APPENDIX H-2

Hydrology and Hydrologic Models

2006

Table of Contents

List of Tables

List of Figures

APPENDIX H-2
HYDROLOGY AND HYDROLOGIC MODELS

This appendix describes the development of historical and future hydrology of the Salton Sea to support the Draft Programmatic Environmental Impact Report (PEIR) and Ecosystem Restoration Study. A comprehensive analysis of the hydrology of the Salton Sea watershed is necessary to approximate the water and salt budgets at the Salton Sea under both existing and future conditions. The PEIR alternatives were developed with consideration of the water and salt budgets, including uncertainty related to future changes in these conditions. This is particularly critical with respect to future proposed Salton Sea elevation and salinity goals.

As part of the PEIR effort, a technical Inflows/Modeling Working Group conducted meetings in 2005 and 2006 relating to the hydrology of the Salton Sea. The purpose of the Working Group meetings were to collect information, present draft technical analyses, receive comments, and allow for discussion regarding Salton Sea hydrology. The components of the hydrology and future hydrologic scenarios presented herein have been previously presented at the Working Group meetings.

DESCRIPTION OF STUDY AREA

The Salton Sea is a terminal, saline lake located in the southeastern corner of California and within one of the most arid regions in North America. The Salton Sea is the largest lake in California, measuring about 35 miles long and 9 to 15 miles wide with about 360 square miles of water surface area and 120 miles of shoreline. The Salton Sea lies in a geographic depression known as the Salton Basin located about -278 feet mean sea level (msl). The water surface elevation on January 1, 2005, is about -228.7 feet msl (USGS, 2005). At this elevation the Salton Sea has a maximum depth of about 50 feet, an average depth of 30 feet, and water storage volume of about 7,200,000 acre-feet.

Background

The Salton Basin is the northern arm of the former Colorado River delta system. Throughout the millennia, the Colorado River has deposited water and sediments across the delta through many distributaries sometimes discharging south to the Gulf of California and sometimes discharging floodwater north into the Salton Basin. The floodwaters in the Salton Basin periodically formed a large, temporary lake known as Lake Cahuilla (Pomeroy and Cruse, 1965; Ogden, 1996). The Colorado River would eventually return to the southerly path and, without a water supply, the lake waters would evaporate leaving behind millions of tons of salts. The last transient existence of Lake Cahuilla may have been as recent as 300 or 400 years ago and is described in native American folklore and verified through carbon dating (Ogden, 1996). Eventually the floods of the Colorado River built a slight natural berm that created a topographically separate Salton Basin from the Gulf of California.

During large floods of the Colorado River, however, flood flows are reported to have reached the Salton Basin in at least 8 years during the 19th century (Ogden, 1996). The current Salton Sea was formed during 1905 to 1907 as a result of a failure of a diversion structure on the Colorado River in which the Colorado River flowed uncontrolled into the Salton Basin (Ogden, 1996; Hely et al., 1966). The water surface elevation of the Salton Sea rose to a maximum of -195 feet msl by the time the diversion dike was repaired in 1907, but rapidly receded to about -250 feet msl in 1925 as evaporation exceeded the rate of agricultural drainage flows to the Salton Sea. In 1925, the elevation of the Salton Sea started to increase due to increased discharge of drainage from agricultural areas in Imperial, Coachella, and Mexicali valleys.

The Salton Sea is saline due to the accumulation of salts left behind through evaporation. The Colorado River water which formed the Salton Sea during 1905 to 1907 is estimated to have had an average salinity of about 500 milligrams/liter (mg/L) (Hely et al., 1966). However, the large amount of salts that had accumulated during previous inundations in past centuries rapidly dissolved into the fresh water. This redissolution of salts, combined with high evaporation rates and minimal inflows, caused the salinity to rapidly rise to above 40,000 mg/L total dissolved solids by 1925. The salinity decreased in the late 1920s as irrigated agriculture expanded and caused greater drainage flows to enter the Salton Sea. During the 1930s, agricultural activity and agricultural drainage flows declined, and the salinity increased to more than 43,000 mg/L. The salinity declined during the 1940s and 1950s to near ocean salinity (35,000 mg/L), and then slowly rose to about 46,550 mg/L in the early 2000s (Hely et al., 1966; Tostrud, 1997; Holdren, 2005).

Salton Sea Watershed

The Salton Sea watershed encompasses an area of about 8,360 square miles from San Bernardino County in the north to the Mexicali Valley (Republic of Mexico) to the south. The Salton Sea lies at the lowest point in the watershed and collects runoff and agricultural drainage from most of Imperial County, a portion of Riverside County, smaller portions of San Bernardino and San Diego counties, as well as the northern portion of the Mexicali Valley, as shown in Figure H2-1. Mountains on the west and northeast rims of the basin reach elevations of 3,000 feet in the Coyote Mountains to over 11,000 feet in the San Jacinto and San Bernardino mountains. To the south, the basin extends to the crest of the Colorado River Delta. About one-fifth of the basin is below or only slightly above mean sea level (Hely et al., 1966). Annual precipitation within the watershed ranges from less than 3 inches near the Salton Sea to 40 inches in the upper San Jacinto and San Bernardino Mountains. The maximum temperature in the basin exceeds 100 degrees Fahrenheit (°F) for more than 110 days/year. The open water surface evaporation rate at the Salton Sea is estimated at about 69 inches/year and average crop reference evapotranspiration rate at Brawley is reported to be about 71 inches/year (DWR, 2005). Average monthly patterns of the precipitation, temperature, and evapotranspiration near the Salton Sea are shown in Figure H2-2. Long term annual precipitation is shown in Figure H2-3.

Agriculture in Imperial and Coachella valleys is sustained by Colorado River water diverted at Imperial Dam and delivered via the All-American and Coachella canals. In recent years, total diversions from the Colorado River at the Imperial Dam have ranged from about 3,000,000 to 3,600,000 acre-feet/year to support irrigated agriculture in the Imperial and Coachella valleys (Reclamation, 1999-2003). Agricultural drainwater from these areas and parts of the Mexicali Valley, as well as municipal and industrial discharges in the watershed, feed the major rivers flowing to the Salton Sea. The principal sources of inflow to the Salton Sea are the Whitewater River to the north, New and Alamo rivers to the south, and direct drainage from agricultural areas in both Imperial and Coachella valleys. Smaller contributions to inflow come from San Felipe Creek to the west, Salt Creek to the east, direct precipitation, and subsurface inflow. Total average inflow to the Salton Sea over the 1950 to 2002 period is estimated to be 1,300,000 acre-feet/year.

Due to a variety of conditions ranging from implementation of the Quantification Settlement Agreement (QSA) which includes Imperial Irrigation District (IID) water transfers to the San Diego County Water Authority (SDCWA), potential transfers to the Metropolitan Water District of Southern California (Metropolitan), water management planning in the Coachella and Imperial valleys, and water conservation/reuse in Mexicali, inflows to the Salton Sea will be reduced in the future. The reduced inflows will result in declining water surface elevations in the Salton Sea and will further contribute to increases in Salton Sea salinity, as described below.

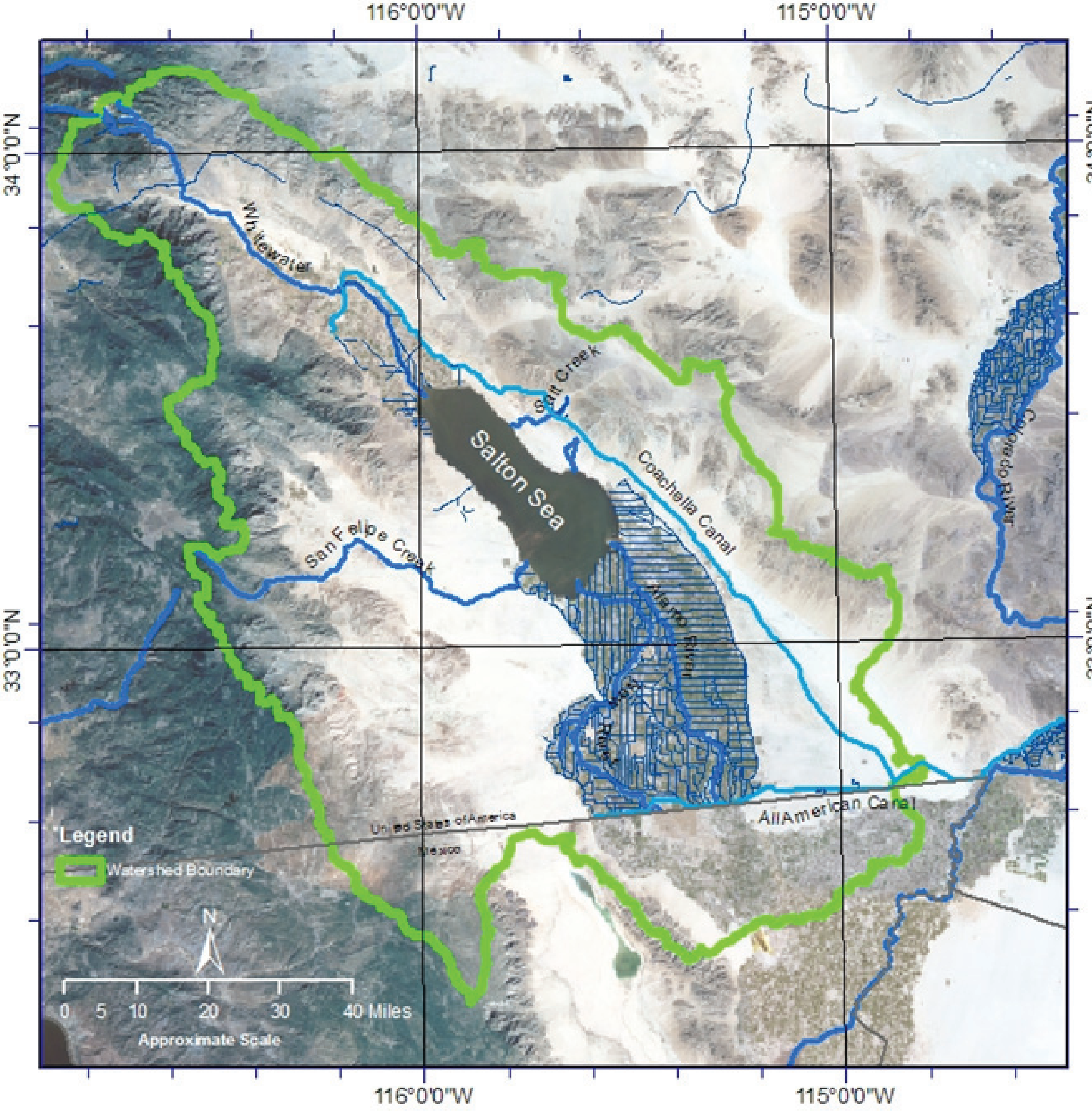

FIGURE H2-1
SALTON SEA WATERSHED AND MAJOR CONTRIBUTING STREAMS

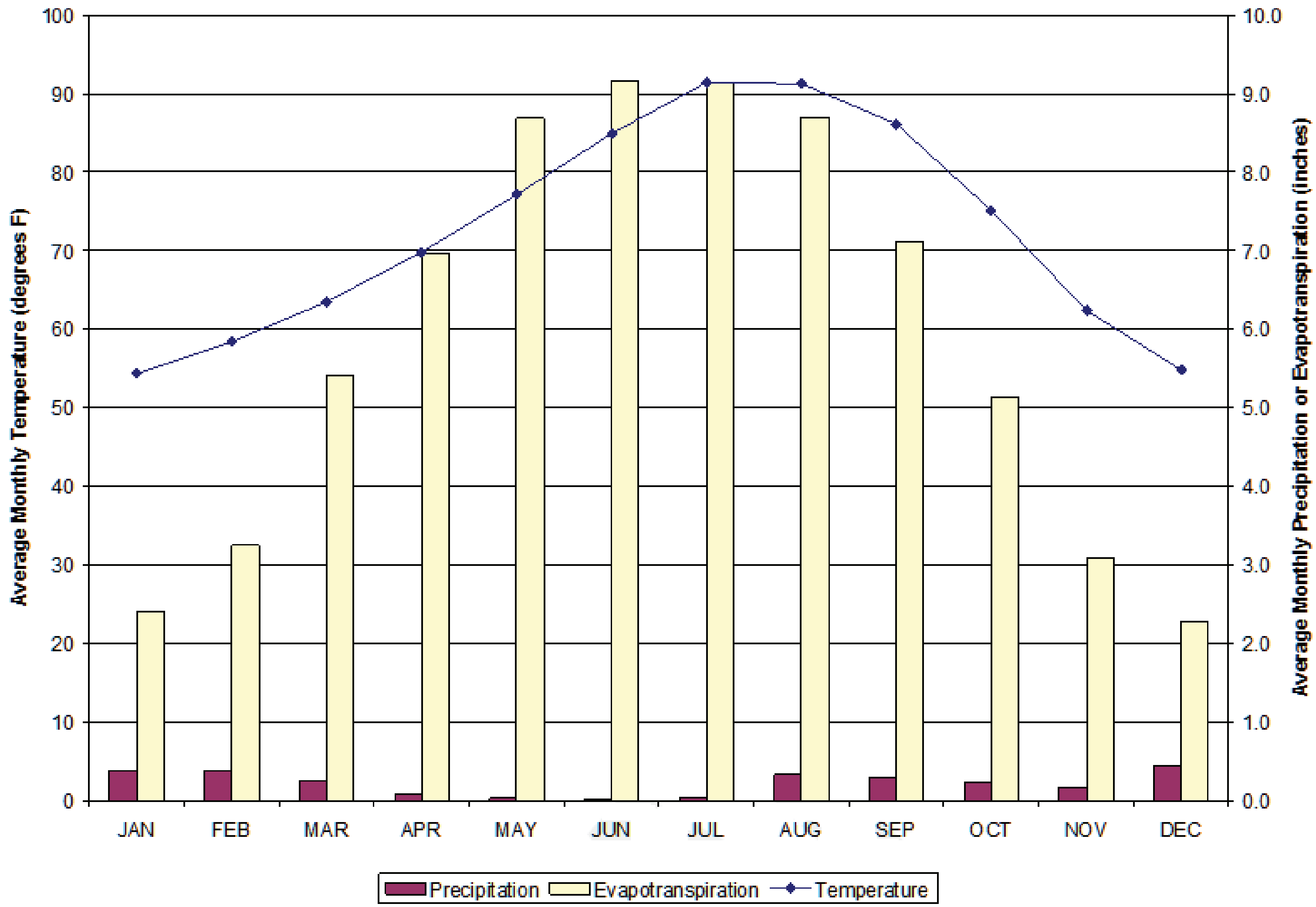

FIGURE H2-2
LONG-TERM AVERAGE MONTHLY TEMPERATURE, PRECIPITATION, AND EVAPOTRANSPIRATION AT BRAWLEY (1927-2005)

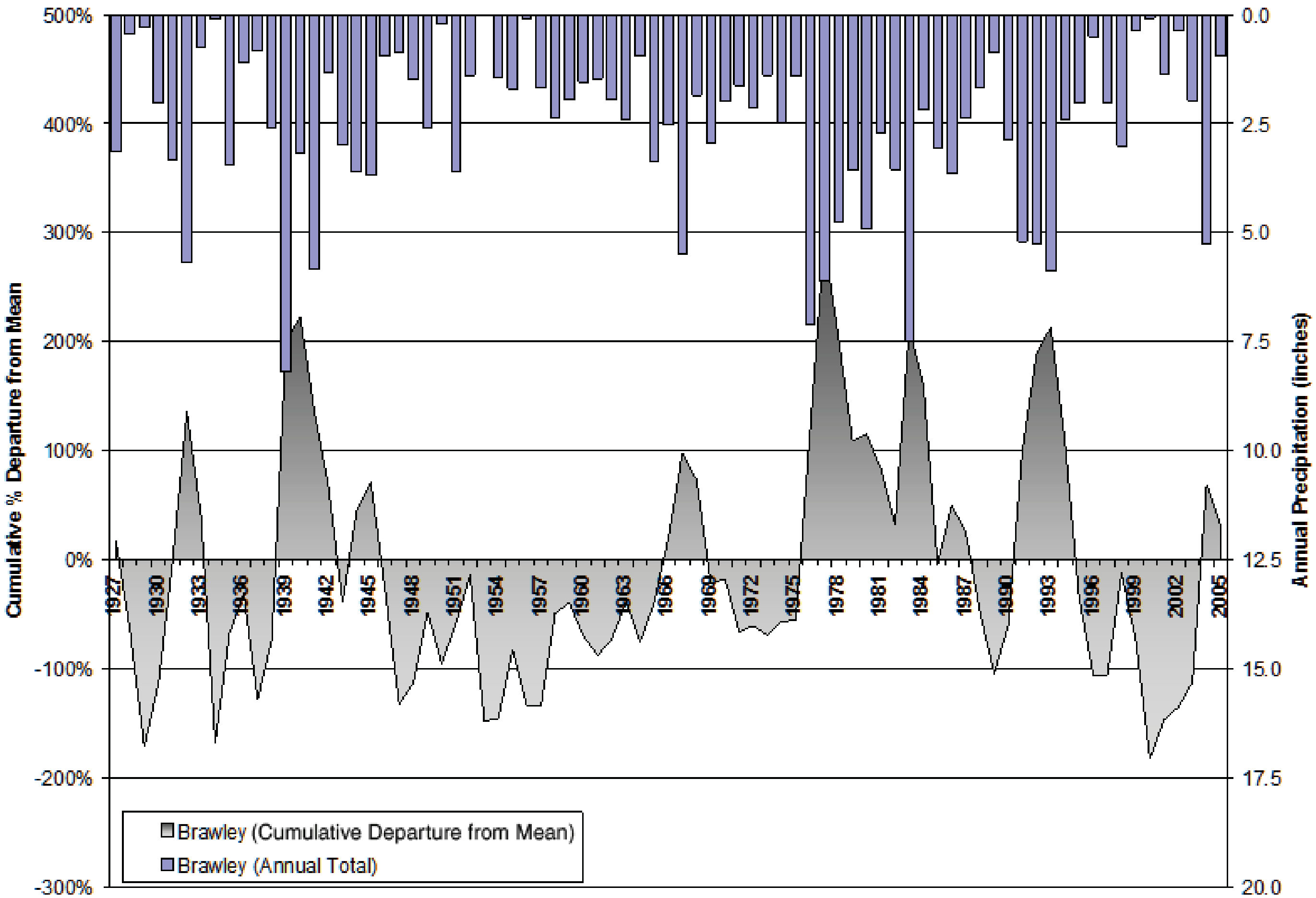

FIGURE H2-3
ANNUAL PRECIPITATION AND PERCENT CUMULATIVE DEPARTURE FROM THE MEAN VALUES AT BRAWLEY (1927-2005)

SUMMARY OF GOALS AND APPROACHES

The principal goals of this hydrologic assessment are to (1) develop a refined *historical* hydrology and water budget based upon review of existing analyses and data, and (2) to prepare estimates of *future* hydrology for use in No Action Alternative analysis in the PEIR. The refined historical hydrology was necessary to include greater spatial detail of the local watershed inflow contribution and resulting historical water budget. Development of the No Action Alternative is a requirement of the California Environmental Quality Act (CEQA). In the PEIR, there were other conditions that could occur in the next 75 years but have not been evaluated in environmental documentation. Therefore two conditions were evaluated for the No Action Alternative. The first condition, No Action Alternative-CEQA Conditions, is governed by guidance from CEQA that limits consideration to those projects and actions which may be reasonably expected to occur in the foreseeable future if the project is not implemented. The second condition, No Action Alternative-Variability Conditions, is described to present a range of estimates of *future* hydrology considering uncertainty in future conditions. The future hydrologic scenarios are necessary to bracket a reasonable range of potential future hydrologic conditions that may occur over the next 75 years.

In many hydrologic analyses, existing levels of development (land and water use conditions) combined with long term climate conditions are used to provide projections of future baseline hydrologic conditions. Future planned projects that may occur are then reviewed to determine their potential impacts on the future baseline hydrology. However, due to the considerable level of detail in previous hydrologic analyses, including the QSA, IID Water Conservation and Transfer Project, Coachella Valley Water District Management Plan, results for several inflow sources were adopted from previous work after review and consultation with Working Group members. New methods and computations developed as part of this assessment attempted to use consistent climate periods and data as previous work. The sources of information used in this analysis are identified under the appropriate sections in the remainder of this appendix.

The hydrologic analyses presented in this appendix are performed on an annual basis over the 75-year planning horizon from 2003 to 2078. The inflows and salt loads to the Salton Sea described in this appendix are categorized by geographical source areas: Mexico, Imperial Valley, Coachella Valley, and local watershed contributions. Estimates of both surface and subsurface flows and salt loads to the Salton Sea are included. In order to support more detailed hydrologic modeling of the PEIR alternatives, the annual hydrology has been down-scaled to a monthly level for the study period.

HISTORICAL HYDROLOGY AND SALT LOADS

Contributions of inflow to the Salton Sea come from agricultural runoff, watershed runoff, subsurface flow, and direct precipitation on the water surface. An analysis of the historical Salton Sea hydrology is necessary to characterize the recent conditions and to provide estimates of water and salt balances at the Salton Sea. In particular, water surface evaporation and precipitation of salts can be estimated from long term water and salt balances. As previously discussed, the hydrologic components are categorized according to source areas due to their general dependence on water management within the respective areas.

Period of Historical Analysis

The selected period of analysis for this historical study is from calendar year 1950 to 2002. This period was selected because it represents the period of time in which most of the existing water infrastructure was in place, a reasonably complete data set could be developed, and it spans a hydrologically varied period ending at the beginning point for the QSA.

Inflows from Mexico

Sources of inflow to the Salton Sea from Mexico are flows in the New and Alamo rivers. Both rivers originate in Mexico and flow to the north across the United States-Mexico border into the United States. The data and methods used to develop the historical hydrology for these sources are described below.

New River

The New River is supplied by agricultural drain flows from the Mexicali Valley, municipal sewage and industrial discharges from Mexicali, and flood flows from the local drainage. During 1905 to 1907, when the Colorado River flowed into the Salton Sea, a considerable portion flowed through the New River channel (USIBWC, 2002). Discharge in the New River at the United States-Mexico border (USGS Station Number 10254970) is reported by the Department of the Interior, Geological Survey (USGS) for 1979 to 2004. IID (2002 and 2003a) estimated the flows at the United States-Mexico border for the period of 1950 to 2002. Minor discrepancies, of less than one percent, exist between IID and USGS estimates for flows in the New River at the United States-Mexico border. To provide consistency with other IID data sources and due to a more complete IID data set, the IID reported discharge in the New River at the United States-Mexico border was used rather than USGS data. Average flow in the New River at the United States-Mexico border is 129,523 acre-feet/year with a minimum of 29,505 acre-feet/year in 1954 and a maximum of 267,904 acre-feet/year in 1984. Flow in the New River at the United States-Mexico border is strongly correlated to the volume of flow in the Colorado River at the location north of the United States-Mexico border that is upgradient of the diversion structure for the Mexicali Valley.

Alamo River

Flows in the Alamo River at the United States-Mexico border are primarily the result of drainage from irrigated agricultural in the Mexicali Valley. Pursuant to an agreement between the United States and Mexico, a weir was constructed in 1997 on the Alamo River in Mexico, about 100 feet upstream of the United States-Mexico border with the intent of preventing dry weather flows from Mexico from flowing into the United States. Although the weir is currently in place, lack of operation and maintenance of drainage channels upstream has caused the water to continue to flow into the United States (CRBRWQCB, 2001). Alamo River flows at the United States-Mexico border have been estimated by IID (2002 and 2003a), but details regarding the methods and sources are not included in those documents. The United States International Boundary and Water Commission (USIBWC) reports that flows from 1949 to 1992 were estimated based on historical daily measurements of gage height at the Cipolleti weir and rating curves developed from monthly current meter measurements. From 1992 to the present, continuous gage height recordings and daily discharge measurements are available from IID (USIBWC, 2002). The data provided by IID have been adopted for use in this analysis. Average flow in the Alamo River at the United States-Mexico border is 1,646 acre-feet/year with a minimum and maximum of 324 and 2,274 acre-feet/year, respectively.

Salt Loads

The total salt load contributed by Mexico to the Salton Sea in the New and Alamo rivers has been estimated by IID as part of an overall Imperial Valley salt balance analyses. The estimates for 1950 to 1999 (IID, 2002) suggest that in recent years about 3 to 4 tons of salt, measured as total dissolved solids, is carried with every acre-foot of flow from Mexico. The salt loads are primarily the result of Colorado River salinity combined with groundwater withdrawals and agricultural practices in the Mexicali Valley. Municipal discharges contribute to a lesser extent. Salt loads from Mexico for 2000 to 2002 were estimated by multiplying the unit loads (tons/acre-feet) for 2003 (IID, 2003b) times the Mexico flows for individual years for the New and Alamo rivers. Average salt load contributed by Mexico in the New and

Alamo rivers for the historical period is estimated at 627,000 tons/year, but analysis suggests that the loads are less than 500,000 tons/year in recent years.

Inflows from Imperial Valley

Sources of inflow to the Salton Sea from the Imperial Valley are the New and Alamo rivers, IID direct drains, and groundwater discharge. The primary source of all Imperial Valley flows to the Salton Sea is from agricultural drainage. The data and methods used to develop the historical hydrology for these sources are described below.

New River

Flows of the New River as measured at the confluence with the Salton Sea are reported by IID for 1950 to 2002 (IID, 2002 and 2003a). Measured discharge data reported by the USGS spans the period of 1943 to present (USGS, 2005). IID reports that in the past IID and USGS alternated years for measuring the discharge of the New River near Westmorland (USGS Station Number 10255550), and some minor discrepancies (less than one percent) resulted in the data sets, particularly since 1987 (Eckhardt, 2005). To provide consistency with other Imperial Valley discharge estimates, IID reported discharge in the New River was used rather than those from the USGS. Since the flow at this location represents combined Mexico and Imperial Valley contributions, the contribution from the Imperial Valley is calculated by subtracting the Mexico contribution from the total flow. Average flow in the New River near the outlet to the Salton Sea is 440,974 acre-feet/year with the Imperial Valley contribution accounting for about 71 percent of the total. Average Imperial Valley contribution to New River discharge is estimated at 311,452 acre-feet/year with a minimum of 229,294 acre-feet/year in 1985 and a maximum of 509,431 acre-feet/year in 1953.

Alamo River

Flows of the Alamo River as measured at the confluence of the Salton Sea are reported by IID for 1950 to 2002 (IID, 2002 and 2003a). Measured discharge data reported by the USGS spans the period of 1963 to present (USGS, 2005). IID reports that in the past IID and USGS alternated years for measuring the discharge of the Alamo River near Niland (USGS Station Number 10254730) and some minor discrepancies (less than one percent) resulted in the data sets, particularly since 1982 (Eckhardt, 2005). To provide consistency with other Imperial Valley discharge estimates, IID reported discharge in the Alamo River was used rather than those from the USGS. Since the flow at this location represents combined Mexico and Imperial Valley contributions, the contribution from the Imperial Valley is calculated by subtracting the Mexico contribution from the total flow. Average flow in the Alamo River near the outlet to the Salton Sea is 625,961 acre-feet/year with the Imperial Valley contribution accounting for over 99 percent of the total. Average Imperial Valley contribution to Alamo River discharge is estimated at 624,315 acre-feet/year with a minimum of 497,102 acre-feet/year in 1986 and a maximum of 755,355 acre-feet/year in 1953.

IID Direct Drains

A portion of the IID drains flow into the New and Alamo rivers. Some of the IID drains flow directly into the Salton Sea and are referred to as "IID direct drains." Historical discharge from IID direct drains has been estimated by IID for the period of 1950 to 2002 (IID, 2002 and 2003a). The USGS (Hely et al., 1966), as part of an evaluation of evaporation at the Salton Sea, independently measured flows and provided estimates of total direct IID drain flows to the Salton Sea for years 1961 to 1962. The values reported by the USGS for 1961 to 1962 are significantly higher (about two times greater) than that estimated by IID for the same period. The USGS attributed the differences in discharge estimates primarily to differences in measurement techniques. USGS estimates were based on direct gage measurements of the major drains. IID estimates were based, in part, on gate rating curves and historic gate openings. However, the IID data provides a consistent, long term continuous data set that is consistent with other measurements in the Imperial Valley. The IID reported direct drain discharge values have been used in this analysis. Direct drainage accounts for about 10 percent of total Imperial Valley contributions to the Salton Sea inflow and is estimated at 93,848 acre-feet/year.

Groundwater Inflows

Groundwater conditions in the Imperial Valley are such that lacustrine deposits prohibit significant deep percolation of irrigation water and inhibit well yields of any substantial quantities (Loeltz et al., 1975). Tile drains have been installed throughout the Imperial Valley to convey shallow groundwater away from the root zone of crops. As such, most shallow groundwater, leaching water, or excess irrigation water is accounted in the surface discharge of drains and the New and Alamo rivers. However, small quantities of groundwater in the Imperial Valley are believed to discharge directly to the Salton Sea. Hely et al. (1966) estimated the groundwater discharge to the Salton Sea to be less than 2,000 acre-feet/year and IID (2002) has estimated this value to be about 1,000 acre-feet/year. The IID estimate of 1,000 acre-feet/year has been adopted as a reasonable estimate of historical groundwater discharge to the Salton Sea from the Imperial Valley.

Salt Loads

The total salt load contributed by the Imperial Valley to the Salton Sea through discharge in the New and Alamo rivers, IID direct drains, and groundwater has been estimated by IID for 1950 to 1999 (IID, 2002). The salt loads are almost solely contributed by agricultural drainage which is affected by source water salinity (Colorado River) and irrigation practices. In order to sustain agriculture in the Imperial Valley, the long term export of salt needs to be equal or greater than that imported through diversion from the Colorado River. About 3 tons of salt is carried with every acre-foot of drainage discharge from the Imperial Valley. Salt loads from the Imperial Valley for 2000 to 2002 were estimated by multiplying the unit loads (tons/acre-foot) for 2003 (IID, 2003b) times the respective flow contribution for individual years for the New and Alamo rivers and IID direct drains. Average salt load from the Imperial Valley for the historical period is estimated at 3,555,000 tons/year.

Inflows from Coachella Valley

Sources of inflow to the Salton Sea from the Coachella Valley are the Whitewater River/Coachella Valley Stormwater Channel (CVSC), direct drainage from the lower valley, and groundwater discharge. The primary sources of flow from the Coachella Valley to the Salton Sea are agricultural return flows, stormwater runoff, and fish farm and municipal wastewater discharges. The data and methods used to develop the historical hydrology for these sources are described below.

Whitewater River/Coachella Valley Storm Channel and Direct Drains

The Whitewater River is the primary river drainage channel of the Coachella Valley and collects stormwater runoff, agricultural return flows, and municipal and fish farm discharges. The CVSC is a 17-mile man-made, unlined extension of the Whitewater River and is the principal drainage channel for the lower valley. The channel was constructed to safely pass storm flows and to provide adequate drainage for agricultural lands in the area of semi-perched groundwater. Throughout the lower valley agricultural drains have been installed to convey shallow groundwater away from crop root zones. These drains convey water to the CVSC and 25 smaller open channel drains that discharge directly to the Salton Sea (CVWD, 2002). Direct discharge of the Whitewater River/CVSC near the Salton Sea has been measured by USGS (Station Number 10259540) since 1960 and has been estimated by Coachella Valley Water District (CVWD) for 1950 to 1959 (IID, 2002). During this period, the direct drains to the Salton Sea contributed nearly 40 percent of the total annual volume of Coachella Valley discharge. Total Coachella Valley surface flow to the Salton Sea has been estimated for 2000 to 2002 through USGS measurements of Whitewater

River/CVSC flow (USGS, 2005) and recent direct drain percentages. Average total surface discharge from the Coachella Valley to the Salton Sea for the historical period is estimated at 113,827 acre-feet/year with a minimum of 53,368 acre-feet/year in 1957 and a maximum of 174,684 acre-feet/year in 1976. In recent years total surface discharge has been less than 90,000 acre-feet/year.

Groundwater Inflows

The Coachella Valley groundwater basin serves as an important source of water for agriculture and municipal uses. Outflows from the groundwater basin (primarily groundwater pumping, discharge to surface drains, phreatophyte consumptive use) have exceeded inflows to the basin (primarily from return flows and artificial recharge) resulting in overdraft conditions (CVWD, 2002). CVWD estimates that total groundwater basin storage has been reduced by 1,421,400 acre-feet since 1936. Declining groundwater levels near the Salton Sea have caused a reversal of the groundwater gradient and has led to intrusion of higher salinity Salton Sea water into the lower portion of the groundwater basin. Groundwater discharge to the Salton Sea is estimated to have been about 2,710 acre-feet/year in 1950 when groundwater levels were higher, and has gradually been reduced (IID, 2002 and CVWD, 2002). Annual groundwater inflows to the Salton Sea for 2000 to 2002 were estimated by extending the recent trend of the 1950 to 1999 data. While direct groundwater interactions with the Salton Sea may appear to be relatively small in terms of discharge volumes, it should be recognized that most of the surface discharge to the Salton Sea through the Whitewater River/CVSC and direct drains are the delayed result of groundwater discharge.

Salt Loads

The total salt load contributed by the Coachella Valley to the Salton Sea through discharge in the Whitewater River/CVSC, direct drains, and groundwater has been estimated by CVWD for 1950 to 1999 (IID, 2002). The salt loads are primarily contributed by agricultural drainage and municipal wastewater flows which are affected by source water salinity (Colorado River and groundwater) and agricultural and urban water management practices. Less than 2 tons of salt per acre-foot of drainage discharge is contributed from the Coachella Valley. Salt load from Coachella Valley surface discharge for 2000 to 2002 was estimated by multiplying the unit load (tons/acre-feet) for 1999 times the total surface flow for individual years. Groundwater salt load (removal in this case) for 2000 to 2002 was estimated by extending the recent trend of the 1950 to 1999 data. Average net salt load from the Coachella Valley for the historical period is estimated at 262,000 tons/year, but in recent year the loads are estimated at less than half this value.

Inflow from Portions of the Watershed Not Tributary to Irrigated Areas of Imperial and Coachella Valleys

The portions of the Salton Sea watershed that are not tributary to the irrigated areas of Imperial and Coachella valleys is about 2,292 square miles and consist of the drainages of San Felipe Creek, Salt Creek, and other minor channels and washes on the west and east shoreline of the Salton Sea. These areas receive only moderate amounts of rainfall, but do contribute both surface and subsurface inflow to the Salton Sea. The data and methods used to develop the historical hydrology for these sources are described below.

San Felipe Creek

The San Felipe Creek watershed encompasses about 1,693 square miles including much of Anza-Borrego State Park, Borrego and Clark Sinks, and most of the western portion of the Salton Sea watershed. Rainfall and snowmelt runoff from the mountains to the west contribute to streamflow in the upper portions of San Felipe Creek. Some perennial reaches exist in the mountain areas, but San Felipe Creek discharge to the Salton Sea is generally restricted to the summer thunderstorms on the desert floor and heavy winter storms. Discharge from San Felipe Creek, about 4 miles upstream of the Salton Sea, was measured by the USGS (Station Number 10255885) from 1961 to 1991 (USGS, 2005). The hydrologic data set was extended for the entire historical period by developing a relationship between San Felipe

Creek discharge and precipitation at Brawley, as shown in Figure H2-4. Estimated average discharge from San Felipe Creek to the Salton Sea for the historical period is 4,532 acre-feet/year with a minimum of 60 acre-feet/year in 1973 and a maximum of 40,638 acre-feet/year in 1976.

Salt Creek

Salt Creek, on the eastern side of the Salton Sea, drains a watershed of about 269 square miles. Salt Creek is a perennial stream supplied by seepage from the Coachella Canal, groundwater discharge downslope of the canal, and occasional rainfall runoff. USGS (2005) has continuously measured discharge at Salt Creek, about 0.3 miles upstream of the Salton Sea (Station Number 10255550) from 1961 to 2004 except for water year 1974. Over time, phreatophyte vegetation has grown steadily in areas upstream of the gaging station and, through consumptive use, has reduced the baseflow at the gage. Baseflow is estimated to have been reduced from about 4,000 acre-feet/year in the early 1960s to less than 600 acre-feet/year between 1996 and 2002. The hydrologic data set was extended for the entire historical period by separating out the baseflow and rainfall runoff components. Analysis of historical trends indicate that little rainfall runoff developed at the gaging station for years in which less than 4 inches of rainfall was measured at Mecca. A relationship between Salt Creek rainfall runoff discharge and precipitation at Mecca was developed, as shown in Figure H2-5. The total annual discharge for the missing periods (1950 to 1960, and 1974) was estimated by adding the estimate of rainfall runoff to the early 1960s estimated baseflow. Estimated average total discharge from Salt Creek to the Salton Sea for the historical period is 3,968 acre-feet/year with a minimum of 486 acre-feet/year in 2002 and a maximum of 17,227 acre-feet/year in 1983. Since 1996, the discharge has not exceeded 700 acre-feet/year due to extensive vegetation.

