and 17 small domestic sewage systems. Forum policy will be followed in the issuance of new or reissued permits.

Nevada - All major municipal discharge to the Colorado River have been required to develop salinity control programs to help minimize point source loading to the river. Under a state order, issued pursuant to the delegated authority, the dischargers are implementing a salt use optimization program to reduce the salt load attributable to back washing of on-site domestic and commercial water softeners. Elements of the program include public education, water softener regulation and infiltration control. Other actions for point source salinity reduction will be implemented in 1982.

Utah - Twenty-seven permits have been reissued or certified for issue. All are renewals of previously issued permits.

Salinity reports will be required for some of the permits. Seven municipal wastewater treatment systems have achieved no discharge status since 1972. All new discharge permits will comply with the Forum policy regarding NPDES permits.

Wyoming - During the period, no permits have been issued nor applications received for municipal permits. Since the Forum policy presented in Appendix A has not been adopted as regulation by Wyoming, and because the 1975 Forum Report (which has been adopted as regulation) does not address municipal discharges, the Forum policy as presented in Appendix A will be considered for adoption as regulation at the same time as this 1978 Revision of the Forum Report.

Agricultural Discharges

The Clean Water Act of 1977 removed irrigation return flows from point source definition. Therefore, permits are not required from EPA to be issued for this category of discharge. The agricultural discharge situation, however, continues to be studied in relation to definition and implementation of on-farm best management practices. Issuance of permits is optional with the states and some may wish to do so in order to be better able to monitor the operation. In January 1977, the California Regional Water Quality Control Board reissued waste discharge requirements for the Palo Verde Irrigation District for agricultural return flows. The permit requires monitoring and reporting of total dissolved solids, suspended solids and flow of both irrigation supply and return.

State Programs - Water Quality Management Planning: 208

The basin states are individually developing water quality management plans to conform with the requirements of Section 208 of the Clean Water Act. These requirements include:

- Public involvement
- Problem assessment
- Development of Best Management Practices (BMP's)
- Establishment of control programs
- Designation of management agencies

Section 208 plans must address the following categories of polluting or potentially polluting activities and sources:

- Municipal wastewater treatment
- Industrial wastewater treatment
- Urban stormwater
- Agricultural activities
- Logging and related activities (silviculture)
- Mining and related activities
- Construction activities
- Salt water intrusion into surface waters
- Disposal of wastes by pumping into wells or subsurface cavities (well injection or deep well injection)
- Contruction or operation of hydrologic modifications such as dams, levees and flow diversion structures
- Residual waste disposal, such as solid waste landfills or disposal sites for municipal or industrial sewage treatment plant sludge

At a meeting between the Forum and the 208 agencies on

March 3, 1977, it was agreed that drafts of the plans would be submitted to the Forum for review of the portions relating to salinity in the Colorado River Basin. This process will enable the Forum to review the drafts to assure rationality in treating the salinity problem and to offer recommendations that would provide for consistency with the Forum's policy and objectives. The development and drafting of the initial State and Areawide 208 plans has been underway for some time. These plans are reviewed in the following section.

Current Status

Arizona - The Northern Arizona Council of Governments and District IV Council of Governments are the planning agencies that have been assigned the responsibility for developing the 208 wastewater management plans for the designated areas in the state which drain to the main stem above Imperial Dam. Work on the plans indicates that the activity with the most potential for improvement of the salinity condition will result from adoption and implementation of on-farm water management programs. Drafts of the plans are anticipated to be completed and distributed for review during September 1978. These recommendations will be incorporated into an overall State program in the State water quality management plan to be completed in April 1979.

California - The Regional Water Quality Control Board has been assigned as the planning agency for the Colorado River tributary drainage which is part of the nondesignated 208

planning area of the state. A specific plan dealing exclusively with Colorado River salinity is being developed to identify best management practices to minimize salinity discharges. This action is a cooperative program with the U. S. Geological Survey, Palo Verde Irrigation District and the Colorado River Board of California, along with the Regional Board. The Palo Verde Irrigation District is responsible for establishing best management practices for the Palo Verde Valley. The areas from which significant salt loading is produced are being determined.

Preliminary data from agricultural drains indicates that a localized area in the southern end of the Valley appears to be the major salt contributor. Complete evaluation of the ground water system is necessary to determine the potential for salt reduction from the Valley. Such an investigation needs to be undertaken as part of the continuing planning process. Local agricultural operators and irrigation district representatives are concerned about the salinity problem and have taken it into consideration in their current on-farm water management program.

The 208 activities in the California portion of the Fort Mohave Indian Reservation and the Reservation Division of the Yuma Project are being directed toward the determination of the magnitude and extent of salt loading to the River. These studies are not sufficiently advanced to include any results in this report.

Colorado - Two areas in the Colorado River Basin of Colorado have been defined as designated areas by the Governor and specific planning agencies have been assigned to develop the 208 plans. These are the Colorado West Area of Governments consisting of Moffat, Rio Blanco, Garfield and Mesa Counties and the Northwest Colorado Council of Governments including Eagle, Grand, Jackson, Routt, Pitkin and Summit counties. The remainder of the basin is in the non-designated 208 planning area which will be included in the statewide plan developed by the Colorado Water Quality Control Division. In the development of the plans, salinity control programs are being considered in the draft plans for areawide waste treatment management.

The Colorado West Area COG probably has the major salinity Impact in comparison to the other designated area and the remainder of the basin in the non-designated category due to more natural contributions and agricultural activity. The 208 plan for this area is being processed through the public hearing phase and is scheduled for a public hearing before the Water Quality Control Commission on September 6, 1978, in Grand Junction, Colorado.

The Northwest Colorado COG is primarily the high mountain headwaters of the Colorado River and does not contribute a large amount of salt. Sources of salinity from this area include mining, milling and runoff from tailings with a small amount of contribution from irrigation of high mountain meadows. Salt concentrating impacts from transmountain

diversions are significant compared to other sources in this region and the 208 is recommending more local control over transbasin diversion. The plan for this area was reviewed at a hearing before the Water Quality Control Commission on July 6, 1978, in Vail, Colorado.

The statewide plan which will cover the remainder of the basin is in preliminary stages with projected completion by March 9, 1979. Initially the planning effort for this area will be to assess the impact of critical salinity yielding areas.

It is proposed initially to develop and coordinate statewide model implementation programs for "Best Management Practices" for on-farm programs. Statewide priorities will be developed for identified problem areas.

Arrangements of most of the institutional and educational efforts in the Colorado River Salinity Control Program will be accomplished at the local level with State review and assistance. Coordination at the State agency level will be accomplished through existing channels and the Water Quality Control Division will be responsible for coordination of the point and non-point source programs. The Department of Agriculture, Soil Conservation Board and the Water Resources Board will be requested to assist the 208 agencies in developing salinity control management capability in existing local agencies.

Nevada - The Clark County Commissioners were assigned in 1975 the responsibility by the Governor of Nevada (and State

law) to conduct the 208 program for the designated area of Clark County. The management of the program was assigned to Clark County Sanitation District No. 1 (CCSD) by the County Commissioners under the direction of which the draft plan was adopted by the Board of Commissioners on May 9, 1978, and conditionally certified by the Governor on June 13, 1978. Thereafter, continuous planning has been assigned to the County Department of Comprehensive Planning. EPA is presently reviewing the plan.

The Clark County 208 Plan recommends close coordination with the Bureau of Reclamation on the Lower Virgin River Salinity Control Unit Study plus expanding the study to include Muddy River drainage. The 208 Program, also, recommends continuing studies be carried out on the Las Vegas Wash/Bay system which will include an assessment of salinity discharges from Las Vegas Valley to the Colorado River System.

These studies will be coordinated with the Bureau of Reclamation's Las Vegas Wash Salinity Control Unit effort.

The Plan incorporates the current salinity control efforts of the Clark County Sanitation District No. 1 and the cities in salt optimization of water softeners as mandated by the State of Nevada NPDES discharge permits.

The remainder of the area of the Colorado River Basin will be treated in the statewide plan which the Nevada Department of Natural Resources, Division of Environmental Protection has the

responsibility to develop the 208 Plan. This activity has been initiated with completion anticipated during the latter part of 1978.

New Mexico - The Section 208 program in New Mexico is being done under the direction of the New Mexico Water Quality Control Commission. The 208 plan will cover the entire state, except that part of the state in the Navajo Reservation. The 208 plan for the Navajo Reservation is being done by the Navajo Tribe. Much of the Colorado River Basin in New Mexico is within the Navajo Reservation.

A major part of the plan will be an assessment of nonpoint sources. The three major nonpoint sources being studied are irrigated agriculture, silviculture and erosional sediment, including the trap efficiency of two dams.

The site of the irrigated agriculture study is near Socorro, New Mexico. Through a contract with New Mexico State University Engineering Experiment Station, the irrigation, runoff, deep percolation and drainage waters are being sampled for nutrients and salts over two irrigation seasons. While application of the results of this study to other areas of the state or in the river basin may be limited, some plan reccomendations are expected to be developed.

The Department of State Forestry has surveyed public and private forest owners and managers to compile an inventory of silvicultural activities which may have adverse water quality impacts. Road construction was identified as the most

significant activity next to grazing. A compilation of forestry best management practices is expected to result in some plan recommendations.

The Natural Resource Conservation Commission is reviewing and evaluating sediment sources and related water quality impacts on a county by county basis. The Commission proposes to conduct studies, inventory problem areas and identify management practices to be used in addressing those problems by reducing erosion. The separation of natural or "geological" erosion from accelerated erosion is being examined in the Middle and Upper Rio Grande.

Available information on the sediment trap efficiency and related effects on water quality of Galisteo and Jemez Canyon Dams was assessed. Report recommendations will focus on the needs to evaluate sediment contributions from tributaries, to sample sediment in the reservoirs behind the two dams for toxic substances, to further explore advisability of dam modification and to emphasize land management practices in reducing sediment production.

Utah - There are three areas in the Colorado River Basin that have been classified as designated areas with assigned planning agencies and one area consisting of Wayne County that is a non-designated area for which the 208 plan will be developed by the Utah State Division of Health.

A detailed agricultural assessment is being performed for the 208 agencies described below. This first phase information is being developed with the assistance of the SCS and SCD's.

The output will prioritize agriculture related water quality problems by area. Specific BMP's and costs will also be developed.

The status of the plans for the defined areas is as noted in the following itemization:

Southwestern Utah - Five County Association of Governments (Virgin, Escalante and Paria River drainages)- Water Quality Inventory and Management Plan: Presently, the 208 is revising the technical Water Quality Phase Document and the Water Quality Management Plan. The Plan will be resubmitted to the State for certification.

Uinta Basin Association of Governments (Duchesne and Upper Green River drainages) - Uintah Basin's Water Quality Management Plan: The draft certification letter is being circulated to state agencies for review and comment -- expect the Governor's certification in August.

Southeastern Utah Association of Governments (Colorado River drainage) - San Juan County has rejoined SEUAOG and the water quality planning for this county will now be undertaken by the SEUAOG 208. A revised Water Quality Management Plan is being developed and will be published in September 1978.

Six County Association of Governments (Dirty Devil River Basin) - Water Quality Management Plan is being developed by the State Division of Health - Bureau of Water Quality. The draft Plan will probably be developed by November 1978.

Wyoming - The Southwestern Wyoming Water Quality Planning Association has been assigned as the planning agency for the designated area consisting of Sweetwater, Uinta and Lincoln Counties. The draft plan for this area has progressed through public hearings and is in the process of revision in preparation for submittal and adoption locally during August 1978 and adoption by the State during October 1978. The draft Southwestern Plan recommends that increased irrigation efficiencies be implemented in the Big Sandy Unit. All other management alternatives were recommended as requiring further study.

The remainder of the area in the Colorado River Basin will be included in the Statewide Plan to be developed by the Water Quality Division, Wyoming Department of Environmental Quality. Only the assessment phase of the 208 plan for Sublette County is scheduled for completion by November 1978. Other elements such as development of best management practices and identification of control programs and management agencies will be scheduled as funding becomes available from EPA.

Education and Public Involvement

The basin-wide nature of salinity presents some difficult challenges in terms of effective public education and public involvement programs. However, implementation of salinity control programs requires a greater awareness of salinity—its sources, impacts, and alternative methods of control. The Forum and the seven basin States will work with concerned agencies to increase public understanding of salinity. The Forum's Annual Progress Report will be a component of this educational effort and will be distributed through the above

channels to interested individuals and organizations.

Since irrigation is the principal man-induced source of salinity, a major thrust of the public education/public involvement effort should focus on educating irrigators as to the sources, impacts, and methods of controlling salinity as it relates to irrigation practices. The goal of this effort is to encourage desirable changes in application of technology and management practices. The Forum and the basin States will work with ongoing efforts (208 programs, Soil Conservation Service, and Science and Education Administration) to achieve this goal.

Future Activities

One of the significant changes in the Clean Water Act of 1977 was to remove irrigation return flows from the point source definition and hence Section 402, NPDES permit requirements of EPA. States, however, can require permits for irrigation return flows if they so desire. The act also specifically added responsibilities for addressing "return flows from irrigated agriculture, and their cumulative effects" to the 208 program.

The Clean Water Act authorized a major new effort, known as the Rural Clean Water Program (Section 208 (j)) which offers considerable potential for correcting salinity problems associated with nonpoint source pollution from rural lands. This program authorizes the Secretary of Agriculture, with the concurrence of the Administrator, Environmental Protection Agency to establish and administer a program to enter into contracts

of from 5 to 10 years with owners or operators having control of rural lands for the purpose of installing and maintaining measures incorporating best management practices to control agricultural nonpoint source pollution for improved water quality. This program may be initiated in those States or areas for which the appropriate Regional Administrator, Environmental Protection Agency has approved the agricultural portion of a Section 208 water quality management plan.

In addition to the preceding legislative changes, EPA has specifically identified salinity as a high priority issue for future 208 activities in the basin. The basin states will be developing salinity control strategies as components of the State/Regional Administrator Agreements required for future water quality managment funding. The Forum will provide review and guidance to this effort.

Other Nonfederal Measures to Control Salinity

As was pointed out in the 1975 Forum report, entities and agencies throughout the Colorado River Basin have initiated programs to minimize increases in salinity. These programs are part of the plan of implementation for salinity control. Among other practices, they include the control of effluent from thermal-electric powerplants and other industries and the plugging of abandoned oil wells.

Minimizing Salinity Increases Caused by Powerplants

Large quantities of water are used to cool thermal-electric

powerplants. As cooling water evaporates, dissolved salts in the remaining water become more and more concentrated. Since the cooling water must be maintained at or below specific levels of concentration, a portion of the concentrated water is discharged or "blown down" periodically and replaced with fresh water. In order to reduce the salinity impacts of these powerplants, most power companies have, in recent years, taken actions to eliminate the return of cooling tower blowdown water to the Colorado River, thus removing the salt diverted with the cooling water from the river system. As of January 1978, there were nine large thermal-electric generating plants, with a total capacity of 11,745 megawatts, either in operation or under construction within the Colorado River Basin, which would be disposing of their blowdown water away from the river, thereby removing dissolved salts from the Colorado River System. In an analysis of these plants, the effect of not returning the blowdown water was to remove about 180,000 tons of dissolved salts annually from the river system. A reduction of 7500 tons of salt per year after 1981 will also result at the Four Corners Plant in New Mexico when facilities are completed for eliminating discharges of fly ash sluice water to the San Juan River.

At the present time, it is expected that, in addition to the nine plants previously mentioned, several more thermal-electric powerplants, with a combined capacity of approximately 1730 megawatts, will be constructed in the Colorado River Basin

by 1990. None of these plants are expected to return salt to the Colorado River System.

Use of Agricultural Drainage Water for Powerplant Cooling

The 1974 California legislature amended the Metropolitan District Act to permit such districts to enter into contracts for the sale of water for use in connection with the generation of electric power. The amendment states in part:

> "b...Every such contract shall provide that agricultural waste water, brackish ground water, or other water not suitable for domestic, municipal, or agricultural purposes shall be utilized for powerplant cooling to the extent practicable and if not immediately available, such waste or brackish water, as it becomes available and to the extent practicable, shall replace the fresh water then being used for such purpose..."

Metropolitan Water District has agreed, in principle, to furnish up to a total of 100,000 acre-feet of Colorado River water each year to sites in the Mojave Desert area for powerplant cooling and related purposes. A plan proposed by the San Diego Gas and Electric Company for the proposed Sundesert nuclear powerplant involved the exchange of water now being used in agriculture for drainage water. Plans for the Sundesert plant have been abandoned and there are no other proposals for powerplants adjacent to the Colorado River in California.

Other states in the Basin are encouraging the use of saline water for cooling purposes. However, complicated water rights or siting problems often must be solved to facilitate such use. This will take time.

Other Uses Associated with Energy Development

Coal Gasification - Two large coal gasification plants are being considered for construction in the Four Corners area of New Mexico. They would have a total initial capacity of 1400 million cubic feet per day. According to current plans none of the water used would be returned to the river system.

Oil Shale - The nation's increasing energy problems, particularly with respect to oil, have caused both industry and government to take significant steps toward development of the tremendous oil shale reserves of the Upper Colorado River Basin. Eight companies or groups of companies have proposed commercial-scale projects in Colorado and Utah. While their status varies, each is recognized as having the potential for someday becoming a reality. One of these companies has a pilot project under construction to test the feasibility of an underground in situ process. Another company, which has a proven above-ground process, has applied to the federal government for aid in constructing a commercial size plant.

All of the oil shale companies have indicated that they intend to manage their retorting process so that no salt will be discharged to the Colorado River system. Saline water encountered in the mining process will either be returned to the

underground strata from which it originated, evaporated in the retorting process or in lined evaporation ponds, or used for compacting spent shale residue. Compaction will minimize salt pickup from precipitation on the spent shale areas. Ditches will be constructed to divert floodwater around the spent shale areas, and drainage water from these areas will be collected and evaporated.

As with the previously described uses wherein water is consumptively used and salts in the water are removed from the river system, the use of Colorado River water in the oil shale industry, with indicated safeguards, should lead to reductions in the salt load of the Colorado River with relatively small increases in downstream concentration. Although the 1975 Forum report anticipated significant development in the oil shale industry, it now appears that little development other than experimental facilities will be on line before 1990.

Coal Slurry Pipelines - Several plans have been announced for coal slurry pipelines to transport coal from western coal fields to more heavily populated areas for use in thermal-electric or coal gasification plants. While no definite plans have been announced for any such pipelines in the Colorado River Basin, the possibility of using saline water to transport coal from the Basin coal fields in Wyoming and Colorado to Texas has been suggested. This would result in reducing the salt load of the Colorado River, with very little increase or, depending on the salinity of the water used, a decrease in downstream con-

centration. Numerous legal and political problems would have to be solved to effectuate such a plan.

Nonfederal Efforts to Cope with Salinity of Colorado River Water Supply

Land Drainage

The Lower Basin users of Colorado River water have spent large sums of money to cope with salinity. Most of the irrigated lands receiving Colorado River water in Arizona and California have man-made drainage facilities to carry away the volume of saline water required to keep soil-water salinity at acceptable levels for farming. Between 1929 and 1977, over $60 million was spent in the Imperial Irrigation District alone for tile drains to combat the effects of saline water. In addition, over $44 million was spent by the district in the same period to line canals and ditches to reduce seepage and thereby reduce drainage problems. It is estimated that an additional $100 million will have to be spent by the district to combat current levels of salinity. Coachella Valley farmers, irrigating about 1/7 of the acreage of Imperial Valley have spent an estimated $15 million to date to install tile drains. Numerous other irrigation districts and farmers are involved in similar programs.

Treating and Blending Water

Many individual water users, as well as water distributing entities, have adopted measures that reduce, to some extent, the harmful effects of high-salinity water. The Metropolitan Water

District of Southern California blends more costly low salinity northern California water, available as a result of the California State Water Project, with the more saline Colorado River water in order to reduce the salinity of the water delivered to its customers. This blending program was halted during the 1977 drought because of the lack of northern California water, but it has now been resumed.

Research and Analysis on Salinity Control in the Colorado River Basin

An effective continuing research and analysis program is an essential component of long-range salinity control in the Colorado River Basin. Several research projects have been funded by various agencies in recent years. These include research on irrigation application rates in the Grand Valley in relation to salinity output which was recently completed by the ARS; a reconnaissance-level investigation by Bresler and Associates directed primarily at the feasibility and cost of recycling and reusing saline waste water and river water; a demonstration project, conducted by Utah State University and funded by Utah Power and Light Company, in which saline waste water from the Huntington Canyon Power Plant is used for irrigation; a study by the University of Wyoming to interpret new and existing data as it relates to the natural interaction of water and rocks in the Green River Basin, with the objective of using the results to evaluate the impact of future water development on salinity in the Colorado River System; and

several studies by the Universities of California and Arizona and the ARS to determine the effect on various crops of water of differing but relatively high salt concentrations.

A recent publication entitled "Optimizing Crop Production Through Control of Water and Salinity Levels in the Soil" is the result of joint efforts of the University of California, the University of Arizona, Utah State University and Colorado State University. Another research project entitled "Salinity Management Options for the Colorado River", by Jay C. Andersen, Alan R. Kleinman and others, has recently been completed.

Denver Research Institute Study

To ensure consideration of all possible state and local measures, the plan of implementation specified as a "research and special studies action" that each basin state, prior to October 1978, would assess its water resources management programs, policies and regulations, and recommend changes in keeping with the salinity control policy and the goal of more efficient water use. In furtherance of this action and on behalf of the seven basin states, EPA decided in 1975 to engage the Denver Research Institute (DRI), University of Denver, as a research contractor to assess state and local management actions.

The DRI study group developed a list of 33 possible state and local management actions that appeared likely to reduce salinity. From these, DRI selected and proposed twelve for state action on the basis of their administrative and technical

feasibility, cost, legality, need, effectiveness in salinity control, scope of applicability, and political and social implications. Of the remaining possible actions, nine were determined by DRI to be already underway in all or some of the states and twelve were judged infeasible or beyond the scope of the study.

At a December 1977 Denver workshop, DRI presented the results of their study to the basin states' 208 planning officials, members of the Forum, and other state officials. After reviewing and incorporating appropriate workshop information and subsequent comments and suggestions submitted by the Forum representatives, DRI finalized its report "State and Local Management Actions to Reduce Colorado River Salinity" in March 1978.

Representatives from each State reviewed the proposed 12 management actions and concluded that: (1) many of the actions are not applicable to individual states or would have limited effectiveness in controlling salinity of the Colorado River, and (2) actions which are applicable have, in most cases, already been fully or adequately implemented.

The 12 proposed management actions are as follows:

1. Regulate irrigation water use so that the water rights holder reduces excess use and implements waste control measures. This may be done by:
   a. Direct action by the agency administering water rights, to limit or control amounts of water diverted if waste occurs; or
   b. Imposing sanctions by the State Engineer, irrigation district or other appropriate agency, on water users using excessive amounts of water.

2. Through the federally funded 208 wastewater planning programs, establish salinity as a priority item to be dealt with and develop a series of local and/or state corrective actions.

3. Because of the need for an integrated approach to salinity control programs, utilize an existing state agency (or establish such an agency) to coordinate and promote salinity control actions by different state institutions.

4. Require minimum standards for water well construction, and require plugging of abandoned water wells and exploratory drill holes to avoid contamination of ground water strata.

5. To reduce salinity from agriculture, use irrigation return flow in nonagricultural areas; e.g., for power plant cooling. Utilize energy facility siting procedures to encourage the use of low quality waters where the water requirements of such facilities could be met utilizing saline and other low quality waters.

6. Through land use controls, prohibit (or limit) irrigated agriculture on lands with high natural salt content in soils and subsoils, and select new lands for irrigation having soils and subsoils that will contribute reduced salt loads to irrigation return flow.

7. Through state economic incentives, promote conversion of land used for irrigated agriculture to other uses when highly saline return flows cannot be prevented, controlled or treated and encourage the modification of vegetation on rangeland (e.g., convert sagebrush to grassland) to reduce natural salinity from storm runoff.

