22-41

HIGH WATER IN THE COLORADO RIVER?

March 1977

Although parts of the West are currently experiencing drought, there is a high probability that sooner or later the Colorado River will once again carry an overabundance of water for brief periods. These excess flows can occur either as regulated floodflows or as nonregulated flows created by flash floods. The following facts are assembled to provide residents and property owners along the Colorado River with an understanding of why these flows may occur. They are intended to create public awareness rather than public alarm.

Late in 1976 the Bureau of Reclamation published a report forecasting possible flooding conditions along the Colorado River during the period from 1977-1986. At that time there was a strong likelihood of excess flows inundating portions of the floodway as early as 1977. Since then a much lighter than usual snowpack in the upper basin has caused a revision of that forecast. Even though the current prediction is still subject to another reversal, nature appears to be giving floodway residents a reprieve for one or two more years. Little chance presently exists for high flows on the Colorado during 1977.

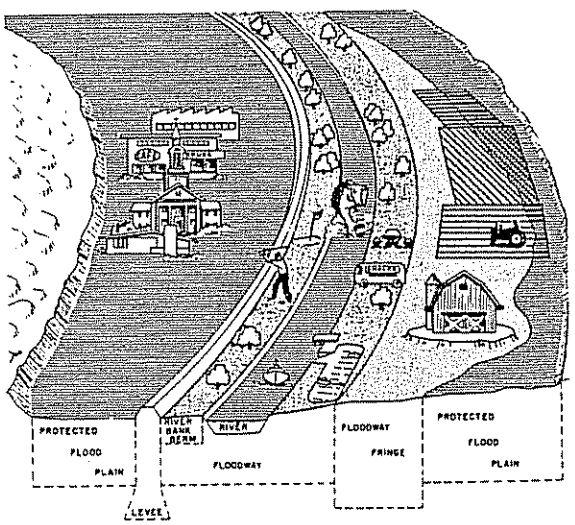
As a result, potential flood problems are not pressing with the sense of immediacy which existed in late 1976. With additional time likely, Reclamation proposes to explore alternatives to current methods of river operation, and to take preventive measures when possible.

Providing water for seven states and two countries, the Colorado River is one of the most important waterways in the United States. For many westerners the Colorado is the only reliable source of water available. To their communities, the river is the giver of life. Under certain circumstances, it can also be the "taker" of life and property. Our objective under a flood control operation is to minimize the latter.

The basin drained by the Colorado River is one of the United States' largest in size. For years, flows from this vast area were variable and often difficult to predict. For these reasons, the Colorado has historically been a river of extremes–too little water or too much water.

The 1928 Boulder Canyon Project Act sought to remedy this situation by providing for the construction of what is now Hoover Dam. Since the Dam's completion in 1935, river residents have been spared the yearly rampages of the Colorado River even though high flows have been periodically experienced prior to the closing of Glen Canyon Dam. During those periods, riverflows in the lower valleys were substantially in excess of water user needs.

The creation of Lake Mead behind Hoover Dam was followed by the completion of similar but much smaller reservoirs downstream behind Parker Dam and Davis Dam and the upstream closing in 1963 of Glen Canyon Dam near the Arizona–Utah border. Since that time nearly all the excess



Cross Section of a Typical Flood Plain

Since Hoover Dam's completion in 1935 Colorado River residents have been spared flood rampages such as this one which struck Yuma in the early 1900's. Uncontrolled floodflows then sometimes exceeded 200,000 ft^3/s.

water not being used in Nevada, Arizona, California, or Mexico, has gone into storage and the lower portion of the Colorado River has experienced little high water.

The violent river of years past soon slipped from people's memory, and development began to occur on lands, which just a few years prior were periodically covered by destructive river waters. The combination of the newly constructed upstream dams and the absence of yearly floods appears to have lulled some valley residents into a false sense of security.

Warnings against unwise development of the river's floodway, those portions between the levees, went largely unheeded. Through reports, visits, and meetings the Bureau of Reclamation advised officials and residents of the river counties that someday the Colorado could once again have substantial riverflows.

Even Nature gave warnings which showed a need for an unobstructed river channel. Sudden storms have caused damaging flows to portions of the river valley in 1939, 1974, and 1976. These unpredictable but periodically occurring storms sometimes flood tributaries, washes, and ultimately portions of the river immediately downstream. Because they can occur on long reaches of the river between the dams, these impoundments do not afford complete protection against the cloudbursts and resulting flash floods.

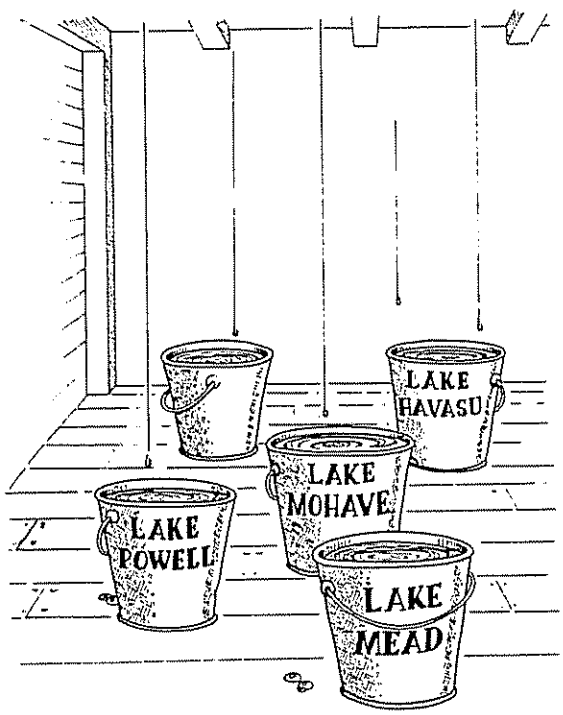
In contrast to excess flows caused by local storms are the high water conditions caused by the regulation of large upstream inflows. Although there is no certainty these flows will occur, the probability for damaging high water is great enough during the next ten years to plan for flooding that may occur either from local storms, from river regulation, or from a combination of both.

Why then do flows which are regulated by man have to result in damaging floodwaters? Perhaps a brief look at the river's present flows and regulation policies will answer the question.

The Boulder Canyon Project Act of 1928, authorizing the construction of Hoover Dam, states that the primary purpose of this structure will be to provide river regulation and flood control. Later legislation placed with the Bureau of Reclamation the responsibility for maintaining a floodway in the river below Hoover Dam. This floodway has been designed to accommodate flood control releases from Hoover of up to 40,000 ft^3/s plus the combined inflows of local storms.

During the next ten years, regulation of the river may require the temporary use of this floodway-designated land. Upstream reservoirs are approaching their highest authorized conservation levels. When those capacities are reached and the forecast of runoff is of sufficient magnitude, additional water must be released from the reservoirs. That which cannot be used in the United States or for treaty obligations to Mexico must be wasted to Mexico.

The probability of high flows occurring during the 10-year span exists in part because of unexercised water rights along the river's course. Several large projects in Colorado and Utah have not been completed. The Central Arizona Project, when it becomes operational, will be capable of using up to 2 million acre-feet annually. Until these projects do come online, the water obligated to them will remain in the river, causing excess flows during years of high storage and heavy runoff. A series of years with less than average runoff would reduce the likelihood of excess flows occurring, but public safety dictates planning for high water problems.



We're running out of storage space.

Hoover Dam's flood control efficiency is dependent upon the existence of an open downstream floodway as well as a flood control storage pool behind the dam. Depending upon the season, varying amounts of flood water storage capacity are required behind Hoover Dam. These capacities range from a January high of 5,350,000 acre-feet providing space for the snow melt runoff, to a late summer and fall low of 1,500,000 acre-feet. When flood conditions develop, Reclamation is required to follow release procedures established by the Corps of Engineers.

Regulations resulting from the Flood Control Act of 1944 prescribe the flood storage pool's minimum capacities as well as the release procedures to be used at Hoover Dam when the required minimum flood control pools are threatened by a combination of existing storage and forecasted runoff.

The damage which would result from some of these flood releases, coupled with possible local flash floods, is cause for concern. With the larger flows of this type, all structures and developments within the river's floodway are in danger of being flooded, if not properly protected.

Current operating strategy, if geared largely toward the maximum conservation of water, could possibly result in flood releases of 40,000 ft^3/s or even greater if an extremely high runoff is forecast. Many people have asked why smaller and less damaging releases cannot begin at an earlier date.

The Bureau of Reclamation, the operator of Hoover Dam, does not have the authority to change the current normal operating procedures without the approval of the Secretary of the Interior who in turn must consult the seven Colorado River Basin states. It has even been suggested by some water interests that special legislation would have to be enacted. The Bureau is also unable to deviate from flood control procedures which

are established by the Corps of Engineers in coordination with the Secretary of the Interior.

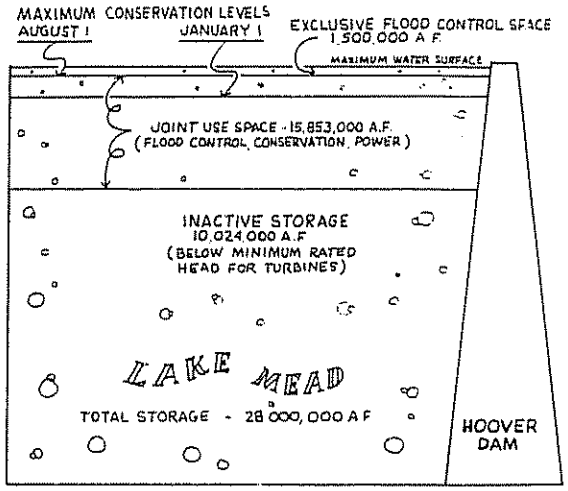
With the scarcity of water in the West, the seven basin states demand that as much water as possible be stored and as little water as possible be wasted to Mexico in overdeliveries. The higher the storage levels in the reservoirs such as Lake Mead, the greater the downstream floodway capacity needed to discharge possible flood control releases. If the allocated storage capacity of Lake Mead is to be used, the floodway below Hoover Dam must be capable of effectively handling combined flood control discharges and inflows from local storms.

