

**A REPORT ON
COLORADO RIVER SALINITY OPERATIONS
UNDER INTERNATIONAL BOUNDARY AND WATER COMMISSION
MINUTE NO. 242
JANUARY 1 to DECEMBER 31, 2013**



**Edward Drusina, P.E.
United States Commissioner
International Boundary and Water Commission
United States Section
November 2016**



Table of Contents

Table of Contents.....	2
Introduction.....	3
Colorado River Salinity Operations, January 1, 2013 through December 31, 2013, Under Agreement IBWC Minute No. 242.....	4
Water Deliveries and Salinity Differential	4
IBWC Minute No. 242 and Water Deliveries	4
IBWC Minute No. 242 Salinity Levels and Salinity Differentials	5
Deliveries at the Southerly International Boundary	7
Quantities of United States Bypass Drain Water	8
Annual Average Flow-Weighted Salinity in Water Delivered to Mexico in 2013 at SIB.....	8
Groundwater – Minute No. 242 Well Field	9
Consultations and Regional Developments	10
Other Lower Colorado River Features and Activities: U.S. and Mexico.....	11
Acknowledgement	14

Figures, Tables, Appendix

Figure 1	Reference Map of Lower Colorado River Area.....	3
Table 1	Summary, Total Deliveries of Colorado River Water to Mexico in 2013	4
Table 2	2013 Colorado River Salinity Levels and Differentials	5
Table 3	Ten year Flow-Weighted Annual Average Salinities of the Water of the Colorado River Delivered Upstream of Morelos Diversion Dam [at NIB] and at Imperial Dam.....	6
Figure 2	Graph of annual Average salinity of water at Imperial Dam and Northerly International Boundary.....	6
Table 4	Ten year Annual Volume of Water Schedule	7
Table 5	United States Bypass Drain Water Delivered at Southerly International Boundary.....	8
Table 6	Ten year Annual Average Flow-Weighted Salinities of the Water Delivered to Mexico at the Southerly International Boundary.....	8
Table 7	Mexico Pumping from its San Luis Mesa (242) Well Field Located within Five Miles (Eight Kilometers) of the Arizona-Sonora boundary near San Luis.....	9
Table 8	Total Volume Pumped by the U.S. & Volume Pumped at the Minute 242 Well Field..	10
Appendix A	History (1974/5 -2013) for Tables 3 through 8 and listed by title above.....	15-21

Acronyms and Short Titles

af - Acre-feet	IBWC – International Boundary and Water Commission
ppm - Parts per million	US and Mexican Section
tcm - Thousand cubic meters	USIBWC - United States Section of the IBWC
NIB - Northerly International Boundary	MxIBWC - Mexican Section of the IBWC
SIB - Southerly International Boundary	Reclamation -United States Bureau of Reclamation
ICMA-Intentionally Created Mexican Allocation	USGS - US Geological Survey

Units converted using: <http://www.unitconversion.org/volume/cubic-meters-to-acre-feet-conversion.html>

Cover Photo: 1) Colorado River Channel in Mexico; 2) Scientists and agency leaders planning Minute 319 environmental projects; 3) Colorado River near Yuma. Photos taken by IBWC staff.

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 of Colorado River water to Mexico annually. In 1973, the International Boundary and Water Commission (IBWC), United States and Mexico, developed Minute No. 242, *Permanent and Definitive Solution to the International Problem of the Salinity of the Colorado River*, to address salinity, groundwater pumping, and discharges of saline water from the Wellton-Mohawk drain that helped create the Santa Clara Wetland. In 1974, Congress enacted 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 commitments to Mexico. 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.

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.

