



HISTORIC  
**SALTON SEA**  
AND  
IMPERIAL IRRIGATION DISTRICT

# IMPE

The central portion of the flat plain, sloping from 100 feet below sea level at the Colorado River flows along the coast to above sea level. To the west, the plain to be irrigated from the Colorado River.

The feasibility of irrigating the Imperial Valley had been studied since May 1901 that the California State Water Project commenced diversions into the Colorado River (about one mile north of the Colorado River) its entire length in Baja California into Imperial Valley.

After a few years, attempts to make a canal downstream in Mexico. In 1905 to February 1907, the Colorado River floods into Imperial Valley. In 1907, the northern part of the Colorado River assets of the California Water Company, both bankrupt.

Rockwood Gate

Dr. (Oliver M.) Wozencraft's first excursion into the desert he describes in his personal diary in a most interesting way. He had conceived an interest in the unknown features of this country and in the early part of May, 1849, set out to see it. He took with him several men, riding mules and a pack train and planned a careful investigation. Describing the "jornada" he says: "We at last reached this - the most formidable of all deserts on this continent. We found its basin filled with turbid water. Crossing in an improvised boat made of ox-hide, we encountered the desert. We started in the evening, taking a trail which soon led us into sand drifts, and as their walls are nearly perpendicular and as unsubstantial as a sand bank, we were compelled to halt. I set about prospecting to find a way out. There was a sand hill not far off. I climbed to the top and found that the sand drifts could be avoided by going to the bottom lands near the river. On my return to the men, they having fallen asleep, I found that the drifting sand had almost covered them up. We were some three days - or more properly speaking - nights - crossing this desert. The extreme heat in the daytime compelled us to seek shelter under our blankets. The heat was so intense that on the third day two of my men failed. It occurred to me, as there was nothing I could do there, to mount my gentle and patient mule, and at a distance of some eight miles I reached the border of the desert and water, with which I filled a bag and brought it back to them.

"It was then and there that I first conceived the idea of the reclamation of the desert."

Excerpt from THE STORY OF THE FIRST DECADE  
By Edgar F. Howe and Wilbur Jay Hall

An Astronaut's View of the Colorado River Basin. This photo was taken by the Gemini V crew during their eight-day flight in space August 21-29, 1965. Area in the foreground is the Laguna Mountain range west of Imperial Valley. Salton Sea, along with Coachella, Imperial and Mexicali Valleys, is located horizontally in the lower third of the photo. The Palo Verde Valley is approximately at the center of the photo. Further upstream Lake Havasu, behind Parker Dam, is clearly visible.



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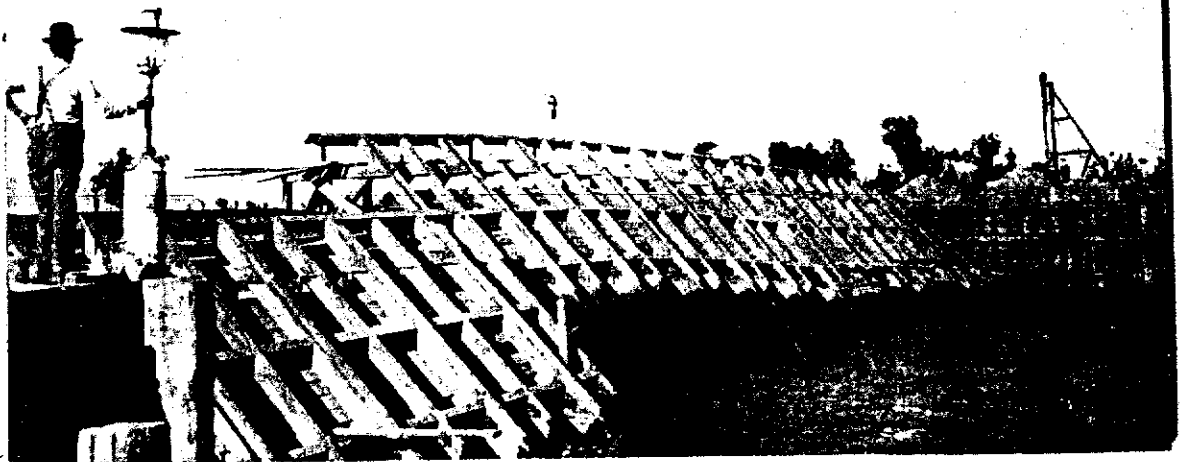
# IMPERIAL VALLEY

The central portion of Imperial Valley under cultivation is a relatively flat plain, sloping from about sea level on the Mexican border to about 232.0 feet below sea level at the surface of the present Salton Sea. The Colorado River flows along the crest of its delta in the Yuma area at almost 150 feet above sea level. To the east and west are broad mesas which are proposed to be irrigated from the All-American Canal.

The feasibility of bringing water from the Colorado River to irrigate Imperial Valley had been recognized since the 1850s. But it was not until May 1901 that the California Development Company completed and commenced diversions into a canal which had its heading in the United States (about one mile north of the international boundary), but which ran almost its entire length in Baja California, Mexico, before recrossing the boundary into Imperial Valley.

After a few years, difficulty with silt at the first heading resulted in attempts to make a temporary diversion from the River a short distance downstream in Mexico. The new heading failed as a result of unusual winter floods from the Gila River, a tributary of the Colorado. From the fall of 1905 to February 1907 the entire discharge of the Colorado River flowed into Imperial Valley, creating a large lake (now known as Salton Sea) in the northern part of the Valley. The break was finally closed in February 1907 by the Southern Pacific Company, which became the owner of the assets of the California Development Company and its Mexican subsidiary company, both bankrupted as a result of the floods and subsequent lawsuits.

*Rockwood Gate at the moment of failure 3:15 p.m., October 11, 1906.*

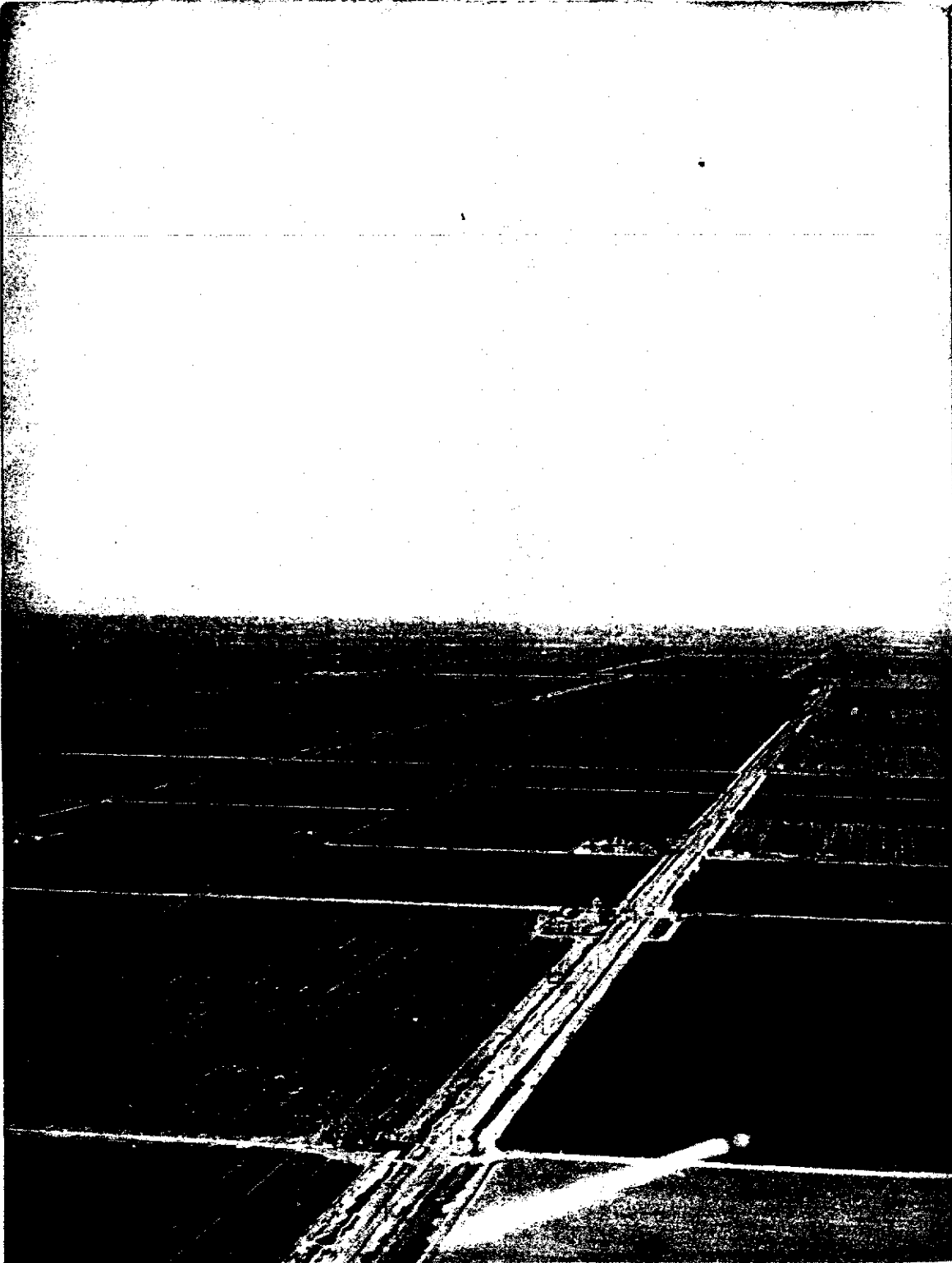


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*Irrigated agriculture is served by a 3,100-mile network of canals and drains.*

## IMPERIAL II

Imperial Irrigatic properties of the ba Mexican subsidiary fr newly-formed IID wa the main transmission canals formerly opera the District system.

Passage by Cong Act made possible the All-American Canal s of Hoover Dam was t the Colorado River to

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Imperial Dam, lo mately 22 miles north provides a permanen of the Canal in the U Canal located in Mex Canal also provided boundaries of the Di

Construction of Imperial Dam and t the U.S. Bureau of I 1, 1932.

It is of interest t mules were employec

*Closing the break*



### IMPERIAL IRRIGATION DISTRICT ORGANIZED 1911

Imperial Irrigation District was organized in July 1911 to acquire properties of the bankrupt California Development Company and its Mexican subsidiary from the Southern Pacific Company. In June 1916 the newly-formed IID was in a secure enough financial position to take over the main transmission canal operations from the SP. By 1922, distribution canals formerly operated by 13 mutual water companies became a part of the District system.

Passage by Congress in December 1928 of the Boulder Canyon Project Act made possible the construction of Hoover Dam, Imperial Dam and the All-American Canal system. One of the primary reasons for construction of Hoover Dam was the need for controlling the floods and silt content of the Colorado River to prevent eventual inundation of Imperial Valley.

Lake Mead, the reservoir back of Hoover Dam, has a usable storage capacity of 28,207,000 acre-feet. The annual average flow of the River is approximately 12,500,000 acre-feet. Construction of Hoover Dam was commenced in 1930, and storage of water behind the Dam was started in February 1935.

Imperial Dam, located at the head of the All-American Canal approximately 22 miles north of the international boundary on the Colorado River, provides a permanent point of diversion for desilted water. Construction of the Canal in the United States, as a substitute for the Alamo or Imperial Canal located in Mexico, eliminated international complications. The new Canal also provided a sufficient capacity to develop all the lands within boundaries of the District, and hydroelectric sites.

Construction of the 80-mile-long, gravity-flow All-American Canal, Imperial Dam and three desilting basins was started in August 1934 by the U.S. Bureau of Reclamation pursuant to a contract dated December 1, 1932.

It is of interest that this was the last major project on which men and mules were employed.

*Closing the break in the Colorado River 1905-07 - Southern Pacific photo.*



*canals and drains.*

The All-American Canal also has a branch which diverts water from the main Canal to and around Coachella Valley. For the first 49 miles, this branch Canal is designed to serve East Mesa farm lands. This Canal was completed in 1949 and is now serving water to Coachella Valley.

Imperial Irrigation District has contracted to repay the United States its share of the cost of the All-American Canal and appurtenant structures over a period of 40 years. The original contract cost was \$25,020,000. Balance due on this contract on December 31, 1965, was \$19,440,743.

Morelos Dam, one mile south of the international boundary, was completed in 1950 and diverts water into the old Alamo Canal for use on lands in the Mexicali Valley in Baja California, under the provisions of the Water Treaty on the Colorado River entered into by the United States and Mexico in 1944.

The main canal system in Baja — formerly owned and operated by a Mexican subsidiary company of the District — is now the property of and operated by the Mexican government.

In 1965, there were 505,419 acres receiving water service in Imperial Irrigation District. Due to the year-round growing season, many of these acres are double cropped.