8. Establish special use charges for irrigation water provided from reclamation projects to cause more efficient usage and to encourage waste control measures. Use excess funds derived to finance waste control capital improvements on farms and in the conveyance systems.

9. By use of state economic incentives, promote conversion of marginal agricultural water to other uses, or increase irrigation efficiency, to reduce or eliminate salinity resulting from irrigation return flows.

10. Administratively modify leases of state lands (at time of lease or renewal) to prohibit agricultural practices which cause erosion or excess runoff of saline water, and to improve the land to reduce runoff by: prohibiting agriculture or grazing on certain soil types, restricting grazing intensity, and modifying vegetation on rangeland to reduce salinity from runoff.

11. To reduce salinity from municipal sources, regulate salt loading appliances, such as water softeners.

12. To reduce salinity from industrial sources, require reuse of wastewater to reduce industrial water demand.

The applicability and status of implementation of the actions based on responses obtained from representatives of each of the basin states is shown on Table 5.

TABLE 5

APPLICABILITY AND STATUS OF IMPLEMENTATION OF PROPOSED STATE AND LOCAL MANAGEMENT ACTIONS TO REDUCE COLORADO RIVER SALINITY

Action	Arizona	California	Colorado	Nevada	New Mexico	Utah	Wyoming
1	NA(1)	NA	IM	IM	NA(1)	IM	NA(1)
2	IM	IM(1)	IM	IM	A(2)	IM	IM
3	A(2)	IC(2)	IM(1)	IM(1)	IC	IM	IM
4	IM	NA	IM	IC	IC	IC	IC
5	IM	IM	A(2)	NA(2)	NA(3)	IM	A(2)
6	NA(3)	NA	NA(3)	NA(2)	NA(4)	A(1)	A(2)
7	NA(3)	NA	NA(4)	NA(2)	NA(5)	A(2)	NA(2)
8	NA(2)	NA	NA(5)	NA	NA(6)	A(3)	A(3)
9	NA(3)	NA	NA(6)	NA	NA(4,6)	A(3)	A(3)
10	NA(2,3)	NA	NA(7)	NA	NA(7)	NA	IM
11	NA(2)	IC(3)	NA(8)	IM(3)	NA(8)	NA	IM
12	IM	NA	IM(9)	IM	IC	IC	NA(3)

NA - not applicable
A - applicable but not implemented
IM - being implemented
IC - implementation completed

FOOTNOTES

(See following sheets)

Table 5 Cont.

ARIZONA

(1) The potential for controlling salinity in the main stem of the Colorado River above Imperial Dam is limited. The only major irrigated area is the Colorado River Indian Reservation which has federal decreed water rights and is already implementing water management practices to enable the irrigation of the reservation's full acreage.

(2) The effectiveness of this action for main stem salinity control is limited or questionable.

(3) This action has very limited applicability in the Colorado River main stem drainage; there are limited amounts of highly saline soils and/or surface return flows.

CALIFORNIA

(1) The nondesignated area 208 effort in California includes study of Colorado River salinity problems.

(2) The Colorado River Board of California plays a major role in coordinating and stimulating salinity control actions in the Colorado River system.

(3) The Regional Water Quality Control Board, which issues NPDES permits, has for more than three years included a prohibition of discharge of water softening brines to the Colorado River or ground water basins which are in hydraulic continuity with the river.

Table 5 Cont.

COLORADO

(1) Being implemented through the cooperation of several agencies.

(2) Irrigation return flows are not located in areas of present need.

(3) State has no legal authority in this area but is attempting to implement this action on municipal projects through persuasion. The action is being implemented on federal projects with the full support and encouragement of the state.

(4) State has no legal authority in this area.

(5) This action is politically unacceptable and it is doubtful whether the state has legal authority to implement the action.

(6) The state has no legal authority or funds to implement this action.

(7) State lands in this category are very minimal and have negligible impact on salinity.

(8) This action will have negligible impact on the salinity of the Colorado River as there are very few water softeners in use.

(9) There is no legal requirement for wastewater reuse, but because of the no discharge policy most industries are reusing wastewater for economic reasons.

Table 5 Cont.

NEVADA

(1) Being implemented under the 208 Program.

(2) The applicability of this action is very limited because the amount of return flow from irrigated agriculture is very small.

(3) Being implemented through an intensive educational program.

NEW MEXICO

(1) At the present time some irrigators divert more water than needed. The excess is returned to the San Juan River through wasteways and natural drainage channels. It does not appear that these excess diversions materially affect salinity or conservation. However, in a few years the demand on Navajo Reservoir and the river system will reduce the flows available during most of the year to those necessary to just meet the demand of the water rights. At that time excess diversions will be terminated and, sluicing and returning through wasteways, will be reduced to a minimum.

(2) Some salinity alleviation might be achieved through Section 208 programs. The amount, if any, cannot be evaluated at this time.

(3) Best possible measures are being incorporated in new projects. Most present irrigated lands are not highly saline.

Table 5 Cont.

NEW MEXICO - Cont.

(4) Acreage with saline soils has been eliminated from new irrigation projects. Present irrigated lands are not highly saline.

(5) There is little opportunity for this in New Mexico.

(6) Because of non-saline soils and minimal canal and return flow losses, this action is not applicable. Currently, sprinkler systems are being installed to reduce labor costs.

(7) State lands in the basin are limited and the soils are not highly saline.

(8) Current use of water softeners is minimal.

UTAH

(1) A comprehensive land use act was defeated by referendum in 1974.

(2) DRI report indicates Utah is doing all that it can to encourage implementation by other means.

(3) The state has no legal authority to implement this action.

WYOMING

(1) State law does not permit excessive diversions.

(2) Situations warranting such action are very limited.

(3) The situation in Wyoming is not sufficiently significant to currently warrant such action at this time.

Studies Currently Underway

The Bureau of Reclamation is presently planning to conduct solar pond field investigations at the Las Vegas Wash Unit site. The objective of this study is to reduce the costs of solar pond brine containment for all the salinity control units under planning study. The field investigation will determine actual evaporation rates, effects of concentrated brine solution, and cost saving design parameters.

The Bureau is also financing a study by Colorado State University in Paradox Valley, Colorado. This study will attempt to ascertain whether a concentrated brine evaporation reservoir, such is proposed for the Paradox Valley Unit, will have an adverse effect on migrating waterfowl.

Utah State University is conducting a study on salt contributions of National Resource Lands. This research is an extension and expansion of the earlier BLM studies. BLM has finished the studies on overland flow, which
Forum report, and is now studying the effects of water which percolates to rather shallow depths and enters the stream channel after a short path through the underground formation.

Additional Studies Needed

While the past and ongoing salinity studies have answered and will answer many of the questions that originally were raised at the beginning of the salinity control program, some additional studies are needed.

More knowledge on evaporation ponds is needed. Studies are underway on the proposed ponds at the Las Vegas Wash. Additional research is currently underway regarding types of linings, design of spray nozzles, pond configuration, and additional methods for increasing evaporation rates. The research should be conducted so that the results could be generally applied instead of being site specifics.

Another research need concerns the precipitation of salts in reservoirs. There is an indication that this takes place and it has been verified on a laboratory basis, but there have been no extensive studies as to what is actually happening. Field investigations should be made to ascertain whether salt precipitation in reservoirs is significant, whether it is confined to certain reservoirs or is widespread and whether the salts stay precipitated or again dissolve as conditions, such as temperature or amount of water in storage, change or reservoir turnover occurs.

Comparison Between Costs and Economic, Social and Environmental Impacts

During the Forum's studies leading to the 1975 report, it was considered premature to attempt overall comparisons of the costs of the salinity control measures and the economic, social and environmental accomplishments of those measures. Much of the available cost and benefit data is still in a preliminary form and subject to very substantial revision as

the studies progress. Thus, an evaluation now could be highly misleading.

An extensive review and reanalysis of past estimates of the economic effects of salinity increases has just been completed. This reanalysis was conducted by representatives of the Bureau of Reclamation and a consortium of western universities including the University of Arizona, University of California, Colorado State University, University of Colorado, and Utah State University. A review draft of the consortium report is now available.

The draft report provides the basis for the net benefits of the authorized salinity control projects. Based on these data, the economic effect is shown in the following tabulation:

Unit	Total Annual Equivalent Economic Cost Including OM&R	Potential Annual Range in Value of Economic Benefits
Paradox Valley	$ 3,581,000	$ 5,915,000 to $ 6,825,000
Grand Valley	10,793,000	13,925,000 to 16,125,000
Las Vegas Wash (Stage I)	3,000,000	1,300,000 to 1,500,000

A comprehensive Environmental Impact Statement for the Colorado River Water Quality Improvement Program was filed in May 1977. This statement discusses in general the environmental effects of each of the salinity control units of the program.

It also includes a detailed final EIS for the Las Vegas Wash Unit. An environmental assessment for the Grand Valley Unit was completed in December 1977, and an EIS is being prepared for the total project. The draft EIS for the Paradox Valley Unit was transmitted for public review in May 1978 with public hearings held in June 1978. An EIS for each of the other units will be prepared as companion documents to the feasibility reports for those unite.

Each of the units will have some locally unfavorable environmental effects in terms of the removal of natural vegetaion, changes in land surface configuration by construction and the addition of facilities and creation of permanent surface salt deposits. On the other hand, the facilities will reduce local low flow salt concentrations and salt encrustation along certain streams. Reductions in salinity will have some desirable environmental effects throughout the balance of the Basin. Impacts on fish and wildlife are being examined for each of the units and provisions for mitigation of habitat loss are being included when applicable.

At this time, and if all elements proceed together on a basinwide basis, it appears clear to the states that the social and environmental impacts of the plan of implementation will be beneficial. Every effort will be made to keep the localized environmental effects, where construction is necessary, to the minimum. Stopping the upward trend in salinity while the basin

states continue to develop and use their compact-apportioned water will provide positive social benefits.

Some salinity control projects will result in increased water depletions from limitations on point source discharges and from natural source control aspects of the plan of implementation. The salinity control projects involving better water management practices on irrigated crop land may result in decreased depletions. These aspects will be examined in the individual EIS for each of the control units and in future revisions of the plan of implementation as more experience and data become available.

The states will continue to advise and comment on USBR proposals, evaluations, and other data as they are developed and will support only those measures that are justified. These analyses will involve comparisons of costs and benefits in terms of economic, environmental and social perspectives. Multi-objective analyses and environmental impact statements are essential parts of the analysis. Cost effectiveness of each unit and alternatives within each unit will be the paramount consideration consistent with P.L. 93-320 and the Clean Water Act of 1977.

CHAPTER VI
MEANS OF MAKING PLAN OPERATIONAL

The plan of implementation for salinity control will require additional legislative authorization for the construction of control units, clear delineation of the responsibility of the various participants, and the continuation of a monitoring program.

Legislation Needed to Carry Out Programs

Federal Programs

USBR Water Quality Improvement Program. P.L. 93-320 authorized the completion of planning reports for 12 salinity control units of the Bureau of Reclamation's Colorado River Water Quality Improvement Program (CRWQIP). These and other units of the CRWQIP will require specific construction authorization by Congress. It has been assumed for purposes of this report that all of these units, or their equivalent, will be in operation by 1990, except as noted, with initial operation estimated as follows:

Salinity Unit	Date of Initial Operation
Lower Gunnison Basin	1983
Unita Basin	1983
LaVerkin Springs	1984
Glenwood-Dotsero Springs	1986
Lower Virgin River (formerly Littlefield Springs)	1985
Price River	1988
San Rafael River	1988
Dirty Devil River	1988

McElmo Creek	1987
Big Sandy River	1987
Meeker Dome 1/	1986
Colorado River Indian Res.	Deferred
Palo Verde Irrigation Dist.	Deferred

The preceding estimated dates of initial operation were based on the Bureau of Reclamation's August 1977 schedule for completion of feasibility reports. The Bureau's 1978 schedule, discussed in Chapter V, would delay the initial operation of the projects, but it is anticipated that the units could be on line by 1990.

Changes and revisions of units assumed in operation in the 1975 Forum report have occurred. The Palo Verde Irrigation District Unit in California and Colorado River Indian Reservation Unit in Arizona have been deferred. Studies by contract consultants and the Bureau of Reclamation have concluded there is little chance for cost effective salinity reduction from water system improvements (lining of canals and laterals) for these two units. However, on-farm improvements may provide some salinity reduction. The Meeker Dome Unit, Colorado, with an estimated salinity reduction potential of 57,000 tons of salt per year, has been added to the list of those in operation by 1990. The Littlefield Springs Unit has been expanded and reformulated by the Bureau into a new unit, the Lower Virgin River Unit, with a

---

1/ Not identified under P.L. 93-320, but included in units assumed completed for salt routing studies.

substantial increase in estimated salt removal. Delays in the estimated completion dates of other units listed above range from one to three years. These estimates reflect delays in initiation of IMS programs and the completion of feasibility reports on various units. The Irrigation Management Services programs of the Bureau of Reclamation for Lower Gunnison and Unita Basin Units were initiated in 1974 and are continuing.

The delays being experienced are having a significant impact on the prospects for meeting the numeric criteria by 1990. Based on past experience, it is apparent that acceleration and simplification of the process for feasibility report preparation are necessary to further define the control units. In addition, legislative authorizations and appropriations are necessary if the salinity control units are to be completed in a timely manner. Requests for authorization for each unit should be made promptly after completion of the planning reports, but the specific timing is difficult to determine at present. As in the case of Title II of P.L. 93-320, authorizing legislation will need to specify the financing, cost-sharing and repayment arrangements for the projects.

Department of Agriculture Program. Participation by the Department of Agriculture in the Colorado River Basin Salinity Control Program in accordance with P.L. 93-320 is being carried out under a cooperative agreement between the USDA and the Department of the Interior. In addition, specific agreements

between participating agencies have been developed to cover investigations and programs by USDA agencies on individual projects. Primary emphasis has been on studies to identify areas contributing to salt loading, and investigations of on-farm measures to increase irrigation efficiencies and reduce salt loading from irrigated areas. Adequate authority exists for activities related to salinity control under the various programs of the USDA. Funding for ongoing salt source studies and other research efforts has generally been adequate and should be continued. Funds for construction and implementation of on-farm programs, such as the plan developed for the Grand Valley Unit, have not been made available and are badly needed.

Bureau of Land Management and Forest Service Programs. Lands under control of the Bureau of Land Management and the Forest Service contribute to the total salt load of the river. No specific action or legislation relating to controlling salinity from these lands is provided in the present plan. The BLM has been studying the contribution of salinity to the river from National Resource Lands, however, with emphasis on the Upper Colorado River Basin. As more information is available from these and other studies, the potential for salinity alleviation can be established and necessary legislation identified.

Financing Salinity Control Projects

There are many entities and levels of government concerned with the salinity of the Colorado River. However, only the federal government is involved in all the major basinwide aspects of the salinity problem, and a solution is only possible in a basinwide context. The governments of the United States and Mexico have agreed that terms of Minute 242 constitute a permanent and definitive solution to the problem of the salinity of the water delivered to Mexico; however, without upstream salinity control, the problem may not remain resolved.

Federal lands, including Indian reservation lands, are the source of most of the naturally occurring salts in the river. Accordingly, it is believed that the federal government is the appropriate unit of government to finance the salinity control projects, and to be allocated a major share of costs.

Financing and Repayment

In enacting P.L. 93-320, Congress recognized the federal responsibility for the Colorado River as an interstate stream and adopted a cost-sharing formula which provides that 75 percent of the costs of the four salinity control projects authorized by Title II of the Act shall be nonreimbursable. The remaining 25 percent of the costs are to be repaid from the basin funds of the Upper and Lower Colorado River Basins. The Act directs the Secretary to consider the benefits to

each of the Upper and Lower Basins from improved water quality, the causes of salinity, and the availability of revenues in each of the basin funds in determining the allocation of costs. However, the maximum allocation to the Upper Basin Fund for any unit is not to exceed 15 percent of the total costs allocated to the two basin funds, with the remainder to be allocated to the Lower Basin Fund.

The cost-sharing arrangements for the other salinity control units authorized for study in the Act will be determined when these projects are authorized. However, the Colorado River Basin Salinity Control Advisory Council has recommended that the same 75 percent federal, 25 percent basinwide financing arrangement be applied to these other units presently under investigation. The Advisory Council, composed of members appointed by the Governor or each of the seven Colorado River Basin states, was created under Title II of P.L. 93-320.

In the case of the Upper Colorado River Basin Fund, revenues necessary to meet the repayment obligations for this fund will be generated by an increase in electric power rates. The costs allocated for salinity control to the Lower Colorado River Basin Development Fund will come from a portion of the power revenues accruing to this fund that were previously to be used for possible projects constructed to augment the flow of the Colorado River.

Thus, power and water users of the Upper and Lower Basins will be paying a part of the costs allocated to the salinity control units.

Additional costs that are not part of the salinity control projects mentioned in Title II of the Act will be incurred by the federal and state governments and by private and local governmental entities in implementing measures that will control the river's salinity. The financing on each particular action or measure will have to be individually determined.

Responsibility for Accomplishing Salinity Control Measures

The plan of implementation recognizes that the Forum, the several federal agencies, and the basin states each have specific responsibilities for furthering the salinity control program. Table 6 presents in summary form the elements of the plan of implementation, including actions to be taken, the time schedule and the responsible entities.

The Forum will provide overall coordination and a continuing review of salinity changes and of program effectiveness. Every three years, or more often if necessary, the Forum, in light of existing depletions and salt concentrations, will reconsider and, where needed, revise the schedule for installing salinity control measures and/or modify the numeric criteria. The review will include both federal and non-federal programs.

Appropriate federal agencies will complete planning reports and seek authorizations and funding for salinity control in accordance with Title II of P.L. 93-320. The Basin states will lend their support to requests for authorization and funding.

TABLE 6
TIMING AND RESPONSIBILITY FOR ACCOMPLISHING IMPLEMENTATION PLAN

Activity or Source of Salinity	Action to be Taken	Timing	Entities Responsible for Taking Action
Paradox Valley Unit	Complete Definite Plan Report	Sept 1978	USBR 1/
	Environmental Statement	Sept 1978	1/
	Provide the leadership and resources required to maintain local and Basin support for project implementation	October 1975 through construction	USBR, State of Colorado, Forum
	Install pumps and pipeline; construct reservoir	1980-1983	USBR
	Initial year of salt removal	1983	Congress & Federal Administration
Grand Valley Unit			
Water Systems Improvement	Complete Definite Plan Report	July 1978	USBR; SCS
	Negative Determination of EIS on Stage I. EIS Remainder of Unit	July 1978	
	Improve canals, laterals, and on-farm irrigation systems	July 1978 1978-1990	USBR; SCS; State of Colorado
Irrigation Management Services and On-Farm Improvements	Complete demonstration program; expand program to full area; arrange for local agency to finance and administer program	Demonstration underway; transfer to water users - 1990	USBR; SCS; State of Colorado; local entities
	Initial year of salt removal	1979	Congress & Federal Administration
General	Provide the leadership and resources required to maintain local and Basin support for project implementation	October 1975 through construction	USBR; SCS; State of Colorado; Forum
Crystal Geyser Unit	Complete Definite Plan Report	Completed June 1976	USBR 1/
	Negative Determination of EIS	June 1976	USBR 1/
	This unit has been indefinitely deferred because of its low cost effectiveness		

TABLE 6 (Continued)
TIMING AND RESPONSIBILITY FOR ACCOMPLISHING IMPLEMENTATION PLAN

Activity or Source of Salinity	Action to be Taken	Timing	Entities Responsible for Taking Action
Las Vegas Wash Unit	Complete Definite Plan Report Environmental Statement	Nov. 1978 Completed May 1977	USBR 1/
	Construction of this unit has been indefinitely deferred, owing to changing conditions as outlined in Chapter V. The project is to be reformulated.		
Lower Gunnison Basin Unit			
Water Systems Improvement Uncompahgre Project Portion	Complete Feasibility Report	Dec. 1979	USBR; SCS; State of Colorado 1/
Balance of Lower Gunnison Basin Area	Complete Feasibility Report	Sept. 1983	USBR; SCS; State of Colorado 1/
Irrigation Management Services And On-Farm Improvements	Complete demonstration program; expand program to full area; arrange for local agency to finance and administer program	Ongoing 2/ IMS On-Farm through 1990	USBR; SCS; State of Colorado; local entities
	Initial year of salt removal	1981	Congress & Federal Administration
Uinta Basin Unit			
Water Systems Improvement	Complete Feasibility Report	Dec. 1979	USBR; SCS; State of Utah 1/
Irrigation Management Services and On-Farm Improvements	Complete demonstration program; expand program to full project area; arrange for local agency to finance and administer program	Ongoing 2/ IMS transfer to water users FY 1981 On-Farm thru 1990	USBR; SCS; State of Utah; local entities
	Initial year of salt removal	1983	Congress & Federal Administration
Meeker Dome Unit	Complete Feasibility Report	Dec. 1981	USBR
	Initial year of salt removal	1986	Congress & Federal Administration

TABLE 6 (Continued)
TIMING AND RESPONSIBILITY FOR ACCOMPLISHING IMPLEMENTATION PLAN

Activity or Source of Salinity	Action to be Taken	Timing	Entities Responsible for Taking Action
Colorado Indian Reservation Unit			
Water Systems Improvement	Complete Status Report	June 1978	USBR; BIA; Colorado River Tribal Council 1/
	No further investigations scheduled at this time		
On-Farm Improvements			SCS
Palo Verde Irrigation Dis District Unit			
Irrigation Management Services and On-Farm Improvements	Status Report Further scheduling dependent on results on on-going 208 Program	June 1978	USBR; State of California; Palo Verde Irrig. Dist.
Water Systems Improvement	Complete Status Report	June 1978	USBR; State of California; Palo Verde Irrig. Dist. 1/
LaVerkin Springs Unit	Complete Feasibility Report	Dec. 1978	USBR; State of Utah 1/
	Initial year of salt removal	1984	Congress & Federal Administration
Lower Virgin River Unit (formerly Littlefield Springs Unit)	Complete Feasibility Report	October 1981	USBR; States of Arizona, Nevada 1/
	Initial year of salt removal	1985	Congress & Federal Administration
Glenwood-Dotsero Springs Unit	Complete Feasibility Report	October 1982	USBR; State of Colorado 1/
	Initial year of salt removal	1986	Congress & Federal Administration

TABLE 6 (Continued)
TIMING AND RESPONSIBILITY FOR ACCOMPLISHING IMPLEMENTATION PLAN

Activity or Source of Salinity	Action to be Taken	Timing	Entities Responsible for Taking Action
Price River Unit	Complete Feasibility Report	Sept 1982	USBR; State of Utah 1/
	Initial year of salt removal	1988	Congress & Federal Administration
San Rafael River Unit	Complete Feasibility Report	Sept 1982	USBR; State of Utah 1/
	Initial year of salt removal	1988	Congress & Federal Administration
Dirty Devil River Unit	Complete Feasibility Report	Sept 1983	USBR; State of Utah 1/
	Initial year of salt removal	1988	Congress & Federal Administration
McElmo Creek Unit	Complete Feasibility Report	Sept 1980	USBR; State of Colorado 1/
	Initial year of salt removal	1987	Congress & Federal Administration
Big Sandy River Unit	Complete Feasibility Report	Sept 1983	USBR; State of Wyoming 1/
	Initial year of salt removal	1987	Congress & Federal Administration
Reformulation of Authorized Projects	Develop revised plan to reduce salinity contribution; prepare revised Definite Plan Report	Ongoing 2/	USBR; affected states & local entities 1/
Industrial Discharges	The objective for industrial discharges shall be a no-salt return policy wherever practicable. EPA has endorsed the policy statement of the Forum and each state that has permit issuing authority has adopted the policy, except Wyoming. All states are following the Forum policy regarding NPDES permits	Nov. 1975	Each state or EPA
Agricultural Discharges		Ongoing 2/	Affected state and/or EPA
	Conduct educational program.	1975 through 1990	Affected state