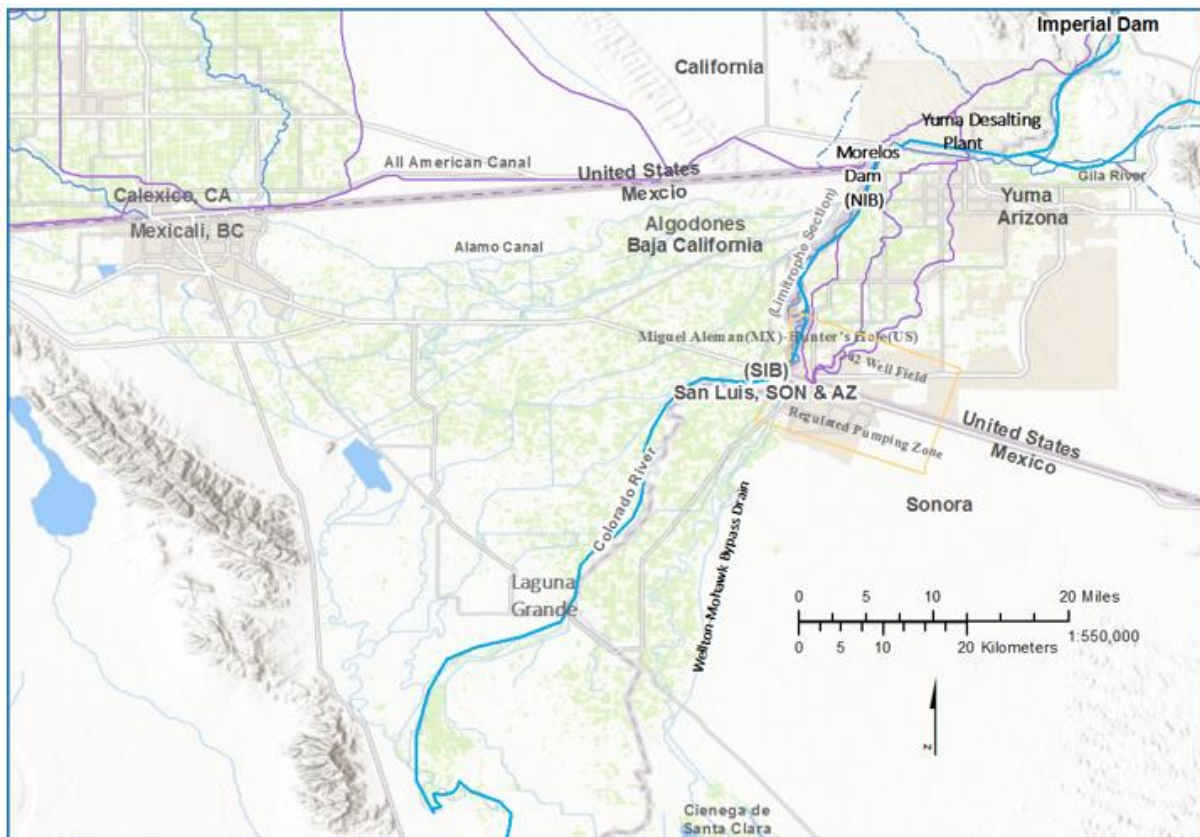


Figure 1: Reference Map of Lower Colorado River Area

COLORADO RIVER SALINITY OPERATIONS,

JANUARY 1, 2013 THROUGH DECEMBER 31, 2013, 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...”

This report presents the results of the operations from January 1 through December 31, 2013, 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 2013 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 the agreement in IBWC Minute No. 242.**

WATER DELIVERIES AND SALINITY DIFFERENTIAL

IBWC Minute No. 242 and Water Deliveries

Table 1 is a summary of the scheduled deliveries and actual deliveries made to Mexico and where those deliveries were made in 2013.

Table 1: Summary, Total Deliveries of Colorado River Water to Mexico in 2013

	Scheduled Deliveries	Actual Deliveries Made
NIB (“at the riverbed above Morelos Dam”)	1,521,812.21 tcm (1,233,095 af) ¹	1,624,656 tcm (1,316,598 af) ²
SIB (“across the land boundary near San Luis, Arizona,” includes the water flows through the limitrophe of the river below Morelos Dam)	172,000 tcm (139,443 af) ¹	157,930 tcm (128,036 af) ³
Downward Delivery Adjustment (Minute 319)	156,421.79 tcm (126,813af) ¹	156,421.79 tcm (126,813af) ¹
Total	1,850,234 tcm (1,500,009af) ¹	1,782,586 tcm (1,445,165af) Not including Mexico’s Downward Delivery
Other water delivered [arriving] to Mexico in the Limitrophe Section ⁴		88,774 tcm (71,970 af) ⁴

*TCM units converted using: <http://www.unitconversion.org/volume/cubic-meters-to-acre-feet-conversion.html>

¹ Source: 2013 Mexico schedule.