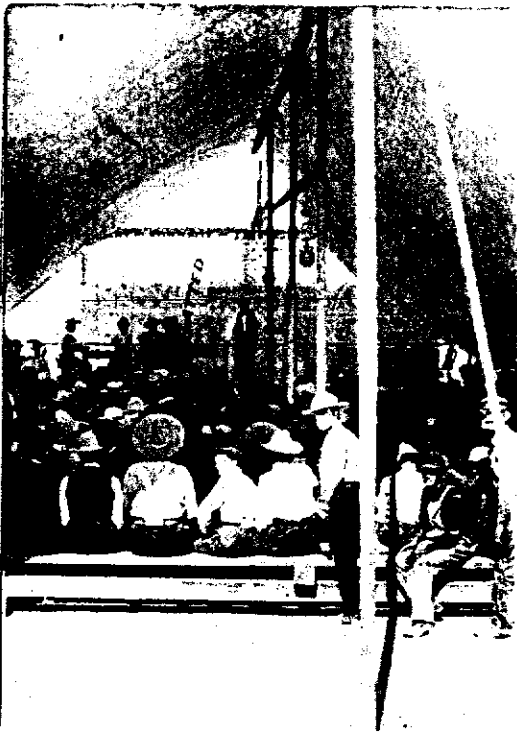
There are 284 miles of main canals and 1,497 miles of lateral canals which deliver irrigation water to consumers in Imperial Valley. All of the cities and towns in the Valley are a part of the District and receive all of their water requirements from District canals.

Over the years, the District has constructed an extensive drainage system to provide a drainage outlet to each 160 acres of land. Imperial Valley was farmed from 1901 to 1923 without drain-

age. A 1922 bond \$2,500,000 for drainage, deep drains was started end of 1965, 1,370 mile had been completed. No discharge into the Rivers, which serve a channels into Salton Se

The District's system not provide sufficient land as there is very little of ground water drains. The drains project into which material system into which landowner can dispose water. As a rule, this by installation of an unc of tile drain lines. This in 1929. It was initiated by the District until private were organized and completed. By the end of 1965 installed over 12,136 miles lines serving about 325

Beds of petrified ocean are found west of Imp



First lots were auctioned in City of Imperial April 21, 1902.

Congressman Phil Swing speaks at All-American Canal dedication.



Canal also has a water from the around Coachella miles, this branch serve East Mesa al was completed serving water to

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age. A 1922 bond issue provided \$2,500,000 for drainage, and a system of deep drains was started in 1923. By the end of 1965, 1,370 miles of open drains had been completed. Most of the drains discharge into the Alamo or New Rivers, which serve as natural outlet channels into Salton Sea.

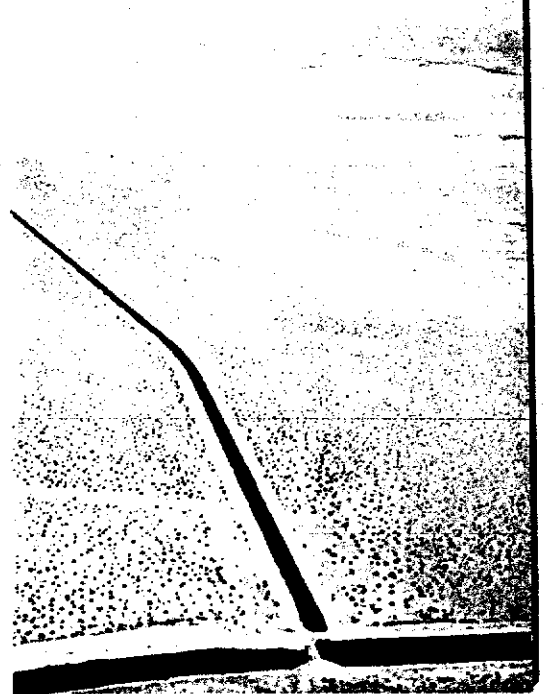
The District's system in itself does not provide sufficient drainage for the land as there is very little lateral movement of ground water to the District drains. The drains provide only an arterial system into which the individual landowner can dispose of his drainage water. As a rule, this is accomplished by installation of an underground system of tile drain lines. This program started in 1929. It was initiated and carried on by the District until private contractors were organized and equipped to take over. By the end of 1965, there had been installed over 12,136 miles of farm tile lines serving about 328,913 acres.

*Beds of petrified ocean-grown oysters are found west of Imperial Valley.*



*The shore line of old Lake Cahuilla is clearly visible on the mountains west of Salton Sea.*

*All-American Canal at the Coachella turnout.*



## DISTRICT POWER

Imperial Irrigation District entered the power generation and distribution business with a three-unit diesel plant in Brawley in 1936. In 1937, the first full year of operation, the District had a generating capacity of 2,250 kilowatts and sold 5,400,000 kilowatt-hours to 1,432 customers.

In 1965, the capabilities of generation and production resources of Imperial Irrigation District on a firm basis were 245,000 kw.

Not only is the District serving more customers, but each customer is using more electric energy. In 1937, the average use was 2,000 kwh per domestic customer. In 1965 the average use was 8,508 kwh as compared with a national average of 4,925 kwh.

The service area comprises 6,600 square miles, including Imperial County and most of the Coachella Valley.

The District owns and operates four hydro plants on the All-American Canal, two low-head hydro plants on main canals in the Valley, steam, diesel and gas turbine generating equipment. Additional electric energy is provided from the Axis Steam Plant near Yuma, the U.S. Bureau of Reclamation Parker-Davis system and Colorado River Storage Project, together with Arizona Public Service Company.

As of December 31, 1965, bonded indebtedness for the power system totaled \$23,448,000.

The District supplies water and power to some of the most productive farm land in the world. Imperial Valley's annual agricultural production ranks among the top in the country, with between 16 and 20 crops a year that can be classed in the multi-million-dollar group.

*Rock was hauled over the District's standard gauge railroad to build levees along the river in Mexico.*



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## SALTON SEA

*Located in Riverside and Imperial Counties, the Sea is about 35 miles long, 15 miles wide and 40 feet deep. It contains 115 miles of shore line and 375 square miles of area.*

*The key to understanding the formation of the present Salton Sea is the delta of the Colorado, which, in its own way, is as impressive as the Grand Canyon from which its sediments originated.*

*The delta has been described as a "T" with arms extending 200 miles from north to south, and with a stem 70 miles long, extending from Pilot Knob — eight miles west of Yuma — to Cerro Prieto, an outlier of the Cocopah Mountains in Baja California, Mexico.*

*The Colorado River may wander through the many miles of relatively flat delta, which has a fall of less than two feet per mile. During the last half of the 19th century, the river meandered down the east side of the delta into the Gulf, maintaining a navigable channel, occasionally flowing into Salton Sink. Records indicate that water from the Colorado River entered the Sink five times during the middle of the last century: 1840, probably when the New River was formed; 1842-1852, which formed a sea discovered by Blake in 1853; 1859 and 1867.*

*In June 1891 a flow of water formed a lake of some 100,000 acres. Investigating this flow into Salton Sink, explorers discovered the mouth of the Alamo River and made their way to the Sea via Beltran's Slough, showing the connection to the Colorado River for the first time. Water from the 1891 flood evaporated, leaving a salt marsh centered west of the railroad at Salton, a salt deposit which was mined by the New Liverpool Salt Company.*

*A boring made by the salt company in 1892 showed a seven-inch crust of sodium and magnesium chlorides above a 22-foot stratum of black ooze. Presence of this ooze may have started the rumor of a continuous stratum to the Gulf through which water could enter the Salton Sea.*

*From THE ECOLOGY OF SALTON SEA, CALIFORNIA  
IN RELATION TO SPORT FISHERY — Department of  
Fish and Game, State of California — 1961*

The Colorado Desert, also known as Salton Basin, extends from San Geronio Pass, where the adjoining mountains reach elevations in excess of 10,000 feet, southeasterly some 200 miles through Coachella Valley, Imperial Valley, and the Mexicali Valley of Baja California, Mexico, to the dividing ridge of the delta of the Colorado River in Baja California. This broad, flat ridge or saddle has an elevation, at its lowest point, of about 47 feet above sea level and divides the delta into two parts. To the east of the

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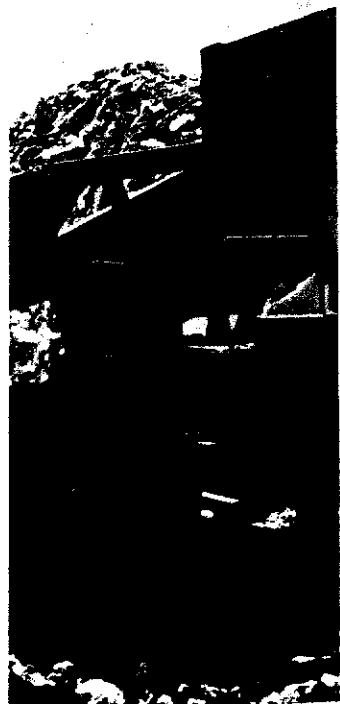
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ridge, the drainage of the delta is southerly into the Gulf of California; to the west, the delta drains to the north through Imperial Valley to Salton Sea.

A large part of Coachella and Imperial Valleys is below sea level. Palm Springs is -500 feet, Indio a few feet below, and Calexico, on the boundary between California and Baja California, sea level. In between, all is below sea level, the lowest point being located near the northerly end of Salton Sea, where the elevation is -277.7 feet - approximately the same elevation as the lowest point in Death Valley.

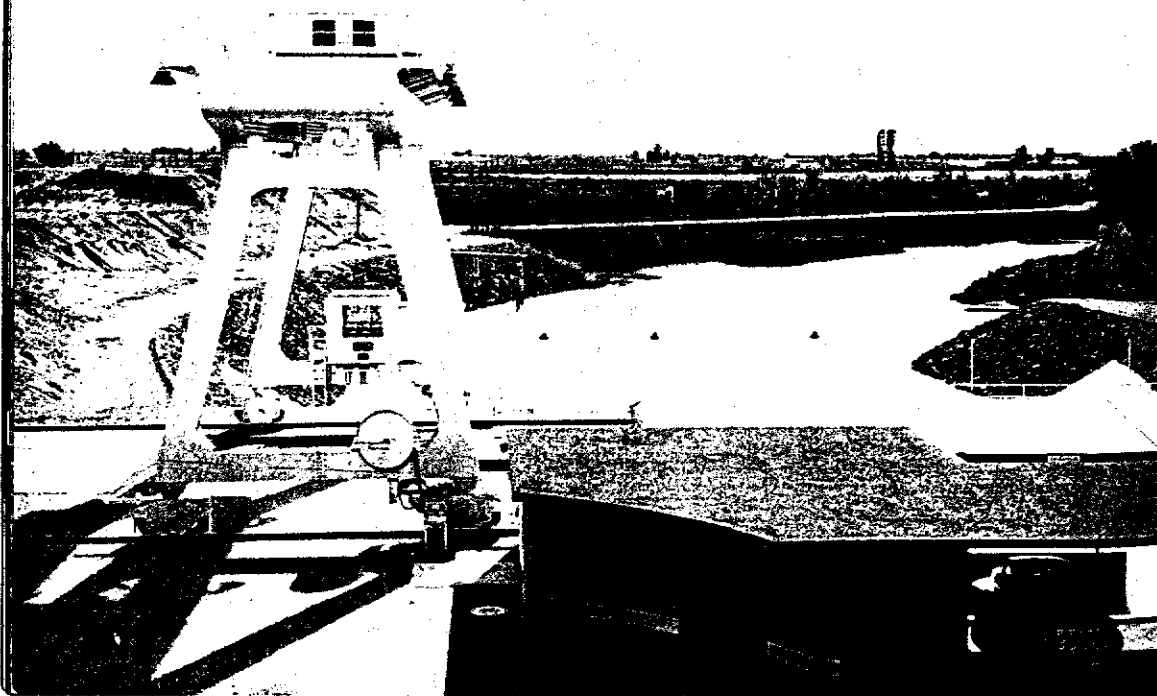
At one time, vast beds of almost pure salt covered more than 1,000 acres in the north end of the present Sea at a point about -265 feet.

Salt from this source was mined by the New Liverpool Salt Company in the late 1800s. Salt beds have been under water since the floods of 1905-1907.

Rising flood waters also covered many miles of Southern Pacific Railroad tracks which followed the former shore line.

The drainage area of this large enclosed basin - the Colorado Desert - comprises some 7,500 square miles, of which about 1,000 square miles are in Baja California, Mexico. It is an area of intense summer heat - for more than 110 days of the year, the maximum temperature is in excess of 100 degrees. It is also one of the most arid sections of our country, with an average rainfall of three inches - in some years it is less than one-half inch.

*Pilot Knob Hydroelectric Plant is located on the All-American Canal, using water which is returned to the River. Between the Plant and the Colorado River is the old Rockwood Heading.*



Few regions of this area, the historic struggle between man and river and use its water for agricultural purposes.

Several million people of California through beyond the Sacramento mountain ranges to the coast.

As evidence of the struggle near the mountains and the boundary. Marine fisheries and many hundreds of fish.

Following this period of the central portion of the Valleys. As this was the area as the River and the vast quantities of water. The area and its thought on the brink of the great chasm to material that has been over its delta.

*Hendon Heading, a control structure in the All-American Canal.*



Few regions of our nation have had as interesting a history as has this area, the history of its geologic past, as well as the history of the struggle between man and nature in which man fought to control an unruly river and use its waters to convert a barren desert into one of the great agricultural producers of the western hemisphere.

### GEOLOGIC HISTORY

Several million years ago an inland sea extended from the present Gulf of California through Imperial, Coachella and San Joaquin Valleys, and beyond the Sacramento Valley. Later, a tremendous upthrust created mountain ranges to the east and west, elevating the entire area.

As evidence of this upthrust, very large oyster beds are now found near the mountains on the west of Imperial Valley near the Mexican boundary. Marine fossils and shells are found in the San Felipe Valley, many hundreds of feet above sea level.

