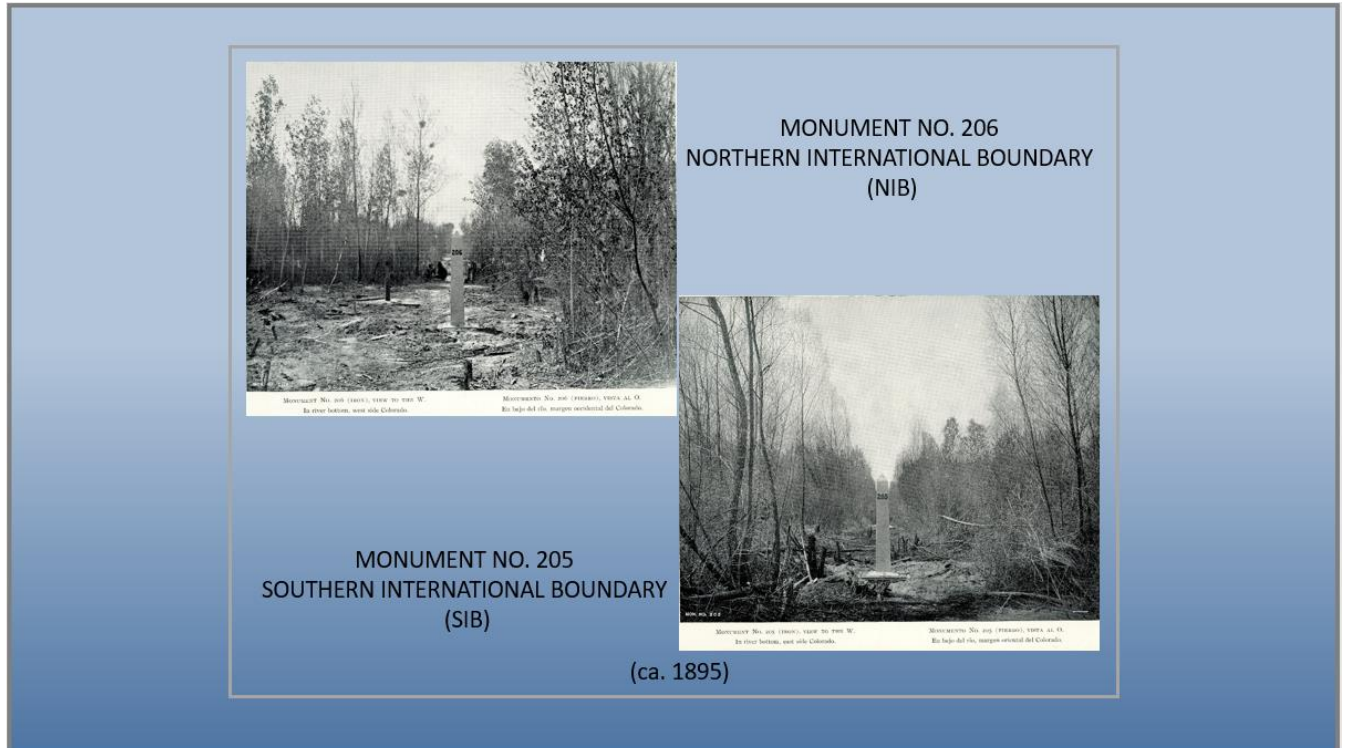


**COLORADO RIVER SALINITY OPERATIONS UNDER  
INTERNATIONAL BOUNDARY AND WATER COMMISSION  
MINUTE 242**

**JANUARY 1, 2014 to DECEMBER 31, 2019**



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United States Commissioner  
International Boundary and Water Commission  
United States Section  
April 24, 2023**



## INTRODUCTION

This report is created to present annual salinity levels in the lower Colorado River as it is being delivered to Mexico. In 1973, the Colorado River basin states formed the Colorado River Basin Salinity Control Forum to address the issue of salinity and to develop standards and a plan to implement salinity control to be approved by the Environmental Protection Agency (EPA).

In accordance with the 1944 Treaty between the United States of America and Mexico, *Utilization of Waters of the Colorado and Tijuana Rivers and of the Rio Grande*, the United States is obligated to deliver 1,500,000 acre-feet (af) of Colorado River water to Mexico annually. On August 30, 1973, the International Boundary and Water Commission (IBWC), United States and Mexico, approved Minute No. 242, *Permanent and Definitive Solution to the International Problem of the Salinity of the Colorado River*, to implement measures to address salinity for waters delivered to Mexico at the Northernly International Boundary (NIB), groundwater pumping in the vicinity of San Luis, and the diversion of discharges of saline water into the Wellton-Mohawk drain that helped create the Santa Clara Wetland.

In 1972, the Governors of the seven basin states of the Colorado River formed the Colorado River Basin Salinity Control Forum (Forum) to recommend and provide oversight on political support and funding to ensure maintenance of water quality in the Colorado River Basin. In 1974, the Forum, in coordination with the State Department and the Department of Interior worked with Congress to enact the Colorado River Basin Salinity Control Act (Act) authorizing the construction, operation and maintenance of salinity control works in the Colorado River Basin. Title I of the Act addresses the United States salinity commitments to Mexico. Title II of the Act created the Colorado River Basin Salinity Control Program (Program) which focuses on improving the water quality of the Colorado River to U.S. users above Imperial Dam. The Forum's purview and objectives are solely related to the Title II provisions of the Act. Operations under Minute 242 first began on June 25, 1974, immediately following approval of the Act, Public Law 93-320 that was signed one day earlier, on June 24, 1974. Implementation of the Program has led to the reduction of the annual salt load of the Colorado River by more than 1.2 million tons. On November 20, 2012, IBWC signed Minute No. 319, Interim International Cooperative Measures in the Colorado River Basin through 2017 and Extension of Minute 318 Cooperative Measures to Address the Continued Effects of the April 2010 Earthquake in the Mexicali Valley, Baja California. This Minute provided for the development of infrastructure improvements and environmental enhancements and included provisions on salinity and other aspects.

This document may be viewed at: [https://ibwc.gov/Files/Minutes/Minute\\_319.pdf](https://ibwc.gov/Files/Minutes/Minute_319.pdf)

On September 21, 2017, IBWC signed Minute No. 323 titled *Extension of Cooperative Measures and Adoption of a Binational Water Scarcity Contingency Plan in the Colorado River Basin*, extending the goals of Minute 319 to Minute 323 through 2026.

This document may be viewed at: <https://ibwc.gov/Files/Minutes/Min323.pdf>

Note: Due to a change in water deliveries because of an experimental environmental flow release under Minute No. 319, Mexico has requested a modification to the 2014 salinity calculation that

will take into consideration the alternative to traditional deliveries and which is pending finalization (for 2014 only).

With the signing of Minute 323 and Intentionally Created Mexican Allocation provisions, delivery and salinity calculations have been modified to take into account water delivery deferrals from Mexico, creating “Mexico’s Water Reserve”. Please see below for more details or refer to the Minutes described above.