TABLE 6 (Continued)
TIMING AND RESPONSIBILITY FOR ACCOMPLISHING IMPLEMENTATION PLAN

Activity or Source of Salinity	Action to be Taken	Timing	Entities Responsible for Taking Action
Measures to Cope With Salinity	Expand land drainage system in Lower Basin	Ongoing[2]	Local agencies
	Treating and blending Colorado River water	Ongoing[2]	Local agencies
Research and Special Studies	Research on irrigation water application in relation to salinity output, Grand Valley, Colorado, and Wellton-Mohawk, Arizona, areas	Ongoing[2]	ARS; USBR; EPA; States of Colorado and Arizona
	Other research and demonstration projects in the Grand Valley area	Ongoing[2]	Colorado Water Conservation Board
	Studies of using waste chemical products in desalting by ion exchange and application of ion exchange process; research on the application of solar distillation	Completed	USBR
	Studies of salt precipitation in reservoirs	Not yet Scheduled	USBR
	Studies of land processes contributing to salt production from diffuse sources	Ongoing[2]	BLM; Utah State University
	Studies of channel processes contributing to diffuse salt production	Completed	USBR
	Study of the natural interaction of water and rocks in the Green River Basin	Ongoing[2]	University of Wyoming

TABLE 6 (Continued)
TIMING AND RESPONSIBILITY FOR ACCOMPLISHING IMPLEMENTATION PLAN

Activity or Source of Salinity	Action to be Taken	Timing	Entities Responsible for Taking Action
Research and Special Studies (continued)	Studies of the effect of differing but relatively high salt concentrations on various crops	Complete	Universities of Arizona and California; ARS
	Studies of other areas where production of salts from non-point sources is significant (the scope and makeup of this study will depend on results from the research already underway)	On-going	USBR; BLM; EPA; affected states
	Studies in other areas of the extent to which increases in irrigation efficiency will be effective in reducing salt loading (the scope and makeup of this study will depend on results from the research already underway)	Not yet scheduled	EPA; affected states
	Identify and evaluate state water resources management programs, policies and regulations and assess them for the purpose of identifying where they can be redirected toward salinity control policy	DRI Investigation Completed revised report	Each Basin State EPA, DRI
	Identify recommended changes in water resources programs, regulations and policies	On-going ~~October 1978~~	Each Basin State
	Examination of municipal discharges as a source of salinity and of possible control measures	Not yet scheduled Calif. completed	Each Basin State
	Studies of brine pond cost reduction	On-going	USBR

TABLE 6 (Continued)
TIMING AND RESPONSIBILITY FOR ACCOMPLISHING IMPLEMENTATION

Activity or Source of Salinity	Action to be Taken	Timing	Entities Responsible for Taking Action
Research and Special Studies (Continued)	Study of relationship between sediment production and salinity	On-going	CSU
208 Planning Programs	Develop 208 Management Plan and Approval		
Arizona		Sept. 1978	Northern Arizona Council of Gov'ts
California			
Statewide		Sept. 1979	Calif. Reg. Water Quality Control Board
Colorado			
Colorado West Area		Sept. 1978	Colo. West Area COG
Northwest Colorado		July 1978	Northwest Colo. COG
Statewide		March 1979	Colo. Water Qual. Control Division
Nevada			
Clark County		June 1978	Clark Co. Comms.
Statewide		Late 1978	Nev. Dept. of Natural Resources
New Mexico			
Statewide		May 1979	New Mex. Water Quality Control Commission
Indian Lands		June 1979	Navajo Tribal Council

TABLE 6 (Continued)
TIMING AND RESPONSIBILITY FOR ACCOMPLISHING IMPLEMENTATION PLAN

Activity or Source of Salinity	Action to be Taken	Timing	Entities Responsibility for Taking Action
208 Planning Programs (Continued)			
Utah			
Southwestern		Aug. 1978	Five County Assn. of Governments
Uintah Basin		Aug. 1978	Uintah Basin Assn. of Governments
Southeastern		Sept. 1978	Southeastern Utah Assn. of Govts.
Six County Area		Nov. 1978	Six County Assn. of Government
Wyoming			
Southwestern		Oct. 1978	Southwestern Wyo. Water Quality Association
Statewide		Nov. 1978	Wyoming Dept. of Environmental Quality
Other Activities	Analyze the monitoring program to determine the adequacy of the selected stations for the establishment of baseline salinity values	1979	Forum and Seven States
	Develop baseline salinity values for the specified monitoring points	1979	Forum

TABLE 6 (Continued)
TIMING AND RESPONSIBILITY FOR ACCOMPLISHING IMPLEMENTATION PLAN

Activity or Source of Salinity	Action to be Taken	Timing	Entities Responsible for Taking Action
Other Activities (Continued)	Prepare annual report on salinity control program and effect of other activities having an influence on salinity	1976 & 1977 completed, annually thereafter	Forum
	Reconsider and where necessary revise schedule for installing salinity control measures and/or modify the numeric criteria	1981 or before; at least each 3 years thereafter	Seven States
	Investigation of measures for limiting salinity in addition to those now in the plan of implementation to be applied after about 1990	1981 and thereafter	Seven States

1/ States will review and comment on research and special studies, feasibility reports, environmental impact statements, and definite plan reports.

2/ Some on-going programs will continue indefinitely; others will have dates assigned for either completion or significant action after they have progressed further.

Identifying and Evaluating Progress in the Salinity Control Program

Progress in the salinity control program will be monitored and evaluated on a continuing basis. Changes in the plan of implementation will be considered annually as appropriate. Also annually, the states, acting through the Forum, will prepare a report which will summarize pertinent results and progress of the salinity control program and the effect of other actions in the basin having an influence on salinity. The report will be transmitted to the Environmental Protection Agency, to state water resources and pollution control agencies, and be available to others interested in the salinity control program.

Baseline salinity values are being developed for 12 monitoring points on the main stem of the Colorado River and major tributaries other than the three mainstream locations for which numerical criteria for salinity have been established. The determination of the baseline values, or ranges of values, will be based on historic flow and quality data modified to the 1972 level of development. A more complete explanation of the computation of the baseline values and a list of locations is given in Chapter IV. As the states continue to develop their water use and as salinity control measures are implemented, salinities at the monitoring points will be compared to the established baseline values. Future adjustments to the baseline values may be necessary.

Procedures for Adopting Revised Standards

Prior to state adoption of the revised standards, public review and discussion will be sought through public meetings. The Forum proposes to hold two regional meetings, at Las Vegas, Nevada, and at Grand Junction, Colorado, to describe the basinwide nature of the salinity problem and the control program and to solicit views from interested agencies, groups, and individuals.

In accordance with provisions of the Clean Water Act, and as outlined in Chapter VIII of the 1975 Forum Report, each of the states in the basin plans to adopt this revision as its salinity standards for the Colorado River Basin, and transmit the revised standards to the Environmental Protection Agency in early 1979. Because of difficulties encountered in the salt routing studies, the states will be unable to meet the October 18, 1978 deadline, but contemplate transmitting standards by early 1979. In spite of this delay, it should be noted that there is no recommendation for change in the numeric criteria for salinity at the three lower main stem stations. Adoption by each state will be accomplished according to the required procedures of each state.

CHAPTER VII

FUTURE POSSIBLE SALINITY CONTROL PROGRAMS

The plan of implementation presented in the 1975 Forum report included all of the salinity control projects authorized or identified for further study by Title II of P.L. 93-320 as part of the Colorado River Water Quality Improvement Program of the Bureau of Reclamation. Since then, the Meeker Dome Unit near Meeker, Colorado, has been added to the program and the Littlefield Springs Unit has been expanded. These units are discussed in Chapter V of this report.

Because the analyses presented in this report cover the period up to 1990 only, and because development will continue to occur beyond 1990, other means of limiting the salinity level must be continuously sought. Only a few of the following described actions have been evaluated in any depth, and their effectiveness and feasibility do not show promise at this time. The others have undergone only very preliminary investigation and their feasibility is not known. Because of the relatively short period before some of them may be required, it is important that a state-federal program to examine these and other possibilities be initiated as expeditiously as possible. Obviously, wherever possible, these investigations will need to be conducted concurrently with the detailed studies and construction program required to carry out the plan of implementation.

Return Flow Utilization

Increasing demands for energy in and near the Colorado River

Basin has focused attention on the need for water to meet projected cooling requirements for energy conversion and power production. A potential source of water for these and other industrial purposes is the return flow from irrigated agriculture which occurs in substantial quantities throughout the Colorado River Basin. The Grand Valley area in Colorado and the San Juan Basin area in New Mexico have been suggested as having potential for such uses of saline return flow. An effort should be made to identify other areas with like potential.

Grand Valley Collection System, Colorado

Part of the return flow from the 60,000 acres of irrigated land in the Grand Valley returns to the Colorado River as surface runoff with little salinity impact. However, a considerable portion returns as highly saline ground water effluent. Investigations to determine the feasibility of collecting the more saline return flows and using them for coal gasification, power plant cooling, or other industrial purposes commenced in 1976; no date has been scheduled for a feasibility report. After some preliminary work, the Bureau of Reclamation decided that it would be impossible to predict either the quantity or the quality of the future return flows with sufficient accuracy for a feasibility report until after some of the proposed Grand Valley salinity control measures had been constructed and their effects had been verified. Therefore, further investigations have been deferred until a later date.

San Juan Collecter System, New Mexico

A San Juan Collecter System feasibility investigation to evaluate the concept of collecting water of impaired quality in the

San Juan Basin of New Mexico originally was scheduled for completion in Fiscal Year 1976. It was estimated that about 100,000 acre-feet per year might be available for use in coal gasification, power production, or other industrial purposes. It was assumed that much of the water would be return flow from the Navajo Indian Irrigation Project. After preliminary studies, it was decided that there would be considerably less return flow from this project than was originally estimated, since most of the area would be sprinkler irrigated. There are also other problems such as: the long distance involved, the numerous points of collection, the likely sediment-laden condition of the drainage water, gross assumptions made regarding the quality of the of the ground water aquifer created, and the match-up of supply and demand for this water. Therefore, further work on this proposal has been deferred pending definitive return flow data from the Navajo Indian Irrigation Project and the resolution of some of the other problems.

Weather Modification

The largest winter orographic cloud seeding experiment in the United States, the Colorado River Basin Pilot Project, was conducted by the Bureau of Reclamation in the San Juan mountains of southwest Colorado. Actual cloud seeding activities under this project were completed in April 1975, and an evaluation of the project results was prepared by Aerometric Research, Inc., of Goleta, California in 1976.

At the present time, Congress has approved planning funds for a demonstration project for Fiscal Year 1979. The Bureau is optimistic that funding for the actual demonstration project will be

available by 1980 or 1981. In the meantime, the planning and design for the project will continue.

The Bureau has estimated that, on a large-scale demonstration and research basis, the potential augmented flows available to the Colorado River System could average 700,000 acre-feet annually. On a full-scale operational seeding program, they have estimated there is a potential for an average annual contribution of 1.3 million acre-feet to the system.

It is axiomatic that, if the flow of the Colorado River is increased through weather modification, there will be an increase in the tonnage of salt that must be carried by the river. However, because of the additional flow a reduction in concentration will result. As long as a substantial portion of the augmented supply is allowed to flow directly down the river system to the Lower Basin, the water quality in the river below Lee Ferry will be improved. The total tonnage of salt in the system would increase but concentration would be reduced. On the other hand, if the augmented supply is consumptively used in the Upper Basin by projects having return flows, the quality to the Lower Basin will be degraded.

Projections of water resources development indicate that augmentation by weather modification would reduce salinity concentration in the lower main stem well beyond 1990.

Desalting Sea Water

Desalting sea water has been suggested as a possible means of augmenting the water supply of the lower main stem of the

Colorado River. This would also improve the quality of water in the river.

Because of the extremely high cost and other factors, including the high energy demands, major augmentation of the lower main stem of the Colorado River by means of the sea water conversion, exclusively for water quality improvement, is not practicable for the foreseeable future.

Desalting River Flows

Desalting Colorado River flows is another potential means of salinity control in the Colorado River Basin. It is technically possible to utilize desalting plants in several situations. Plants might be sited to desalt point sources or collected nonpoint source discharges such as irrigation return flows. Plants could be located to desalt the flows of some of the more saline tributaries. Also, the quality of water being diverted for use could be improved by being desalted in whole or in part. None of these alternatives has been given more than cursory attention because of high energy costs and large power demands.

Phreatophyte Eradication

Phreatophyte eradication has been suggested as a means for salinity control in the Colorado River Basin. Phreatophytes are water-loving plants which consume large quantities of fresh water and exist along stream channels and floodplains. Any reduction in phreatophytes would result in corresponding reductions in loss of fresh water and improvements in the river's salinity.

The Bureau of Reclamation made a preliminary study in the

middle 1970's of the potential for phreatophyte reduction and the impact such reduction might have on wildlife habitat. They concluded that, because of the present environmental climate, large-scale phreatophyte elimination would be politically infeasible and no further studies have been made.

Vegetation Management

A possible way in which the water supply of the Colorado River could be augmented is through large-scale manipulation of vegetative cover. It has long been realized that natural vegetation has a significant effect on runoff and streamflow. Numerous studies and experiments have been performed over the past few decades to establish exact relationships. Some of the largest of these were in the Colorado Rocky Mountains under the direction of agencies of the U. S. Department of Agriculture.

Because of environmental and funding problems, no significant augmentation due to watershed and vegetative cover management are expected by 1990. Moreover, an increase in water supply by this means would not necessarily decrease salinity. Increasing river supply through vegetation management would encounter similar problems as those associated with weather modification. Erosion reduction by vegetation management would decrease salinity.

Importing Water from Outside the Basin

Importing water of low mineral content directly into the lower main stem would reduce the salinity of the Colorado River if water is not consumptively used in the drainage basin. However, the cost of all importation schemes that have been proposed would be

tremendous, and they are complicated by legal and political problems. There is little likelihood of any large-scale importations in the foreseeable future.

Transfer of Water from One Use to Another in the Same State

Changes in the place and type of use can have an effect on salinity. There are indications that there will be future transfers of water from agricultural to industrial use in some of the energy-rich areas of the Upper Basin. In most instances, this would result in a decrease in the salt load because there would be little or no salt return from industry due to the no-salt return policy for industrial discharges.

CHAPTER VIII

PROVISION FOR REVISING AND UPDATING STANDARDS INCLUDING NUMERIC CRITERIA AND PLAN OF IMPLEMENTATION

The plan of implementation and the numeric criteria are to be continuously reviewed in the light of changed conditions or new information. Revisions to the plan of implementation and upward or downward changes to the numeric criteria will be considered at three-year intervals.

The Colorado River Basin Salinity Control Forum in its statement of "Principles and Assumptions for Development of Colorado River Salinity Standards and Implementation Plan," approved by the Forum on September 20, 1974, included Principle 7 as follows:

***

> "7. The plan of implementation shall be reviewed and modified as appropriate from time to time, but at least once each 3 years. At the same time, the [numeric] standards, as required by Section 303(c)(1) of PL 92-500 shall be reviewed for the purpose of modifying and adopting standards consistent with the plan so that the Basin States may continue to develop their compact-apportioned waters while providing the best practicable water quality in the Colorado River Basin."

***

The Forum took this position because the Colorado River is a large and complex area with many problems. A wide range of research, technical studies, and actions are underway and much knowledge is yet to be gained. Usable procedures for dealing with much of the salinity of irrigation return flows are only in the initial stages of development. Construction on the

authorized units in the USBR salinity control program is underway. There are as yet no firm procedures for the financing or cost sharing of salinity control works other than for the four authorized units of the USBR program.

The permanent Work Group continues to keep current with salinity control efforts and suggests revisions. The Work Group operates under a schedule which enables the states to take action on any potential revisions by the required revisions date.

APPENDIX A

"Policy for Implementation of the
Colorado River Salinity Standards
Through the NPDES Permit Program"
February 28, 1977

POLICY FOR IMPLEMENTATION OF THE COLORADO RIVER SALINITY STANDARDS THROUGH THE NPDES PERMIT PROGRAM

Prepared By

The Colorado River Basin Salinity Control Forum
February 28, 1977

In November 1976, the United States Environmental Protection Agency Regional Administrators notified each of the seven Colorado River Basin states of the approval of the water quality standards for salinity for the Colorado River System as contained in the document entitled "Proposed Water Quality Standards for Salinity Including Numeric Criteria and Plan of Implementation for Salinity Control, Colorado River System, June 1975," and the supplement dated August 25, 1975. The salinity standards including numeric criteria and a plan of implementation provide for a flow weighted average annual numeric criteria for three stations in the lower main stem of the Colorado River: below Hoover Dam, below Parker Dam, and at Imperial Dam.

The Plan of Implementation is comprised of a number of Federal and non-Federal projects and measures to maintain the flow-weighted average annual salinity in the Lower Colorado River at or below numeric criteria at the three stations as the Upper and Lower Basin states continue to develop their compact-apportioned waters. One of the components of the Plan consists of the placing of effluent limitations, through the National Pollutant Discharge Elimination System (NPDES) permit program, on industrial and municipal discharges.

The purpose of this policy is to provide more detailed guidance in the application of salinity standards developed pursuant to Section 303 and through the NPDES permitting authority in the regulation of municipal and industrial sources. (See Section 402 of the Federal Water Pollution Control Act.) This policy is applicable to discharges that would have an impact, either direct or indirect on the lower main stem of the Colorado River System. The lower main stem is defined as that portion of the main river from Hoover Dam to Imperial Dam.

I. Industrial Sources

The Salinity Standards state that "the objective for discharges shall be a no-salt return policy whenever practicable." This is the policy that shall be followed in issuing NPDES discharge permits for all new industrial sources, and upon the reissuance of permits for all existing industrial sources, except as provided herein. The following addresses those cases where no-discharge of salt may be deemed not to be practicable.

A. New Construction

1. New construction is defined as any facility from which a discharge may occur, the construction of which is commenced after October 18, 1975. (Date of submittal of water quality standards as required by 40 CFR 120, December 11, 1974.) Appendix A provides guidance on new construction determination.

a. The permitting authority may permit the discharge of salt upon a satisfactory demonstration by the permittee that it is not practicable to prevent the discharge of all salt from proposed new construction.

b. The demonstration by the applicant must include information on the following factors relating to the potential discharge:

(1) Description of the proposed new construction.

(2) Description of the quantity and salinity of the water supply.

(3) Description of water rights, including diversions and consumptive use quantities.

(4) Alternative plans that could reduce or eliminate salt discharge. Alternative plans shall include:

(a) Description of alternative water supplies, including provisions for water reuse, if any.

(b) Description of quantity and quality of proposed discharge.

(c) Description of how salts removed from discharges shall be disposed of to prevent such salts from entering surface waters or groundwater aquifers.

(d) Costs of alternative plans in dollars per ton of salt removed.

(5) Of the alternatives, a statement as to the one plan for reduction of salt discharge that the applicant recommends be adopted.

(6) Such other information pertinent to demonstration of non-practicability as the permitting authority may deem necessary.

c. In determining what permit conditions shall be required, the permit issuing authority shall consider, but not be limited to the following:

(1) The practicability of achieving no discharge of salt.

(2) Where no discharge is determined not to be practicable:

(a) The impact of the total proposed salt discharge of each alternative on the lower main stem in terms of both tons per year and concentration.

(b) Costs per ton of salt removed from the discharge for each plan alternative.

(c) Capability of minimizing salinity discharge.

(3) With regard to both points, one and two above, the compatibility of state water

laws with either the complete elimination of a salt discharge or any plan for minimizing a salt discharge.

(4) The no-salt discharge requirement may be waived in those cases where the salt load reaching the main stem of the Colorado River is less than one ton per day or 350 tons per year, whichever is less. Evaluation will be made on a case-by-case basis.

B. Existing Facilities

1. The permitting authority may permit the discharge of salt upon a satisfactory demonstration by the permittee that it is not practicable to prevent the discharge of all salt from an existing facility.

2. The demonstration by the applicant must include information, in addition to that required under Section I,A,1,b; the following factors relating to the potential discharge:

   (a) Existing tonnage of salt discharged and volume of effluent.

   (b) Cost of modifying existing industrial plant to provide for no salt discharge.

   (c) Cost of salt minimization.

3. In determining what permit conditions shall be required, the permit issuing authority shall consider the items presented under I,a,1,c (2), and

in addition; the annual costs of plant modification in terms of dollars per ton of salt removed for:

a) No salt return.

b) Minimizing salt return.

4. The no-salt discharge requirement may be waived in those cases where the salt load reaching the main stem of the Colorado River is less than one ton per day or 350 tons per year, whichever is less. Evaluation will be made on a case-by-case basis.

II. Municipal Discharges

The basic policy is that a reasonable increase in salinity shall be established for municipal discharges to any portion of the Colorado River stream system that has an impact on the lower main stem. The incremental increase in salinity shall be 400 mg/l or less, which is considered to be a reasonable incremental increase above the flow weighted average salinity of the intake water supply.

A. The permitting authority may permit a discharge in excess of the 400 mg/l incremental increase at the time of issuance or reissuance of a NPDES discharge permit, upon satisfactory demonstration by the permittee that it is not practicable to attain the 400 mg/l limit.

B. Demonstration by the applicant must include information on the following factors relating to the potential discharge:

1. Description of the municipal entity and facilities.

2. Description of the quantity and salinity of intake

water sources.

3. Description of significant salt sources of the municipal wastewater collection system, and identification of entities responsible for each source, if available.
4. Description of water rights, including diversions and consumptive use quantities.
5. Description of the wastewater discharge, covering location, receiving waters, quantity, salt load, and salinity.
6. Alternative plans for minimizing salt contribution from the municipal discharge. Alternative plans should include:
   (a) Description of system salt sources and alternative means of control.
   (b) Cost of alternative plans in dollars per ton, of salt removed from discharge.
7. Such other information pertinent to demonstration of non-practicability as the permitting authority may deem necessary.

C. In determining what permit conditions shall be required, the permit issuing authority shall consider the following criteria including, but not limited to:

1. The practicability of achieving the 400 mg/l incremental increase.
2. Where the 400 mg/l incremental increase is not

determined to be practicable:

(a) The impact of the proposed salt input of each alternative on the lower main stem in terms of tons per year and concentration.

(b) Costs per ton of salt removed from discharge of each alternative plan.

(c) Capability of minimizing the salt discharge.

D. If, in the opinion of the permitting authority, the data base for the municipal waste discharger is inadequate, the permit will contain the requirement that the municipal waste discharger monitor the water supply and the wastewater discharge for salinity. Such monitoring program shall be completed within 2 years and the discharger shall then present the information as specified above.

E. Requirements for establishing incremental increases may be waived in those cases where the incremental salt load reaching the main stem of the Colorado River is less than one ton per day or 350 tons per year, whichever is less. Evaluation will be made on a case-by-case basis.

F. All new and reissued NPDES permits for all municipalities shall require monitoring of the salinity of the intake water supply and the wastewater treatment plant effluent in accordance with the following guidelines:

Treatment Plant Design Capacity	Monitoring Frequency	Type of Sample
<1.0 MGD	Quarterly	Discrete
1.0 - 5.0 MGD	Monthly	Composite
5.0 - 50.0 MGD	Weekly	Composite
>50.0 MGD	Daily	Composite

1. Analysis for salinity may be either as total dissolved solids (TDS) or by electrical conductivity where a satisfactory correlation with TDS has been established. The correlation should be based on a minimum of five different samples.
2. Monitoring of the intake water supply may be at a reduced frequency where the salinity of the water supply is relatively uniform.