Following this upthrust, there was a gradual settling or downfolding of the central portion of the area now occupied by Imperial and Coachella Valleys. As this went on, the Colorado River began disgorging its silt into the area as the River meandered back and forth across its delta, depositing the vast quantities of silt eroded from the 240,000 square miles of its drainage area and its thousands of miles of deep canyons. One has but to stand on the brink of the Grand Canyon of the Colorado in Arizona and look at that great chasm to get some appreciation of the tremendous quantity of material that has been eroded during past ages by the River and spread over its delta.

*Hanlon Heading, built during the Colorado River floods of 1905, was a major control structure until 1940 when the All-American Canal replaced the Alamo Canal.*

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## LAKE CAHUILLA

Gradually the delta extended itself for hundreds of miles southerly into the Gulf of California, and westerly and northerly through the Mexicali Valley and into Imperial Valley. While we are not certain how deep the River silt is in Imperial Valley, we know that in places it has a depth of as much as 12,000 feet.

There must have been periods of many years when the entire flow of the River was into Imperial Valley. This is evidenced by the vast lake which was formed, the shore line of which can still be seen at many places around Imperial and Coachella Valleys, particularly along the mountains to the northwest of Salton Sea. The old shore line shows distinctly in the vicinity of Travertine Point, on Highway 86 near Desert Shores. This shore line has an elevation of something over 30 feet above sea level — which is the height at which the lake would overflow back into the Gulf of California. That the water stood at this elevation for many years at a time is evidenced by the thickness of the travertine deposit on the rocks below the water line. The lake, which has been given the name Lake Cahuilla, was some 150 miles in length, with an average width of about 30 miles and a maximum depth of over 300 feet.

However, it would appear that for at least 500 years before development of Imperial Valley was attempted by man, there had been no major diversion of the River into the Valley for any extended period, and the area had lain as a naked, burning desert, with only an occasional clump of greasewood and here and there a few willows along one or two of the shallow water courses, which now and then received some overflow during spring floods of the River. Records indicate that there was some water in Salton Sea in the 1850s and early eighties, and in 1891 the overflow of the River was sufficient to cover about 100,000 acres; but when development commenced in 1900, Salton Sea was dry and a salt works was in operation near what is now the northerly end of the Sea.

*Unusual geological formations, such as "sand chimneys," are found in nearby mountains.*



## EARLY

It was across the Mountains that De A from northern Mexic later trips, he and h the 100 or more mile to the mountains on

The same hard: army in 1847 — sorr through this region t Battalion. During th Imperial Valley, and a decade later, the Butterfield Stages e these, the trip from the most feared and continental journey. at the turn of the cen

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## EARLY CROSSINGS AND DEVELOPMENT

It was across this desolate, waterless waste from Yuma to the Coast Mountains that De Anza made his way in 1774, searching for a land route from northern Mexico to Monterey in California. On this and his several later trips, he and his party suffered tremendous hardships in traversing the 100 or more miles from the Colorado River across the Imperial Valley to the mountains on the west.

The same hardships were experienced by General Kearny and his army in 1847 — some 70 years after De Anza's first trip — in his march through this region to San Diego, and in the following year by the Mormon Battalion. During the gold rush of '49 and '50, thousands passed through Imperial Valley, and many lives were lost on this treacherous desert; about a decade later, the same route was traveled for several years by the Butterfield Stages en route from St. Louis to San Francisco. For all of these, the trip from Yuma across Imperial Valley to the mountains was the most feared and considered to be the most hazardous part of the trans-continental journey. This is the area man sought to subdue and develop at the turn of the century.

As mentioned previously, the possibility of bringing Colorado River water to reclaim the million acres of desert land in Imperial Valley was realized as early as 1850, but it was not until 1900 that private financing was secured and canal construction started. The first water from the River, 60 miles away, reached Imperial Valley in June 1901, and there followed one of the most rapid irrigation developments, on a large scale, ever witnessed in our nation.

In addition to the disastrous effect of the 1905-07 Colorado River flood on the early development, the people had many other difficulties to overcome. Among these was the fact that Imperial Valley was isolated from centers of population by wide deserts and high mountain ranges, making transportation a serious problem. There were also annual floods from the Colorado, followed by a low-flow period each year when diversion problems became serious. The flood menace required large expenditures by the people of the Valley in the construction and maintenance of an extensive protective levee system in Mexico; another break such as the one in 1905-07 might have engulfed the entire Valley.

They had to contend with the heat and dust of the long summer period and with a water supply heavily laden with silt. The silt choked their canals, piled up on their lands, and required costly treatment of the canal water to make it suitable for domestic use — no potable local water supply was or is available in the Valley.

The planting, growing and harvesting of nearly every crop had to be adjusted to the new and different conditions not experienced elsewhere. They also had to cope with international complications which resulted from the fact that their main canal system had to be brought to the Valley through Baja California, Mexico. These were but a few of the major difficulties.

Another dramatic chapter in the history of Imperial Valley covers the many years of struggle by the people of that Valley, later joined in by all sections of Southern California, to secure passage by Congress of the

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in the entire flow of and by the vast lake seen at many places along the mountains flows distinctly in the Desert Shores. This is above sea level — back into the Gulf for many years at a deposit on the rocks when the name Lake was given width of about

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Boulder Canyon Project Act authorizing construction of Hoover Dam and the All-American Canal, and also making possible the Colorado River Aqueduct to Southern California. All of these great works are now realities, but this chapter need not be detailed here as it is so well known throughout the country.

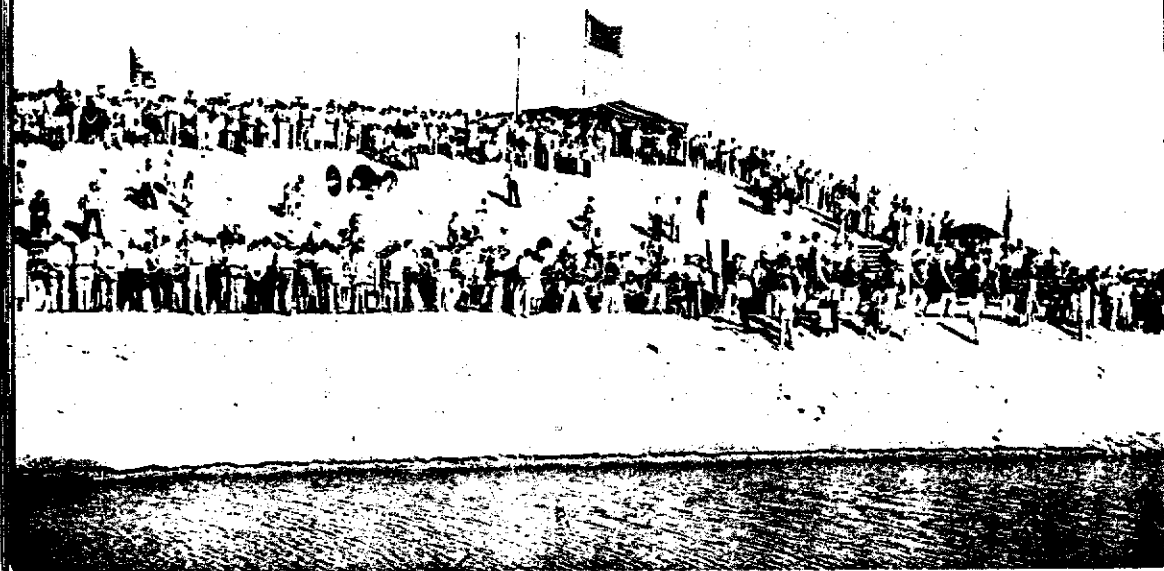
It was by the will and determination of the people to overcome all obstacles, and to fight through to success, that water was brought to the land. One by one, the problems were met, and the great transformation which we see today was accomplished. Although the area is favored by a year-round growing season and good soil, it took a lot of "blood, sweat and tears" to convert a half million acres of barren desert into an agricultural empire now producing crops with an annual value of over \$200,000,000 within this short period of 65 years.

When one now sees the hundreds of thousands of acres of farms in Imperial Valley producing bountiful crops of every type the year around and the homes with all the modern conveniences; the prosperous and modern cities and towns which dot the area, with most of the stores, buildings and homes — both urban and rural — air conditioned; and the hundreds of miles of paved highways and roads, it is difficult for one to visualize or appreciate what these people had to endure and overcome in conquering the desert.

#### NATIONWIDE INTEREST

With such an interesting geologic background and eventful and colorful period of development as Imperial Valley has had, it is no wonder that it has attracted the interest of the whole nation and has offered such a fertile field for writers of all types, both literary and scientific. Perhaps the best-known novel about Imperial Valley is "The Winning of Barbara Worth" — a best-seller in its day — written in 1910 by Harold Bell Wright. The story is built around the River break of 1905-07 and the heroic and

*Dedication ceremonies of All-American Canal attracted a large crowd.*



costly efforts to close the Gulf of California. Since scientific papers and no major events in its history.

Throughout the 19th Congress, the flood men publicized all over the million acres of farms which the water could very dramatic story. It and was to be expected financial credit of the V

During the same period effect that the continue on its delta was so incrust that it would sink submerge Imperial Valley have been a number since or valid evidence, but the kind that has been fixed doubts as to the p

With the completion last of the major problem and it may now be said more assured of a permanent situation. Of recent years a basis for their books. Of course, Coachella V

*Floating dredges work Rockwood Heading to*



of Hoover Dam and the Colorado River works are now reality it is so well known

people to overcome all was brought to the great transformation area is favored by a of "blood, sweat and into an agricultural of over \$200,000,000

of acres of farms in type the year around prosperous and modern stores, buildings and the hundreds of miles visualize or appreci- conquering the desert.

and eventful and color- it is no wonder that I has offered such a d scientific. Perhaps Winning of Barbara Harold Bell Wright, and the heroic and

costly efforts to close the break and return the River to its channel to the Gulf of California. Since then, many hundreds of books, magazine articles, scientific papers and newspaper stories about the Valley, or some of the major events in its history, have been published.

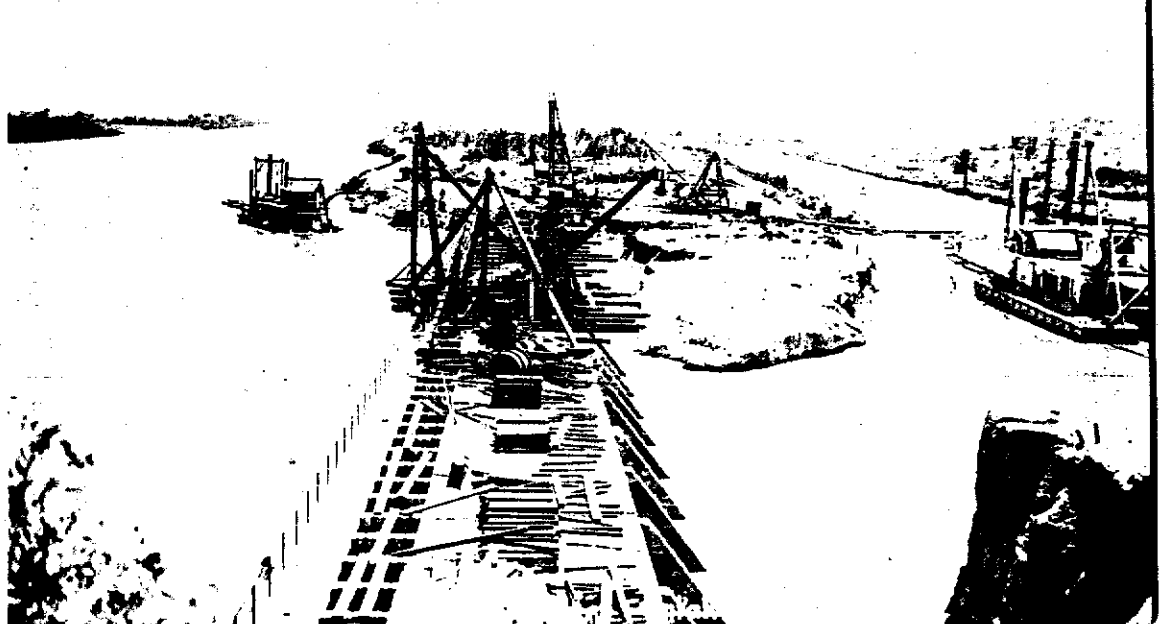
Throughout the many years that the River legislation was before Congress, the flood menace to Imperial Valley from the Colorado River was publicized all over the nation. The possibility of inundation of half a million acres of farms and a number of cities lying below sea level, from which the water could be removed only by natural evaporation, made a very dramatic story. However, this publicity was based on actual fact and was to be expected, but it did, at the time, severely damage the financial credit of the Valley.