² Source: Northerly International Boundary tcm + Cooper Wasteway tcm + Tijuana tcm (No water was delivered to Tijuana in 2013)

³ 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. when flows are diverted into the Wellton-Mohawk Bypass)

⁴ Source: USIBWC Yuma Field Office calculations. Other water arriving in the limitrophe of the Colorado River not accounted for in scheduled deliveries.

The accumulated volume of Colorado River water recorded at Imperial Dam in 2013 was 6,551,272 tcm (5,311,182 af)⁵. Imperial Dam serves Yuma County, Imperial County and deliveries to Mexico. The quantities requested by Mexico to be delivered for 2013 were in accordance with Article 10 of the 1944 Water Treaty. The quantities requested are for deliveries to be made 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 flows through the limitrophe of the river below Morelos Dam.

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 Minute No. 314. **No delivery of Colorado River water was made to Mexico at Tijuana, Baja California, in 2013.**

The April 2010 earthquake (magnitude 7.2) in the Mexicali Valley, Baja California, Mexico caused damage to Irrigation District 014, Rio Colorado infrastructure in Baja California and Sonora. The earthquake damaged 398 miles of canals in Mexico making it difficult to receive and transport its full allotment of Treaty water. In response to this situation, IBWC Minute No. 318, *Adjustment of Delivery Schedules of Water Allotted to Mexico for the Years 2010 Through 2013 as a Result of Infrastructure Damage in Irrigation District 014, Rio Colorado, Caused by the April 2010 Earthquake in the Mexicali Valley, Baja California*, dated December 17, 2010, was established. This Minute allowed for the downward adjustment of Treaty deliveries at Mexico’s request by a maximum of 260,000 af between the remaining portion of 2010 and December 31, 2013, and subsequent delivery of the water when Mexico is able to make beneficial use of it.

On November 20, 2012, the IBWC signed Minute 319, entitled “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.” Minute 319 authorizes the creation of Intentionally Created Mexican Allocation (ICMA), allowing for limited deferment of water deliveries with a 3% reduction for evaporation and a 2% water assessment reserved for environmental purposes.

IBWC Minute No. 242 Salinity Levels and Salinity Differentials

Both U.S. and Mexican values are between acceptable ranges as agreed to in Minute No. 242. Table 2 provides a summary of the salinity levels and differentials in the lower Colorado River in 2013.

Table 2: 2013 Colorado River Salinity Levels and Differentials

Waters	U.S. count (ppm)	Mexican count (ppm)
Arriving Upstream of Morelos Diversion Dam at NIB	806	885
Arriving at Imperial Dam	677	741
Salinity Differential	129	144

(Minute 242, Resolution 1.a) 115 ppm ± 30 ppm U.S. count, 121 ppm ± 30 ppm Mexican count)

Table 3 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.

⁵ Source: United States Geological Survey

Table 3: Annual Average Flow-Weighted Salinity Levels

Year	Annual Average Salinity (U.S. Count) as TDS (ppm)		Differential (U.S. Count) (ppm)
	At Imperial Dam	Upstream of Morelos Dam	
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

USIBWC collects samples at NIB and tests and distributes samples to MxIBWC and Reclamation. USIBWC sends samples twice a month to Reclamation to do a complete 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 be more than 30 micro Siemens/deciliter apart otherwise resampling is required.

The Reclamation collects samples at Imperial Dam and shares with MxIBWC and USIBWC. Samples are tested and results are compared. Imperial Dam produces 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.

Figure 2 below 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.