Other Surface Inflows

The remaining 330 square miles of the watershed not tributary to the irrigated areas of Imperial and Coachella valleys or San Felipe and Salt creeks consist of nearly equal areas on the western and eastern shore. No data are available for runoff from these areas. As part of this analysis, the runoff from these areas was estimated by assuming the rainfall runoff response was similar to that of the adjacent gaged areas. It was assumed that rainfall in the western portion of the watershed responds similarly to rainfall in the lower San Felipe Creek drainage and that rainfall in the eastern portion of the watershed responds similarly to the rainfall runoff component of the Salt Creek discharge. Estimates of discharge for these areas were developed by prorating the respective gaged discharge (either San Felipe Creek or rainfall runoff component of Salt Creek discharge) by the relative size of watershed. For the western portion of the watershed, only the lower hydrologic unit of the San Felipe Creek drainage (504 square miles) was assumed to contribute to discharge at the Salton Sea as most of the upper drainage runoff flows to sinks or groundwater recharge, or is consumed by phreatophyte vegetation. The estimated average discharge from these ungaged areas for the historical period is 2,031 acre-feet/year.

Groundwater Inflows

Groundwater inflow to the Salton Sea from areas outside of the Imperial and Coachella valleys was estimated by Hely et al (1966) and Loeltz et al. (1975) to be about 10,000 acre-feet/year. The groundwater underflow entering the perimeter of the Salton Sea comes primarily from the alluvium underlying San Felipe Creek. The geology of the east shore is such that most of the groundwater flow discharges as either surface inflow or evapotranspiration (Hely et al., 1966). While it is likely that annual variations in the groundwater inflow to the Salton Sea occur, understanding of the groundwater conditions is not well-known. A constant groundwater inflow of 10,000 acre-feet/year from areas not tributary to the Imperial and Coachella valleys is assumed.

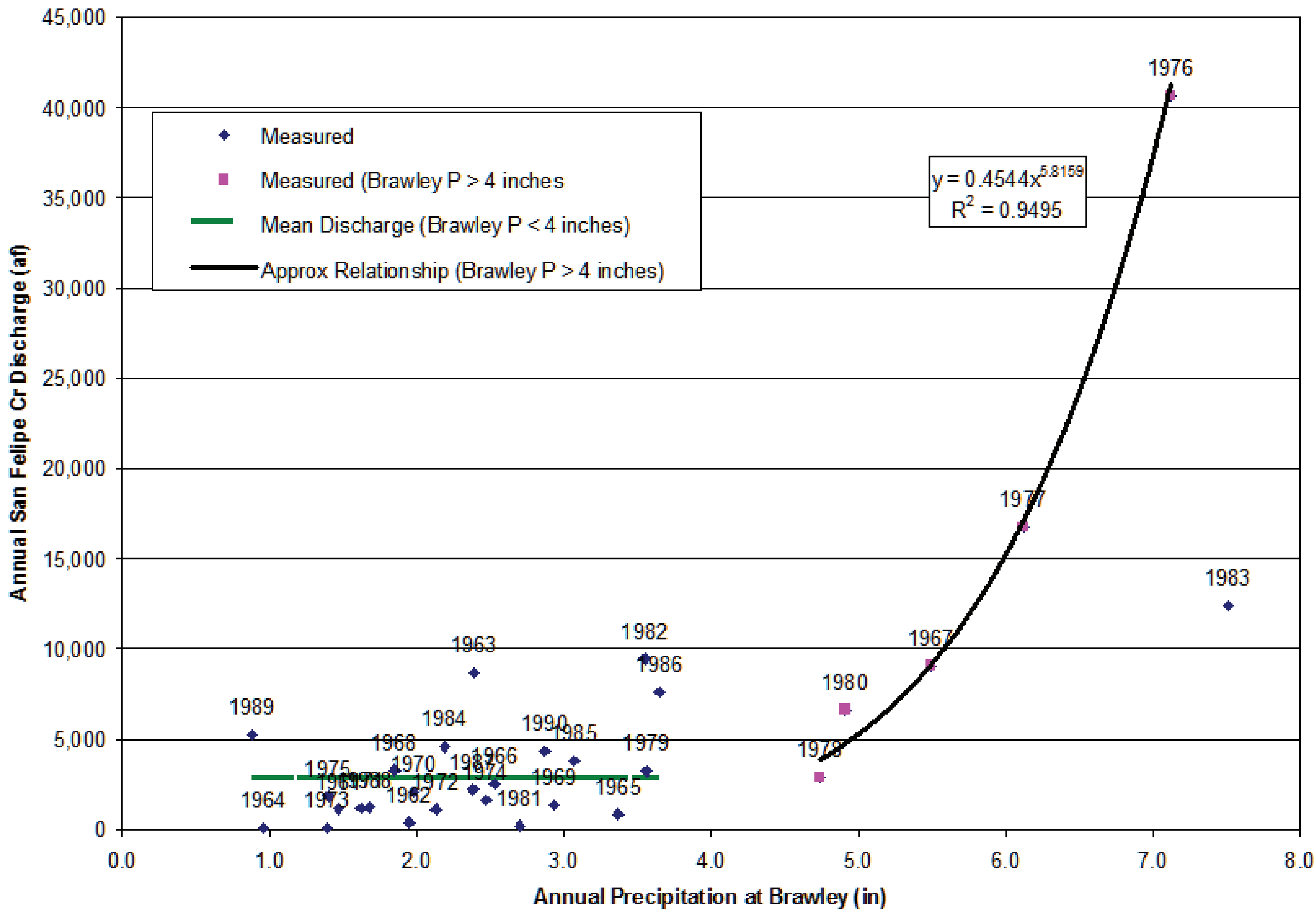

FIGURE H2-4
RELATIONSHIP BETWEEN SAN FELIPE CREEK DISCHARGE AND PRECIPITATION AT BRAWLEY

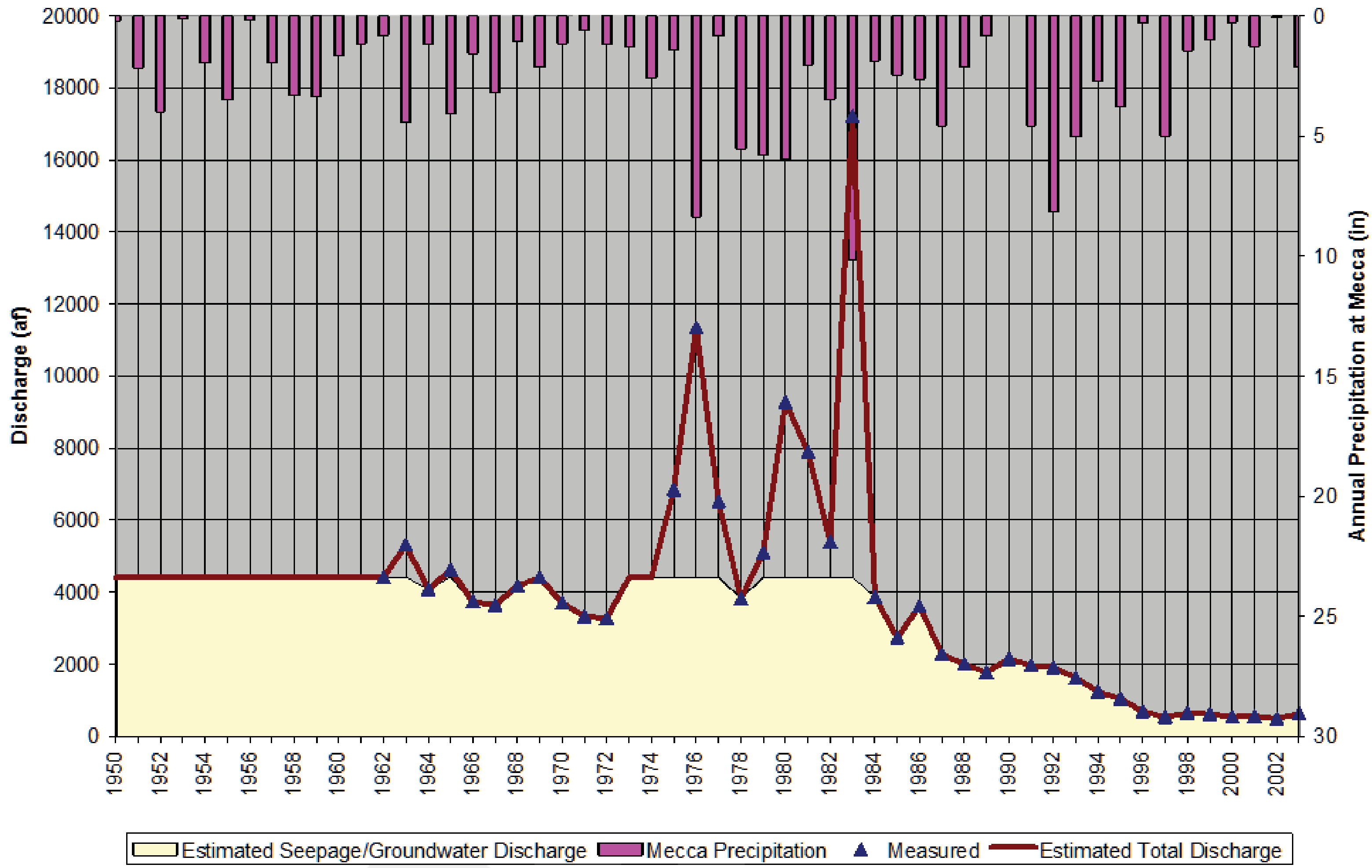

FIGURE H2-5
HISTORICAL SALT CREEK DISCHARGE AND ESTIMATED BASEFLOW FROM SEEPAGE/GROUNDWATER

Note: USGS Station 10254050

Salt Loads

Total salt load contributed to the Salton Sea by the watershed not tributary to the irrigated areas of the Imperial and Coachella valleys has been estimated from rather limited data. Salt load contributions from San Felipe Creek and the ungaged areas were estimated from limited total dissolved solids measurements for San Felipe Creek in Sentenac Canyon obtained from the Colorado River Basin Regional Water Quality Control Board (CRBRWQCB, 2005a). The average of the lower total dissolved solids measurements (less than 3,000 mg/L) was used from this data since the higher values are not believed to be representative of rainfall runoff, but may be more attributable to the low flows and associated high evapoconcentration at the times of these measurements. The salt load contribution from Salt Creek was estimated by applying the average total dissolved solids value of measurements taken at the outlet of Salt Creek over ten years (CRBRWQCB, 2005a). Groundwater salinity was estimated from the average reported total dissolved solids values in wells in the San Felipe Creek-Superstition Hills area reported by Loeltz et al. (1975). While the level of uncertainty regarding the San Felipe Creek and groundwater salinities is considered high, the salt load from these sources makes up less than 2 percent of the total load to the Salton Sea. Average salt load from the watershed not tributary to the irrigated areas of the Imperial and Coachella valleys for the historical period is estimated at 72,994 tons/year of which more than half is contributed by groundwater inflows.

Precipitation

Precipitation on the Salton Sea water surface is best estimated by an average of rainfall recorded from stations closest to the Salton Sea due to the size of the Sea. An average of the Brawley and Mecca stations recorded rainfall (WRCC, 2005) was used to approximate rain on the Salton Sea surface. Both stations have continuous annual data for the entire historical period. Average rainfall at Brawley and Mecca is 2.55 and 2.65 inches/year, respectively with a two-station average of 2.6 inches/year. The average precipitation on the Salton Sea water surface for the historical period is estimated at 49,142 acre-feet/year.

Evaporation

Evaporation is the single largest hydrologic component in the Salton Sea water budget and the only significant outflow (some minor outflow occurs at the interface with the Coachella groundwater basin). Evaporation studies at the Salton Sea have been performed by the USGS (Hughes, 1966, Hely et al. 1966) in which water budget, energy budget, and mass transfer techniques were evaluated and compared to pan evaporation rates. Hely et al. (1966) concluded that a "good estimate of normal annual evaporation" at the Salton Sea is 69 inches, as determined from water and energy budgets in 1961 to 1962 and correlated to measured evaporation rates from sunken pans for 1948 to 1962. The water budget method is considered the most appropriate if the inflows can be estimated with sufficient accuracy. Two different methods were used to determine evaporation for the historical period: (1) the water budget method using the inflows described above and (2) an application of pan evaporation coefficients to pan evaporation data.

In the water budget method, annual evaporation is computed as the difference between the sum of all inflows (including precipitation) and the storage volume change in the Salton Sea over the year. The inflow sources are those described in previous sections and the storage volume change was calculated from water surface elevation measurements (USGS, 2005) and Salton Sea bathymetry (Reclamation, 2005). Using the water budget method, the total average evaporation from the Salton Sea for the historical period is estimated at 1,294,124 acre-feet/year, or 69.0 inches/year, when expressed as a unit rate. The computed unit evaporation rate ranged from 64 to 75 inches/year.

A second method based upon pan evaporation rates was used to provide an estimate of evaporation independent of measurements or estimates of inflows, areal precipitation, water surface elevation, bathymetry, and other parameters. Hely et al. (1966) performed a similar verification and determined that Salton Sea annual evaporation rates could be approximated by multiplying 0.69 by the average annual pan evaporation rates for Sandy Beach, Imperial Salt Farm, and Devil's Hole sunken pans. Data for these three stations (Three Flags replaced Sandy Beach in June 1990) was obtained from IID for the period of 1950 to 2001 (IID, 2005b). The resulting average evaporation rate from this method is 68.4 inches/year. It should be noted that there appears to be a systematic downward shift in recorded evaporation rates at the Devil's Hole and Three Flags stations beginning in the early 1980s and an apparent erroneous data point for the Imperial Salt Farm station in 1998. No adjustment was made for these trends and data concerns. However, a third estimate was prepared using the Imperial pan station (Reclamation, 2004) and adjusting the pan coefficient to be commensurate with the analysis of Hely et al. (1966). This station does not exhibit the trends and data concerns of the other pan stations. The average evaporation rate using only the Imperial station is 69.4 inches/year.

While deviations in annual evaporation rates developed by the water budget method and the pan evaporation coefficient method occur, as shown in Figure H2-6, the long term annual average rates between the two methods are virtually identical. It is concluded that the rates determined from the water budget method are reasonable for both a historic assessment of past Salton Sea evaporation and for use in future analyses. Average net evaporation (evaporation minus precipitation) rates for the historical period are estimated at 66.4 inches/year.

Estimated Historical Water Balance for the Salton Sea

The estimated historical water balance for the Salton Sea has been outlined in the previous sections and is summarized here. The total average inflow to the Salton Sea, not including precipitation directly on the water surface, for the 1950 to 2002 period is estimated at about 1,296,023 acre-feet/year with a minimum of 1,145,991 acre-feet/year in 1992 and a maximum of 1,461,736 acre-feet/year in 1953. In recent years the total inflow has been about 1,300,000 acre-feet/year. The total average outflow (through evaporation) for the historic period is estimated at 1,294,124 acre-feet/year, resulting in an increase in water surface elevation. The estimated historical water budget is shown in Table H2-1 and Figure H2-7. The relative contribution of each source area to the water budget is summarized in Table H2-2. About 76.5 percent of the total inflow is from Imperial Valley, 9.8 percent from Mexico, 8.5 percent from Coachella Valley, and 5.2 percent from the remainder of the watershed (including precipitation).

Estimated Historical Salt Balance for the Salton Sea

Salinity in the Salton Sea has been estimated for the entire historical period by IID (2000 and 2005) by averaging total dissolved solids measurements at four near-shore stations: Bertram Station, Sandy Beach, Desert Beach, and Salton Sea Beach. In addition, Reclamation (Holdren and Montano, 2002, Holdren, 2005) has measured near-surface and near-bottom total dissolved solids at three locations along the longitudinal axis of the Salton Sea. These data are available for 17 days throughout the year for 1999 and quarterly for 2004 and 2005. Salinity, as estimated by IID, has ranged from about 38,000 mg/L in 1950 to about 48,000 mg/L in 2003. Holdren and Montano's (2002) salinity measurements for 1999 differed from IID's measurements by about 1,200 mg/L. However, both the measurement of salinity and the ability of point measurements to represent Salton Sea average conditions contain significant uncertainty. IID measurements are based on samples collected at near shore locations, while those of Reclamation are taken at three locations along the center axis of the Salton Sea and at various depths. It is expected that the measurements by Reclamation would be more representative of the average salinity of the Salton Sea due to the reduced influence of near-shore effects. Unfortunately, salinity measurements from Reclamation using this method are only available for recent years.

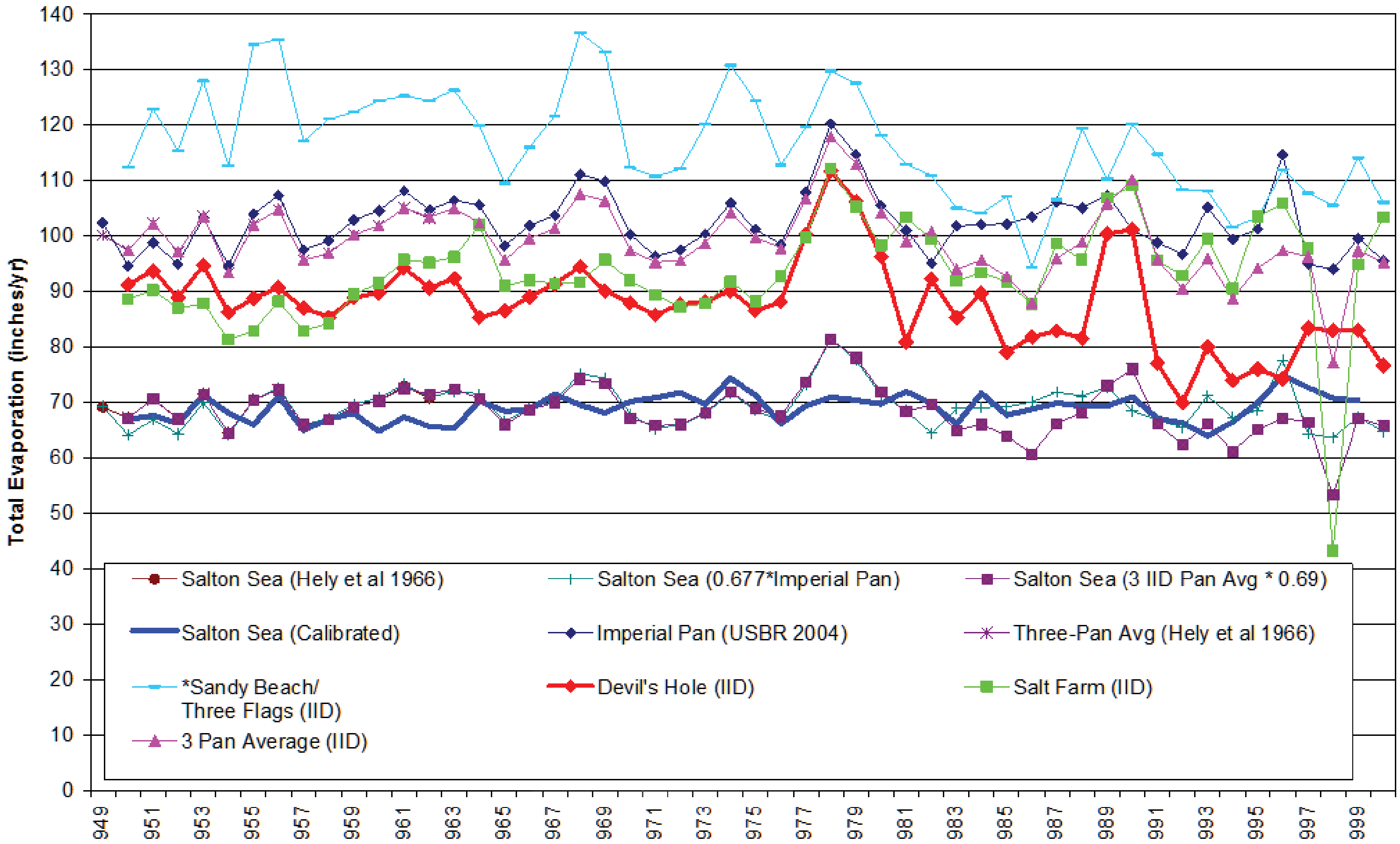

FIGURE H2-6
ESTIMATED ANNUAL EVAPORATION RATES FROM WATER BUDGET AND PAN EVAPORATION MEASUREMENTS

Table H2-1
Estimated Historic Inflows to the Salton Sea

Year	Alamo River from Mexico (af/yr)	Alamo River from Imperial Valley (af/yr)	Alamo River TOTAL (af/yr)	New River from Mexico (af/yr)	New River from Imperial Valley (af/yr)	New River TOTAL (af/yr)	Imperial Valley Direct Drains to Sea (af/yr)	Surface Flows from Coachella Valley (af/yr)	Groundwater Flows from Coachella Valley (af/yr)	San Felipe Cr (af/yr)	Salt Cr (af/yr)	Ungaged Watershed (af/yr)	Local Groundwater (af/yr)	Precipitation (af/yr)	Total Inflow (w/o Precip) (af/yr)	Total Inflow (af/yr)	Total from Mexico (af)	Total from Imperial Valley (af)	Total from Coachella Valley (af)	Total from Local (w/o Precip) (af)	Total from Local (incl Precip) (af)
1950	1393	605469	606862	36992	423673	460665	75658	65811	2710	2834	4420	1057	10000	3578	1230017	1233595	38385	1104800	68521	18311	21889
1951	1385	640646	642031	35508	454160	489668	74621	108765	2632	2834	4420	1057	10000	48632	1336028	1384660	36893	1169427	111397	18311	66943
1952	1250	695997	697247	35917	488544	524461	76032	87139	2341	2834	4420	1057	10000	46361	1405531	1451892	37167	1260573	89480	18311	64672
1953	1308	755355	756663	31116	509431	540547	81212	62607	2396	2834	4420	1057	10000	966	1461736	1462702	32424	1345998	65003	18311	19277
1954	1431	731390	732821	29505	463232	492737	78588	72467	2064	2834	4420	1057	10000	30378	1396988	1427367	30936	1273210	74531	18311	48690
1955	1915	652540	654455	46985	348875	395860	68394	85367	2016	2834	4420	1057	10000	46818	1224403	1271221	48900	1069809	87383	18311	65129
1956	2042	682113	684155	42713	386942	429655	52333	70602	2067	2834	4420	1057	10000	2520	1257123	1259644	44755	1121388	72669	18311	20832
1957	1762	621088	622850	70845	331671	402516	58620	53368	2205	2834	4420	1057	10000	32496	1157870	1190367	72607	1011379	55573	18311	50808
1958	1991	612490	614481	103983	301211	405194	60344	56358	2243	2834	4420	1057	10000	51340	1156931	1208271	105974	974045	58601	18311	69651
1959	1819	649931	651750	121824	312395	434219	58637	57105	2345	2834	4420	1057	10000	47973	1222367	1270340	123643	1020963	59450	18311	66284
1960	1921	680529	682450	121312	323747	445059	55528	70431	2336	2834	4420	1057	10000	29084	1274115	1303200	123233	1059804	72767	18311	47396
1961	1795	673781	675576	115031	321936	436967	54983	83894	2290	1129	4420	421	10000	23864	1269680	1293544	116826	1050700	86184	15970	39834
1962	1705	679395	681100	132179	323151	455330	86419	112692	2241	374	4420	140	10000	25373	1352716	1378089	133884	1088965	114933	14934	40307
1963	2158	721607	723765	138936	338543	477479	93647	133333	2062	8695	5310	3852	10000	63030	1458143	1521173	141094	1153797	135395	27857	90887
1964	1834	561723	563557	105087	260770	365857	82660	123248	1991	99	4079	37	10000	19786	1151528	1171314	106921	905153	125239	14215	34001
1965	1798	533298	535096	111339	246408	357747	103256	138788	2172	832	4627	452	10000	69144	1152970	1222114	113137	882962	140960	15911	85055
1966	1545	609200	610745	102958	280511	383469	114974	128071	2220	2505	3735	934	10000	38026	1256653	1294680	104503	1004685	130291	17174	55201
1967	1556	619535	621091	96899	286312	383211	122123	133784	2244	9077	3643	3386	10000	80416	1288559	1368975	98455	1027970	136028	26106	106522
1968	1469	609620	611089	106019	278059	384078	113348	133097	2262	3272	4181	1221	10000	27077	1262548	1289624	107488	1001027	135359	18674	45750
1969	1595	591069	592664	103312	272137	375449	99433	130583	2319	1348	4403	503	10000	46920	1216702	1263622	104907	962639	132902	16254	63174
1970	1645	617373	619018	99671	290816	390487	112314	131253	2390	2072	3694	773	10000	29117	1272001	1301117	101316	1020503	133643	16539	45655
1971	1510	670260	671770	107281	315714	422995	106597	142977	2403	1167	3330	435	10000	20427	1361674	1382102	108791	1092571	145380	14932	35360
1972	1435	637308	638743	111165	306898	418063	119331	155126	2387	1112	3274	415	10000	30895	1348451	1379346	112600	1063537	157513	14801	45696
1973	1370	637532	638902	117160	311479	428639	116403	163211	2372	60	4420	22	10000	25193	1364029	1389222	118530	1065414	165583	14502	39695
1974	1227	681093	682320	111839	324736	436575	117663	157208	2342	1614	4420	602	10000	47361	1412744	1460105	113066	1123492	159550	16636	63997
1975	1568	680777	682345	99791	334716	434507	112775	173502	2229	1850	6840	690	10000	26302	1424738	1451040	101359	1128268	175731	19380	45682
1976	1071	637846	638917	102588	332523	435111	114924	174684	2002	40638	11338	19891	10000	146734	1447505	1594239	103659	1085293	176686	81867	228601
1977	1419	613590	615009	107713	305265	412978	101942	156787	1784	16741	6522	6245	10000	66320	1328008	1394327	109132	1020797	158571	39508	105827
1978	1296	601777	603073	98408	294637	393045	99260	144098	1727	2879	3828	1074	10000	98275	1258984	1357259	99704	995674	145825	17781	116056
1979	1416	633710	635126	144905	312815	457720	110127	151002	1595	3219	5098	1665	10000	89483	1375552	1465035	146321	1056652	152597	19982	109465
1980	1655	639926	641581	156320	298224	454544	105091	143958	1453	6632	9278	5797	10000	104874	1378334	1483207	157975	1043241	145411	31707	136580
1981	2274	589317	591591	155443	277798	433241	95810	156788	1402	217	7894	81	10000	45773	1297024	1342797	157717	962925	158190	18192	63965
1982	1990	541463	543453	157009	259293	416302	87919	152282	1415	9462	5399	3529	10000	67763	1229761	1297524	158999	888675	153697	28390	96153
1983	1909	550062	551971	242606	234827	477433	82946	150956	1186	12408	17227	13389	10000	170870	1317516	1488386	244515	867835	152142	53024	223894
1984	1831	562086	563917	267904	244356	512260	88592	140985	1053	4580	3868	1708	10000	39404	1326963	1366368	269735	895034	142038	20156	59561
1985	1867	507680	509547	260238	229294	489532	93867	123855	983	3785	2736	1412	10000	53719	1235717	1289436	262105	830841	124838	17933	71652
1986	1890	497102	498992	264837	247511	512348	89354	122959	836	7605	3614	2837	10000	60839	1248545	1309383	266727	833967	123795	24056	84894
1987	2058	510142	512200	250862	242290	493152	99262	117032	757	2202	2281	821	10000	67334	1237707	1305041	252920	851694	117789	15304	82638
1988	2152	556535	558687	226802	262138	488940	100053	117188	603	1227	1998	458	10000	36809	1279154	1315963	228954	918726	117791	13683	50492
1989	1883	591781	593664	153439	277989	431428	96109	110816	572	5246	1775	1957	10000	16394	1251567	1267961	155322	965879	111388	18978	35372
1990	1993	615873	617866	133088	297422	430510	91088	109613	526	4337	2155	1618	10000	27601	1267713	1295314	135081	1004383	110139	18110	45711
1991	1951	592175	594126	130775	279854	410629	88341	103866	415	6706	1966	2502	10000	94066	1218551	1312617	132726	960370	104281	21174	115240
1992	1709	544334	546043	143178	253417	396595	80734	100817	255	7012	1920	2615	10000	128906	1145991	1274897	144887	878485	101072	21547	150453
1993	1642	615383	617025	190457	269839	460296	88589	93505	169	13420	1623	5006	10000	105115	1289633	1394748	192099	973811	93674	30049	135164
1994	1744	639327	641071	145260	297804	443064	108805	100277	51	2834	1238	1057	10000	49698	1308398	1358096	147004	1045936	100328	15129	64827
1995	1223	644944	646167	148762	323924	472686	115134	98063	-149	2834	1047	1057	10000	56512	1346839	1403351	149985	1084002	97914	14938	71450
1996	1077	639897	640974	118678	317911	436589	118746	94147	-197	2834	692	1057	10000	7754	1304842	1312595	119755	1076554	93950	14583	22337
1997	1653	635157	636810	160762	326461	487223	107093	90686	-108	2834	530	1057	10000	68045	1336125	1404170	162415	1068711	90578	14421	82467
1998	1446	647674	649120	174870	316060	490930	108387	85723	-287	2834	650	1057	10000	43031	1348414	1391445	176316	1072121	85436	14541	57572
1999	1668	641758	643426	176447	289332	465779	94414	81765	-366	2834	618	1057	10000	13338	1299527	1312866	178115	1025504	81399	14509	27848
2000	2059	643668	645727	158115	287232	445347	103208	86427	-445	2834	540	1057	10000	3378	1294695	1298073	160174	1034108	85982	14431	17809
2001	1616	662671	664287	144458	292325	436783	102958	83651	-524	2834	561	1057	10000	25254	1301608	1326862	146074	1057954	83127	14452	39706
2002	324	681675	681999	115402	300344	415746	105302	81476	-603	2834	486	1057	10000	4137	1298298	1302435	115726	1087321	80873	14377	18514
Avg (1950-2002)	**1646**	**624315**	**625961**	**129523**	**311452**	**440974**	**93848**	**113287**	**1422**	**4532**	**3968**	**2031**	**10000**	**49142**	**1296023**	**1345164**	**131169**	**1029615**	**114709**	**20531**	**69672**
Min	**324**	**497102**	**498992**	**29505**	**229294**	**357747**	**52333**	**53368**	**-603**	**60**	**486**	**22**	**10000**	**966**	**1145991**	**1171314**	**30936**	**830841**	**55573**	**13683**	**17809**
Max	**2274**	**755355**	**756663**	**267904**	**509431**	**540547**	**122123**	**174684**	**2710**	**40638**	**17227**	**19891**	**10000**	**170870**	**1461736**	**1594239**	**269735**	**1345998**	**176686**	**81867**	**228601**

Table H2-2
Relative Contribution of Inflow Sources to the Salton Sea (1950 to 2002)

Inflow Source to the Salton Sea	Percent of Historical Annual Average Inflow
Mexico	9.8
Imperial Valley	76.5
Coachella Valley	8.5
Local Watershed	1.5
Precipitation directly on the Salton Sea	3.7
TOTAL	**100.0**

It is possible to compare the computed salinity from estimated annual salt loads to the trends of measured Salton Sea salinity over time. As shown in Figure H2-8, the salinity computed from this method compares very well to the trend in measured salinity over time with an average difference of less than 1 percent. Salinity in the Salton Sea, however, cannot be entirely attributable to the external loads entering from surface and subsurface sources. Beginning in the mid-1980s or early 1990s, precipitation of significant quantities of salts (primarily gypsum and calcite) began and has been estimated between 360,000 to 1,650,000 tons/year with a range of 770,000 to 1,320,000 tons/year believed to be the most reasonable (Amrhein et al., 2001). The computed salinity in Figure H2-8 does not equal the measured salinity without incorporating a salt loss term (salt precipitation) from 1990 onward. The estimated salt precipitation developed from the computed analysis is about 1,500,000 tons/year beginning around 1990. This salt precipitation value is at the high end of the range of previous independent estimates (Amrhein et al., 2001) and is similar to that of Tostrud (1997).

The total average external salt load to the Salton Sea for the 1950 to 2002 period is estimated at about 4,516,991 tons/year with a minimum of 3,079,481 tons/year in 1950 and a maximum of 5,730,956 tons/year in 1976. In recent years the total external load has been about 3,800,000 tons/year. Salt precipitation (an internal "sink") accounts for removal of about one-third of the annual external load. he relative contribution of each source area to the salt budget is summarized in Table H2-3. The estimated historical salt budget is shown in Figure H2-9 and Table H2-4. About 78.7 percent of the salt loads are from the Imperial Valley, 13.9 percent from Mexico, 5.8 percent from Coachella Valley, and 1.6 percent from the remainder of the watershed.

DESCRIPTION OF NO ACTION ALTERNATIVE-CEQA CONDITIONS

This section describes the methods and data used to develop the projected hydrology and salt loads for use in the No Action Alternative-CEQA Conditions. The assumptions used to develop inflow projections under the No Action Alternative-Variability Conditions are described later in this appendix.

Table H2-3
Relative Contribution of Inflow Sources to the Salton Sea Salt Loads (1950 to 2002)

Inflow Source to the Salton Sea	Percent of Historical Annual Average Salt Load
Mexico	13.9
Imperial Valley	78.7
Coachella Valley	5.8
Local Watershed	1.6
TOTAL	100.0

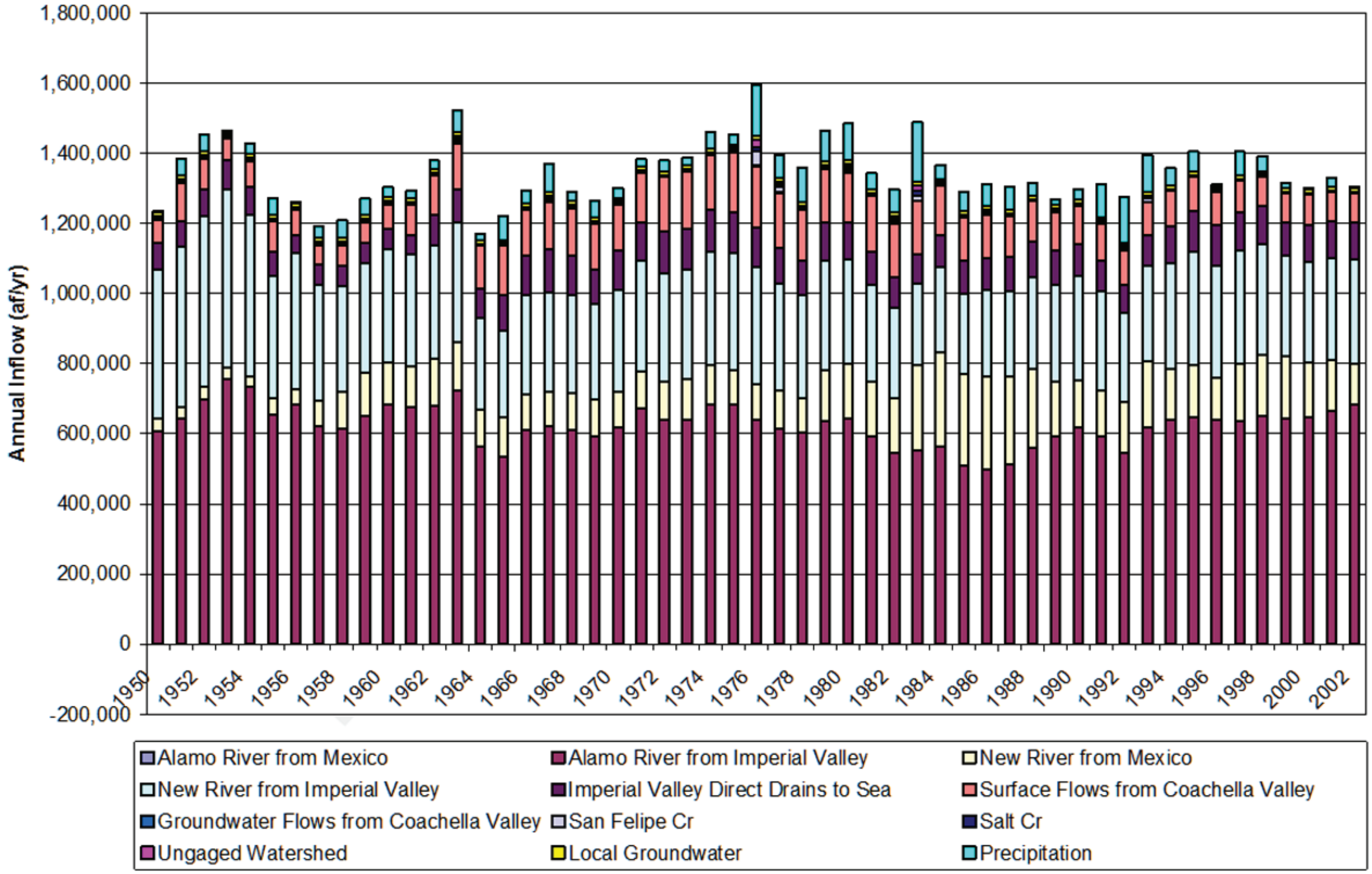

FIGURE H2-7
ESTIMATED HISTORICAL INFLOWS TO THE SALTON SEA

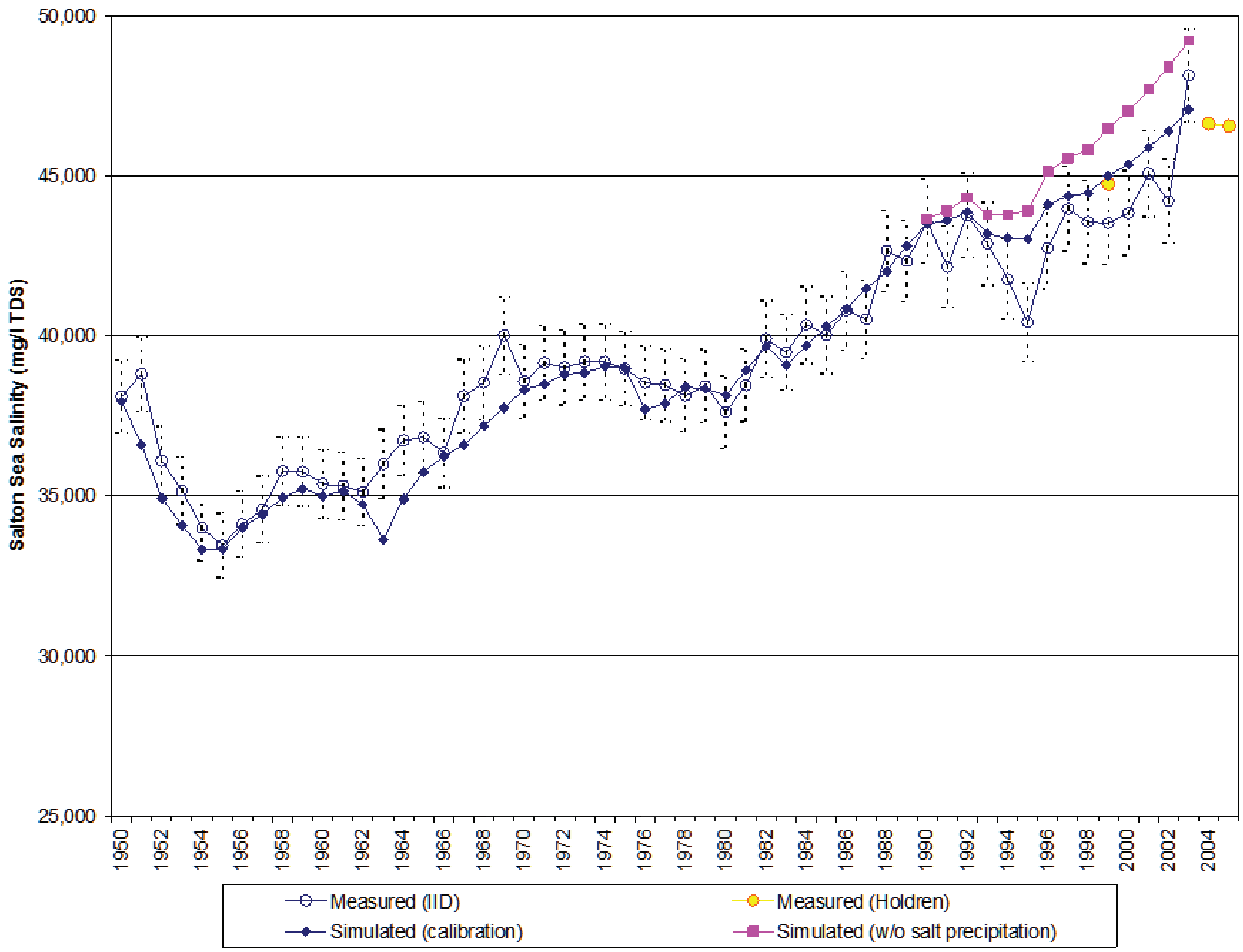

FIGURE H2-8
MEASURED AND SIMULATED SALTON SEA SALINITY

Note: Error bars represent ± 3%.