**Cover: Photos of Monuments 205 and 206 are from USIBWC Library, Report Upon Survey and Re-Marking, 1891-1896 Album (Circa 1890s)**

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### Acronyms and Short Titles

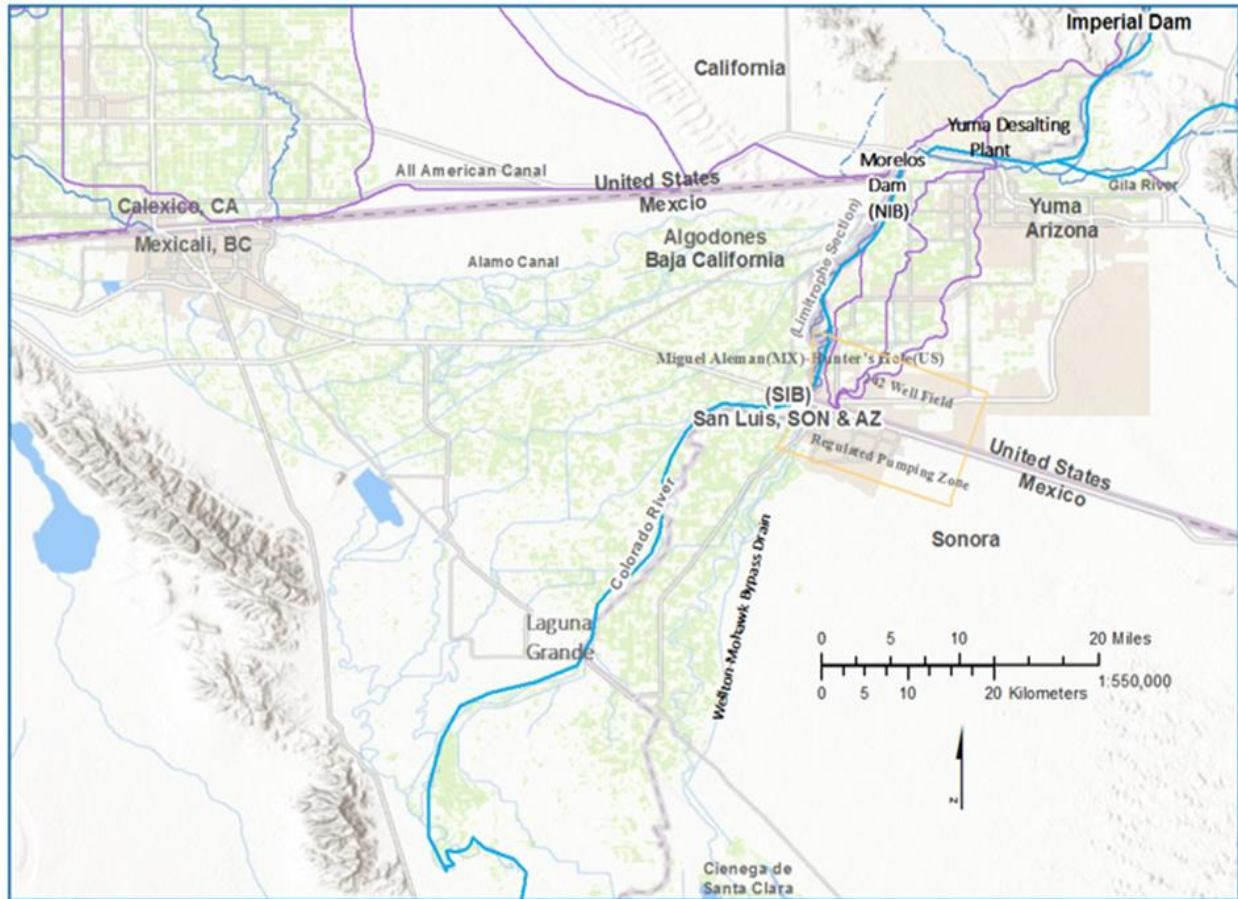
<b>af</b> - acre-feet	<b>IBWC</b> – International Boundary and Water Commission, US and Mexican Sections
<b>ppm</b> - Parts per million	<b>USIBWC</b> - United States Section of the IBWC
<b>tcm</b> - thousand cubic meters	<b>MxIBWC</b> - Mexican Section of the IBWC
<b>NIB</b> - Northerly International Boundary	<b>Reclamation</b> -U.S. Bureau of Reclamation
<b>SIB</b> - Southerly International Boundary	<b>USGS</b> - US Geological Survey
<b>ICMA</b> -Intentionally Created Mexican Allocation	

## COLORADO RIVER SALINITY OPERATIONS,

JANUARY 1 THROUGH DECEMBER 31, FOR THE YEARS OF 2014-2019,  
UNDER IBWC MINUTE NO. 242

Resolution 1.a) of IBWC Minute No. 242 provides that:

*“The United States shall adopt measures to assure that the approximately 1,360,000 acre-feet (1,677,545,000 cubic meters) delivered to Mexico upstream of Morelos Dam, have an annual average salinity of no more than 115 p.p.m.  $\pm$  30 p.p.m. U.S. count (121 p.p.m.  $\pm$  30 p.p.m. Mexican count) over the annual average salinity of Colorado River waters which arrive at Imperial Dam...”*



**Figure 1: Reference Map of Lower Colorado River Area**

This report presents the results of the operations from January 1, 2014 through December 31, 2019, under Minute No. 242. This report is based on United States Section of the IBWC (USIBWC) records on water flows and salinity levels determined jointly by the United States and Mexican Sections of the IBWC, as well as flow-monitoring data from the United States Geological Survey and volume and chemical investigations data from the U.S. Bureau of Reclamation (Reclamation). Figure 1 shows the locations referred to in this report. **The 2015-2018 records show that the United States (U.S.) operations of the lower Colorado River resulted in compliance (129 ppm, within range of 115 +/- 30) with Minute No. 242. The differential for 2019, U.S. count, was not met.**

## WATER DELIVERIES AND SALINITY DIFFERENTIAL

### IBWC MINUTE NO. 242 and WATER DELIVERIES

*“The United States shall adopt measures to assure that the approximately 1,360,000 acre-feet (1,677,545,000 cubic meters) delivered to Mexico upstream of Morelos Dam...” (Minute No. 242)*

Table 1- summary of the scheduled deliveries and actual deliveries made to Mexico and where those deliveries were made from January 2014 through December 2019.