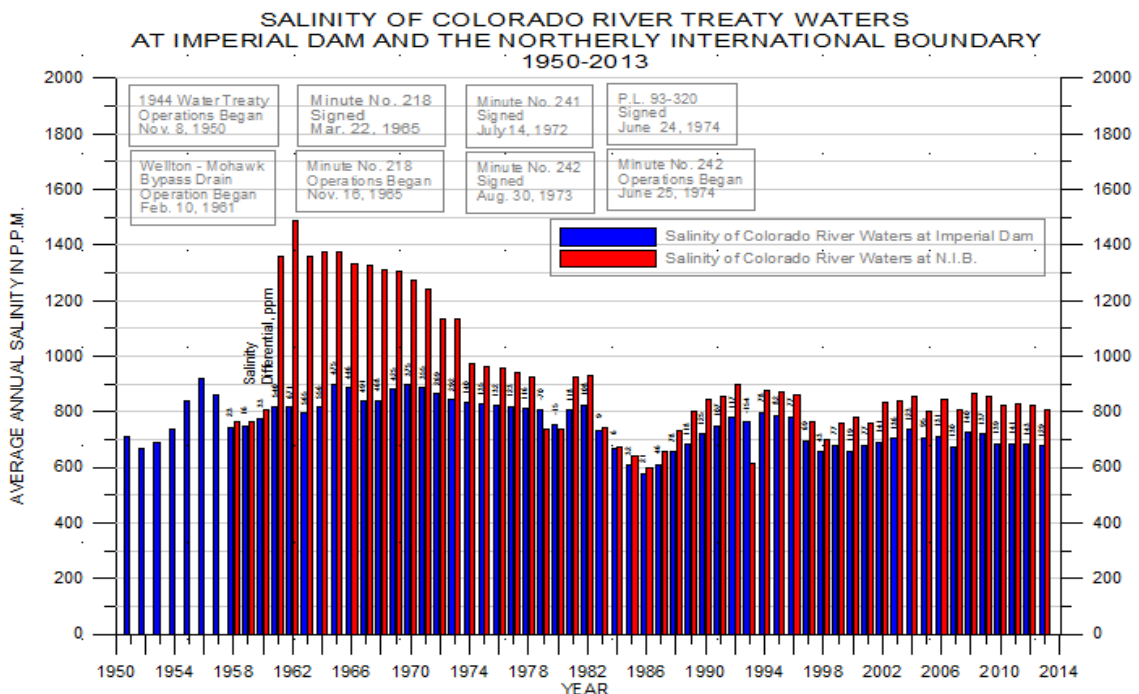


Figure 2: Annual Average Salinity Levels

The IBWC previously conducted a study of the differences in measurements and calculations by the United States and Mexico. A full detail of the study results is presented in a final joint report titled *Binational Study Regarding the Technical Methods and Joint Monitoring of the Salinity in the Colorado River for the fulfillment of International Boundary and Water Commission Minute No. 242 Between the United States and Mexico Conducted from January 2006 to December 2007- Final Report 2011*.

DELIVERIES AT THE SOUTHERLY INTERNATIONAL BOUNDARY

Resolution 1.b) of Minute No. 242 further 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 since Minute No. 242 operations began on June 25, 1974 are shown in Table 4. 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 volume on the land boundary at San Luis and in the limitrophe section made in 2013, which totaled 157,930 tcm (128,036 af)⁶, was less than the annual volume of 172,689 tcm (140,001 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 on page 4).

Table 4: Annual Volume of Water Schedule

Year	Annual Volume Delivered	
	(tcm)	(af)
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

Deliveries are calculated as follows:

- Actual deliveries at NIB=Northerly International Boundary tcm + Cooper Wasteway tcm + Tijuana tcm*
- 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. when flows are diverted into the Wellton-Mohawk Bypass)

(*No emergency deliveries were made to Tijuana in 2013 as discussed on p.5)

⁶Based on volumes from East Main Canal Wasteway + West Main Canal Wasteway + Main Drain + 242-Lateral - Diversion at SIB + 11-Mile Wasteway + 21-Mile Wasteway.

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.

Table 5: United States Bypass Drain Water discharged at Southerly International Boundary (SIB)⁷ and delivered to the Ciénega.

Year	Annual Volume Discharged	
	(tcm)	(af)
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	110,909

Table 5 above shows quantities of United States Bypass Drain water delivered, including the 2013 delivery of 136,805 tcm (110,909 af)⁸ at SIB and on to the Ciénega. To view the complete record since implementation of the Minute in 1974, see Appendix A.