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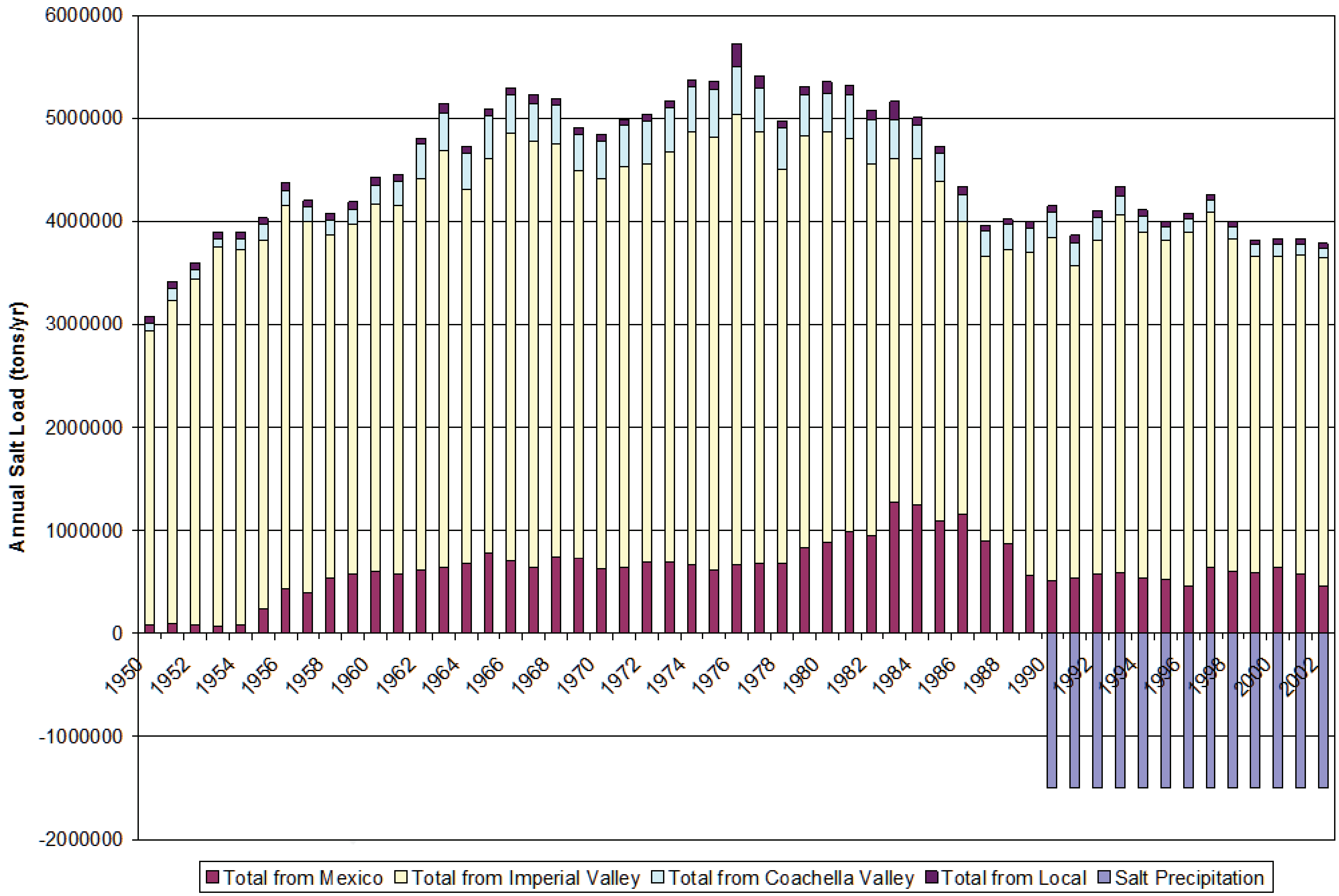


FIGURE H2-9
ESTIMATED HISTORIC SALT LOADS TO THE SALTON SEA

Table H2-4
Estimated Historical Salt Loads to the Salton Sea

Year	Mexico Salt Load (tons/yr)	IID Salt Load (tons/yr)	CWWD Surface Flow Salt Load (tons/yr)	CVWD Groundwater Flow Salt Load (tons/yr)	San Felipe Cr Salt Load (tons/yr)	Salt Cr Salt Load (tons/yr)	Ungaged Watershed Salt Load (tons/yr)	Local Groundwater Salt Load (tons/yr)	Salt Precipitation (tons/yr)	Total Salt Load to Sea (w/o precipitation) (tons/yr)	Total Salt Load to Sea (tons/yr)	Total from Mexico (tons/yr)	Total from Imperial Valley (tons/yr)	Total from Coachella Valley (tons/yr)	Total from Local (tons/yr)
1950	84823	2855378	62200	7600	6003	21521	2239	39716	0	3079481	3079481	84823	2855378	69800	69480
1951	92572	3139970	107100	7300	6003	21521	2239	39716	0	3416422	3416422	92572	3139970	114400	69480
1952	75842	3364335	80900	6400	6003	21521	2239	39716	0	3596957	3596957	75842	3364335	87300	69480
1953	74128	3684315	63800	5800	6003	21521	2239	39716	0	3897523	3897523	74128	3684315	69600	69480
1954	84301	3648649	95100	4600	6003	21521	2239	39716	0	3902130	3902130	84301	3648649	99700	69480
1955	244785	3577562	142000	2200	6003	21521	2239	39716	0	4036027	4036027	244785	3577562	144200	69480
1956	436841	3713208	148100	1500	6003	21521	2239	39716	0	4369129	4369129	436841	3713208	149600	69480
1957	389519	3603489	141300	1500	6003	21521	2239	39716	0	4205288	4205288	389519	3603489	142800	69480
1958	530475	3341376	136900	2000	6003	21521	2239	39716	0	4080231	4080231	530475	3341376	138900	69480
1959	569705	3401652	145600	2000	6003	21521	2239	39716	0	4188437	4188437	569705	3401652	147600	69480
1960	603009	3558534	190600	2200	6003	21521	2239	39716	0	4423823	4423823	603009	3558534	192800	69480
1961	576148	3572808	237100	1300	2392	21521	892	39716	0	4451877	4451877	576148	3572808	238400	64521
1962	612071	3806946	328200	100	792	21521	296	39716	0	4809642	4809642	612071	3806946	328300	62325
1963	639664	4050087	364200	-1500	18419	25854	8160	39716	0	5144601	5144601	639664	4050087	362700	92150
1964	678175	3635121	355600	-4700	210	19861	78	39716	0	4724061	4724061	678175	3635121	350900	59865
1965	786501	3819255	418900	-6400	1762	22529	957	39716	0	5083221	5083221	786501	3819255	412500	64965
1966	704090	4148874	386500	-3800	5307	18186	1979	39716	0	5300852	5300852	704090	4148874	382700	65188
1967	635787	4139477	374700	-3900	19229	17738	7173	39716	0	5229919	5229919	635787	4139477	370800	83855
1968	740074	4012009	372700	-4100	6931	20357	2586	39716	0	5190273	5190273	740074	4012009	368600	69590
1969	733842	3754477	362200	-4300	2856	21438	1065	39716	0	4911294	4911294	733842	3754477	357900	65075
1970	630950	3780732	369500	-4000	4389	17986	1637	39716	0	4840911	4840911	630950	3780732	365500	63729
1971	635685	3900990	397200	-3500	2472	16214	922	39716	0	4989699	4989699	635685	3900990	393700	59324
1972	684430	3876592	421700	-3900	2356	15941	879	39716	0	5037714	5037714	684430	3876592	417800	58892
1973	693063	3980338	437100	-4800	127	21521	47	39716	0	5167113	5167113	693063	3980338	432300	61412
1974	664649	4204158	444400	-5700	3419	21521	1275	39716	0	5373439	5373439	664649	4204158	438700	65932
1975	618895	4196407	474600	-7000	3919	33304	1462	39716	0	5361303	5361303	618895	4196407	467600	78401
1976	669954	4361658	486400	-10200	86087	55205	42136	39716	0	5730956	5730956	669954	4361658	476200	223144
1977	681825	4187227	442000	-14500	35464	31756	13229	39716	0	5416716	5416716	681825	4187227	427500	120164
1978	684077	3824323	419000	-18000	6099	18639	2275	39716	0	4976129	4976129	684077	3824323	401000	66729
1979	830984	3998131	421900	-19300	6819	24822	3526	39716	0	5306599	5306599	830984	3998131	402600	74884
1980	886112	3988611	391700	-21400	14049	45175	12280	39716	0	5356243	5356243	886112	3988611	370300	111220
1981	983071	3825050	453400	-24600	460	38436	171	39716	0	5315704	5315704	983071	3825050	428800	78783
1982	951238	3608490	454000	-25200	20044	26288	7477	39716	0	5082053	5082053	951238	3608490	428800	93525
1983	1269999	3333260	407500	-24300	26285	83879	28362	39716	0	5164701	5164701	1269999	3333260	383200	178242
1984	1245141	3360246	360400	-28700	9702	18833	3619	39716	0	5008958	5008958	1245141	3360246	331700	71871
1985	1094768	3296231	300600	-30700	8018	13322	2991	39716	0	4724946	4724946	1094768	3296231	269900	64047
1986	1156095	2837518	291500	-30900	16110	17597	6009	39716	0	4333646	4333646	1156095	2837518	260600	79433
1987	902813	2753625	282900	-32600	4665	11106	1740	39716	0	3963965	3963965	902813	2753625	250300	57227
1988	867612	2854307	281100	-32500	2599	9728	970	39716	0	4023532	4023532	867612	2854307	248600	53013
1989	558769	3139003	271900	-34400	11113	8643	4145	39716	0	3998889	3998889	558769	3139003	237500	63617
1990	516591	3328850	273800	-33700	9187	10493	3427	39716	-1500000	4148364	2648364	516591	3328850	240100	62823
1991	533884	3033473	263500	-33700	14207	9572	5299	39716	-1500000	3865952	2365952	533884	3033473	229800	68795
1992	574283	3247280	248300	-35500	14853	9349	5540	39716	-1500000	4103821	2603821	574283	3247280	212800	69458
1993	585887	3476144	225000	-39600	28429	7902	10605	39716	-1500000	4334083	2834083	585887	3476144	185400	86652
1994	529953	3371582	196400	-41000	6003	6028	2239	39716	-1500000	4110922	2610922	529953	3371582	155400	53987
1995	528697	3293672	174300	-45100	6003	5098	2239	39716	-1500000	4004626	2504626	528697	3293672	129200	53057
1996	456753	3445080	177800	-53700	6003	3369	2239	39716	-1500000	4077262	2577262	456753	3445080	124100	51329
1997	643617	3444677	177300	-54700	6003	2581	2239	39716	-1500000	4261434	2761434	643617	3444677	122600	50540
1998	601958	3229808	186900	-63900	6003	3165	2239	39716	-1500000	4005890	2505890	601958	3229808	123000	51124
1999	594727	3066967	179200	-68900	6003	3009	2239	39716	-1500000	3822962	2322962	594727	3066967	110300	50968
2000	633161	3031589	189275	-73900	6003	2629	2239	39716	-1500000	3830713	2330713	633161	3031589	115375	50588
2001	577364	3099926	183197	-78900	6003	2732	2239	39716	-1500000	3832278	2332278	577364	3099926	104297	50691
2002	457192	3185772	178433	-83900	6003	2366	2239	39716	-1500000	3787823	2287823	457192	3185772	94533	50326
Avg (1950-2002)	**627105**	**3554514**	**282564**	**-20130**	**9601**	**19320**	**4302**	**39716**	**-367925**	**4516991**	**4149067**	**627105**	**3554514**	**262434**	**72939**
Min	**74128**	**2753625**	**62200**	**-83900**	**127**	**2366**	**47**	**39716**	**-1500000**	**3079481**	**2287823**	**74128**	**2753625**	**69600**	**50326**
Max	**1269999**	**4361658**	**486400**	**7600**	**86087**	**83879**	**42136**	**39716**	**0**	**5730956**	**5730956**	**1269999**	**4361658**	**476200**	**223144**

Development of the Hydrologic Model

The No Action Alternative-CEQA Conditions hydrology can be developed through a series of building blocks, or intermediate computations, anchored to existing conditions. The building blocks, in this case, are the historical water budgets previously accepted for the QSA baseline in the IID Water Conservation and Transfer Project Environmental Impact Report/Environmental Impact Statement (EIR/EIS) (IID and Reclamation, 2002), referred to henceforth in this appendix as the QSA EIR/EIS. A historical analysis was performed to develop an improved understanding of the past and current conditions in order to project conditions that may exist in the future. For example, the historical analysis described in previous sections of this report provided improved estimates of evaporation rates, local watershed runoff, and salt precipitation that are used for future projections. The No Action Conditions described in the QSA EIR/EIS represented a projection of future hydrologic conditions based on information available at the time the environmental document was prepared. The No Action Alternative-CEQA Conditions hydrology and salt loads used in the PEIR were developed by maki9ng adjustments to the QSA EIR/EIS No Action Conditions water budget to reflect the effects of the projects to be included in the No Action Alternative-CEQA Conditions.

The results of several computer models have been used to describe future conditions. For example, results from model simulations using the Imperial Irrigation District Decision Support System (IIDSS) (IID, 2002) and Coachella Valley Groundwater Model (CVWD, 2005) have been used to describe discharge and salt loads from Imperial and Coachella valleys, respectively. In each of these models, future climate conditions (primarily rainfall, evaporation, and evapotranspiration) and associated variability are assumed to be adequately represented by past conditions. While the historical periods of these models are not entirely coincident (1925 to 1999 for IIDSS, and 1936 to 1996 for the Coachella Valley Groundwater Model), refinements made for other hydrologic components (local watershed and evaporation) attempted to match the 1925 to 1999 climate conditions.

In the discussion that follows, the QSA EIR/EIS No Action Conditions for each major source area contributing inflow to the Salton Sea is discussed first, followed by the adjustments made for projects to be considered in the No Action Alternative-CEQA Conditions. All projected future inflows are reported in the nearest 1,000 acre-feet/year and salt loads to the nearest 1,000 tons/year due to the significant uncertainty in these estimates.

Study Period

The study period for the PEIR and this analysis is the 75-year contract period of the QSA and IID Water Conservation and Transfer Project which was initiated and approved in 2003. The hydrologic analysis is performed on an annual basis for the 2003 to 2078 planning horizon.

A second period of time is considered in this analysis for 2018 to 2078. This second period represents conditions following the cessation of “mitigation water” and better represents conditions following the construction of major facilities under the PEIR alternatives.

Summary of Projects Considered in No Action Alternative-CEQA Conditions

The preliminary selection of projects included in the No Action Alternative-CEQA Conditions was based on CEQA Guidelines of reasonable and foreseeable actions. A description of the process used for selecting projects to be included in the No Action Alternative-CEQA Conditions, the criteria used for selection, a summary of each project considered, and the rationale for inclusion or exclusion of each project for the No Action Alternative-CEQA Conditions are included in Chapter 3. Many of the projects were excluded from the No Action Alternative-CEQA Conditions due to uncertainty regarding their implementation and are considered in the No Action Alternative-Variability Conditions scenario. While the list of projects considered is extensive, only a small subset of these projects has the potential to appreciably affect future inflows or salt loads to the Salton Sea. The projects included in the No Action Alternative-CEQA Conditions that could affect inflows to the Salton Sea are:

- QSA Projects;
- IID Water Conservation and Transfer Project (and associated required mitigation measures);
- Coachella Canal Lining Project;
- All-American Canal Lining Project;
- Colorado River Basin Salinity Control Program;
- Mexicali Wastewater Improvements;
- Mexicali Power Production;
- Total Maximum Daily Loads Implementation; and
- Coachella Valley Water District Water Management Plan.

The estimated inflows and salt loads that may result after implementation of the No Action Alternative CEQA Conditions projects are described below.

Inflows from Mexico

Flow from Mexico to the United States in the New River is strongly correlated to the amount of Colorado River water delivered at the northern crossing of the United States-Mexico border, as shown in Figure H2-10. The strong relationship is due to the dependence of irrigated agriculture in the Mexicali Valley on the Colorado River diversions from Morelos Dam near the northern crossing of the United States-Mexico border. Flows at the northern crossing of the United States-Mexico border can also be influenced by flood flows in the Gila River which discharges into the Colorado River downstream of Imperial Dam. A Colorado River System Simulation Model-Lite (CRSS-Lite) 75-year model simulation of Colorado River operations using June 2005 storage conditions was supplied by Metropolitan (Scott, 2005). The model results (90 traces of the 75-year simulation) for Colorado River flow below Imperial Dam were added to historic flows from the Gila River to obtain a total flow at the northern crossing of the United States-Mexico border. The relationship shown in Figure H2-10 was used to approximate the total annual inflow to the Imperial Valley from Mexico for each of the projected 75 years. The resulting mean of all trace values for inflow from Mexico averages 129,000 acre-feet/year and ranges from 119,000 to 134,000 acre-feet/year for the 2003 to 2078 period, and averages 130,000 acre-feet/year for the 2018 to 2078 period.

Salt loads from Mexico for the No Action Conditions used in the QSA EIR/EIS were estimated by assuming that the total dissolved solids (as a measure of salinity) values reported in 2003 for the New and Alamo rivers (IID, 2003b) would not significantly change in the absence of future projects. Projects associated with the Colorado River Basin Salinity Control Program would have the effect of maintaining or reducing lower Colorado River salinity, and subsequently could have some effect on agricultural return flows from the Imperial, Coachella, and Mexicali valleys. The average flow-weighted salinity at Imperial Dam in 2003 was 735 mg/L and was about equal to the average salinity in the 1990s. The average total dissolved solids for flows in the New and Alamo rivers at the United States-Mexico border in 2003 was about 3,000 mg/L. The salt load from Mexico was estimated at 511,000 tons/year for the 2003 to 2078 period and 515,000 tons/year for the 2018 to 2078 period.

Under the No Action Alternative-CEQA Conditions, both inflows and salt loads would decrease due to Mexicali wastewater improvements and Mexicali powerplant projects, as described below. Inflows from Mexico would decrease to an average inflow of 98,000 acre-feet/year for the 2003 to 2078 and 97,000 acre-feet/year for the 2018 to 2078 period. Salt loads under the No Action Alternative-CEQA Conditions would decrease slightly to 479,000 tons/year for the 2003 to 2078 period and 481,000 tons/year for the 2018 to 2078 period.

Mexicali Wastewater Improvements

Mexico has proposed a treatment plant near Mexicali designed to treat wastewater generated in the Mexicali II service area which currently flows untreated into the New River. It is proposed that the treated wastewater would be discharged into a tributary of the Rio Hardy that flows to the Gulf of California. Therefore, the wastewater would no longer flow into the New River and eventually into the Salton Sea. Implementation of this wastewater project would reduce inflows to the Salton Sea from the New River by 15,000 acre-feet/year as soon as the treatment plant and pipelines are constructed, as shown in Table H2-5. It is anticipated that these facilities will be completed in late 2006. The plant is designed to treat and convey 20.1 million gallons/day (mgd) to accommodate growth in the region through 2014. The salt load associated with the existing untreated wastewater would be removed from the New River. The reduction in salt load has been estimated to be about 20,000 tons/year at 2006 and up to 30,000 tons/year at full capacity in 2014.

Mexicali Power Plants

The power plant projects consist of two natural gas-fired combined-cycle power plants: the InterGen La Rosita Power Complex and the Sempra Termoeléctrica de Mexicali, located west of Mexicali, Mexico, and transmission lines from the power plants to the Imperial Valley Substation. These plants commenced operations in 2003 and were not included in the QSA EIR/EIS No Action Conditions. Water used for cooling purposes at both of the power plants is diverted from the Zaragoza Oxidation Lagoons and treated before use. Operation of these plants results in the consumption of about 11,000 acre-feet/year for cooling purposes which reduces New River flows by a corresponding amount. Through the reduction in flows from the lagoons to the New River, the project is expected to reduce salt loads by about 4,500 tons/year.

These facilities are considered to be part of the Existing Conditions. However, they were not included in the historical inflows and no inflow projections were developed for Existing Conditions in the PEIR.

These facilities also were not included in inflow projections in the QSA EIR/EIS No Action Conditions. Therefore, the estimated reductions in inflows from the power plant operations must be included in the development of the No Action Alternative-CEQA Conditions, as shown in Table H2-5.

All-American Canal Lining Project

The All-American Canal Lining Project was not included in the QSA EIR/EIS No Action Conditions or in the No Action Alternative-CEQA Conditions.

Inflows from Imperial Valley

Agricultural drainage from the Imperial Valley is conveyed to the Salton Sea in the New and Alamo rivers and drains that discharge directly to the Salton Sea. The discharge to the Salton Sea is directly related to the quantity and quality of diverted Colorado River water, the type and amount of irrigated acreage, water management within IID, and irrigation techniques and on-farm water management. Both inflows and salt loads from the Imperial Valley to the Salton Sea would change in the future due to water conservation programs and QSA provisions, in addition to other factors affecting water use in the Imperial Valley.

Flows and salt loads from the Imperial Valley to the Salton Sea in the QSA EIR/EIS No Action Conditions were used as the basis for the development of the hydrologic projections for the PEIR. These inflows and salt loads for the Imperial Valley were developed to provide a representative future 75-year period using 1925 to 1999 climate conditions, and have been shifted forward from the original 2000 to 2074 period to the current 2003 to 2078 study period for the No Action Alternative-CEQA Conditions. The estimated average inflow from the Imperial Valley to the Salton Sea would be 995,000 acre-feet/year for both the 2003 to 2078 period and the 2018 to 2078 period. The inflows would range from 850,000 to 1,114,000 acre-feet/year.

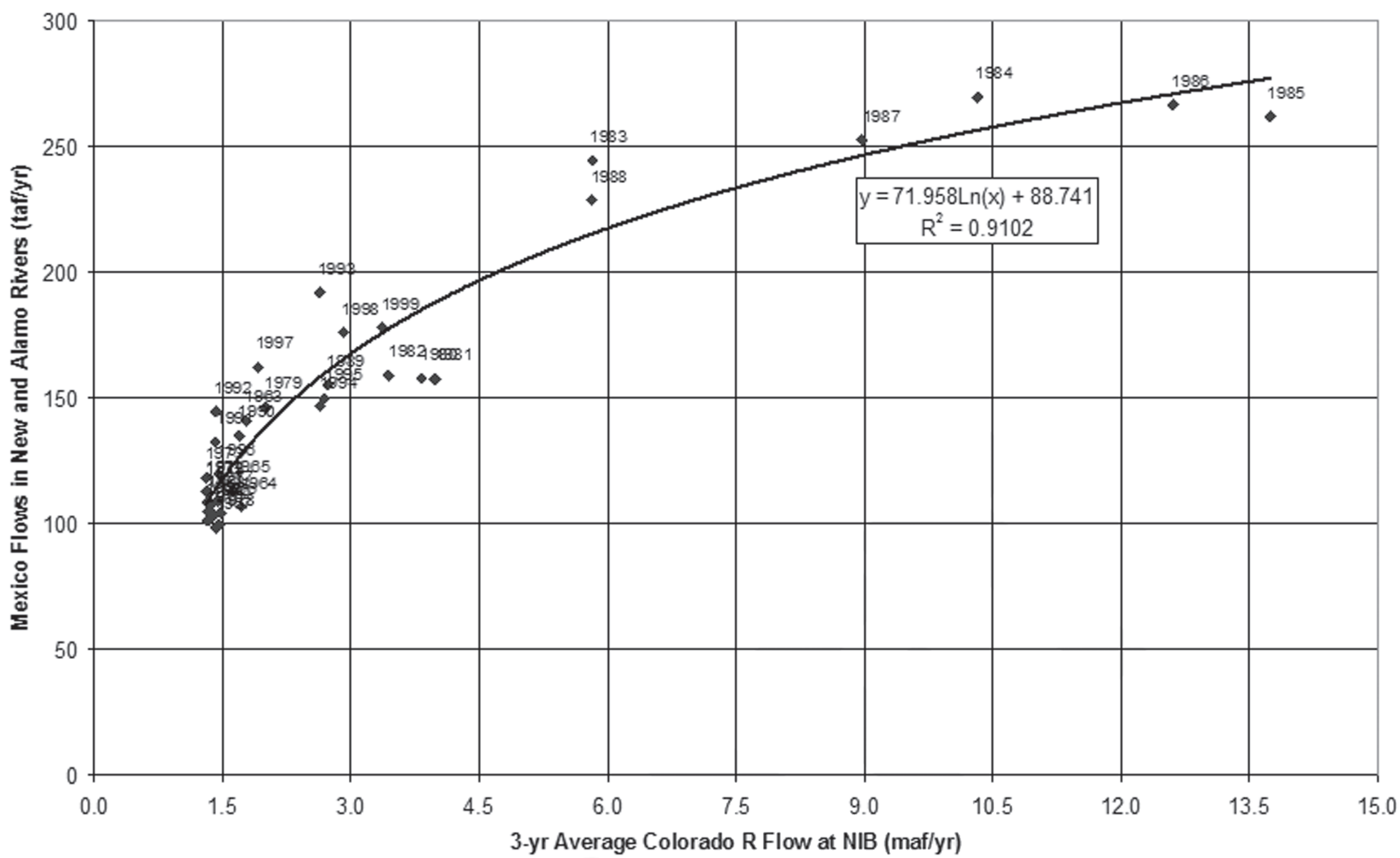


FIGURE H2-10
RELATIONSHIP BETWEEN COLORADO RIVER FLOW AT THE NORTHERLY UNITED STATES-MEXICO BORDER AND FLOWS INTO IMPERIAL VALLEY FROM MEXICO

Table H2-5
Projected Salton Sea Inflows for No Action Alternative-CEQA Conditions

	Mexico				Imperial Valley			Coachella Valley				Local Watershed				
Year	Mexico Baseline Inflow (af/yr)	Adjustment for Mexicali Power Plants (af/yr)	Adjustment for Mexicali Wastewater Treatment Plant (af/yr)	Adjusted Mexico Inflow (af/yr)	Imperial Valley Baseline Discharge to Sea (af/yr)	Adjustment for QSA (af/yr)	Adjusted Imperial Valley Discharge to Sea (af/yr)	Adjusted Coachella Valley Surface Flows to Sea (af/yr)	Adjusted Coachella Valley Aquifer Flows to/from Sea (af/yr)	Total Coachella Valley Discharge to Sea (af/yr)	IOPP (af/yr)	San Felipe Creek (af/yr)	Salt Creek (af/yr)	Ungaged Watershed Inflows (af/yr)	Local Groundwater Inflows (af/yr)	Total Inflow to Sea (af/yr)
2003	119082	-10667	0	108415	952178	0	952178	72561	-630	71930	-56856	2834	623	1057	10000	1090181
2004	120213	-10667	0	109546	1053354	0	1053354	78079	-671	77408	-56856	2834	623	1057	10000	1197966
2005	120879	-10667	0	110212	1019665	0	1019665	79792	-709	79082	-56856	2834	623	1057	10000	1166618
2006	121866	-10667	-15342	95857	980000	0	980000	76887	-745	76142	-56856	2834	623	1057	10000	1109657
2007	122508	-10667	-16237	95604	949340	0	949340	76818	-779	76039	-56856	2834	623	1057	10000	1078641
2008	123300	-10667	-17132	95501	940522	-4000	936522	72165	-808	71357	-56856	2834	623	1057	10000	1061038
2009	124250	-10667	-18027	95556	934397	-8000	926397	72781	-828	71953	-56856	2834	623	1057	10000	1051564
2010	125942	-10667	-18922	96353	1027601	-12000	1015601	73777	-843	72934	-56856	11197	3161	5913	10000	1158303
2011	127264	-10667	-19816	96781	938780	-16000	922780	75531	-852	74680	-56856	2834	623	1057	10000	1051900
2012	128544	-10667	-20711	97166	976357	-21000	955357	78110	-853	77256	-56856	2834	623	1057	10000	1087438
2013	129236	-10667	-21606	96963	940652	-16000	924652	77121	-847	76274	-56856	2834	623	1057	10000	1055548
2014	130723	-10667	-22501	97555	1096364	-11000	1085364	80827	-833	79994	-56856	2834	623	1057	10000	1220571
2015	131307	-10667	-22501	98139	1102122	-6000	1096122	84281	-809	83471	-56856	2834	623	1057	10000	1235390
2016	132184	-10667	-22501	99016	1035992	-1000	1034992	87687	-782	86905	-56856	2834	623	1057	10000	1178571
2017	132400	-10667	-22501	99232	1015039	5000	1020039	90933	-745	90187	-56856	92453	8444	39836	10000	1303334
2018	132774	-10667	-22501	99606	1057841	-193000	864841	97406	-696	96709	-56856	2834	623	1057	10000	1018814
2019	132745	-10667	-22501	99577	958137	-228000	730137	101218	-636	100582	-56856	13156	3438	6833	10000	906868
2020	132344	-10667	-22501	99176	1097408	-268000	829408	105150	-567	104583	-56856	2834	623	1057	10000	990825
2021	132302	-10667	-22501	99134	970489	-288000	682489	109366	-501	108865	-56856	2834	623	1057	10000	848146
2022	132149	-10667	-22501	98981	1102483	-288000	814483	113687	-417	113269	-56856	2834	623	1057	10000	984391
2023	132552	-10667	-22501	99384	933630	-288000	645630	113475	-280	113195	-56856	2834	623	1057	10000	815866
2024	132524	-10667	-22501	99356	1018457	-293000	725457	118647	-107	118540	-56856	2834	623	1057	10000	901011
2025	132814	-10667	-22501	99646	984430	-298000	686430	123826	82	123908	-56856	2834	623	1057	10000	867642
2026	133017	-10667	-22501	99849	1105981	-303000	802981	128795	240	129035	-56856	2834	623	1057	10000	989523
2027	133634	-10667	-22501	100466	1041634	-303000	738634	133511	398	133910	-56856	2834	623	1057	10000	930668
2028	133883	-10667	-22501	100715	987664	-303000	684664	137868	540	138408	-56856	2834	623	1057	10000	881445
2029	133607	-10667	-22501	100439	1009093	-303000	706093	141721	658	142379	-56856	2834	623	1057	10000	906569
2030	132706	-10667	-22501	99538	1028147	-303000	725147	145188	757	145944	-56856	2834	623	1057	10000	928287
2031	132219	-10667	-22501	99051	988991	-303000	685991	148357	838	149194	-56856	2834	623	1057	10000	891894
2032	132384	-10667	-22501	99216	991076	-303000	688076	151285	904	152188	-56856	2834	623	1057	10000	897139
2033	132551	-10667	-22501	99383	1106342	-303000	803342	154047	957	155004	-56856	2834	623	1057	10000	1015387
2034	132393	-10667	-22501	99225	997398	-303000	694398	156366	999	157364	-56856	2834	623	1057	10000	908645
2035	131720	-10667	-22501	98552	947379	-303000	644379	158268	1032	159300	-56856	2834	623	1057	10000	859889
2036	130969	-10667	-22501	97801	1035849	-303000	732849	158352	1059	159411	-56856	2834	623	1057	10000	947720
2037	130785	-10667	-22501	97617	1029275	-303000	726275	158240	1081	159320	-56856	2834	623	1057	10000	940870
2038	131111	-10667	-22501	97943	945364	-303000	642364	157955	1098	159053	-56856	2834	623	1057	10000	857018
2039	131438	-10667	-22501	98270	1022577	-303000	719577	157519	1111	158631	-56856	2834	623	1057	10000	934135
2040	131228	-10667	-22501	98060	1021389	-303000	718389	156951	1122	158073	-56856	2834	623	1057	10000	932179
2041	131224	-10667	-22501	98056	1091373	-303000	788373	156267	1130	157397	-56856	2834	1098	1382	10000	1002283
2042	130574	-10667	-22501	97406	1002077	-303000	699077	155484	1136	156620	-56856	2834	623	1057	10000	910761
2043	130754	-10667	-22501	97586	938756	-303000	635756	154613	1141	155754	-56856	2834	731	1131	10000	846936
2044	130920	-10667	-22501	97752	884449	-303000	581449	153668	1145	154813	-56856	2834	623	1057	10000	791672
2045	130558	-10667	-22501	97390	937873	-303000	634873	152658	1148	153806	-56856	9093	623	3392	10000	852321

Table H2-5 (continued)
Projected Salton Sea Inflows for No Action Alternative-CEQA Conditions