Delivery Site	Year	Scheduled Deliveries <sup>1</sup>		Actual Deliveries Made	
		(tcm)	(af)	(tcm/af)	(af)
NIB (“at the riverbed above Morelos Dam”) <sup>2</sup>	2014	1,609,147	1,304,550	1,792,546	1,453,232
	2015	1,678,234	1,360,559	1,683,593	1,364,903
	2016	1,678,234	1,360,559	1,684,692	1,365,794
	2017	1,678,234	1,360,559	1,706,432	1,383,419
	2018	1,678,234	1,360,559	1,691,167	1,371,043
	2019	1,678,234	1,360,559	1,708,679	1,385,241
SIB (“across the land boundary near San Luis, Arizona,” includes the water flows through the limitrophe of the river below Morelos Dam) <sup>3</sup>	2014	172,000	139,442	157,858	127,977
	2015		0	184,931	149,925
	2016		0	176,927	143,436
	2017	172,689	140,000	164,390	133,272
	2018		0	159,983	129,700
	2019		0	144,931	117,497
Downward Delivery Adjustment (Minute 319 & 323)	2014	69,087	56,009	69,087	56,009
	2015	0	0	0	0
	2016	0	0	0	0
	2017	0	0	0	0
	2018	8,231	6,673	8,231	6,673
	2019	45,563	36,938	45,563	36,938
Total as stipulated in Article 10(a) of the 1944 Water Treaty	2014			1,889,890	1,532,150
	2015			1,868,524	1,514,828
	2016	1,850,234	1,500,000	1,861,619	1,509,230
	2017			1,870,822	1,516,691
	2018			1,851,150	1,500,743
	2019			1,853,610	1,502,737
Other water delivered [arriving] to Mexico in the Limitrophe Section <sup>4</sup>	2014			39,657	32,150
	2015			18,290	14,828
	2016			11,385	9,230
	2017			20,587	16,690
	2018			9,147	7,416
	2019			48,940	39,676

<sup>1</sup>Source: Mexico schedule

<sup>2</sup>Source: Northerly International Boundary tcm + Cooper Wasteway tcm + Tijuana tcm + ICMA created + diversions into the Wellton Mohawk Drain – ICMA Delivered

<sup>3</sup>Sources: Southerly Land Boundary Combined Flow (East Main Canal Wasteway, West Main Canal Wasteway, Main Drain, 242-Lateral) + 11-Mile Wasteway + 21-Mile Wasteway – Diversion Channel (Diversion Channel is subtracted only for the months of Jan., Oct., Nov., and Dec. under Minute 319 and changed to Sept-Dec under Minute 323, when flows are diverted into the Wellton-Mohawk Bypass Drain)

<sup>4</sup>Source: USIBWC Yuma Field Office calculations. Other water arriving in the limitrophe of the Colorado River are not deliveries scheduled by Mexico.

The volume of Colorado River water arriving at Imperial Dam during the years of 2014-2019 are shown in the table below.

**Table 2.** Volume of Colorado River water arriving at Imperial Dam

<b>Flows Arriving at above Imperial Dam</b>		
<b>Year</b>	<b>tcm</b>	<b>af</b>
2014	6,750,138	5,472,394
2015	6,614,292	5,362,262
2016	6,677,294	5,413,339
2017	6,583,525	5,337,319
2018*	6,527,465	5,291,871
2019*	6,388,745	5,179,409

\*Indicates adjustments were made because of the U.S. Government Furlough. For salinity purposes, the flows to Imperial Dam and NIB were not included in the salinity calculations because water samples were not taken during the (Dec-Jan 2018-19) furlough for analysis. Missing IBWC data for these (furlough) days was provided for by U.S. Bureau of Reclamation.

Note: Imperial Dam serves users in the counties of Yuma, Imperial and the country of Mexico. The quantities requested by Mexico to be delivered during the years of 2014-2019 were in accordance with Article 10 of the 1944 Water Treaty. The quantities requested are delivered at the riverbed above Morelos Diversion Dam, also referred to as the Northerly International Boundary (NIB), and across the southern land boundary near San Luis, Arizona, also referred to as the Southerly International Boundary (SIB). Deliveries across the SIB include the water diversions made into the limitrophe of the river below Morelos Dam.

**EMERGENCY DELIVERIES TO TIJUANA**

Under IBWC Minute No. 240 and subsequent Minutes, emergency deliveries are made to Tijuana, B.C., during periods of shortages. Water from Parker Dam is provided through the All-American Canal to Otay Mesa in San Diego, California. These deliveries are calculated into the total deliveries made at NIB and are governed by IBWC Minutes No. 314 and then beginning in January 2017, Minute No. 322.

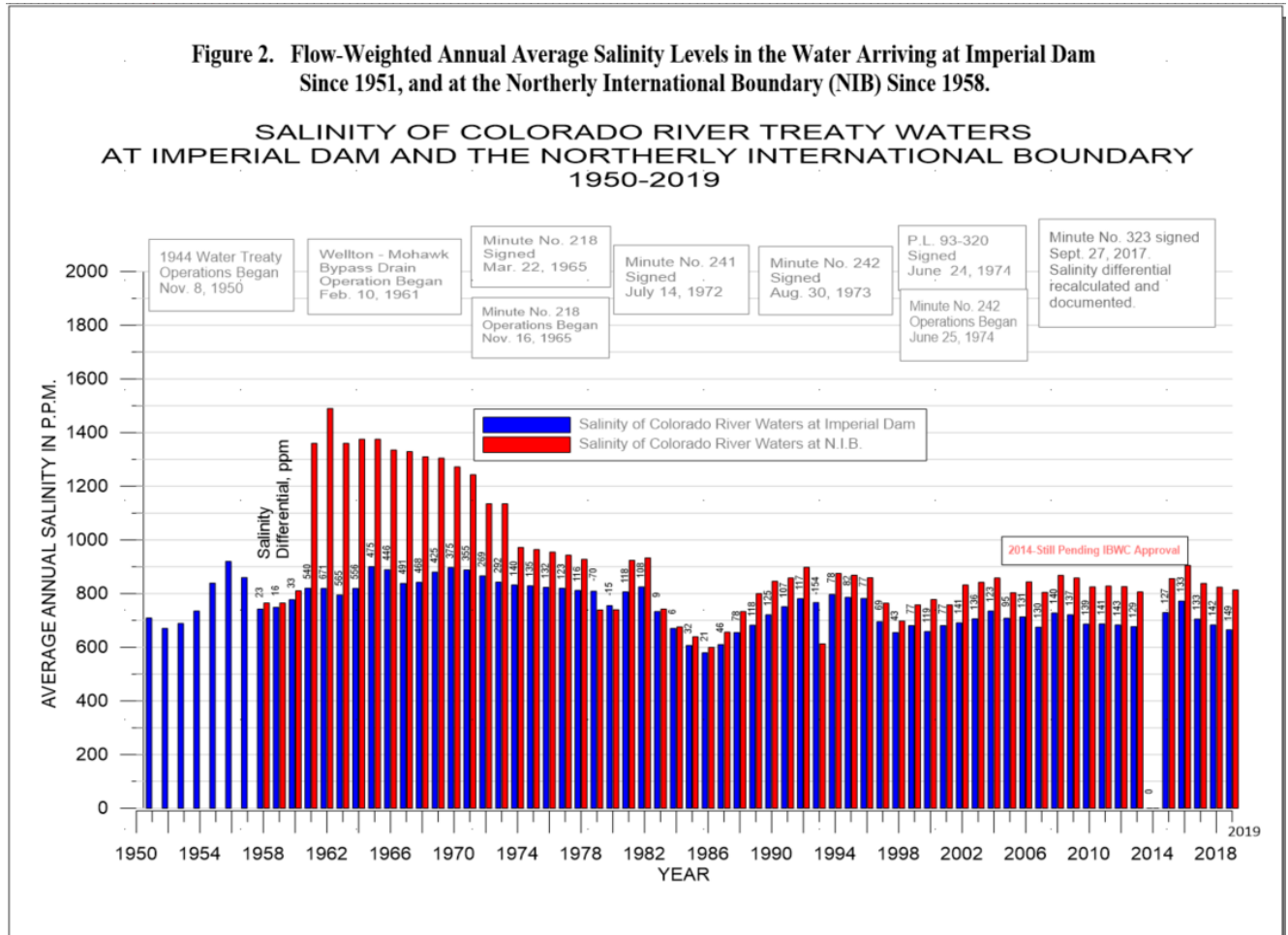
- **No deliveries of Colorado River water were made to Mexico at Tijuana, Baja California, in years 2014-2017.**