Annual Average Flow-Weighted Salinity in the Water Delivered to Mexico in 2013 at SIB

The annual average flow-weighted salinity levels of the water delivered to Mexico at SIB near San Luis under IBWC Minute No. 242 for the last ten years are shown in Table 6. The 2013 average salinity of 1,146 ppm was lower than the 40-year average of 1,307 ppm, as well as the average of 1,540 ppm for the 10-year period of 1963-72. To view the complete record since implementation of the Act in 1974, see Appendix A.

Table 6: Annual Average Flow-Weighted Salinity Levels at SIB

Year	Annual Average Flow-Weighted Salinity (U.S. Count) as TDS (ppm)
2004	1,155
2005	1,103
2006	995
2007	984
2008	1,032
2009	1,116
2010	1,103
2011	1,157

⁷Source: USIBWC Yuma Field Office calculations.

⁸Source: East Main Canal Wasteway + West Main Canal Wasteway + Main Drain + 242-Lateral - Diversion at SIB + 11-Mile Wasteway + 21-Mile Wasteway.

2012	1,142
2013	1,146

As part of the 1944 Treaty and the exchange of Commission letters on September 12 and 14, 1955, the flows crossing the SIB would be accounted towards Mexico’s Treaty allocation. The U.S. deliveries to Mexico are still made at SIB to meet those obligations.

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.”

In 2013, Mexico pumped 166,893 tcm (135,302 af) from its San Luis Mesa (242) Well Field. Table 7 below shows the last ten years of 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 7: Annual Volume Pumped by Mexico

Year	Annual Volume Pumped	
	(tcm)	(af)
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

Part of the Reclamation’s Protective and Regulatory Pumping Unit, the 242 Well Field, consists of 21 wells which intercept southward moving groundwater within a five-mile strip adjacent to the international boundary near San Luis, AZ. The U.S. pumped a total of 37,144 af (45,817 tcm) within five miles of the boundary, including the Minute 242 Well Field.

Table 8 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 2004 through 2013 (limited to 160,000 acre-feet [197,358,000 cubic meters] for each country pursuant to Minute 242). Water captured 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 2013, all 21 wells were pumped. To view the complete record, see Appendix A.

Table 8: Total volume pumped by the United States

Year	Total Volume Pumped		242 Well Field Volume Pumped	
	(tcm)	(af)	(tcm)	(af)
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	61,983	50,250	41,756	33,852
2011	53,499	43,372	36,013	29,196
2012	41,277	33,463	26,234	21,268
2013	45,817	37,144	31,980	25,926

CONSULTATIONS AND REGIONAL DEVELOPMENTS

Point 6 of Minute No. 242 provides that:

“ ... the United States and Mexico shall consult with each other prior to undertaking any new development of either the surface or the groundwater resources, or undertaking substantial modifications of present developments, in its own territory in the border area that might adversely affect the other country.”

Minute 319

Introduced above, IBWC 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*, was signed on November 20, 2012. Minute 319 allows for cooperation between the United States and Mexico on water conservation, system operations, environmental restoration, and new water sources projects. It provides for additional water deliveries to Mexico under high elevation reservoir conditions and reduced deliveries during low elevation reservoir conditions, allows Mexico to defer delivery of some of its allotted water until a later date, allows for U.S. financial support for Mexico’s water infrastructure, and restores some flows of the Colorado River for environmental benefits.

Minute 319 also extended Minute 318, *Adjustment of Delivery Schedules for Water Allotted to Mexico for the Years 2010 Through 2013 as a Result of Infrastructure Damage in Irrigation District 014, Rio Colorado, caused by the April 2010 Earthquake in the Mexicali Valley, Baja California*, which was created and signed on December 17, 2010. It allowed Mexico to defer delivery of a portion of its Colorado River water allotment until it could repair water infrastructure in Mexico that was damaged in the earthquake that occurred on Easter Sunday, April 4, 2010. IBWC Minute No. 317, *Conceptual Framework for U.S.-Mexico Discussions on Colorado River Cooperative Actions*, signed June 17, 2010, provided the framework for discussions on cooperative actions in the Colorado River Basin focusing on the topics of water conservation, identifying new water sources, improving system operations, and identifying water for environmental purposes.