	Mexico				Imperial Valley			Coachella Valley				Local Watershed				
Year	Mexico Baseline Inflow (af/yr)	Adjustment for Mexicali Power Plants (af/yr)	Adjustment for Mexicali Wastewater Treatment Plant (af/yr)	Adjusted Mexico Inflow (af/yr)	Imperial Valley Baseline Discharge to Sea (af/yr)	Adjustment for QSA (af/yr)	Adjusted Imperial Valley Discharge to Sea (af/yr)	Adjusted Coachella Valley Surface Flows to Sea (af/yr)	Adjusted Coachella Valley Aquifer Flows to/from Sea (af/yr)	Total Coachella Valley Discharge to Sea (af/yr)	IOPP (af/yr)	San Felipe Creek (af/yr)	Salt Creek (af/yr)	Ungaged Watershed Inflows (af/yr)	Local Groundwater Inflows (af/yr)	Total Inflow to Sea (af/yr)
2046	130319	-10667	-22501	97151	987754	-303000	684754	151593	1150	152743	-56856	2834	623	1057	10000	892306
2047	129928	-10667	-22501	96760	927646	-250000	677646	150480	1152	151632	-56856	2834	623	1057	10000	883696
2048	130196	-10667	-22501	97028	982748	-250000	732748	149326	1153	150480	-56856	2834	623	1057	10000	937913
2049	129788	-10667	-22501	96620	992067	-250000	742067	148138	1154	149292	-56856	2834	623	1057	10000	945637
2050	129419	-10667	-22501	96251	1005793	-250000	755793	146919	1155	148074	-56856	2834	623	1057	10000	957777
2051	129637	-10667	-22501	96469	1016584	-250000	766584	145675	1156	146831	-56856	2834	623	1057	10000	967542
2052	129396	-10667	-22501	96228	1022530	-250000	772530	144409	1156	145565	-56856	2834	623	1057	10000	971982
2053	129479	-10667	-22501	96311	879393	-250000	629393	143124	1157	144281	-56856	2834	623	1057	10000	827642
2054	129082	-10667	-22501	95914	944597	-250000	694597	141823	1157	142980	-56856	41246	8256	20606	10000	956743
2055	129357	-10667	-22501	96189	1114332	-250000	864332	140509	1157	141666	-56856	17104	623	6380	10000	1079439
2056	129412	-10667	-22501	96244	923277	-250000	673277	139183	1157	140340	-56856	3870	2620	2809	10000	872304
2057	129120	-10667	-22501	95952	996533	-250000	746533	137847	1157	139005	-56856	2834	3000	2683	10000	943150
2058	129201	-10667	-22501	96033	939315	-250000	689315	136503	1158	137660	-56856	4750	3330	3624	10000	887857
2059	129031	-10667	-22501	95863	1017618	-250000	767618	135151	1158	136309	-56856	2834	623	1057	10000	957448
2060	129250	-10667	-22501	96082	942368	-250000	692368	133794	1158	134951	-56856	2834	623	1057	10000	881059
2061	128867	-10667	-22501	95699	946206	-250000	696206	132431	1158	133589	-56856	56244	13153	29551	10000	977585
2062	128934	-10667	-22501	95766	918281	-250000	668281	131063	1158	132221	-56856	2834	623	1057	10000	853927
2063	128626	-10667	-22501	95458	1090278	-250000	840278	129692	1158	130850	-56856	2834	623	1057	10000	1024244
2064	128594	-10667	-22501	95426	1018620	-250000	768620	129711	1158	130869	-56856	2834	623	1057	10000	952572
2065	128659	-10667	-22501	95491	886105	-250000	636105	129727	1158	130885	-56856	2834	1293	1516	10000	821267
2066	128754	-10667	-22501	95586	936635	-250000	686635	129740	1158	130898	-56856	2834	623	1057	10000	870777
2067	128628	-10667	-22501	95460	971767	-250000	721767	129751	1158	130909	-56856	2834	623	1057	10000	905795
2068	128400	-10667	-22501	95232	984432	-250000	734432	129761	1158	130919	-56856	2834	623	1057	10000	918241
2069	128398	-10667	-22501	95230	937504	-250000	687504	129770	1158	130927	-56856	6706	1293	2960	10000	877765
2070	128267	-10667	-22501	95099	850081	-250000	600081	129777	1158	130934	-56856	7012	7775	7507	10000	801552
2071	128498	-10667	-22501	95330	942359	-250000	692359	129783	1158	130941	-56856	13420	1886	5870	10000	892950
2072	128594	-10667	-22501	95426	983336	-250000	733336	129788	1158	130946	-56856	2834	623	1057	10000	917366
2073	128772	-10667	-22501	95604	1016119	-250000	766119	129792	1158	130950	-56856	2834	623	1057	10000	950331
2074	128793	-10667	-22501	95625	1084471	-250000	834471	129796	1158	130954	-56856	2834	623	1057	10000	1018708
2075	126627	-10667	-22501	93459	1103947	-250000	853947	129799	1158	130957	-56856	2834	1858	1902	10000	1038101
2076	123971	-10667	-22501	90803	1094724	-250000	844724	129802	1158	130960	-56856	2834	623	1057	10000	1024145
2077	120863	-10667	-22501	87695	1000653	-250000	750653	129805	1158	130963	-56856	2834	623	1057	10000	926969
Avg (2003-77)	**129366**	**-10667**	**-21171**	**97527**	**995413**	**-217960**	**777453**	**125756**	**542**	**126298**	**-56856**	**6064**	**1316**	**2736**	**10000**	**964539**
Avg (2018-77)	**130212**	**-10667**	**-22501**	**97044**	**994894**	**-270950**	**723944**	**137572**	**873**	**138446**	**-56856**	**5238**	**1317**	**2429**	**10000**	**921562**
Min	**119082**	**-10667**	**-22501**	**87695**	**850081**	**-303000**	**581449**	**72165**	**-853**	**71357**	**-56856**	**2834**	**623**	**1057**	**10000**	**791672**
Max	**133883**	**-10667**	**0**	**110212**	**1114332**	**5000**	**1096122**	**158352**	**1158**	**159411**	**-56856**	**92453**	**13153**	**39836**	**10000**	**1303334**

The QSA EIR/EIS No Action Conditions salt load projections from the Imperial Valley to the Salton Sea may overestimate the future salt load due to the assumption in the IIDSS modeling that future Colorado River salinity at Imperial Dam would be at the maximum numeric target of 879 mg/L (IID, 2002) as compared to recent trends of salinity under 800 mg/L. If the future Colorado River salinity at Imperial Dam is lower than the numeric target, the leaching requirement (amount of water needed for on-farm salinity control) and associated salt load of Imperial Valley drain water would be reduced. The uncertainty in Imperial Valley salt loads due to future Colorado River salinity could be as much as 500,000 tons/year and could reduce the IID-projected tilewater flows by as much as 40,000 acre-feet/year. Due to the considerable degree of uncertainty regarding future Colorado River salinity, this factor is not considered in the No Action Alternative-CEQA Conditions estimates. The QSA EIR/EIS Conditions average salt loads from the Imperial Valley have been estimated at 3,374,000 tons/year for the 2003 to 2078 period and 3,376,000 tons/year for the 2018 to 2078 period, and would range from 3,051,000 to 3,595,000 tons/year.

The inflows from the Imperial Valley will be reduced in the future by 56,856 acre-feet/year based on the Entitlement Enforcement and Inadvertent Overrun and Payback Policy. These assumptions were included in the QSA EIR/EIS No Action Conditions.

Under the No Action Alternative-CEQA Conditions, average flows from the Imperial Valley to the Salton Sea would decrease to 777,000 acre-feet/year over the 2003 to 2078 period and 724,000 acre-feet/year for the 2018 to 2078 period. Salt loads from the Imperial Valley under the No Action Alternative-CEQA Conditions would decrease to 3,101,000 tons/year for the 2003 to 2078 period and 3,051,000 tons/year for the 2018 to 2078 period. The projected reductions in Imperial Valley flows and salt loads from historic conditions would be due to the implementation of the QSA and IID Water Conservation and Transfer Project described below.

IID Water Conservation and Transfer Project

Under the No Action Alternative-CEQA Conditions, implementation of the QSA and the IID Water Conservation and Transfer Project will reduce water use in the IID water service area. Under the QSA, water is conserved by IID and transferred to SDCWA, CVWD, and/or Metropolitan over an initial contract term of 45 years (or possibly 35 years, if appropriate water wheeling arrangements are not reached between Metropolitan and SDCWA). If there is consent among all parties, the transfer will be extended for an additional 30 years. The amount of water to be conserved and transferred under the IID Water Conservation and Transfer Project will increase over the first 24 years to 303,000 acre-feet/year, as shown in Table H2-6. During the first 15 years of the IID Water Conservation and Transfer Project, mitigation water is being generated and discharged to the Salton Sea using fallowing to manage salinity in the Salton Sea through 2017 as required by the State Water Resources Control Board (SWRCB). By 2017, the method of generating water for transfers will be converted from land fallowing to conservation/efficiency improvements, and will result in reductions in inflows to the Salton Sea that would not be replaced through mitigation measures. The average reduction in inflows to the Salton Sea from Imperial Valley due to the QSA and IID Water Conservation and Transfer Project have been estimated to be 218,000 acre-feet/year for the 2003 to 2078 period and 271,000 acre-feet/year for the 2018 to 2078 period.

Table H2-6
Quantification Settlement Agreement Delivery Schedule by Conservation Method

QSA Year	Calendar Year	IID and SDCWA	IID and CVWD [a],	IID and Metro-politan	Total Delivery	Total Efficiency	Fallowing for Delivery	Mitigation Fallowing	Total Fallowing
1	2003	10	0	0	10	0	10	5	15
2	2004	20	0	0	20	0	20	10	30
3	2005	30	0	0	30	0	30	15	45
4	2006[b]	40	0	0	40	0	40	20	60
5	2007	50	0	0	50	0	50	25	75
6	2008	50	4	0	54	4	50	25	75
7	2009[b]	60	8	0	68	8	60	30	90
8	2010	70	12	0	82	12	70	35	105
9	2011	80	16	0	96	16	80	40	120
10	2012	90	21	0	111	21	90	45	135
11	2013	100	26	0	126	46	80	70	150
12	2014	100	31	0	131	71	60	90	150
13	2015	100	36	0	136	96	40	110	150
14	2016	100	41	0	141	121	20	130	150
15	2017	100	45	0	145	145	0	150	150
16	2018	130	63	0	193	193	0	0	0
17	2019	160	68	0	228	228	0	0	0
18	2020	192.5	73	0	268	268	0	0	0
19	2021	205	78	0	288	288	0	0	0
20	2022	202.5	83	0	288	288	0	0	0
21	2023	200	88	0	288	288	0	0	0
22	2024	200	93	0	293	293	0	0	0
23	2025	200	98	0	298	298	0	0	0
24	2026	200	103	0	303	303	0	0	0
25	2027	200	103	0	303	303	0	0	0
26	2028	200	103	0	303	303	0	0	0
27 to 45	2029 to 2047	200	103	0	303	303	0	0	0
46 to 75[b]	2048 to 2078	200	50	0	250	250	0	0	0

Source: CVWD et al. 2003; IID, 2003.
All values in thousands of acre-feet

[a] If CVWD declines to acquire these amounts, Metropolitan has an option to acquire them, but acquisition by Metropolitan of conserved water in lieu of CVWD during the first 15 years is subject to satisfaction by Metropolitan of certain conditions, including subsequent environmental assessment.

[b] This assumes that the parties have approved the extension of the 45-year initial term of the IID Water Conservation and Transfer Project.

The reductions in salt loads from the Imperial Valley associated with the QSA and IID Water Conservation and Transfer Project were developed using assumptions consistent with IID (2002) and Reclamation revised estimates (Weghorst, 2004). The change in salt load was estimated to be about 879 mg/L. The water conserved through fallowing and delivered out of the watershed was estimated to reduce return flows to the Salton Sea, in the absence of mitigation water, by one-half the quantity of delivered water. Salt concentration in the return flows was estimated to be 3.6 tons/acre-foot of flow (Weghorst, 2004). This value was not been independently confirmed.

Water transferred to CVWD would be conserved through efficiency measures and a portion of the water delivered would be returned to the Salton Sea after use in the Coachella Valley. Estimated reductions in salt loads from the Imperial Valley due to the QSA and IID Water Conservation and Transfer Project have been estimated to be 272,000 tons/year for the 2003 to 2078 study period and 325,000 tons/year for the 2018 to 2078 period.

Sedimentation/Silt Total Maximum Daily Loads for New and Alamo Rivers

Sedimentation/Siltation Total Maximum Daily Loads (TMDLs) for the New and Alamo rivers have been adopted and approved and are just beginning full implementation. Compliance with TMDLs is projected to occur due to implementation of the Imperial County Farm Bureau (ICFB) Voluntary Watershed Program that provides education material for farmers, promotes Best Management Practices (BMPs), suggests monitoring methods, and identifies potential funding sources. The effect of TMDL compliance on drain water flows to the Salton Sea is not yet known, but is estimated to reduce inflows further as on-farm tailwater management improves. Kalin (2005), an ICFB on-farm TMDL consultant, has indicated that total drain water may be reduced by 30 percent on some fields due to implementation of BMPs. Pump-back systems or transition to sprinkler or drip irrigation methods would result in little or no tailwater (ICFB, 2003).

Although the TMDLs are considered to be part of the Existing Conditions, reductions in inflows and salinity have not been measured on a uniform basis. In addition, the PEIR analysis does not include a hydrologic analysis of inflows under Existing Conditions. Therefore, consideration of changes in inflows due to implementation of TMDLs are included in the No Action Alternative-CEQA Conditions. However, due to the uncertainty surrounding the actual methods farmers in the Imperial Valley could implement to comply with the TMDLs, no adjustments were made to the inflows.

Inflows from Coachella Valley

Agricultural and storm runoff in the Coachella Valley is conveyed to the Salton Sea in the Whitewater River/CVSC and through drains that discharge directly to the Salton Sea. The amount discharged to the Salton Sea is related to the management of the Coachella Valley groundwater basin, the supplies available to CVWD from both the Coachella Canal and the Colorado River Aqueduct, the quantity and quality of diverted Colorado River water, the type and amount of irrigated acreage, water management within CVWD, and on-farm water management. Contrasting with agriculture drainage in the Imperial Valley, farm drainage in the Coachella Valley mostly returns to the groundwater basin by percolation through the permeable soils. In the lower valley, however, relatively impermeable subsurface layers restrict downward percolation and have created shallow semi-perched groundwater conditions. An extensive drain network has been developed in this area to convey shallow groundwater away from root zones to the CVSC and smaller drains. Thus, changes in management of the groundwater basin or lower valley drainage system, in addition to other changes in water management, would affect inflows and salt loads to the Salton Sea from the Coachella Valley.

Flows and salt loads from the Coachella Valley to the Salton Sea in the QSA EIR/EIS No Action Conditions were used as the basis for the development of the hydrologic projections for the PEIR. The inflows and salt loads were extended to meet the 2003 to 2078 study period by CVWD (Ringel, 2005).

Average flows from the Coachella Valley to the Salton Sea would significantly increase to 126,000 acre-feet/year over the 2003 to 2078 period and 138,000 acre-feet/year for the 2018 to 2078 period. Salt loads from the Coachella Valley under the No Action Alternative-CEQA Conditions would increase to 385,000 tons/year for the 2003 to 2078 period and 452,000 tons/year for the 2018 to 2078 period. The projected increases in Coachella Valley flows and salt loads would be caused by implementation of QSA related projects and the Coachella Valley Water Management Plan (CVWD, 2002).

QSA Related Projects

Under the QSA projects and IID Water Conservation and Transfer Project (IID, 2002), up to 103,000 acre-feet/year of water will be conserved by IID and transferred to CVWD, as shown in Table H2-6. After 45 years of the QSA implementation, IID will conserve the first 50,000 acre-feet/year of the water to be supplied to CVWD and Metropolitan is projected to provide 50,000 acre-feet/year (CVWD et al., 2003). Water delivered to CVWD from IID will be conserved from on-farm or other efficiency measures. Some portion of the delivered water would be expected to return to the Salton Sea.

Coachella Valley Water Management Plan

CVWD developed a comprehensive plan for future management of water resources in the Coachella Valley to address overdraft conditions in the Coachella Valley groundwater basin, declining groundwater levels, the possibility of future land subsidence, and degradation in groundwater quality. The Coachella Valley Water Management Plan and State Water Project (SWP) Entitlement Transfer EIR (CVWD, 2002) describes the CVWD water plan involving water conservation, acquisition of additional water supplies, source substitution, and groundwater recharge to satisfy future water demand and provide sustainable management of the groundwater basin. The additional water supplies considered in the Water Management Plan include Colorado River water from the IID transfer (103,000 acre-feet/year), water savings from the Coachella Canal Lining Project (26,000 acre-feet/year), SWP Entitlement delivery through an exchange with Metropolitan (100,000 acre-feet/year entitlement, average 50,000 acre-feet/year delivery), additional imported water most likely from SWP Entitlement purchases (40,000 acre-feet/year), additional treated municipal wastewater (16,000 acre-feet/year), and desalted drain water from the CVSC in the Oasis area (11,000 acre-feet/year). These supplies, along with the conservation programs, source substitution, and groundwater recharge, would stabilize water levels and improve the groundwater quality.

The effects of the water management projects on the Coachella Valley water resources were evaluated by CVWD (2002) using a three-dimensional groundwater model of the basin. As a result of elevated groundwater levels in the lower valley, the discharge to surface drains and inflows to the Salton Sea were projected to increase substantially. Results from the modeling indicate that the average inflows to the Salton Sea from the Coachella Valley would be about 126,000 acre-feet/year for the 2003 to 2078 period and 138,000 acre-feet/year for the 2018 to 2078 period.

The salt loads to the Salton Sea from the Coachella Valley also would increase as salts are flushed from the groundwater basin. The salt loads would be 385,000 tons/year for the 2003 to 2078 period and 452,000 tons/year for the 2018 to 2078 period.

Inflows from Portions of the Watershed Not Tributary to Irrigated Areas of the Imperial and Coachella Valleys

The portion of the Salton Sea watershed that is not tributary to the irrigated areas of Imperial and Coachella valleys contributes relatively small quantities of flow to the Salton Sea. These inflows were included in the assumptions for the QSA EIR/EIS No Action Conditions.

The future estimated average inflow to the Salton Sea from the portion of the watershed not tributary to the irrigated areas of Imperial and Coachella valleys would be 20,000 acre-feet/year for the 2003 to 2078 period and 19,000 acre-feet/year for the 2018 to 2078 period and would range from 15,000 to 151,000 acre-feet/year. Future average salt loads from the local watershed have been estimated to be 65,000 tons/year for the 2003 to 2078 period and 62,000 tons/year for the 2018 to 2078 period.

The contribution from San Felipe Creek, Salt Creek, and surface runoff from other smaller areas on the west and east shore were estimated through the use of the historically developed relationships between rainfall and runoff. Rainfall records for Brawley and Mecca stations were obtained and extended for the 1925 to 1999 period to provide consistency with the historical climate period used for projecting future Imperial Valley inflows.

Future San Felipe Creek inflows to the Salton Sea were estimated by applying the runoff relationship to Brawley rainfall, as shown in Figure H2-4. The future "runoff" portion of Salt Creek discharge was estimated in a similar fashion using the historical rainfall at Mecca, as shown in Figure H2-5. However, since a large portion of Salt Creek discharges are caused by seepage from the Coachella Canal and other groundwater discharges upstream of the Salton Sea, the baseflow of 623 acre-feet/year was added to the future estimated runoff. The 623 acre-feet/year value is the average of the 1996 to 1999 discharge (low rainfall years) and the amount that CVWD has committed to provide at the Salt Creek gage as mitigation for the Coachella Canal Lining Project (Reclamation and CVWD, 2001). Only in higher rainfall years are flows expected to be significantly higher than this value. Using the same method as historical estimates, runoff from the ungaged areas on the east and west shore of the Salton Sea were estimated by prorating either San Felipe Creek discharge or Salt Creek runoff by relative watershed areas. Future groundwater inflows from the west shore were assumed to be the same as those for the historic period.

Future estimated salt loads from the watershed not tributary to the irrigated areas of Imperial or Coachella valleys were developed by assuming the estimated historic salinity would be the same in the future.

Evaporation and Precipitation

The development of historic evaporation rates at the Salton Sea was described in previous sections of this appendix. Long term evaporation rates developed from a historic water budget compared well to those estimated by Hely et al. (1966) and to adjusted pan evaporation rates. The average evaporation rate was estimated at 69 inches/year, or 66.4 inches/year as a net evaporation rate (evaporation minus precipitation). The net evaporation rates estimated from the historical analysis have been adopted for use in the No Action Alternative-CEQA Conditions.

Summary of Projected Salton Sea Inflows and Salt Loads under No Action Alternative-CEQA Conditions

The projected total average inflow to the Salton Sea for the 2003 to 2078 period has been estimated at about 965,000 acre-feet/year with a minimum of 792,000 acre-feet/year and a maximum of 1,303,000 acre-feet/year, as summarized in Table H2-5 and Figure H2-11. The average inflow for 2018 to 2078 would be 922,000 acre-feet/year. Figure H2-12 shows a comparison of average annual inflows to the Salton Sea by source, for the Historic, QSA No Action Alternative, and No Action Alternative-CEQA Conditions. Use of average annual inflows is of limited value for projecting absolute flows because it does not show changes due to reliability and inter-annual variability aspects; however, it is useful for evaluating trends.

The No Action Alternative-CEQA Conditions inflows would be significantly lower than Historic conditions due primarily to the QSA-related transfers from IID and a projected reduction in inflows from Mexico due to reduced surplus Colorado River flows, power plant use of New River flows, and treatment and conveyance of wastewater flows out of the Salton Sea watershed. A projected increase in Coachella Valley drain flows to the Salton Sea would partially offset reductions from the Imperial Valley and Mexico.

In the discussion above, the sequence of future climate conditions has been assumed to occur as it did in the past. For example, projected future 2003 to 2078 conditions for Imperial Valley and local watershed flows to the Salton Sea are based on the estimated climate conditions of the 1925 to 1999 historical sequence (primarily rainfall, evapotranspiration rates, and evaporation rates). Even if the climate is consistent with that during the historical period, the historical sequence would not reproduce identically in the future. For this reason, the inflow analysis for the No Action Alternative-CEQA Conditions was developed using a statistical approach known as Monte-Carlo analysis to generate many possible future sequences (no adjustment to values, just sequence) based on the historic climate values and patterns. Using this approach, the future projections incorporate variability in climate conditions and can be viewed in a probabilistic fashion. The results of this type of analysis for the estimated No Action Alternative-CEQA Conditions inflows are shown in Figure H2-13. The projected variability of total inflow to the Salton Sea could be up to 200,000 acre-feet in any one year.

The projected total average salt load to the Salton Sea for the 2003 to 2078 period has been estimated at about 3,958,000 tons/year with a minimum of 3,672,000 tons/year and a maximum of 4,243,000 tons/year, as shown in Figure H2-14 and Table H2-7. The annual variability of salt loads would be less than the annual variability of inflows.

DESCRIPTION OF NO ACTION ALTERNATIVE-VARIABILITY CONDITIONS

As described above, the No Action Alternative-CEQA Conditions represents future conditions with be reasonably foreseeable projects. However, many other future changes are possible within the next 75 years. Due to this uncertainty in future inflows, the Inflows/Modeling Working Group recommended an approach that would include future possibilities and accommodates principles of risk to describe an alternative future condition. This alternative future is termed the “No Action Alternative-Variability Conditions.” This section describes the purpose, approach, and development of the hydrology for the No Action Alternative-Variability Conditions.

Basis for No Action Alternative-Variability Conditions

Like most terminal lakes, the Salton Sea is highly sensitive to changes in inflows and climate conditions. The Salton Sea is constantly adjusting to the external forces of inflows, evaporation, and precipitation and is attempting to reach equilibrium water balance conditions in which the water surface evaporation balances with inflows. However, the hydrologic regime is not in static equilibrium and this dynamic condition causes continual changes in water volume, surface area, and elevation. In recent years, water surface evaporation has been about equal to total inflows causing only minor changes in the water surface area or elevation of the Salton Sea. However, the changes in inflows projected under the No Action Alternative-Variability Conditions would cause evaporation to become greater than inflows, and the water surface area of the Salton Sea would decrease.

The Salton Sea has no entitlement to the water that has historically been discharged. Other than rainfall and local surface and subsurface flows, which are minimal, inflow to the Salton Sea is from drainage that is incidental from the beneficial use of local groundwater and Colorado River water imported into the basin. The numerous factors that affect the volume of water used within the basin and the volumes of incidental drainage that would be discharged to the Salton Sea create a certain level of uncertainty in projecting future inflows.

Water quality and biological resources at the Salton Sea are sensitive to changes in inflows and salt loads; therefore, the Working Group believed that is was imperative to consider a range of possible future conditions such that decisions regarding the future restoration of the Salton Sea and placement of major infrastructure elements accommodate uncertainty.

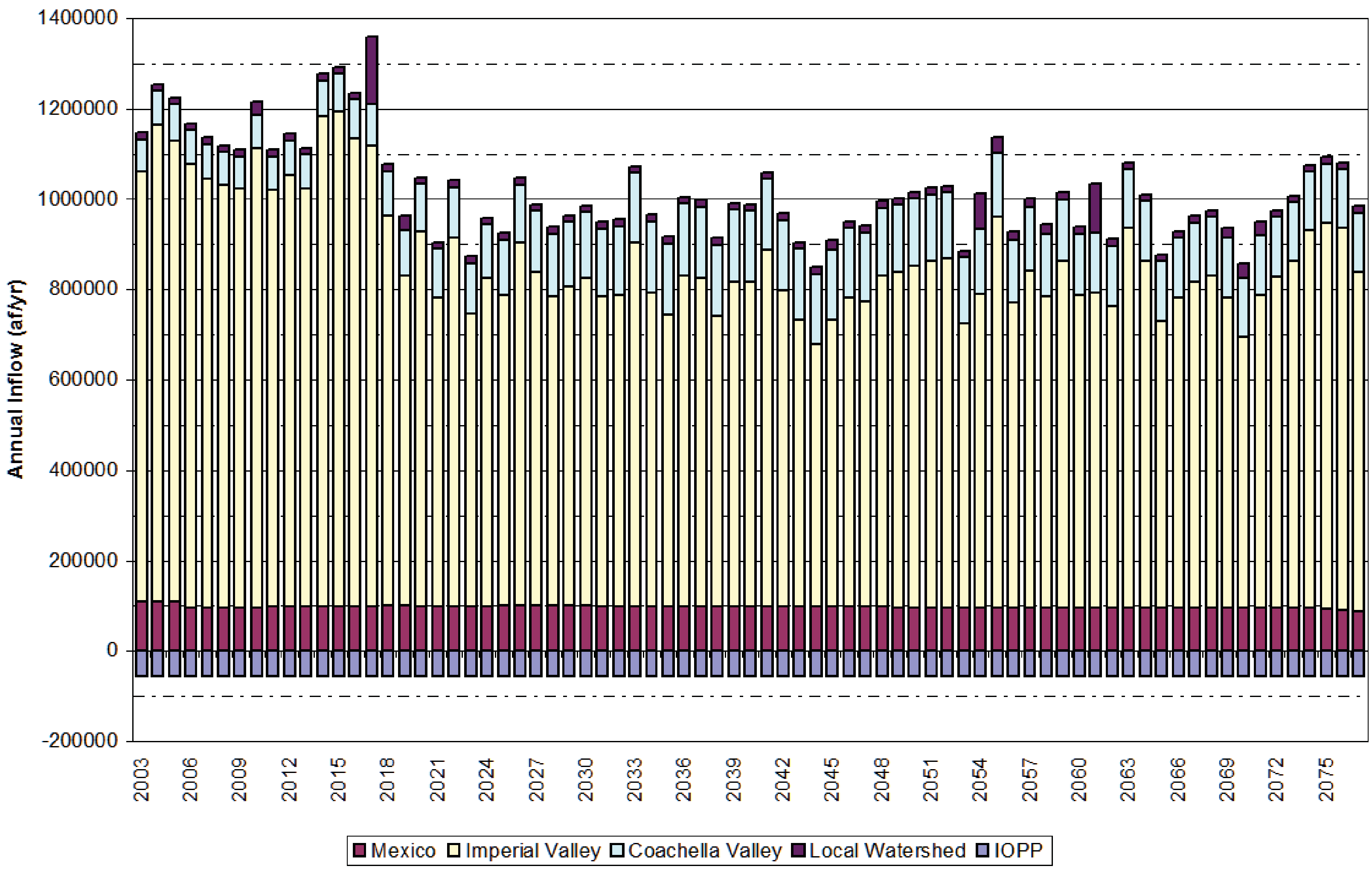
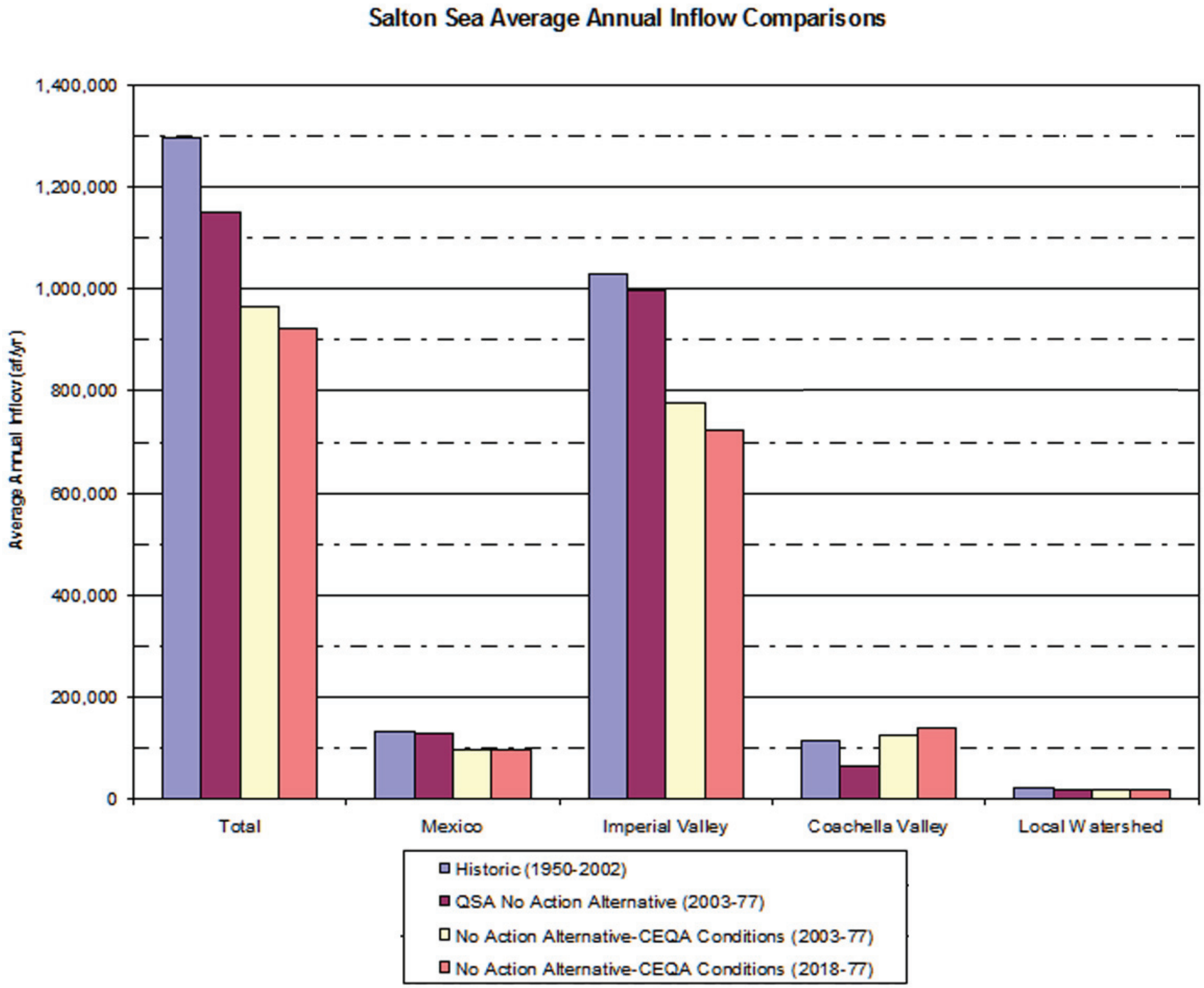


FIGURE H2-11
PROJECTED SALTON SEA INFLOWS FOR NO ACTION ALTERNATIVE-CEQA CONDITIONS



Note: "Total" includes a reduction of 56 kaf/yr in Future scenarios to represent compliance with IOPP which would come from a reduction in water delivery by either IID, CVWD, or both.

FIGURE H2-12
COMPARISON OF AVERAGE ANNUAL INFLOWS TO THE SALTON SEA UNDER HISTORIC, QSA NO ACTION ALTERNATIVE, AND NO ACTION ALTERNATIVE-CEQA CONDITIONS

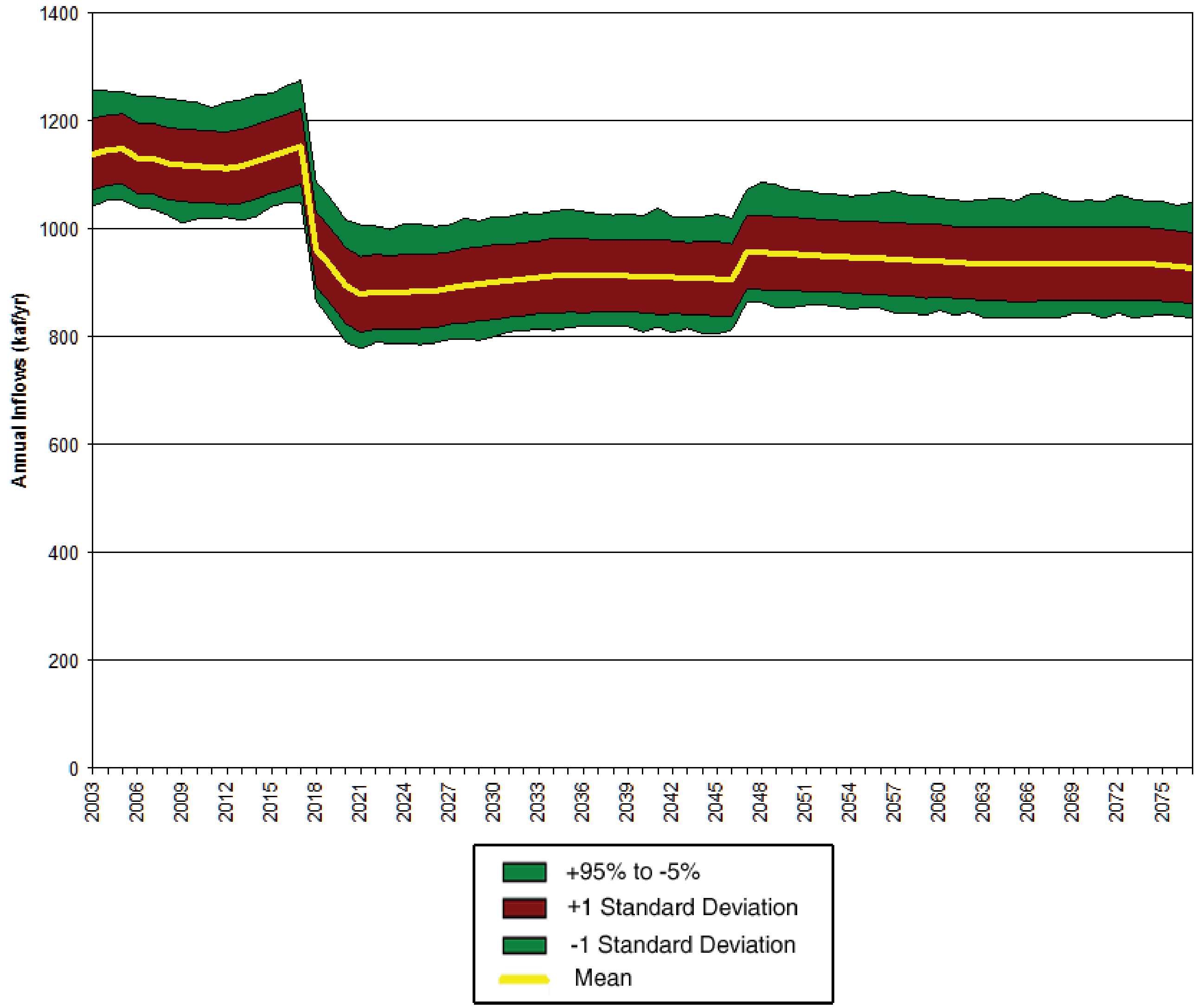


FIGURE H2-13
PROJECTED NO ACTION ALTERNATIVE-CEQA CONDITIONS INFLOWS

Note: Based on historical climate variability.