APPENDIX A

GUIDANCE ON NEW CONSTRUCTION DETERMINATION

For purposes of determining a new construction, a source should be considered new if by October 18, 1975, there has not been:

(1) Significant site preparation work such as major clearing or excavation; and/or

(2) Placement, assembly, or installation of unique facilities or equipment at the premises where such facilities or equipment will be used; and/or

(3) Any contractual obligation to purchase unique facilities or equipment. Facilities and equipment shall include only the major items listed below, provided that the value of such items represents a substantial commitment to construct the facility:

(a) structures; or

(b) structural materials; or

(c) machinery; or

(d) process equipment; or

(e) construction equipment.

(4) Contractual obligation with a firm to design, engineer, and erect a completed facility (i.e., a turnkey plant).

APPENDIX B

Present and Projected Water Use in the Colorado River Basin

TABLE B-1

SUMMARY ESTIMATED USES*
COLORADO RIVER BASIN

(Thousands of Acre-Feet Per Year)

By State	YEAR 1976 Base Condition	YEAR 1980 Low	YEAR 1980 Moderate	YEAR 1980 High	YEAR 1985 Low	YEAR 1985 Moderate	YEAR 1985 High	YEAR 1990 Low	YEAR 1990 Moderate	YEAR 1990 High
UPPER COLORADO RIVER BASIN (Depletions)										
State										
Arizona	26	42	47	48	44	49	50	45	50	50
Colorado	1,756	1,668	1,896	2,083	1,724	2,003	2,468	1,836	2,108	2,578
New Mexico	279	276	321	390	348	408	596	369	444	667
Utah	742	772	820	823	819	881	1,032	875	1,037	1,170
Wyoming	337	376	389	397	402	421	463	416	456	521
Subtotal Depletions Upper Colorado River Basin*	3,140	3,134	3,473	3,741	3,337	3,762	4,609	3,541	4,095	4,986
LOWER COLORADO RIVER BASIN (Mainstream Diversions less Surface returns)										
State										
Arizona**	1,094	1,157	1,198	1,297	1,177	1,690	1,854	2,800	2,800	2,800
California	4,610	4,562	4,751	5,125	4,572	4,884	5,273	4,400	4,400	4,400
Nevada	108	138	153	193	186	203	235	231	248	288
Subtotal Mainstream Diversions Less Returns-Lower Colorado River Basin	5,812	5,857	6,102	6,615	5,935	6,777	7,362	7,431	7,448	7,488
TOTAL - Colorado River Basin	8,952	8,991	9,575	10,356	9,272	10,559	11,971	10,972	11,543	12,474

* Does not include estimated CRSP reservoir evaporation from the Upper Colorado River Basin. (656,000 acre-feet in 1976; 520,000 a.f. average for the period 1977-1990)

** Base Condition values for Arizona are diversions less returns including estimated unmeasured return flows.

TABLE B-2

ESTIMATED INCREASES OVER BASE
COLORADO RIVER BASIN
(Thousands of Acre-Feet Per Year)

Category of Uses (by State)	YEAR 1976	YEAR 1980			YEAR 1985			YEAR 1990		
		Low	Moderate	High	Low	Moderate	High	Low	Moderate	High
UPPER COLORADO RIVER BASIN (Depletions)										
Out-of-Basin Exports										
Colorado	495	60	120	195	100	140	290	132	192	350
New Mexico	84	-34	-24	0	-24	-9	15	-14	13	35
Utah	133	10	40	40	40	55	100	70	129	129
Wyoming	7	2	3	4	5	6	7	8	9	10
Subtotal	719	38	139	239	121	192	412	196	343	524
In-Basin Agricultural Use										
Arizona	8	-1	0	1	0	1	1	0	1	1
Colorado	1,198	-154	0	103	-154	70	286	-84	84	317
New Mexico	155	17	47	72	79	112	191	85	117	213
Utah	577	1	11	14	10	43	101	32	82	135
Wyoming	280	6	9	9	9	14	34	14	19	39
Subtotal	2,218	-131	67	199	-56	240	613	47	303	705
In-Basin Coal Development (Including electrical power generation)										
Arizona	13	17	21	21	17	21	21	17	21	21
Colorado	8	5	17	19	21	26	55	28	36	64
New Mexico	26	14	19	33	14	24	98	19	34	124
Utah	8	19	19	19	19	19	49	19	49	79
Wyoming	18	15	18	23	23	23	35	23	30	58
Subtotal	73	70	94	115	94	113	258	106	170	346
In-Basin Oil Shale										
Arizona	0	0	0	0	0	0	0	0	0	0
Colorado	0	0	0	6	0	0	43	0	9	50
New Mexico	0	0	0	0	0	0	0	0	0	0
Utah	0	0	0	0	0	10	25	0	20	60
Wyoming	0	0	0	0	0	0	0	0	0	4
Subtotal	0	0	0	6	0	10	68	0	29	114

TABLE B-2 (cont'd)

Category of Uses (by State)	YEAR 1976	YEAR 1980			YEAR 1985			YEAR 1990		
		Low	Moderate	High	Low	Moderate	High	Low	Moderate	High
Other In-Basin Uses (Fish & Wildlife & Other M&L Uses)										
Arizona	5	0	0	0	1	1	2	2	2	2
Colorado	55	1	3	4	1	11	38	4	31	41
New Mexico	14	0	0	6	0	2	13	0	1	16
Utah	24	0	8	8	8	12	15	12	15	25
Wyoming	32	16	22	24	28	41	50	34	61	73
Subtotal	130	17	33	42	38	67	118	52	110	157
Total by States										
Arizona	26	16	21	22	18	23	24	19	24	24
Colorado	1,756	-88	140	327	-32	247	712	80	352	822
New Mexico	279	-3	42	111	69	129	317	90	165	388
Utah	742	30	78	81	77	139	290	133	295	428
Wyoming	337	39	52	60	65	84	126	79	119	184
Total Upper Colorado River Basin	3,140	-6	333	601	197	622	1,469	401	955	1,846
LOWER COLORADO RIVER BASIN (Diversions less returns)										
Out-of-Basin Exports										
Arizona	0	0	0	0	0	0	0	0	0	0
California	4,147	-85	65	415	-85	165	515	-261	-311	-355
Nevada	0	0	0	0	0	0	0	0	0	0
Subtotal	4,147	-85	65	415	-85	165	515	-261	-311	-355
In-Basin Agricultural Use										
Arizona	1,040	52	85	161	42	434	545	1,351	1,314	1,286
California	458	37	76	100	47	92	128	16	62	100
Nevada	7	0	5	10	5	7	12	10	12	15
Subtotal	1,505	89	166	271	94	533	685	1,377	1,388	1,401

TABLE B-2 (cont'd)

Category of Uses (by State)	YEAR 1976	YEAR 1980			YEAR 1985			YEAR 1990		
		Low	Moderate	High	Low	Moderate	High	Low	Moderate	High
In-Basin Electrical Generation										
Arizona	0	0	0	0	0	0	0	0	0	0
California	0	0	0	0	0	17	20	30	34	40
Nevada	15	0	0	25	8	8	20	8	8	30
Subtotal	15	0	0	25	8	25	40	38	42	70
Other In-Basin Uses (Fish & Wildlife Plus Other M&L Uses)										
Arizona	54	11	19	42	41	162	215	355	392	420
California	5	0	0	0	0	0	0	5	5	5
Nevada	86	30	40	50	65	80	95	105	120	135
Subtotal	145	41	59	92	106	242	310	465	517	560
Total by State										
Arizona	1,094	63	104	203	83	596	760	1,706	1,706	1,706
California	4,610	-48	141	515	-38	274	663	-210	-210	-210
Nevada	108	30	45	85	78	95	127	123	140	180
Total Lower Colorado River Basin	5,812	45	290	803	123	965	1,550	1,619	1,636	1,676

TABLE B-3

SUMMARY OF ESTIMATED WATER USE IN COLORADO RIVER BASIN[1/]

COMPARISON BETWEEN 1975 FORUM REPORT AND CURRENT STANDARDS REVISION
(1,000 acre-feet)

	Base Condition		Assumption as to Level of use	1980		1985		1990	
	1975 Report (1973 cond.)	Stds. Revision (1976 cond.)		1975 Report	Standards Revision	1975 Report	Standards Revision	1975 Report	Standards Revision
Upper Basin[2/]	2,976	3,140	Low	3,426	3,134	3,686	3,337	4,111	3,541
			Moderate	3,576	3,473	4,176	3,762	4,594	4,095
			High	4,021	3,741	4,589	4,609	5,464	4,986
Lower Basin[3/]	6,143	5,812	Low	5,813	5,857	6,238	5,935	7,461	7,431
			Moderate	5,953	6,102	6,838	6,777	7,476	7,448
			High	6,203	6,615	8,168	7,362	7,500	7,488
TOTAL	9,119	8,952	Low	9,239	8,991	9,924	9,272	11,572	10,972
			Moderate	9,529	9,575	11,014	10,539	12,070	11,543
			High	10,224	10,356	12,757	11,971	12,964	12,474

1/ Does not include deliveries to Mexico.

2/ Depletions at point of use. Does not include CRSP reservoir evaporation estimated by the USBR to average 520,000 acre-feet per year.

3/ Diversions from the mainstem less returns. Does not include main stem reservoir evaporation and stream losses estimated by the Forum to average 1,400,000 acre-feet per year.

APPENDIX C

Documents in Support of
USBR Salinity Control Program

Statement of
The Colorado River Basin Salinity Control Forum
on Appropriations for
Colorado River Basin Salinity Control

The Colorado River Basin Salinity Control Forum is composed of water resources and water quality representatives appointed by the Governors from the seven basin states of Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming*. For the past few years, the Forum has presented statements to your committee in support of funding for Colorado River Basin Salinity control. The seven states are again united in presenting this statement on behalf of appropriations for Title II of Public Law 93-320, the Colorado River Basin Salinity Control Act, and the Colorado River Water Quality Improvement Program authorized under earlier legislation. This basin-wide program will benefit citizens in both the United States and Mexico.

The President's budget recommends $13,433,000 for funding of Title II of Public Law 93-320 for continued construction of three authorized salinity control units: Paradox Valley, Colorado, $2.358 million; Grand Valley, Colorado, $4.159 million; and Las Vegas Wash, Nevada, $6.916 million. The budget also recommends $1,595,000 for continuing investigations leading to feasibility reports on other salinity control units, a decrease of about $867,000 from the 1978 F.Y. appropriation.

The budgeted funds for construction on the three funded units is sufficient to keep these units on schedule, which is essential in order to meet the Congressional directive in P.L. 93-320, the Colorado

---

* See attachment for membership of Forum

Presented in 1978

River Basin Salinity Control Act, that salinity levels in the lower mainstem of the Colorado River be maintained at or below 1972 levels while the Basin states continue to develop their compact-apportioned waters and to meet the salinity standards adopted by the seven states in 1975. Unless these standards are met, rising salinity will cause economic detriments to U. S. citizens of many millions of dollars annually. In addition, if the Colorado River's salinity rises substantially, the United States may be faced with a new salinity problem with Mexico, notwithstanding the salinity reductions that will result from operation of the Yuma Desalting Plant. Thus, the salinity control units now under construction are not only essential to the well-being of United States' citizens, but contribute materially to international comity with Mexico.

In the latter part of 1975, the Forum and the Basin states approved Colorado River water quality standards for salinity, including numeric criteria and a plan of implementation for salinity control, in response to the Environmental Protection Agency (EPA) regulations of December 18, 1974, under the Water Pollution Control Act Amendments of 1972 (P. L. 92-500). The salinity standards have been approved by EPA. The plan of implementation consists of a number of federal and non-federal projects and measures to maintain the flow-weighted average annual salinity in the lower main river at or below the recommended numeric criteria through 1990, while the Basin states continue to develop their compact-apportioned waters.

The states are fully committed to do all within their power to control the river's salinity. However, the Colorado River is an interstate and international stream, with most of its drainage area

owned or controlled by the federal government. A large amount of salinity is generated from these lands. Thus, the major thrust of the implementation plan lies with the federal salinity control program identified in Title II, P. L. 93-320.

The Administration's recommended funding for F. Y. 1979 is below the 1978 F. Y. appropriation for continuing feasibility investigations (General Investigations) of potential salinity control units under the Colorado River Water Quality Improvement Program. This reduction will delay the completion of the Bureau of Reclamation's investigations of several of these units, by about one year to two and a half years.

These delays will cause corresponding delays in the subsequent steps necessary in authorizing, funding, and constructing salinity control units. The Forum's on-going studies of future river salinities, to be used for updating the Colorado River salinity standards, indicate that extensions in completion of the salinity control units could adversely affect the achievement of the standards.

Accordingly, the Forum urges that the total appropriation for the Colorado River Water Quality Improvement Program be increased by about $600,000 to $2,195,000, as this sum should be sufficient to keep the investigational work on schedule.

On behalf of the seven Colorado River Basin states represented on the Colorado River Basin Salinity Control Forum, I thank you for the opportunity to present this statement.

MEMBERS OF

COLORADO RIVER BASIN SALINITY CONTROL FORUM

ARIZONA: Dr. Ron Miller, Chief, Bureau of Water Quality Control
Wesley E. Steiner, Executive Director, Arizona Water Commission

CALIFORNIA: Myron B. Holburt, Chief Engineer, Colorado River Board of California
W. Don Maughan, Vice Chairman, State Water Resources Control Board

COLORADO: Evan Dildine, Technical Secretary, Colorado Water Quality Control Commission, Colorado Department of Health
Laren D. Morrill, Deputy Director, Colorado Water Conservation Board
Fitzhugh Scott, III, Attorney at Law

NEVADA: Ernest G. Gregory, Chief, Bureau of Environmental Health, State Department of Health
Donald L. Paff, Administrator, Division of Colorado River Resources
Roland D. Westergard, State Engineer, Division of Water Resources

NEW MEXICO: Stephen E. Reynolds, State Engineer

UTAH: Daniel F. Lawrence, Director, Division of Water Resources
Lynn M. Thatcher, Director, Bureau of Environmental Health, Utah State Division of Health

WYOMING: George L. Christopulos, State Engineer
Clement Lord, State Engineer's Office

CHAIRMAN OF FORUM:

Daniel F. Lawrence, Director, Division of Water Resources, Utah

SECRETARY OF FORUM:

Ival V. Goslin, Executive Director
Upper Colorado River Commission

Statement of
The Colorado River Basin Salinity Control Forum
on Appropriations for the
Colorado River Basin Salinity Control

Presented by
Ival V. Goslin, Secretary

The Colorado River Basin Salinity Control Forum is composed of water resources and water quality representatives appointed by the Governors from the seven basin states of Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming.* In the spring of 1976, the Forum presented a statement to your committee in support of funding for Colorado River Basin salinity control. Again the seven states are united in presenting this statement on behalf of appropriations for implementing Title II of Public Law 93-320, the Colorado River Basin Salinity Control Act, and the Colorado River Water Quality Improvement Program authorized under earlier legislation. These basin-wide programs will benefit citizens in both the United States and Mexico.

Summary of Specific Action Requested

Colorado River Water Quality Improvement Program:

For General Investigations - add to budget item	$ 100,000
In President's budget	1,980,000
Total appropriation requested for Colorado River Water Quality Improvement Program	$2,080,000

The President's budget recommends $8,385,000 for funding of Title II of Public Law 93-320 for continuing construction of three authorized salinity control units, Paradox Valley, Colorado; Grand Valley, Colorado; and Las Vegas Wash, Nevada. The budget also recommends $1,980,000 for continuing investigations leading to feasibility reports on other salinity control units.

It is essential that construction on these three units continue without delay in order to meet the Congressional directive in P.L. 93-320, the Colorado River Basin Salinity Control Act, that salinity levels in the lower mainstem of the Colorado River be maintained at or below 1972 levels while the basin states continue to develop their compact apportioned waters and to meet the salinity standards adopted by the seven states in 1975.

---

*See attachment for membership of Forum.

Presented in 1977

Without salinity control, water users in the Colorado River Basin can expect increasing salinity accompanied by major economic detriments. By the year 2000, annual detriments are estimated to increase by around $160,000,000 if there are no salinity control measures.

While the Administration may justify spending under Title I as being required for our international relations, salinity control features constructed under Title II are also important to long-range comity with Mexico. The seven-state Committee of Fourteen, which was advisory to the U. S. Department of State on the United States - Mexico Colorado River salinity problem, stated in testifying in support of H.R. 12165, 93rd Congress, "Without the control of upstream salinity, the United States will be faced with a new salinity problem with Mexico . . . ." This fact was recognized by both the United States and Mexican negotiators. Ambassador Herbert Brownell, the United States negotiator with Mexico in 1972-1973 on the U.S.-Mexico salinity problem stated, ". . . that unless the United States does control this threatened and almost certain increase of 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." Thus, the salinity control projects authorized by Title II are not only essential to the well-being of United States citizens, but contribute materially to international comity with Mexico.

In the latter part of 1975, the basin states, through the "Forum," approved Colorado River water quality standards for salinity, including numeric criteria and a plan of implementation for salinity control, in response to the Environmental Protection Agency (EPA) regulations of December 18, 1974. The salinity standards have been approved by EPA. The plan of implementation consists of a number of federal and non-federal projects and measures to maintain the flow-weighted average annual salinity in the lower main river at or below the recommended numeric criteria through 1990, while the basin states continue to develop their compact-apportioned waters. The key components of the plan are:

1. prompt construction of the four salinity control projects authorized by Title II of P.L. 93-320,

2. construction of the 12 other projects identified in Title II or their equivalents,

3. placing of effluent limitations on industrial discharges, and the states will implement a no-salt return policy wherever practicable,

4. reformulation of previously authorized, but unconstructed, federal water projects to reduce salt loading, and

5. use of saline water for industrial purposes whenever practicable.

The states are fully committed to do all within their power to control the river's salinity. The Colorado River is an interstate and international stream, with most of its drainage area owned or controlled by the federal government. A large amount of salinity is generated from these lands. Therefore, the heart of the implementation plan lies with the federal salinity control program identified in Title II, P. L. 93-320.

Since submission of the President's budget to the Congress, it has been ascertained that the Bureau of Reclamation possesses the capability to prudently use $100,000 in addition to the $1,980,000 in the budget for continuing feasibility investigations (General Investigations) of potential salinity control units under the Colorado River Water Quality Improvement Program:

Total Add-on requested	$ 100,000
In President's budget	1,980,000
Total appropriation requested for the Colorado River Water Quality Improvement Program	$2,080,000

On behalf of the seven Colorado River Basin States represented on the Colorado River Basin Salinity Control Forum, thank you for the opportunity to present this statement.

MEMBERS OF COLORADO RIVER BASIN SALINITY CONTROL FORUM

ARIZONA:
Clifford C. Tabor, Consulting Engineer
Wesley E. Steiner, Executive Director, Arizona Water Commission

CALIFORNIA:
W. Don Maughan, Vice Chairman, State Water Resources Control Board
Myron B. Holburt, Chief Engineer, Colorado River Board of California

COLORADO:
Evan Dildine, Technical Secretary, Colorado Water Quality Control Commission, Colorado Department of Health
Laren D. Morrill, Deputy Director, Colorado Water Conservation Board
Fitzhugh Scott III, Attorney at Law

NEVADA:
Ernest G. Gregory, Chief, Bureau of Environmental Health, State Department of Health
Donald L. Paff, Administrator, Division of Colorado River Resources
Roland D. Westergard, State Engineer, Division of Water Resources

NEW MEXICO:
Stephen E. Reynolds, State Engineer

UTAH:
Lynn M. Thatcher, Director, Bureau of Environmental Health, Utah State Division of Health
Daniel F. Lawrence, Director, Division of Water Resources

WYOMING:
George L. Christopulos, State Engineer

CHAIRMAN OF FORUM:
Donald L. Paff, Administrator, Division of Colorado River Resources

SECRETARY OF FORUM:
Ival V. Goslin, Executive Director, Upper Colorado River Commission

Statement of
The Colorado River Basin Salinity Control Forum
on Appropriations for the

Colorado River Basin Salinity Control

Presented by: Ival V. Goslin, Secretary
April 1, 1976

The Colorado River Basin Salinity Control Forum is composed of water resource and water quality representatives appointed by the Governors from the seven basin states of Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming.* In the spring of 1975, the Forum presented a statement to your committee in support of funding for the Colorado River Basin salinity control. Again the seven states come, united, in presenting this statement on behalf of appropriations for Title II of Public Law 93-320, the Colorado River Basin Salinity Control Act, and the Colorado River Water Quality Improvement Program authorized under earlier legislation. This basin-wide program will benefit citizens in both the United States and Mexico.

Summary of Specific Action Requested

Colorado River Basin Salinity Control Program (P.L. 93-320, Title II):

For Construction:

Paradox Valley Unit	- add	$ 500,000 to budget amount
Grand Valley Unit	- add	580,000 to budget amount
Las Vegas Wash Unit	- add	500,000 to budget amount
Total for construction	- add	$1,580,000
In President's budget for pre-construction		520,000
Total requested appropriation for Title II of P.L. 93-320		$2,100,000

Colorado River Water Quality Improvement Program:

For General Investigations	- add	$ 100,000 to budget amount
In President's budget		1,950,000
Total appropriation requested for Colorado River Water Quality Improvement Program		$2,050,000

---

*See attachment for membership of Forum.

The President's budget recommends $520,000 for funding Title II of Public Law 93-320 for pre-construction activities for the four authorized salinity control units, Paradox Valley, Colorado; Grand Valley, Colorado; Las Vegas Wash, Nevada; and Crystal Geyser, Utah. The budget also recommends $1,950,000 for continuing investigations leading to feasibility reports on other potential salinity control units.

Although Definite Plan reports for the four projects will be completed by June, 1976, the proposed budget does not provide for initiation of construction. We believe this to be a shortsighted action that will eventually result in more costly solutions. By comparison, the President's budget calls for an appropriation of $42,600,000 to initiate construction of facilities for Title I of P.L. 93-320, which will benefit only Mexico.

We respectfully point out to the committee that it was twenty years ago that Congress first directed the Department of the Interior to conduct salinity studies of the river. The Bureau of Reclamation, the Geological Survey, the Environmental Protection Agency and its predecessors, the states individually and collectively through the Forum have all conducted studies on this matter. After years of study, Congress, in June, 1974, enacted P.L. 93-320, the "Colorado River Basin Salinity Control Act," which authorized construction of the four salinity control units, previously mentioned, upstream from Imperial Dam. In order to meet the Congressional directive contained in the 1974 Act that salinity levels in the lower main stem of the Colorado River be maintained at or below 1972 levels and to meet the salinity standards adopted by the seven states in 1975, it is necessary that construction be initiated on the salinity control projects in fiscal 1977.

Without salinity control, water users in the Colorado River Basin can expect increasing salinity accompanied by major economic detriments. By the year 2000 annual detriments are estimated to increase by around $70,000,000 if there are no salinity control measures.

Another aspect of salinity control is international relations. While the Administration may justify spending under Title I as being required for our international relations, salinity control features constructed under Title II are also important to long-range comity with Mexico. The seven-state Committee of Fourteen, which was advisory to the U.S. Department of State on the U.S.-Mexico Colorado River salinity problem, stated in testifying in support of H.R. 12165, 93rd Congress, "Without the control of upstream salinity, the United States will be faced with a new salinity problem with Mexico . . . ." This fact was recognized by both the U.S. and Mexican negotiators. Ambassador Herbert Brownell, the U.S. negotiator with Mexico in 1972-73 on the U.S. Mexico salinity problem stated, ". . . that unless the United States does control this threatened and almost certain increase of 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." Thus, the salinity control projects authorized by Title II are not only essential to the well-being of United States citizens, but contribute materially to international comity with Mexico.