In 2013, planning for implementation continued in earnest for Minute 319 projects. Projects included infrastructure improvement projects and environmental enhancement projects. Improvements include canal linings for more efficient conveyance and water deliveries. The environmental enhancement projects include the restoration of selected sites along the Colorado River channel in the limitrophe and towards the delta and the Sea of Cortez.

Environmental enhancement projects considered under Minute 319 include:

- Miguel Alemán Restoration Site – 300-acre cottonwood and willow vegetation improvement and habitat site in the limitrophe. Site preparation and planting has begun.
- Laguna Grande Restoration Site – 1200-acre cottonwood and willow vegetation improvement and habitat site halfway between SIB and the Colorado River Delta at the Sea of Cortez/Gulf of California.
- Water for the Environment and Intentionally Created Mexican Allocation (ICMA)/Intentionally Created Surplus (ICS) Exchange Pilot Program – Identifies water for the environment.
- River flows to the Colorado River limitrophe and delta ecosystem – Delivering water for environmental purposes to the limitrophe and delta.

The full text versions of the Minutes referenced are available on-line at:

http://www.ibwc.gov/Treaties_Minutes/Minutes.html.

OTHER LOWER COLORADO RIVER FEATURES AND ACTIVITIES: U.S. AND MEXICO

The Morelos Diversion Dam Sediment Removal Project

The Morelos Diversion Dam Sediment Removal Project and the associated Environmental Mitigation Project were completed in 2012. This project consisted of removing sediment that accumulates around the spillway preventing the spillway from operating efficiently. The sediment removal was complemented by a 40-acre restoration project designed to substitute the displaced habitat that had encroached into the sediment build-up in the effective portion of the spillway. The “CILA” site, chosen for the mitigation/restoration for habitat compensation, is downstream, and entirely in Mexico. The work there has been completed. CILA, Comisión Internacional de Límites y Aguas, is the Mexican Section of IBWC and USIBWC’s counterpart in Mexico. This site is part of the larger Laguna Grande site described below.

Laguna Grande Restoration Site

This area is the largest stand of dense habitat along the Colorado River in Mexico, providing valuable habitat along this corridor. Located near the community of Ejido Doctor Alberto Oviedo Mota (also known as El Indiviso), Baja California, this area consists of: 1200-acre cottonwood and willow vegetation and habitat improvement site on the main river channel with 150 acres of restored habitat. Members and volunteers with Sonoran Institute, Pronatura Noroeste and other groups have been removing salt cedar and planting native willow and cottonwood. In 2013, irrigation water was bought from farmers. The Sonoran Institute and Pronatura have demonstrated the feasibility and success of restoration in this area. The efforts of these groups have enabled the dedication of water to this region. Minute 319 will support these efforts and activities over the next 5 years. Both the Miguel Alemán and the Laguna Grande projects have employed local residents for greenhouse work, planting, and site maintenance.

Miguel Alemán Restoration Site

Pronatura Noroeste, in collaboration with the Reclamation, Mexico’s National Commission on Natural Protected Areas (CONANP), Mexico’s National Water Commission (CONAGUA), IBWC, the community of Colonia Miguel Alemán in Baja California and others, has been implementing a riparian restoration project in 90 acres along the limitrophe section of the Colorado River. The restoration site is located on the Mexican side of the river, 3 miles north of the Southerly International Boundary. This project was developed as a sister effort of the Hunter’s Hole restoration project in Arizona just across the river, and is part of the implementation projects under the framework of Minute 319. The completed activities for the project include the completion of the restoration design, installation of a 3-mile long, 12” diameter pipeline to deliver water for the project, clearing non-native salt cedar at the site, land contouring and leveling, and the production of 60,000 native trees. The restoration goal for the area is 300 acres, and subsequent phases to reach this goal will be implemented between 2014 and 2016.