<b>Quantities of Emergency Volumes to Tijuana</b>		
<b>Year</b>	<b>tcm</b>	<b>af</b>
2014	0	0
2015	0	0
2016	0	0
2017	0	0
2018	390	316
2019	870	705

**Table 3.** Deliveries of emergency volumes to Tijuana

## **IBWC MINUTE NO. 242 SALINITY LEVELS and SALINTY DIFFERENTIALS**

*"The United States shall adopt measures to assure ... annual average salinity of no more than 115 p.p.m.  $\pm$  30 p.p.m. U.S. count (121 p.p.m.  $\pm$  30 p.p.m. Mexican count) over the annual average salinity of Colorado River waters which arrive at Imperial Dam..." (Minute No. 242)*



**Figure 2.** This graphs the annual average salinity levels in the water arriving [delivered] at Imperial Dam since 1951 (the first full year of deliveries to Mexico under the 1944 Water Treaty) and at NIB since 1958. The salinity differential is indicated by the number above the blue column. A full-page image of this graph is available in Appendix A.

- Both U.S. and Mexican values are between acceptable ranges as agreed in Minute No. 242 for 2015-2018.
- The U.S. count for the salinity value exceeds Minute 242 guidelines for 2019.
- Due to Minute No. 319 experimental (pulse) flows, binational data for 2014 has not yet been made official and are still considered provisional.



**Table 4.** U.S. compared with Mexico’s Colorado River Salinity Levels and Differentials (Minute 242, Resolution 1.a) 115 ppm ± 30 ppm U.S. count, 121 ppm ± 30 ppm Mexican count)

<b>Waters</b>	<b>Year</b>	<b>U.S. count (ppm)</b>	<b>Mexican count (ppm)</b>
<b>Arriving Upstream of Morelos Diversion Dam at NIB</b>	<b>2014*</b>	<b>822</b>	<b>897*</b>
	<b>2015</b>	<b>856</b>	<b>927</b>
	<b>2016</b>	<b>844</b>	<b>920</b>
	<b>2017</b>	<b>838</b>	<b>894</b>
	<b>2018</b>	<b>824</b>	<b>896</b>
	<b>2019</b>	<b>814</b>	<b>891</b>
<b>Arriving at Imperial Dam</b>	<b>2014*</b>	<b>693</b>	<b>759*</b>
	<b>2015</b>	<b>729</b>	<b>791</b>
	<b>2016</b>	<b>716</b>	<b>784</b>
	<b>2017</b>	<b>705</b>	<b>751</b>
	<b>2018</b>	<b>683</b>	<b>748</b>
	<b>2019</b>	<b>665</b>	<b>752</b>
<b>Salinity Differential</b>	<b>2014*</b>	<b>129</b>	<b>138*</b>
	<b>2015</b>	<b>127</b>	<b>136</b>
	<b>2016</b>	<b>128</b>	<b>136</b>
	<b>2017</b>	<b>133</b>	<b>143</b>
	<b>2018</b>	<b>142</b>	<b>148</b>
	<b>2019</b>	<b>149</b>	<b>140</b>

\*Due to Minute No. 319 experimental (pulse) flows, binational data for 2014 has not yet been made official and are still considered provisional.

Table 5 below provides the annual average flow-weighted salinity levels and salinity differentials of the water resulting from operations under IBWC Minute No. 242 for the last ten years. It was first implemented in June 1974. To view the complete record, see Appendix A.

**Table 5. U.S. Annual Average Flow-Weighted Salinity Levels**

A complete record is available in Appendix A

<b>Year</b>	<b>Annual Average Salinity (U.S. Count) as TDS (ppm)</b>		<b>Differential (U.S. Count) (ppm)</b>
	<b>At Imperial Dam</b>	<b>Upstream of Morelos Dam</b>	
2014*	693	822	129
2015	729	856	127
2016	772	905	133
2017	705	838	133
2018	683	824	142
2019	665	814	149

\*Due to Minute No. 319 experimental (pulse) flows, binational data for 2014 has not yet been recognized as official and are still considered provisional.

USIBWC collects samples at NIB, tests and distributes samples to MxIBWC and Reclamation. USIBWC sends samples twice a month to Reclamation to conduct a complete chemical analysis. From the complete analysis, a factor is produced that is used to convert the electrical conductivity

(EC) to the corresponding salinity value as Total Dissolved Solids (TDS) in milligrams per liter (MG/L). IBWC and Reclamation results must not differ by more than 30 micro-Siemens/deciliter, otherwise resampling is required.

Reclamation collects samples at Imperial Dam and distributes samples to MxIBWC and USIBWC. Samples are tested and results are compared. Reclamation staff at Imperial Dam produce a salinity factor twice a month for this location. The NIB and Cooper flows come from USIBWC measurements and records, and the Imperial Dam flows come from USGS.

The calculation for the annual average salinity of the Colorado River waters delivered to Mexico under Minute 323 is by the calculation below. Differences between the U.S. and Mexico are due to laboratory methods.

Sum of the volumes upstream of Morelos Dam\*salinity used for the salinity calculation=  
 Volume delivered to NIB\* salinity at NIB  
 +Volume of ICMA Created\*salinity at Imperial Dam  
 -Volume of ICMA Delivered\*salinity at Imperial Dam  
 +Volume at Cooper Lateral\*salinity of Imperial Dam  
 +Volume Delivered to Tijuana\*salinity at Imperial Dam  
 + Volume diverted into the Wellton-Mohawk Drain \* salinity at the point of delivery into the Wellton-Mohawk Drain.