This method of river regulation assures adequate water storage, but at the risk of moderate flood control releases in the floodway. An alternative would be smaller and less damaging flood releases, but at a greater risk of wasting precious water. Any premature or gradual release of excess water from storage must be made so far in advance of runoff inflows that replacement is not a certainty.

Therefore, in controlling the releases from Hoover, the Bureau of Reclamation serves only as the custodian of the water, not as its owner. It has no authority to arbitrarily release flows in such a manner as to waste water. It does have the responsibility, however, to maintain and operate an open floodway below Hoover Dam.

Encroachment which has occurred in recent years along this floodway is the real problem. This difficulty is compounded by the fact that Reclamation has no regulatory authority over private land. Floodway land is in both Federal Government and private ownership.

Repeated attempts have been made to keep this designated floodway open and undeveloped. In addition to the Flood Control Act of 1944, Executive Order 11296 discourages development in the flood plain below Federal dams. Lines of communication have been established between Reclamation officials and the six counties along the lower Colorado River Valley. In some instances, zoning and building restrictions have resulted from these efforts.



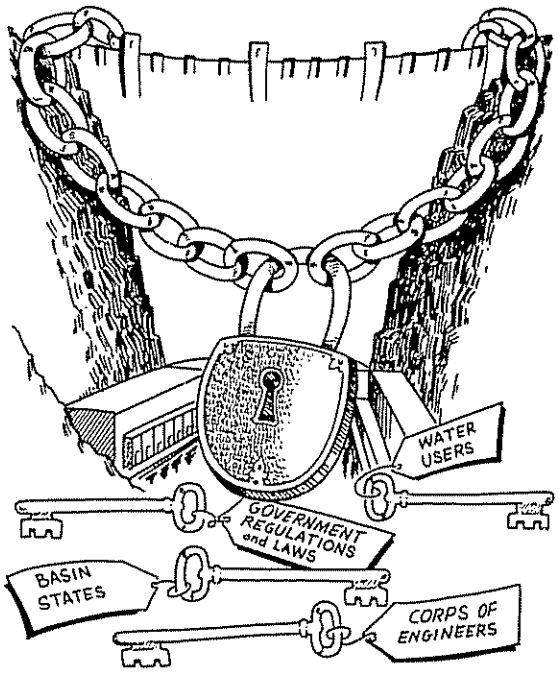
RESERVOIR SPACE ALLOCATIONS
AT
LAKE MEAD

The result of all these actions is that while some floodway development has been prevented, many vulnerable structures have been erected. Even though regulated excess flows may not cause damage for much of this construction, it is just a question of time before local flash floods pose a threat to both people and property.

Today the Bureau of Reclamation's main concern is the prudent management of the Colorado River with minimum adverse impact on riverside residents. Although these two goals sometimes appear opposed within the current plan of operation, efforts are being made to explore all possibilities to minimize flooding.

Nature may also be giving decision makers a reprieve of one year or longer, and as a result immediate choices may not be forced. The criteria for operating Hoover Dam under flood conditions are being reviewed this year by the Corps of Engineers and the Bureau of Reclamation. The Bureau is also studying the possibility of adopting alternative operating strategies for Hoover Dam during regular operation. Some of these alternatives would provide for less flooding downstream at the risk of losing storage water to Mexico by prematurely making releases which are not replenished.

The consequences of any change in the river's operation must be given careful study.



Operational changes benefiting a few cannot prudently be made if the majority of water users risk far greater losses. The current drought situations in California and other western states dictate the adherence to this principle.

Such changes, if they are made, must be reviewed by the basin states and ultimately approved by the Secretary of the Interior. Such a task will be both time consuming and difficult, particularly during time of drought. The Lower Colorado River is the sole water supply for one of the world's most productive agricultural areas and a prime source of municipal and industrial water for millions of urban dwellers. During times of water scarcity, the loss of the water is a threat to the economic stability of an entire region.

The drought, which intensifies the need for water conservation, may also turn out to be a blessing in disguise for those who have interests of various sorts in the floodway. If runoff is reduced until the river's resources are more fully utilized, the need for regulated high flows could be reduced but probably not eliminated. Until this does occur, planning and thinking must take into account the possibility that a sudden reversal of the weather pattern could subject residents to another decade of high flows.

IN SUMMARY - A DILEMMA

Serving as the custodian of Colorado River water has placed the Bureau of Reclamation in an unenviable position, because the agency has many publics. Several of these publics have conflicting interests in the same water.

Valley property owners with interests in the floodway want to prevent high water and flooding by avoiding the large predicted releases.

Water users in Nevada, Arizona, and California, fearful of a continued drought, do not want water released as unusable excess flows.

Power interests do not want large releases to exceed generator capacity. Excess water bypassing the turbines represents lost electrical power for an energy-hungry country.

None of the Colorado River Basin states is in favor of an early release program that would waste excess flows during time of drought.

The Corps of Engineers has established flood release regulations which call for 40,000 ft^3/s releases when the flood control pool behind the dam is being encroached upon and the forecast of runoff reaches certain levels.

What can be done? Planning should include the harsh reality of recognizing that damaging floodflows may occur. If excess water accumulates in the reservoirs, it must come down the river. When it does, the time for planning has passed. Now is the time to move, elevate, or strengthen structures in the flood plain. Some areas may wish to investigate flood insurance, while others might be interested in working up evacuation plans. Consideration might also be given to the construction on private lands of flood control devices such as earthwork and riprap. These latter activities would require a permit from the Corps of Engineers if located within the normal high waterline of the river.

And what is being done now? The seven Colorado River Basin states have been advised of the potential excess releases necessary for flood control. As runoff forecasting

techniques continue to improve, greater advance warning as to when regulated excess flows in the floodway might occur will be possible. Localized flash flooding will remain a threat to some sections of the Colorado, but high flows resulting from river regulation are much more predictable. Time for planning may be available, thanks to a below normal amount of precipitation in the upper basin.

Because one of the objectives of operating the river is to prevent property loss if at all possible, the Bureau of Reclamation will explore all possible alternatives. It will continue its efforts to determine if a change to an alternate strategy for normal river operations is now advisable. The Corps of Engineers, in consultation with the Bureau, is now reviewing the flood operations manual for Hoover Dam to determine if its revision is in order. In the course of these two planning processes, the numerous publics just cited will have the opportunity to express their interests, concerns, and needs.

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22-42

San Diego Union
April 27 1965

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MORE DEVELOPMENT NEEDED

Water Shortage Is Foreseen

UNLESS SOMETHING is done, the United States will be using every available drop of fresh water by the year 2000 and rationing will become a way of life.

It is a paradoxical problem in which there is approaching scarcity in the midst of plenty. To unlock the riddle, man must find a way to catch, distribute and use the plenty.

For example, in one week last year the flooding Northern California rivers discharged more water into the Pacific Ocean than the massive $2.2 billion California Water Project now under construction will carry in three years.

Each day of the year an average of 4.4 billion gallons of water falls on the United States in the form of rain or snow. Only about one-fourth of it is used.

The problems of approaching scarcity are particularly acute in the arid Pacific Southwest, which is now approaching total use of available supply while the population is growing phenomenally.

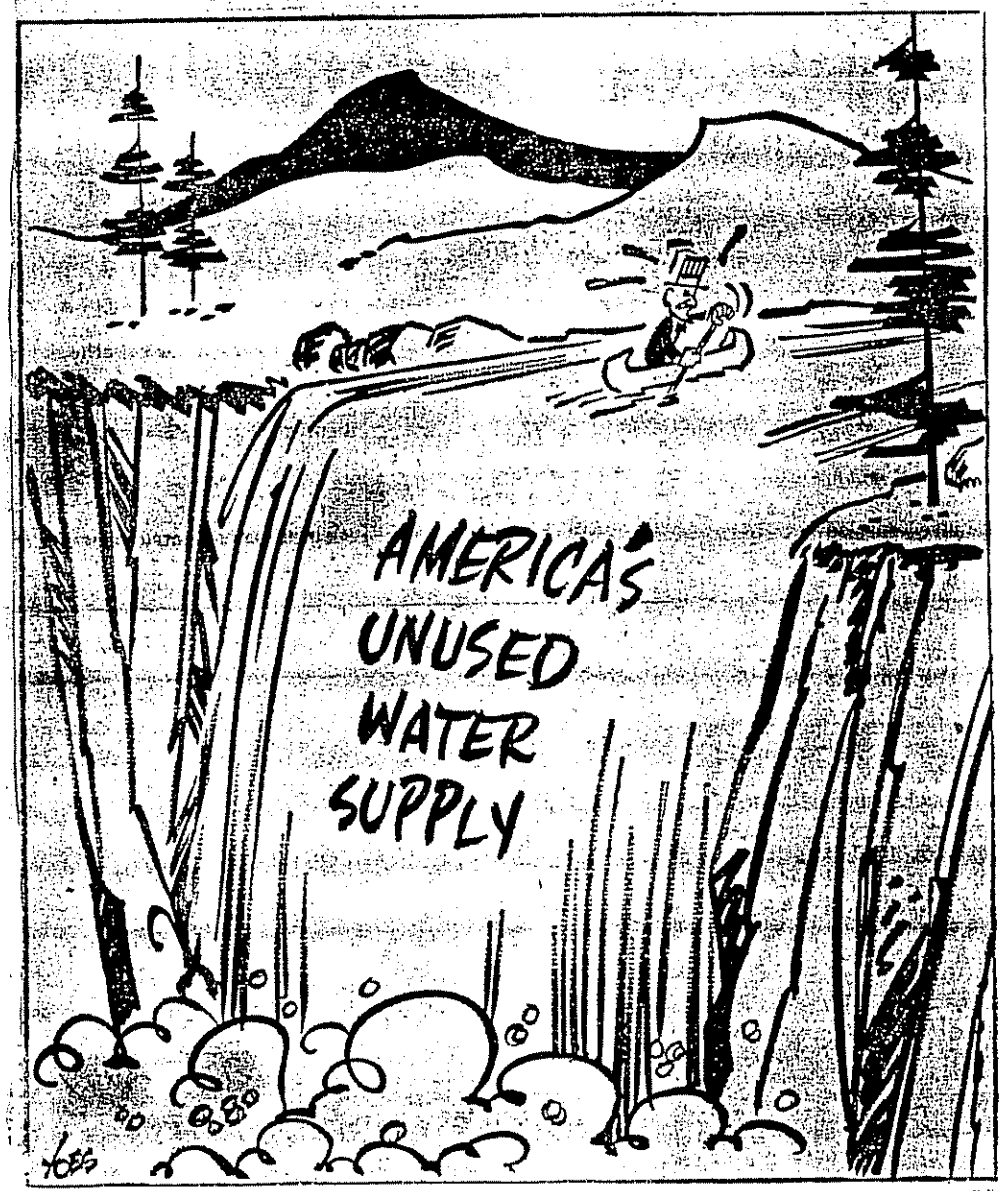
About 80 per cent of the 13 million people in the Pacific Southwest drink water from the Colorado River, a supply that already is severely strained. By the year 2000, there will be an estimated 30 million persons in the Pacific Southwest.