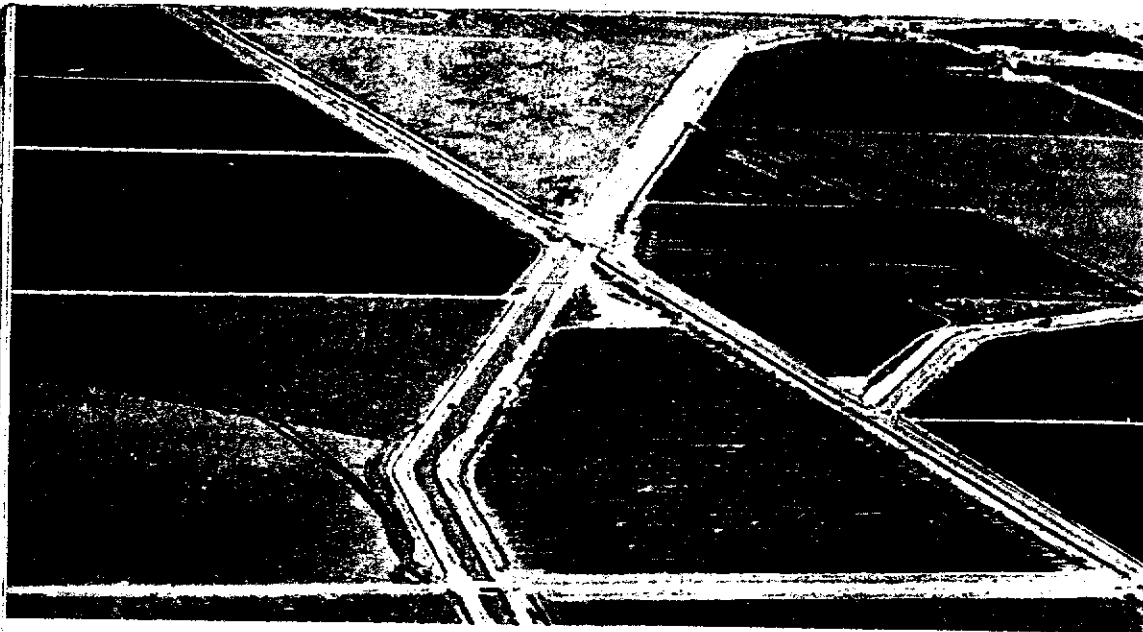
During the same period, another type of story was circulated to the effect that the continued deposit of the large volume of Colorado River silt on its delta was so increasing the weight on that segment of the earth's crust that it would sink and permit the waters of the Gulf to rush in and submerge Imperial Valley. This type of sensational story, of which there have been a number similar in character, was not based on scientific facts or valid evidence, but simply on someone's imagination or fancy, and is the kind that has been detrimental to Imperial Valley by creating unjustified doubts as to the permanency of its development.

With the completion of Hoover Dam and the All-American Canal, the last of the major problems which confronted Imperial Valley was eliminated, and it may now be said with confidence that no section of our nation is more assured of a permanent and prosperous future than is this Valley. But a certain class of writers was not to be discouraged by this changed situation. Of recent years, they have discovered new "dangers" to use as a basis for their books and articles predicting the doom of Imperial Valley. Of course, Coachella Valley would have to share the same fate as Imperial

*Floating dredges worked constantly in the Colorado River and Alamo Canal at Rockwood Heading to keep water flowing to Imperial Valley.*

at a large crowd.



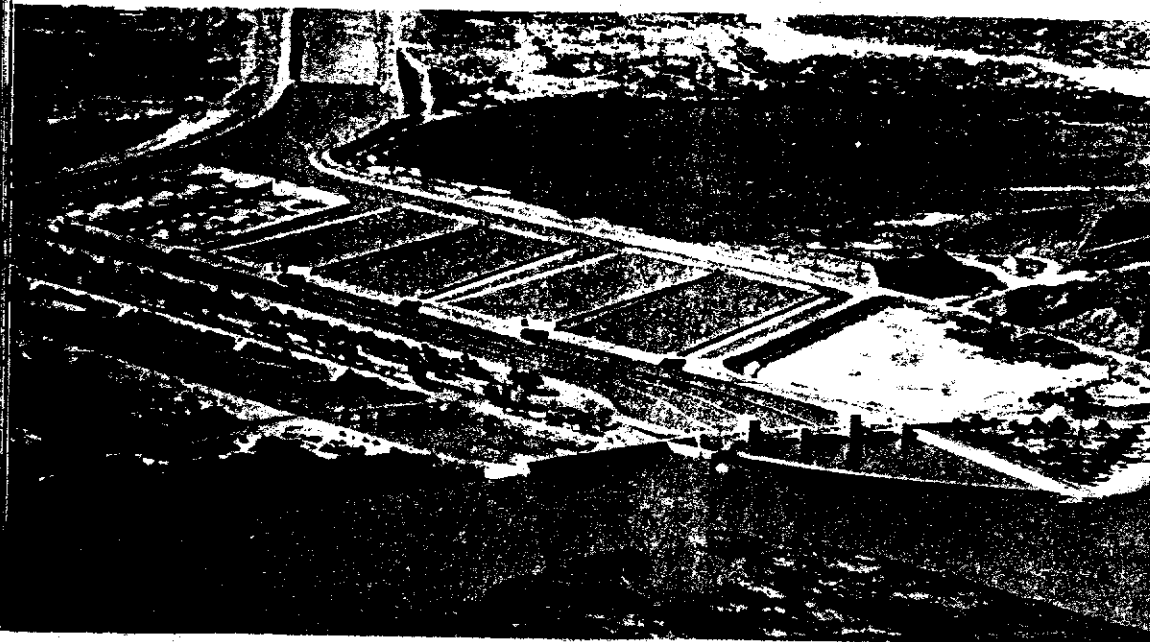


*With a year-round growing season, crops are harvested and planted every month of the year.*

Valley, should these imagined "dangers" prove to be real, but as a rule this is overlooked and most of such stories deal mainly with the terrible fate awaiting Imperial Valley.

As examples of such stories, there may be mentioned (1) the book written by a New York yachtsman, Randolph Leigh, called "Forgotten Waters," which was published in 1941; (2) an article appearing in the April 1950 issue of Harper's Magazine under the title "A Cataclysm Threatens California," by Alfred M. Cooper - this article was revised and appeared as late as 1965 in another magazine; and (3) an article entitled "California's Weird Overflowing Sea," by Keith Monroe, which appeared in The Saturday Evening Post of August 30, 1952.

*Imperial Dam on the Colorado River diverts water through desilting basins into the All-American Canal.*



These stories and theories:

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#### STORIES BASED

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To illustrate th published on the 0 advised the people could and buy Palm ocean beach to add calls or letters from to one or more of ti

An even more fears occurred wher an offer to remove the Valley was inun



These stories are based on one or more of the following erroneous theories:

... That Hoover Dam has cut off the tremendous volume of silt in the River which formerly reached the Gulf of California, with the consequence that the high tides of the Gulf – the second highest in the world – no longer have this silt to feed on and are now eroding and washing away the delta and will soon eat through the comparatively low barrier in the delta between the Gulf and Imperial Valley, which will permit the waters of the Gulf to rush into the Valley, and it will then be covered by an inland sea, as it was ages ago.

... That over the past, earthquakes have opened up deep underground cracks in the delta, through which water from the Gulf is seeping into Salton Sea, which, it is claimed, is evidenced by the rise in that Sea; and that these cracks will enlarge until the overlying area of the delta collapses, permitting the Gulf to reclaim its own.

... That Salton Sea is a mysterious and weird body of water, about which little is known; that it has been rising rapidly of late and is now bursting its banks, with no way to stop it; and that it will continue to rise and gradually submerge a large part, if not all, of the farmlands, cities and "villages" in Imperial and Coachella Valleys.

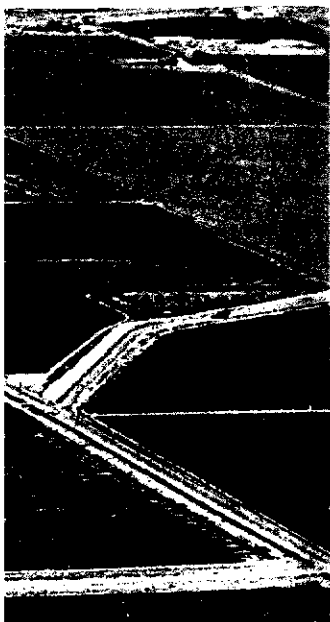
These are intriguing possibilities, if they be true – which they are not – and it is easy to imagine how stories or articles predicting such a calamity would create so-called "reader interest" all over the country. But, a categorical answer of "no" can be given to each and all of these scare stories. It is regrettable that certain of the more responsible publishers of nationwide importance appear willing to accept and publish such stories, which can injure a section of our country, without first making certain that the authors are fully qualified and that all of the facts are correct.

#### STORIES BASED ON CONCOCTED "DANGERS" DETRIMENTAL

In each of the three stories mentioned, writers have taken a few actual facts, which they have colored and exaggerated to suit their purposes, and added speculative theories of their own, which cannot be supported by factual evidence. As a result, a reader not acquainted with the real facts gets the impression that the writer is an expert on the subject and that the destruction of Imperial Valley is really imminent.

To illustrate the effect of such stories, one of the weekly newspapers published on the Coast, commenting editorially on the Cooper article, advised the people of Imperial and Coachella Valleys to sell out while they could and buy Palm Springs property, as Palm Springs would soon have an ocean beach to add to its attractions. Valley people have received telephone calls or letters from relatives in other parts of the country calling attention to one or more of these stories and expressing fear for their safety.

An even more macabre attempt to capitalize on the manufactured fears occurred when a Midwest funeral director circularized residents with an offer to remove the bodies of loved ones from local cemeteries before the Valley was inundated!



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*Land reclamation is accomplished by installation of drainage tile and flooding (leaching) the land for .  
photo taken near Salton Sea shows salt-laden land in foreground, fields with leach borders, and one fie*



*by installation of drainage tile and flooding (leaching) the land for a period of time to wash out salts. Air salt-laden land in foreground, fields with leach borders, and one field under cultivation.*

This is the humorous side of the picture, and to those who know what the real facts are, these stories would be laughable were it not for the serious side.

Stories of this type — although completely unfounded — tend to create a doubt about the Valley's future in investment circles. Of course, Imperial Irrigation District and other agencies do what they can to correct these erroneous stories, but it is a difficult matter for local agencies to compete with a magazine of nation-wide circulation.

Let us examine the cold facts as to whether the delta is being washed away from its top by erosion and from its bottom by seepage and leakage . . . whether Salton Sea is weird and mysterious and is now bursting its banks, uncontrolled.

### ARE THE GULF TIDES ERODING THE DELTA?

How do we know the waters of the Gulf are not eroding or eating away the delta?

First, something should be said about the delta itself. Due to the high silt content of the Colorado River in its natural state, its delta is as large as, if not larger than, that of any river in the world of comparable discharge. The delta covers several millions of acres and, as it was built up over past ages, it spread out to the west and north into Imperial Valley, a distance of some 150 miles from the present location of the city of Yuma, and to the south to the Gulf of California and for as much as 100 miles into the Gulf.

Considering the magnitude of the tides and tremendous volume of sea water they include, what we consider to be the large volume of Colorado River silt would be relatively small. Consequently, even during periods in past centuries when the River may have been discharging its entire silt load into the Gulf, the dissipating and spreading of that silt by the waters of the Gulf was but a minor incident. In other words, the slope of the delta for as much as a hundred miles from the head of tide-water out into and under the Gulf was established over the centuries by tidal action, and there is no evidence to indicate that this slope was in anywise affected by silt entering the Gulf.

But we know that for at least a hundred years before man undertook to control the River, a great percentage of its silt did not reach the Gulf, but was deposited over the broad areas of the delta, above the effect of tidewater, by overflow of the banks of the River during much of each year.

A survey of the River channel made in 1903 showed that the width near Yuma was about 800 feet, while downstream some 80 miles, which would mean near tidewater, the channel was only half as wide. River bank overflow between the two points accounts for the decrease in size of the channel. Thus, if there had been a tendency for the tides to erode the delta because of the absence of Colorado River silt, such would have taken place during this period, but there is not the slightest evidence to indicate that it did.

### AMOUNT OF SILT REACHING GULF

We also know that the amount of silt reaching the Gulf was changed very little by the construction of Hoover Dam. From 1904 to 1907, during the break of the River into Imperial Valley, all of the water and, of course,

all of the silt came into natural conditions in the hundreds of years, causing miles below the California entirely away from the coast westerly into the Volcano

Had man not prevented no question but that the Imperial Valley, as it had Lake Cahuilla would have

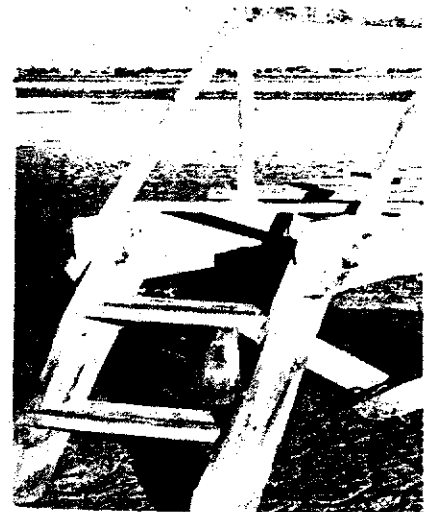
Thus it was that the extensive Volcano Lake silting in of the area at

A dangerous situation Volcano Lake area, ended. In 1922, the District was Lake section into the Imperial Volcano Lake and the River

Until construction of sorbed practically all of

So for at least 30 years little of the River's silt had change this situation.

*Recent photo at mouth same gauge 10 years earlier*



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It is being washed eepage and leakage is now bursting its Delta? eroding or eating self. Due to the high its delta is as large mparable discharge. s built up over past Valley, a distance of f Yuma, and to the miles into the Gulf. rrendous volume of re large volume of nently, even during eading of that silt In other words, the m the head of tide- ver the centuries by at this slope was in

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water and, of course, e Gulf was changed 1904 to 1907, during

all of the silt came into this area; none reached the Gulf. In 1908-09, natural conditions in the delta, which had been developing for several hundreds of years, caused a major change in the River's course some 20 miles below the California-Mexico boundary. The River diverted itself entirely away from the old channel below that point and followed a course westerly into the Volcano Lake area, located on the dividing ridge.

