A REPORT ON
COLORADO RIVER SALINITY OPERATIONS, UNDER INTERNATIONAL BOUNDARY AND WATER COMMISSION MINUTE NO. 242
JANUARY 1 to DECEMBER 31, 2011

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Figures, Tables, Exhibits

Acronyms

Af - Acre-feet	IBWC – International Boundary and Water Commission
Ppm - Parts per million	USIBWC - United States Section of the IBWC
Tcm - Thousand cubic meters	NIB - Northerly International Boundary
TDS - Total dissolved solids	SIB - Southerly International Boundary

Cover Photo: Colorado River, Yuma, Arizona, taken July 2012.

COLORADO RIVER SALINITY OPERATIONS, JANUARY 1, 2011 THROUGH DECEMBER 31, 2011, UNDER IBWC MINUTE NO. 242

This report presents the results of the operations from January 1 through December 31, 2011 under the agreement with the Republic of Mexico (Mexico) titled *Permanent and Definitive Solution to the International Problem of the Salinity of the Colorado River*. The agreement is incorporated into International Boundary and Water Commission, United States and Mexico (IBWC) Minute No. 242 dated August 30, 1973. Minute No. 242 replaced Minute No. 241 (which replaced Minute No. 218). Operations began on June 25, 1974 under Minute No. 242, immediately following approval of Public Law 93-320 *Colorado River Basin Salinity Control Act* (Act of 1974) on June 24, 1974.

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 Bureau of Reclamation. **Exhibit 1** shows the locations referred to in this report. The 2011 records show that the United States (U.S.) operations of the lower Colorado River resulted in compliance with the agreement in IBWC Minute No. 242.

SALINITY DIFFERENTIAL

IBWC Minute No. 242 and Water Deliveries

Point 1 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. ± 30 p.p.m. U.S. count (121 p.p.m. ± 30 p.p.m. Mexican count) over the annual average salinity of Colorado River waters which arrive at Imperial Dam . . ."*

A summary of the "scheduled deliveries" and "actual deliveries" made to Mexico follows in **Table 1**:

Table 1: Summary, Total Deliveries of Colorado River Water to Mexico in 2011

	Scheduled Deliveries	**Actual Deliveries Made**
NIB ("at the riverbed above Morelos Dam")	**1,678,233** tcm (1,360,562 af)[1]	**1,717,058 tcm** (1,392,036 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 (139,442 af)[1]	**167,242 tcm** (135,585 af) [3]
Total	**1,850,233 tcm** (1,500,004 af)[1]	**1,884,300 tcm** (1,527,621 af)
Other water delivered [arriving] to Mexico in the Limitrophe Section[4]		**96,156 tcm** (77,955 af) [4]

[1] Source: 2011 Mexico schedule.
[2] Source: Northerly International Boundary tcm + Cooper Wasteway tcm + Tijuana tcm
[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 2011 was 7,058,171 tcm (5,722,157 af)[5]. The quantities requested by Mexico to be delivered for 2011 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.

No deliveries[6] of Colorado River water were made to Mexico at Tijuana, Baja California in 2011. Deliveries to Tijuana are diverted at Parker Dam through an existing pipeline at Otay Mesa in San Diego, California and are calculated into the total deliveries made at NIB. Deliveries made through this diversion are governed by IBWC Minute No. 314 which replaced Minute No. 310 in November 2008. This Minute is intended to address periods of shortages expected to occur over the subsequent five years.

The April 2011 earthquake 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 allows 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.

Salinity

Table 2 shows a summary of salinity levels and differentials in the lower Colorado River in 2011.

Table 2: Annual Average Flow-Weighted Salinity at Imperial Dam and Morelos Diversion Dam in 2011

Waters	U.S. count (ppm)	Mexican count (ppm)
Arriving Upstream of Morelos Diversion Dam at NIB	828	893
Arriving at Imperial Dam	687	740
Salinity Differential	141	153