Each family uses an average of 16,000 gallons a month. It takes 1.6 million gallons a year to irrigate an acre of land, and industry use averages 170 gallons per person per day. All figures are increasing constantly.

Much already is being done to solve the riddle of distribution and supply, such as the 740-mile California Water project to bring excess Northern California water to the south, desalination of sea water—97 per cent of the earth's supply—and conservation.

The California Water Plan must be carried through to capture and conserve the vast waters of the great rivers in the state's north coast regions. These are the rivers which periodically do millions in damage in the winter, leaving the same areas arid in the summer.

Another Brink



However, even these programs will probably not be enough to prevent scarcity. Hope of the Pacific Southwest now appears to be a regional plan to tap rivers farther north and distribute the supply over a large region.

The parched Southwest could well use the 170 million acre feet of water from the Columbia River that now empties into the Pacific or the 10 million acre feet annually unused in the Snake River.

Unused fresh water running into the ocean is a waste of a precious resource that must be used if generations of the next century are to enjoy the luxurious water use we have today.

The water programs will take a great deal of time. They will be very expensive and will undoubtedly resound with regional friction. But unless we continue to press forward now, they will not be brought to fruition before demand exceeds supply.

Wall Street Journal
April 22, 1965

West's Water Fight

Colorado River Basin States Begin Struggle To Tap Giant Columbia

Southwest's Growth Depends On New Supply; Northwest Battles to Block Diversion

A Matter of Political Muscle?

By JAMES E. BYLIN
Staff Reporter of THE WALL STREET JOURNAL

SAN FRANCISCO — A group of Western states, embroiled in a battle royal over the water of the Colorado River for almost half a century, are about ready to stop slugging each other and turn on an innocent bystander, the Pacific Northwest.

Their strategy is simple enough: Instead of concentrating only on wringing more water out of the Colorado, they plan to bring new water into it. "The Colorado River is the most thoroughly developed stream in our country," says William E. Warne, director of California's Department of Water Resources. "So far, however, all projects have been to take water out of it. But most of us are now sitting down and thinking about sizable importations into the Colorado."

This is not to say the Colorado is fully developed. Indeed, most states now taking water

"Unto the place from whence the rivers come, thither they return again. . . ." Thus does Ecclesiastes describe the immutable nature of water—the amount available today is unchanged from primeval times. But if pollution and waste are not checked and new supplies found for a growing population, widespread scarcity of fresh water is in sight in the U.S. Solutions may include tapping the oceans, redistributing our rivers, intensifying pollution control and countless other costly measures. This is one of a series of articles about how the nation hopes to preserve a precious resource.

from it are vigorously promoting schemes to increase their take out of its present flow. But they are also casting covetous eyes northward to the Columbia, one of the mightiest rivers in North America with a flow more than 10 times that of the Colorado. They look upon the Columbia and one of its tributaries, the Snake, as the most likely sources for siphoning water into the Colorado. (See map on page 10.)

A half-dozen plans already are hatched to bring this water from the Pacific Northwest. One grandiose proposal is advanced by F. E. Pirkey, retired planning engineer for California's Department of Water Resources. At a cost of $11 billion, Mr. Pirkey would extract 12.9 million acre-feet of water yearly from the Columbia at The Dalles Dam in Oregon, lift it 5,000 feet over mountain barriers with atomic power and carry it 1,200 miles to Hoover Dam on the lower Colorado (with a branch feeding water through Northern California into Southern California).

This amount of water—one acre-foot equals 325,850 gallons—would nearly double the present water supply in the Pacific Southwest, an area embracing Southern California and portions of Nevada, Arizona, Utah and New Mexico. Mr. Pirkey claims the water could be obtained from the Columbia during its annual spring flood stage and stored in Oregon until

Such colossal water projects probably would mean a heavy tax burden for citizens in distant states. But the Colorado is the key to the prosperity of an area larger than France and one which is a vital consumer of the nation's raw materials and finished goods.

The river drains sections of seven states—Wyoming, Colorado, Utah, Nevada, Arizona, New Mexico and California—as it rolls southward for some 1,300 miles before crossing into Mexico. It is the chief source of water in this arid land and the demands on it are tremendous. About 80% of Southern California's 10 million people drink its water. Fast-growing Arizona believes it must move Colorado water some 450 miles through the desert to Phoenix and Tucson if these two urban centers are to continue to blossom.

Living on Borrowed Time

The breakneck pace of Southwest growth is fast outstripping currently available water. Central Arizona, for example, finds itself living on borrowed time. It must take about 3.5 million acre-feet of water each year from underground wells; but nature returns only 1.2 million acre-feet each year. As a result, irrigation wells constantly go deeper. Some must be dug 25 feet further down each year to reach the water table.

The population of the Pacific Southwest totals some 13 million. By the year 2000 it is expected to reach 20 million. By then, Interior Secretary Stewart Udall figures the area will need about 20 million acre-feet of water a year for homes, industry and farms, assuming no large increase in the amount of irrigated farm land. That's 6.6 million acre-feet more than what is now readily available. Where will this new ocean come from?

Some help—2.5 million acre-feet a year—will come from the state of California's north-south water project, a 740-mile system that will bring water from the northern part of the state to more arid land. It is now under construction and will cost $2.2 billion. A little more water could come from fuller development of the Colorado and more intense conservation to salvage water now being wasted. But even all this would still leave a "water gap" of 2.5 million acre-feet a year in 2000, experts say.

Water War Shapes Up

Southwesterners look to the Pacific Northwest to close the gap. But already it is obvious they face a fierce political fight. To understand how the water war is apt to go, it is first necessary to dig into the convoluted water struggle of the past.

Two years ago, after 11 years of legal scrapping, the U.S. Supreme Court reached a historic decision on how to divide Colorado River water among California, Arizona and Nevada. Based on the river's current normal yearly flow of 16 million acre-feet southward from a point near Hoover Dam, the court ruled that 7.5 million acre-feet would be available to California, Arizona and Nevada. Of this, 4.4 million would go to California, 2.8 million to Arizona and 300,000 to Nevada. Of the remaining water, Mexico is guaranteed 1.5 million acre-feet a year under a 1944 treaty; another one million are lost through evaporation.

The decision hardly was popular in California where the southern part of the state already draws off 700,000 acre-feet more than the court awarded it. To be sure, Southern Californians are in no immediate danger of losing the water because it will be many years before Arizona uses its full allotment. One of Arizona's first hurdles is to get the money to build its Central Arizona project, a $1.1 billion plan to bring Colorado River waters to the Phoenix-Tucson areas.

When the Arizona project is completed, both Arizona and California may find it hard to obtain their court-decreed shares of Colorado River water. An agreement dating back 42 years among the upper basin states of New Mexico, Colorado, Utah and Wyoming stipulates that only 7.5 million acre-feet of water must be left for the entire lower basin. From this the Mexican guarantee would have to be supplied while evaporation would reduce the amount available even further, leaving California, Nevada and Arizona far less than the 7.5 million acre-feet decreed by the Supreme Court.

The upper basin states rapidly are increasing their demands on the river. It may be 35 years or more before these states cut the river's flow to the stipulated minimum, but their usage will begin cutting the lower basin's supply by 1975, experts figure.

The spectre of shortages has forced California and Arizona to bury the hatchet. A few months ago the previously feuding states managed to reach a compromise on California's demand that its 4.4 million acre-feet be guaranteed forever. Californians agreed to support the Central Arizona project while Arizona said California should be guaranteed its 4.4 million acre-feet "until such time as works are authorized and constructed to bring at least 2.5 million acre-feet of additional water into the Colorado River."

Parties to the informal pact included Sen. Kuchel and Gov. Brown of California, Arizona Gov. Goddard, Interior Secretary Udall, the Metropolitan Water District of Southern California, the Colorado River Board and the Arizona Water Commission. Arizona's Sen. Hayden said he will support the plan if it is passed by the House of Representatives; meanwhile he is pushing in the Senate a proposal more favorable to Arizona.

Udall Will Investigate

A key provision of the pact directs Mr. Udall to investigate all potential outside sources of additional water for the Colorado and to report back to Congress in three years. "The surplus waters of any rivers, anywhere, which could be feasibly utilized, along with the possibilities of desalination and any other solutions, if any there be, would be examined," says Sen. Kuchel.

Whether the Arizona-California compromise will result in the necessary legislation in Congress remains to be seen. But alarms already are being sounded in the Pacific Northwest.

"We would fight attempts to export water from our state," declares M. G. Walker, supervisor of the Washington Division of Water Resources.

In neighboring Oregon, John Davis, chairman of the state water resources board, cautions that "the Pacific Northwest may face some overpowering political muscle from the Southwestern states that could snow us under even though our facts are right and our cause just." Oregon Gov. Hatfield observes that water diversion ideas "have quite naturally evoked a certain amount of hostility in our area, particularly when underscored by some degree of interest and support on the part of the Federal Government."