Had man not prevented the River from continuing westerly, there is no question but that its course would have continued into and through Imperial Valley, as it had done many times over ages in the past, and Lake Cahulla would have been recreated.

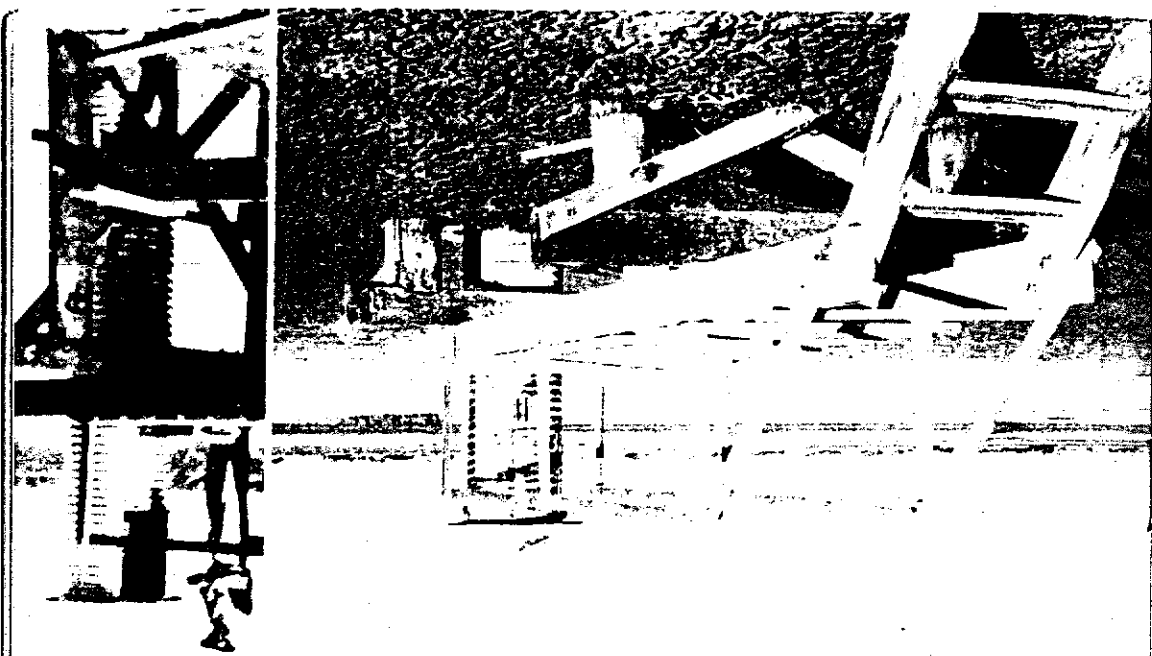
Thus it was that the River deposited practically all of its silt in the extensive Volcano Lake area from 1909 until 1922, and records indicate a silting in of the area at a rate of about one foot per year.

A dangerous situation was created by this rapid siltation of the Volcano Lake area, endangering lands in the Mexicali and Imperial Valleys. In 1922, the District was forced to divert the entire River out of the Volcano Lake section into the Pescadero Basin . . . a low-lying area between Volcano Lake and the River's old course along the Sonora Mesa.

Until construction of Hoover Dam in 1935, the Pescadero Basin absorbed practically all of the silt.

So for at least 30 years prior to the completion of Hoover Dam, very little of the River's silt had been reaching the Gulf, and the Dam did not change this situation.

Recent photo at mouth of Colorado River shows heavy siltation. Inset shows same gauge 10 years earlier.



As further evidence that the delta is not being eroded, we have the report of the American Section of the International Boundary and Water Commission, United States and Mexico, that aerial photographs of the upper portion of the Gulf of California, taken in 1942 and 1949, compared with maps of the same area made by the United States Navy in 1873-75, show no discernible change in the past 75 years in the position of the mouth of the River, the head of the Gulf, or the deltaic Montague Island, which is located in the Gulf 1.6 miles off the mouth of the River. If the tides were washing away the delta, such would first be reflected in conditions in and around the mouth of the River.

Recent studies by desert naturalist Morlin Childers, in fact, show that the reverse is true. That is, the bore tides of the Gulf of California are depositing silt in the mouth of the River which in time will seal the River completely.

The American Section of the Commission also reports that the extreme high tides of the past have now decreased somewhat, due to the fact that Hoover Dam has controlled the floods of the Colorado River. It was this large volume of flood water, in the past, meeting the Gulf tides that caused their extreme height. The effect of the lower tides would be to decrease the tendency, if any, of the tides to erode the delta.

Lastly, the delta is still growing. While Hoover, Davis and Parker Dams have cut off 95 per cent or more of the River's silt, there is still some reaching the delta by erosion of the coarse silt and sand from the bed of the River below Parker Dam (the lowest of the three dams). This silt deposited on the delta, while not large in amount, is nevertheless increasing the thickness of the barrier between the Gulf and Imperial Valley.

Other evidence could be given, but it would seem that the foregoing should be sufficient to prove beyond question that the delta is not being eroded or washed away by the Gulf's tides. Finally, even if it were being so eroded, it would be a comparatively small task to protect the small section of the delta where there would be any danger whatever from a breaching of the barrier between the Gulf and Imperial Valley.

### FALLACY OF SEEPAGE THEORY

What about the possibility of cracks in the delta through which water may be seeping into Salton Sea?

This possibility was first rumored following the San Francisco earthquake in 1906, at the time of the break of the Colorado River into Imperial Valley, which was causing Salton Sea to rise rapidly. Someone had the idea that that earthquake, and possibly others, had opened up cracks in the delta through which there was seepage from the Gulf and claimed that such was the cause of the rapid rise in Salton Sea. Careful investigation at that time showed no justification for such a contention. This unproved theory has been revived by certain writers from time to time.

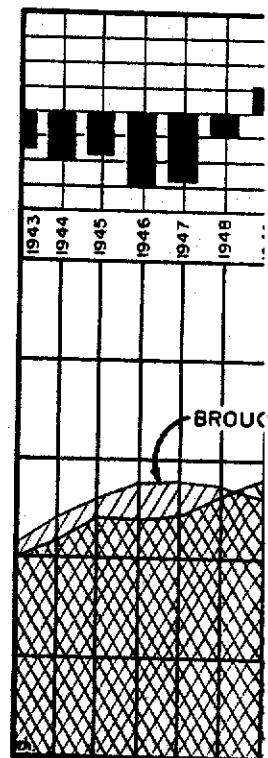
The delta of the Colorado River serves as a dam between the Salton Sea and the Gulf of California. It is a dam constructed over countless ages by nature with silt deposited as the River meandered back and forth across its delta.

This dam has a height of about 300 feet.

Let us compare  
 The top width  
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eroded, we have the Boundary and Water photographs of the 1922 and 1949, compared with the position of the Salton River in 1873-75, and the position of the Salton River in 1949. If the delta is not being eroded, the delta would be reflected in conditions, in fact, show that the Gulf of California are not being sealed the River

ports that the extreme tides, due to the fact that the Salton River. It was this tides that would be to the delta.

er, Davis and Parker silt, there is still some sand from the bed of the Salton River (from three dams). This silt nevertheless increasing in the Imperial Valley.

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San Francisco earthquake opened up cracks in the Gulf and claimed that the delta was eroded. Careful investigation at the delta. This proved to be a mistake.

between the Salton River and the Gulf of California. The delta is eroded over countless years and is eroded back and forth

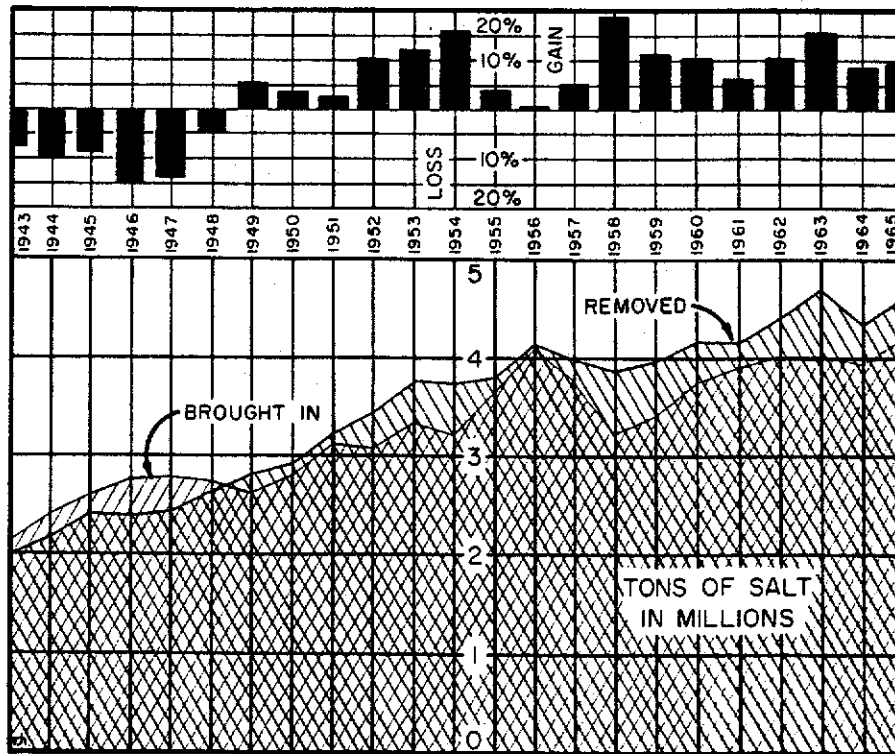
Let us compare it with a dam of similar height, if built by man. The top width of the man-made dam would be, perhaps, 100 feet – the top of nature's dam has a width of from 8 to 10 miles. The man-made dam would have a freeboard of, maybe, 5 or 10 feet – nature's dam has a freeboard of 35 feet above maximum tide of the Gulf. The thickness through the base of the man-made dam would be something like 2,000 feet – the comparative thickness through nature's dam is 140 miles. At the normal height of the water above nature's dam – sea level – the thickness of that dam is 60 miles.

Nature's dam has remained intact for countless centuries and there is not the slightest evidence of seepage from the Gulf. It would seem that the people of Imperial Valley have little to fear from the possibility of nature's dam failing.

### NOTHING WEIRD OR MYSTERIOUS

Is Salton Sea weird and mysterious and will it, in the future, submerge a large part of Imperial and Coachella Valleys?

Salton Sea is located in the northern part of Imperial County and the southern part of Riverside County, California. It must receive not only the



IMPERIAL VALLEY SALT BALANCE  
INCLUDING WATER & SALT FROM MEXICO

runoff from storms over 7,500 square miles of the enclosed basin it drains, but also the return from some 700,000 acres of presently irrigated land, including 550,000 acres in Imperial and Coachella Valleys, California, and 150,000 acres in Mexicali Valley of Baja California, Mexico.

Reference has already been made to old Lake Cahuilla the shore line of which can be seen in various parts of the Imperial and Coachella Valleys, representing long periods of Colorado River inflow. Other shore lines exist at lower elevations, indicating that in past centuries there were shorter periods of overflow of the River into the basin before a change in conditions in the delta would force the River to discharge back into the Gulf.

In 1907, at the time of the closure of the break of the River into Imperial Valley, the Sea covered about 350,000 acres and had reached a maximum elevation of 195 feet below sea level. For the next 12 or 13 years, an excess of evaporation over inflow caused the elevation of the Sea to drop rapidly.

However, by 1920, irrigation development in the Imperial and Mexicali Valleys had reached a point where return flow to the Sea was equal to evaporation. For the next few years, the rate of lowering slowed down, with elevations levelling off until 1925, when a low point of about 250 feet below sea level was reached. From then until 1931, there was a rise in the Sea of about seven feet, due in part to a plentiful water supply for irrigation and in part to several severe local winter storms. However, water shortages, particularly in 1931 and 1934, which caused large crop losses in Imperial Valley, resulted in a drop of several feet in the Sea to another minimum of -248 feet in 1935.

Since the commencement of storage behind Hoover Dam in February 1935, there has been an ample water supply available to the lower River, and the Sea has been rising at varying rates. The elevation on December 31 1965, was 232.00 feet below sea level.

#### RISE IN SALTON SEA AND FACTORS INVOLVED

There was a gradual rise in the surface elevation of Salton Sea from 1935 until 1950. During the period from 1950 to 1955, the Sea rose more rapidly - at an average rate of about one foot per year. However, since 1955, except for seasonal fluctuations, the level has remained between 234.35 and 231.85 feet below sea level.\*

The rise in the Sea between 1935 and 1955 apparently attracted the attention of several writers who made it appear the rise was unaccountable, unless it was due in large part to seepage from the Gulf.