### **DELIVERIES AT THE SOUTHERLY INTERNATIONAL BOUNDARY (SIB)**

Resolution 1.b) of Minute No. 242 provides that:

*“The United States will continue to deliver to Mexico on the land boundary at San Luis and in the limitrophe section of the Colorado River downstream from Morelos Dam approximately 140,000 acre-feet (172,689,000 cubic meters) annually with a salinity substantially the same as that of the waters customarily delivered there.”*

The annual volumes of water delivered to Mexico on the land boundary at San Luis through the Sanchez Mejorada Canal and in the limitrophe section of the river below Morelos Dam under Minute No. 242 began on June 25, 1974. Results for 2014-2019 for this report are shown below. To view the complete record, see Appendix A. These volumes exclude the Wellton-Mohawk drainage water that was bypassed in accordance with Minute No. 242 delivery volumes on the land boundary at San Luis and in the limitrophe section made in 2014-2019 and was less than the annual volume of 172,689 tcm (140,000 af) referred to in IBWC Minute No. 242. The quantity of water to make up the difference was delivered in the bed of the Colorado River above Morelos Dam, as stipulated in Resolution 1.c) of IBWC Minute No. 242, which states: *“Any decrease in deliveries under point 1(b) will be made up by an equal increase in deliveries under point 1(a)”* (Point 1(a) is referenced above).

**Table 6.** Annual Volume of Water Schedule delivered to Mexico at the SIB

Year	Annual Volume Delivered	
	(tcm)	(af)
2014	162,940	132,097
2015	184,931	149,925
2016	176,927	143,436
2017	164,390	133,272

2018	159,983	129,700
2019	144,931	117,497

**Table 7.** Annual Average Flow-Weighted Salinities of the water delivered to Mexico at SIB

Year	Annual Average Flow-Weighted Salinity (U.S. Count)
2014	1059
2015	1,146
2016	1,070
2017	1,136
2018	1,069
2019	1,029

**Deliveries for NIB and SIB are calculated as follows:**

- **Actual deliveries at NIB (Minute No. 319)** =Northerly International Boundary tcm + Cooper Wasteway tcm + Tijuana tcm
- **Actual deliveries at NIB (Minute No. 323)** =NIB tcm + ICMA Created tcm – ICMA Delivered + Cooper Lateral tcm+ Tijuana tcm + Diversions into the Wellton-Mohawk Drain
- **Actual deliveries at SIB**=Southerly Land Boundary Combined Flow (East Main Canal Wasteway, West Main Canal Wasteway, Main Drain, 242 Lateral) + 11-Mile Wasteway + 21-Mile Wasteway – Diversion Channel

(Diversion Channel is subtracted only for the months of Jan., Oct., Nov., and Dec. for Minute No. 319 and Sep.-Dec. for Minute No. 323, when flows are diverted into the Wellton-Mohawk Bypass)

**Quantities of United States Bypass Drain Water**

The Yuma Desalting Plant, which is located four miles west of Yuma, was built to reduce the salinity of pumped drainage water from the Wellton-Mohawk Irrigation and Drainage District before the water is returned to the Colorado River. Pending completion and operation of desalting projects, the U.S. adopted an interim measure to achieve the agreed-upon salinity differential. This measure consisted of discharging all Wellton-Mohawk pumped drainage water into the United States Bypass Drain, which conveys these waters to the Santa Clara Slough (now commonly referred to as the Ciénega de Santa Clara), the largest wetland in the Colorado River Delta. These volumes also include diversions by the MODE 3, below Morelos Dam, into the Limitrophe. A description of the Ciénega de Santa Clara is provided below.

Also described below is a description of the MODE improvement project that diverted flows below Morelos Dam and into the Limitrophe while halting flows to the Bypass Drain Extension and to the Ciénega for approximately four months. This project and the reduction of flows to the Ciénega was monitored by a binational team of scientists to determine the impacts. The final report is pending.

**Table 8. United States Bypass Drain Water delivered at Southerly International Boundary (SIB)**

<b>(Extension from the Bypass Drain to the Santa Clara Slough was not complete until 1977)</b>		
Year	Annual Volume Discharged	
	(tcm)	(af)
2014	178,364	144,602
2015	187,478	151,991
2016	185,260	150,191
2017	156,285	126,701

2018	151,188	122,569
2019	176,397	143,007

### GROUNDWATER – MINUTE NO. 242 WELL FIELD

Point 5 of Minute No. 242 provides that:

*“Pending the conclusion by the Governments of the United States and Mexico of a comprehensive agreement on groundwater in the border areas, each country shall limit pumping of groundwaters in its territory within five miles (eight kilometers) of the Arizona-Sonora boundary near San Luis to 160,000 acre-feet (197,358,000 cubic meters) annually.”*

Table 9 2014-2019 annual quantities pumped by Mexico from its San Luis Mesa field located within five miles (eight kilometers) of the Arizona-Sonora boundary near San Luis. To view the complete record, see Appendix A.

**Table 9: Annual Volume Pumped by Mexico**

Year	Annual Volume Pumped	
	(tcm)	(af)
2014	182,493	147,949
2015	190,666	154,575
2016	196,816	159,560
2017	180,900	146,657
2018	166,860	135,275
2019	128,719	104,354

Part of Reclamation’s Protective and Regulatory Pumping Unit, the 242 Well Field, consists of 21 groundwater wells within a five-mile strip adjacent to the international boundary near San Luis, AZ.

Table 10 below provides the annual quantities pumped by the U.S. from the Minute 242 Well Field and the total water pumped within five miles of the boundary near San Luis from 2014 through 2019 (limited to 160,000 acre-feet [197,358,000 cubic meters] for each country pursuant to Minute 242). Water from these wells is then delivered to Mexico at the SIB in partial satisfaction of the 1944 Water Treaty as substitution for Main Drain water diverted to the United States Bypass Drain. In 2014-2019, all 21 wells were pumped. To view the complete record, see Appendix A.

**Table 10: Total volume pumped by the United States**

Year	Total Volume Pumped		242 Well Field Volume Pumped	
	(tcm)	(af)	(tcm)	(af)
2014	51,707	41,920	37,053	30,039
2015	69,675	56,486	49,640	40,244
2016	53,119	43,064	42,962	34,830
2017	40,224	32,610	32,089	26,015
2018	58,078	47,085	49,194	39,882
2019	46,243	37,490	37,058	30,043

## **ACTIVITIES IN THE LIMITROPHE AND DELTA REGION OF THE LOWER COLORADO RIVER**

**Minute 319** On November 20, 2012, IBWC signed Minute No. 319, *Interim International Cooperative Measures in the Colorado River Basin through 2017 and Extension of Minute 318 Cooperative Measures to Address the Continued Effects of the April 2010 Earthquake in the Mexicali Valley, Baja California*. This Minute provided for the development of infrastructure improvements and environmental enhancements and included provisions on salinity and other studies to increase efficiency in the region.

Minute 319 allowed Mexico to defer water deliveries through adjustments to its annual schedule. Water deliveries could be deferred either through a program of Intentionally Creation Mexican Allocation (ICMA) or through the cooperative measures established under Minute 318 to address the continued effects of the April 2018 earthquake in the Mexicali Valley, Baja California. Water for the ICMA program would come from conservation projects or new water sources which would be subsequently available under terms that are consistent with drought preventative measures but has yet to be implemented.

Replacing and extending the measures from Minute 319, Minute 323 allows Mexico to continue to defer water deliveries for storage in one of three categories. These deferred volumes are stored as Emergency Storage, Revolving Account, or ICMA. Collectively these are referred to as Mexico's Water Reserve and include waters deferred under Minutes 318 and 319. A description of this process and the terms for storage and deliveries are outlined in each of the Minutes (318, 319, and 323).