The U.S. count of the annual average salinity differential for 2011 is within the respective ranges contemplated in Minute No. 242. The Mexican count for the annual salinity differential is 153, which is higher than the Mexican range of 121 ppm *+30 ppm.* In recent years, the two countries have worked together to determine the reason for the large difference in the salinity values and differential between the U.S. and Mexican counts. For example, in 2007, the U.S. count of the annual average salinity differential was within the range contemplated in Minute No. 242 while the Mexican count that year and in 2004 were above the Minute No. 242 limit. A bi-national team composed of the IBWC, Bureau of Reclamation, and National Water Commission of Mexico was organized to evaluate sampling methods from collection and analysis to data reporting. Additional data was collected in 2006 and 2007 at Imperial Dam and NIB and analyzed by each nation's respective laboratories. A meeting was held in April 2011 to finalize the report of the findings. The findings determined after a review of all of the data collected, laboratory techniques, and methods used in both countries that the differences in salinity values are mostly due to differences in analysis methods and total

[5] Source: Table No. 4 from USIBWC Joint Salinity Report.
[6] Source: USIBWC Yuma Field Office calculations

dissolved solids (TDS) computations. The majority of the difference in salinity values can be attributed to the application of a bicarbonate correction factor used by the U.S. laboratory in the TDS by summation calculation. In addition, differences in chloride and sulfate values between U.S. and Mexican laboratories due to differing methods of analysis also contributed to differences in the salinity values. Other contributing factors include the analysis of additional parameters by the U.S. as well as differences in instrumentation used by each country for analysis and their respective levels of detection which introduce sources of error in the salinity calculation. A full detail of the study results is presented in the 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.*

The bi-national team continues to meet and share data and to conduct third party analysis for comparison of data. A lab visit in the United States was conducted on Nov 17, 2011. No visit was done in Mexico because of the temporary relocation of their lab due to damage of the permanent lab from the earthquake. Third party analyses are done in the months of May and November. Salinity discussions are included in the monthly operations meeting with the Bureau of Reclamation, CILA and National Water Commission of Mexico.

Table 3 shows all of the annual average flow-weighted salinity levels and salinity differentials of the water resulting from operations under IBWC Minute No. 242 which began on June 25, 1974.

Exhibit 2, which demonstrates the effect of operations under the Minute, 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.

Quantities of United States Bypass Drain Water

The Yuma Desalting Plant, 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 (Cienega de Santa Clara) on the Gulf of California in Mexico. The water diverted to the United States Bypass Drain is then substituted by an equal volume of other water consisting of drainage return flows above the Northerly International Boundary (NIB) and Colorado River water from upstream storage.

Table 4 shows quantities of United States Bypass Drain water delivered, including the 2011 delivery of 161,108 tcm (130,612 af)[7], at SIB and substituted for by other water for the deliveries to Mexico under IBWC Minute No. 242 since the Act of 1974. There was no Bypass Drain water discharged back into the Colorado River above SIB during 2011.

DELIVERIES AT THE SOUTHERLY INTERNATIONAL BOUNDARY

[7] Source: USIBWC Yuma Field Office calculations

Point 1 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 5.** These volumes exclude the Wellton-Mohawk drainage water that was bypassed in accordance with Minute No. 242 (discussed above). Delivery volume made in 2011, which totaled 167,242 tcm (135,585 af) [8], 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 Point 1 c) of IBWC Minute No. 242.

Annual Average Flow-Weighted Salinity in the Water Delivered to Mexico in 2011 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 since the Act of 1974 are shown in **Table 6**. The 2011 average salinity of 1,157 ppm was lower than the 37-year average of 1,320 ppm, as well as the average of 1,540 ppm for the 10-year period of 1963-72.

The U.S. intends to continue meeting its legal obligations as described in IBWC Minute No. 242 by continuing to make the land boundary water deliveries with the salinity level required by this Minute.

Southerly International Boundary (SIB) Issues and Resolutions

Beginning in late 1995, Mexico raised objections to peaks in salinity levels and variability of flows in water delivered at SIB. The IBWC addressed these SIB matters through an international task force involving the federal water agencies of each country.

Mexico utilizes the 1944 Water Treaty water diverted at Morelos Dam for irrigation and domestic uses in the Mexicali Valley and conveys some of the water via aqueduct to Tecate and Tijuana. Mexico also uses some of the NIB delivered water, along with water from wells near San Luis, Sonora, for mixing with the drainage water that the U.S. continues to deliver at SIB so that the salinity level of these waters is suitable for farming. Mexico uses this combination of waters to irrigate agricultural land in the area of the Mexicali Valley in Sonora known as the Left Bank Unit. Thus, Mexico was concerned about reduction of crop yields, deterioration of soil quality, and increased water salinity on the Mexican side of the river.