One writer referred to the Sea as being "weird" and "mysterious" and said that it was "bursting its banks," uncontrolled. Another claimed Salton

\*Salton Sea elevations since 1955 as of December 31 of each year are as follows:

1955 .....	-234.35	1960 .....	-233.75
1956 .....	-234.50	1961 .....	-233.35
1957 .....	-234.45	1962 .....	-232.65
1958 .....	-234.60	1963 .....	-231.45
1959 .....	-234.30	1964 .....	-231.85
		1965 .....	-232.00

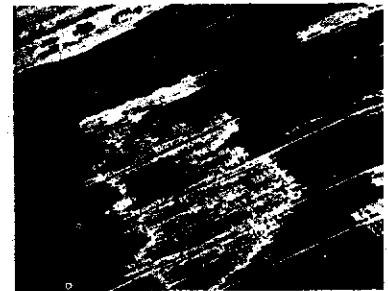
Sea was created by seepage in 1904 and that this, together with the inundation of the land and the destruction of the Valleys." He said further that the likelihood of this happening again is as to when the

These are but same

No, there is nothing about its rapid rise between 1951 and again in 1955, ever, during a year, the flow from the irrigated land by evaporation, the level

In the last 65 years the level of the Sea has come down, fact, although major storage has been a number of instances the elevation of the Sea

Another factor has been the loss of some 100,000 acres of Colorado River water, which





Sea was created by seepage through cracks opened up by "a minor quake" in 1904 and that this, together with subsequent events, has "set the stage for the inundation of three million acres of Southern California's best farm land and the destruction of 25 towns and villages in Imperial and Coachella Valleys." He said further that "West Coast scientists do not question the likelihood of this impending cataclysm, they differ chiefly in their estimates as to when the event will occur."

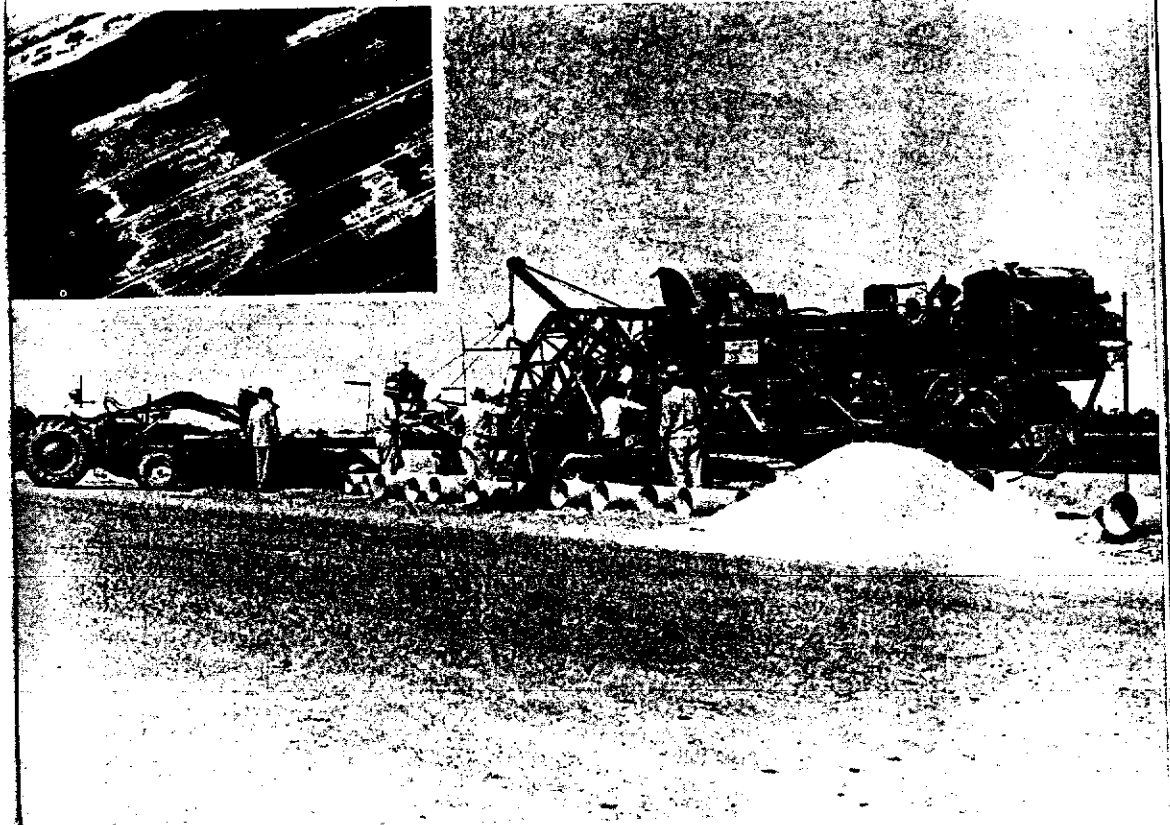
These are but samples of the nonsense contained in these stories.

No, there is nothing weird or mysterious about the Salton Sea, or about its rapid rise between 1950 and 1955. Neither is the rise of 1.5 feet in 1951 and again in 1952 unprecedented nor is it unaccountable. Whenever, during a year, the inflow to Salton Sea, from local storms and return flow from the irrigated lands, exceeds the amount removed from the Sea by evaporation, the level of the Sea rises.

In the last 65 years, there have been a number of times when the level of the Sea has come up as much as 1.5 feet in a year. As a matter of fact, although major storms in the drainage area are infrequent, there have been a number of instances when the runoff from a single storm has raised the elevation of the Sea from 0.75 of a foot to 1.5 feet.

Another factor has been the increase in acreage irrigated, amounting to some 100,000 acres, with a consequent increase in the requirements for Colorado River water, a part of which showed up as drainage to Salton Sea.

Drainage tile installation.



the enclosed basin it of presently irrigated la Valleys, California, a, Mexico.

huilla, the shore line and Coachella Valleys, Other shore lines exist s there were shorter a change in conditions nto the Gulf.

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- ..... -231.45
- ..... -231.85
- ..... -232.00

Changes in cropping patterns also affect irrigation water requirements.

To illustrate, in 1951 cotton was planted in the Valley for the first time in more than 20 years. Total acres planted ranged from a low of 28,000 in 1951 to a high of 108,000 acres in 1953. Cotton requires heavy irrigation during the summer, resulting in a greater return flow than other crops.

The effect of cotton planting on total water diversions through the All-American Canal is indicated by the following: total diversions during 1948 totaled 2,900,000 acre-feet; in 1953, the high cotton year, diversions totaled 3,900,000 acre-feet, representing an increase of one million acre-feet.

A further factor is the increase in the mileage and efficiency of the drainage system in Imperial Valley, which has increased the inflow to Salton Sea.

As previously mentioned, more than 12,000 miles of farm tile have been installed by individual farmers. The efficiency of field drainage systems is being further improved by "splitting" existing lines . . . i.e., adding new tile to make the spacing in the tile grid closer and improve production.

All of these factors combined explain the rise of Salton Sea. As development of the area progresses, and the salt content of the River water increases, the factors mentioned will no doubt result in some further increase in the height of the Sea . . . but there is nothing weird or mysterious about it.

#### FUTURE ELEVATION OF SALTON SEA

At what elevation is it anticipated that the level of Salton Sea will be stabilized?

So many unknown factors are involved that it is almost impossible to predict, with any accuracy, the future elevation of the Sea.

. . . The 150,000 acres in Baja California in the Salton Sea drainage basin have a partial drainage system. An extensive drainage system must be built to permit continued farming.

. . . The 1944 water treaty between the United States and Mexico is silent on the matter of wasting water from Mexican canals and farms to Salton Sea.

. . . The salinity of Colorado River water arriving in Imperial Valley will no doubt increase due to reservoir evaporation and additional irrigation development upstream. Just what this increase will amount to has not yet been determined, but it could mean a contribution of five or six million tons of salt per year in the Salton Sea drainage basin which will have to be removed in order to maintain a salt balance. How much water this will require is unknown.

. . . Weather conditions in the 7,500-square-mile drainage basin also affect the Sea's elevation. If the area should enter a "wet cycle" over an extended number of years, the Sea would no doubt rise.

The Sea normally evaporates about six feet per year. In years with long, hot summers, the evaporation will be slightly greater than in cooler years. Since the Sea has a gradually sloping coast line as the Sea rises, a greater surface is available, and the evaporation rate is somewhat faster.

The importance of for a great many years its behavior and what Government, by Executive the United States in feet below sea level, a

At that time, the sea level, and the free this was without prop

In the middle 20s. tigation of the probal 1927 stated that the tributary area was full and 226 feet below sea should be considered higher than the present Federal Government, of entry all public land below this elevation area to the Public Re

In view of all th have a tendency to r to show whether the not be too conservati no danger of the int amount of good farm or towns in either Ir

#### ACQUISITI

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As a result, the practically all of the connection with its v has expended nearly

The District is j in the Southwest fo water conservation r

Construction of has made it possibl curately.

water requirements.

Valley for the first time. The Valley has been flooded from a low of 244 feet below sea level. It requires heavy irrigation flow than other

diversions through the Salton River. During the last year, diversions of one million acre-feet. The efficiency of the diversions has increased the inflow to

of farm tile have been installed. The efficiency of field drainage systems is . . . i.e., increased and improved

of Salton Sea. As the content of the River increases, the result is some further increase in the weir or

SEA

of Salton Sea will be

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Salton Sea drainage system must

States and Mexico is to build canals and farms to

ing in Imperial Valley. The additional irrigation amount to has not yet reached five or six million acre-feet which will have to be diverted. Much water this will

the drainage basin also has a "wet cycle" over an average of 10 years.

year. In years with greater than in cooler years, the Sea rises, and it is somewhat faster.

The importance of Salton Sea as a drainage basin has been realized for a great many years. Studies have been made, from time to time, as to its behavior and what might be expected in the future. In 1924, the Federal Government, by Executive Order, withdrew from entry all public lands of the United States in the Salton Sea area lying below an elevation of 244 feet below sea level, and created a Public Water Reserve.

At that time, the elevation of the Sea was approaching 250 feet below sea level, and the freeboard of six feet was thought to be sufficient. But this was without proper consideration of future conditions.

In the middle 20s, the United States Geological Survey made an investigation of the probable future stages of Salton Sea. A report issued in 1927 stated that the future stabilized elevation of the Sea, when the tributary area was fully developed, might be between elevations 223 feet and 226 feet below sea level, but that for safety the maximum elevation should be considered as 220 feet below sea level. This is about 12 feet higher than the present elevation. Based on these conclusions, in 1928 the Federal Government, by another Executive Order, withdrew from all forms of entry all public lands of the United States in the Salton Sea area lying below this elevation of 220 feet below sea level, adding the withdrawn area to the Public Reserve created in 1924.

In view of all these facts, it may be anticipated that Salton Sea will have a tendency to rise for a number of years. It remains for the future to show whether the elevation of -220 feet set by the USGS may or may not be too conservative. But it can be stated with assurance that there is no danger of the inundation by the Sea at any time of any appreciable amount of good farm land, nor is there any such danger to any of the cities or towns in either Imperial or Coachella Valley.

#### ACQUISITION OF PRIVATE LANDS BY DISTRICT

As a result of the investigation of the United States Geological Survey, and also based on its own studies in the late 20s, the District attempted to acquire the private lands under and around Salton Sea lying below an elevation of 230 feet below sea level. The District realized the possibility of the Sea's reaching a higher elevation in the future, when development of the entire tributary area has been completed, but it was felt at the time that such acquisition was as much as the District could then undertake.

As a result, the District has acquired fee title to, or flooding rights on practically all of the private lands lying below the -230-foot elevation. In connection with its work of establishing this drainage reserve, the District has expended nearly \$350,000 to date.

#### WATER CONSERVATION

The District is justifiably proud of its reputation among water agencies in the Southwest for efficiency of water control, having originated many water conservation measures over the years.

Construction of the All-American Canal and upstream storage dams has made it possible to control water diversions to the Valley more accurately.

Today, the Colorado River is controlled by Glen Canyon Dam, Hoover Dam, Davis Dam and Parker Dam, which is 148 miles upstream and the last storage point above Imperial Dam. Water released at Parker arrives at Imperial Dam in approximately 72 hours.

Since 1957, remote-control operation of the main canal system from a central point in Imperial has been possible through installation of a telemetering system. Constant radio contact is maintained with operating personnel, including a fleet of 30 zanjeros or ditch riders and supervisors who are responsible for water delivery to individual farmers.

A master order for water covering a seven-day period is placed on Wednesday of each week for delivery to start the following Monday. This master order can be changed four days in advance of the actual delivery date, taking into consideration the transit time from Parker to Imperial Dam.

Farmers order their water from the nearest District division office.

The order may be received within a three-day period. To illustrate, an order placed before 11:00 a.m. may be delivered the following day, the second day or, at latest, the third day. In any event, the farmer may check with the division, or be notified between 3:00 and 5:00 p.m. the day prior to delivery. Water runs are made in 24-hour increments.

The major portion of District main and lateral canals are unlined. However, at the present time, lateral canals are being concrete lined at the rate of approximately 70 miles per year on a cooperative basis with the adjacent landowners.

*Gravity-flow 80-mile-long All-American Canal passes through mountains, sand dunes and raw desert en route from the Colorado River to Imperial Valley.*



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SALT BALANCE

The maintenance of a favorable salt balance — that is, removal of at least as much salt through the drainage system as is brought in with irrigation water — assures the continuous production of irrigated land in Imperial Valley. Salton Sea performs an invaluable function as a collecting basin for drainage water.

Just as the elevation of the Sea has fluctuated over the years, so has the salinity. In general, the salinity has gradually increased due to the continuous flow of drainage water into the Sea and evaporation at the rate of about six feet per year. However, records show that salinity of the Sea has been diluted during a time of high surface elevation.

The following table shows the effect of elevation on salinity of the Sea at various times since it was formed:

	Elevation of Sea on June 1	Tons of Salt Per Acre-Foot of Water
1907 .....	-195.00	35
1913 .....	-222.00	43.5
1941 .....	-241.30	49.65
1951 .....	-237.00	48.55
1962 .....	-232.65	47.42
1964 .....	-230.65	47.15
1966 .....	-231.40	50.42

The 1907 figure shows conditions immediately following the closing of the break in the Colorado River when the Sea was at its maximum elevation. By 1913, the Sea had dropped 27 feet in elevation but of course, the same amount of salt remained, plus the additional amount brought in by drainage water, resulting in increased salinity.