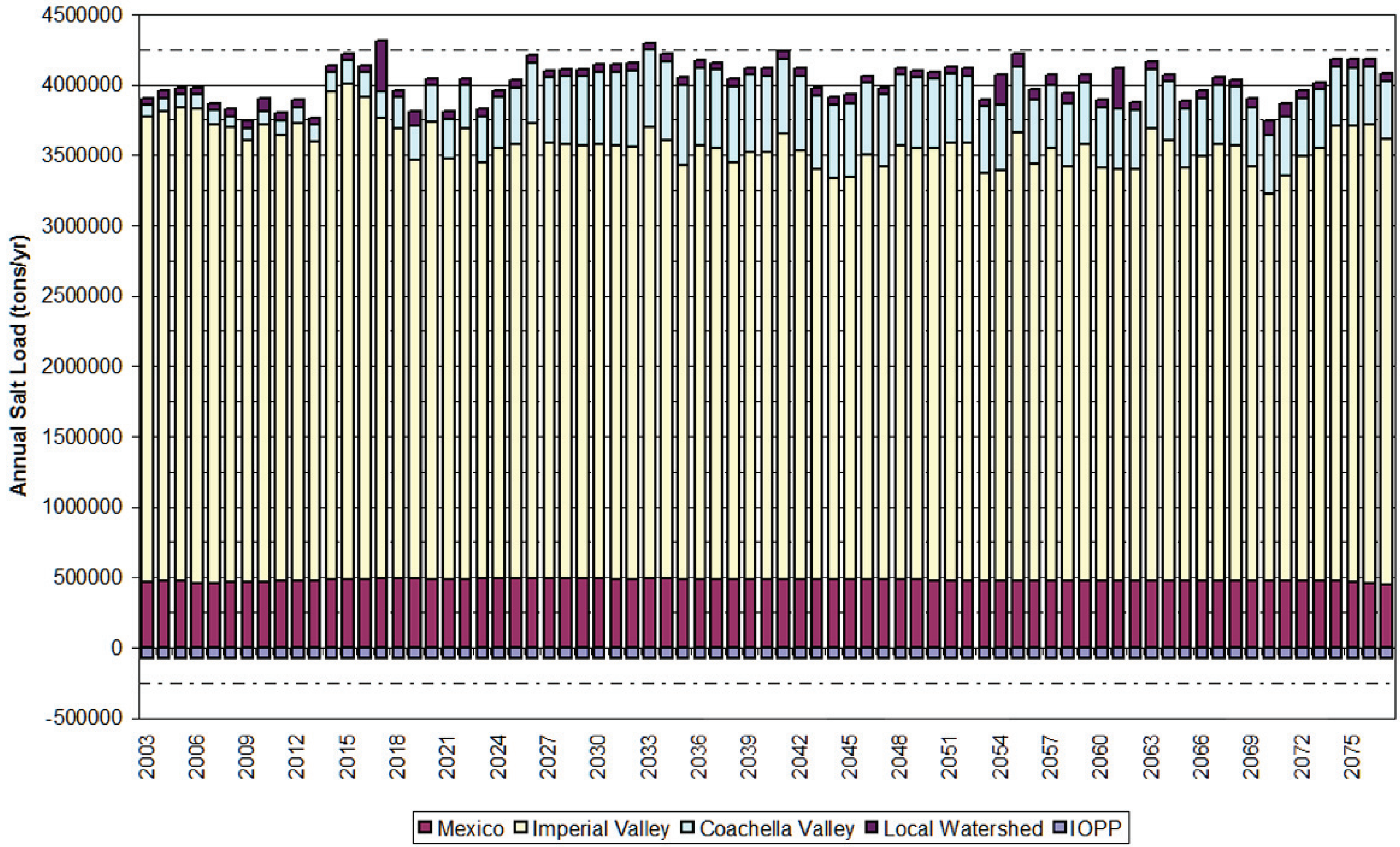


FIGURE H2-14
PROJECTED SALT LOADS TO THE SALTON SEA UNDER NO ACTION ALTERNATIVE-CEQA CONDITIONS

Note: Does not include internal sources from Sea Bed.

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Table H2-7
Projected Salt Loads to the Salton Sea Under No Action Alternative-CEQA Conditions

	Mexico				Imperial Valley			Coachella Valley		Local Watershed				
Year	Mexico Baseline Salt Load (tons/yr)	Adjustment for Mexicali Power Plants (tons/yr)	Adjustment for Mexicali Wastewater Treatment Plant (tons/yr)	Adjusted Mexico Salt Load (tons/yr)	Imperial Valley Baseline Salt Load (tons/yr)	Adjustment for QSA (tons/yr)	Adjusted Imperial Valley Salt Load (tons/yr)	Adjusted Coachella Valley Salt Load (tons/yr)	IOP Payback (tons/yr)	San Felipe Creek (tons/yr)	Salt Creek (tons/yr)	Ungaged Watershed (tons/yr)	Local Groundwater (tons/yr)	Total Salt Load to Sea (tons/yr)
2003	470834	-4500	0	466334	3322499	-12000	3310499	80174	-71052	6003	3033	2239	39716	3836948
2004	475301	-4500	0	470801	3366696	-24000	3342696	93387	-71052	6003	3033	2239	39716	3886825
2005	477934	-4500	0	473434	3396683	-36000	3360683	94991	-71052	6003	3033	2239	39716	3909048
2006	481829	-4500	-20161	457168	3424603	-48000	3376603	94146	-71052	6003	3033	2239	39716	3907857
2007	484365	-4500	-21338	458527	3323010	-60000	3263010	93182	-71052	6003	3033	2239	39716	3794660
2008	487494	-4500	-22514	460480	3299450	-64800	3234650	79358	-71052	6003	3033	2239	39716	3754429
2009	491246	-4500	-23690	463056	3227023	-81600	3145423	84018	-71052	6003	3033	2239	39716	3672438
2010	497931	-4500	-24866	468565	3349659	-98400	3251259	90477	-71052	23719	15391	12525	39716	3830601
2011	503154	-4500	-26041	472614	3288365	-115200	3173165	100266	-71052	6003	3033	2239	39716	3725985
2012	508210	-4500	-27217	476493	3381829	-133200	3248629	114662	-71052	6003	3033	2239	39716	3819725
2013	510943	-4500	-28393	478050	3232189	-115200	3116989	118764	-71052	6003	3033	2239	39716	3693744
2014	516815	-4500	-29569	482746	3551068	-85200	3465868	139836	-71052	6003	3033	2239	39716	4068391
2015	519121	-4500	-29569	485052	3576103	-55200	3520903	162701	-71052	6003	3033	2239	39716	4148597
2016	522586	-4500	-29569	488516	3445681	-25200	3420481	178335	-71052	6003	3033	2239	39716	4067273
2017	523439	-4500	-29569	489370	3264394	6000	3270394	193471	-71052	195851	41112	84387	39716	4243249
2018	524915	-4500	-29569	490846	3427082	-231600	3195482	222207	-71052	6003	3033	2239	39716	3888476
2019	524803	-4500	-29569	490734	3248941	-273600	2975341	240923	-71052	27870	16740	14475	39716	3734748
2020	523219	-4500	-29569	489150	3565121	-321600	3243521	261172	-71052	6003	3033	2239	39716	3973783
2021	523053	-4500	-29569	488983	3331390	-345600	2985790	282395	-71052	6003	3033	2239	39716	3737109
2022	522447	-4500	-29569	488377	3546706	-345600	3201106	306397	-71052	6003	3033	2239	39716	3975821
2023	524039	-4500	-29569	489970	3301865	-345600	2956265	328649	-71052	6003	3033	2239	39716	3754825
2024	523929	-4500	-29569	489860	3407048	-351600	3055448	364296	-71052	6003	3033	2239	39716	3889545
2025	525076	-4500	-29569	491007	3445370	-357600	3087770	402167	-71052	6003	3033	2239	39716	3960885
2026	525877	-4500	-29569	491807	3594752	-363600	3231152	433380	-71052	6003	3033	2239	39716	4136280
2027	528314	-4500	-29569	494245	3458898	-363600	3095298	459793	-71052	6003	3033	2239	39716	4029276
2028	529297	-4500	-29569	495228	3447560	-363600	3083960	478479	-71052	6003	3033	2239	39716	4037607
2029	528207	-4500	-29569	494138	3434276	-363600	3070676	495625	-71052	6003	3033	2239	39716	4040379
2030	524648	-4500	-29569	490578	3452860	-363600	3089260	512215	-71052	6003	3033	2239	39716	4071994
2031	522723	-4500	-29569	488654	3440297	-363600	3076697	526732	-71052	6003	3033	2239	39716	4072023
2032	523378	-4500	-29569	489309	3436980	-363600	3073380	540190	-71052	6003	3033	2239	39716	4082820
2033	524036	-4500	-29569	489967	3567579	-363600	3203979	552874	-71052	6003	3033	2239	39716	4226761
2034	523413	-4500	-29569	489344	3475968	-363600	3112368	563082	-71052	6003	3033	2239	39716	4144734
2035	520754	-4500	-29569	486684	3305266	-363600	2941666	571103	-71052	6003	3033	2239	39716	3979394
2036	517789	-4500	-29569	483720	3448445	-363600	3084845	553486	-71052	6003	3033	2239	39716	4101991
2037	517060	-4500	-29569	482991	3434391	-363600	3070791	551376	-71052	6003	3033	2239	39716	4085098
2038	518348	-4500	-29569	484278	3322073	-363600	2958473	548565	-71052	6003	3033	2239	39716	3971257
2039	519641	-4500	-29569	485572	3404727	-363600	3041127	545196	-71052	6003	3033	2239	39716	4051835
2040	518809	-4500	-29569	484740	3399918	-363600	3036318	541374	-71052	6003	3033	2239	39716	4042372
2041	518795	-4500	-29569	484726	3527938	-363600	3164338	537182	-71052	6003	5345	2927	39716	4169186
2042	516228	-4500	-29569	482159	3412273	-363600	3048673	532694	-71052	6003	3033	2239	39716	4043466
2043	516936	-4500	-29569	482867	3278980	-363600	2915380	527967	-71052	6003	3559	2396	39716	3906837
2044	517593	-4500	-29569	483524	3215236	-363600	2851636	523047	-71052	6003	3033	2239	39716	3838147
2045	516163	-4500	-29569	482093	3226817	-363600	2863217	517968	-71052	19263	3033	7185	39716	3861424
2046	515220	-4500	-29569	481151	3381318	-363600	3017718	512760	-71052	6003	3033	2239	39716	3991569
2047	513674	-4500	-29569	479605	3242971	-300000	2942971	507446	-71052	6003	3033	2239	39716	3909962
2048	514733	-4500	-29569	480663	3384930	-300000	3084930	502045	-71052	6003	3033	2239	39716	4047579
2049	513122	-4500	-29569	479053	3372211	-300000	3072211	496580	-71052	6003	3033	2239	39716	4027785
2050	511665	-4500	-29569	477595	3370741	-300000	3070741	491056	-71052	6003	3033	2239	39716	4019333
2051	512527	-4500	-29569	478457	3412826	-300000	3112826	485492	-71052	6003	3033	2239	39716	4056716
2052	511576	-4500	-29569	477507	3408825	-300000	3108825	479889	-71052	6003	3033	2239	39716	4046161
2053	511900	-4500	-29569	477831	3195655	-300000	2895655	474256	-71052	6003	3033	2239	39716	3827683
2054	510333	-4500	-29569	476264	3213389	-300000	2913389	468598	-71052	87374	40198	43652	39716	3998139
2055	511421	-4500	-29569	477352	3488604	-300000	3188604	462919	-71052	36234	3033	13516	39716	4150322
2056	511638	-4500	-29569	477569	3263426	-300000	2963426	457225	-71052	8198	12755	5951	39716	3893788
2057	510484	-4500	-29569	476414	3374209	-300000	3074209	451520	-71052	6003	14606	5683	39716	3997101
2058	510804	-4500	-29569	476735	3245841	-300000	2945841	445802	-71052	10062	16216	7676	39716	3870997
2059	510132	-4500	-29569	476063	3402452	-300000	3102452	440080	-71052	6003	3033	2239	39716	3998536
2060	510996	-4500	-29569	476927	3231338	-300000	2931338	434350	-71052	6003	3033	2239	39716	3822555
2061	509486	-4500	-29569	475417	3224846	-300000	2924846	428613	-71052	119145	64043	62599	39716	4043327
2062	509748	-4500	-29569	475679	3223631	-300000	2923631	422880	-71052	6003	3033	2239	39716	3802130
2063	508533	-4500	-29569	474463	3518586	-300000	3218586	417136	-71052	6003	3033	2239	39716	4090126
2064	508406	-4500	-29569	474337	3432582	-300000	3132582	417018	-71052	6003	3033	2239	39716	4003877
2065	508661	-4500	-29569	474592	3236172	-300000	2936172	416902	-71052	6003	6296	3210	39716	3811840
2066	509038	-4500	-29569	474968	3314338	-300000	3014338	416783	-71052	6003	3033	2239	39716	3886030
2067	508540	-4500	-29569	474471	3405320	-300000	3105320	416662	-71052	6003	3033	2239	39716	3976394
2068	507639	-4500	-29569	473570	3395959	-300000	3095959	416545	-71052	6003	3033	2239	39716	3966014
2069	507633	-4500	-29569	473564	3246003	-300000	2946003	416424	-71052	14207	6296	6270	39716	3831429
2070	507115	-4500	-29569	473046	3050843	-300000	2750843	416302	-71052	14853	37855	15903	39716	3677467
2071	508026	-4500	-29569	473957	3183190	-300000	2883190	416184	-71052	28429	9183	12435	39716	3792043
2072	508406	-4500	-29569	474337	3315452	-300000	3015452	416065	-71052	6003	3033	2239	39716	3885794
2073	509110	-4500	-29569	475041	3373925	-300000	3073925	415947	-71052	6003	3033	2239	39716	3944853
2074	509192	-4500	-29569	475122	3535882	-300000	3235882	415831	-71052	6003	3033	2239	39716	4106776
2075	500637	-4500	-29569	466567	3540304	-300000	3240304	415711	-71052	6003	9048	4029	39716	4110328
2076	490146	-4500	-29569	456077	3558742	-300000	3258742	415591	-71052	6003	3033	2239	39716	4110350
2077	477868	-4500	-29569	443799	3469929	-300000	3169929	415471	-71052	6003	3033	2239	39716	4009139
Avg (2003-77)	**511455**	**-4500**	**-27822**	**479133**	**3373633**	**-272752**	**3100881**	**384592**	**-71052**	**12846**	**6409**	**5796**	**39716**	**3958320**
Avg (2018-77)	**514798**	**-4500**	**-29569**	**480729**	**3376220**	**-325140**	**3051080**	**452110**	**-71052**	**11097**	**6412**	**5145**	**39716**	**3975237**
Min	**470834**	**-4500**	**-29569**	**443799**	**3050843**	**-363600**	**2750843**	**79358**	**-71052**	**6003**	**3033**	**2239**	**39716**	**3672438**
Max	**529297**	**-4500**	**0**	**495228**	**3594752**	**6000**	**3520903**	**571103**	**-71052**	**195850.527**	**64043**	**84387**	**39716**	**4243249**

Analytical Approach

To address the level of uncertainty regarding future inflows to the Salton Sea over the 75-year planning horizon, a stochastic analytical approach was developed with the Inflows/Modeling Working Group members to approximate the range of possible future conditions. In the stochastic analytical approach, hydrologic variability and future uncertainty are expressed as a range of possible future inflows to the Salton Sea. The major sources of inflow uncertainty are identified and the potential range in uncertainty related to each source is described through selection of a probability distribution. The Monte Carlo simulation technique is then used to sample each of the input probability distributions hundreds or thousands of times and generate an equivalent number of possible inflow traces. The final result of this process is a probability distribution that represents the best approximation of the full range of future Salton Sea inflow variability and uncertainty. From this distribution, simpler statistics can be generated to describe the variability and uncertainty. The possible factors of inflow variability and uncertainty, selected probability distributions, and results for each major inflow source are described in the following sections.

The factors discussed below are presented to illustrate the considerable uncertainty in future inflow assumptions under the No Action Alternative-Variability Conditions. The information is presented as changes compared to the No Action Alternative-CEQA Conditions.

Inflows from Mexico

Future inflows from Mexico could change over the next 75 years due to the following projects.

Enlargement of the Colorado River-Tijuana Aqueduct

The Colorado River-Tijuana Aqueduct was built in 1975 and conveys water from the Colorado River to the cities of Tecate and Tijuana to the west. In order to satisfy the growing demand in these water short regions, the capacity of the aqueduct is being increased from about 141 (cubic feet/second) cfs to 187 cfs (4.0 to 5.3 cubic meters/second) (COSAE, 2005). The request for bid for construction of this project was noticed in July 2005. The source of water to be conveyed through the enlarged aqueduct has not yet been determined, but the National Water Commission has indicated that the supply would be developed through transfers from agricultural users in the Mexicali Valley, recovery of losses, or through improved efficiency in the use of water (Comision Estatal del Agua Baja California, 2005). Therefore, flows in the New River would be impacted if water is exported out of the basin.

All-American Canal Lining Project

Existing documentation has not identified changes in seepage from the All-American Canal that would substantially affect agricultural return flows from Mexico to the Salton Sea. However, the potential for that to occur was considered in the No Action Alternative-Variability Conditions.

Increased Water Use and Reuse Within Mexico

Water demand in Baja California is projected to increase at a high rate. For example, the population requiring potable water in Mexicali is projected to double by 2030 (CESPM, 2004). The cities of Tijuana and Tecate also are projected to grow at high rates. In addition, it is likely that in the future, effluent would be conveyed from the Salton Sea watershed for disposal (as the Mexicali II project) or would be reused. Agricultural water use efficiency is also likely to improve in the Mexicali Valley. All of these actions are projected to reduce flows to the Salton Sea.

Reduced Availability of Colorado River Surplus Flows

The recent drought conditions on the Colorado River have demonstrated the limited ability to satisfy all future demands. In the past, Mexico has often received surplus or non-storable flows in excess of treaty requirements. However, increased development in the Colorado River basin and completion of water facilities in the lower Colorado River basin would reduce the availability of these flows to Mexico.

Probability Distribution and Range of Future Inflows

The cumulative uncertainty in future inflows from Mexico is represented by a triangular probability distribution of future inflow reductions as shown in Figure H2-15. This probability distribution was developed and discussed with the Working Group. The probability distribution is described as a percent reduction from the No Action Alternative-CEQA Conditions inflows and ranges from no change to a 100 percent reduction in inflows. All values between these two bounds are considered possible and are sampled in the Monte Carlo simulation. A future reduction in inflows from Mexico of 75 percent from the No Action Alternative-CEQA Conditions projections is considered the most likely as several of the above projects/actions are currently being evaluated. The projection of reduced inflows is consistent with recent declining inflows. Actual inflows from Mexico for 2003 were the lowest in the past 25 years.

Under the No Action Alternative-Variability Conditions the projected inflows based on the mean of all traces sampled in the Monte Carlo analysis is 48,000 acre-feet/year, and 40,000 acre-feet/year for the 2003 to 2078 and 2018 to 2078 periods, respectively, as shown in Figure H2-16.

Inflows from Imperial Valley

Under the No Action Alternative-CEQA Conditions, future inflows from the Imperial Valley reflect the IID Water Conservation and Transfer Project and related mitigation measures. In the previous discussion under No Action Alternative-CEQA Conditions, several other actions were identified but the impact to Salton Sea inflows due to their implementation could not be adequately described within the definition of the No Action Alternative-CEQA Conditions. These actions as well as several other factors that could possibly change future inflows from the Imperial Valley are described below.

Implementation of Total Maximum Daily Loads

The Colorado River Basin Regional Water Quality Control Board (CRBRWQCB) has adopted TMDLs for sedimentation/siltation for the New and Alamo rivers and for Imperial Valley drains, and TMDLs for pathogens in the New River, as described in Chapter 6. The CRBRWQCB is developing a nutrient TMDL for the Salton Sea. Full quantification of the impacts of TMDLs on inflows to the Salton Sea is unknown at this time. However, implementation of many of the BMPs suggested in the TMDL reports (CRBRWQCB 2002a, b) and the ICFB Voluntary TMDL Compliance Program reports (Kalin, 2003) are expected to reduce tailwater runoff from farms. On-farm BMPs include modification of tailwater drop boxes, filter strips and draining water across the ends of fields, and sprinkler/drip irrigation and pumpback systems. The cost of implementing on-farm efficiency improvements could be partially offset through programs such as the Environmental Quality Incentive Program from the Natural Resources Conservation Service which provides cost-share of up to 75 percent on certain control measures (NRCS, 2004). Some of these BMPs could result in significant reductions in tailwater and improved on-farm irrigation/fertilizer management (Kalin, 2005).

Possible Future Water Use Determinations by Reclamation or State Water Resources Control Board

Under Existing Conditions and No Action Alternative-CEQA Conditions, IID would continue to utilize 3,100,000 acre-feet/year of Colorado River water. However, under the No Action Alternative-Variability Conditions, uncertainty of revising the maximum amount of available water is considered based upon the actions initiated by Reclamation in 2003. This factor was included in the hydrologic analysis based upon input from the Working Group.

In 2003, Reclamation initiated an evaluation (Part 417 proceedings) that resulted in Reclamation asserted determination of the IID water use requirements and approved Colorado River diversion for that year (Reclamation, 2003). The determination, which ultimately led to Reclamation approving only 2,800,000 acre-feet/year of the requested 3,100,000 acre-feet/year of Colorado River delivery request based on the IID water need estimates and operating practices. IID challenged Reclamation's determination and obtained a preliminary injunction which prohibited Reclamation from imposing the determination without further proceedings. The dispute was ultimately settled. The SWRCB in Decision 1600 (SWRCB, 1984) and Water Resources Order 88-20 evaluated the "reasonable and beneficial use" of water by IID. The SWRCB required a plan for water conservation measures and retained jurisdiction. That plan was adopted and implemented, and the SWRCB evaluates compliance of IID each year.

Colorado River Basin Salinity Control Forum

As discussed above under the No Action Alternative-CEQA Conditions, the inflow and salt load projections for the Imperial Valley are based on the maximum numeric target for Colorado River salinity at Imperial Dam of 879 mg/L established by the Colorado River Basin Salinity Control Forum (CRBSCF) (CRBSCF, 2005). The numeric target was established to maintain salinities at or below 1972 levels, however, since that time the salinity at Imperial Dam has never exceeded the target, as shown in Figure H2-17. Over the past two decades, the salinity only exceeded 800 mg/L in one year and was less than 700 mg/L in six out of the past ten years. Recent modeling projections by Reclamation for the Colorado River estimate that there is an 86 percent probability that salinity at Imperial Dam will be less than or equal to the target through 2035 (CRBSCF, 2005). Future Colorado River salinity frequently would be less than the numeric target at Imperial Dam and, therefore could result in lower salt loads and inflows to the Salton Sea than that projected under the No Action Alternative-CEQA Conditions.

Improved On-farm Water Use Efficiency

Improved on-farm water use efficiency and IID delivery system improvements could continue in the future. Tailwater from the total IID water service area has been estimated between 15 percent and 27 percent of total on-farm water delivery (IID, 2003; Reclamation, 2003) and represents between 39 percent and 68 percent of Imperial Valley's contribution to Salton Sea inflow. Reclamation (2003) contended that improved on-farm water management could result in significant reductions in tailwater (to as low as 5 percent), lower fertilizer application rates, improved crop yields, and reduced costs. Others have indicated that tailwater reductions of this magnitude are possible (Gilbert, 2005). However, some studies indicate that because of high salt content in the soil, higher water leaching rates would be necessary to maximize crop yield, and the higher efficiency could be costly and possibly counter-productive (IID, 2003).

Change in Cropping Patterns

The crop types and quantities in the Imperial Valley have changed over the years in response to water and market conditions. Hay and forage crops (primarily alfalfa, Bermuda grass, and Sudan grass) are estimated to be about 50 percent of the total irrigated acreage of the Imperial Valley (IID, 2000) and have the higher consumptive use requirements as compared to row crops. It is possible that future changes in the crop mix of the Imperial Valley could require less applied water and result in lower return flows even without change in on-farm irrigation efficiencies.

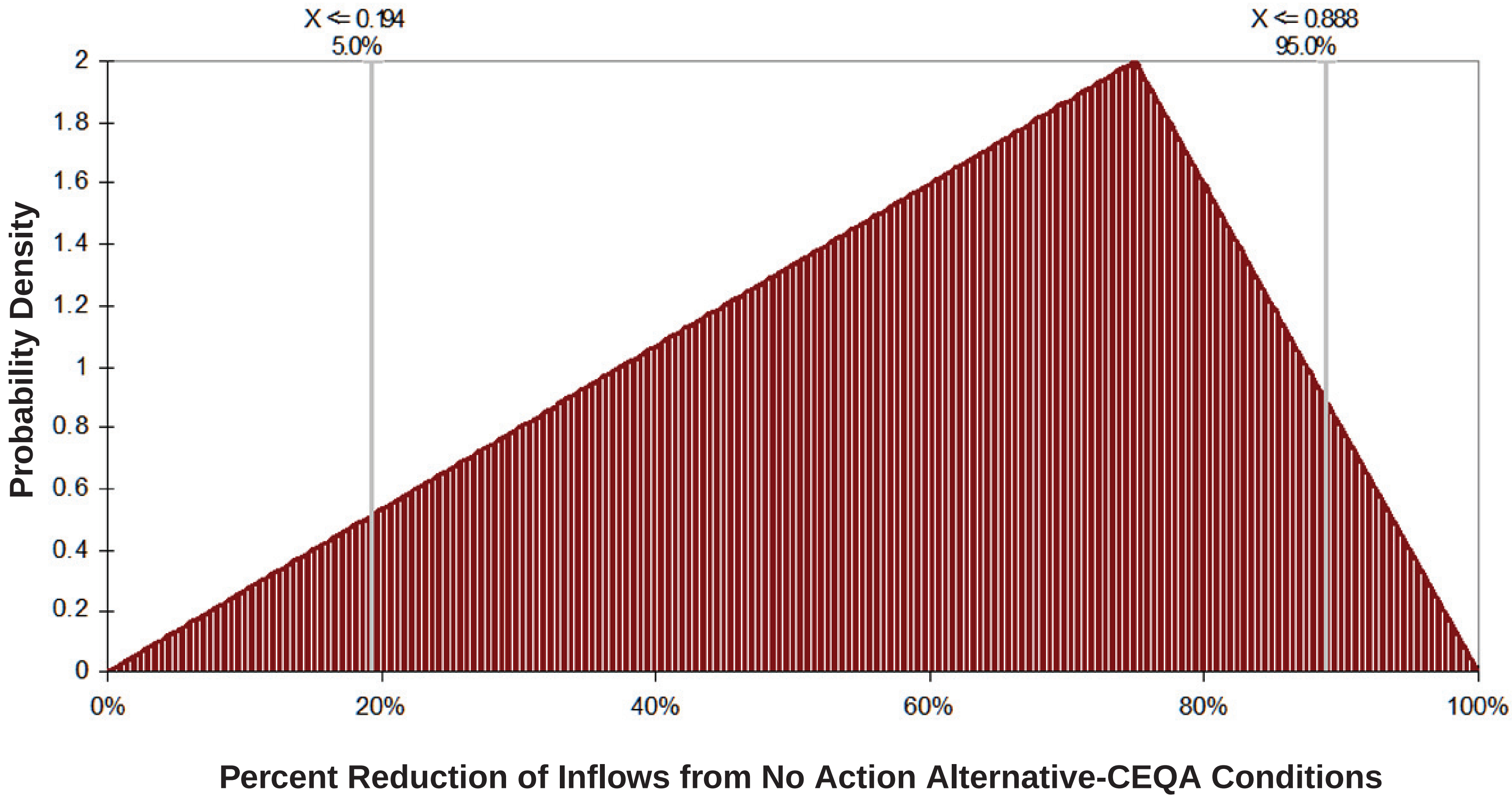


FIGURE H2-15
DISTRIBUTION OF POSSIBLE FUTURE REDUCTIONS IN MEXICO INFLOWS

ES112005003SAC figure_H2_15.ai 08-14-06 dash

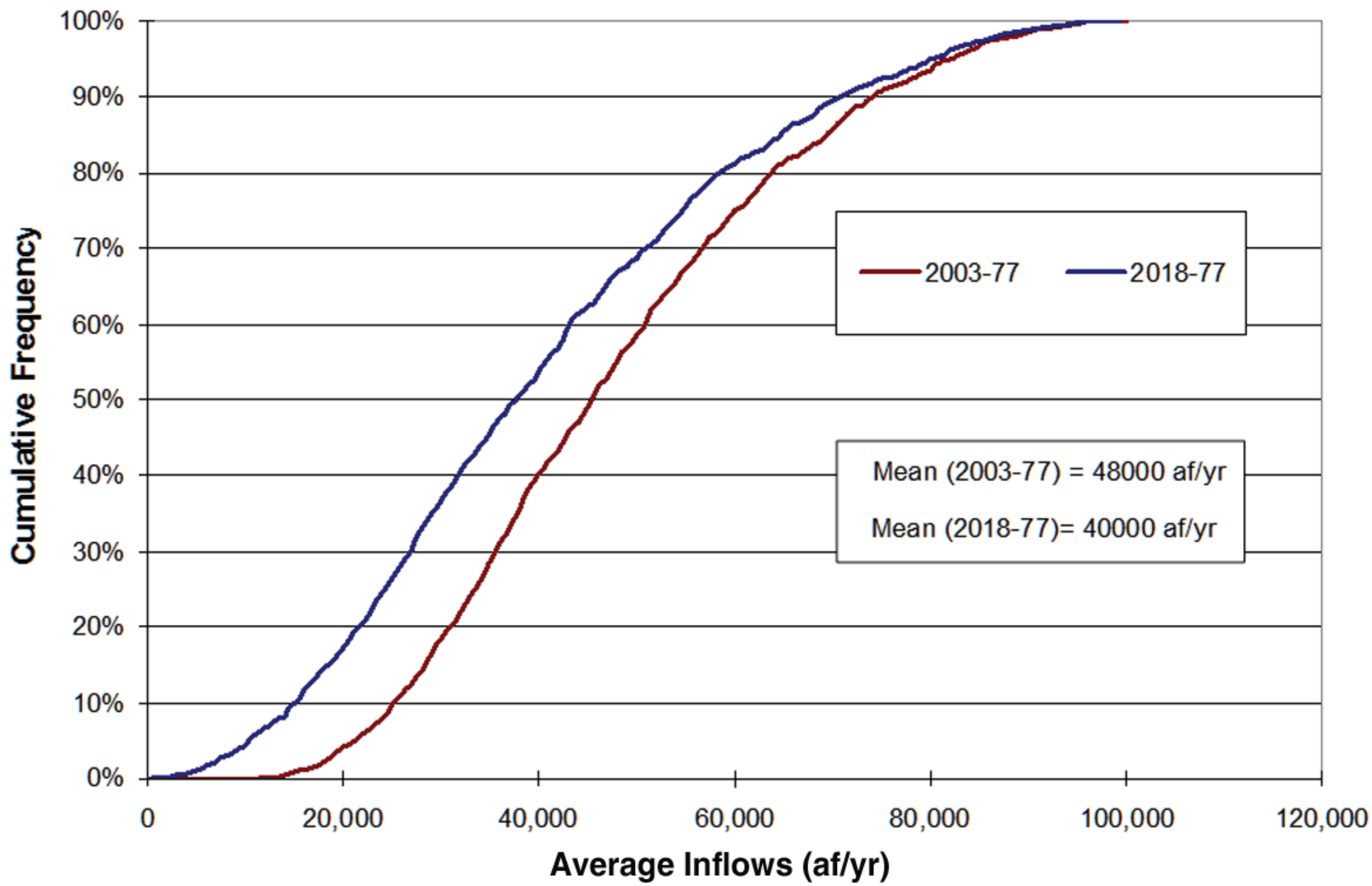


FIGURE H2-16
POSSIBLE INFLOWS FROM MEXICO FOR NO ACTION ALTERNATIVE-VARIABILITY CONDITIONS

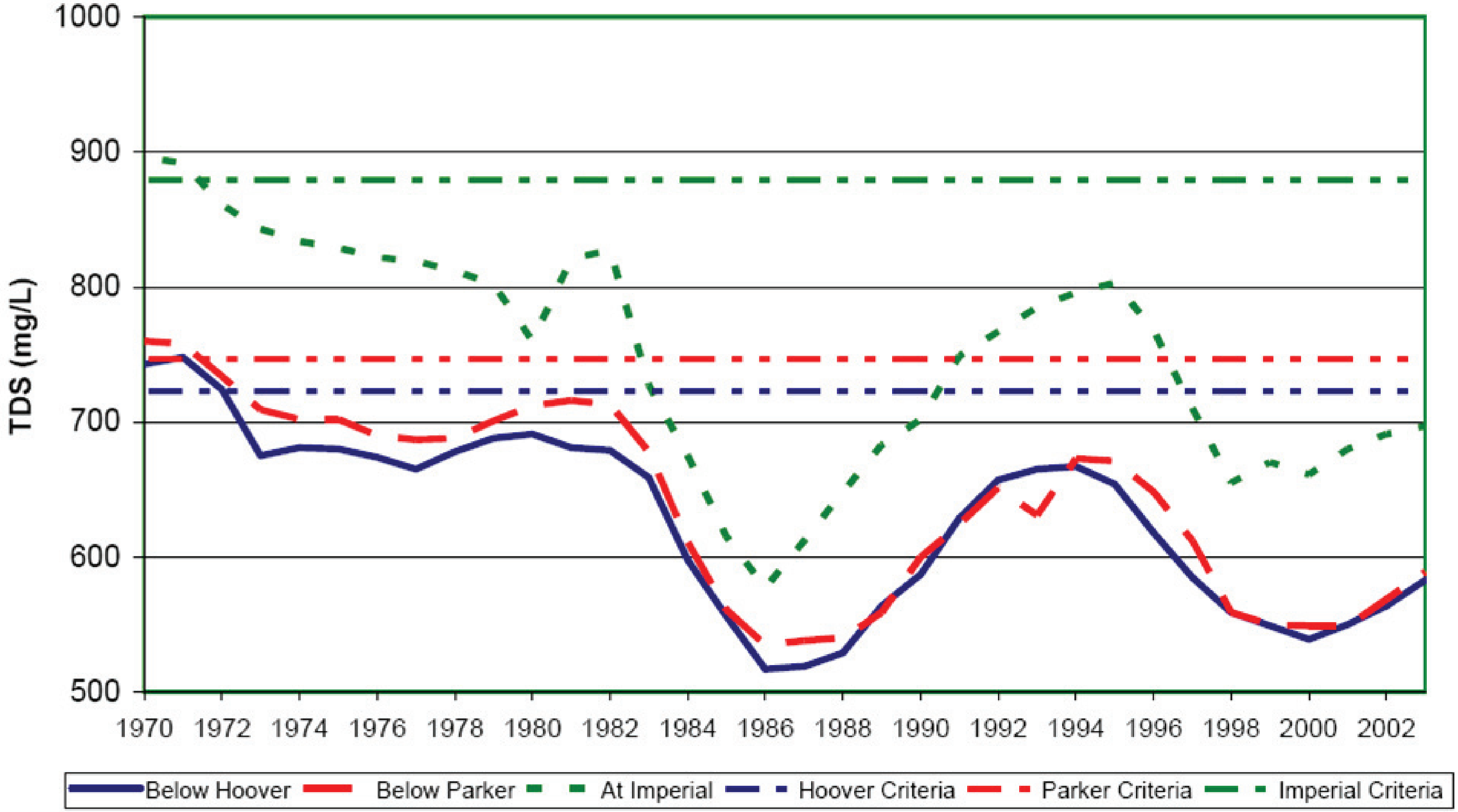


FIGURE H2-17
SALT CONCENTRATIONS AT NUMERIC CRITERIA STATIONS

Source: CRBSCF, 2005

Agriculture to Urban Land Use Conversions

All regions within the Salton Sea watershed are experiencing significant growth and are projected to continue to grow (Department of Finance, 2004). Depending on the future patterns of urbanization in Imperial County, it is possible that some current agricultural lands could be converted to urban uses. Depending upon the density of housing and the types of crops replaced by urban uses, the water demands per acre may not change. However, inflows to the Salton Sea could increase because most of the urban water could flow to the Salton Sea as wastewater effluent and urban runoff. If the urban areas use water recycling, inflows to the Salton Sea could be less than existing inflows.

Responses by agriculture to land conversions also could affect inflows. The total area in IID that is irrigated by Colorado River water is legally limited. However, if portions of the land are converted, other areas could become cultivated and irrigated. This type of land use change in addition to urban conversions also could reduce inflows to the Salton Sea.

Colorado River Supply Reliability and Shortage Criteria

The management of Colorado River water under shortage conditions is the subject of on-going studies by the Department of the Interior, Basin states, and Colorado River water users. Because a shortage year has never been declared by the Secretary of the Interior, there is substantial uncertainty as to how the river would be operated under shortage conditions. There is also substantial uncertainty regarding future water supply in the Colorado River.

Colorado River Basin is experiencing the most significant drought on record. Analysis of historical flow records indicates flow at Lee’s Ferry has decreased at a rate of about 500,000 acre-feet each decade for the 1895 to 2003 period (USGS, 2004). Tree-ring reconstructions in the Colorado River basins provide a longer term record that can be used to assess drought frequency. The USGS report (2004) states that one of the most important conclusions from dendrochronology (tree-ring dating) is that the period from 1906 through 1930, which was partially used to determine flow allocations under the Colorado River Compact, was likely the highest period of runoff in 450 years. It is assumed that the IID water deliveries likely would not be affected by future shortages on the Colorado River due to the IID senior water right. However, IID contends that the possibility exists that their supplies could be reduced under severe conditions (Eckhardt, 2005).