Water Is "Insurance"

The Northwest views its surplus water as critical insurance to handle—and, more importantly, to stimulate—future growth in the region. Oregon and Washington say that vast quantities of water, perhaps 12 million acre-feet annually, will be needed to unlock the arid east-central sectors of the two states to large-scale agriculture.

West's Water Fight: States in Colorado River Basin Begin Struggle to Tap Resources of Mighty Columbia

Continued From First Page

In addition, the Northwest charges that depletion of the Columbia River where it forges the Oregon-Washington border would seriously cripple the important salmon industry.

Gov. Hatfield argues that people, industry and agriculture should come to where there is water, not vice versa. The governor ponders whether it is in the public interest, to transport water long distances at great expense to grow crops that could be raised near the stream from which the water would be diverted. "What is surplus water?" the governor asks. "Who is entitled to the lower cost water?"

The Oregon legislature just passed, and the governor signed, a bill aimed at counteracting Southwestern claims to Columbia River and other waters in the Northwest. The measure appropriates $350,000 to cover the first two years of a five-year "ultimate need" water study. The study "may well be the most important piece of legislation enacted this session," says Stafford Hansell, a member of the Oregon house. Washington state is considering a similar water resources study and Idaho recently launched one.

Some Diversion Inevitable

Nevertheless, Oregon leaders glumly agree that some water diversion looms as inevitable. "There is no question but that diversion of our water will be authorized," admits LaSelle E. Coles, president of the Oregon Reclamation Association, who notes the state has only five spokesmen in Congress. "It is only a matter of compromising on how. We should prepare to protect ourselves. We can't afford to sit by and do nothing. Things are happening too fast."

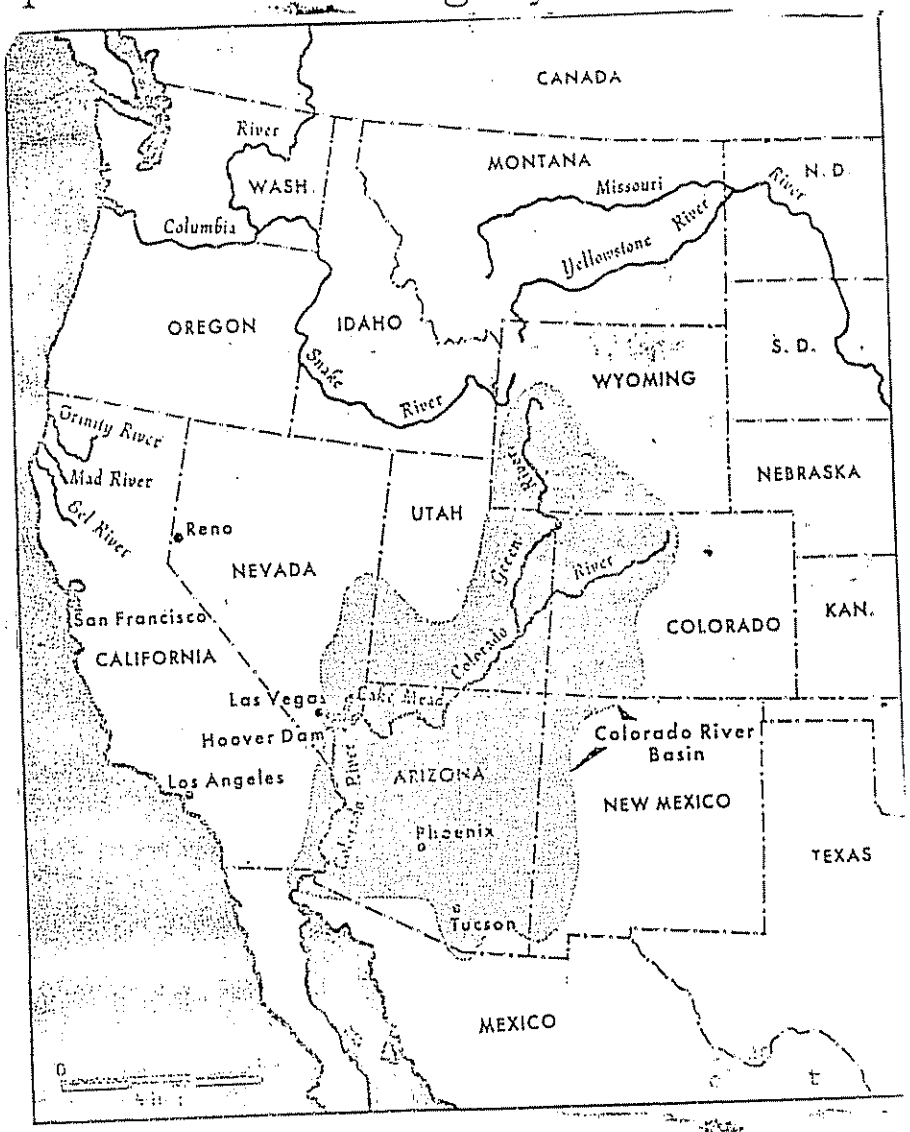
Things are indeed happening fast, at least in the realm of propaganda and proposals put forth by Southwestern water leaders and politicians. Officials of the Metropolitan Water District of Southern California, which takes huge amounts of Colorado River water for Los Angeles and vicinity, continually decry Columbia River "waste." They also proclaim that a Columbia diversion project would be a "milestone" in the Colorado's development.

Wayne M. Akin, chairman of the Arizona Interstate Stream Commission, contends that the Columbia each year discharges some 160 million to 170 million acre-feet of water into the sea. "The obvious place from which (large) quantities are available is the Columbia River," he says. "The problem of moving something on the order of magnitude of 10 million to 15 million acre-feet of this water to the areas of need is engineeringly and financially feasible and would deliver water in the Southwest at a price much lower than would be feasible under a program of moving a limited amount of water—that is, one or two million acre-feet—from northwest California."

One California Congressman, Craig Hosmer, ranking Republican on the House Interior and Insular Affairs Committee, feels "the importation of 2.5 million acre-feet of (Columbia River) water as the first stage of a regional importation program will protect existing economies" and provide supplies for future Colorado River projects.

The Snake River's Role

The thundering Columbia isn't the only target on which the Southwest has set its sights. Another prime source, water experts say, might be the Snake River, which cuts across Idaho and forms part of the Oregon-Idaho border. "Idaho is all for regional planning, but just don't mention the Snake," says a California water leader ruefully.



The Feather River Project Association (FRPA), a nongovernmental group active in California water planning, recently suggested that a conduit could bring five million acre-feet annually 1,000 miles from the Snake to Lake Mead on the Colorado with one branch slanting into Southern California and another into Arizona to Phoenix. The estimated cost: Close to $4 billion, not counting the two branches.

William G. Dunn, FRPA adviser who drew up the plan, calculates that some 10 million acre-feet of the Snake River water are being wasted now. His Snake project is a bigger version of one put forth in late 1963 by Samuel Nelson, general manager of the Los Angeles Department of Water and Power. Another plan even envisions tapping the Yellowstone River in Wyoming and Montana.

The Southwest rejects any notion that modern migrants will shift their destinations en masse to water-rich territories, thus making multi-billion-dollar importation projects unnecessary. "It is folly to plan the development of water resources in the area of great water surpluses on the premise that to do so will attract a large population and a thriving economy," says California's Mr. Warne.

More Growth Seen

He sees California far outdrawing northern areas of the Pacific Coast. For a century the name California has been linked to "a romantic and presumably pleasant way of life," he contends. Southern California planners think [illegible] dents pouring in daily—will continue for many years. Arizona, with 1.7 million people, anticipates its population will rocket to 6 million [illegible]

While leading the fight to beef up the Colorado by bringing water from the Pacific Northwest, Californians aren't at all anxious to volunteer water from the northwest portion of their own state. That area is one of the largest underdeveloped watersheds in the country. There the Eel, the Trinity, the Mad and other streams pound unhampered to the sea, occasionally causing multi-million-dollar havoc as they did in floods last December.

Officially, California doesn't oppose diverting water from these rivers into the Colorado. The state's stance is that all potential water sources for the Colorado should be fully studied. Actually, though, the state would like to use these rivers within its own borders. When California completes its north-south water project in 1972, engineers talk of a new project to harvest some 12 million acre-feet of water from northwestern California rivers for diversion to all parts of the state. This would cost $3.7 billion on top of the $2.2 billion outlay for the north-south project.

While the state is financing its north-south project entirely by itself, it hopes to get Uncle Sam to share the burden of the costlier second project. But Federal officials are hinting that Federal money would mean some of the California water would go to the Colorado

22-43

COLORADO RIVER BASIN SALINITY CONTROL ACT

(16)

601.1001

HEARINGS

BEFORE THE

SUBCOMMITTEE ON WATER AND POWER RESOURCES

OF THE

COMMITTEE ON INTERIOR AND INSULAR AFFAIRS HOUSE OF REPRESENTATIVES

NINETY-THIRD CONGRESS

SECOND SESSION

ON

H.R. 12165 and Related Bills

HEARINGS HELD IN WASHINGTON, D.C., MARCH 4, 5, AND 8, 1974

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that you have before you to clean up the Colorado River on a comprehensive basis.

Thank you, Mr. Chairman, and members of the Committee.

Mr. JOHNSON. Our next witness will be Mr. Northcutt Ely, special counsel for the Imperial Irrigation District, accompanied by Mr. Carl Bevins, president; Mr. Robert Carter, general manager, and Mr. Reginald Knox, general counsel.

STATEMENT OF NORTHCUTT ELY

Mr. ELY. Mr. Chairman, the hour is late. Our statement has been filed, may I ask that it be inserted into the record as read.

Mr. JOHNSON. Your statement will appear in the record as if read in full. You may summarize, and if the other gentlemen wish to make any remarks, feel free to do so.

Mr. ELY. With me are Robert Carter, general manager of the Imperial Irrigation District, Reginald Knox, general counsel, and Mr. Carl Bevins, director, and member of the Colorado River Board of California.