By 1941, the Sea had dropped an additional 19.3 feet — with salt content increasing as a result of evaporation and dissolved salts brought in with drainage effluent. However, by 1966, water surface elevation had increased to -231.40, with salinity increasing to 50.42 tons per acre foot.

Many persons have been concerned with the increasing salinity as it affects marine life. Fears have been expressed that the excellent fishing of the Sea might be short-lived as a result of increasing salinity. It may be possible that with the relatively small increase in salinity each year, fish will adjust to the change and survive in the Sea for many years.

At the present time, the salinity of Salton Sea is slightly more than that of ocean water and considerably less than that of other non-sea bodies of water, as shown in the following table:

Name	Tons of Salt per Acre-Foot
Dead Sea .....	303.00
Great Salt Lake .....	266.00
Salton Sea .....	50.42
Ocean Water .....	47.80

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For a number of years, the District has maintained records of salt coming into Imperial Valley through the All-American Canal water supply and from Mexico through the Alamo and New Rivers, and the amount of salt being removed from the Valley to Salton Sea. Until 1949, the amount of salt being removed each year was less than that being brought in. For the year 1948, as an example, approximately 2,758,000 tons of salt were brought into Imperial Valley and only about 2,645,000 tons removed. However, commencing in 1949, there has been a favorable salt balance, as shown by the graph on Page 27.

It is expected that in the years to come, as the drainage system is further extended and its effectiveness increases, the results will show an even more favorable increase in the percentage of gain of the salt removed from the Valley. The question remains, as previously stated, as to how much inflow to Salton Sea in the future will result from the maintenance of salt balance in the irrigated areas of Coachella, Imperial and Mexicali Valleys and the answer will be a factor in the future stabilized elevation of the Sea. But Salton Sea does not now, nor will it in the future constitute a "threat" to either Imperial Valley or Coachella Valley.

### RECREATIONAL DEVELOPMENT

Salton Sea is the largest inland sea in the United States and the largest body of water in Southern California. Because of weather and location, the recreational area is increasingly popular with residents of nearby coastal regions for all forms of water sports, camping and fishing.

More than a million persons annually visit the Sea, with approximately half of this number using the facilities of a 16,000-acre state park. On the eastern shore, the park provides developed spaces for more than 200 tents or trailers. In addition, there is improved beach space extending another two miles south, with another four miles of undeveloped open beach.

The recreation area is served by excellent roads and recreational facilities including modern motels, three yacht clubs with a fourth planned for

*Salton Sea's large expanse of open water is ideal for boating.*

early construction, repair, marinas, and improvement extends almost

Planned communities installed to provide and commercial units in years to come.

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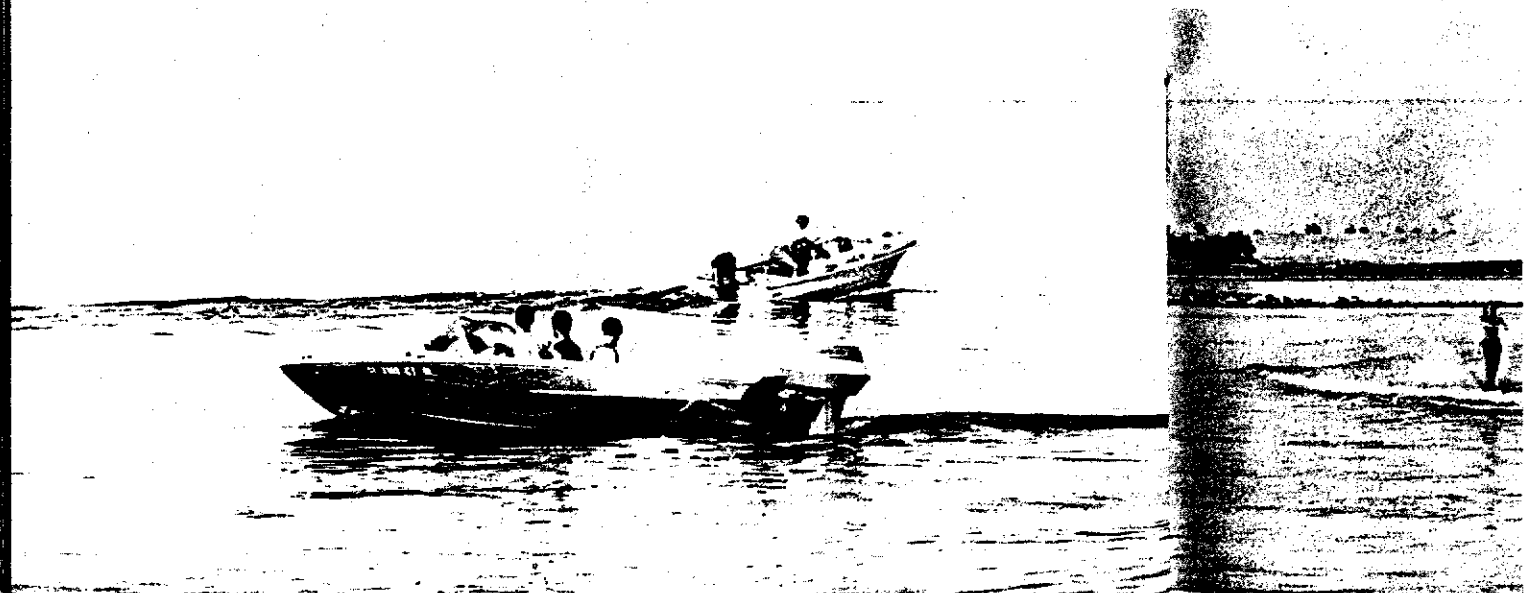
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early construction, many public and private boat-launching ramps and marinas, and improved and wilderness-type campgrounds. The development extends almost around the entire Sea.

Planned communities have been laid out, and streets and services installed to provide for approximately 18,000 residential, multiple-family and commercial units. The development envisions over 30,000 homesites in years to come.

Major development was started in 1959. Improved property around the Sea has approximately 20 to 25 million dollars assessed valuation. At the present time, about 900 to 1,000 homes and multiple-family dwellings have been built. Motel accommodations include about 250 units.

The Salton Sea "500" boat race is the only 500-mile marathon in boating circles and annually attracts powerboat enthusiasts from all over the United States.

The Salton Sea area has modern paved highways. The State of California is acquiring right-of-way to build a 26-mile four-lane expressway along the western shore of the Sea (State Highway 86 which was formerly U.S. 99).

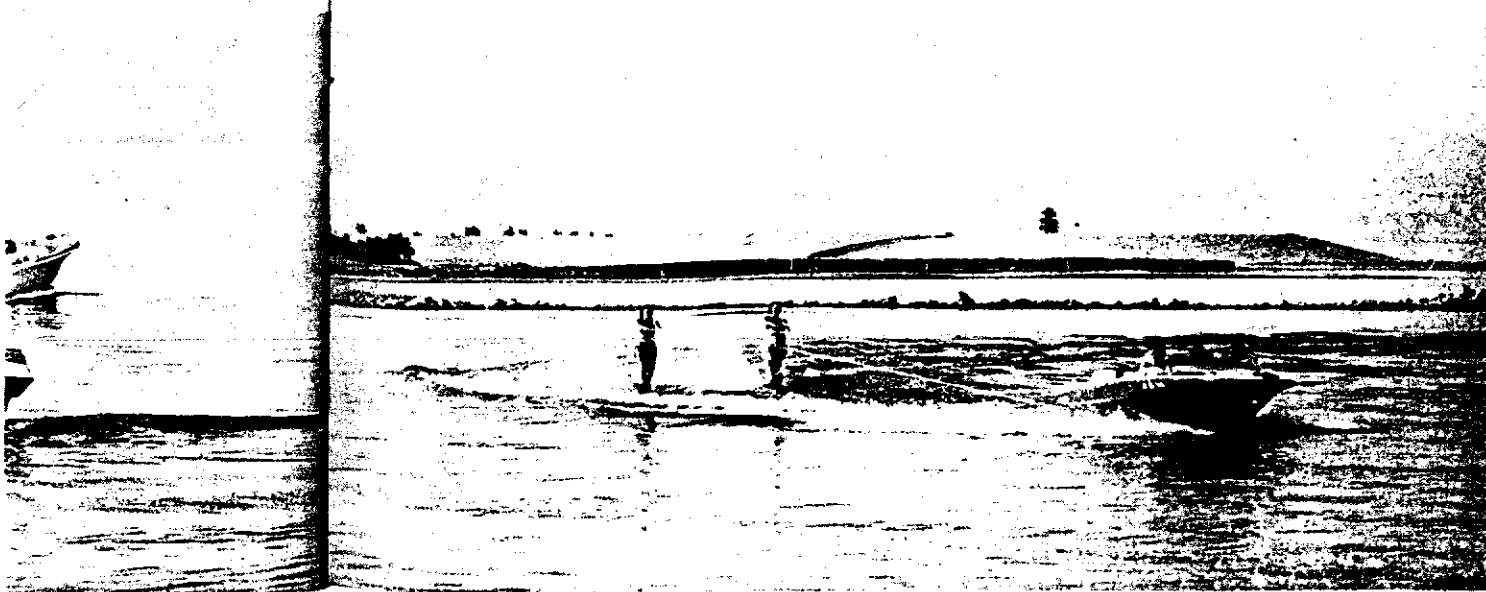
An airport with a 2,500-foot landing strip has been in operation for some time, and additional airport construction is expected in the near future.

#### NATURAL RESOURCES

The area around Salton Sea is rich in minerals. Semi-precious and precious metals have been found commercially in the surrounding mountains. The desert nearby has been a productive prospecting area for "rock-hounds." Deposits of black obsidian and other semi-precious stones have been found near the Sea.

A favorite attraction for many years was the "mud pots" located at the southern end of the Sea, but now under water. The "mud pots" emitted

*Water skiers from all over Southern California are attracted to the Sea's warm water and sloping beaches.*



pure carbon dioxide which was used as a source of commercial dry ice during World War II.

Hot mineral springs are located approximately 12 miles north of the town of Niland. The area surrounding the mineral springs has been leased from the Federal Government by Imperial County and subleased for private development.

### GEOHERMAL EXPLORATION

Engineers and geologists have long recognized that surface signs on the southern shores of Salton Sea indicate the existence of natural steam, which could prove to be a new source of energy for electric generation and of commercial chemicals.

Successful steam wells have been drilled in other areas of the world where the magma — or molten mass — which is ordinarily deep within the earth, is close to the surface. Where this occurs, steam formed from water in the magma is emitted through underground fissures. Even more steam is formed by surface waters that circulate deeply and come in contact with the heated rock.

To prove or disprove these theories, Imperial Irrigation District leased several thousand acres of land to the firm of J. I. O'Neill, Jr., John B. Ashmun, and H. T. Hilliard of Midland, Texas, to drill exploratory wells in the area.

Producing geothermal wells have been drilled and tested in accordance with the terms of this lease. Also, other developers not associated with the District have drilled in the area with success.

Under the terms of the lease with the joint venture group, the District has first right to buy either electric generation or steam developed anywhere in Imperial County by the group. In addition, the District will re-

*Experimental power generation from geothermal steam.*

ceive royalties from gaseous or solid form.

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Morton International Products, Inc., has a and Associates and in of 1965. In addition, tion from the brine by ponds.

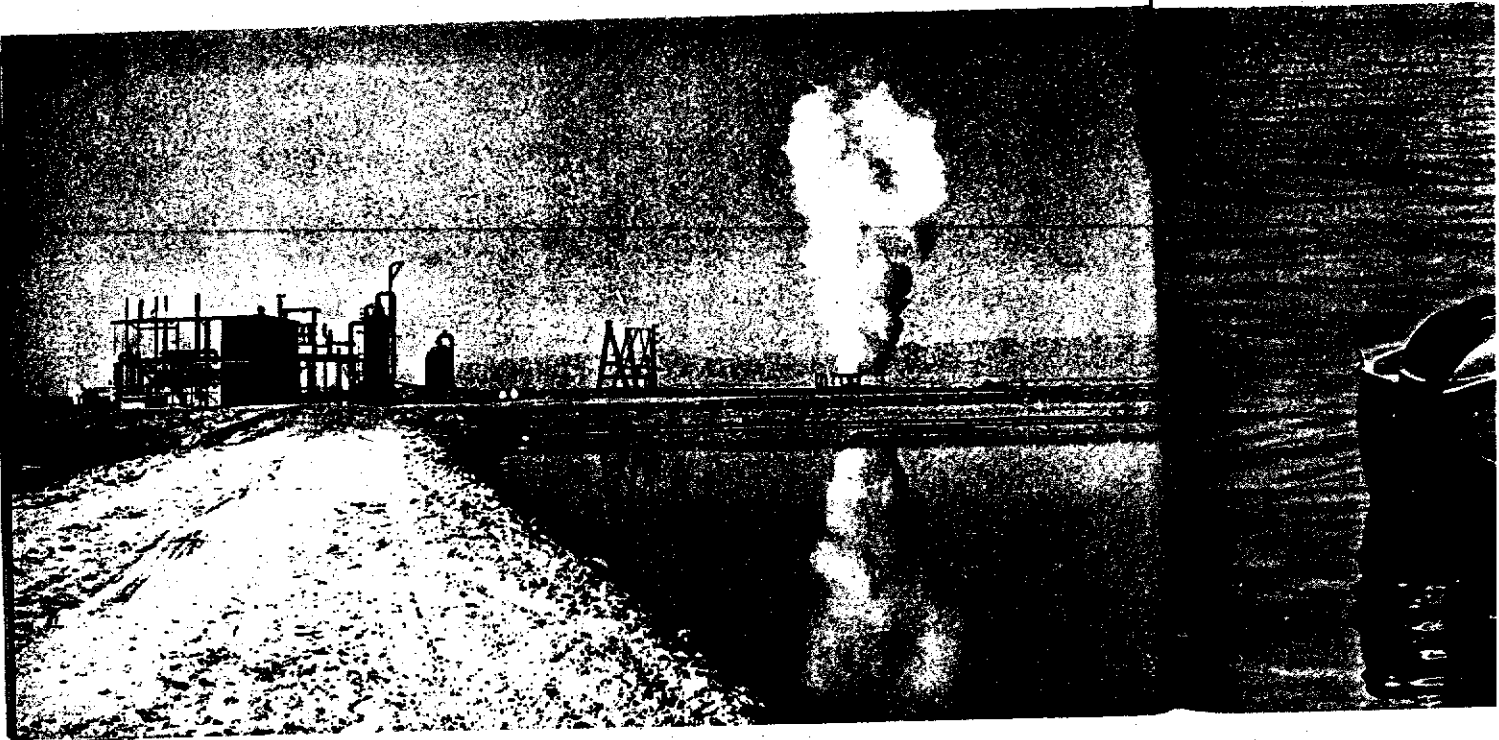
Union (Pure) C Company, is the other

At the present time must continue to be drilled, and pilot plant will be built by private

It is possible that industries, as has been

Much of the late Munson J. Irrigation District the geology, ge Colorado River.