Probability Distribution and Range of Future Inflows

The cumulative uncertainty in future inflows from the Imperial Valley is represented by a uniform probability distribution of future reductions in tailwater as compared to the No Action Alternative-CEQA Conditions, as shown in Figure H2-18. Tailwater was selected as a reasonable surrogate of the future maximum change in Imperial Valley contributions to the Salton Sea inflows. Drain water from the IID service area includes tailwater (surface water drainage), tilewater (subsurface drainage), operational spills, and canal seepage. The probability distribution of possible future reductions in tailwater is described as a percent reduction from No Action Alternative-CEQA Conditions estimates and ranges from a 5 to 95 percent reduction. All values between these two bounds are considered possible and are sampled in the Monte Carlo simulation. Based on comments received from the Working Group, a triangular distribution was adopted to reflect the greater reductions in tailwater that would generally require more complex methods of water conservation and potentially at greater costs. As with many agricultural and urban water conservation measures, conservation of the first unit of water is significantly easier to achieve than subsequent water reductions. As described previously, tailwater from the IID water service area has been estimated between 15 percent and 27 percent of total on-farm water delivery (IID, 2002; Reclamation, 2003) and represents between 39 percent and 68 percent of Imperial Valley’s contribution to Salton Sea inflow. A second uniform probability distribution was applied to capture this range of uncertainty in tailwater estimates, as summarized in Figure H2-19.

Under the No Action Alternative-Variability Conditions the projected inflows based on the mean of all traces sampled in the Monte Carlo analysis is 690,000 acre-feet/year and 615,000 acre-feet/year for the 2003 to 2078 and 2018 to 2078 periods, respectively, as shown in Figure H2-20.

Inflows from the Coachella Valley

Factors that could change inflows from the Coachella Valley as compared to the projected No Action Alternative-CEQA Conditions are described below.

Change in Assumptions for Implementation of the Coachella Valley Water District Water Management Plan

CVWD would acquire additional water supplies to stabilize groundwater levels and improve basin water quality under the CVWD Water Management Plan. In addition to the CVWD SWP entitlement and transfer programs with Metropolitan, the CVWD Water Management Plan includes an additional 40,000 acre-feet/year of SWP water supply through future transfers or participation in programs, such as the State Drought Water Bank. As the demand for SWP water increases in the future, the availability and reliability of such water could be reduced. This could change the groundwater management in Coachella Valley. In addition, the CVWD Water Management Plan proposes desalting about 11,000 acre-feet/year of supply obtained from the CVSC. CVWD has stated the intent to appropriate water from the Whitewater River. As noted in the Water Management Plan (CVWD, 2002), the SWRCB has declared the Whitewater River to be fully appropriated. New water right applications would need to be filed and approved to use such water. Some degree of uncertainty exists in regard to the groundwater basin conditions, and resulting Salton Sea inflows, in the absence of these supplies.

The No Action Alternative-CEQA Conditions assumes implementation of the CVWD Water Management Plan with a constant water demand after the year 2035. It is possible that population and water demand could continue to grow in the future. This would increase water demand and wastewater effluent flows in the future. The CVWD Water Management Plan, while not addressing projects or conditions in the Coachella Valley beyond 2035, notes that future expansion of drain water desalination also could affect flows after 2035. In addition, the Torres Martinez tribe has land within the CVWD service area that is planned for development with water and drainage service from CVWD. It is unclear whether this was analyzed in the CVWD Water Management Plan. The possibility exists that future growth could result in reduced flows to the Salton Sea.

As with any model representation of a physical process, there is some measure of uncertainty in the Coachella Valley groundwater model results, particularly in the upper aquifer of the lower valley as water level calibration data are sparse (CVWD, 2002). Uncertainty in some water level measurements and model calibration simulation results could be more than 10 feet. This was an area of concern raised by some members of the Working Group, but a quantitative assessment of potential changes to Salton Sea inflow was not possible without access to the CVWD Water Management Plan model.

Projected Colorado River salinity for the analyses as part of the CVWD Water Management Plan assumed the numeric criteria of 879 mg/L (CVWD, 2002). As described above for Imperial Valley, future Colorado River salinity could be less than the numeric criteria and result in slightly lower salt loading to the Coachella Valley and have minor effects on the need for offsetting supplies.

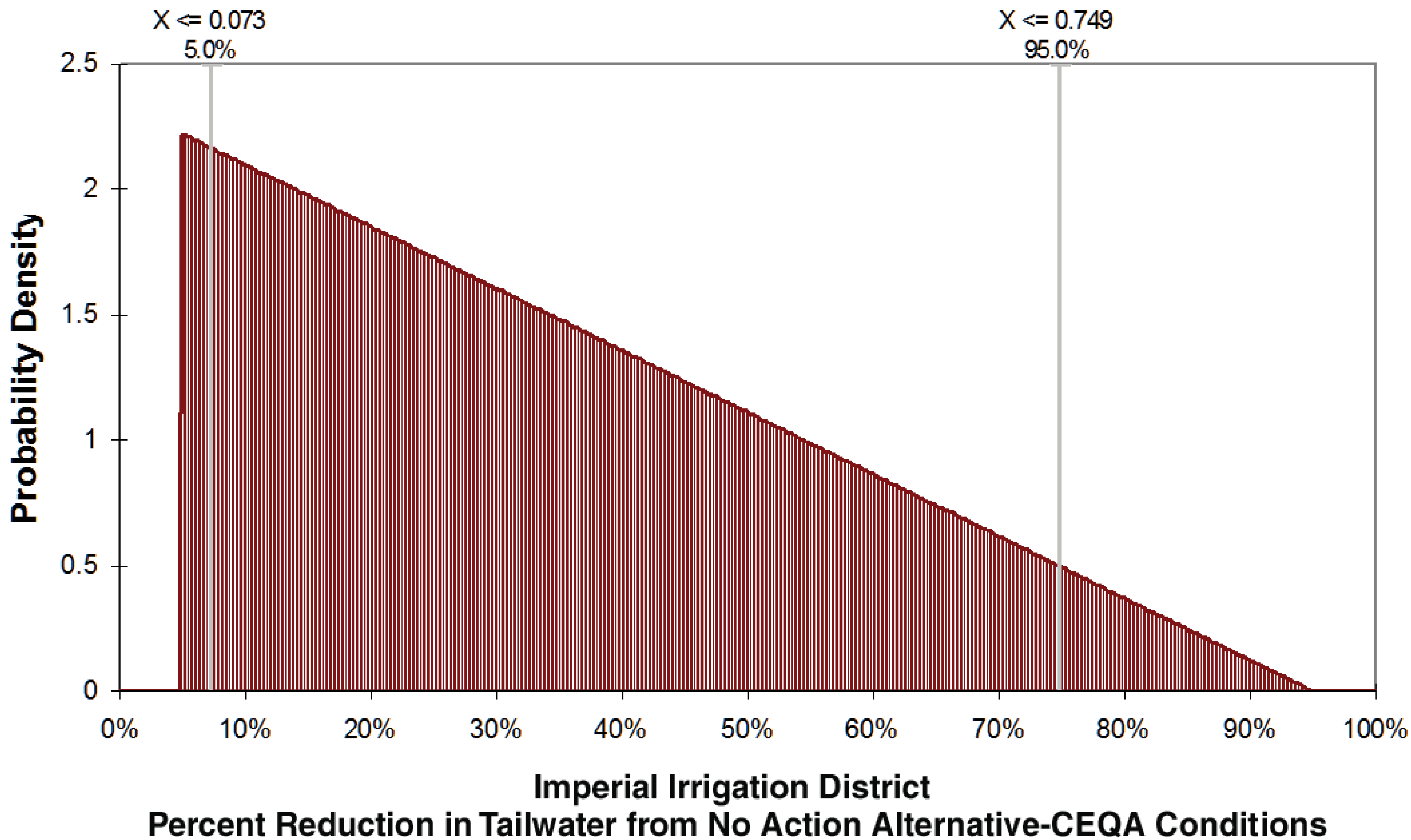


FIGURE H2-18
DISTRIBUTION OF POSSIBLE FUTURE REDUCTIONS IN IMPERIAL IRRIGATION DISTRICT TAILWATER FLOWS

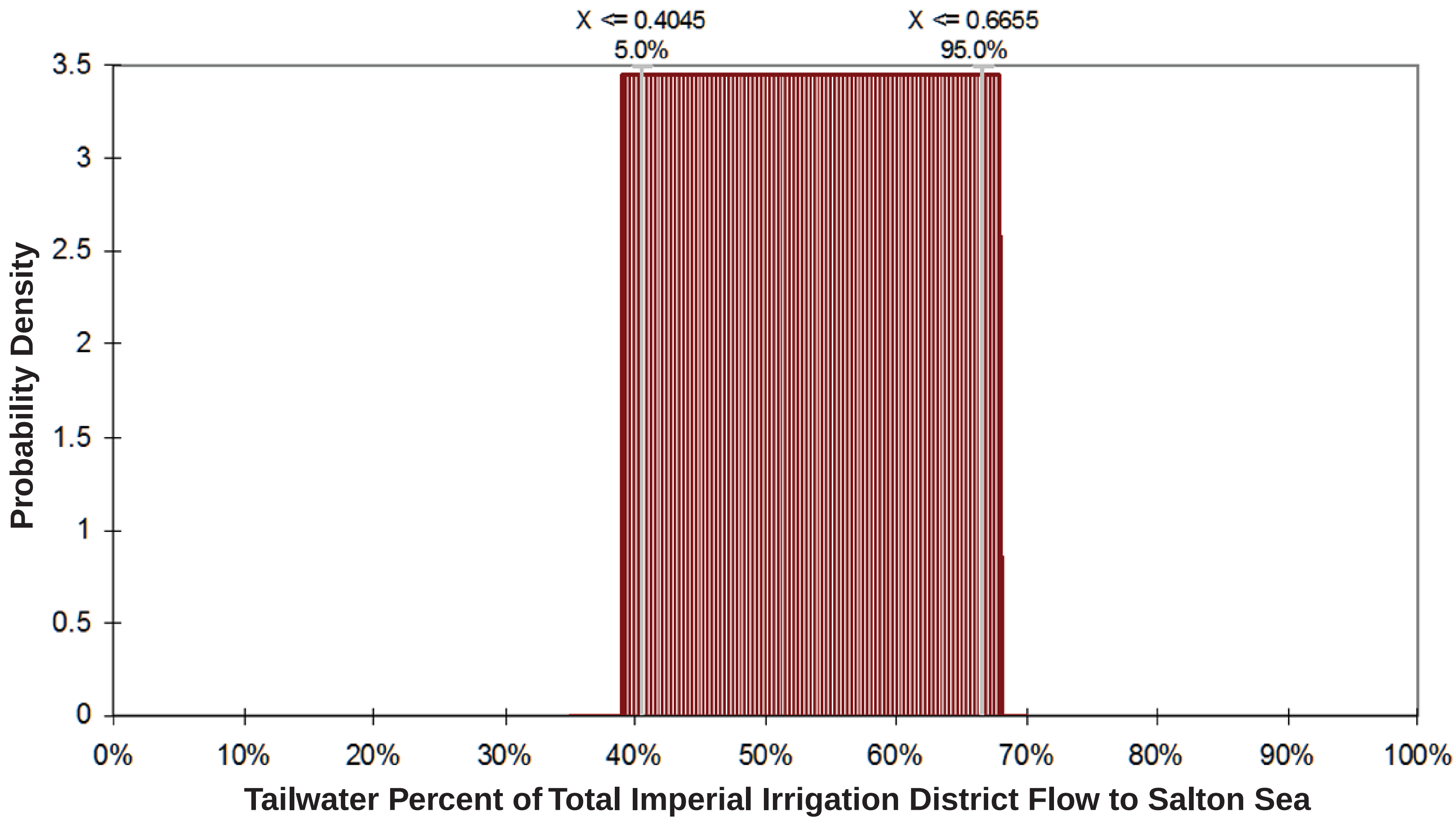


FIGURE H2-19
DISTRIBUTION OF UNCERTAINTY IN IMPERIAL IRRIGATION DISTRICT TAILWATER VOLUMES

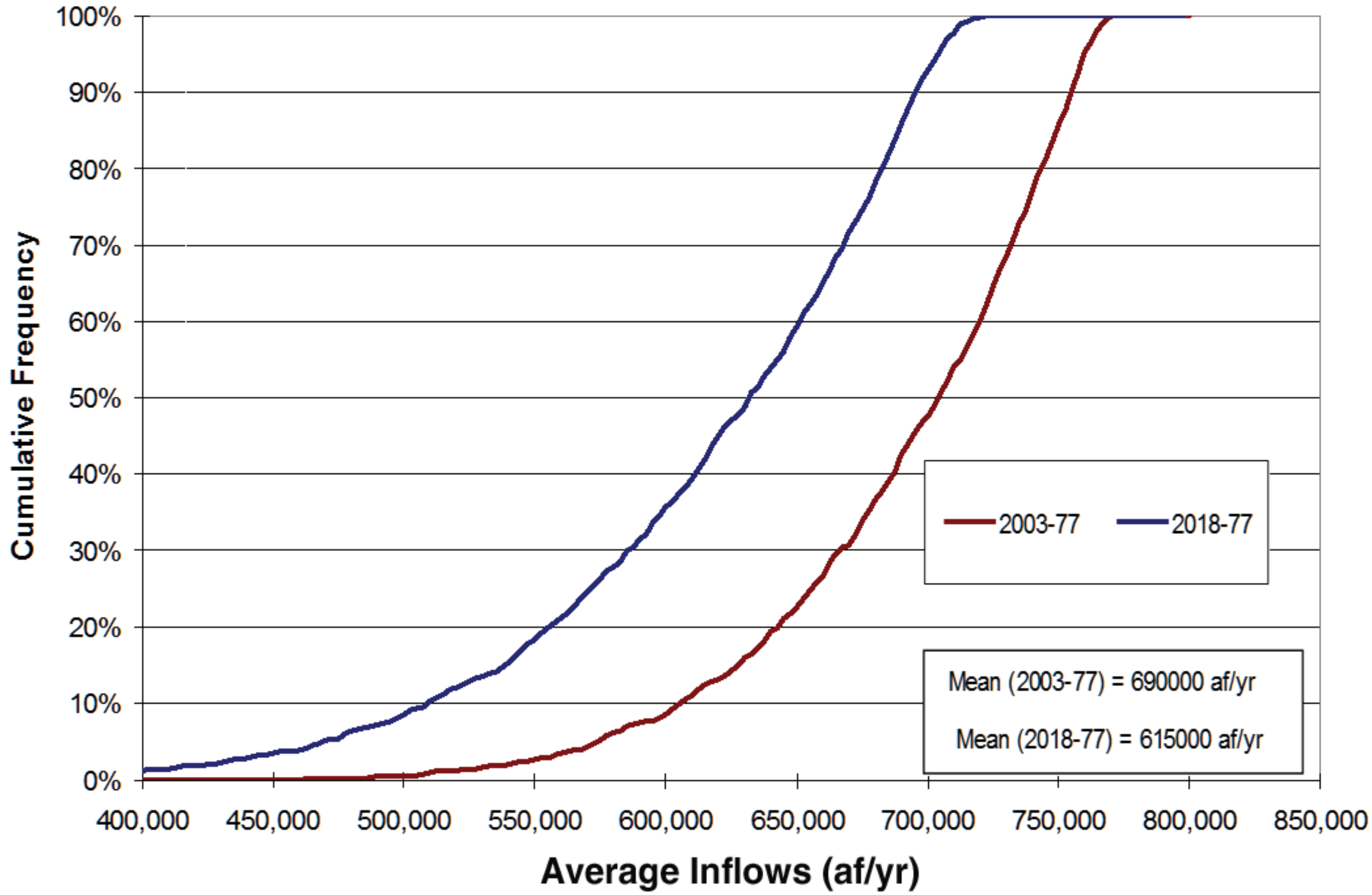


FIGURE H2-20
POSSIBLE INFLOWS FROM IMPERIAL VALLEY FOR NO ACTION ALTERNATIVE-VARIABILITY CONDITONS

Probability Distribution and Range of Future Inflows

The cumulative uncertainty in future inflows from the Coachella Valley is represented by a uniform probability distribution of changes between the simulated “Proposed Project” and “No Project” in the Water Management Plan. The simulated inflows to the Salton Sea from the Coachella Valley under the Water Management Plan Proposed Project are about 90,000 acre-feet/year higher than those simulated for the Water Management Plan No Project by 2035, as summarized in Figure H2-21. The differences are much smaller prior to 2035 as the initial conditions are the same for both simulations. The range of inflow trajectories between these two conditions are used to represent the future uncertainty of inflows from Coachella Valley, as shown in Figure H2-22.

The probability distribution of possible future reductions in Coachella Valley flows are described as possible reduction in inflows at year 2035 and are mapped onto a trajectory from 2003 to 2078, based on the results shown in Figure H2-21. All values between these two bounds are considered possible and are sampled in the Monte Carlo simulation.

Under the No Action Alternative-Variability Conditions the projected inflows based on the mean of all traces sampled in the Monte Carlo analysis is 94,000 acre-feet/year for the 2003 to 2078 period and 98,000 acre-feet/year for the 2018 to 2078 period, as shown in Figure H2-23.

Inflows from Portions of the Watershed Not Tributary to Irrigated Areas of Imperial and Coachella Valleys

The inflows from the portions of the watershed not tributary to the irrigated areas of Imperial and Coachella valleys are not expected to appreciably change in the future beyond that represented in the No Action Alternative-CEQA Conditions. Most of the inflows generated from these areas are the direct result of rainfall runoff on open space or subsurface flows to the Salton Sea. While future changes in the amount of precipitation and storm intensity would have an impact on the inflows to the Salton Sea, the most recent projections of future climate conditions do not indicate any clear precipitation trends over the next century in California (CalEPA, 2006; Dettinger, 2005).

Climate Change

The issue of climate change has begun to have an increasing role in scientific research and policy decision making. In recent years, there is a growing scientific consensus that climate change will be inevitable as the result of increased concentration of greenhouse gases (IPCC, 2001; Kiparsky and Gleick, 2003; CalEPA, 2006). The National Academy of Sciences (2006) has recently supported the conclusion that it is likely that the past few decades exhibited higher global mean surface temperatures than during any comparable period during the preceding four centuries. The State of California has taken a proactive role in addressing climate change and has recently released a Climate Action Team Report outlining the emission scenarios, uncertainties, impacts, adaptations, and recommendations for reducing emissions (CalEPA, 2006). There is little difference between climate projections prior to 2035. Temperature has been shown to increase in all future climate projections and is likely to have a considerable impact on evaporation and evapotranspiration. The projected change in average daily temperature in California was derived from three climate models with three scenarios of future emissions is shown in Figure H2-24. There is uncertainty regarding the magnitude of future warming in California, but all future projections indicate temperature increases throughout the 21st century. Statewide temperature increases of 1.7 to 3.0 degrees Celsius (°C) (3.1 to 5.4 Fahrenheit [°F]) represent the low range, 3.1 to 4.3° C (5.6 to 7.7 °F) represent the middle range, and 4.4 to 5.8 °C (7.9 to 10.4 °F) represent the high range. Similarly, Hayhoe et al., (2004) evaluated the highest and lowest Intergovernmental Panel on Climate Change emission scenarios and reported annual average temperatures projected to increase from 1.35 to 2.0 °C (2.4 to 3.6 °F) by mid-century and 2.3 to 5.8 °C (4.1 to 10.4 °F) by the end of the century. Less warming is predicted in the southern California coastal areas with increased warming is predicted in the northern and northeastern portions of the United States.

Unlike the strong trend toward increasing temperatures, the projections of future climate conditions do not indicate any clear trends regarding California precipitation, as summarized in Figure H2-25. Amongst various projections of future climate there are considerable differences between models and scenarios, from wetter to drier conditions. However, the center of the distribution of simulations indicates little change, with a tendency for a slight decrease in precipitation (Cayan et al., 2006). Inter-decadal variability dominates precipitation in California (Hayhoe et al., 2004). The recent findings of precipitation trends or lack thereof, contrast with some older projections of future climate that suggested potentially significant increases in southwestern United States precipitation (United States Global Change Research Program, 2000). The more recent projections were developed with improved versions of the same models used to make the prior assessments, as well as United States and Japanese models not available previously, and appear to have superseded the older work.

General Circulation Models have been increasingly applied to evaluate large scale changes in climate parameters under differing future emission scenarios. Regional down scaling is often performed to evaluate finer scale climate impacts.

Evaporation

Evaporation is the single largest component in the water budget equation for the Salton Sea. Under the No Action Alternative-CEQA Conditions, the historical climate conditions and variability are assumed to be a reasonable estimate of future conditions and the evaporation rates are assumed to be represented by the historical estimated rates. The average evaporation rates determined from the annual water budget analysis were 69 inches/year as total evaporation and 66.4 inches/year as net evaporation.

The evaporation rate is sensitive to small changes in meteorological conditions which are influenced by long term climate trends. In order to address the potential effects of climate change on the future Salton Sea evaporation, an uncertainty analysis similar to that for inflows was applied. Uncertainty was evaluated by relating changes in evaporation to changes in predicted temperature. Four climate projections for grid cells centered near the Salton Sea were provided by Scripps Institute of Oceanography (Cayan, 2006). These projections were developed using two state-of-the-art general circulation models and two future emission scenarios. The models are the Parallel Climate Model (PCM) from the National Center for Atmospheric Research (NCAR) and the U.S. Department of Energy (DOE), and the Geophysical Fluids Dynamics Laboratory (GFDL) CM2.1 model from the National Oceanographic and Atmospheric Administration (NOAA). The PCM is considered a low-sensitivity model while the GFDL is considered a medium-sensitivity model. Lower (B1) and mid-range (A2) future emission scenarios were simulated with both models. The model projections are identical to those included in the State of California's Climate Action Team Report (CalEPA, 2006) and the projected statewide temperature changes are shown in Figure H2-24. Projections for the regions near the Salton Sea suggest slightly smaller temperature changes than those statewide, ranging from 1.5 to 4.4 °C (2.7 to 7.9 °F) by the end of the century.

The effect of the increased temperature on future evaporation was evaluated through an analysis of CIMIS reference evapotranspiration rates, temperature, wind, net radiation, and other meteorological data. Sensitivity analysis on the parameters influencing evapotranspiration at the Salton Sea indicated that temperature and net radiation are the dominant controls. The historical evapotranspiration of CIMIS Station Number 41 was adjusted by perturbing the mean temperature input to the modified Penman-Monteith equation (DWR, 2005), while maintaining other meteorological data at historic values. Annual evapotranspiration increased between 3 and 4 percent for each degree Celsius of temperature change. A similar value was previously derived from a simple regression of evapotranspiration and temperature historical data for the same station.

FIGURE H2-21
ESTIMATED FUTURE SALTON SEA INFLOWS FROM THE COACHELLA VALLEY WITH AND WITHOUT COACHELLA VALLEY WATER MANAGEMENT PLAN IMPLEMENTATION

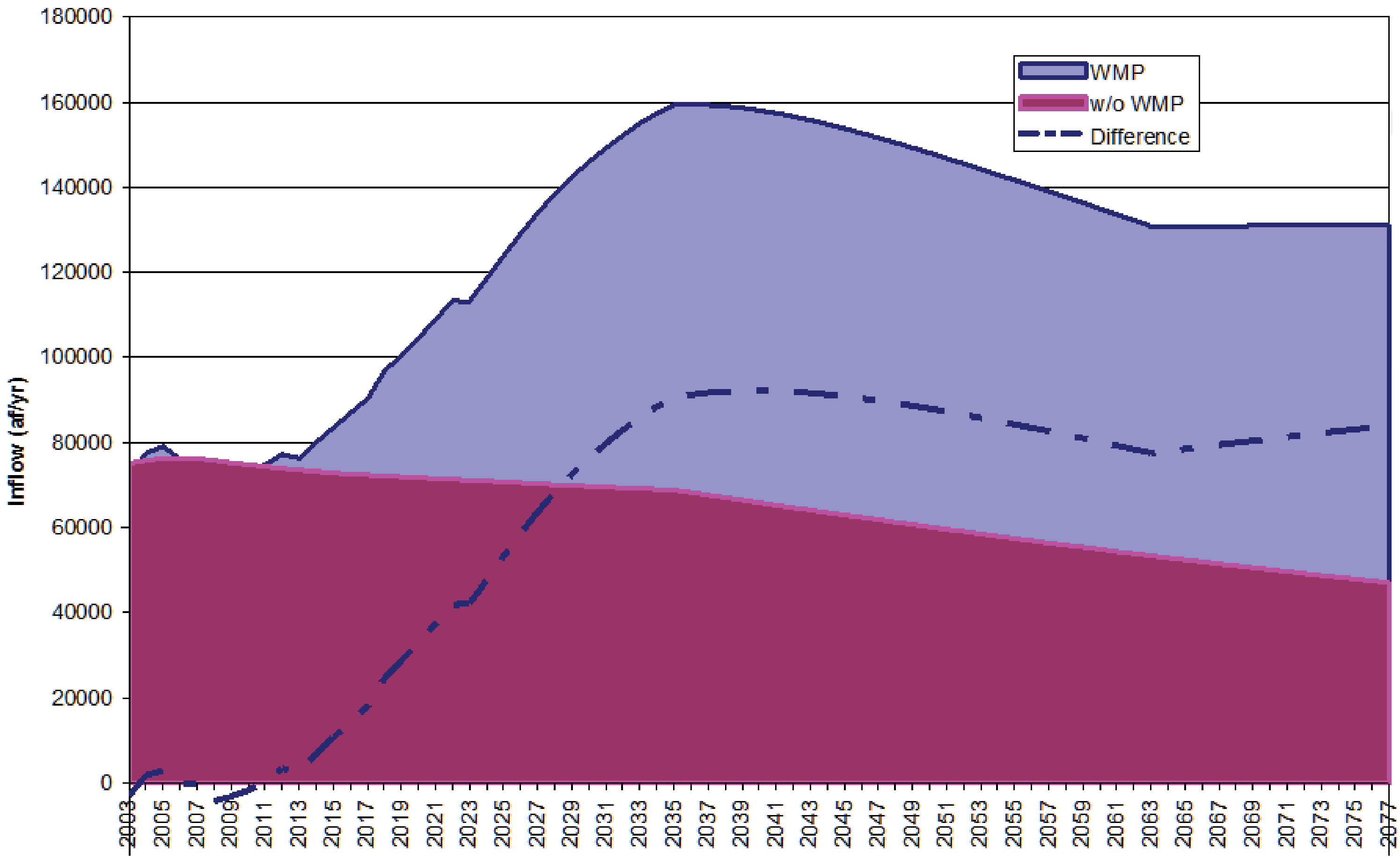


FIGURE H2-21
ESTIMATED FUTURE SALTON SEA INFLOWS FROM THE COACHELLA VALLEY WITH AND WITHOUT COACHELLA VALLEY WATER MANAGEMENT PLAN IMPLEMENTATION

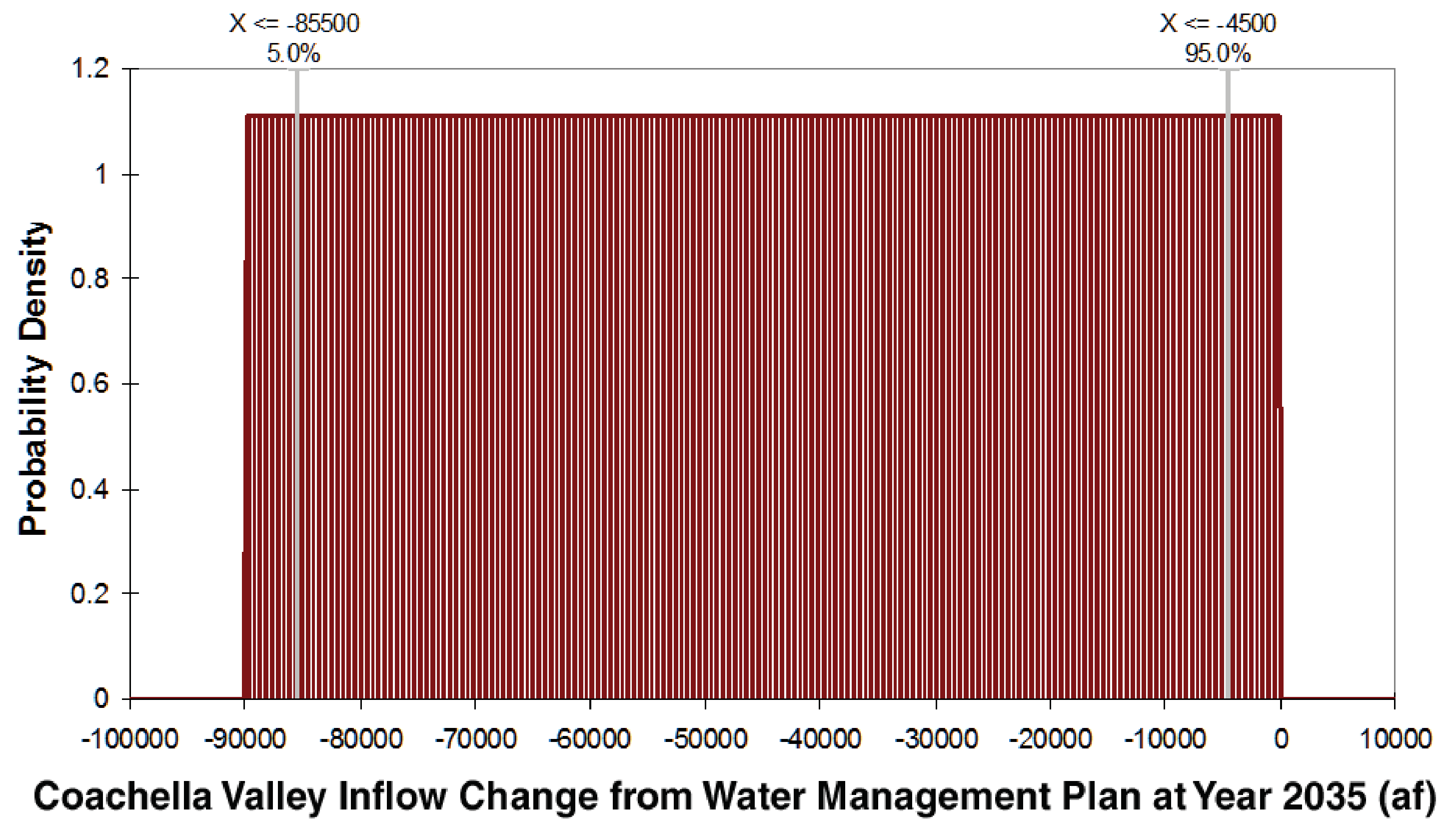


FIGURE H2-22
DISTRIBUTION OF POSSIBLE FUTURE REDUCTIONS IN COACHELLA VALLEY FLOWS

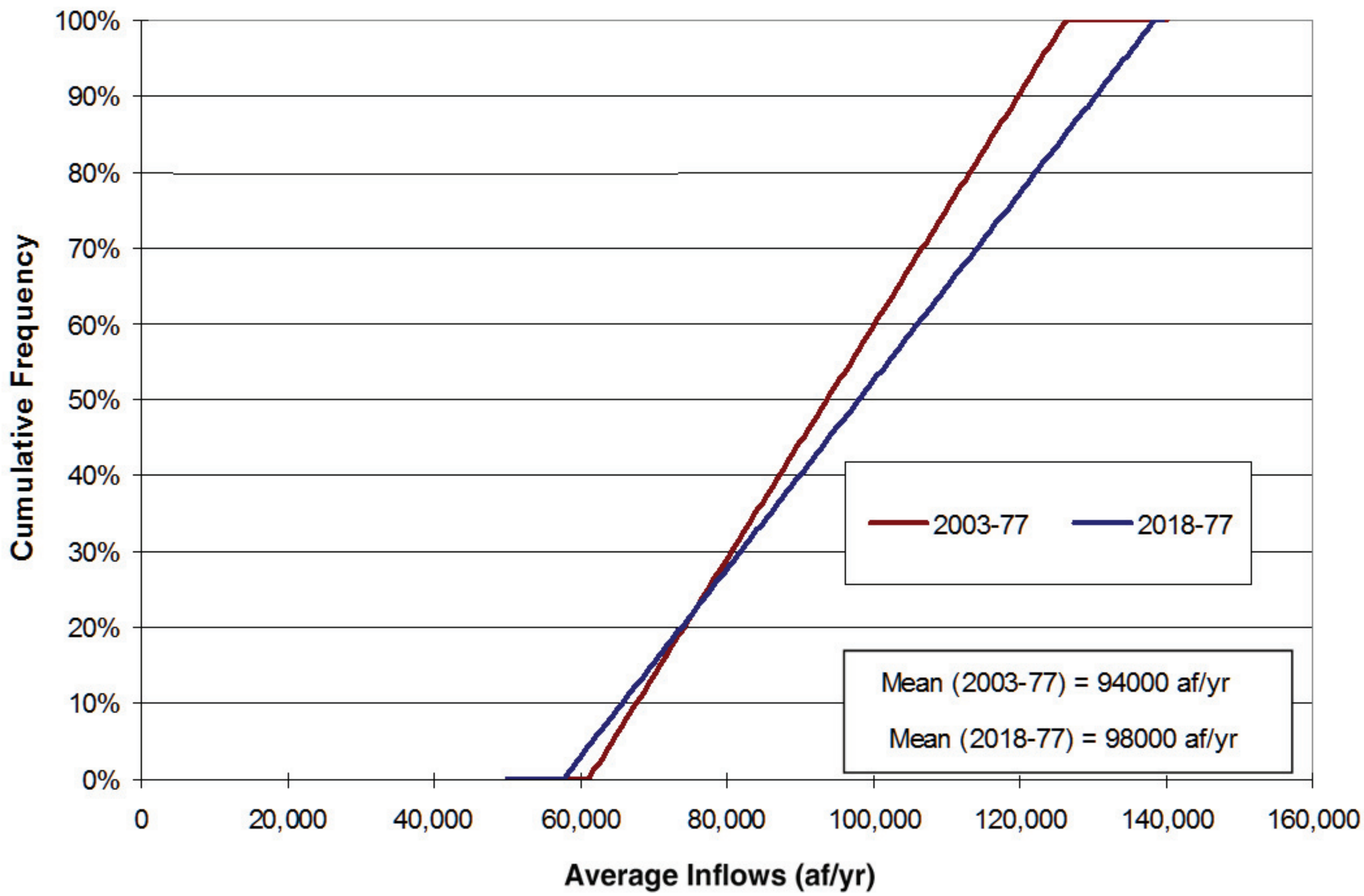
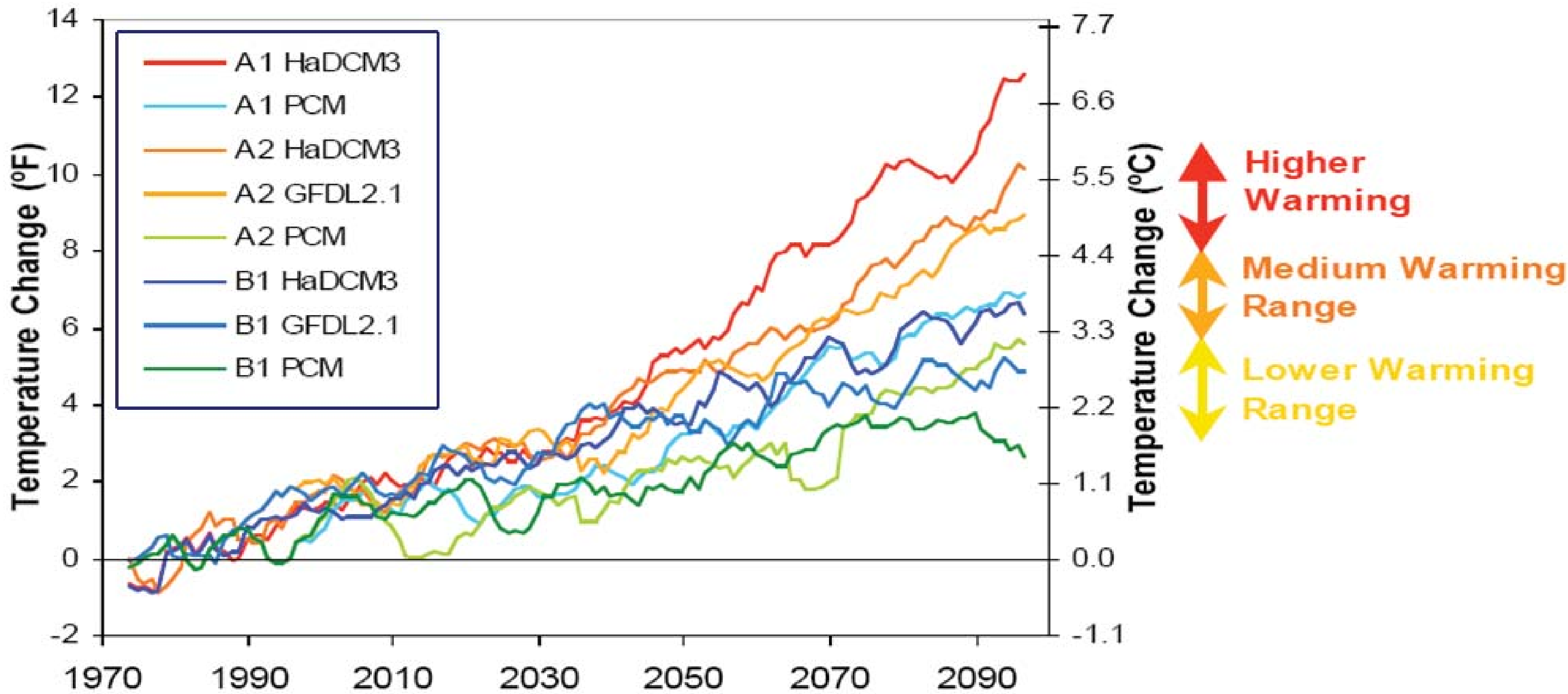


FIGURE H2-23
POSSIBLE INFLOWS FROM THE COACHELLA VALLEY FOR NO ACTION ALTERNATIVE-VARIABILITY CONDITIONS



Notes:

Change in California annual mean temperature (˚F and ˚C) by year from 1961 to 2100 relative to 1961-1990 average–7-year running mean.