I would refer the committee to the conclusion of our statement, commencing on page 10. The Imperial Irrigation District, occupying a position at the tail end of the Colorado River system, is perhaps more interested in alleviation of salinity than those who are more fortunate and are located in the upper reaches.

The district has faced up to its problems of silt and salt in the past, and expects to continue to do so in the future. For example, it will be necessary, as shown in the annexed tabulation, to expend approximately $167 million to complete the district and landowners' concrete lining and tile drain programs. The total overall capital outlay, on completion, will exceed $246 million, some $60 million having been spent out of the district's resources.

The Imperial Irrigation District has made and is making its contributions, and we feel that it is appropriate, as well as timely, for the United States to do its part to reduce salinity of the waters reaching us.

Imperial Irrigation District does not desire a reduction of its rights or obligations with respect to the main All-American Canal, and prefers that the full capacity of the main canal be maintained.

If there are to be changes in any water delivery contracts, they will be amendments or supplements negotiated between the Secretary and the particular water user, such as Imperial Irrigation District, or Coachella Valley County Water District, without effect on contractual rights of others.

We made amendments to both H.R. 12165 and H.R. 12834 to carry out the foregoing recommendations.

Imperial Irrigation District takes this occasion to state its appreciation for the efforts of the Committee of Fourteen, and its support, in principle, of the committee's recommendations.

The Imperial Irrigation District believes that the Government should move forward with its obligation to fund this legislation to accomplish the objectives as a national obligation. We strongly recommend enactment of H.R. 12165 because it comes to grips with the salinity problem on a basinwide basis.

Thank you, Mr. Chairman.

Mr. JOHNSON. Thank you for your statement, and your summar it is very thoroughly stated, concerning the interests of the people y represent.

I was down in the area of the Imperial Valley long before knowled of these things. My first venture was back in the midtwenties when used to go down to help harvest the crops. Then I was in and out there through 1938. I noticed a great change when we made the tr down there 2 years ago. We saw from the air that you have continu to perfect it. I have never seen a better irrigation district improveme for cropping and for drainage works than has been built. When we g on the ground we had the opportunity to see the drainage progra They were having some problems and were installing a new type drainage. They tell us you have now taken care of that.

We certainly don't want to do anything in this legislation that woul in any way impede your operation there, as you have had a very su cessful irrigation district over a period of time.

Mr. ELY. It has been for the period of time that we have been i existence, and I assume it will continue to be that way.

Mr. JOHNSON. Do the other gentlemen have anything to say?

Mr. CARTER. I think the record speaks for itself. And as you sai going over the ground with us a couple of years ago, you did see firs hand the problems we are confronted with.

Mr. JOHNSON. Mr. Knox?

Mr. KNOX. I have nothing, Mr. Chairman.

Mr. BLEVINS. As counsel noted, we have put an amendment i there, and ask for consideration as far as our interest and protection i concerned.

Mr. JOHNSON. We thank you for coming, gentlemen. I have note that you have been here for the entire hearings, so you know the stor of the administration. I am glad to see you supporting H.R. 12165 and support the Committee of Fourteen. Thank you.

[The statement of Northcutt Ely is as follows:]

STATEMENT OF IMPERIAL IRRIGATION DISTRICT, PRESENTED BY NORTHCUT ELY, SPECIAL COUNSEL

Mr. Chairman, my name is Northcutt Ely. I am an attorney with offices i Washington, D.C. I am appearing before this Committee today to present th views of the Imperial Irrigation District of Imperial County, California.

ORGANIZATION

First, I would like to point out, for the benefit of Irrigation and Reclamatio Water and Power Committee members on Interior and Insular Affairs, tha Imperial Irrigation District is a publicly-owned water and power utility organize pursuant to the Irrigation District Act of 1911, which operates under the Wate Code of the State of California.

FUNCTION

The District performs three functions: (a) Diversion, transmission and delivery of Colorado River water for irrigation and domestic uses; (b) Operation an maintenance of drainage canals and facilities; and (c) Generation, transmissio and distribution of electric energy to a 7,500 square mile area equal in size to th states of Connecticut and Rhode Island.

Under rights which are vested, the District annually diverts approximately 2.9 million acre-feet of water from the Colorado River at Imperial Dam, an transports the same into the main All American Canal for a distance of 80 mile

into its 1,650 mile canal system to serve 6,000 headgates which, in turn, deliver water to 444,000 acres of farmland and to the seven incorporated cities for municipal and industrial purposes within its service area. Said area is principally comprised of the Imperial Unit, which occupies the central and main portion of land within the boundaries of the District (see General Map 27F0189 attached).[1]

The District is the largest single diverter in the entire Colorado River system, with present perfected and vested rights to the water it diverts dating back to 1901. The District enjoys a third priority for the water it receives from the Colorado River pursuant to the Seven-Party Agreement, the California Limitations Act, the Colorado River Compact, and the Boulder Canyon Project Act.

The District further provides a 1,375 mile drainage system serving an 18,988 mile grid of subsurface farm drains, which serve 385,146 acres (as of 12/31/73, see Exhibit B). This system, in turn, helps to remove four million tons of salt from the soil annually, resulting in the net removal of 500,000 tons of salt from Imperial Valley soils each year, which is a direct reflection of the historic application of Colorado River water.

SILT PROBLEM

The contract service area of the District, including Imperial, East Mesa, West Mesa, and Pilot Knob units, approximates one million acres (see Exhibit 27F0189). The presently developed area of Imperial Valley is part of a delta of the Colorado River. The soil, to great depths, is made up of silt brought in by the river from the seven states of the Colorado River Basin. These highly stratified alluvial deposits, comprised of fine-textured clays, silts and fine sands, have resulted in a very complex soil which has offered many problems in connection with providing adequate drainage.

Though these river deposits of silts and fine sands in place have produced a splendid productive record from an agricultural point of view, we must not forget the difficulty the District experienced during its early years of development when it had to adjust its operations to handle tremendous volumes of suspended solids. Obviously, this silt burden represented a high degree of pollution; but, on the other hand, we must accept the fact that it was a problem that created a challenge to the pioneers who had to resolve it. I have heard it said that "The First Forty Years of Imperial Valley History" vividly sets forth the trials and tribulations suffered in attempting to recover enough water from the mud to grow a crop.

FROM SILT TO SALT

Though the District has been successful in controlling the silt problem to a certain degree, it now faces the pollution problem of salinity. This has yet to be resolved, although Imperial, with its own resources, has accomplished a great deal at high cost. For example, as shown in the appendix, nearly $67,000,000 has already been spent to create a massive drainage system. Further, in 1957, the District expended 1.5 million dollars to construct the Vail Cutoff Canal and the Rositas Supply Canal, intertying the East Highline Canal with lands to the west of the Alamo River. These canals serve a combined area of 50,000 acres, which were previously served by diversions from that river. It became obvious, however, in the mid 1950's that the salinity level in the Alamo River had reached an intolerable level, and that the supply of water for these acreages must, necessarily, be of a better quality.

In reviewing the records, we find the quality of water coming into our system as late as 1953 averaged 600 ppm at a minimum, while today we are required to use water that averages approximately 900 ppm. The battle against salinity has been a continuous one. Of the 444,000 agricultural acres referred to previously, 385,000 acres had subsurface tiling installed by the end of 1973, at a cost of $43,759,700, leaving 59,000 acres to be tiled, which will cost an additional $25,400,000, thus representing a total capital investment of $69,159,700 (see Exhibit B).

In 1968, Imperial Irrigation District presented testimony before the Subcommittee on Irrigation and Reclamation, of the House of Representatives Committee on Interior and Insular Affairs during hearings concerning Bills H.R. 3300 and S. B. 1004. On page 884 of the transcript of these hearings T-1044 entitled, "Salinity of Irrigation Water Received by District and Leaching Requirement, 1964-66", (resubmitted here under the same designation), indicates that 926 ppm water requires a leaching factor of 22%.

[1] Placed in Subcommittee file.

During the same hearings, Mr. Floyd E. Dominy, Commissioner, Department of the Interior, Bureau of Reclamation, stated that, "Our judgment at the moment, collective judgment of the Geological Survey and the water pollution people and the Bureau of Reclamation in the Department, would be that with full Upper Basin development the water quality at Imperial Dam would gradually worsen to probably something like 1,400 parts per million of dissolved minerals." (Transcript page 854).

Assuming that the Colorado River water delivered to Imperial Irrigation District reaches the salinity index of 1,200 ppm by the year 2000, the leaching factor requirement (based on the Blaney-Criddle formula by direct proportion) will increase from 22% to 29%. We realize that soil susceptibility is a factor in applying this quantity of leaching water. When one considers that Imperial Irrigation District diverts 2.9 million acre-feet of water, now averaging approximately 900 ppm, it is very apparent that a further deterioration in quality of the water coming into our system will mean that a considerably greater quantity of water will be required to do the same job we are doing now, based on this premise.

In view of the limitations imposed as to quantity—namely, those prescribed by the contractual agreements referenced earlier—an increased leaching requirement on the part of Imperial Irrigation District will, of course, operate to the disadvantage of the contractors without present perfected rights—or other rights of appropriation.

COACHELLA CANAL AND EAST MESA LANDS

Concerning the matter of lining the Coachella Branch of the All American Canal, the Imperial Irrigation District is willing, under certain conditions, to relinquish its capacity interests in that canal to facilitate its lining by the United States. There are approximately 4,200 acres of East Mesa land, which have been included and have a certificate of water availability, that are contiguous to the Coachella Canal and subject to irrigation therefrom without crossing public lands. Approximately 10% of these 4,200 acres were shown to be in crop during 1973.

Realizing that the 4,200 acres of land contiguous to the Coachella Canal could be served by approximately 100 cfs of capacity, the fact remains that the District contracted for 1,000 cfs capacity in the main, as well as in the Coachella Branch of the All American Canal to serve the East Mesa lands, approximately 220,643 gross acres (see Exhibit 27F0189). The District's 1,000 cfs capacity, if constructed, would add approximately 13 million dollars in addition to the projected 20 million dollar cost for the Coachella Valley County Water District's 1,500 cfs capacity.