*Salt-water fishing Southern California*





ceive royalties from sale of minerals or chemicals, whether in liquid, gaseous or solid form, found on IID-leased property.

A great amount of technical information has been developed and is a matter of record. However, since the District's lease specifically stipulates that no geological or engineering data shall be disclosed without written permission from O'Neill, Ashmun, Hilliard and Associates, requests for more specific information should be addressed to them.

Morton International, Inc., through a subsidiary, Imperial Thermal Products, Inc., has assumed the operating interest of J. I. O'Neill, Jr., and Associates and installed a small test generator at the site in the spring of 1965. In addition, Morton's is making arrangements for chemical extraction from the brine by construction of large solar evaporation and leaching ponds.

Union (Pure) Oil Company, in joint venture with Magma Power Company, is the other major developer of geothermal energy in this area.

At the present time, the commercial adaptations of this natural resource must continue to be tested. It is expected that additional wells will be drilled, and pilot plants, both for power generation and chemical recovery, will be built by private interests.

It is possible that geothermal energy could form the basis for new industries, as has been the case in other areas of the world.

Much of the foregoing material was based on a talk by the late Munson J. "Mike" Dowd, Consulting Engineer for Imperial Irrigation District for many years, and a recognized authority on the geology, geography and history of Imperial Valley and the Colorado River.

*Salt-water fishing in Salton Sea is comparable with that of any other area in Southern California.*

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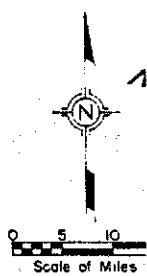
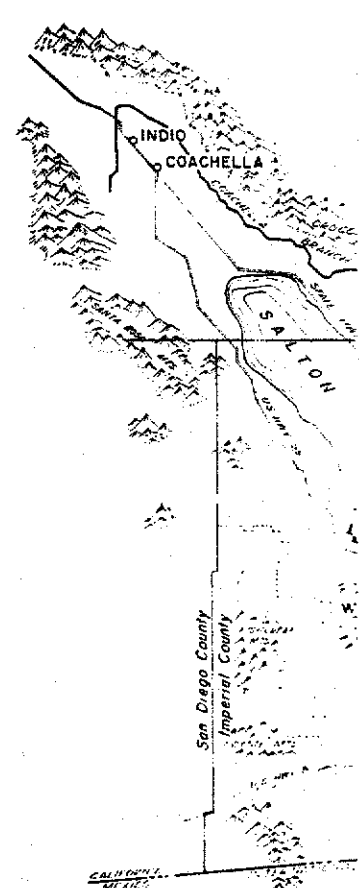
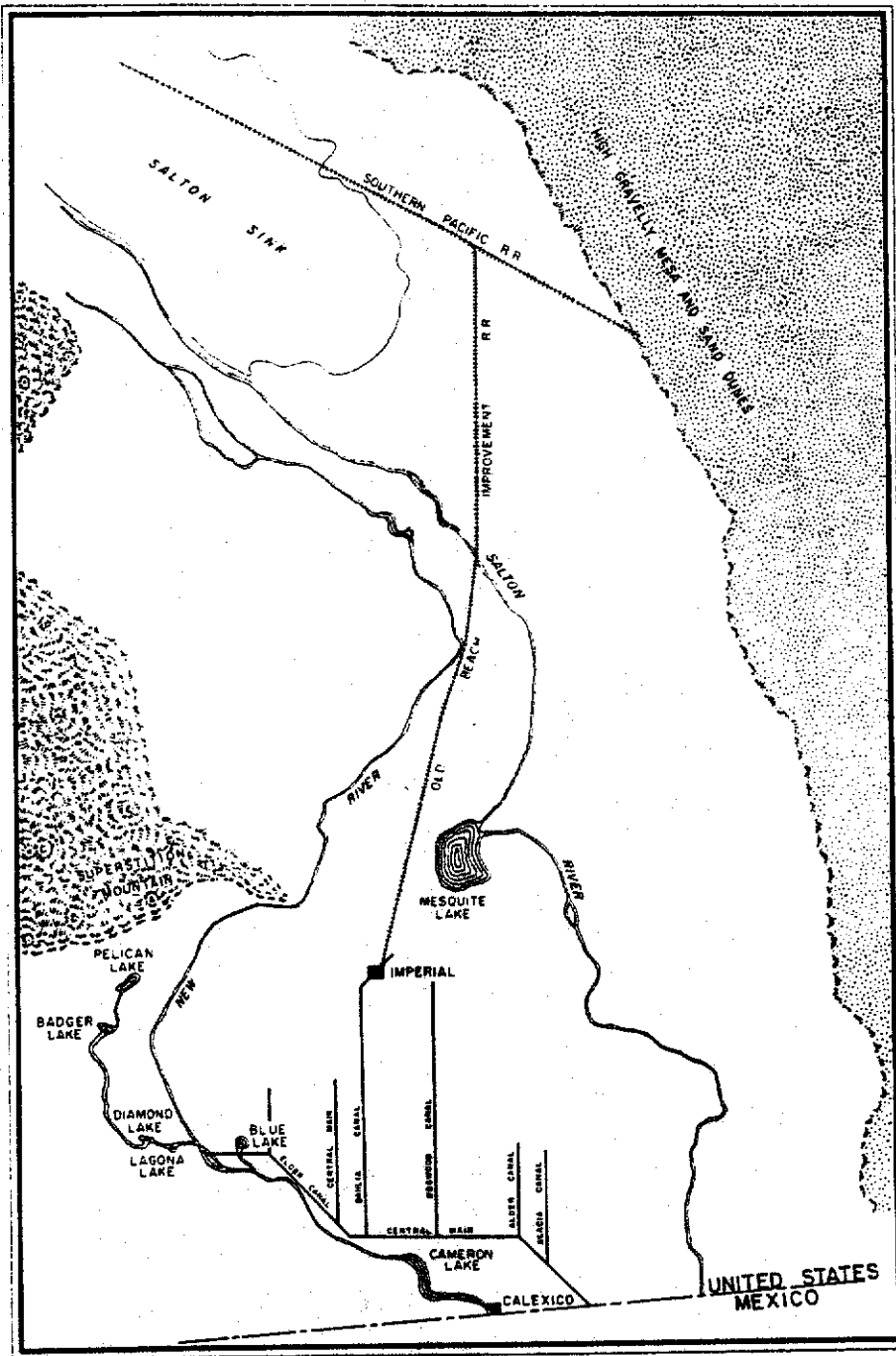
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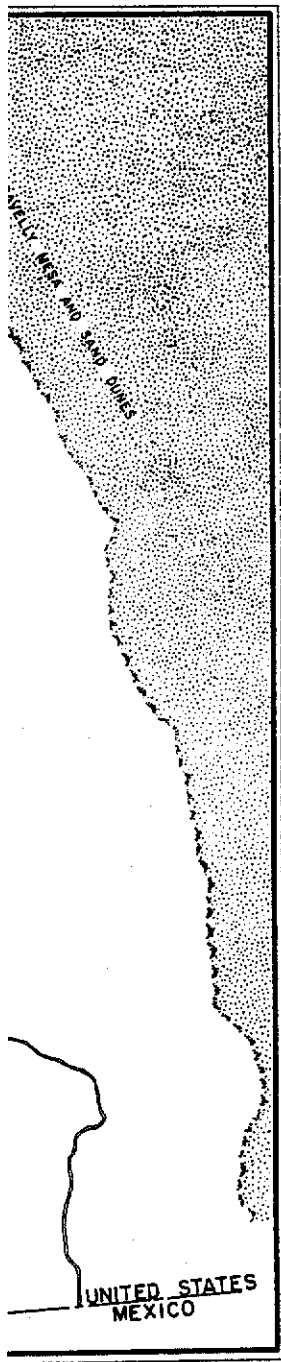
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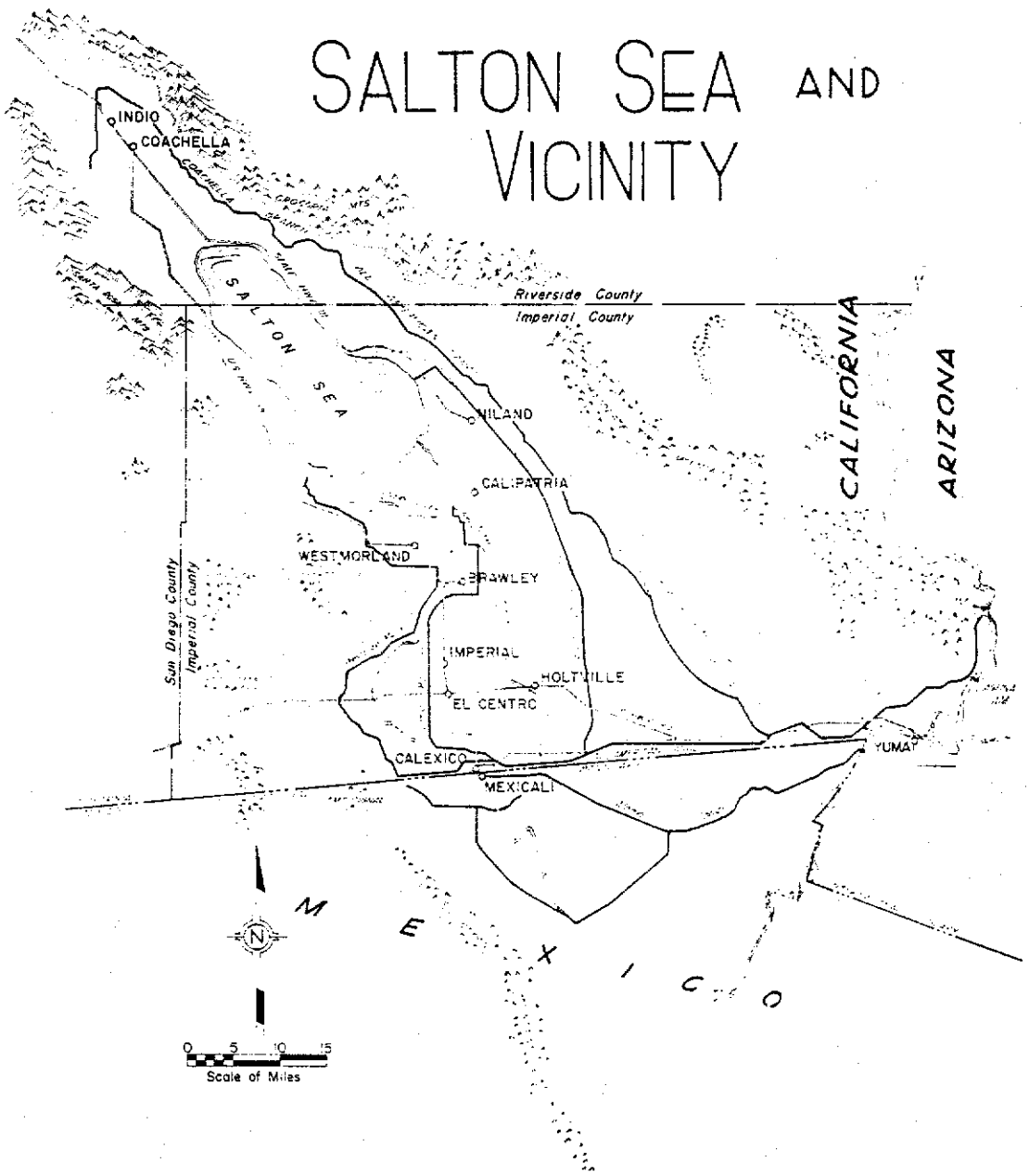
# HISTORICAL MAP OF IMPERIAL VALLEY



# IAL VALLEY



# SALTON SEA AND VICINITY





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