### **2014 Pulse Flow**

As provided under this Minute to the 1944 U.S-Mexico Water Treaty, an experimental pulse flow of approximately 132 million cubic meters (mcm) was released from Morelos Dam into the dry Colorado River channel below. This pulse flow began on March 23, 2014 and ended on May 18, 2014 and briefly re-established the historical connection between the Colorado River to the Sea of Cortez.

Part of Minute 319 was the establishment of nine restoration sites of over 1200 acres of riparian habitat along the approximately 100 miles below Morelos Dam to maintain the Pacific Flyway to benefit migratory birds. Part of this Minute also included \$18 million in infrastructure improvements to Irrigation District 014, including canal linings, gate structures, laser leveling of fields all to improve efficiency and conserve water.

**2017-Minute 323** *Extension of Cooperative Measures and Adoption of a Binational Water Scarcity Contingency Plan in the Colorado River Basin* is signed September 21, 2017. As the name implies, this Minute further develops the work accomplished under Minute 319 and continues to study the potential for future conservation studies and projects.

As mentioned above, *Extension of Cooperative Measures to Address Potential Emergencies in Mexico* (Minute 323, Section V.) addresses the creation of Mexico's Water Reserve and

maintaining the ability to generate Intentionally Created Mexican Allocation (ICMA) to ensure Colorado River water for current and future generations in both the U.S. and Mexico.

There are currently three environmental restoration project sites along the channel of the Colorado River in Mexico. They include the Miguel Aleman Phase V Project, Laguna Larga Phase I Project, and the Vado Carranza Restoration Project. These are extensions of existing Minute 319 environmental restoration projects.

Water conservation projects are currently being reviewed and evaluated for future development.

**Drought Contingency Plan (DCP)-** On May 20, 2019, representatives from all seven states of the Colorado River Basin signed the DCP, an historical and important accomplishment, which is designed to reduce risks from ongoing drought to Colorado River water users in the Western United States and Mexico. It was a collaborative effort of local, state, and federal agencies, Tribes, and governmental and non-governmental organizations.

<https://www.congress.gov/bill/116th-congress/house-bill/2030>

**Main Outlet Drain Extension (MODE) Project by the U.S. Bureau of Reclamation.** Beginning September 2019 to replace the Diversion Structure at the Main Outlet Drain Extension (MODE) and includes construction of reinforced concrete diversion structure, pipe connection well and two Outlet transitions. Work is located in the Wellton-Mohawk Irrigation and Drainage District (WMIDD), Colorado River Front Work and Levee System, approximately 3 miles east of Yuma, Arizona. This project halted the flow to the Ciénega de Santa Clara for approximately four months (September 5, 2019-January 13, 2020) which was monitored by teams that were in place performing monitoring studies in the region for Minute 323 monitoring. This was a Binational effort by scientists from the Universidad Autonomas de Baja California (Autonomas University of Baja California, UABC) and the University of Arizona in Tucson.

The report for this study is being prepared and the results will be described in the next salinity report.

### **Ciénega de Santa Clara**

The Ciénega de Santa Clara is the largest wetland (approximately 15,000 acres) in the Colorado River Delta and one of the largest within the entire Colorado River Basin that provides critical habitat for resident and migratory wildlife. The origins of the Ciénega date back to 1977 with the beginning of the disposal of brackish groundwater from the Wellton-Mohawk Irrigation and Drainage District in Arizona into the region now known as the Ciénega de Santa Clara. The Ciénega is a protected area managed by Mexico's natural lands protection commission, Comisión Nacional de Áreas Naturales Protegidas, CONANP. The Ciénega's vegetation is dominated by cattail, with some stands of common reed, and bulrush. These species of plants are tolerant of the saline conditions. The Ciénega has flourished under these conditions and benefited from the brackish discharges.



Photos taken by IBWC, Yuma Field Office staff

The Ciénega provides habitat for over 260 species of birds, including marsh birds, shorebirds, waterfowl, and migratory birds, as well as dozens of fish species. Two listed species inhabit the Ciénega: the Yuma clapper rail and the desert pupfish. Both are listed as endangered in the U.S., while the pupfish is classified as endangered, and the clapper rail is classified as threatened in Mexico. Habitat of this type in the West has become fragmented or eliminated, making this area vital for both resident and migratory species. The Ciénega has also become an important resource for the local economy for fishing, building materials and ecotourism.

For deliveries to the Ciénega, see the section titled “Quantities of United States Bypass Drain Water” above. Deliveries through the Bypass Drain started in 1974 and are listed in Table 5 below. Completion of the Bypass Drain extension to the Santa Clara Slough occurred in 1977. Daily discharge data has been collected since 1977 to the present. Daily discharge data is available from June 1977 through September 2010 on the IBWC website at:

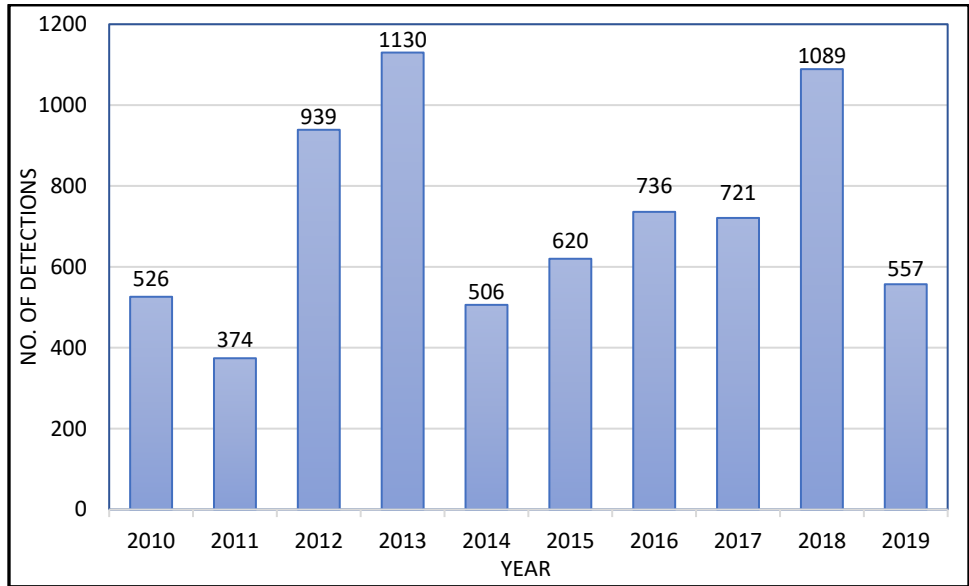
<http://www.ibwc.gov/wad/DDQWMSIB.HTM>.

### **Yuma Ridgeway’s (Clapper) Rail and Other Marshbirds in the Ciénega de Santa Clara**

Since 1999, Pronatura Noroeste with the support of Mexico’s CONANP-Upper Gulf of California and Colorado River Delta Biosphere Reserve have surveyed for wetland birds in the Ciénega de Santa Clara. The monitoring efforts for marshbirds in the Ciénega continued through 2019 in 130 survey points, following the Standardized Protocols for Monitoring Marsh Birds in North America, and targeting Black Rail, Sora, Virginia Rail, Least Bittern, Yuma Ridgeway’s Rail and American Bittern.