Mexico, in this respect, requested that all its 1944 Water Treaty deliveries be made at NIB. This proposal was not practical to the U.S. because it is impossible to stop drainage flows arriving at SIB and the U.S. continues to have the right to make deliveries at SIB as part of the 1944 Water Treaty volume. Further, this request would require an additional release of stored Colorado River water in the U.S. that is fully appropriated. Finally, there was a need to better understand all the factors that influence increasing soil and groundwater salinity and lower crop yields along the west bank of the Colorado River.

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

The International Task Force met several times to exchange information on U.S. operations and Mexico's management of the delivered water. The Task Force narrowed the various alternatives for salinity control at SIB to a period of four months of the year (January and October through December) during which up to 8,000 af (9,868 tcm) of drainage water from the Boundary Pumping Plant, which pumps Main Drain water into the Sanchez-Mejorada Canal into Mexico, would be diverted to the United States Bypass Drain. It would be replaced with better quality water from the Minute 242 Well Field, discussed in the next section.

The Task Force also recommended structural modifications to the water delivery system at the SIB to reduce salinity levels and lessen the variability of flows delivered to Mexico. After examining various alternatives to ameliorate salinity peaks and variations in flows at SIB, the alternative to use variable speed motor controllers on the pumps at the Boundary Pumping Plant was chosen. The variable speed motor controller allows a pump to gradually increase its discharge until it reaches its maximum rate of discharge. If the forebay water surface elevation at the Boundary Pumping Plant does not drop, the variable speed pump will shut down and another pump will start up. If the forebay elevation still does not drop, the variable speed pump will start up again. Then it gradually increases its discharge rate until the forebay elevation drops. This should reduce the size of variation in water deliveries and salinity peaks at SIB.

Additions to the facilities at SIB based on the Task Force recommendations included: the replacement of one pump with a variable speed pump; construction of a bifurcation structure with three sluice gates; construction of a 7,000-foot concrete-lined diversion channel from the Boundary Pumping Plant to the United States Bypass Drain; and a control panel for the operation of all pumps and sluice gates.

All facilities have been completed with the exception of a remotely-operated salinity monitoring and control system. Installation of the original supervisory control and data acquisition (SCADA) system has occurred; however, equipment problems persist and the Bureau of Reclamation continues to evaluate the equipment to ensure it meets project specifications. Implementation of control strategies for the variable speed motor controller is pending further evaluations by the Bureau of Reclamation.

Yuma Desalting Plant

The Yuma Desalting Plant (YDP) has been maintained in ready reserve status since the first part of 1993 when the concrete lining of the United States Bypass Drain was damaged by floodwater from the Gila River and the quantity and quality of flows arriving at NIB made operation of the YDP unnecessary. A 90-day demonstration run of the plant at ten percent of its full capacity was conducted in 2007 by the Bureau of Reclamation which allowed 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 Bureau of Reclamation regarding an additional Pilot Run of the YDP 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.

The Bureau of Reclamation initiated the Pilot Run on October 29, 2009. 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 arranged for the delivery of 30,000 af of water to the Santa Clara Slough wetlands in Mexico to compensate for the reduction in flow and increased salinity from the operation of the YDP, as well as environmental monitoring of the wetland system. From October 2009 through March 2010, the U.S. conveyed their commitment of 10,000 af. Mexico began conveying flows through the bypass canal in the U.S. in April 2010 with the conveyance of 5,011 af by the end of the year. The non-governmental organizations did not convey flows to the Cienga de Santa Clara in 2010.

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 treated at the YDP and included in Treaty deliveries to Mexico, resulting in the conservation of a similar volume of water in Lake Mead. Storage credits for the conserved water were distributed among the water agencies which provided funding for the Pilot Run. Review of the data from the Pilot Run is being conducted by the Bureau of Reclamation and participating water agencies to evaluate potential long-term operation of the plant.

Cienaga de Santa Clara

The Cienega de Santa Clara (the Cienega) is the largest wetland on the Mexican portion of the Colorado River Delta. The origins of the Cienega 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 Cienega de Santa Clara. The Cienega is a protected area managed by Mexico's Comisi6n Nacional de Areas Naturales Protegidas (National Commission on Protected Natural Areas). The Cienega provides habitat for over 260 species of birds, including marsh birds, shorebirds, waterfowl, and migratory birds, as well as for dozens of fish species. Two listed species (threatened or endangered; both in the U.S and Mexico) inhabit the Cienega: the Yuma Clapper Rail and the Desert Pupfish.