Invasive Species Management

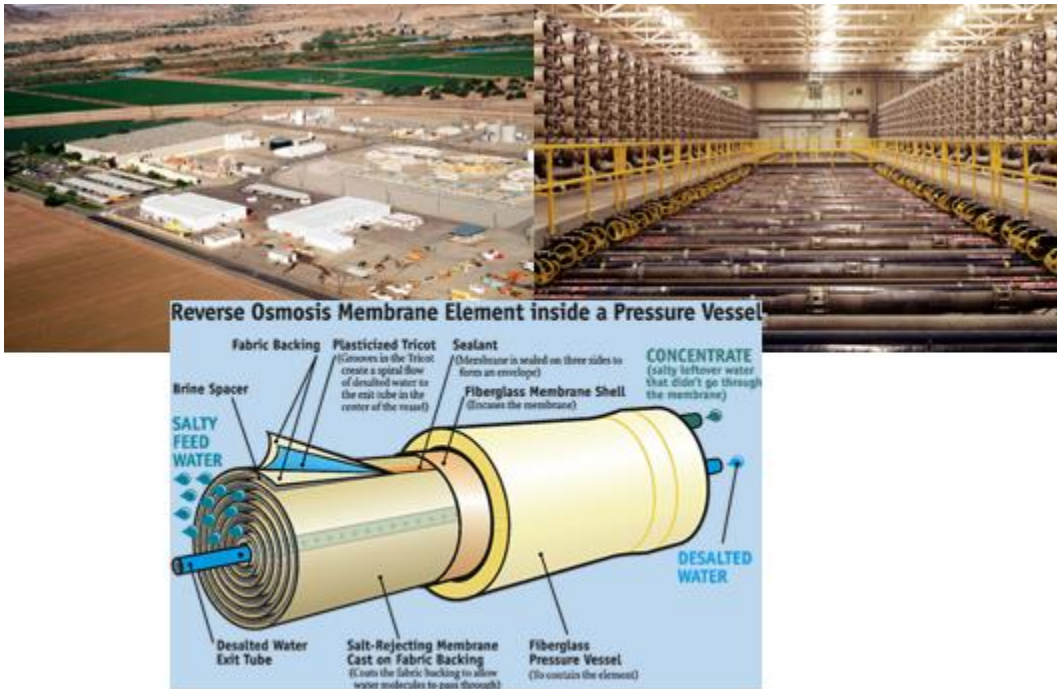
The IBWC continues to participate in addressing aquatic nuisance species inhabiting the lower Colorado River Basin. Chaired by the University of Arizona, the Colorado River Aquatic Invasive Species Task Force is a group of federal, state, and local agencies and organizations. The Task Force conducts meetings to discuss the invasive species problem and work on solutions for the control of the invasive species. The Palo Verde Irrigation District, Reclamation and U.S. Fish and

Wildlife Service continue to treat giant salvinia along the irrigation drains with chemical and manual controls. The presence of giant salvinia is also being reduced in Mexico as a result of control efforts.

Quagga mussels have been found but have not yet become problematic. A Reclamation in-house task force continues to monitor and inspect facilities from Imperial Dam downstream to Yuma.

Yuma Desalting Plant

Maintained by the Reclamation, the Yuma Desalting Plant (YDP) was constructed to meet the salinity requirements set forth in Minute 242. The YDP was completed in 1992 and has been maintained in ready reserve status since the first part of 1993. It operates using reverse osmosis, a process by which a solvent, in this case saline water, passes through a semipermeable membrane opposite to that of natural osmosis and is subjected to hydrostatic pressure to remove saline particles from water.



Photos courtesy of the U.S. Bureau of Reclamation

The Main Outlet Drain Extension (MODE) that provides feed water to the YDP was damaged by floodwater from the Gila River. Subsequent years of higher flow quantity and quality arriving at NIB made operation of the YDP unnecessary. A 90-day demonstration run of the plant at 10 percent of its full capacity was conducted in 2007 by the Reclamation to allow for the evaluation of the operational condition of the plant and design deficiencies. In 2008, the Metropolitan Water District of Southern California, the Southern Nevada Water Authority, and the Central Arizona Water Conservation District initiated discussions with the Reclamation regarding an additional Pilot Run of the YDP. This led to a plan for a pilot run consisting of operating the plant at one-third capacity of the original design for 365 operating days during a 12 to 18 month period in order to provide sufficient performance and cost data and to assess seasonal variation on the operation of the plant.