In the latter part of 1975, the basin states, through the Forum, approved Colorado River water quality standards for salinity, including numeric criteria and a plan of implementation for salinity control, in response to the Environmental Protection Agency regulations of December 18, 1974. The plan of

implementation consists of a number of federal and non-federal projects and measures to maintain the flow-weighted average annual salinity in the lower main river at or below the recommended numeric criteria through 1990, while the Basin states continue to develop their compact-apportioned waters. The key components of the plan are:

1. Prompt construction of the four salinity control projects authorized by Title II of P.L. 93-320,
2. Construction of the 12 other projects identified in Title II or their equivalents,
3. Placing of effluent limitations on industrial discharges. The states will implement a no-salt return policy wherever practicable,
4. Reformulation of previously authorized, but unconstructed, federal water projects to reduce salt loading, and
5. Use of saline water for industrial purposes whenever practicable.

The states are fully committed to do all within their power to control the river's salinity. However, the Colorado River is an interstate and international stream, with most of its drainage area owned or controlled by the federal government. A large amount of salinity is generated from these lands. Thus, the heart of the implementation plan lies with the federal salinity control program identified in Title II, P.L. 93-320.

It is essential that construction be commenced in fiscal year 1977 on the initially authorized salinity control units. Since submission of President Ford's budget to the Congress it has been ascertained that the Bureau of Reclamation possesses the capability to prudently use funds to initiate construction on three of the salinity control units, as follows:

Paradox Valley unit	$ 500,000
Grand Valley unit	580,000
Las Vegas Wash unit	500,000
Total add-on requested for construction	$1,580,000
In President's budget for pre-construction activities	520,000
Total appropriation requested for Title II of P.L. 93-320	$2,100,000

The Bureau also needs $100,000 in addition to the $1,950,000 in the budget for continuing feasibility investigations (General Investigations) of potential salinity control units under the Colorado River Water Quality Improvement Program:

Total Add-on requested	$ 100,000
In President's budget	1,950,000
Total appropriation requested for the Colorado River Water Quality Improvement Program	$2,050,000

On behalf of the seven Colorado River Basin States represented on the Colorado River Basin Salinity Control Forum, I thank you for the opportunity to present this statement.

MEMBERS OF COLORADO RIVER BASIN SALINITY CONTROL FORUM

ARIZONA:	Clifford C. Tabor, Consulting Engineer Wesley E. Steiner, Executive Director, Arizona Water Commission
CALIFORNIA:	W. Don Maughan, Vice Chairman, State Water Resources Control Board Myron B. Holburt, Chief Engineer, Colorado River Board of California Warren J. Cole, Chief, Interstate Planning Branch, Department of Water Resources
COLORADO:	E. B. Pugsley, Director, Engineering and Sanitation, Colorado Department of Health Laren D. Morrill, Deputy Director, Colorado Water Conservation Board Fitzhugh Scott, III, Attorney at Law
NEVADA:	Ernest G. Gregory, Chief, Bureau of Environmental Health, State Department of Health Donald L. Paff, Administrator, Division of Colorado River Resources Roland D. Westergard, State Engineer, Division of Water Resources
NEW MEXICO:	Stephen E. Reynolds, State Engineer
UTAH:	Lynn M. Thatcher, Director, Bureau of Environmental Health, Utah State Division of Health Daniel F. Lawrence, Director, Division of Water Resources
WYOMING:	Arthur E. Williamson, Administrator, Water Quality Division, Wyoming Department of Environmental Quality George L. Christopulos, State Engineer

CHAIRMAN OF FORUM:
Donald L. Paff, Administrator
Division of Colorado River Resources

SECRETARY OF FORUM:
Ival V. Goslin, Executive Director
Upper Colorado River Commission

STATEMENT OF
THE COLORADO RIVER BASIN SALINITY CONTROL FORUM
ON APPROPRIATIONS FOR THE
COLORADO RIVER BASIN SALINITY CONTROL ACT
TITLE II, P.L. 93-320

Submitted by Ival V Goslin, Secretary

In the spring of 1974, the Committee of Fourteen appeared before Congress on behalf of the seven Colorado River Basin States, and recommended that the Colorado River Basin Salinity Control Act of 1974 be enacted, subject to some recommended modifications. Subsequently, that legislation was enacted as Public Law 93-320, and we now have before Congress the Administration's Budget for fiscal year 1975-1976 to begin implementation of the Act.

Again, the seven Colorado River Basin States are united in presenting a statement in support of the salinity control program, speaking through the seven-state Colorado River Basin Salinity Control Forum. The Forum is comprised of representatives, appointed by the Governors, of water quality and water resources agencies in the seven states. The Forum is now engaged in developing salinity standards for the Colorado River, including numeric criteria and a plan of implementation for salinity control, in cooperation with the Environmental Protection Agency.

The need for a basin-wide salinity control program was presented in the Committee of Fourteen's 1974 statement, and is further documented in reports of the Federal Environmental Protection Agency* and the U. S. Bureau of Reclamation.** The current studies of the Forum emphasize the need and urgency to implement the salinity control program authorized by P.L. 93-320.

---

* "The Mineral Quality Problem in the Colorado River Basin," 1971.

** "Colorado River Water Quality Improvement Program, Status Report," January 1974.

Presented in 1975

The Administration has proposed a budget for fiscal year 1976 that includes $3,508,000 for Title II of the Colorado River Basin Salinity Control Act, P.L. 93-320, and provides $913,000 for the three-month budget transition period, July 1 - September 30, 1976. As testified by Commissioner Stamm on the appropriation request, the Bureau of Reclamation has additional capability for the amount of $500,000 ($200,000 in the regular fiscal year 1976 and $300,000 for the transition quarter). These additional funds would be utilized for preconstruction activities, preparation of designs and specifications, and purchase of right-of-way for the Las Vegas Wash salinity control unit. It is essential that these additional funds be made available to enable meeting the salinity control objectives of the Colorado River Basin Salinity Control Act.

The Colorado River Basin Salinity Control Forum supports the Administration's budget and the additional funds for the Las Vegas Wash Unit, and recommends that Congress appropriate these funds.

On behalf of the seven Colorado River Basin States represented on the Colorado River Basin Salinity Control Forum, thank you for the opportunity to present this statement.

Statement of

The Colorado River Basin Salinity Control Forum
on Appropriations For
Colorado River Basin Salinity Control

Presented by

Daniel F. Lawrence, Chairman

March 20, 1978

The Colorado River Basin Salinity Control Forum is composed of water resources and water quality representatives appointed by the Governors from the seven basin states of Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming.

Following the enactment of the Colorado River Basin Salinity Control Act in 1974 (P.L. 93-320) state, local, and federal efforts in the basin have largely centered on implementing the programs mandated in Title II of the Act. The Forum and the basin states approved Colorado River Salinity standards that depend upon the Title II programs and other non-federal actions being carried through to completion.

The primary responsibility for implementing the Title II programs rests with the Secretary of Interior. Congress also directed the Secretary of Agriculture to undertake activities to carry out the objectives of Title II. The seven states would like to emphasize the importance of the Department of Agriculture's role and urge additions to the Department's fiscal year 1979 budget in order that its responsibility for salinity control can be met.

The Department of Agriculture, through the Soil Conservation Service has been cooperating with the Bureau of Reclamation, other federal agencies and state and local agencies in the investigation of salt source units in the basin where irrigated agriculture and private watershed lands are believed to be contributing in a major way to the increasing salt concentrations in the river. These investigations are funded through the River Basins Surveys and Investigations line item in the budget. We support funding levels for this activity which will permit these investigations to continue on schedule with activities of the Department of the Interior. The research work of the Agriculture Research Service at the U.S. Salinity Lab at Riverside, California and at other locations is making important contributions in understanding the complex nature of salinity problems and this work needs to continue.

The Soil Conservation Service has just completed its final report on the feasibility of an on-farm program for salinity control in the Grand Valley area of Western Colorado. The Grand Valley Unit is one of the major salinity control projects authorized in Title II (a map of the project area is attached). The authorization directs the combining and lining of off-farm irrigation canals and laterals. This work is now underway by the Bureau of Reclamation. Title II also authorizes the Secretary of Agriculture to plan and construct on-farm system measures. These measures include activities such as ditch lining to reduce seepage, land leveling to facilitate the use of lined ditches and to allow more uniform applications of water, installation of subsurface

drains where practicable, and conversion to drip and sprinkler methods of irrigation.

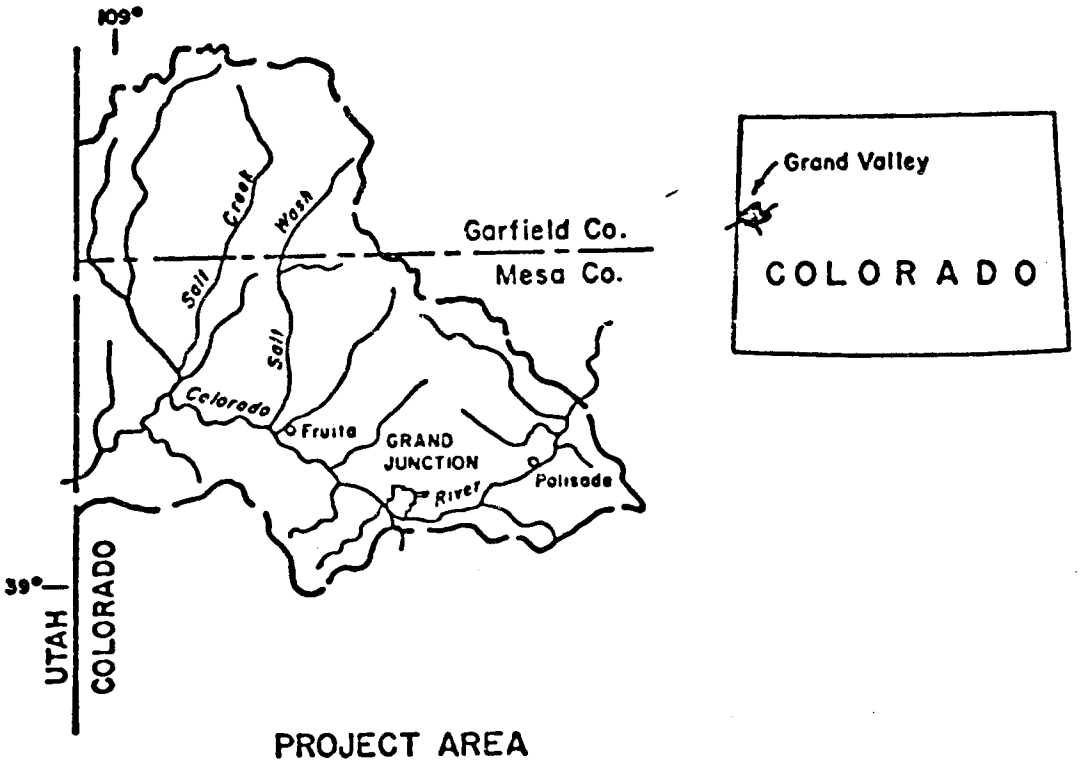
The Grand Valley contributes about 600,000 to 700,000 tons of salt annually to the Colorado River. Most of the salt is leached from the soil and the underlying Mancos shale, and carried to the river by deep percolation from irrigation and by seepage from the irrigation delivery system. Of this amount, on-farm irrigation practices and systems contribute about 300,000 tons while runoff and erosion from upland areas adds an additional 80,000 tons. The Soil Conservation Service study demonstrates that implementation of on-farm measures can effectively reduce the annual salt load from irrigated farmland by 130,000 tons at a total cost of $21,050,000. Based on the other salinity control measures authorized and under construction in the basin the on-farm program in the Grand Valley would be one of the most cost effective.

We therefore request that an appropriation of $1.5 million be included in Conservation Operations for the Soil Conservation Service to initiate Colorado River Basin on-farm salinity control work in The Grand Valley Unit in Colorado in fiscal year 1979. There is presently no money in the President's budget for this purpose.

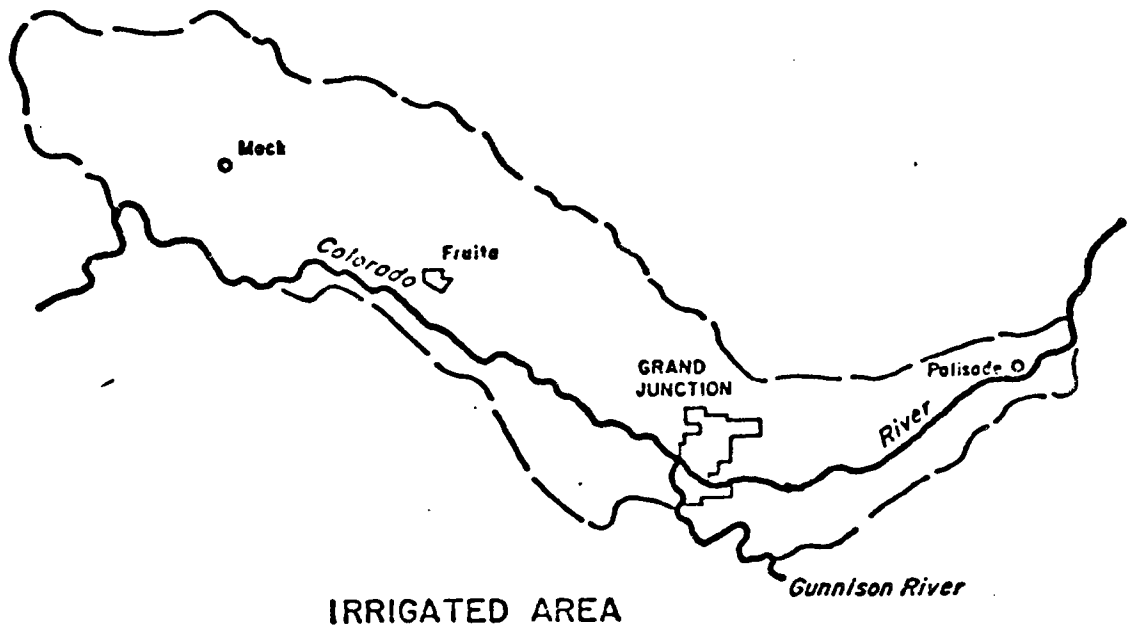
It is necessary that the on-farm program be funded and implemented at the same time as the major canals and laterals are improved by the Bureau of Reclamation. The efficient control of salts from this area depends on both the on-farm and off-farm improvements.

GRAND VALLEY SALINITY STUDY

PROJECT LOCATION MAP



PROJECT AREA



IRRIGATED AREA

MEMBERS OF COLORADO RIVER BASIN SALINITY CONTROL FORUM

ARIZONA:	Dr. Ron Miller, Chief, Bureau of Water Quality Control Wesley E. Steiner, Executive Director, Arizona Water Commissior
CALIFORNIA:	W. Don Maughan, Vice Chairman, State Water Resources Control Board Myron B. Holburt, Chief Engineer, Colorado River Board of California
COLORADO:	Evan Dildine, Technical Secretary, Colorado Water Quality Control Commission, Colorado Department of Health Laren D. Morrill, Deputy Director, Colorado Water Conservation Board Fitzhugh Scott, III, Attorney at Law
NEVADA:	Ernest G. Gregory, Chief, Bureau of Environmental Health, State Department of Health Donald L. Paff, Administrator, Division of Colorado River Resources Roland D. Westergard, State Engineer, Division of Water Resources
NEW MEXICO:	Stephen E. Reynolds, State Engineer
UTAH	Lynn M. Thatcher, Director, Bureau of Environmental Health, Utah State Division of Health Daniel F. Lawrence, Director, Division of Water Resources
WYOMING:	George L. Christopulos, State Engineer Clement Lord, State Engineers Office

CHAIRMAN OF FORUM:
Daniel F. Lawrence, Director Utah
Division of Water Resources

SECRETARY OF FORUM:
Ival V. Goslin, Executive Director
Upper Colorado River Commission

Statement of
The Colorado River Basin Salinity Control Forum
to
Subcommittee on Department of Agriculture and Related Agencies
Committee on Appropriations

Presented by
Ival V. Goslin, Secretary

The Colorado River Basin Salinity Control Forum is composed of water resources and water quality representatives appointed by the Governors of the seven basin states, Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming.* This Forum has presented testimony before the Public Works Subcommittee in support of funding for the Colorado River Basin salinity control program executed under Title II of Public Law 93-320, the Colorado River Basin Salinity Control Act. While major activities in the program are under the leadership of the Secretary of the Interior, there are equally important activities under the jurisdiction of the Secretary of Agriculture. The seven states are united in support of the important work which the Department of Agriculture already has underway as its part of the Colorado River Basin salinity control program.

Summary of Specific Action Requested

The "Forum" endorses an addition of $1,500,000 to the fiscal year 1978 budget to implement the installation of on-farm irrigation measures that will be effective in reducing salt loading of the river.

The Soil Conservation Service has been cooperating with the Bureau of Reclamation, other federal, state, and local agencies in the investigation of salt sources in the basin where irrigated agriculture and private watershed are believed to be contributing to the increasing salt concentrations in the river. These investigations are funded through the River Basins Surveys and Investigations item in the budget. We support funding levels for this activity which will permit these investigations to continue on schedule with the activities of the Department of the Interior. The research work of the Agricultural Research Service at the U. S. Salinity Laboratory at Riverside, California, and at other locations, is making important contributions to the understanding of the complex nature of salinity problems. This work should be continued.

---

*See attachment for membership of Forum.

Presented in 1977

Results of investigations in the Grand Valley Unit, Colorado, show that of the 600,000 to 1,000,000 tons of salt entering the river in this reach, about 360,000 tons per year are added as a result of seepage from on-farm ditches and application of excess water during the irrigation season.

Detailed studies of the Soil Conservation Service show that a program of ditch lining, contouring, land leveling, and improved irrigation methods can reduce this salt loading by 180,000 tons per year. Another 20,000 tons of salt can be prevented from entering the river by proper treatment and management of watershed lands adjacent to the irrigated area. The estimated total cost of these measures is $15 to $20 million. Based on the other salinity control measures authorized and under consideration in the basin, the on-farm program in the Grand Valley will be one of the most cost effective.

We request that $1.5 million be added to the budgeted item for Conservation Operations for the Soil Conservation Service to initiate this program in the Grand Valley Unit in fiscal year 1978. The program should be administered in a manner similar to the Wellton-Mohawk Irrigation Improvement Program being performed by the Service with funds provided by the Department of the Interior under authority of Title I of the Act for the benefit of Mexico. We believe a federal cost share of 75 percent is necessary to assume timely installation of the improvement measures and would be justified by downstream benefits.

We wish to emphasize that to be practicable the on-farm program should be implemented simultaneously with the improvement of the major canals and laterals by the Bureau of Reclamation. This work is scheduled for installation beginning in 1978. Effective control of salts depends on both the on-farm and off-farm improvements.

Thank you for the opportunity to present this statement to this subcommittee on behalf of the water users of the seven Colorado River basin states.

MEMBERS OF COLORADO RIVER BASIN SALINITY CONTROL FORUM

ARIZONA:
Clifford C. Tabor, Consulting Engineer
Wesley E. Steiner, Executive Director, Arizona Water Commission

CALIFORNIA:
W. Don Maughan, Vice Chairman, State Water Resources Control Board
Myron B. Holburt, Chief Engineer, Colorado River Board of California

COLORADO:
Evan Dildine, Technical Secretary, Colorado Water Quality Control Commission, Colorado Department of Health
Laren D. Morrill, Deputy Director, Colorado Water Conservation Board
Fitzhugh Scott III, Attorney at Law

NEVADA:
Ernest G. Gregory, Chief, Bureau of Environmental Health, State Department of Health
Donald L. Paff, Administrator, Division of Colorado River Resources
Roland D. Westergard, State Engineer, Division of Water Resources

NEW MEXICO:
Stephen E. Reynolds, State Engineer

UTAH:
Lynn M. Thatcher, Director, Bureau of Environmental Health, Utah State Division of Health
Daniel F. Lawrence, Director, Division of Water Resources

WYOMING:
George L. Christopulos, State Engineer

CHAIRMAN OF FORUM:
Donald L. Paff, Administrator, Division of Colorado River Resources

SECRETARY OF FORUM:
Ival V. Goslin, Executive Director, Upper Colorado River Commission

COLORADO RIVER BASIN SALINITY CONTROL ADVISORY COUNCIL
P. O. BOX 19090
LAS VEGAS, NEVADA 89119

September 26, 1977

Mr. Keith I. Higginson, Commissioner
Bureau of Reclamation
Department of the Interior
Room 7651, Interior Building
Washington, D. C. 20240

Dear Commissioner:

It is with pleasure I transmit four copies of the September 19, 1977, Report on Colorado River Basin Salinity Control Program by the Colorado River Basin Salinity Control Advisory Council pursuant to Section 204 of PL 93-320 and the Council's Charter of June, 1976. This is the second annual report by the Council, which is transmitted through you to the Secretaries of Interior and Agriculture and the Administrator of the Environmental Protection Agency.

The transmittal of this report concludes my responsibilities as Chairman of the Council and any future communication relating to the Council's activities will be handled by Mr. Daniel Lawrence in accordance with my letter to you dated August 8, 1977.

Sincerely,

Donald L. Paff
Chairman

cc w/enclosure:
Mr. Daniel F. Lawrence, Chairman, Division of Water Resources, 435 State Capitol Bldg., Salt Lake City, Utah 84114
Mr. Wesley E. Steiner, State Engineer & Executive Director, Arizona Water Commission, 222 N. Central, Phoenix, Arizona 85003
Mr. Myron B. Holburt, Chief Engineer, Colorado River Board of Calif., 107 S. Broadway, Los Angeles, California 90012
Mr. John Keyes, Jr. III, Chief, Water Quality Office, USBR, Denver Federal Center, P. O. Box 25007, Denver, Colorado 80225

REPORT ON COLORADO RIVER BASIN SALINITY CONTROL PROGRAM

By

Colorado River Basin Salinity Control Advisory Council

The Council is comprised of no more than three members, appointed by the Governor, from each of the Seven Colorado River Basin states. It currently consists of 20 members. The current membership is shown on Attachment A. During the 1976-77 fiscal year, Donald L. Paff, Nevada, served as Council Chairman and Daniel F. Lawrence, Utah, as Vice Chairman. Most of the members of the Advisory Council are also members of the Colorado River Basin Salinity Control Forum. The Council and Forum have different, but related, functions.

The legislative authority, functions, and duties of the Advisory Council, its relationship to the Salinity Control Forum and the Colorado River Basin salinity control program were covered in the Council's first annual report, dated July 22, 1976.

The Advisory Council met twice since the last report was given, on March 1, 1977 in Phoenix, Arizona, and on July 15, 1977 in San Francisco, California. At the second meeting, Daniel F. Lawrence, Utah, and Wesley E. Steiner, Arizona, were elected Chairman and Vice-Chairman of the Council, effective October 1, 1977. The permanent Work Group of the Colorado River Basin Salinity Control Forum continued to serve the Council in

the capacity of a technical review and study team. Myron B. Holburt, California, is Chairman of the Work Group. The Work Group is currently in the process of revising and updating the Salinity Control Forum Standards and also reviewing the Salinity portion of all the Section 208 Water Quality Plans in the Colorado River Basin for conformance with the Forum's Water Quality Standards for Salinity.

Program Recommendations

Las Vegas Wash Salinity Control Unit

A U. S. Bureau of Reclamation re-evaluation of the Las Vegas Wash Salinity Control Unit indicated a reduction in salt removal potential from the amount originally estimated. Consequently, the Bureau posed the question as to whether or not it should continue with the project. Based on a USBR report presented on February 28, 1977, which indicated a possible increase in the amount of salt that could be removed and a reduction in the overall cost of the project, the Advisory Council, on March 1, 1977, recommended that the Bureau proceed with the project.

Salinity Control Policy

The U. S. Bureau of Reclamation presented to the Advisory Council a proposal regarding the preparation of a written policy on salinity control. The Council did not feel that such a document was needed because national policy has already been established by P.L. 93-320. The Council, on March 1, 1977, recommended that, instead, the Bureau should prepare a plan of implementation and schedule for salinity control.

Repayment for Salinity Control Units

P.L. 93-320 specifies that repayment for the authorized salinity control units be based on a 75 percent Federal and 25 percent basin-wide cost sharing arrangement. The Council agreed on March 1, 1977, that the same repayment percentages should be applied to the other units which are under feasibility investigation.