In 2010, Minute 316 to the 1944 treaty between Mexico and United States stated the intention of the U.S. Bureau of Reclamation to operate the YDP for 365 days within an 18 month period beginning in May 2010. Minute 316 also expressed the intention by the U.S., Mexico and Non-Governmental Organizations to each arrange for 10,000 acre-feet of water delivered to the Bypass Drain and to implement a monitoring plan during the 2010-2011 pilot run of YDP.

In preparation for the 2010-2011 pilot run of the YDP, a binational group of scientists from universities, agencies and non-governmental organizations designed a monitoring program elements of which were funded by a contract with Central Arizona Water Conservation District, Metropolitan Water District of Southern California (MWD) and Southern Nevada Water Authority (SNWA), with additional funding from Mexico's Comisi6n Nacional de Areas Naturales Protegidas (CONANP) and the Institute Nacional Ecologia (INE). The monitoring program was facilitated by the International Boundary and Water Commission (IBWC) and Comisi6n Intemacional de Limites y Aguas (CILA). This monitoring project was a collaborative effort among the University of Arizona, the Sonoran Institute, Pronatura Noroeste, the Universidad Aut6noma de Baja California, and Centro de Investigaci6n en Alimentaci6n y Desarrollo.

The pilot run of the YDP ran from May 3, 2010 to March 26, 2011 and used some of the water that normally flows to the Cienega and added saline effluent to the canal that supplies water to the Cienega. Monitoring began in December 2009 and extended to June 2011, from approximately three months before until three months after the pilot operation of the YDP. Data from smaller-scale monitoring efforts that began in August 2006 were also utilized in this study.

Other events that occurred during the monitoring period included dredging of the Santa Clara-Riito Drain, the nearby magnitude 7.2 El Mayor-Cucapah earthquake of April4, 2010, the delivery of approximately 30,000 acre-feet (37 million cubic meters) of arranged water to the Cienega de Santa Clara, and the late-March 2011 fire that burned approximately 80% of the Cienega's vegetation.

The Cienega's vegetation is dominated by cattail *(Typha domingensis)* with some stands of common reed *(Phragmites australis)* and bulrush *(Scirpus americanus).* Satellite imagery and repeat oblique aerial photography showed strong seasonal changes in photosynthetic activity and a strong rebound in photosynthetic activity following an extensive fire in late March 2011. The vegetated footprint of the Cienega did not change substantially during the monitoring period and the vegetation recovered quickly from short-term disturbances such as changes in water level and fire.

Changes in marsh bird populations during the monitoring period were within the normal range of variability observed since surveys began in 1999, with 631 total detections of Yuma Clapper Rails during 2011, and a population estimate of 8,642 individuals for the same year. Marsh bird populations are not evenly distributed within the Cienega, indicating variation in habitat preferences among species. Yuma Clapper Rails show changes in their distribution within the Cienega since the surveys started in 1999. In 2011, these rails had the highest number of detections per point since the marsh bird surveys began in 1999.

Water loss occurs principally through direct evaporation and through transpiration by plants during their growing season. TDS varied at several sites during the monitoring period. The most common pattern observed was an increase in the spring and summer of 2010. Spring and summer increases of these magnitudes and durations were not observed at the same sites in spring and summer periods dating back to summer 2006. This pattern occurred at both interior and marginal sites. The increases were roughly coincident with the operation of the YDP at times when little or no arranged water was delivered to the Bypass Drain. TDS values returned to their baseline range of variability after the summer of 2010.

The short-term changes associated with the pilot operation of the YDP accompanied by the ~30,000 acre feet of arranged water, dredging, an earthquake and. an extensive fire did not cause significant changes to the features of the Cienega de Santa Clara monitored during the period of this study. The Cienega de Santa Clara appears to be an ecosystem that is resilient in the face of short-term disturbances and minor changes in water quality and quantity, minor changes in drainage resulting from earthquakes, and fire.