A major part of the East Mesa Unit is public land, and the District's contract with the United States, namely, Contract Ammendatory of and Supplemental to All American Canal Contract of December 1, 1932, dated March 4, 1952, provides in Article 23, "Assessment of Public Land", the following, and I quote: "Within a reasonable time, to be determined by the Secretary, from the date water is available for and can be delivered to any public lands within the boundaries of the District, such lands shall be opened to entry."

Taking this provision of the contract literally, the District, as explained above, contracted for capacity in the main, as well as in the Coachella Branch of the All American Canal to serve said lands. However, since California, as a result of the decision in *Arizona* v. *California*, is obligated to reduce diversions less returns to 4.4 million acre-feet per year in the future, any lands opened for entry on the East Mesa would have to be served to the detriment of other users. We do not intend this.

In the matter of *Hugh S. Ritter, Thomas M. Bunn* (*A-30415*), decided February 24, 1965, the Under Secretary of the Interior ruled that, "it would be contrary to the public interest at this time to increase the pressure on the inadequate water supply available for use in California from the Colorado River by classifying * * * public lands as available for disposition under the desert land law." The lands referred to are in Imperial and Riverside Counties, California. The above is from 43 CFR 2234.3-1, and is quoted further as follows: "For the reasons stated in the *Ritter-Bunn* decision, supra, it is contrary to the public interest to permit the use of federally owned lands within Imperial and Riverside Counties for the construction of canals and ditches in order to effect agricultural reclamation with water from the Colorado River of desert lands in those counties. Therefore, no applications for rights-of-way for this purpose under the provisions of the Act of March 3, 1891, as amended, will be allowed or permitted on federally owned lands within Imperial and Riverside Counties, Calif., unless the applicant shows that the water

to be carried is from a source other than the Colorado River." The Secretary continues to hold that East Mesa lands non-contiguous to the main All American Canal and to the Coachella Branch are not subject to irrigation because of the water inventory, and the Government will not grant rights-of-way across public lands for this purpose, including access across the canal bank itself.

DISTRICT OPPOSED TO PROVIDING CAPACITY IN COACHELLA BRANCH CANAL FOR EAST MESA LANDS

Furthermore, even though the District had been authorized to expand the acreage entitled to water pursuant to the All American Canal contract, providing water is available, we would, in good conscience, have to decide not to do so insofar as these particular lands are concerned.

To reinforce this position, reference is made to two contracts with the Federal Government. The first, No. 14-06-300-615, dated April 30, 1957, covering the lease of land for agricultural purposes known as the Drop No. 3 Experimental Farm, which was terminated as of October 30, 1973 because of its failure to become economically self-supporting due to limitation of crops, excessive water duty, and inadequate drainage (see Exhibit 27F0189 for location). The second, No. 14-06-300-613, dated May 1, 1947, amended April 30, 1957, covering the lease of land for agricultural purposes known as the Drop No. 2 Experimental Farm, following initial development by the District was sublet to Brock Ranches for a long-term study to determine the feasibility of commercially producing various citrus crops on the East Mesa (see Exhibit 27F0189 for location). Water duty on the farm over the past ten years of operation has averaged 22.4 acre-feet per acre, with no indication that this rate of application will improve to any great extent.

Therefore, Imperial Irrigation District believes that the land included in the East Mesa Unit, except the experimental farm referenced herein, should not be opened to entry under any circumstances and, further, that the District should be relieved of responsibility for serving irrigated, as well as unirrigated, privately-owned lands on the East Mesa adjacent to the Coachella Canal by means appropriate to the United States including purchase, exchange, eminent domain, or condemnation of said private lands or interest therein at no cost to the District.

LEACHING REQUIREMENT—IMPERIAL UNIT

Reference is, again, made to the presentation of Imperial Irrigation District in hearings before the Sub-committee on Irrigation and Reclamation of the Committee on Interior and Insular Affairs, House of Representatives, during consideration of H.R. 3300 and S.B. 1004 on February 2, 1968, and to certain exhibits attached thereto. Exhibit T-1033, titled, "Water for Consumptive Use and Leaching Requirement and Theoretical Farm Efficiency, 1959-66", and resubmitted here under the same designation, shows an eight-year average consumptive use per acre irrigated of 4.26 acre-feet and a leaching requirement factor of 20%. Exhibit T-1063, attached hereto, updates the previous exhibit and shows a ten-year average consumptive use of 4.24 acre-feet per acre irrigated and a leaching factor of 21%. It will be noted that for the year 1972, the consumptive use factor was down slightly, but the leaching factor rose to 22%, which correlates with the figure previously mentioned.

It follows, however, that if the Colorado River water quality improvement feature of the Bill is implemented, resulting in improved quality in flows arriving at Imperial Dam, then, obviously, Imperial's leaching requirement would be reduced accordingly, and water saved would be available to assist in the satisfaction of the demands of the Coachella Valley County Water District and The Metropolitan Water District of Southern California.

CONCLUSION

The Imperial Irrigation District, occupying a position at the tail en Colorado River system, (sperhaps, more interested in alleviation of salin those who are more furtunate and are located in the upper reaches.

The District has faced up to its problems of silt and salt in the past, anc to continue to do so in the future. For example, it will be necessary, as show annexed tabulation, to expend approximated $167 million dollars to comp District and landowners' concrete lining and tile drain programs. The tota capital outlay, on completion, will exceed $264 million dollars.

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If there are to be changes in any water delivery contracts, they will be ments or supplements negotiated between the Secretary and the particula user, such as Imperial Irrigation District or Coachella Valley County District, without effect on contractual rights of others.

We annex amendments to both bills to carry out the foregoing recommenc

Imperial Irrigation District takes this occasion to state its appreciation efforts of the Committee of Fourteen, and its support, in principle, of th mittee's recommendations.

The Imperial Irrigation District believes that the Government shoul forward with its obligation to fund this legislation to accomplish the object national obligation. We strongly recommend enactment of H.R. 12165, i it comes to grips with the salinity problem on a basin-wide basis.

EXHIBIT A.—AMENDMENTS PROPOSED BY IMPERIAL IRRIGATION DIST TO H.R. 12165, 93d CONG.

P. 9, line 1: Strike all commencing with "authorized" and substitut return such lands to the public domain, but withdrawn from entry. The States shall not acquire any water right by such acquisition of lands."

P. 9, line 9: Strike "All American and". Change "Canals" to "Canal".

AMENDMENTS PROPOSED BY IMPERIAL IRRIGATION DISTRICT TO H.R. 93D CONG.

Page 4, line 5: Strike "All-American and", Change "Canals" to "Canal"

Page 4, line 17: Strike through line 22, and substitute: "return such lands public domain, but withdrawn from entry. The United States shall not a any water right by such acquisition of lands."

APPENDIX

IMPERIAL IRRIGATION DISTRICT: LINING AND TILE COSTS

With respect to: (1) the costs regarding tile installed; (2) cost of concrete District laterals from 1954–1972, inclusive; (3) estimated costs of private ditches installed by landowners at their expense from 1949–72, inclusive; (4 required, as programmed, based on past experience for future installation, c additional tile required if existing tile spacing is reduced to 100-foot inter (5) projected costs of concrete lining to be considered in future years; and (6

Period	Cost per foot	Cost per period	Accumulated total in round figures
1. Value of tile installed since 1929 within Imperial Irrigation District Country:			
1929-30—17.53 miles at $528 per mile	$0.10	$9,250	$9,250
1931-40—182.08 miles at $950 per mile	.18	363,000	372,250
1941-50—2,017.14 miles at $1,690 per mile	.32	3,409,000	3,781,250
1951-60—[illegible] miles at $2,112 per mile	.40	12,154,000	15,935,250
1961-70—7,723.99 miles at $2,432 per mile	.47	19,171,000	35,106,250
1971—919.34 miles at $2,798 per mile	.53	2,572,300	37,678,550
1972—1,019.40 miles at $2,798 per mile	.53	2,852,300	40,530,850
2. Cost of concrete lining district laterals from 1954-72, inclusive (524.15 miles)			10,341,950
3. Costs of private farm ditches installed by landowners at their expense 1949-72 inclusive (1,848.30 miles)			15,893,000
			66,765,800
4. Presuming a 100-foot spacing concept is accepted, the application of the appropriate formula develops the following:			
Tiling requirements to complete tile systems in cultivated area HO 17,934 miles tile installed (1929-72)—94,000,000 feet or 377,000 acres; Average spacing needed plus minus 100 feet: 100-foot space per 160 acres equals 65,000 feet to tile.			
65,000 over 160 equals 400 feet per acre to tile complete to 100 feet			
Existing tile 94,000,000 feet over 377,000 acres equals 250 per foot per acre existing			
400 feet per acre—250 feet per acre equals 150 feet per acre needed for split out; 150 feet times 377,000 equals 57,000,000 feet needed for split-out; 57,000,000 feet at $0.053 per foot			30,200,000
New tile—120,000 acres untiled (59,000 acres—no tile; 61,000 acres—partial tile); 120,000 acres times 400 feet per acre equals 48,000,000 feet new tile; 48,000,000 feet at $0.053 per foot			25,400,000
Total estimated cost of tile for 105,000,000 feet			55,600,000
Note.—For the year 1972, total tile footage under new tile design numbers was 918,000 feet. Total footage for year—5,160,000 feet. Total jobs for the year 1972 were 360, of which 36 were new grids. Therefore, 10 percent of all tile jobs were new grids representing 16.8 percent of all footage installed or 83.2 percent of all tile installed was split-outs			
5. Projected cost for concrete lining balance of district lateral canals in future years			28,012,300
6. Estimated projected 1983 cost of concrete lining district main canals are as follows:			
East Highline Canal (45 miles)			46,500,000
Central Main Canal (31 miles)			23,400,000
West Side Main Canal (45 miles)			39,000,000
Vail cut-off			3,000,000
Balance of the Rositas Canal unlined			2,000,000
Total cost concrete lining district lateral and main canals			141,913,300
Grand total concrete lining and tile lines installed and to be completed			264,279,100

The information submitted covering the costs of tile lines and concrete lined ditches installed has been developed from available records.