Total Water Management Plan

A study of a basin-wide total water management plan was proposed by the U. S. Bureau of Reclamation's Washington office. The Council saw no need for such a study and recommended on March 1 and July 15, 1977 that the study not be undertaken.

Comprehensive Environmental Impact Statement

The Department of Interior, in response to a request from the Environmental Defense Fund, has instructed the Bureau of Reclamation to undertake a comprehensive environmental impact statement of the entire Colorado River Basin. This statement will consider the cumulative impact on the river's salinity of various alternative water development schedules. The cost of the statement, between $1.5 and $2 million, is to be included with the costs of the individual development projects. The Council questioned at their July 15, 1977 meeting the propriety of having the water users pay for the study which is not legally required.

Geohydrologic Study of Coal Producing Areas

Utah representatives proposed that the Bureau of Reclamation undertake a comprehensive geohydrologic study of the potential

coal producing areas in the basin to determine the impact of mine dewatering on river salinity. The Council recommended on July 15, 1977, that representatives from the Bureau and Utah develop a proposed program for consideration by the Council.

LaVerkin Springs Unit

The Bureau of Reclamation is scheduled to complete its feasibility level report on the LaVerkin Springs Unit in the middle of the 1978 Fiscal Year. Based on progress reports received by individual Council members, the project appears to be feasible and, if the final reports verify the interim findings, the Council recommends that the report be promptly submitted to Congress for construction authorization.

Budget Recommendations

Fiscal Year 1979

Department of the Interior

The Council continues its recommendation made last year for the expeditious completion of three of the four salinity units authorized for construction: Grand Valley, Colorado; Paradox Valley, Colorado; and Las Vegas Wash, Nevada. Funds in the amount of $8.5 million have been appropriated for construction on the above projects in Fiscal Year 1978. It is essential that this construction be continued at the maximum practicable rate. Complete and accurate information on construction schedules and specific dollar amounts are not available to the Council at this time. On the basis of what

information is available, the Council recommends that the Bureau of Reclamation include in its budget for Fiscal Year 1979 funding for construction in the approximate amount of:

Grand Valley Unit	$4.0 million
Paradox Valley Unit	2.5 million
Las Vegas Wash Unit First Stage	5.0 million
	$11.5 million

Investigation and planning on the other salinity control units and other activities identified as the Water Quality Improvement Program should be continued at the current level of about $2 million. In planning the expenditure of these planning and investigation funds, we continue our request for the Bureau of Reclamation to budget funds for research in reducing the costs of solar evaporation ponds.

Funds should be budgeted for the Bureau of Land Management in the amount of $200,000 for the 1979 Fiscal Year to continue its investigatory work on measures to reduce salt contributed by natural resource lands. In addition, the Bureau of Land Management should budget a one-time sum of $900,000 to purchase and install facilities for monitoring salinity, from those areas found to be contributing significant volumes of salt. The Bureau of Land Management should budget annually sufficient funds to operate these monitoring devices.

Department of Agriculture

The Council had understood that $1.5 million was available in the Soil Conservation Service's Fiscal Year 1978 budget to begin construction of the on-farm portion of the Grand Valley Unit.

Later, the Council discovered that it is uncertain whether these funds will be available. Accordingly, the Council now recommends that the Soil Conservation Service include in its budget for Fiscal Year 1979 approximately $1.5 million for construction of on-farm measures of the Grand Valley Unit. The Soil Conservation Service and the Agricultural Research Service should continue their present salt source studies and research efforts at their current funding level of about $700,000.

Environmental Protection Agency

The Agency should vigorously support the recommendations herein for necessary authorizations and funding for the Departments of Interior and Agriculture as being consistent and compatible with the goals and objectives of the Standards for Salinity and Plan of Implementation for Salinity Control adopted by each of the Colorado River Basin States.

ATTACHMENT A

MEMBERSHIP
COLORADO RIVER BASIN SALINITY CONTROL
ADVISORY COUNCIL

Arizona -	Wesley E. Steiner State Engineer & Executive Director Arizona Water Commission Phoenix
	Clifford C. Tabor Consulting Engineer and Chairman, Arizona State Water Quality Control Council Wellton-Mohawk Irrigation & Drainage District Wellton
California -	W. Don Maughan, Vice Chairman State Water Resources Control Board Sacramento
	Myron B. Holburt, Chief Engineer Colorado River Board of California Los Angeles
	Robert W. Miller Department of Water Resources Sacramento
Colorado -	Laren D. Morrill, Deputy Director Colorado Water Conservation Board Department of Natural Resources Denver
	Evan Dildine, Executive Secretary Colorado Water Quality Control Commission Denver
	Fitzhugh Scott, III Attorney at Law Aspen

Nevada -	Donald L. Paff, Administrator Division of Colorado River Resources Las Vegas
	Roland D. Westergard, State Engineer Division of Water Resources Department of Conservation and Natural Resources Carson City
	Ernest G. Gregory, Chief Bureau of Environmental Health Division of Health Environmental Protection Services Department of Human Resources Carson City
New Mexico -	Steve E. Reynolds State Engineer Santa Fe
	Carl L. Slingerland, Staff Engineer Interstate Stream Commission Santa Fe
	Aaron L. Bond Environmental Improvement Agency Health & Social Services Department Santa Fe
Utah -	Lynn M. Thatcher, Director Bureau of Environmental Health Utah State Division of Health Salt Lake City
	Daniel F. Lawrence, Director Board of Water Resources & Interstate Stream Commissioner Salt Lake City
	Dallin W. Jensen Assistant Attorney General Division of Water Rights Salt Lake City

Wyoming -	Administrator Water Quality Division Department of Environmental Quality Cheyenne
	George L. Christopulos, State Engineer State Office Building East Cheyenne
	Dan S. Budd Big Piney

COLORADO RIVER BASIN SALINITY CONTROL ADVISORY COUNCIL

July 23, 1976

Mr. Gilbert C. Stamm
Commissioner of Reclamation
Bureau of Reclamation
Washington, D.C. 20240

Dear Mr. Stamm:

The Charter of the Colorado River Basin Salinity Control Advisory Council directs the Council to report to the Secretaries of the Departments of the Interior and Agriculture and the Administrator of the Environmental Protection Agency through you.

Enclosed are separate letters to the Secretaries of Interior and Agriculture and the Administrator of EPA submitting the first report from the Council.

Sincerely,

SIGNAL SIGNED BY
D. L. PAFF

Donald L. Paff
Chairman, Advisory Council
P. O. Box 19090
Las Vegas, Nevada 89119

Enclosures

REPORT ON COLORADO RIVER BASIN SALINITY CONTROL PROGRAM

by
Colorado River Basin Salinity
Control Advisory Council
July 22, 1976

Public Law 93-320, the "Colorado River Basin Salinity Control Act of 1974" authorized construction, operation and maintenance of certain works in the Colorado River Basin to control the salinity of water available in the Colorado River for use in the United States and Mexico. Section 204 of the Act established a Colorado River Basin Salinity Control Advisory Council. The Council is comprised of no more than three members from each state appointed by the governor. A Charter for the Council was approved by the Secretaries of the Interior and Agriculture and the Administrator, Environmental Protection Agency on February 6, 1976 and revised June 22, 1976. This Charter further defines the activities of the Council.

Membership & Functions of the Council

The Council currently consists of 20 members from the seven basin states. The current membership is shown on Attachment A.

The Council is to advise the Secretaries of the Departments of Interior and Agriculture and the Administrator of the Environmental Protection Agency on all matters relating to efficient and timely planning and execution of the salinity control measures and procedures specified in Public Law 93-320, Title II. The Council's duties include receiving reports from Interior and making suggestions on the plans and progress of the salinity control activities; reviewing and commenting on research activities related to salinity control;

serving as a liaison between the states and the three federal agencies; and recommending to the three agencies the study of new projects, techniques and methods to control salinity.

The Advisory Council has had two meetings since its formation. The Council elected Don Paff, Nevada, Chairman, and Dan Lawrence, Utah, Vice Chairman. The permanent Work Group of the Colorado River Basin Salinity Control Forum was assigned to serve the Council in the capacity of a technical review and study team. Myron Holburt, California, is Chairman of the Work Group.

Relationship to the Forum

Most of the members of the Advisory Council are also members of the Colorado River Basin Salinity Control Forum. The Council and Forum are related in their activities but do have different functions.

P.L. 92-500, as interpreted by the Environmental Protection Agency, required setting of numerical criteria for salinity for the Colorado River including the establishment of an interstate organization to develop a salinity control plan. The Basin states, in response to EPA's requirements formed the interstate agency, the Colorado River Basin Salinity Control Forum. The Forum developed water quality standards for salinity for the Colorado River including a plan of implementation which have been adopted by the seven basin states as part of their state standards and are under consideration by EPA. A permanent Work Group, under the authority of the Forum, is charged with making the necessary studies, providing technical advice and keeping current with events and changes which will enable the Forum to make any needed revisions in the numeric criteria and plan of implementation.

Salinity Control Program

The plan of implementation as set forth by the Forum is designed to reduce salinity by the most cost-effective means in order to offset the expected increase in salinity caused by future basin water use. The plan consists of more than implementation of the facilities identified in Title II, P.L. 93-320. Although these units constitute the major salt reduction efforts, additional control will be achieved by placing effluent limitations, principally under the National Pollution Discharge Elimination System (NPDES) permit program, reformulation of previously authorized but unconstructed federal water projects to reduce salt loading, and other non-federal actions.

Studies conducted by the Forum in establishing the standards showed that without construction of the units specified in P.L. 93-320, it would be impossible to meet the established standards, while the basin states continue to develop their compact-apportioned waters.

The amount of salt in water directly influences the utility of the water, and increased salt concentrations have detrimental impacts on water users. Such detriments include either decreased productivity or increased production costs or both for agricultural and industrial users. Urban water users also suffer significant detriments. Current studies by the U.S. Bureau of Reclamation and university researchers show that significant economic benefits will accrue from maintaining salinity at the 1972 levels. The lower basin alone will realize benefits ranging from 90-100 million dollars annually. Benefits will also be realized by some Upper Basin users,

but at a much lesser magnitude, through improved water management options.

Another aspect of salinity control is international relations. Since the early 1960's, the United States experienced difficulties with Mexico regarding the salinity of Colorado River water delivered to that Country. Following a series of temporary agreements, a permanent agreement was finally reached between the United States and Mexico in August 1973. The agreement's key element is a guarantee that the salinity of the water delivered to Mexico will not exceed by more than 115 mg/l (plus or minus 30 mg/l) the average annual salinity of the Colorado River at Imperial Dam.

The importance of control of salinity upstream of Imperial Dam was recognized by Ambassador Herbert Brownell, the United States negotiator with Mexico in 1972-73 on the United States - Mexico salinity problem when he stated, ". . . that unless the United States does control this threatened and almost certain increase of 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." The salinity control projects authorized by Title II are not only essential to the well-being of United States citizens, but will contribute materially to international comity with Mexico.

Program Recommendations

Fiscal Year 1978

The Advisory Council makes the following recommendations:

Department of Interior - The Council recommends expeditious completion of three of the four salinity units authorized for construction; Grand Valley, Colorado, Paradox Valley, Colorado, and Las Vegas Wash, Nevada. Funds in the amount of $2.08 million have been appropriated to commence construction on the above projects in Fiscal Year 1977. It is essential that this construction be continued at the maximum possible rate. Complete and accurate information on feasible construction schedules and specific dollar amounts are not available to the Council at this time. On the basis of what information is available, it is recommended that the Bureau of Reclamation include in its budget for Fiscal Year 1978 funding for construction in the approximate amount of:

Grand Valley Unit	$ 3.5 million
Paradox Valley Unit	3.0 million
Las Vegas Wash Unit first stage	3.5 million
	$ 10.0 million

Investigation and planning on the other salinity control units and other activities indentified as the Water Quality Improvement Program should be continued at the current level of about $2 million. Most of the proposed salinity control projects include evaporation pond facilities whether control is solar evaporation of saline source water or evaporation of the brine reject stream following desalting.

A large portion of the proposed project costs are related to the evaporation ponds. The Bureau of Reclamation should budget sufficient funds for research in the area of evaporation pond cost reduction.

Funds should be budgeted for the Bureau of Land Management in the amount of $200,000 to continue its investigatory work on measures to reduce salt contributed by natural resource lands.

Department of Agriculture - The Soil Conservation Service and the Agricultural Research Service should continue their present salt source studies and research efforts at their current funding level of about $700,000. The Department should actively seek authority and funding for the purpose of financing the installation of needed on-farm improvement measures for salinity control as recommended by the studies being performed.

Environmental Protection Agency - The Agency should vigorously support the recommendations herein for necessary authorizations and funding for the Departments of Interior and Agriculture as being consistent and compatible with the goals and objectives of the Standards for Salinity and Plan of Implementation for Salinity Control adopted by each of the Colorado River Basin States.

ATTACHMENT A

COUNCIL MEMBERSHIP

Arizona

Mr. Wesley E. Steiner
State Water Engineer and Executive Director
Arizona Water Commission
Phoeniz

Mr. Clifford C. Tabor
Consulting Engineer and Chairman
Arizona State Water Quality Control Council
Wellton

California

Mr. W. Don Maughan, Vice Chairman
State Water Resources Control Board
Sacramento

Mr. Myron B. Holburt, Chief Engineer
Colorado River Board of California
Los Angeles

Mr. Warren J. Cole
Department of Water Resources
Sacramento

Colorado

Mr. Laren D. Morrill
Deputy Director
Colorado Water Conservation Board
Department of Natural Resources
Denver

Mr. Evan Dilding
Technical Secretary
Colorado Water Quality Control Commission
Denver

Mr. Fitzhugh Scott, III
Attorney at Law
Aspen

Nevada

Mr. Donald L. Paff, Administrator
Division of Colorado River Resources
Las Vegas

Mr. Roland D. Westergard
State Engineer
Division of Water Resources
Department of Conservation and Natural Resources
Carson City

Mr. Ernest G. Gregory, Chief
Bureau of Environmental Health
Division of Health
Environmental Protection Services
Department of Human Resources
Carson City

New Mexico

Mr. Stephen E. Reynolds
State Engineer
Santa Fe

Mr. Carl L. Slingerland
Staff Engineer
Interstate Stream Commission
Santa Fe

Mr. Aaron L. Bond
Environmental Improvement Agency
Health and Social Services Department
Santa Fe

Wyoming

Mr. Arthur E. Williamson
Administrator
Water Quality Division
Department of Environmental Quality
Cheyenne

Mr. George L. Christopulos
State Engineer
Cheyenne

Mr. Dan S. Budd
Big Piney

Utah

Mr. Lynn M. Thatcher, Director
Bureau of Environmental Health
Utah State Division of Health
Salt Lake City

Mr. Daniel F. Lawrence, Director
Board of Water Resources and
Interstate Stream Commissioner
Salt Lake City

Mr. Dallin W. Jensen
Assistant Attorney General
Division of Water Rights
Salt Lake City

COLORADO RIVER BASIN SALINITY CONTROL FORUM
355 South Fourth East Street
Salt Lake City, Utah 84111

July 7, 1975

Hon. Gilbert G. Stamm
Commissioner
Bureau of Reclamation
Department of the Interior
Washington, D. C. 20240

Dear Commissioner Stamm:

Public Law 93-320 created the Colorado River Basin Salinity Control Advisory Council. In November 1974, Assistant Secretary of the Interior Jack Horton wrote each of the Colorado River Basin States' Governors requesting the individual Governors designate their representatives on the Council. All of the Governors have responded and the Council now stands ready to fulfill its advisory responsibilities.

While not explicitly stated in the bill, presumably it is the responsibility of the Secretary of the Interior or his representative to call a meeting of the Council. We hope such a meeting is called soon. In the meantime, the Colorado River Basin Salinity Control Forum, whose membership is practically identical with that of the Council, considered the above subject at its June 20, 1975, meeting. It was concluded that the Forum should present its views on a highly important matter, i.e., the management of the USBR salinity control program. The Forum is in a good position to offer some positive suggestions in this area because of the long association of many of its members with the program to date and because of the need for a successful program in the future.

Background

Briefly the pertinent background information on the salinity control program follows:

During the latter part of 1970, representatives of the Colorado River Basin states discussed the establishment of a basinwide salinity control program. Included were discussions of which entity could best implement the proposed Colorado River Basin Salinity Control Program. Consideration was given to an organization of the basin states, a new federal-state entity

and the existing federal agencies. It was concluded that the Bureau of Reclamation would be the best agency to carry out this new program because of its long experience and expertise on the river. In November, 1970, a meeting was held with the Commissioner of Reclamation and he agreed to transfer funds early in 1971 from the Westwide Program to stream monitoring activities for suggested salinity control projects.

In the spring of 1971, legislators from the Colorado River Basin States were instrumental in adding $500,000 for Colorado River salinity control studies in fiscal year 1971-72. On July 30, 1971, representatives of the basin states met with former Under Secretary of the Interior Pecora. The Under Secretary stated that Interior should play the major role in the salinity control program and he directed the Commissioner of Reclamation to prepare a report on salinity control projects and a timetable for studies and construction. In the fall of 1971, Commissioner Armstrong established the USBR's Colorado River Water Quality Improvement Program (CRWQIP). In February, 1972, the Bureau issued its report entitled "Colorado River Water Quality Improvement Program," which described the program and its organizational management structure.

From fiscal year 1971-72 through fiscal year 1974-75, a total of about $7,800,000 has been expended for the salinity control program. An additional $4.4 million is budgeted through September, 1976.

Current Organization of Salinity Control Program

As we understand it, the organizational structure within the Bureau of Reclamation for execution of CRWQIP is as follows: The responsibility for overall direction is assigned to the Assistant Commissioner - Resources Planning, with the work activities being carried out under the direction of the Regional Directors of the Upper Colorado and Lower Colorado Regions. The work in the Lower Colorado Region is accomplished in the region's planning office. The work in the Upper Colorado Region is accomplished in the region's planning office and its Western Colorado Projects Office. The Water Quality Office in Denver has the responsibility to coordinate, develop and expedite the activities of the CRWQIP and to work with other federal, state and local agencies. The Chief of the Water Quality Office reports to the Chief of the Division of Planning in Denver who reports to the Assistant Commissioner - Resources Planning.

Comments on Current Organization

To date, it appears that the current Regional Director - Water Quality coordinator arrangement has not been as effective as had been hoped, which may be due to the fact that the coordinator does not have the responsibility of directing the program. The current programs appear to be operated as several related but independent programs rather than as a basinwide program. It may be that the Regional Director-coordinator arrangement is an impediment to the Bureau conducting the salinity control program as truly a basinwide program.

Recommended Management Structure

The Forum members are convinced that a Project Manager for the CRWQIP as discussed below would be the best management approach for the future of the program. However, it is recognized that because of the existing structure of the Bureau, other approaches may be more desirable. Therefore, two modified project manager alternatives are also presented.

Project Manager Concept

The CRWQIP is considered by the basin states to be a major continuous program that will last for years. It differs from many of the USBR programs that have been handled in the past and deserves special consideration by the USBR of a different management approach. In the past, representatives from the basin states asked the Bureau to reorganize the salinity control program using the project manager concept. The organizational structure envisioned would be similar to that used by industry and many other well-managed organizations for important programs. A high level project manager would have the responsibility for overall policy, determination of the scope of each activity, and control of priorities.

The individuals to work on the program would be selected primarily from within the Bureau's two regional offices, field offices, and the Engineering and Research Center staff in Denver, but would physically remain within their functional units.

The Project Manager should be in a position to manage research, general investigations, feasibility studies and advance planning for salinity control measures through the Colorado River Basin, and provide the liaison with the States. He should be responsible for establishing the scope, schedule, and funding for all work activities and for decisions on which of these should be expedited, delayed, added or abandoned. He should also be able to use funds for consultants as well as for Bureau personnel.

Management Board - Project Manager Concept

Under this concept, the Project Manager would operate under an overall policy with priorities and scope determined by a board of USBR officials. The board would consult with the Assistant Commissioner - Resources Planning, and the two Colorado Regional directors and other members as the Commissioner determined to be desirable.

Lead Region - Project Manager Concept

In this approach, one regional office would be assigned as the lead region for the salinity control program. A project manager would be appointed for CRWQIP who would report to the Regional Director of the lead region. Knowledgeable personnel in Denver could be assigned as consultants or given specific tasks.

Summary

The Forum recommends that the Bureau adopt the project manager concept for the CRWQIP. The alternative approaches of Policy Board - Project Manager Concept and Lead Region - Project Manager Concept are also submitted for your consideration.

Sincerely yours,

Lynn M. Thatcher
Chairman

cc: Members of Forum
David L. Crandall
Manual Lopez
John Maletic

STATE OF CALIFORNIA—THE RESOURCES AGENCY EDMUND G. BROWN JR., Governor

COLORADO RIVER BOARD OF CALIFORNIA
107 SOUTH BROADWAY, ROOM 8103
LOS ANGELES, CALIFORNIA 90012
(213) 620-4400

September 8, 1977

Mr. Keith R. Higginson, Commissioner
U. S. Bureau of Reclamation
Interior Building
Washington, D. C. 20240

Dear Keith:

We are writing to you because of our concern over lack of construction progress on the Grand Valley Unit of the Colorado River Salinity Control Program. We are particularly concerned about your understanding of the effectiveness of this project as expressed at our August 23 meeting (without Don and Ival present). While you proposed at that time to again review this issue with your staff, we are writing in the belief that it would be helpful for you to hear directly from us concerning our knowledge of the background and expected effectiveness of the Grand Valley Salinity Unit.

HISTORY OF GRAND VALLEY UNIT

The increase in the salt load of the Colorado River as a result of irrigation activities in Grand Valley has been extensively investigated over many years. The U. S. Geological Survey first identified the magnitude of salt loading from irrigation in Grand Valley in its comprehensive report, "Water Resources of the Upper Colorado River Basin - Technical Report," Professional Paper No. 441, published in 1965.

In the late 1960's, the Bureau of Reclamation and the predecessor of the Environmental Protection Agency jointly funded extensive studies on Colorado River salinity sources and potential control. A report summarizing these studies entitled "The Mineral Quality Problem in the Colorado River Basin," was completed around 1970 but not published until 1971 by the EPA. This report substantiated the analyses made by the USGS regarding salt loading in Grand Valley, and advanced the concept that salts were picked up as seepage water from the irrigation transmission and distribution systems and farm operations percolated through and over the underlying Mancos Shale formation in returning to the Colorado River. The report also outlined a salinity control project in Grand Valley based on reducing canal and farm seepage losses so as to decrease the volume of dissolved salts entering the Colorado River.

In order to obtain field work on these concepts, the EPA began funding research projects in the Grand Valley in 1970 and 1971. These projects, primarily conducted by Colorado State University (CSU), included the lining of canals and laterals in a small section of Grand Valley, the construction of experimental farms, and other research activities. CSU's work verified the concepts that salt loading occurred as a result of deep percolation returning to the river and that reductions in deep percolation from canal lining and on-farm improvements would reduce the river's salt load.

In 1972, the Bureau of Reclamation presented a program for controlling the salinity of the Colorado River, called the Colorado River Water Quality Improvement Program. Studies investigating control measures outlined in the program commenced in that year. In 1974, Congress passed P. L. 93-320 which authorized for construction four of the salinity control measures presented in the Bureau's program, including the Grand Valley Unit. While the Grand Valley Unit is the only irrigation improvement project authorized for construction by P. L. 93-320, the Act directed the Bureau to expedite completion of planning reports on four other irrigation source units.

In 1973, the Agricultural Research Service (ARS) began detailed analyses of irrigation operations in Grand Valley. Since that time, a total of about $1.6 million has been spent by ARS on its studies. The USBR also continued its activities which included extending grants to other agencies as well as performing analyses with its own staff that verified the relationship between canal leakage and salt pickup. The Soil Conservation Service (SCS) and the Colorado Water Conservation Board (CWCB) also conducted salinity investigations in Grand Valley.