The Yuma Ridgeway’s (clapper) rail was listed as endangered on March 11, 1967 pursuant to the Endangered Species Act of 1966. California lists it as threatened. Arizona classified the Yuma Ridgeway’s rail in 1978 as a species of special concern, similar to the Federal status of endangered. Nevada classifies the Yuma Ridgeway’s rail as endangered, and it is listed as threatened in Mexico.

Below is a 2010-2019 graph of the Yuma Ridgeway Rail detections for 2010 through 2019 from 130 survey points. The Ciénega provides habitat to approximately 70-75% of the endangered species.



**Figure 3.** Detections of Yuma Ridgway's Rails in the Cienega de Santa Clara from 2010 to 2019.

Below is a table showing the results of the surveys for 2010 through 2019 for the following species: Black Rail (BLRA), Least Bittern (LEBI), Sora (SORA), Virginia Rail (VIRA), Yuma Ridgway's Rail (RIRA) and American Bittern (AMBI).

**Table 11.** Detections of marshbirds in the Cienega de Santa Clara, 2010 to 2019.

Year	BLRA	LEBI	SORA	VIRA	RIRA	AMBI	Total
2010	22	364	141	364	526	19	1436
2011	12	243	1	186	374	26	842
2012	13	209	129	463	939	55	1808
2013	17	1286	240	946	1130	54	3673
2014	3	485	295	321	506	33	1643
2015	34	691	175	440	620	28	1988
2016	7	562	174	415	736	26	1920
2017	24	591	183	392	721	54	1965
2018	17	539	202	307	1089	50	2204
2019	12	323	164	197	557	35	1288
<b>Total</b>	<b>161</b>	<b>5293</b>	<b>1704</b>	<b>4031</b>	<b>7198</b>	<b>380</b>	<b>18767</b>

## ACKNOWLEDGMENTS

The full cooperation of the United States Geological Survey and the U.S. Bureau of Reclamation, as reported herein, is acknowledged with appreciation. This cooperation enabled compliance with the 1944 Water Treaty and with the salinity agreement with Mexico.



**APPENDIX A**  
**History (1974.5 -2020) for Tables 3 through 8**

*Minute No. 242 became effective on June 25, 1974*

*Please note that data for 2014 has not yet been mutually approved by both Sections of the IBWC per agreement.*

*\*TCM units converted using a conversion of 1 acre-foot= 1233.489 cubic meters*

**Table 4. Annual Average Flow-Weighted Salinities of the water of the Colorado River delivered upstream of Morelos Diversion Dam [at Northerly International Boundary] and at Imperial Dam [Resulting from Operations under IBWC Minute No. 242, since the Colorado River Salinity Control Act, as amended, became effective on June 24, 1974]**

Year	Annual Average Salinity (U.S. Count) as TDS (ppm)		Differential (U.S. Count) (ppm)
	At Imperial Dam	Upstream of Morelos Dam	
1974 (Effective 6/25-12/31)	832	972	140
1975	829	964	135
1976	823	955	132
1977	820	943	123
1978	812	928	116
1979	809	739	-70
1980	755	740	-15
1981	806	924	118
1982	825	933	108
1983	733	742	9
1984	670	676	6
1985	607	639	32
1986	579	600	21
1987	610	656	46
1988	655	733	78
1989	682	800	118
1990	721	846	125
1991	751	858	107
1992	781	898	117
1993	767	613	-154
1994	797	875	78
1995	787	869	82
1996	782	859	77
1997	695	764	69
1998	655	698	43
1999	681	758	77
2000	659	778	119
2001	681	820	139
2002	691	832	141
2003	706	842	136
2004	735	858	123
2005	708	803	95
2006	713	844	131
2007	675	805	130
2008	728	868	140
2009	721	858	137
2010	686	825	139

2011	687	828	141
2012	683	826	143
2013	677	806	129
2014 <sup>5</sup>	693	822	129
2015	729	856	127
2016	772	905	133
2017	705	838	133
2018	683	824	142
2019	665	814	149

<sup>5</sup>Due to Minute No. 319 experimental flows, binational data for 2014 has not yet been made official and are still considered provisional.

**Table 5. Annual Average Flow-Weighted Salinities of the water delivered to Mexico at the Southerly International Boundary** (Under IBWC Minute No. 242, since the Colorado River Basin Salinity Control Act, as amended, became effective on June 24, 1974)

<b>Year</b>	<b>Annual Average Flow-Weighted Salinity (U.S. Count) as TDS (ppm)</b>
1974 (Effective 6/25 – 12/31)	1,515
1975	1,500
1976	1,480
1977	1,510
1978	1,470
1979	1,538
1980	1,582
1981	1,572
1982	1,470
1983	1,434
1984	1,487
1985	1,513
1986	1,496
1987	1,431
1988	1,488
1989	1,300
1990	1,333
1991	1,223
1992	1,312
1993	1,306
1994	1,299
1995	1,313
1996	1,358
1997	1,341
1998	1,214
1999	1,242
2000	1,173
2001	1,192

2002	1,166
2003	1,094
2004	1,155
2005	1,103
2006	995
2007	984
2008	1,032
2009	1,116
2010	1,103
2011	1,157
2012	1,142
2013	1,146
2014	1059
2015	1,146
2016	1,070
2017	1,136
2018	1,069
2019	1,029

**Table 6. Annual Volumes of Water scheduled (actually delivered) to the Sanchez Mejorada Canal, at the Southerly International Boundary near San Luis, Arizona, and in the Limitrophe Section of the Colorado River below Morelos Dam (Under IBWC Minute No. 242, since the Colorado River Salinity Control Act, as Amended; effective on June 24, 1974)**

Year	Annual Volume Delivered	
	(tcm)	(af)
1974 (June 25 – Dec. 31)	70,377	57,055
1975	133,377	107,916
1976	133,328	108,090
1977	115,034	93,259
1978	99,409	80,592
1979	108,263	87,770
1980	126,058	102,196
1981	143,077	115,994
1982	134,843	107,697
1983	120,616	97,784
1984	138,007	111,884
1985	138,091	111,952
1986	153,974	124,829
1987	145,581	118,025
1988	138,832	112,553
1989	167,355	135,677
1990	165,169	133,905

1991	166,289	134,813
1992	157,069	127,338
1993	139,929	113,442
1994	155,091	125,734
1995	144,663	117,279
1996	144,331	117,010
1997	142,013	115,131
1998	159,782	129,537
1999	164,643	133,477
2000	169,577	137,478
2001	164,736	133,553
2002	151,919	123,162
2003	141,523	114,734
2004	160,957	130,488
2005	157,437	127,634
2006	155,992	126,465
2007	168,661	136,735
2008	165,841	134,449
2009	175,567	142,334
2010	154,688	125,407
2011	167,242	135,585
2012	153,895	124,764
2013	157,930	128,036
2014	162,940	132,097
2015	184,931	149,925
2016	176,927	143,436
2017	164,390	133,272
2018	159,983	129,700
2019	144,931	117,497