The estimated costs of additional tile lines, as well as new lines to be installed to split out existing lines; and the concrete lining of lateral as well as main canals, has been estimated, using cost information developed from our records to which there has been added what we believe to be an appropriate increase to accomplish the work proposed.

IMPERIAL IRRIGATION DISTRICT

SALINITY OF IRRIGATION WATER RECEIVED BY DISTRICT AND LEACHING REQUIREMENT 1964-66

Year	Annual discharge AF [a]	Total salt tons [b]	Historic weighted average salinity			Leaching required percent [d]
			TAF	PPM	$K \times 10^4$ [c]	
	(1)	(2)	(3)	(4)	(5)	(6)
1964	2,770,474	3,284,284	1.19	875	1,250	21
1965	2,624,363	3,406,457	1.30	956	1,370	23
1966	2,817,912	3,650,447	1.30	956	1,370	23
Average	2,737,583	3,447,053	1.26	[e] 926	1,320	22

[a] Total discharge all-American canal below drop 1.
[b] Based on weekly salinity samples.
[c] Based on conversion factor of 0.7 for ppm to conductivity (micromhos cm. to nearest 10).
[d] Based on average salt tolerance for 50 percent yield reduction and historic conductance of water delivered to district. Refer USDA Handbook No. 60 and Bulletin 283. Includes allowance for minimum nonuniformity of application.
[e] Weighted average.

IMPERIAL IRRIGATION DISTRICT

WATER FOR CONSUMPTIVE USE AND LEACHING REQUIREMENT AND THEORETICAL FARM EFFICIENCY 1959 66

Year	Total irrigation acre (1 000 acres)	Per irrigated acre: Consumptive use[1]	Leaching requirement (percent)	Consumptive use + leaching requirement (2)×100 / (100)−(3)	Leaching requirement only (4)−(2)	Total delivered to users	Total consumptive use[1] (1)×(2)	Total leaching requirement (1)×(5)	Available for farm efficiency[2] (6)−(7+8)	Farm efficiency (percent) (6−9)/(6)×100 =
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1959	440.0	4.32	17	5.20	0.88	2.250	1.899	387	(−36)	(101.6)
1960	434.5	4.36	19	5.38	1.02	2.395	1.894	443	59	97.5
1961	435.5	4.23	20	5.29	1.06	2.415	1.840	462	113	95.3
1962	429.5	4.13	20	5.16	1.03	2.446	1.774	442	230	90.6
1963	430.5	4.30	20	5.37	1.07	2.513	1.853	461	200	92.0
1964	431.5	4.39	21	5.56	1.17	2.399	1.893	505	(1)	(100.0)
1965	432.5	4.25	23	5.52	1.27	2.312	1.839	549	(−76)	(103.3)
1966	437.5	4.15	23	5.39	1.24	2.470	1.815	543	112	95.5
8-yr average	433.9	[3] 4.26	20	[3] 5.33	[3] 1.07	2.400	1.851	[3] 464		

Note: Cols 1, 6, 7, 8, and 9 are in 1,000 acre-feet

[1] Based on Blaney-Criddle Formula.

[2] Represents water that was available for farm losses after leaching requirements and consumptive use had been satisfied

[3] Weighted average: Col 2 refer T 1029 Col 3 refer T 1031 Col 6 refer T 1019.

IMPERIAL IRRIGATION DISTRICT WATER FOR CONSUMPTIVE USE AND LEACHING REQUIREMENTS AND THEORETICAL FARM EFFICIENCY 1959 68

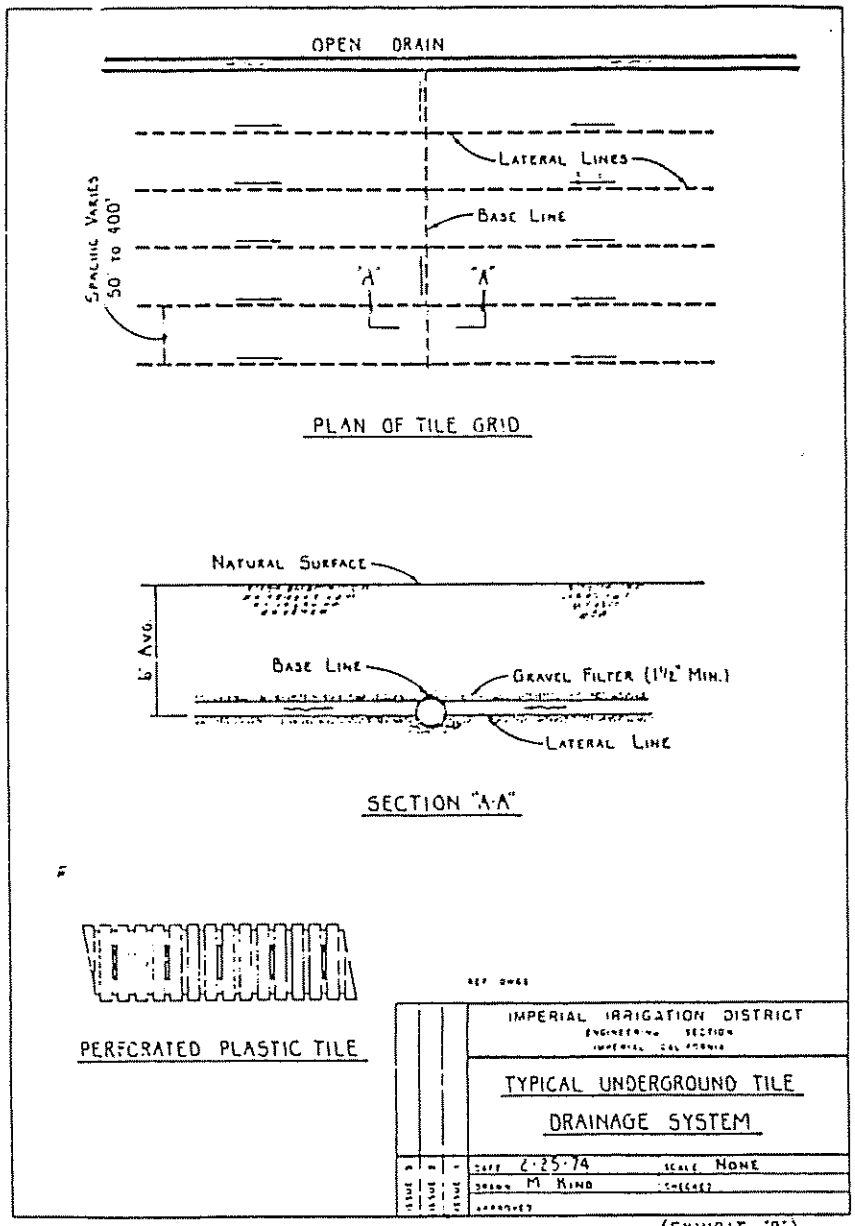
Year	Total irrigated acre (1,000 acres)	Per irrigated acre: Consumptive use[1]	Leaching requirement (percent)	Consumptive use + leaching requirement (2)×100 / (100)−(3)	Leaching requirement only (4)−(2)	Total delivered to users	Total consumptive use[1] (1)×(2)	Total leaching requirement (1)×(5)	Available for farm efficiency[2] (6)−(7+8)	Farm efficiency (percent) (6−9)×100 / (6) =
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
59	440.0	4.32	17	5.20	0.88	2.250	1.899	387	(−36)	(101.6)
60	434.5	4.36	19	5.38	1.02	2.396	1.894	443	59	97.5
61	435.5	4.23	20	5.29	1.06	2.415	1.840	462	113	95.3
62	429.5	4.13	20	5.06	1.03	2.446	1.774	442	230	90.6
63	430.5	4.30	20	5.37	1.07	2.513	1.853	461	200	92.0
4	431.5	4.39	21	5.56	1.17	2.399	1.893	505	1	100.0
5	432.5	4.25	23	5.52	1.27	2.312	1.839	549	(−76)	(103.3)
6	437.5	4.15	23	5.39	1.24	2.470	1.815	543	112	95.5
7	445.5	4.24	21	5.37	1.13	2.365	1.889	503	(−27)	(101.1)
8	441.0	4.04	21	5.11	1.07	2.476	1.782	472	222	91.0
10 yr average	436.0	[3] 4.24	21	[3] 5.07	[3] 1.13	2.404	1.848	[3] 493		76.7
2	444.5	4.12	22	5.28	1.16	2.531	1.833	516	182	92.8

Based on Blaney-Criddle formula.

Represents water that was available for farm losses after leaching requirement and consumptive had been satisfied

[3] Weighted average

Note: Col 1, 6, 7, 8, and 9 are in 1,000 acre-feet



(EXHIBIT "B")

Mr. JOHNSON. Our next witness was to be Mr. Roland C. Fischer, Secretary-Engineer of the Colorado River Water Conservation District.

Mr. GOSLIN. Mr. Chairman, I have been in touch with Mr. Fischer, and he announced he would not be here today, but would like to have permission to file a statement.

(The statement of Roland C. Fischer is as follows and was submitted in writing.)

JOINT STATEMENT OF THE COLORADO RIVER WATER CONSERVATION DISTRICT AND THE SOUTHWESTERN WATER CONSERVATION DISTRICT

Mr. Chairman and members of the subcommittee, We ask that this statement, which is submitted jointly by the Colorado River Water Conservation District and the Southwestern Water Conservation District in support of H.R. 12165, the "Colorado River Basin Salinity Control Act", be made a part of the record. To save the time of the Subcommittee and its staff, we add our support to the statement of the Committee of Fourteen which includes comments and detail of great value to the Subcommittee, but need not be repeated.

The Districts are public agencies of the State of Colorado, each established by a special act of the state legislature. Together they geographically encompass all of the area in Colorado West of the Continental Divide and are the source of 70% of the virgin flow of the Colorado River at Lee Ferry, Arizona, the dividing point between the Upper and Lower Colorado River Basins. The Districts are shown on the attached map. At present only a small fraction of the flow generated by the two Districts is utilized within their boundaries, but the construction of several water resource projects is imminent.