In the early 1970's, all of the entities involved in the Grand Valley salinity control measures formed the Grand Valley Salinity Coordinating Committee to coordinate their activities. This committee included representatives of canal companies and water users within Grand Valley, ARS, SCS, USBR, CSU, and the CWCB.

CONCLUSIONS OF COORDINATING COMMITTEE

The agencies conducting research in Grand Valley have reached a series of conclusions with regard to the salinity situation therein to which all agree. These are briefly set forth as follows:

1. Quantity of salt added to river system due to irrigation operations. Initially, there was some question as to the quantity of salt picked up due to Grand Valley irrigation operations. This resulted from the procedure used to determine salt pickup, which used data from stream flow gaging of both flow rates and salinity to conduct mass balances. Because of the large volumes of river

flow past the gaging stations, small errors in the basic data resulted in widely-fluctuating values of computed salt pickup. However, using other procedures to determine salt pickup that are based on analyses of surface and subsurface flow within Grand Valley, and using data gathered over the past seven years, all investigators have reached general agreement that the rate of salt pickup averages about 700,000 tons per year in Grand Valley.

2. Volume of salts picked up is proportional to volume of water percolating through the ground back to the River. Research studies on highly-instrumented experimental farms and on sub-drainage basins by both CSU and ARS have proved the concept that reductions in deep percolation in Grand Valley would reduce salt pickup in a roughly proportional manner.

3. Sources of water percolating through the ground. Deep percolation of water from irrigation operations occurs from the following sources: the Government Highline Canal, the non-federal canals, laterals from the canals to farmers' fields, on-farm irrigation ditches, and deep percolation of water applied to farmers' fields.

ESTIMATES OF SALT LOADING CONTRIBUTIONS

The ARS and CSU researchers have approached the problem of determining salt loading from the above sources by different approaches, independently evaluating sources of salt loading due to deep percolation. The latest estimates developed by the two groups of researchers, based on data gathered over the past 5-7 years, are as follows:

	Annual Salt Loading (in tons/year)	
Source	ARS	CSU
Seepage from Canals	248,000	155,000
Seepage from Laterals	217,000	222,000
Seepage from Farm Ditches	114,000	105,000
On-Farm Deep Percolation	143,000	209,000
Totals	722,000	691,000

The tabulation shows that the estimates by CSU and ARS are essentially identical for the total salt loading occurring and for the contributions made by laterals and farm ditches. The contribution from main canals was estimated to be 93,000 tons greater in the ARS estimate than in CSU's estimate and on-farm percolation

contributed 66,000 tons less in the ARS estimate as compared to the CSU estimate. These differences should be resolved as additional data are gathered and analyzed, but even the lower level of the estimated rates of salt pickup therefrom are significant enough to justify appropriate salinity control measures. The CSU investigators concur with ARS in the estimated salt load contribution from the Government Highline Canal. Thus, most of the differences between the two estimates of canal contributions of salt are based upon different assumptions regarding seepage rates from the non-federal canals in Grand Valley.

Lack of Construction Progress

In March 1975 the Colorado River Basin states were told that the Definite Plan Report (DPR) for the entire Grand Valley Project would be completed in June 1976. In July 1976, we were informed that the DPR would not be completed until June 1977. In June 1977, we were told that because of a number of problems on certain aspects of the project, it was decided to prepare a DPR only on the 7000 acre Salt Wash area. This would allow construction of the field station to commence in the current fiscal year. The new schedule called for completion of the DPR by September 1, 1977, commencement of construction of a field station in August, 1977, followed by detailed design which would allow construction to commence in the fall of 1978.

The states were in agreement with this program since it allowed for a rapid commencement of construction. We were shocked to find out after the Bureau's August, 1977, programming conference that the Salt Wash area had been cancelled and that the Reed Wash area was selected with a possibility of still further delay in the commencement of construction for the Grand Valley Project.

Conclusions and Recommendations

The problem of salt contribution to the Colorado River from irrigated agriculture in Grand Valley has been extensively studied for many years, with essential agreement being reached upon the total salt contribution, the mechanisms causing the salt contribution, and feasible control measures. These measures include lining laterals and farm ditches, lining the Government Highline Canal, and on-farm measures. The only factor not yet resolved is the volume of salts resulting from the unlined non-federal canal systems in Grand Valley, and the concerned investigators are working to resolve this issue. Construction of the Grand Valley Project should not be held up pending monitoring of a small portion of the project. Sufficient information has been developed over the past decade to assure that the measures to be taken under the Grand Valley Salinity Control Program will significantly reduce the amount of salt entering the Colorado River.

We recommend that:

(1) The DPR and design work for the Reed Wash area be completed as soon as possible so that construction can commence in the fall of 1978.

(2) Construction of the field station should commence early in calendar year 1978.

(3) The DPR and design work for units following the Reed Wash area should be completed as soon as possible so that there will be no delay in construction.

(4) Construction of the second and subsequent units should not await the results of any monitoring of the Reed Wash area.

(5) The entire Grand Valley program should be scheduled so that there will be no unexpended funds in fiscal 1978.

We appreciate that you took time out from a very busy schedule to meet with us and look forward to meeting with you again on this subject. Please do not hesitate to contact any of us if you need additional information.

Because of a lack of time, we were unable to have contributions to this letter from all of the state agencies in the seven basin states that support the Grand Valley Salinity Control Unit. However, the letter was discussed with Felix Sparks, Director, CWCB, and has the support of the state of Colorado wherein the project is located.

MYRON B. HOLBURT, Chief Engineer
Colorado River Board of California

WESLEY E. STEINER, Executive Director
Arizona Water Commission

DONALD L. PAFF, Administrator
Division of Colorado River Resources

IVAL V. GOSLIN, Executive Director
Upper Colorado River Commission

M. B. Holburt

By MYRON B. HOLBURT
Chief Engineer

United States Department of the Interior

BUREAU OF RECLAMATION
WASHINGTON, D.C. 20240

IN REPLY
REFER TO: 725
520.

OCT 20 19[illegible]

Mr. Myron B. Holburt
Chief Engineer
Colorado River Board of
California
107 South Broadway
Los Angeles, California 90012

Dear Mr. Holburt:

Your letter of September 8, 1977, expressed the concern of yourself and others over the progress we are making toward the initiation of construction on the Grand Valley Unit of the Colorado River Basin Salinity Control Project.

We, too, regret the delay that has occurred in the Grand Valley Unit. However, you should keep in mind that the project was authorized without a feasibility report and the associated supporting studies that are normally completed prior to project authorization. As a result certain problems have arisen that would have normally been uncovered during the feasibility study stage. For example, we generally agree that there have been sufficient studies conducted in the Valley to indicate that the construction of the unit as authorized would effect a significant reduction in salt loading to the Colorado River. We are concerned, however, that the studies have not been sufficiently detailed to provide the necessary information to determine precisely which areas or which sources (i.e. canal and lateral seepage or irrigation deep percolation) are contributing the greatest load. We need that information to determine the most cost-effective plan for reducing the salt loading from Grand Valley. There has been a substantial disagreement among those who have been active in the Valley as to the precise direction our activities should take.

We believe it is important to proceed cautiously at first with an initial stage, in the Reed Wash area, that has an associated monitoring program to evaluate the impact of our activities on the salt contribution to the river. We agree that long delays while a monitoring program is conducted are not desirable but believe that we can obtain the needed information and guidance from such a monitoring program as construction proceeds.

In addition, we are concerned about the possibility that the water saved by the unit may be used to irrigate new lands, be applied to the existing irrigated lands, or be used for other purposes which could contribute significant salt loading to the river and negate all or part of the benefits from the unit. As a result of this concern, we are exploring, with the State of Colorado and the water users in the Grand Valley, means of assuring ourselves that such a situation will not occur.

When we have satisfied ourselves that we have adequate protection with regard to the future use of saved water and have completed negotiation and signing of an operation, maintenance, and replacement contract with the local entities involved, we plan to proceed on a schedule similar to the one you propose with two exceptions. Those exceptions are associated with your last two recommendations. We believe that future construction activities should be guided by information obtained from monitoring the results of our program in the Reed Wash area. While we do not propose to delay continuation of the project while we complete a long-term monitoring program, we feel that further work in the Valley should be guided by any information we can obtain from such monitoring to assure that we develop a program that is cost-effective rather than one that would line all canals and laterals regardless of the variability in impact on salt loading from one area to another.

We should point out that it is not our intention to stop the program to wait for input from monitoring activities. We are presently evaluating several areas of the Grand Valley to determine where sufficient information is available to proceed. As such areas are identified we will proceed as rapidly as practicable.

With regard to your last recommendation, we cannot commit ourselves at this time, to a program that will assure that there will be no unexpended funds for the Grand Valley Unit in fiscal year 1978. It is our intent, however, to proceed with a program that will result in the obligation of all construction funds available for the Grand Valley Unit by the end of the fiscal year.

Again, we regret the delays that have occurred in development of the Grand Valley Unit and assure you that we intend to proceed as rapidly as practicable in the future.

If we can be of further assistance, please feel free to call on us.

Sincerely yours,

Assistant Commissioner

COLORADO RIVER BASIN SALINITY CONTROL FORUM
355 SOUTH FOURTH EAST STREET
SALT LAKE CITY, UTAH 84111

July 21, 1978

Mr. R. Keith Higginson, Commissioner
U.S. Bureau of Reclamation
Interior Building
Washington, D.C. 20240

Dear Keith:

The Colorado River Basin Salinity Control Forum is in the process of developing for the seven-basin states the once-in-three-years revision of the water quality standards for salinity in the Colorado River. The Bureau of Reclamation's Salinity Control Program and Water Quality Improvement Program represent the major components of the implementation plan for salinity control.

The Forum is gravely concerned that the Bureau's program continues to fall significantly behind schedule. In 1975, when the Forum developed its implementation plan for salinity control, the Bureau's schedule called for eight salinity control units to be either fully or partially on line by 1980. Now only one of those eight units, Grand Valley, is scheduled to be partially on line by 1980. In fact, all of the units authorized or identified in P.L. 93-320 have encountered delays, since 1975, ranging from one to four years.

The Forum understands there are several reasons for these delays. Most critical are higher priority being given to construction projects and planning activities, and man-power limitations.

The Forum urges that the salinity control projects and programs be given a much higher priority and that the Bureau employ consulting engineering firms to carry out the planning studies and design activities.

Without the expeditious completion of the salinity control program, the states will be unable to meet the adopted numeric criteria for salinity; nor will the Secretary of the Interior be able to implement the salinity control policy for the Colorado River, as directed by Congress in P.L. 93-320, to maintain salinity at or below the 1972 levels in the lower main stem while the Basin states continue to develop their compact-apportioned waters.

Sincerely,

Daniel F. Lawrence

Daniel F. Lawrence
Colorado River
Salinity Control Forum

COLORADO RIVER BASIN SALINITY CONTROL FORUM
355 SOUTH FOURTH EAST STREET
SALT LAKE CITY, UTAH 84111

September 14, 1978

Mr. R. Keith Higginson
Commissioner
Bureau of Reclamation
U. S. Department of the Interior
Washington, D. C. 20240

Dear Keith:

My July 21, 1978 letter to you expressed the concern of the seven state Colorado River Basin Salinity Control Forum that the Bureau's salinity control program continues to fall significantly behind schedule. On August 2nd, Wesley Steiner, Myron Holburt, and I met with you, members of your staff, and the Colorado River Basin Regional Directors on this issue during your annual program conference. Our purpose was to directly convey those concerns to you and ask for expeditious completion of the planning reports authorized by P.L. 93-320 and a schedule which would result in earlier completion dates. At the end of that meeting, the three of us believed that we had made considerable progress in coming to some meeting of minds as to a more expeditious schedule.

We were therefore shocked when we were informed about the Bureau's revised schedule which was issued subsequent to your program conference. Attached is a table which lists the schedules of completion of the planning reports presented by the Bureau in 1975, late 1977, and the current August 1978 schedule. You will see that the delays of one to four years from 1975 to 1977, noted in my July 21st letter, have been increased by about one to two and a half years for most of the projects. The net result is that the Bureau's current response to the directive by Congress in June 1974 (Public Law 93-320), that the Bureau expedite completion of planning reports is that, with the exception of LaVerkin Springs Unit (which had considerable work done on it prior to 1974), the earliest planning report is scheduled to be completed seven years after the date that Congress told the Bureau to expedite, and the latest will be completed eleven years after that date. We believe the purpose of the planning reports' language included in P.L. 93-320 is to find out as quickly as possible which projects are feasible and what should be their priority for construction. It is not necessary to proceed to detailed designs and final decisions for all of the items being covered in the report.

We recognize the problems that the Bureau has with reduced manpower, funding, and the requirements to complete other high priority work. However, consistent with your other responsibilities, we believe that the salinity program can be expedited. Our knowledge of the projects indicates that there are two methods for shortening the completion time for the Bureau's reports: (1) through use of consulting engineering firms (A-E contracts) to complete the feasibility reports, and (2) by reducing the amount of detail required by the Bureau staff for the feasibility studies.

We have been informed that the Bureau intends to let an A-E contract for the Meeker Dome project, but believe that other A-E contracts should also be promptly let. We believe that the Bureau's current approach of waiting to see if the consulting firm selected does a good job on the Meeker Dome report before negotiating other A-E contracts is much too cautious and will lead to further delays. The use of A-E contracts should advance the Bureau's August 1978 schedule for the following units by about two years. A-E contracts should be let for the Uintah Basin Unit, the Glenwood Springs-Dotsero Unit, and the Big Sandy Unit. We understand that some members of your staff are sympathetic to letting a contract for the Glenwood Springs-Dotsero Unit, but are unsure whether there will be sufficient money in your budget to do so. We would be pleased to work with others in the Administration to try and obtain additional funds for this unit. The work accomplished to date on the Uintah Unit by the Bureau would lend itself to prompt completion by a consulting engineering firm. Although the Big Sandy Unit does not appear to be cost effective if the water has to be disposed of, it should be promptly completed so that it can be used as a possible low quality water supply for energy development in the Upper Basin.

We also believe that time and money could be saved on the Lower Gunnison Basin Unit, the Uintah Basin Unit, and the McElmo Creek Unit, if more realistic requirements were set for the feasibility reports. Completion of these reports is apparently being held up in order to obtain more seepage data, groundwater movement data, and water quality data. It appears that sufficient data have been obtained so that the preliminary design can now proceed with sufficient accuracy to attain the necessary cost estimates. If it is determined that additional data are essential, they can be gathered concurrently with development of the design data and cost information. The final report can be modified to reflect any changes warranted by the additional data.

In addition to the problems of completion of the planning reports, there are the problems of the projects authorized for construction in 1974. The four authorized projects are in various stages of disarray. The Crystal Geyser Unit has been deferred indefinitely, and the Las Vegas Wash Unit is being re-evaluated. My September 1, 1978 letter to you expressed our concerns about the Grand Valley Unit. By decision of the Bureau, this unit is moving at a snail's pace, with self-imposed inhibitors to any rapid progress. Only the Paradox Valley Unit seems to have some consistent movement to it, although it is also considerably behind schedule.

In summary, we believe it is essential that the Bureau indicate a strong commitment to achieve the objectives for salinity control which Congress directed to the Secretary of the Interior in 1974. It is also essential that the schedule given to us last month be improved so it can be counted on as the basic element in the plans of the seven Colorado River Basin States to meet the salinity standards on the Colorado River. The seven Basin States are united in their determination to achieve a strong Colorado River salinity control program.

Sincerely yours,

Daniel F. Lawrence
Chairman

DFL:hiw

cc: Each member of "Forum"

COMPARISON OF ESTIMATED COMPLETION DATES OF
FEASIBILITY REPORTS OF USBR SALINITY CONTROL PROJECTS

SALINITY CONTROL PROJECT	USBR 1975 SCHEDULE	USBR 1977 SCHEDULE	USBR AUGUST 1978 SCHEDULE
LaVerkin Springs Unit	June 1975	December 1978	April 1979
Lower Gunnison Basin Unit	June 1978	December 1979	December 1981
Uintah Basin Unit	June 1978	December 1979	June 1982
McElmo Creek Unit	June 1979	September 1980	March 1982
Lower Virgin River Unit*	June 1976	October 1981	July 1981
Meeker Dome Unit (New Unit)		December 1981	December 1981
Glenwood-Dotsero Springs Unit	June 1979	October 1982	September 1983
Price River Unit	June 1978	October 1982	March 1985
San Rafael River Unit	June 1979	October 1982	March 1985
Dirty Devil River Unit	June 1979	September 1983	September 1985
Big Sandy River Unit	June 1978	September 1983	December 1983

* Replaces the Littlefield Springs Unit

SUPPLEMENT TO

1978 REVIEW

SUPPLEMENT INCLUDING MODIFICATIONS TO
"PROPOSED 1978 REVISION, WATER QUALITY STANDARDS
FOR SALINITY INCLUDING NUMERIC CRITERIA AND PLAN OF
IMPLEMENTATION FOR SALINITY CONTROL,
AUGUST 1978, COLORADO RIVER SYSTEM"

December 18, 1978

SUPPLEMENT INCLUDING MODIFICATIONS TO

PROPOSED
1978 REVISION
WATER QUALITY STANDARDS FOR SALINITY
INCLUDING
NUMERIC CRITERIA
AND
PLAN OF IMPLEMENTATION
FOR SALINITY CONTROL
AUGUST 1978

COLORADO RIVER SYSTEM

Prepared by
Colorado River Basin Salinity Control Forum

December 18, 1978

December 18, 1978

Supplement including Modifications to
"Proposed 1978 Revision - Water Quality Standards
for Salinity Including Numeric Criteria and Plan
of Implementation for Salinity Control,
Colorado River System, August 1978"

This supplement to the subject report contains a summary and analysis of the comments on the report received at public meetings held in Las Vegas, Nevada, on November 14, 1978, and Grand Junction, Colorado, on November 16, 1978, and comments received by mail dated no later than November 22, 1978. The supplement also includes modifications to the Forum's August 1978 report based upon the comments received and corrects minor errors that appear in the report. The states of the Colorado River Basin, acting through their Colorado River Basin Salinity Control Forum, prepared these revisions pursuant to Section 303(c)(1) of the Clean Water Act.

Summary and Analyses

Bureau of Reclamation

The Bureau representative stressed the importance of the salinity standards to the Department of the Interior and to the Bureau of Reclamation. These agencies are charged with the responsibility for planning and constructing the principal physical components of the plan of implementation. The Bureau continues to support, as it did in 1975, the Forum's basin-wide approach to the salinity problem. Independent analyses by the Bureau support the Forum's conclusion that the numeric criteria at the three stations for which criteria have been established will not be exceeded during the next three-year period. The Bureau's studies confirmed the Forum's finding that there has been a significant reduction in salt load as compared to runoff during the past several years. The Bureau recognizes the need for expeditious action on its salinity control efforts and has made changes in priorities and procedures and expects to make significant progress on the projects identified in the implementation plan. No recommendations were made as to changes in the Forum's report.

Citizen's Environmental Resources Advisory Board for Clark County, Nevada

The Advisory Board expressed its concerns with the Bureau of Reclamation's salinity control program for Las Vegas Wash and its impact on the [illegible] and timing of the 208 Plan for Clark County. The Board urges the Bureau to integrate its research activities with others and to consider the 208 Plan for the County. The Bureau's proposed Lower Virgin River salinity control project is also of concern to the Board. It is the Board's opinion that the project as proposed violates

the provisions of the 208 Plan and will not be acceptable to the residents of Clark County. The Board made no specific recommendations for changes in the Forum report.

With respect to the Board's concerns regarding the Las Vegas Wash Salinity Control Program, it is the Forum's understanding that the Bureau is coordinating with others on this project.

Planning on the Lower Virgin River salinity control unit has not advanced sufficiently for the Forum to evaluate the Board's proposal regarding that unit. Multiple Objective Planning teams have been formed for the Lower Virgin River Unit and the public has been invited to participate.

Clark County Environmental Quality Policy Review Board

The Review Board recommends the Forum clarify the language and intent, as regards municipal discharges, of the "Policy for Implementation of the Colorado River Salinity Standards through the NPDES Permit Program" presented in Appendix A.

The Forum believes that the language of the policy adequately describes its intent. The proposed 400 mg/l incremental increase in total dissolved solids above the flow-weighted average salinity of the intake water supply is a guideline which, if exceeded, would require demonstration by the permittee that it is not practicable to limit the incremental increase to 400 mg/l. The Forum in no way intends to preclude the individual states from establishing more stringent requirements if they so desire.

The Review Board also recommends that, with the deferment of construction of the Las Vegas Wash Unit, the Bureau fully integrate its activities with the on-going investigations by Clark County. The Board recommends the addition of the following language in the report regarding both the Las Vegas Wash and Lower Virgin River Units: "The Bureau of Reclamation should coordinate and integrate the studies and investigations of the Las Vegas Wash and Lower Virgin River Units with the Clark County 208 Program continuing planning activities."

The Forum accepts this recommendation with modifications and makes the following changes to the report:

Page 42, second paragraph - the last sentence is deleted and the following added:

> "The Bureau of Reclamation and the 208 agency should coordinate and consult with each other on the studies and investigations, as part of the public involvement process. When the 208 plan has been defined and the hydrosalinity studies completed, a salinity control project will be recommended."

Page 46, the following sentence is inserted at the end of the first complete paragraph:

> "The Bureau of Reclamation and the 208 agency should coordinate and consult with each other on the studies and investigations of the Lower Virgin River as part of the public involvement process."

California Farm Bureau Federation

The spokesman for the Federation endorsed, in general, the proposed revision. The Federation in no way wishes to interfere with the other basin states' right to develop their compact-apportioned waters, however, the Federation is concerned with the provision of the plan which allows for temporary increases in salinity above 1972 levels should water development projects be completed before control measures are brought on line. The Federation recommends that offsetting salinity control units be completed within 30 days of water development projects.

The Forum believes the Federation recommendation is unrealistic. The federal regulations of December 18, 1974, under which the original salinity standards were prepared stated in part:

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

The plan of implementation includes sufficient salinity control measures to offset the salinity increases caused by the 1990 level of development.

The Metropolitan Water District of Southern California

MWD fully supports the recommended numeric criteria and the revised plan of implementation. The District is concerned about the delays that have occurred in the scheduled completion dates for the salinity control projects and urges the Bureau to expedite its program. The District made no recommendations for changes in the report.

John E. Hiatt, Las Vegas

The statement recommended that the Bureau concern itself with the salinity impact of reservoir evaporation. He urged the Bureau to re-evaluate its program for river operation and storage, to either minimize reservoir evaporation or eliminate it. No recommendations were made for changes in the Forum report.

Environmental Protection Agency (EPA)

Salt Routing Studies - EPA suggests that the report include a discussion of the results of the routing studies developed for the draft report and the basis for the selection of the specific results presented in the report.

The Forum believes the report essentially describes the scenarios examined by the Work Group in conducting the salt routing studies. For clarification, the following changes are to be made on pages 16 and 17. Starting with the third paragraph on page 16, the report should read as follows:

> "Historical flow-weighted annual salinities and projected salinities at Imperial Dam for the 14 maf water supply condition and low level of development are shown on Figure 2. The projection for the low level of development and the 14 maf water supply is shown as it approximates the average recent historical rate of development and the average water supply for the period 1941 to 1976. The five-year moving mean of historical and projected salinities is shown on Figure 3. The moving mean dampens annual fluctuations and should be a better indication of salinity trends. These two figures have been included in order to compare historical and projected salinity trends. Figure 4, showing historical and projected salinities at Imperial Dam for the 14 maf water supply condition and moderate level of development, has also been included to demonstrate the effect of a higher depletion level. The approximate effects of a 500 thousand ton per year reduction in base salt load on 1990 salinities are shown on Figures 2 and 4."