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 groundwater 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 2011, Mexico pumped 153,515 tcm (124,456 af) from its San Luis Mesa Well Field located within five miles (eight kilometers) of the boundary near San Luis. **Table 7** shows the annual quantities pumped by Mexico from its San Luis Mesa field.

The U.S. pumped a total of 53,449.5 tcm (43,332.1 af) within five miles of the boundary, including the Minute 242 Well Field. **Table 8** shows the annual quantities pumped by the U.S. from the Minute 242 Well Field and the total pumpage within five miles of the boundary near San Luis from 1975 through 2011.

The Bureau of Reclamation has constructed 21 wells of the original plan to build up to 35 wells that would eventually be required on the U.S. side of the SIB. Construction of the remaining 14 wells has been deferred until additional water supply needs make it necessary. All of the existing wells are located on the mesa within 5 miles (8 kilometers) of the SIB near San Luis. 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 2011, 21 wells were pumped.

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."*

On June 17, 2010, IBWC Minute No. 317 *Conceptual Framework for U.S.-Mexico Discussions on Colorado River Cooperative Actions* was signed and subsequently approved by the U.S. and Mexican governments. The agreement provides the framework for cooperative comprehensive planning of water management 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 addition to the Binational Core Group and four Work Groups established in 2008 under the U.S.-Mexico Joint Statement to identify Joint Cooperative Actions for management of Colorado River waters in both countries, a Consultative Council will be established under Minute No. 317 to facilitate consideration of the legal, administrative, and policy matters associated with the actions.

The Morelos Dam Sediment Removal Project conducted by the IBWC in 2009 removed a total of 256,977 cubic yards of sediment upstream and downstream of the spillway. On behalf of the U.S., Mexico is conducting the environmental mitigation project for the 15.6 hectares of vegetation cleared during the sediment removal project. A contract with PRONATURA Mexico, A.C. was signed December 6 and work began on December 14, 2010 for the restoration of 40 acres at the Laguna Grande site along the Colorado River in Mexico. Funding is being provided by the USIBWC. To date, PRONATURA has completed over 60% of the project.

The IBWC worked to address problems with giant salvinia (*Salvinia molesta*) and quagga mussels (*Dreissena bugensis*), two invasive species that have inhabited the Lower Colorado River Basin. The Aquatic Nuisance Species Task Force conducted quarterly meetings to discuss the invasive species problem. The Palo Verde Irrigation District continued to treat giant salvinia along the irrigation drains with chemical and manual controls; the giant salvinia has been removed from four of the five reaches under treatment. The presence of giant salvinia is also being reduced in Mexico as a result of control efforts.

ACKNOWLEDGMENT

The full cooperation of the United States Geological Survey and the 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.