HadCM3 = Hadley Climate Model version 3

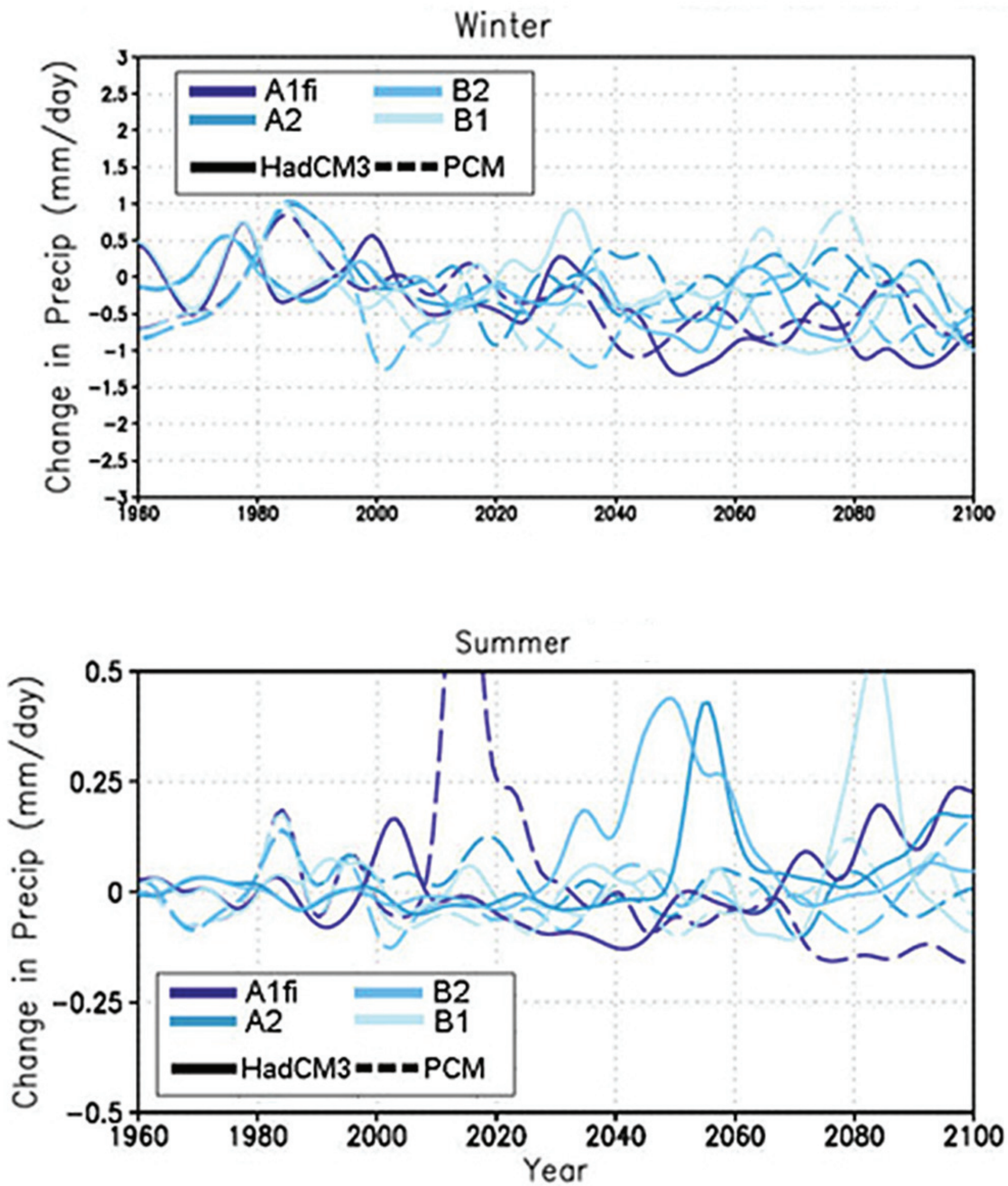
PCM = Parallel Climate Model

GFDL2.1 = Geophysical Fluid Dynamics Laboratory model 2.1

A1, A2, and B1 refer to global emission scenarios. They are higher (A1), medium-high (A2), and lower (B1) emission scenarios.

Source: CalEPA, 2006

FIGURE H2-24
PROJECTED CHANGE IN CALIFORNIA ANNUAL AVERAGE DAILY MEAN TEMPERATURE 1961 TO 2100 RELATIVE TO 1961 TO 1990



Notes:
HadCM3 = Hadley Climate Model version 3
PCM = Parallel Climate Model
A1fi = high-range emission scenario
A2 and B2 = mid-range emission scenarios
B1 = low-range emission scenario
Source: Hayhoe et al., 2004

FIGURE H2-25
PROJECTED SEASONAL DAILY PRECIPITATION CHANGES FOR CALIFORNIA FOR 1961 TO 2100 RELATIVE TO 1961 TO 1990 AVERAGE

Using the least sensitive model, associated projected end of century temperature increases of 1.5 to 2.4 °C (2.7 to 4.3 °F), and current Sea elevation, evaporation losses from the Salton Sea could increase by as much as 100,000 acre-feet/year. However, the process of global, and regional, climate change is considered to be gradual and the impacts will initially be zero and increase over time. Because the effect of this uncertainty is dependent on the water surface area of a particular alternative, the evaporation rate (as opposed to volumetric evaporation) is the appropriate parameter to be addressed. The uncertainty is expressed in terms of an average annual increase in the rate of evaporation as shown in Figure H2-26.

Range of Future Evaporation

Under the No Action Alternative-CEQA Conditions, estimated Salton Sea water surface net evaporation rates average 66.4 inches/year. Under the uncertainty analysis, considering possible future climate effects, the mean of all traces sampled in the Monte Carlo analysis increases evaporation by about 2.3 inches/year by 2035 and 5.3 inches/year by 2078. Using the 2078 mean annual evaporation rate change, the equivalent inflow reduction under current water surface elevation would be about 100,000 acre-feet/year. The volumetric impact of this uncertainty would depend on the size of any future water surface area.

Projected Range of Inflows

The cumulative effect of all future inflow possibilities was evaluated through simultaneous sampling of all uncertainty probability distributions in the Monte Carlo approach. The mean of all traces sampled in the Monte Carlo analysis (not considering uncertainty in future evaporation) is about 795,000 for the 2003 to 2078 period and about 717,000 acre-feet/year for the 2018 to 2078 period, as shown in Figure H2-27.

Considering Uncertainty in Sizing/Placement of Major Infrastructure

The range of inflows to the Salton Sea when considering future uncertainty, as shown in Figure H2-26, enables a relative assessment of the risk associated with various assumptions of future water availability. For example, the placement of a Barrier to manage a Marine Sea on an assumed future inflow of 900,000 acre-feet/year would have a greater risk of failure to meet design objectives (elevation, salinity, and water depth) than if it were based on a lower inflow assumption. As one moves along the probability curve, trade-offs are made between greater certainty of satisfaction of goals and size of overall project. Similar evaluations of trade-offs and risk are part of many hydrologic or hydraulic analyses such as the sizing of flood control levees or water supply dams (failure or yield versus cost). While the hydrologic uncertainty often dominates the total uncertainty in these assessments, many decisions are made with an understanding of uncertainty. The concept of “margin-of-safety” is widely used to account for uncertainty in various actions.

For the purposes of sizing components in the alternatives considered in the PEIR, a set of inflows needed to be identified. Overall sizing of components, such as the Marine Sea, required assumptions of long term average annual inflows to define the available water budget. These components would be large and could accommodate daily, monthly, and even annual variations in inflows. In general, the assumptions for the PEIR were conservative with an acknowledgement that project-level documents would have more information available to reduce the risks before final design. For the purposes of sizing components of the alternatives in the PEIR, inflows under the No Action Alternative-Variability Conditions were evaluated at a level of uncertainty represented by the 80 percent exceedance probability (20 percent cumulative frequency) of the possible long term average annual inflows. For the period of 2003 to 2078, this value would be about 737,000 acre-feet/year. However, because the major facilities are not likely to be constructed and fully operational until 2017 or after, the inflows considered for sizing larger components of the alternatives is about 646,000 acre-feet/year based on the 80 percent exceedance probability of the average annual inflow over the 2018 to 2078 period.

Considering Uncertainty in Comparing Alternatives

The average inflows over the 2018 to 2078 period were used to provide a uniform basis of comparison of the alternatives. As described in the attachments to this appendix, a stochastic analysis was conducted to provide a basis of comparison of the alternatives using the Monte Carlo analyses.

Spatial and Temporal Disaggregation of Flows

The projected inflows for the Salton Sea were estimated for Mexico, Imperial Valley, Coachella Valley, and the local watershed on an annual basis. In order to facilitate more detailed hydrologic modeling of the Salton Sea, it was necessary to disaggregate the total flows from a grouped inflow projection for individual streams or drains. For example, flows from Imperial Valley had to be disaggregated into quantities for the New and Alamo rivers, direct drains, and groundwater seepage. The average annual flows for individual streams were downscaled to monthly values. These analyses are described below.

Spatial Disaggregation of Flows

Spatial disaggregation was performed based on historical percentages of individual flow component contribution to the total flow for each major source area. For example, the Imperial Valley total inflow to the Salton Sea was disaggregated in to New and Alamo rivers, direct drains-east of the Alamo River, direct drains-west of the New River, direct drains-between the rivers, and groundwater seepage, as shown in Figure H2-28. In this figure, the boxes represent the level of aggregate information and the arrows indicate the spatial disaggregation. Table H2-8 outlines the general method that was applied for the development of each disaggregated flow point.

Monthly Downscaling

The annual inflow data, now spatially disaggregated by individual source, was downscaled into a monthly time series based on a review of historical monthly flow patterns. For all rivers or creeks for which historical flow data could be obtained, the following process was performed:

- Historical annual flow was computed from daily records for each source;
- Annual flows were sorted and divided into bins representing 0-20 percentile (bin 1), 20-40 percentile (bin 2), 40-60 percentile (bin 3), 60-80 percentile (bin 4), and 80-100 percentile (bin 5); and
- For each bin, and for an average of all years, determine the monthly percentage contribution to annual flow to determine if significant changes in patterns occur depending on hydrologic conditions.

The monthly patterns developed from this approach are shown in Figures H2-29 through H2-36. The New River contribution from the Imperial Valley was computed as the difference between the gaged flow near the Salton Sea and the New River near Calexico.

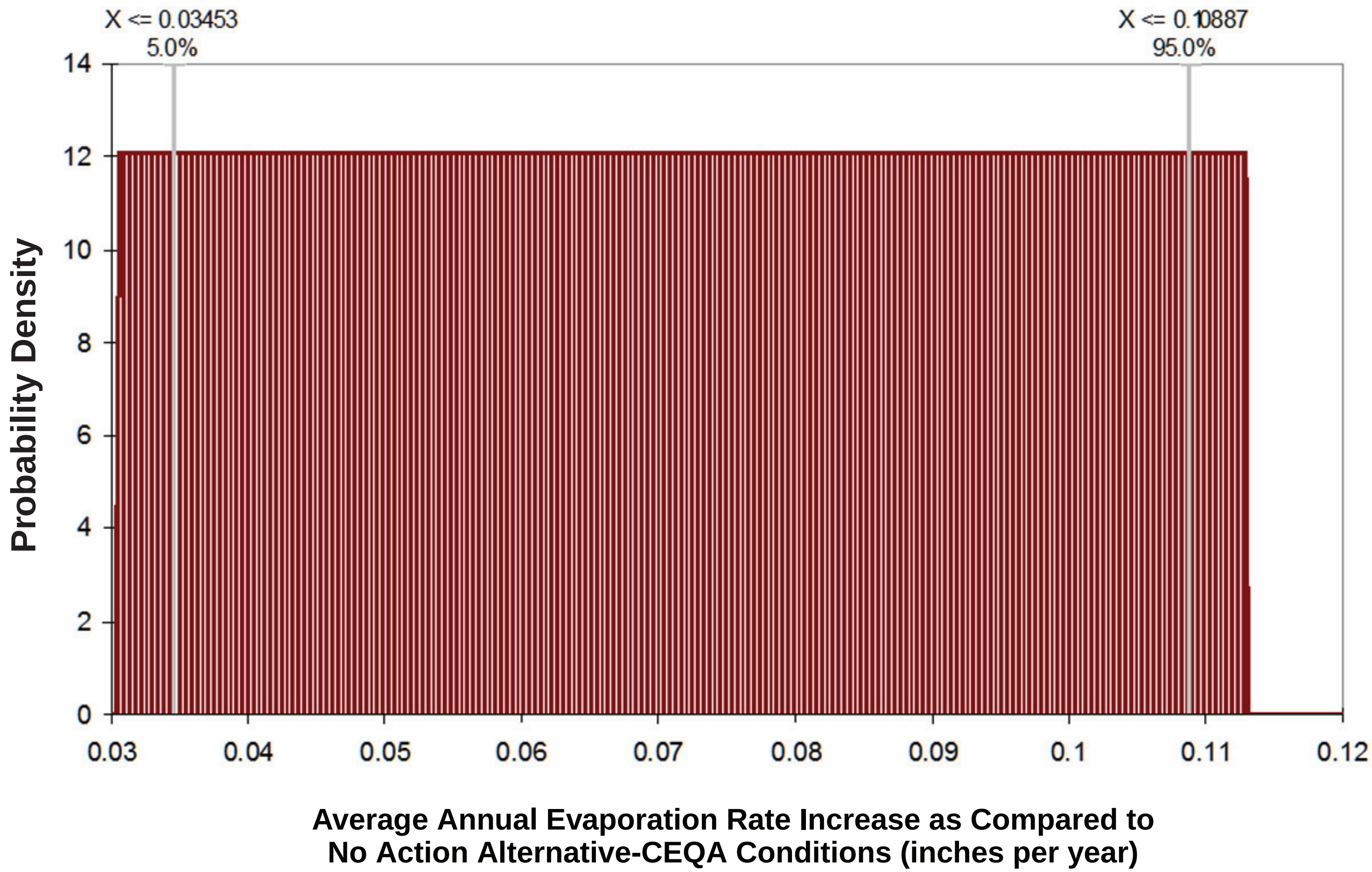


FIGURE H2-26
DISTRIBUTION OF UNCERTAINTY INCREASE IN EVAPORATION RATES DUE TO FUTURE CLIMATE CHANGE

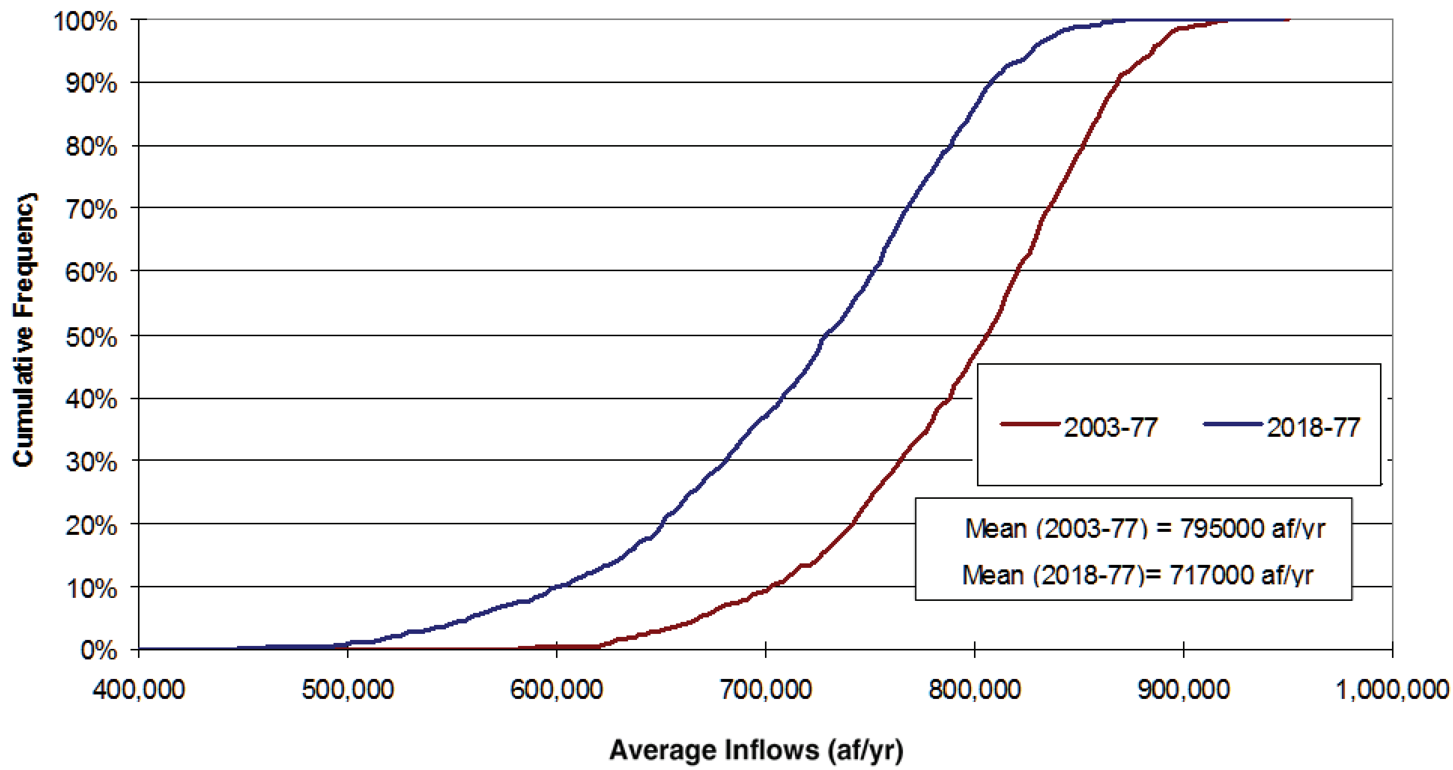


FIGURE H2-27
POSSIBLE TOTAL SALTON SEA INFLOWS FOR NO ACTION ALTERNATIVE-VARIABILITY CONDITIONS

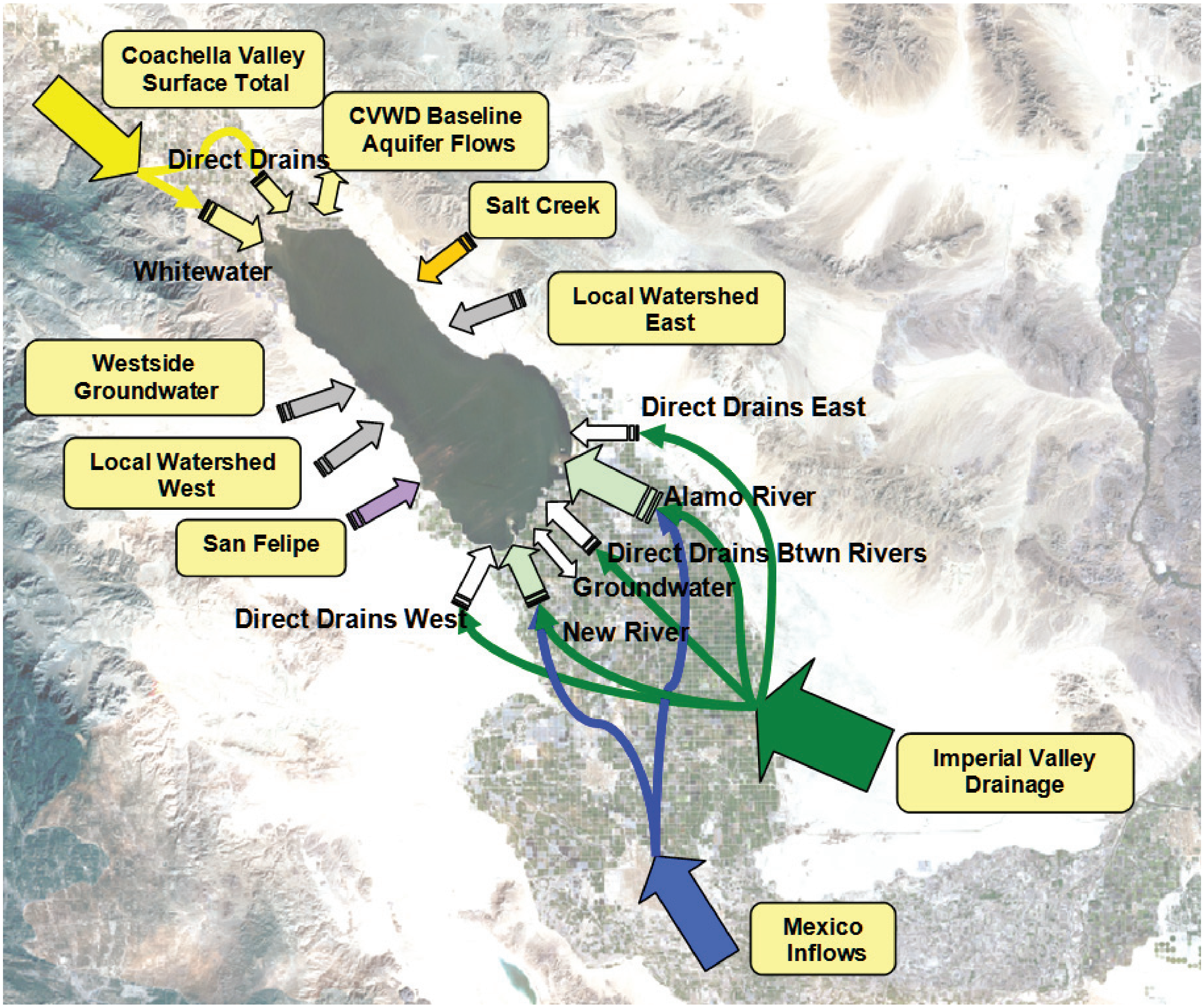


FIGURE H2-28
COMPONENTS OF INFLOWS TO SALTON SEA

Table H2-8
Spatial and Temporal Disaggregation Methods for Data Sources

Disaggregated Source	Aggregated Source	Method of Spatial Transformation	Monthly Disaggregation Method
Imperial Valley Groundwater	N/A	Assumed 1,000 acre-feet/year	Constant pattern
Alamo River - Imperial Valley flows, only	Imperial Valley Total flows *minus* groundwater	0.607 * (Imperial Valley + IOPP Adjustments - Imperial Valley Groundwater)	Pattern based on historical distributions
New River - Imperial Valley flows, only	Imperial Valley Total flows *minus* groundwater	0.29 * (Imperial Valley + IOPP Adjustments - Imperial Valley Groundwater)	Pattern based on historical distributions
Imperial Valley Direct Drains-East (east of Alamo River)	Imperial Valley Total flows *minus* groundwater	0.0242 * (Imperial Valley + IOPP Adjustments - Imperial Valley Groundwater)	Pattern based on historical distributions of Alamo River
Imperial Valley Direct Drains-West (west of New River)	Imperial Valley Total flows *minus* groundwater	0.0285 * (Imperial Valley + IOPP Adjustments - Imperial Valley Groundwater)	Pattern based on historical distributions of Alamo River
Imperial Valley Direct Drains-Between New and Alamo Rivers	Imperial Valley Total flows *minus* groundwater	0.503 * (Imperial Valley + IOPP Adjustments - Imperial Valley Groundwater)	Pattern based on historical distributions of Alamo River
Alamo River - Mexico Inflows, only	N/A	Assumed at recent historical 2,000 acre-feet/year	Pattern based on historical distributions
New River - Mexico Inflows, only	Mexico Total flows *minus* Alamo River flows	Mexico total minus 2,000 acre-feet/year	Pattern based on historical distributions
Coachella Valley Groundwater	N/A	Per CVWD	Constant pattern
Whitewater River	Coachella Valley Total flows *minus* groundwater	0.5946*(Coachella Valley Total - Coachella Valley Groundwater)	Pattern based on historical distributions
Coachella Valley Direct Drains	Coachella Valley Total flows *minus* groundwater	0.4054*(Coachella Valley Total - Coachella Valley Groundwater)	Pattern based on historical distributions
San Felipe Creek	San Felipe Creek	N/A	Pattern based on historical distributions
Salt Creek	Salt Creek	N/A	Pattern based on historical distributions
Ungaged Watershed West	Ungaged Watershed West	N/A	Pattern based on historical distributions
Ungaged Watershed East	Ungaged Watershed East	N/A	Pattern based on historical distributions
Local Groundwater	N/A	Assumed 10,000 acre-feet/year	Constant pattern

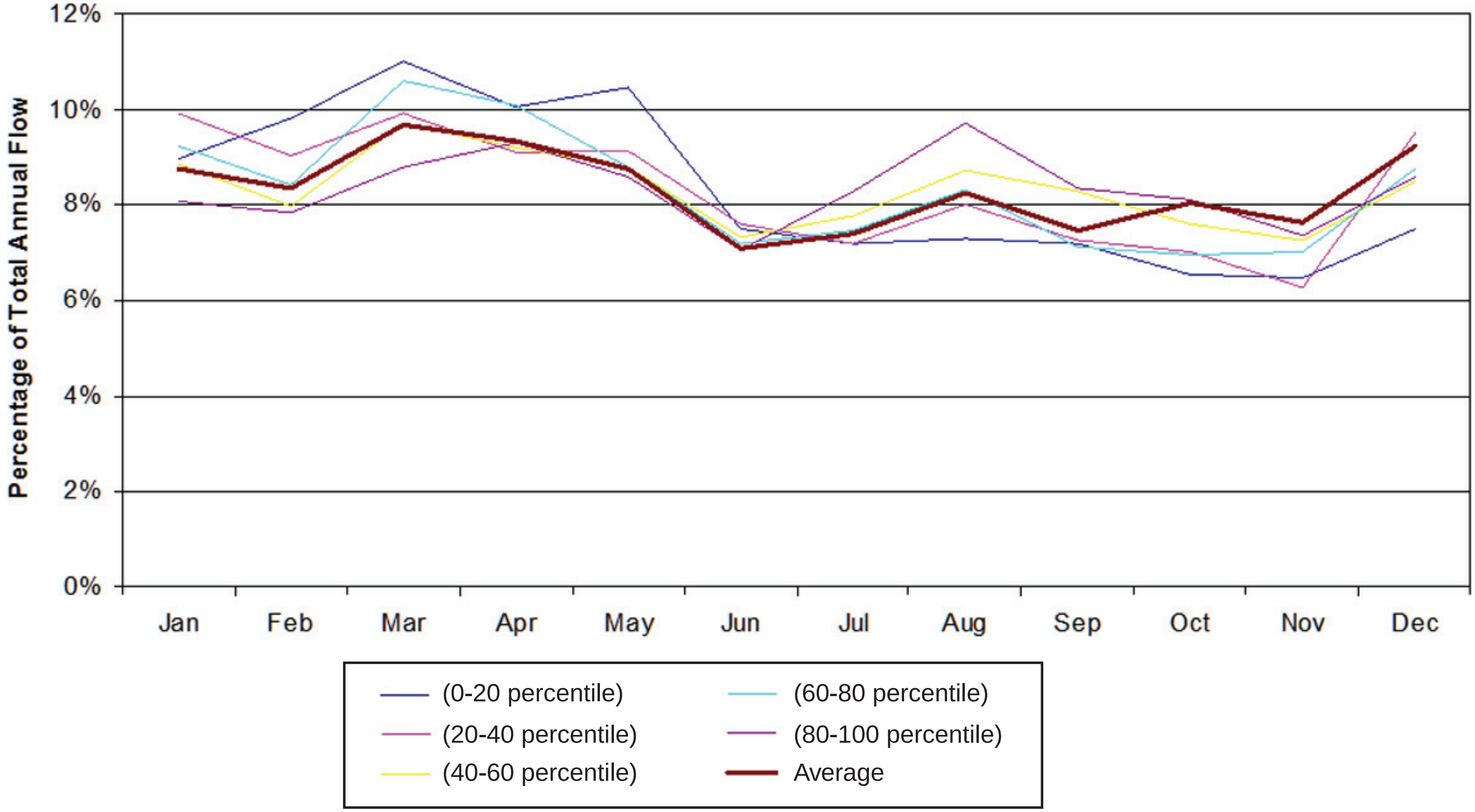


FIGURE H2-29
MONTHLY FLOW PATTERN FOR NEW RIVER NEAR CALEXICO

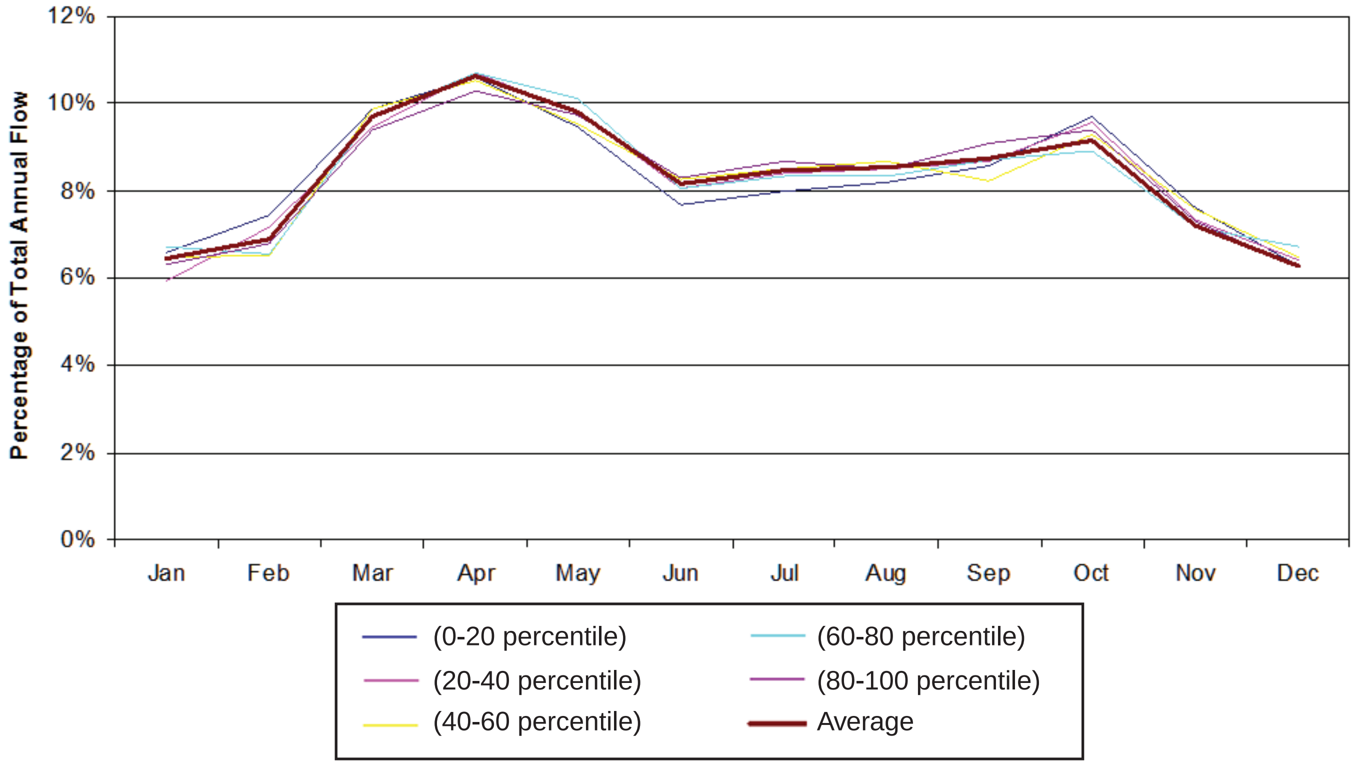


FIGURE H2-30
MONTHLY FLOW PATTERN FOR NEW RIVER CONTRIBUTION FROM IMPERIAL VALLEY

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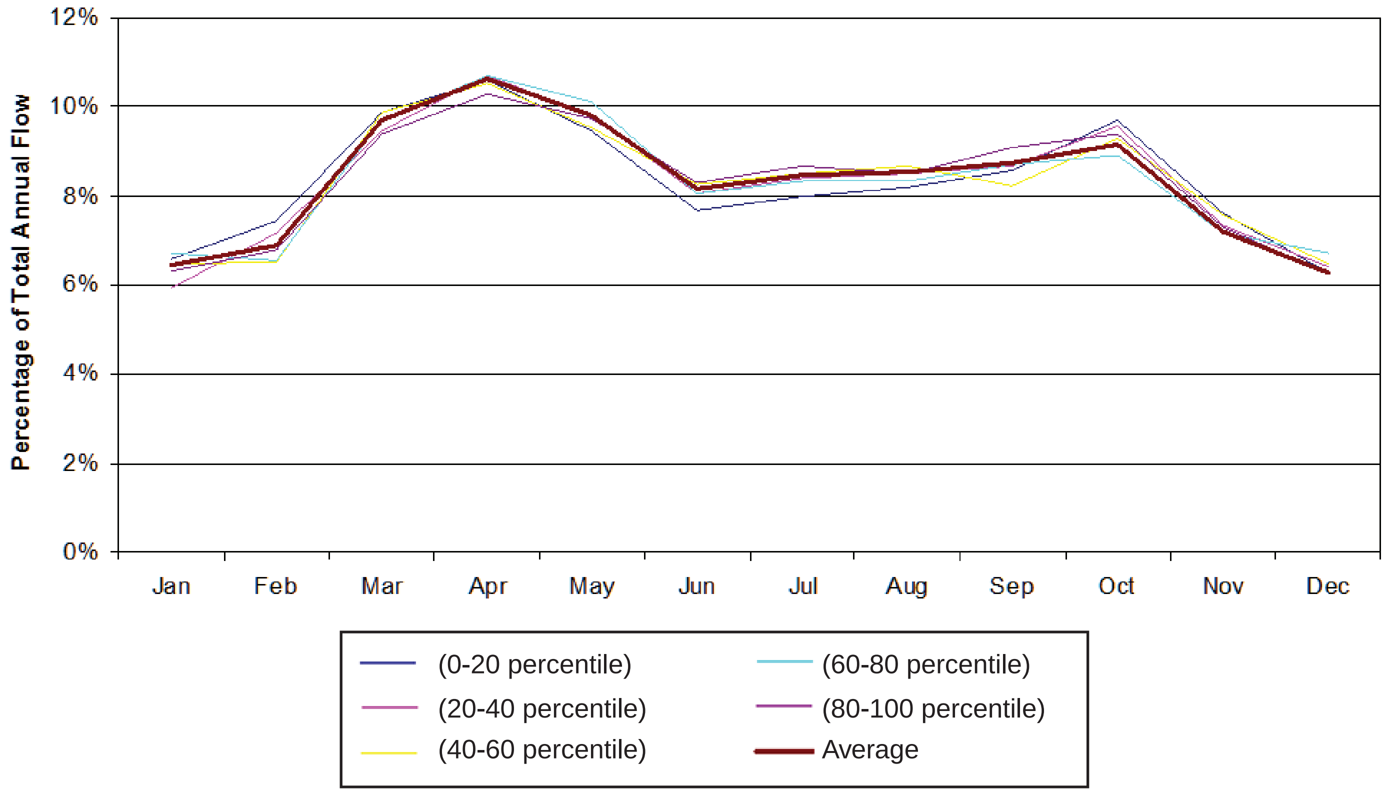