Temporary Salinity Increases - EPA proposes that a "mitigation salinity control policy" should be maintained. The policy would require that any development project which increased salinity must be accompanied by a decrease in salinity in some other part of the basin, which would at least equal the expected increase. EPA contends this policy is based on the conclusions and recommendations of the Seventh Session of the Conference in the Matter of Pollution of the Interstate Waters of the Colorado River and Its Tributaries and the federal regulations printed in the Federal Register on December 18, 1974.

The basic thrust of the Conference was a basin-wide approach to both salinity control and water development. It did not include the concept that specific water development projects be accompanyed by specific salinity control projects. The Forum recognizes that the duration and magnitude of temporary increases is a potential problem. The present program

of continuous review, monitoring and salinity projections should help identify any potential difficulties which the Forum will then address within the framework of the federal regulation of December 18, 1974.

Each of the items presented in Table 6 address the problem of salinity increase, temporary or otherwise.

Colorado River Below Imperial Dam - It is the belief of EPA that the standards should cover the entire River including that portion below Imperial Dam. However, the Forum's position is that salinity below Imperial Dam is subject to Minute 242 and Title I of P.L. 93-320 (P.L. 95-217, Sec. 310(a) and Sec. 511(a)).

State and Local Role in Salinity Control - The 1975 Forum report called for the Basin states to "identify and evaluate water resources management programs, policies, and regulations and assess them for the purpose of identifying where they can be redirected toward salinity control policy". EPA recommends the results of that activity be reported in the 1978 Revision.

The Basin states worked with the EPA-funded Denver Research Institute's study and thoroughly reviewed their report. The above process has resulted in an identification and evaluation of state programs, regulations, and policies and the results are presented in Table 5 and the accompanying text. The Forum encourages state and local entities to investigate and implement these and other actions which they find applicable.

Conservation - EPA suggests the Forum include an examination of opportunities for implementation of water conservation practices as components of the salinity control plan. The Forum agrees that opportunities for further reduction in salt pickup and reductions in non-beneficial uses of water may exist and should be investigated. The following is added to Table 6, page 116:

Activity or Source of Salinity	Action to be Taken	Timing	Entities Responsible for Taking Action
	Investigate areas where reduction in salt pickup and reductions in non-beneficial uses of water may be achieved.	Oct 1981	Forum and Basin States

Future Direction - EPA notes that the Forum focused on the period up to 1990 and recommends an analysis of long-term solutions. The Forum feels that projections in excess of 12-15 years are too speculative. The 1981 Revision will go beyond 1990 in keeping with the 12-15 year projections. At that time, the Forum will also look at possibilities beyond the 12-15 year period.

Northern Colorado Water Conservancy District

The District supports the 1978 Revision, however, it is concerned with the provision for inclusion of 208 Plans as part of the Forum's implementation plan, and suggests modification of the approach which would automatically incorporate all 208 Plans.

After the salinity portions of the 208 Plans have been adopted by a state and approved by EPA, they automatically become a part of the state's plan. The Forum will continue to work with the basin states to provide guidance in an effort to insure consistency of the salinity portions of the 208 Plans with the Forum's goals and objectives. The Forum appreciates the District's concern but does not intend to either support or oppose any portions of 208 Plans which might proport to control the place or purpose of use of any of the states' apportioned waters.

Atlas Minerals, Inc.

The representative from Atlas requested that the Forum grant an exemption from the NPDES permit policy for a naturally occurring ground water which does not contain process water and is discharged to a land disposal site. According to Atlas, no disposal water reaches the river system.

The above described conditions are accomodated without any changes in the Forum policy. Discussions with the Utah Environmental Health Services Branch indicate that both construction and discharge permits are required to assure compliance by Atlas Minerals, Inc., with existing State and federal regulations. This requirement is based on factors other than total dissolved solids present in the discharge.

National Council of Public Land Users

The Council feels that the water quality problem originates on National Resource Lands (NRL) and is mainly due to overgrazing. It suggests that grazing programs be drastically reduced and land management methods, other than those presently used, be adopted.

The Forum recognizes that National Resource Lands contribute to the salinity of the Colorado River. The Bureau of Land Management (BLM) is studying the effect of these lands on salinity. Management programs for reduction in salinity for NRL have been proposed in the BLM report, "The Effects of Surface Disturbance on the Salinity of Public Lands in the Upper Colorado River Basin - 1977 Status Report", February 1978. Those programs are now under review and consideration by BLM. The Forum supports cost-effective management programs which will minimize salinity contributions to the river. At present, the Forum is studying the BLM proposals and will submit comments in the near future.

Izaak Walton League of America, Inc.

The Grand Junction Chapter of the League supports the report in general and specifically the wildlife habitat mitigation measures related to the Grand Valley Unit. The League made no recommendations for changes in the report.

Northwest Colorado Council of Governments (NWCOG)

The Council submitted comments in rebuttal to statements made by the Northern Colorado Water Conservation District.

The Council suggests that the center heading on page 79, "Other Non-Federal Measures to Control Salinity", be changed to "Total Consumptive Use of Saline Water". The Forum considered this suggestion but believes that the existing title is appropriate. However, the Forum amends the report as follows: Fifth line from the bottom of the page: ". . . they include the elimination of discharges to the river system from".

NWCOG urges the State of Colorado as well as the other members of the Forum to actively seek implementation of the recommended DRI management actions. NWCOG disagrees with Colorado's responses (page 92). In response to NWCOG's comments, the Forum amends the report as follows:

Page 87, end of third paragraph:

Add the following:

"The states and local entities are encouraged to use whatever authority they have to implement those actions which are applicable."

Page 92, (2):

Should read:

"Saline irrigation return flows are not located in areas of present need. However, as plans are initiated for new plants, studies should be made of the feasibility of using saline return flows or other low quality waters for cooling, either by locating the plants near such waters or piping the waters to the location of the plants."

Page 92, (3):

Should read:

"Even though the state itself probably lacks legal authority to impose land use controls which would prohibit or limit agriculture on saline lands, local entities seem to have such authority."

Page 92, (4):

Should read:

"The DRI report says 'Colorado statutes give no authority for the state to use economic incentives to promote change in land use . . .' However, the legislature could provide such authority and money to implement it."

Page 92, (5):

Should read:

"Because water conservancy districts or irrigation districts are the prime agencies responsible for setting prices of water to the ultimate user, such districts, not the state, are the entities with legal authority to make special use charges. The DRI report states 'Although this action has potential to reduce the amount of agricultural water delivered, particularly in areas where agricultural return flows contribute substantially to salinity, it does not meet the criterion of being politically acceptable at the local level. . .' Even though this is generally the case, there may be some instances where special use charges would be acceptable and beneficial in salinity control."

Page 92, (6):

Should read:

"The legal authority of the state itself to provide economic incentives for such purposes is

questionable. However, as stated in 3 above, the legislation could provide such authority and money to implement it."

Utah Power and Light Company

The Company's comments may be summarized as follows: 1) New upstream users should not be required to compensate for salinity resulting from natural sources and existing uses; 2) undue emphasis has been placed on industrial discharges, which have a negligible impact on salinity, while efforts to reduce irrigation of saline soils have been large ignored; and 3) the Company suggests that further efforts must be directed toward determination of the best and most economical method of reducing downstream salinity, and that industrial users should not be required to clean up discharges while agricultural users are not required to do so.

To attain the plan's objective of maintaining the numeric salinity criteria, while the basin states continue to develop their compact-apportioned waters, requires the implementation of all practicable salinity control measures. The plan includes six salinity control units which will control natural sources and eight which are directed, totally or in part, at agricultural sources. In addition, the Soil Conservation Service is proposing on-farm practices which will further reduce salt loading from irrigation sources.

The effects of the Company's present and proposed consumptive use of water on salinity are not negligible. The Company's consumptive use of 20,000-40,000 acre-feet, if that part of the amount diverted which is not consumed is returned to the stream, would be equivalent to adding 20-40,000 tons of salt per year to the supply remaining in the river, resulting in a salinity increase of 2-4 mg/l at Imperial Dam.

The Forum's policy for industrial discharges requires no-salt return whenever practicable. If a permittee can demonstrate that no salt return is not practicable, a permit can be issued with less stringent requirements. The Forum believes that its policy, which has been adopted by the states and approved by EPA, contains sufficient flexibility to handle site-specific situations.

Maintenance of the numeric criteria by practicable and cost-effective methods has always been the Forum's objective. The Forum's recommendation for deferral of two authorized salinity control units because of their low cost-effectiveness is an indication of this objective.

Soil Conservation Service

The Service expresses its concern over the lack of progress in implementing the salinity control program and the lack of coordination with water quality and conservation efforts. The Service states that delays in the Bureau of Reclamation's Grand Valley Unit could hamper the successful completion of on-farm measures in the Valley, since these measures are dependent upon the location, design and construction of the main canals and laterals.

The Forum is pleased that the Soil Conservation Service is now taking a significant role in salinity control. The Forum is also concerned about the delays in the Bureau's program. A significant item is the Bureau of Reclamation's plan to have a year's delay in initiation of construction of Stage II of the Grand Valley Unit following the completion of Stage I (letter of October 2, 1978, Commissioner Higginson to Dan Lawrence). The Forum urges the Soil Conservation Service to meet with the Bureau of Reclamation to see if the one-year delay planned by the Bureau can be eliminated so that the SCS on-farm program will not be delayed. The Forum's overall concern is evidenced by the discussion in the report, pages 50-54, and the material presented in Appendix C.

The SCS urges that efforts be made to secure the best possible coordination between the local 208 agencies, the Forum and federal agencies.

Coordination of effort between responsible agencies is a Forum objective. The Forum initiated a cooperative effort with the 208 agencies in 1977, and, in a number of states, the agencies to which Forum members belong are active participants in the development of 208 Areawide Waste Treatment Management Plans.

The SCS believes that the immediate need is a salinity control plan that will address not only salinity but other water quality aspects, water conservation, water supply, fish and wildlife and instream flow, rather than a more accurate salt routing analysis.

The Forum's objective is a salinity control plan which will maintain the adopted numeric criteria while the basin states develop their compact-apportioned waters. The Forum's objective is limited to salinity. In order for the Forum to develop a timely and cost-effective salinity control plan, accurate salinity projections are required. Therefore, the Forum believes that re-analysis of runoff-salt relationships and new salinity projections are of primary importance.

Wyoming, Department of Environmental Quality

The Department points out that the first sentence on page 67, under the heading Wyoming, is incorrect and should be deleted.

The Forum accepts the suggestion and deletes the sentence.

The Navajo Nation

The Navajo Nation shares with the Forum the general concern over increasing salinity of the Colorado River, but is concerned that needed growth will be hampered by salinity control requirements. They are also concerned that future attempts to control the Blue Springs may result in activities contrary to the religious beliefs of the Navajo and Hopi peoples.

The intent of the Forum is to maintain the adopted salinity criteria while the basin states continue to develop their compact-apportioned waters. The control measures included in the plan of implementation consist of federal and non-federal actions encompassing existing man-made and natural sources, as well as future development.

In 1974, when the Forum was investigating salinity sources and possible control measures, consideration was given to Blue Springs, a significant point source. However, because of its special religious significance to the Indian people and other factors, the Forum decided not to include Blue Springs as part of the implementation plan.

Environmental Defense Fund (EDF)

Salt Routing Studies - EDF suggests that, in addition to Figures 2, 3, and 4, the results of all of the salt routing studies should have been included in the report.

The Forum disagrees with this suggestion. See comments on page 5 under the heading Environmental Protection Agency, Salt Routing Studies.

Change in Flow Versus Salt Load Relationships - EDF questions the Forum's conclusion that a change in flow versus salt load relationships has occurred in recent years stating that the salinity at Lees Ferry in 1976 is only 10 mg/l below that in 1972.

The Forum's conclusion was based on a preliminary analysis of records beginning in 1941 for Lees Ferry, stations above Lees Ferry, and on the lower main stem of the river. On the lower main stem, 1976 salinities are nearly 60 mg/l lower than those in 1972. Due to reservoir storage, a lag of about two years exists between Lees Ferry and lower main stem stations. Therefore, a comparable period for Lees Ferry would be 1970 through 1974. During this period, the decrease in salinity at Lees Ferry was 83 mg/l.

The Forum appreciates the reference to the article in Science magazine (Vol. 202, pgs. 629-631, November 10, 1978)

and will consider the information in its new studies. However, at this time, the Forum sees no reason to alter its conclusion that the flow versus salt-load relationships used in the model result in salinity projections that are too high.

Monitoring Points and Baseline Values - EDF suggests that the baseline curves for Upper Basin stations for which baseline values are to be developed should be included in the report. The Forum has not yet completed its analyses of the data needed to establish baseline values. Difficulties with the data base and limitations in manpower and funds have delayed the development of baseline values. However, the analyses and collection of data are continuing. The Forum feels that the baseline curves should not be included in the report until these analyses are completed.

Salinity Control Projects - EDF states that the Forum should consider alternative measures of salinity control that focus on the major controllable sources, such as agriculture and other (unspecified) land-use related sources, and cites the effectiveness of the Soil Conservation Service's on-farm management program in the Wellton-Mohawk area as an example.

The Forum supports all cost-effective programs of salinity control including programs to control salt contributions from agricultural areas. Actually, of the control units discussed in the report, eight are directed totally or in part at agricultural sources and primary consideration will be given to on-farm improvement programs for all of these units. For example, an on-farm improvement program is an integral part of the Grand Valley Salinity Control Unit. In addition, the Bureau of Land Management is studying the effects of National Resource Lands on salinity. Management programs for those lands are under review by BLM.

Denver Research Institute Study of State and Local Management Actions for Salinity - EDF contends that the Forum has taken no action in implementing the 12 state and local management actions for salinity control recommended by the Denver Research Institute study.

The Forum disagrees with this statement. The individual states have reviewed their programs, regulations and policies and believe these reviews and the results are adequately described on pages 86-94 in the report.

Industrial and Municipal Effluent Limitations - EDF contends that industrial and municipal discharges account for only 1 percent of the total salt contribution to the river. While this is true at this time, industrial sources will constitute a significant salinity problem in the future. About one-half of the projected increase in in-basin water use in the Upper Basin is projected to be by industry. EDF

states that, as regards industrial and municipal effluent limitations, the State of Colorado adopted a policy which does not set a limit on salt concentration and that the State of Wyoming did not adopt a policy at all.

EDF's statement regarding the State of Colorado is in error because Colorado has adopted the Forum policy as presented in Appendix A in its entirety. In 1975 the State of Wyoming adopted the salinity standards for the Colorado River which included in the implementation plan the policy of no-salt return whenever practicable for industrial dischargers. While Wyoming has not yet adopted the policy presented in Appendix A, that policy will be considered for adoption as regulation at the same time as the 1978 Revision of the Forum Report.

Oil Shale - EDF states that the report fails to recognize that the modified in-situ process, proposed for two Colorado leases will result in leaching large quantities of salts from the retorted shale when groundwater is allowed to fill back the mine voids.

The Forum adheres to the general policy of no-salt return whenever practicable for industrial discharges. This policy applies also to the oil shale industry. It should be recognized, however, that specific problems will require specific solutions and that the states and EPA, not the Forum, have enforcement authority.

Coal Slurry Pipelines - EDF contends that coal slurry pipelines will result in accelerated use and depletion of basin water resources with attendant increases in salinity.

The Forum recognizes that any consumptive use of water will have an impact on available resources and on salinity. However, the use of water for coal slurry pipelines will not have a greater impact on resource availability and salinity than out-of-basin exports or in-basin industrial uses with no-salt return, and will have a lesser impact on salinity than other in-basin uses. If water having a salinity greater than about 750 mg/l (one ton/acre-foot) is used for coal slurry pipelines, the impact of such use would be a decrease in salinity in the lower main stem under present hydraulic conditions.

Conclusion - EDF concludes that the Forum's implementation plan will fail to meet the goal of maintaining river salinities at 1972 levels because, according to EDF, the Forum neglects the major controllable sources; namely, agriculture and other (unspecified) land-use related sources. In

addition, EDF concludes that salinity standards should be set for five additional stations, located at and upstream of Lees Ferry, to ensure proper control, monitoring, and guidance for future development.

The first conclusion, that the Forum neglects agricultural and other land-use related sources of salinity, is in error. As stated previously, the Forum is considering all sources of salinity and eight of the salinity control units included in the plan of implementation are directed totally or in part at agricultural sources. In addition, management plans to minimize salt contribution from National Resource Lands are being investigated.

As regards the second conclusion, the Forum feels that setting standards at additional stations is unnecessary. The three lower main stem stations for which numeric salinity criteria have been established, appropriately address the salinity problem; those stations plus the baseline stations, should ensure adequate monitoring, control, and plan evaluation. The setting of stateline or sub-basin standards would dictate the selection of salinity control projects and measures that would not be the most cost-effective or consistent with the basin-wide approach as the basin states develop their compact-apportioned waters.

Miscellaneous Comments

A number of agencies submitted comments supporting the report and made no recommendations for changes. The agencies are: International Boundary and Water Commission, Imperial Irrigation District, California Department of Water Resources, Department of Water and Power of the City of Los Angeles, Colorado River Water Conservation District, and District 10, Regional Planning Commission, Colorado.

December 18, 1978

MODIFICATIONS TO THE 1978 REVISION WATER QUALITY STANDARDS FOR SALINITY INCLUDING NUMERIC CRITERIA AND PLAN OF IMPLEMENTATION FOR SALINITY CONTROL

COLORADO RIVER SYSTEM

Prepared by the
Colorado River Basin Salinity Control Forum

August 1978

On the bases of statements made at regional public meetings held in Las Vegas, Nevada, on November 14, 1978, and Grand Junction, Colorado, on November 16, 1978, and on written comments dated November 22, 1978, or before; and to correct other minor errors, the following changes, additions and deletions to the above identified report were approved by the Salinity Control Forum on December 18, 1978.

Page 4, last line of first paragraph; change date from "December 3, 1976" to "November 23, 1976"

Page 5, 8th line; should read: "EPA Regions VI, VIII, and IX. . ."

Page 10, footnote 1; should read: "....U. S. Supreme Court..."

Page 16-17; starting with the 3rd paragraph, page 16, the text should read as follows:

"Historical flow-weighted annual salinities and projected salinities at Imperial Dam for the 14 maf water supply condition and low level of development are shown on Figure 2. The projection for the low level of development and the 14 maf water supply is shown as it approximates the average recent historical rate of development and the average water supply for the period 1941 to 1976. The five-year moving mean of historical and projected salinities is shown on Figure 3. The moving mean dampens annual fluctuations and should be a better indication of salinity trends. These two figures have been included in order to compare historical and projected salinity trends. Figure 4, showing historical and projected salinities at Imperial Dam for the 14 maf water supply condition and moderate level of development, has also been included to demonstrate the effect of a higher depletion level. The approximate effects of a 500 thousand ton per year reduction in base salt load on 1990 salinities are shown on Figures 2 and 4."

Page 24

The chapter title should read "Water Quality Standards for Salinity."

Figure 5, page 26

Item number 13 should read "San Rafael River near Green River, Utah." And Item number 19 should read "Lees Ferry, Arizona."

Page 28, listing, sixth item: should read "Colorado River at Lees Ferry, Arizona"

Page 37, second line from bottom; should read:
". . . with a Stage I . . ."

Page 42

Second paragraph: delete the last sentence and insert the following:

"The Bureau of Reclamation and the 208 agency should coordinate and consult with each other on the studies and investigations as part of the public involvement process. When the 208 plan has been defined and the hydrosalinity studies completed, a salinity control project will be reformulated."

Page 42, forth line from the bottom of the page; delete "indefinitely"

Page 46

Insert the following sentence at the end of the first complete paragraph:

"The Bureau of Reclamation and the 208 agency should coordinate and consult with each other on the studies and investigations of the Lower Virgin River, as part of the public involvement process."

Page 56, seventh line from bottom; should read:

"...(National Pollutant..."

Page 61, fourth line

Should read: "...the 'no-salt return policy wherever practicable.'"

Page 67

The first sentence under the heading Wyoming,"During the period no permits have been issued nor applications received for municipal permits," is deleted.

Page 79, fifth line from bottom of page; should read:

"... they include the elimination of discharges to the river system from"

Page 87, end of third paragraph

Add the following:

"The states and local entities are encouraged to use whatever authority they have to implement those actions which are applicable."

Page 92, (2)

Should read:

"Saline irrigation return flows are not located in areas of present need. However, as plans are initiated for new plants, studies should be made of the feasibility of using saline return flows or other low quality waters for cooling, either by locating the plants near such waters or piping the waters to the location of the plants."

Page 92, (3)

Should read:

"Even though the state itself probably lacks legal authority to impose lands use controls which would prohibit or limit agriculture on saline lands, local entities seem to have such authority."

Page 92, (4)

Should read:

"The D.R.I. report says 'Colorado statutes give no authority for the state to use economic incentives to promote change in land use...' However, the legislature could provide such authority and money to implement it."

Page 92, (5)

Should read:

"Because water conservancy districts or irrigation districts are the prime agencies responsible for setting prices of water to the ultimate user, such districts, not the state, are the entities with legal authority to

make special use charges. The D.R.I. report states 'Although this action has potential to reduce the amount of agricultural water delivered, particularly in areas where agricultural return flows contribute substantially to salinity, it does not meet the criterion of being politically acceptable at the local level...' Even though this is generally the case, there may be some instances where special use charges would be acceptable and beneficial in salinity control."

Page 92, (6)

Should read:

"The legal authority of the state itself to provide economic incentives for such purposes is questionable. However, as stated in 3 above, the legislation could provide such authority and money to implement it."

Page 95, third paragraph, fourth line; should read:

"...which was mentioned in the 1975..."

Page 96, seventh line; delete the "s" on "specifics."

Page 98, end first paragraph; should read:

"...for those units."

Page 110, Table 6, Colorado Indian Reservation Unit

Should read:

Water Systems Improvement	Complete Status Report	June 1979	USBR; BIA; Colorado Indian Tribal Council 1/
	No further investigations scheduled at this time		
On-Farm Improvements	Conduct Water Management Study	Not yet Scheduled	SCS

Page 110, Table 6, Palo Verde Irrigation District

Dates under column heading "Timing" should read as follows:

June 1979
July 1979 (208)
June 1979

Page 113, Table 6

The fifth item under "Action to be Taken" should read:

"Continual review and identification of recommended changes in water resources programs, regulations and policies."

and "October 1978" should be changed to "On-going"

Page 114, Table 6, New Mexico; first column; should read:

"Navajo Lands"

Page 116, Table 6

Add the following item to the table:

Activity or Source of Salinity	Action to be Taken	Timing	Entities Responsible for Taking Action
	Investigate areas where reduction in salt pickup and reductions in the non-beneficial uses of water may be achieved.	Oct 1981	Forum and Basin states

Appendix A: Add the attached letter.

Appendix A, Page A-2, Industrial Sources, 2nd line:

Should read: "...the 'no-salt return wherever practicable.'"

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION VI

DENVER COLORADO 80203

JUN 30 1977

REF: 8E-PC

Mr. Donald L. Paff, Chairman
Colorado River Basin Salinity
Control Forum
P. O. Box 19090
Las Vegas, Nevada 89119

Dear Mr. Paff:

Thank you for the "NPDES Policy for Implementation of the Colorado River Salinity Standards" that was provided us. We appreciate the time and effort that your Work Group applied to this element of the approved Water Quality Standards. This letter will serve to inform you that this Office and the Region VI and IX EPA Offices will use the Policy as guidance in the issuance and reissuance of NPDES permits to point source dischargers in the Colorado River Basin.

We understand that you have informed the Colorado River Basin States who administer NPDES programs of the development of this Policy.

Best personal regards.

Sincerely yours,

ORIGINAL SIGNED BY
JOHN A. GREEN

John A. Green
Regional Administrator

cc: Myron B. Holburt
Colorado River Board of California
107 South Broadway, Room 8103
Los Angeles, California 90012

Bruce Elliott, Region VI

Dick O'Connell, Region IX