**Table 7. United States Bypass Drain Water delivered at Southerly International Boundary (SIB)**  
(Extension from the Bypass Drain to the Santa Clara Slough was not complete until 1977)

Year	Annual Volume Discharged	
	(tcm)	(af)
1974 (6/25 – 12/31)	140,180	113,645
1975	264,866	214,729
1976	253,353	205,395
1977	255,113	206,822
1978	224,540	182,036
1979	219,472	177,928
1980	190,735	154,630

1981	183,082	148,426
1982	184,651	149,698
1983 <sup>6</sup>	2,209,881	1,791,571
1984 <sup>7</sup>	1,549,442	1,256,152
1985	159,987	129,704
1986	135,747	110,052
1987	120,562	97,741
1988	158,103	128,176
1989	170,990	138,624
1990	164,900	133,690
1991	173,583	140,726
1992	124,716	101,109
1993 <sup>8</sup>	757,843	614,393
1994	156,477	124,435
1995	154,772	125,475
1996	138,632	112,390
1997	109,971	89,155
1998	140,332	113,769
1999	97,044	78,675
2000	132,530	107,443
2001	127,969	103,746
2002	150,176	121,749
2003	141,523	114,734
2004	121,883	98,812
2005	132,519	107,433
2006	132,617	107,514
2007	131,914	106,944
2008	142,387	115,435
2009	141,567	114,770
2010	144,892	117,465
2011	161,108	130,612
2012	155,697	126,225
2013	136,805	110,910
2014	178,364	144,601
2015	187,478	151,990
2016	185,260	150,192
2017	156,285	126,702
2018	151,188	122,569
2019 <sup>9</sup>	99,123	80,360

<sup>6</sup> Includes undetermined volume of floodwater from bypass canal levee breaks in U.S.

<sup>7</sup> Includes Gila River water.

<sup>8</sup> Low flows due to damage on drainage canal by Gila River floodwater. Drainage water entered the Gila River, Feb. 21, 1993 - Jan. 18, 1994 and was diluted by high flows.

<sup>9</sup> Low flows due to MODE repairs requiring water to be diverted into the Limitrophe below Morelos Dam.

**Table 9. Mexico pumping from its San Luis Mesa Well Field located within five miles (Eight Kilometers) of the Arizona-Sonora boundary near San Luis**

Year	Annual Volume Pumped	
	(tcm)	(af)
1975	131,030	106,227
1976	120,722	97,870
1977	159,905	129,636
1978	121,172	98,235
1979	29,063	23,562
1980	17,735	14,378
1981	148,742	120,586
1982	162,498	131,738
1983	22,437	18,190
1984	8,963	7,266
1985	37,373	30,299
1986	13,308	10,789
1987	64,453	52,253
1988	157,374	127,585
1989	173,551	140,700
1990	167,848	136,077
1991	153,227	124,223
1992	81,374	65,971
1993 <sup>10</sup>	7,237	5,867 <sup>12</sup>
1994	76,281	61,841
1995	48,830	39,587
1996	81,039	65,699
1997	36,576	29,653
1998 <sup>11</sup>	0	0
1998 <sup>11</sup>	0	0
1999 <sup>11</sup>	0	0
2000 <sup>11</sup>	0	0
2001	67,173	54,458
2002	135,687	110,003
2003	174,747	141,669
2004	182,994	148,355
2005	153,762	124,655
2006	174,778	141,693
2007	191,221	155,025
2008	165,113	133,859
2009	194,717	157,859
2010	117,180	94,999
2011	153,515	124,457
2012	161,360	130,816
2013	166,893	135,302
2014	182,493	147,949
2015	190,666	154,575
2016	196,816	159,560
2017	180,900	146,657
2018	166,860	135,275
2019	128,719	104,354

<sup>10</sup>The reduced pumping was due to excess delivery from the Gila River flood flows.

<sup>11</sup>No Pumping required due to adequate flows in the Colorado River.

**Table 10. Total volume pumped by the United States and volume pumped at the Minute 242 Well Field<sup>11</sup>**  
(Limited to 160,000 acre-feet for each country as per Minute 242)

Year	Total Volume Pumped		242 Well Field Volume Pumped <sup>12</sup>	
	(tcm)	(af)	(tcm)	(af)
1975	33,401	26,787	n/a	n/a
1976	28,047	22,738	n/a	n/a
1977	28,358	22,990	n/a	n/a
1978 <sup>12</sup>	22,079	17,900	106	86
1979	31,353	25,418	201	163
1980	35,188	28,527	2,244	1,819
1981	47,443	38,463	23,361	18,939
1982	50,516	40,954	29,036	23,540
1983	20,608	16,707	4,856	3,937
1984	19,078	15,467	3,721	3,017
1985	16,818	13,635	2,531	2,952
1986	32,497	26,346	3,358	2,723
1987	33,213	26,926	4,215	3,417
1988	29,512	23,096	3,073	2,491
1989	63,020	51,091	35,430	28,724
1990	71,721	58,145	38,050	30,848
1991	53,000	42,968	38,461	31,181
1992	38,696	31,371	28,319	22,958
1993	18,473	14,976	8,001	6,486
1994	40,478	32,816	23,738	19,245
1995	38,879	31,520	15,354	12,448
1996	21,546	17,468	8,055	6,530
1997	9,776	7,926	550	446
1998	20,592	16,694	6,337	5,138
1999	14,107	11,437	4,884	3,960
2000	14,311	11,602	5,240	4,248
2001	13,329	10,806	2,788	2,260
2002	17,576	14,249	4,402	3,569
2003	31,589	25,609	18,727	15,182
2004	37,605	30,487	27,797	22,536
2005	53,466	43,345	36,906	29,920
2006	56,710	45,975	40,548	32,872
2007	78,803	63,886	62,864	50,964
2008	81,594	66,149	68,812	55,787
2009	73,299	59,424	56,385	45,712
2010	61,984	50,251	41,756	33,852
2011	53,499	43,372	36,013	29,196
2012	41,277	33,464	26,234	21,268
2013	45,817	37,144	31,980	25,927

2014	51,707	41,919	37,053	30,039
2015	69,675	56,486	49,640	40,244
2016	53,119	43,064	42,962	34,830
2017	40,224	32,610	32,089	26,015
2018	58,078	47,084	49,194	39,882
2019	46,243	37,490	37,058	30,043

<sup>12</sup>Minute No. 242 Well Field was constructed and put into operation in 1978



**Figure 2. Flow-Weighted Annual Average Salinity Levels in the Water Arriving at Imperial Dam Since 1951, and at the Northerly International Boundary (NIB) Since 1958.**

**SALINITY OF COLORADO RIVER TREATY WATERS AT IMPERIAL DAM AND THE NORTHERLY INTERNATIONAL BOUNDARY 1950-2019**