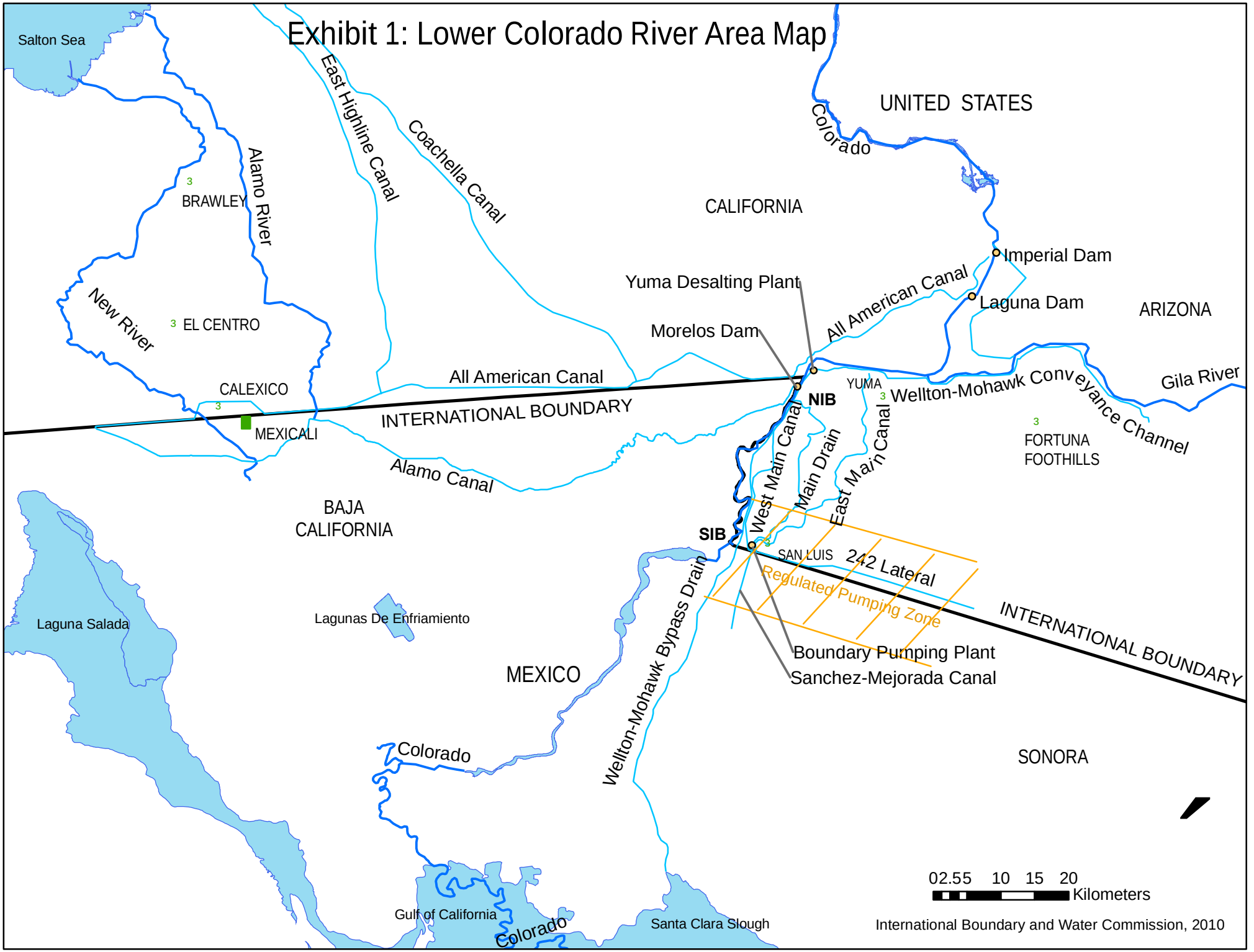
Exhibit 1: Lower Colorado River Area Map
Salton Sea
East Highline Canal
Coachella Canal
Colorado
UNITED STATES
Alamo River
BRAWLEY
CALIFORNIA
Imperial Dam
Yuma Desalting Plant
All American Canal
Laguna Dam
New River
EL CENTRO
Morelos Dam
ARIZONA
All American Canal
Gila River
CALEXICO
YUMA
NIB
Wellton-Mohawk Conveyance Channel
INTERNATIONAL BOUNDARY
MEXICALI
West Main Canal
Main Drain
East Main Canal
FORTUNA FOOTHILLS
Alamo Canal
BAJA CALIFORNIA
SIB
SAN LUIS
242 Lateral
Regulated Pumping Zone
INTERNATIONAL BOUNDARY
Laguna Salada
Lagunas De Enfriamiento
Wellton-Mohawk Bypass Drain
Boundary Pumping Plant
Sanchez-Mejorada Canal
MEXICO
Colorado
SONORA
Gulf of California
Colorado
Santa Clara Slough
02.55 10 15 20
Kilometers
International Boundary and Water Commission, 2010

Exhibit 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.