Both Districts have the statutory responsibility of conserving and applying to beneficial use in their respective areas the waters of the Colorado River and its tributaries within the State of Colorado. Rivers included are the headwaters and a substantial part of the runoff area of the mainstem of the Colorado River and many of its principal tributaries. These tributaries include the San Juan, Dolores, Gunnison, White and Yampa Rivers, as well as numerous streams tributary to them.

We appreciate the opportunity to present this statement in support of the passage of H.R. 12165, a bill designed to reduce the salinity of the Colorado River, but our support certainly does not imply any responsibility for salinity; this is a basin-wide problem. Salinity control measures provided for in H.R. 12165 will allow and should provide for continuing economic growth so dependent on the increased use of water. We commend the sponsors of H.R. 12165 for the language in Sec. 201a, directing the Secretary to implement the salinity control policy that recognizes that the Upper Basin States shall develop their compact-allocated share of Colorado River Basin water.

Two of the four projects to reduce salinity to be authorized by Title II of the proposed legislation, the Paradox Valley unit and the Grand Valley unit are within the geographic area of the districts. Three of the units for which the Secretary is authorized and directed to complete planning reports in Section 203; Lower Gunnison, Glenwood-Dotsero Springs and McElmo Creek, are also within the boundaries of the Districts. The five salinity control projects are shown on the map.

Our continuing and abiding interest in this legislation can be further demonstrated by the fact, as this committee knows, that seven reclamation projects n the area of the Districts have been authorized by Congress for construction but are not constructed because of lack of funding. Two, Fruitland Mesa and Savery-Pot Hook, authorized in 1964, received no recommendation for any appropriation in the President's FY 1975 Budget message. The other five (San Miguel, Dolores, Animas-LaPlata, Dallas Creek and West Divide) are recommended for only small amounts of planning moneys. Two of these projects, Animas-LaPlata and Dolores, would greatly benefit the Ute Indian tribes in Southwestern Colorado. One, West Divide, is essential to supply water for the emerging oil shale industry. The seven water resource projects are shown on the map.

All seven projects are essential to the nation's economy, prosperity and ability to be self-sustaining in energy and food and fiber. The energy crisis has focused national attention on the coal as well as oil shale potential of Western Colorado. The development of these energy resources cannot proceed without a reliable water supply. The construction of these authorized projects can, in part at least, guarantee the requisite water supply reliability. We would, therefore, request that, as the opportunities present themselves, the committee members will urge their counterparts in the Appropriations Committees to better fund the planning and construction of these projects.

22-44

File #600.0001

IMPERIAL IRRIGATION DISTRICT
WEIGHTED AVERAGE SALINITY OF IRRIGATION WATE
ALL AMERICAN CANAL BY YEARS

Year	Salinity 1/ ECx10^6	t.a.f.	p.p.m.	Composition Ca	Mg	Na+K	HCO_3		
				Meq/l/ppm 2/					
1976	1,265	1.17	860	4.62 / 93	2.82 / 34	5.51 / 127	1.57 / 96	6.12 / 294	3.75 / 133
1977	1,222	1.13	831	4.87 / 98	2.88 / 35	4.30 / 99	1.09 / 67	6.08 / 292	3.76 / 133
1978	1,172	1.08	797	4.81 / 96	2.73 / 33	4.71 / 108	1.12 / 69	6.22 / 298	3.75 / 133
1979	1,240	1.15	843	4.97 / 100	3.05 / 37	4.68 / 108	1.01 / 62	6.62 / 318	4.02 / 143
1980	1,194	1.10	812	4.62 / 93	2.75 / 33	4.46 / 102	0.96 / 59	6.14 / 295	3.73 / 132
1981	1,246	1.15	847	5.19 / 104	3.27 / 40	4.42 / 102	0.87 / 53	6.94 / 333	4.17 / 148
1982	1,254	1.16	853	5.26 / 105	3.22 / 39	4.65 / 107	1.08 / 66	6.59 / 317	4.35 / 154
1983	1,135	1.05	772	4.80 / 96	3.61 / 44	3.37 / 78	1.71 / 51	6.16 / 296	3.87 / 137
1984	1,084	1.00	737	4.36 / 87	3.05 / 37	4.06 / 93	2.02 / 61	6.11 / 293	3.25 / 115
1985	1,016	0.94	691	< DISCONTINUED MAY, 1985 >					

1/ Weighted average t.a.f. and p.p.m. of monthly samples at All-American Canal below Drop No. 1.
ECx10^6 computed by using factor of 0.68 as the average ratio of p.p.m. to conductance.

2/ Weighted average of monthly samples at Drop No. 1, All-American Canal.

3/ HCO_3 is reported as Bicarbonate.

Legend: $5.55 = \frac{\text{meq/l}}{\text{parts per million}}$ $\qquad$ $\text{meq/l} = \frac{\text{Tons for year X 735 X comb. wt.}}{\text{AF for year}}$

cc: General Manager, Executive Officer, Water Manager
Water Eng.
LAB-S1
(19)

Dwg. 8G-0050

IMPERIAL IRRIGATION DISTRICT

WEIGHTED AVERAGE SALINITY OF IRRIGATION WATER
ALL-AMERICAN CANAL BY YEARS
1959-1975

Year	Salinity 1/			Composition					
				Ca.	Mg.	Na.+K	HCO_3 2/	SO_4	Cl.
	$ECx10^6$	t.a.f.	p.p.m.	Meq/l/ppm 2/					
1959	1081	1.00	735	4.61	2.17	4.43	2.67	5.86	2.69
				92	26	102	163	281	95
1960	1146	1.06	779	4.70	2.49	4.72	2.76	6.13	3.02
				94	30	109	168	394	107
1961	1222	1.13	831	4.77	2.57	5.15	2.79	6.44	3.27
				96	31	118	170	309	116
1962	1243	1.15	845	4.85	2.72	5.38	2.80	7.06	3.53
				97	33	124	171	339	125
1963	1222	1.13	831	4.78	2.60	5.22	2.79	6.51	3.26
				96	32	120	170	313	116
1964	1287	1.19	875	5.04	2.69	5.67	2.71	6.89	3.58
				101	33	130	165	331	127
1965	1404	1.30	955	5.55	2.90	6.19	2.80	7.36	4.21
				111	35	142	171	354	149
1966	1404	1.30	955	5.26	2.92	6.40	3.04	7.24	4.41
				105	36	147	185	348	156
1967	1319	1.22	897	5.34	2.95	6.74	3.25	7.30	4.51
				107	36	155	198	351	160
1968	1307	1.21	889	5.05	2.85	6.36	3.03	7.18	4.06
				101	35	146	185	345	144
1969	1372	1.27	933	5.24	2.93	6.47	3.22	7.29	4.18
				105	36	149	196	350	148
1970	1372	1.27	933	5.34	2.91	6.46	3.22	7.51	4.01
				107	35	149	196	361	142
1971	1372	1.27	933	5.15	2.90	6.34	3.07	7.39	3.99
				103	35	146	186	355	141
1972	1340	1.24	911	5.11	2.83	6.18	3.06	7.22	3.85
				102	34	142	186	347	136
1973	1275	1.18	867	5.27	2.75	5.69	3.08	6.98	3.66
				106	33	131	188	335	130
1974	1287	1.19	875	4.79	2.91	6.60	2.98	7.37	3.64
				96	35	152	182	354	129
1975	1287	1.19	875	4.64	3.00	6.37	3.52	6.63	3.97
				93	36	147	215	318	141

1/ Weighted average t.a.f. and p.p.m. of weekly samples at A.A.C. Below Drop 1.

$ECx10^6$ computed by using factor of 0.68 as the average ratio of p.p.m. to conductance.

2/ Weighted average of samples every two weeks at Drop No. 1, All-American Canal.

3/ HCO^3 is reported as Bicarbonate.

Legend $5.55 = \frac{\text{meq/l}}{\text{parts per million}}$

Rev. 10/12/76 $\text{meq/l} = \frac{\text{Tons for year x 735 x comb. wt.}}{\text{AF for year}}$
Eng. Ofc.
c. c. Messrs. Carter, Twogood,

22-45

United States Department of the Interior
BUREAU OF RECLAMATION
LOWER COLORADO REGIONAL OFFICE
P.O. BOX 427
BOULDER CITY, NEVADA 89005

IN REPLY REFER TO: LC-430
452.1

APR 9 1976

Mr. Robert F. Carter, General Manager
Imperial Irrigation District
P. O. Box 937
Imperial, California 92251

Dear Mr. Carter:

In our salinity studies of the Colorado River Basin, we have a need for more complete information on salt loading. We are informed that Imperial Irrigation District compiles an annual summary of salt loading. We would appreciate having a copy of this annual summary for the years 1967 to the present, if it is available. Please send this information to the attention of code 430.

Sincerely,

C. W. Bowser
Acting Regional Supervisor of
Water and Land Operations

CC For Action:
Mr. Carter
For Information:
Mr. Wilson
Mr. Pachon

AMERICAN REVOLUTION BICENTENNIAL 1776-1976

22-46

LAWRENCE LIVERMORE LABORATORY

November 7, 1975

Re: Your letter, Oct. 29

Mr. J. M. Sheldon
Manager, Water Department
Imperial Irrigation District
Operating Headquarters
Imperial, California 92251

Attention: Mr. D. A. Twogood

Dear Mr. Sheldon:

First of all, thank you very much for sending me the salt balance data from 1959-date. It will be extremely helpful to us.

I would also like to obtain copies of the data from 1943-1959 showing concentrations by Total Dissolved solids only; these, too will be very useful to us. I will be in the area next week on Wednesday and Thursday; I will check with you to see if I can visit your offices and obtain a copy of the data at that time.

Sincerely yours,

Neil B. Crow
Geologist, Environmental Sciences Group

NBC:n

CC For Action
Mr. Twogood
For Information
Mr. Carter
Water Engineering

University of California P.O. Box 808 Livermore, California 94550 □ Telephone (415) 447-1100 □ Twx 910-386-8339 AEC LLL LVMR