Ongoing binational consultation resulted in the signing of IBWC Minute No. 316, *Utilization of the Wellton-Mohawk Bypass Drain and Necessary Infrastructure in the United States for the Conveyance of Water by Mexico and Non-Governmental Organizations of Both Countries to the Santa Clara Wetland during the Yuma Desalting Plant Pilot Run* dated April 16, 2010. Under this agreement, the United States, Mexico, and a binational coalition of non-governmental organizations (NGOs) arranged for the delivery of 30,000 af of water to the Santa Clara Wetland in Sonora, Mexico, in connection with the reduction in flow and increased salinity that would otherwise result from the operation of the YDP, as well as environmental monitoring of the wetland system

The Pilot Run commenced on May 3, 2010 and ceased on March 26, 2011. Greater than 30,000 af of irrigation return flow water was included in Treaty deliveries to Mexico, resulting in the conservation of a similar volume of water in Lake Mead (22,666 af treated and mixed with 7830 af untreated to achieve similar salinity levels to NIB). Storage credits for the conserved water were distributed among the water agencies that provided funding for the Pilot Run. Review of the data from the Pilot Run is being conducted by Reclamation and participating water agencies to evaluate potential long-term operation of the plant. The report is available at:

<http://www.usbr.gov/lc/yuma/facilities/ydp/YDPPilotRunFinal072712.pdf>.

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 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 endangered and the clapper rail is 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 2013 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 Clapper Rail Surveys in the Ciénega de Santa Clara

The monitoring efforts for marsh birds in the Ciénega de Santa Clara continued in 2013 in 130 survey points, following the Standardized Protocols for Monitoring Marsh Birds in North America. This is an effort implemented by Pronatura Noroeste and Mexico’s Upper Gulf of California and Colorado River Delta Biosphere Reserve. During 2013, a total of 1,120 Yuma clapper rails were detected, with a population of 6,322 estimated for the entire Ciénega. These surveys have been implemented since 1999, and no significant trend in the population of clapper rails in the Ciénega has been detected,

although a steady population has been sustained since 2006. Since 2010, the highest estimate was 8,640 rails recorded in 2011.

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 -2013) for Tables 3 through 8

Table 3. 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 (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

Table 4. Annual Volumes of Water scheduled (and/or 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, became 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

Table 5. 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	2,209,881 ⁹	1,791,571 ⁹
1984	1,549,442 ¹⁰	1,256,152 ¹⁰
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	757,843 ¹¹	614,393 ¹⁰
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

⁹ Includes undetermined volume of floodwater from bypass canal levee breaks in U.S.

¹⁰ Includes Gila River water.

¹¹ 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.

Table 6. 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)

Year	Annual Average Flow-Weighted Salinity (U.S. Count) as TDS (ppm)
1974 (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	1146

Table 7. 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	7,237 ¹²	5,867 ¹²
1994	76,281	61,841
1995	48,830	39,587
1996	81,039	65,699
1997	36,576	29,653
1998	0 ¹³	0 ¹³
1998	0 ¹³	0 ¹³
1999	0 ¹³	0 ¹³
2000	0 ¹³	0 ¹³
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

¹² The reduced pumping was due to excess delivery from the Gila River flood flows.

¹³ No Pumping required due to sufficient flows in the Colorado River.

Table 8. Total volume pumped by the United States and volume pumped at the Minute 242 Well Field (Limited to 160,000 acre-feet for each country as per Minute 242)

Year	Total Volume Pumped		242 Well Field Volume Pumped ¹⁴	
	(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 ¹³	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	73,299.4	59,424.6	56,385	45,712
2010	61,983.7	50,250.8	41,756	33,852
2011	53,499.5	43,372.7	36,013	29,196
2012	41,277.1	33,463.89	26,234	21,268.23
2013	45,817	37,144	31,980	25,927

¹⁴Minute No. 242 Well Field was constructed and put into operation in 1978.