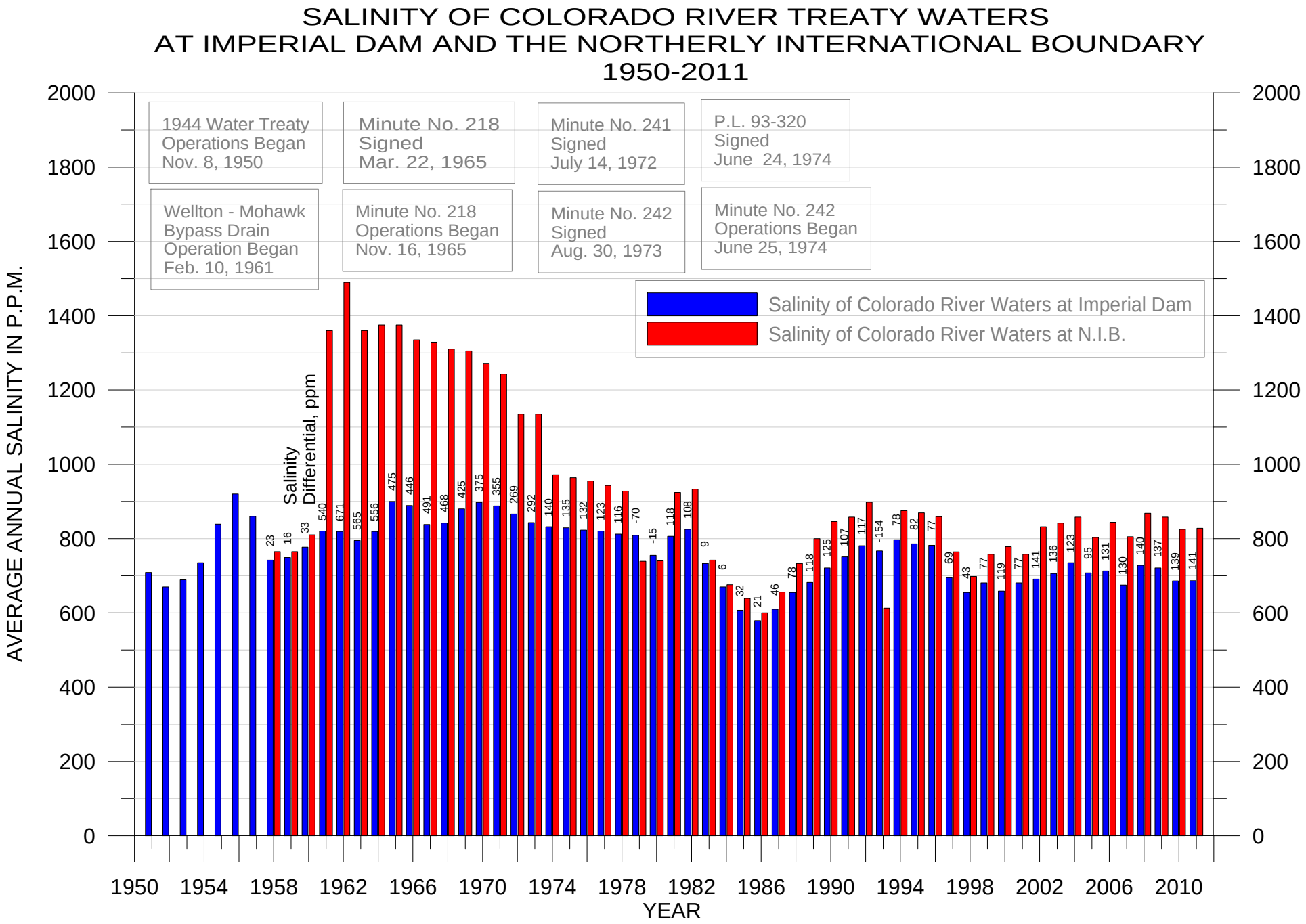

Table 3. Annual Average Flow-Weighted Salinities of the Water of the Colorado River Delivered Upstream of Morelos Diversion Dam [at Northerly International Boundary] and at Imperial Dam [Resulting from Operations under IBWC Minute No. 242, since the Colorado River Salinity Control Act, as amended, became 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

Table 4. United States Bypass Drain Water Delivered at Southerly International Boundary (SIB)		
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	220,988[1]	179,157[1]
1984	154,944[2]	125,615[2]
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	75,784[3]	61,439[3]
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

[1] Includes undetermined # floodwater from bypass canal levee breaks in U.S.

[2] Includes Gila River water.

[3] 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 5. 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

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

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[1]	5,867[1]
1994	76,281	61,841
1995	48,830	39,587
1996	81,039	65,699
1997	36,576	29,653
1998	0[2]	0[2]
1998	0[2]	0[2]
1999	0[2]	0[2]
2000	0[2]	0[2]
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

[1] The reduced pumping was due to excess delivery from the Gila River flood flows.
[2] 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				
Year	**Total Volume Pumped**		**242 Well Field Volume Pumped [1]**	
	(tcm)	**(af)**	**(tcm)**	**(af)**
1975	33,401	26,787		
1976	28,047	22,738		
1977	28,358	22,990		
1978[1]	22,079	17,900		
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

[1] Minute No. 242 Well Field was constructed in 1978.