FIGURE H2-31
MONTHLY FLOW PATTERN FOR
ALAMO RIVER NEAR NILAND

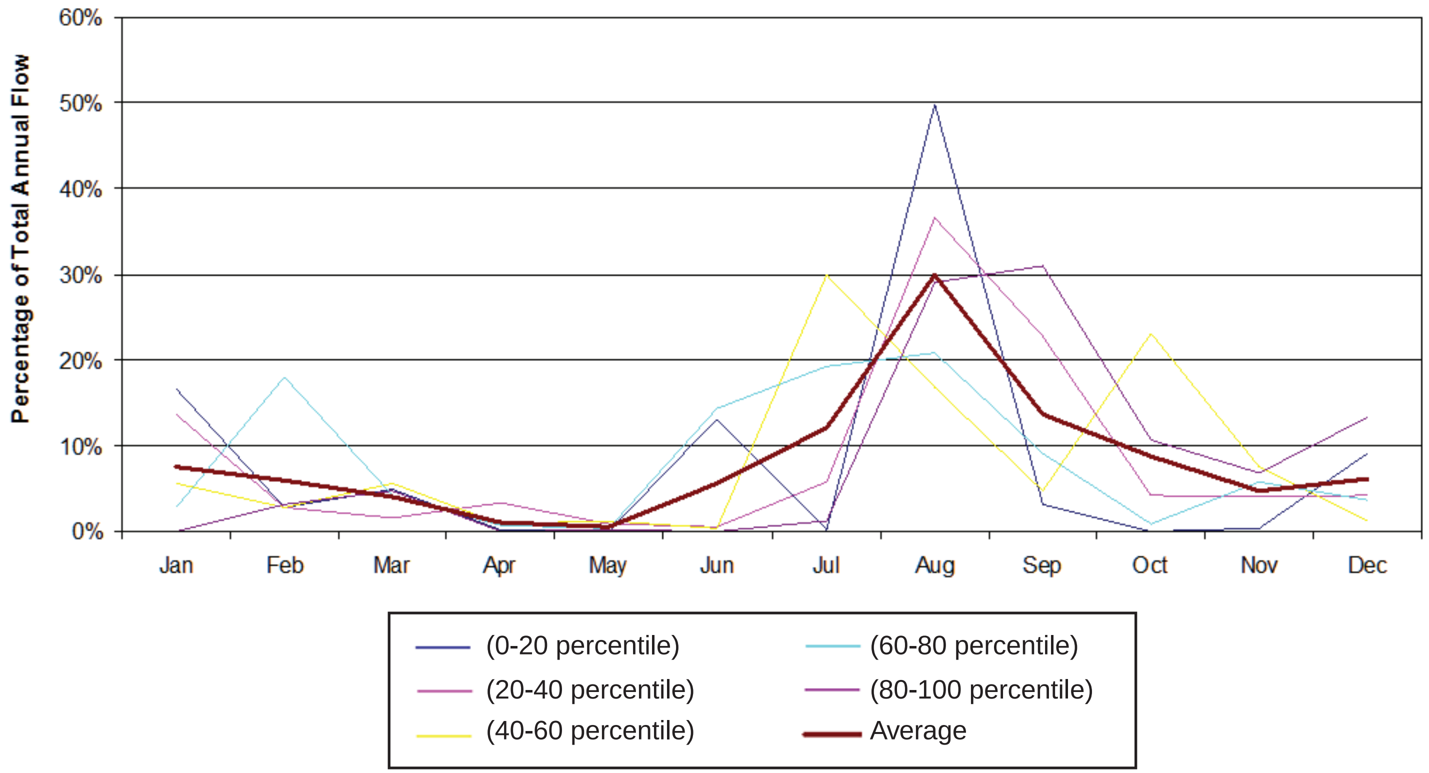

FIGURE H2-32
MONTHLY FLOW PATTERN FOR SAN FELIPE CREEK NEAR WESTMORLAND

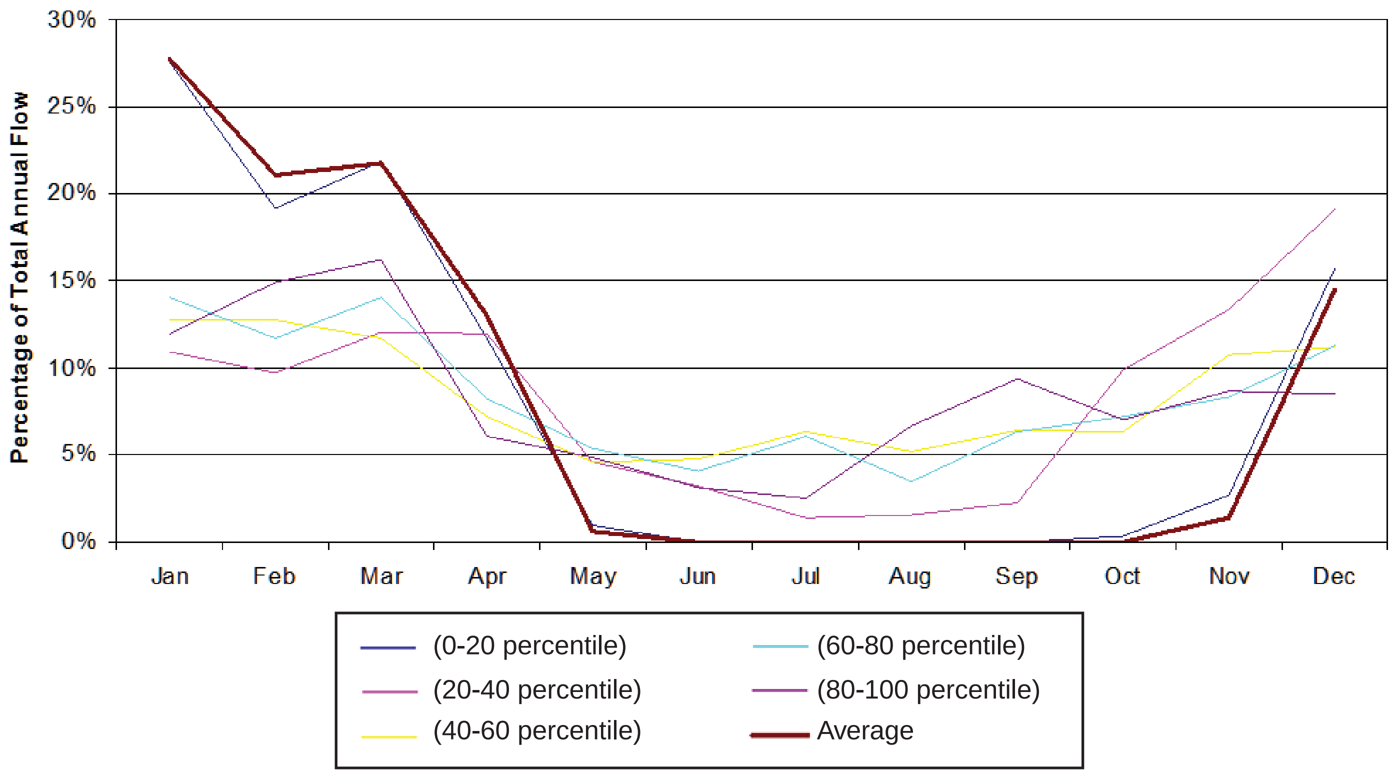

FIGURE H2-33
MONTHLY FLOW PATTERN FOR SALT CREEK NEAR MECCA

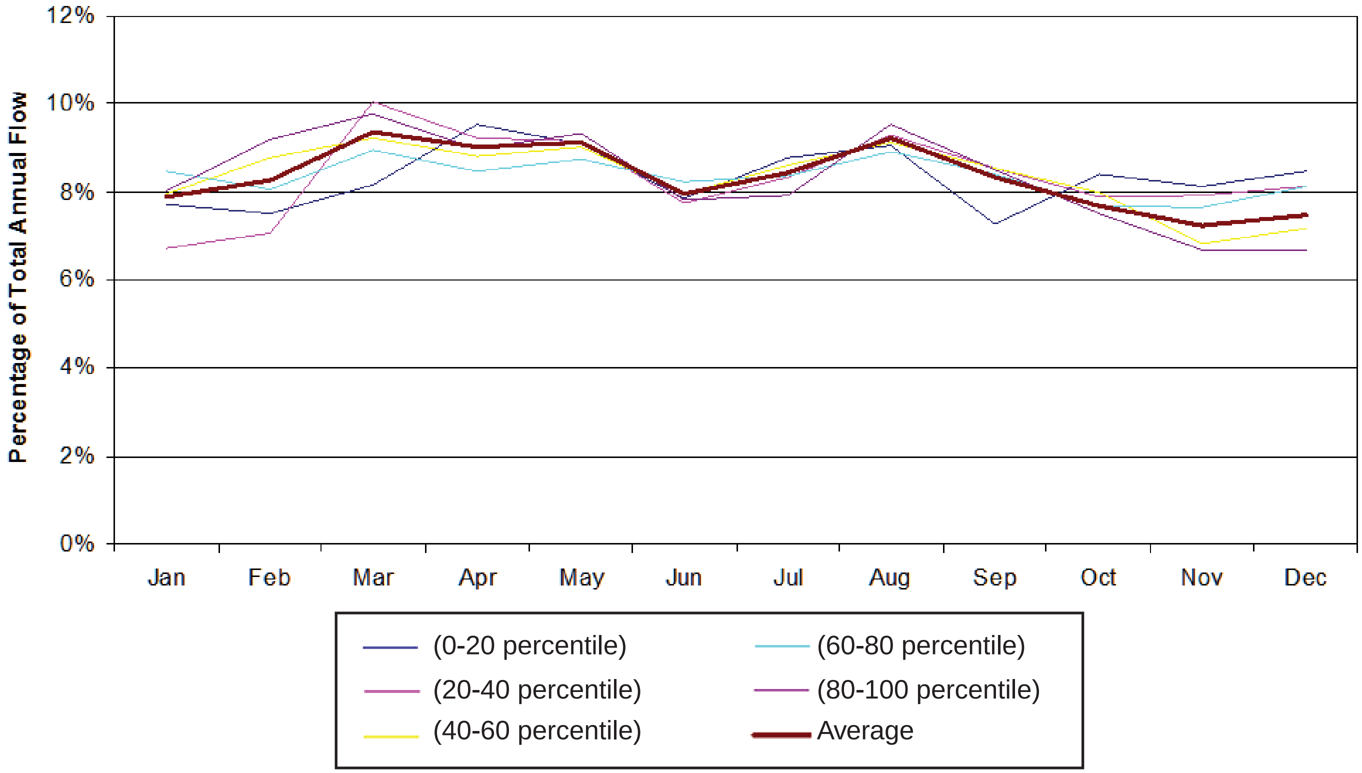

FIGURE H2-34
MONTHLY FLOW PATTERN FOR WHITEWATER RIVER NEAR MECCA

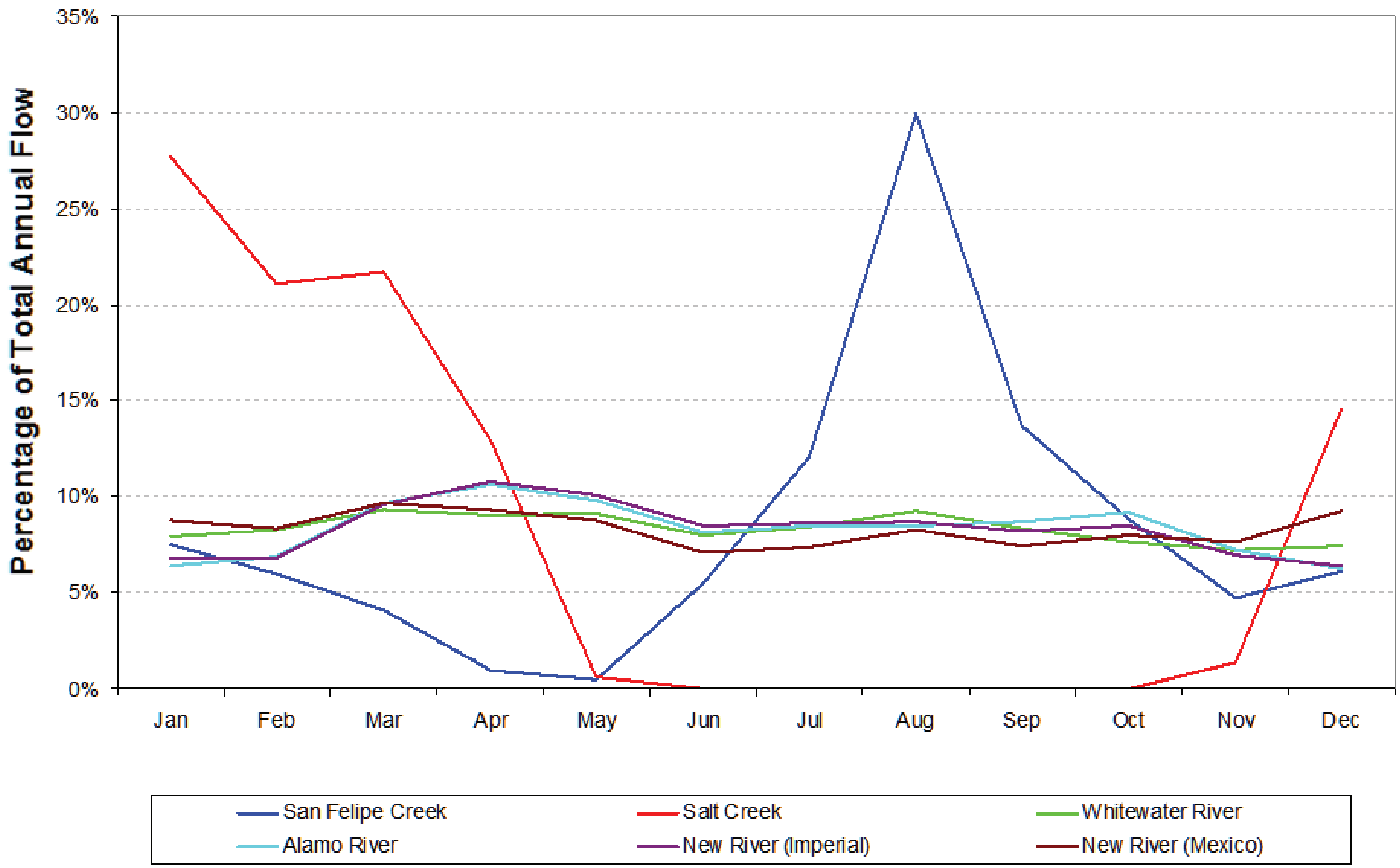

FIGURE H2-35
AVERAGE MONTHLY FLOW PATTERN FOR GAGED STREAMS FLOWING INTO THE SALTON SEA

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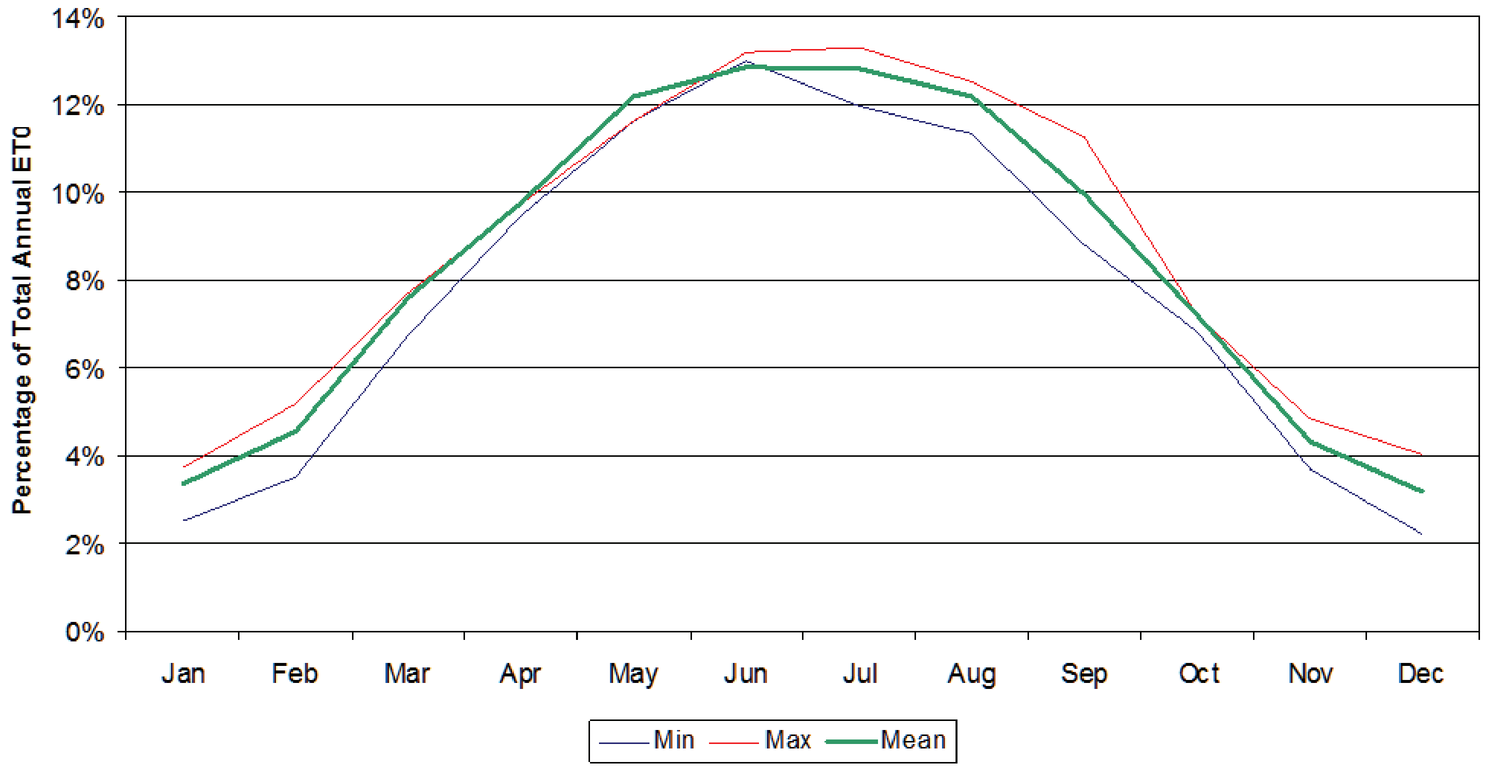

FIGURE H2-36
MONTHLY REFERENCE EVAPOTRANSPIRATION RATES NEAR BRAWLEY

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General Conclusions

There are several conclusions that can be determined from this analysis. First, only San Felipe Creek and, to a lesser extent, Salt Creek display widely varying monthly patterns. These are the only two drainages that respond largely unimpeded by agricultural or urban development and reflect a stronger rainfall-runoff influence. Second, the Alamo, New, and Whitewater rivers display a very constant pattern governed by upstream agricultural and drainage practices. Monthly patterns do not show a significant variation from year to year. Third, the New River at Calexico exhibits a strong agricultural drainage pattern, but shows a higher percentage of flows in wet years during the January through May period.

Based on this assessment of monthly pattern variations, it was determined that the application of an average pattern would provide a suitable representation of conditions for all drainages except Salt Creek. For Salt Creek, the average of the last five years of data was used to define future patterns for this creek. This period was selected to better reflect the flows to be provided under the Coachella Canal Lining Project mitigation measures.

Multiple patterns could have been applied for San Felipe Creek, but this would be difficult for this relatively small source. In addition, while the patterns do vary for this creek, the use of an average pattern appeared to be appropriate to represent seasonal variations.

The average patterns used to downscale the annual flows in the tributary streams to the Salton Sea are shown in Figure H2-35. The annual flows were multiplied by the appropriate percentage for each month to develop a monthly time series for use in hydrologic modeling.

The evapotranspiration pattern was developed from measured evapotranspiration at Brawley, as shown in Figure H2-36. The pattern reflects the long period of summer heating that is present in the watershed. This pattern was used for both evaporation and evapotranspiration in the hydrologic modeling analyses.

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APPENDIX H-2, ATTACHMENT 1

Hydrologic Modeling Documentation

2006

Table of Contents

Items **Page**

List of Tables

List of Figures

APPENDIX H-2, ATTACHMENT 1
HYDROLOGIC MODELING DOCUMENTATION

INTRODUCTION

This attachment to Appendix H-2 describes the hydrologic modeling performed as part of the Draft Programmatic Environmental Impact Report (PEIR). A generalized hydrologic model was adapted for the specific conditions at the Salton Sea, calibrated over a 50 year historical period, and applied for both the current and possible future configurations and hydrologic conditions at the Salton Sea.

Background

Long term policy and planning analyses of the Salton Sea have typically used the Salton Sea Accounting Model (SSAM) developed by the U.S. Department of the Interior, Bureau of Reclamation (Reclamation) (IID, 2002). The SSAM is a spreadsheet-based, annual time step, water and salt balance model for the Salton Sea. The model was initially developed to analyze effects to the Salton Sea water surface elevation and salinity of changes in long term inflows. It was in this mode that the effects of the Quantification Settlement Agreement (QSA) and the Imperial Irrigation District (IID) Water Conservation and Transfer Project on the Salton Sea were analyzed. Over the years, however, the SSAM has been modified to evaluate alternatives in which one portion of the Salton Sea is managed for salinity and elevation control while the other portion is a Brine Sink. As the complexity of the alternatives increased so did the complexity of spreadsheet calculations and the difficulty of simulating additional components.

As part of the preparation of the PEIR, Reclamation and the Resources Agency agreed to investigate a new modeling platform to allow for a more robust evaluation of wide-ranging alternatives. After initial screening of several available models and discussions with the Inflows/Modeling Working Group, the generalized CALSIM reservoir-river basin simulation model was selected as the platform on which to build a new model for the Salton Sea. The CALSIM model is a generalized reservoir-water allocation model that allows for specification and achievement of user-specified allocation targets, or goals (Draper et al., 2002).

Summary of Modeling Goals and Approaches

The overall objectives of the model development and application were to provide a tool for hydrologic and salinity analysis of PEIR alternatives to measure performance towards goals and trade-offs, provide information to assist in alternative configurations and designs, evaluate Salton Sea impacts due to hydrologic uncertainty, be publicly-available and documented, facilitate consistency of data, and serve as an analysis tool beyond the PEIR. The Resources Agency desired a computer model that could rapidly analyze various alternatives and could be maintained and improved in the future. Associated with these model development objectives, the following requirements were established for any new model:

- Simulate future Salton Sea elevation and salinity under varying configurations and inflow assumptions;
- Account for full water and salt balances;
- Allow simulation of monthly time steps to capture seasonal variation;
- Incorporate multiple impoundments and major components or processes of likely alternatives;
- Optimize for simultaneous solution of elevation and salinity targets

- Incorporate functional relationships of evaporation suppression with increasing salinity, salt precipitation, and salt re-dissolution; and
- Incorporate a stochastic simulation mode to analyze uncertainty.

SALSA MODEL DESCRIPTION

The application of the generalized CALSIM model to the Salton Sea has been named the SALSA (Salton Sea Analysis) model. The simulation model uses single time-step optimization techniques to efficiently route water through a network of storage nodes and flow arcs based on a series of user-specified relative priorities for water allocation and storage. Physical capacities and specific regulatory and contractual requirements are input as linear constraints on system operation using the water resources simulation language (WRESL). The process of routing water through the channels and storing water in reservoirs is efficiently performed by a mixed-integer linear programming (MIP) solver. For each time step, the solver maximizes the objective function to determine a solution that delivers or stores water according to the specified priorities and satisfies all system constraints. The sequence of solved MIP problems represents the simulation of the system over the period of analysis.

The CALSIM model was developed jointly by the DWR and Reclamation and is used extensively for simulation of the State Water Project and Central Valley Project in California. Other applications of the CALSIM model include simulation of the Klamath Project, the American River Basin, and the San Joaquin River Basin.

Network Approach

The SALSA model represents the water resources system, consisting of lakes/reservoirs, channels (natural and artificial), and demand locations, as a network of nodes and arcs. Nodes in the network may represent lakes/reservoirs, groundwater basins, junction points of two or more flows, or simply a point of interest on a channel. Arcs represent water flows between nodes, or out of the system, and may be inflows, channel flows, return flows, or diversions to consumptive uses. The common SALSA network for the Salton Sea is shown in Figure H2-1-1.

Mathematical Formulation

The mathematical formulation used in the SALSA model consists of a linear objective function and a set of linear constraints. The objective function describes the priority in which water should be routed through the network and the constraint set describes the physical and operational limitations toward achieving the objective. SALSA *maximizes* the objective function in each time period to obtain an optimal solution that satisfies all constraints. Priority weights assigned to variables (flow or storage) in the objective function describe the relative importance of that particular variable in the system operation.

Decision variables represent the choices available to the linear programming (LP) model for storing water in nodes (reservoirs) or routing water through arcs. Weights on the decision variables encourage or discourage the router to allocate water to the specified variable. Typical decision variables used in the SALSA model are delivery of water to demand nodes or end of period storage in node i, zone j. State variables describe the state of the system at the beginning of any time period. The term ‘state’ is used rather loosely in this document to describe data as well as states of the system. These variables have known constant values for the upcoming period and can be thought of as the information available to planner/operator prior to any system operation. Unregulated inflows are assumed to be known for the current period and thus represent a state variable.

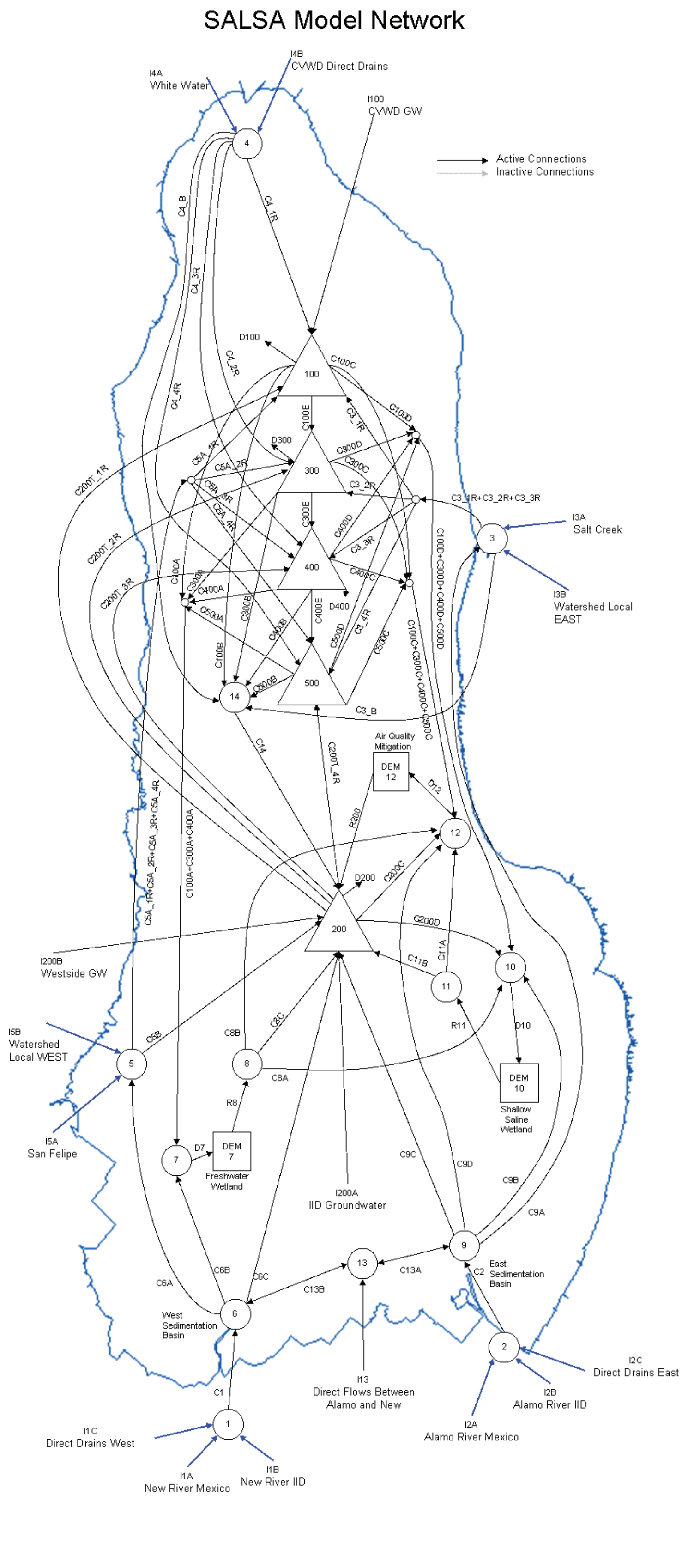


FIGURE H2-1-1
COMMON SALSA MODEL NETWORK

System constraints in CALSIM represent the limitations of allocating water to a particular flow or storage arc. Continuity equations at each node, maximum capacity of reservoirs and channels, and maximum reservoir release and pumping plant capacities are typical physical constraints in the model. These constraints, since they describe the physical limitations of the system, may not be violated. Operational or target reservoir storage is simulated by dividing reservoir storage into any number of zones and assigning priority weights to each particular zone. In this fashion, minimum operating pools, conservation pools, and flood control pools may be specified and operated according to the desired policy. Deliveries and minimum instream flows are similarly modeled; dividing arcs into zones and assigning priority weights. With each priority weight, the objective function is modified to reflect the relative importance of the associated variable.

Some operational and institutional constraints may be best modeled as a goal minimizing the deviation between a decision variable and its target value (possibly also a decision variable). Constraints such as these are termed ‘soft constraints’ because they may be violated when other system constraints do not allow the goal to be achieved. These constraints are internally reformulated by CALSIM by the introduction of auxiliary variables in the constraint equation. The power of this technique lies in the ability to penalize the auxiliary variables in the objective function, resulting in the minimization of the deviation between the left-hand-side and right-hand-side of the constraint equation. CALSIM allows the user to specify goals of this type and the respective penalty weights through the WRESL language.

CALSIM also enables the incorporation of nonlinear ‘IF-THEN’ type constraints through the use of binary (0 or 1) integers. While the mixed integer problem is much more difficult to solve than an ordinary linear programming problem, constraints such as gate closures and trigger-type minimum flows often necessitate the introduction of integers.

Objective Function

The objective function in the CALSIM model is linear combination of decision variables and their associated priority weights. In addition, slack and surplus variables added to the objective function from ‘soft’ constraints are multiplied by their associated negative penalties. The complete objective function is:

$$\max Z = \sum_{i=1}^{nwt} (w_i \cdot X_i) + \sum_{j=1}^{npen} (-p_j \cdot x_j^{+} | x_j^{-})$$

where X is a decision variable, w is a priority weight, x^- is a slack variable, x^+ is a surplus variable, and p is the penalty weight associated with the slack or surplus variable.

Sequential Linear Programming

CALSIM allows the decision maker to specify multiple models to be simulated in a particular order. The modeler decides which parts of a system should be included in which models and the order in which to simulate the models. The decision variable results of each higher order model (i.e. simulated prior to the current model) are accessible in the current model. This type of simulation allows the modeler to cycle through components of the system, systematically adding or removing constraints.

Time Step

Daily and monthly time steps are permitted in the CALSIM model, but input data must be consistent with the simulation time step. For the SALSA application, *monthly* input data and simulation time steps were used.

Restoration Components Incorporated into SALSA

The SALSA model incorporates approximations of the key components included in the PEIR alternatives. These include open water storage elements (SEA), habitat wetlands (HAB), air quality management areas (AQM), and natural and mechanical treatment systems (NTS and MTS).

All Marine Seas, Concentric Rings, Concentric Lakes, and Brine Sinks were considered SEA components. SEA components were simulated as storage reservoirs in the SALSA model with elevation and salinity targets specified by the user. Water volume, surface area, elevation, and salinity are specifically calculated for this component. SEA components require bathymetric data to describe the elevation-area-capacity relationship, evaporation rates, and outlet release capacities.

The shallow cells associated with the Saline Habitat Complex and any other type wetland were simulated as HAB components. Water volume, elevation, and salinity are not explicitly tracked for this component. The water surface area, land area, time-varying reference evapotranspiration rates (ETo) or evaporation rates, time-varying crop coefficients (Kc), and return flow fractions may be specified for these components. Depending on the vegetation coverage of these shallow water bodies, evaporation rates may be directly specified or computed based on reference ETo and Kc.

The air quality management areas are considered as the AQM component. Similar to HAB components, the water demand of the type of AQM control (vegetation) is computed from time-varying reference ETo, Kc, and return flow fractions. The user specifies what fraction of the Exposed Playa would require a water demand and from which elevation to begin delivery of water to this component. The SALSA model dynamically tracks the area of the Exposed Playa considering water surface area of the SEA and HAB components as well as the land area of the HAB component.

The NTS operates identically to the HAB component, while the MTS is simulated as a simple percent loss of supplied water. The effluent of the MTS can be directed to the brine, any other component, or out of the simulated system.

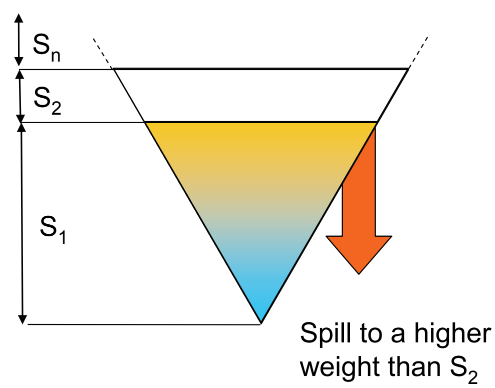
Water Allocation

Inflows

Inflows into the SALSA model are required to be pre-processed and supplied as input data. The SALSA model does not incorporate a watershed runoff model. Typical inflows to the model are supplied from historic data analysis or from the results of other models. Sources of data used as input to the SALSA model include U.S. Department of the Interior, Geological Survey (USGS) and IID flow records; results from the Imperial Irrigation District Decision Support System (IIDSS), Colorado River System Simulation Model (CRSS), and Coachella Valley Water District (CVWD) groundwater models; and from simplified rainfall-runoff and regression models.

Lake Elevation Targets

SEA components are simulated as reservoirs in the SALSA model with storage operating targets required to drive the allocation of water to various zones. The reservoir is subdivided into several zones reflecting storage levels with differing priorities. Elevation targets are specified by the user and are translated into storage targets through the relational bathymetry tables. In a typical application of the SALSA model, only the target elevation and spillway elevation are specified. Positive priority weights are specified for the beneficial storage zone and negative weights for the flood



$$0 \le S_{ij} \le S_i level_j - S_i level_{j-1}$$

storage pool. This is shown in the equation, where S is the storage volume, i is the reservoir/lake node, and j is the storage zone.

Consumptive Use Demands and Deliveries

The HAB, AQM, and NTS components each represent a consumptive use and associated water requirement. As discussed above, the water requirement can be either specified directly by the user, computed based on a evaporative demand, or computed based on vegetation water use characteristics. The water delivery requirement is increased from the consumptive demand to account for a user-specified return flow fraction. The water allocation to this particular demand location is governed by the priority assigned to the delivery arc. In general, water allocation to all consumptive use demands (either HAB, AQM, or NTS) were assigned higher priority weights than the allocation of water to lake storage targets. This allows the model to first allocate all water these consumptive uses and, if insufficient water is available for all uses, to allow the lake elevation target to not be satisfied. The area for the HAB, AQM, and NTS components are directly specified by the user. The AQM component, however, has the option to dynamically compute the area of the Exposed Playa. The water requirement is implemented as

$$demand = \frac{ETo * Kc * A}{(1 - rfactor)}$$

$$0 \leq D_{ij} \leq demand_{ij}$$

Where ETo is the reference evapotranspiration rate, Kc is the crop coefficient, A is the irrigated area, rfactor is the return flow fraction, and D is the actual delivery.

Lake Evaporation

Reservoir surface water evaporation is computed as the period unit evaporation rate multiplied by the period average surface water area. This implies that the beginning and end of period surface water area, a function of reservoir storage, must be known before evaporation can be computed. While the beginning of period surface water area can be found from the reservoir storage at this time, the end of period storage is unknown. Network flow algorithms often iterate until the estimate of evaporation and the actual evaporation converge. CALSIM employs a linearization method to describe the area-storage curve for each reservoir. This method allows for an accurate and fast computation of evaporation without iteration.

$$E_i = ev_i \cdot 0.5\left[A_i(S_i^{t-1}) + A_i(S_i^t)\right]$$

where $A_i(S_i^t)$ is linearized as

$$A_i(S_i^t) \approx A_i(S_i^{t-1}) + coefEV_i(S_i^t - S_i^{t-1})$$

and

$$coefEV_i = \frac{\left[A_i((1+c)S_i^{t-1}) - A_i((1-c)S_i^{t-1})\right]}{2cS_i^{t-1}}$$

where A is the surface area, S is the storage volume, ev is the unit evaporation rate, and t is the time step. The fractional constant, c, indicates the step size for the area-storage slope approximation. It can be estimated as the average percent change in storage over a time period for a particular reservoir.

The rate of evaporation decreases as the salinity of the water increases. While this increase is insignificant for many water resources problems, it has a pronounced effect on the rate at which a hypersaline terminal lake would decrease in size. For the application to the Salton Sea, an evaporation-salinity relationship was developed to better simulate this process. Using the results from the Reclamation Salton Sea Salinity Control Research Project (Reclamation 2004), Agrarian studies at Bombay Beach, and comparing to previous work on Bonneville Salt Flats (Turk 1970), and Owens Lake brines, a revised evaporation-salinity relationship was developed for the Salton Sea. Evaporation suppression is governed by a number of factors including the molecular activity of the water, the size and number of salt molecules, and temperature of the water. The evaporation to specific gravity relationship developed by Reclamation from the Salton Sea Salinity Control Research Project was used directly. However, since the SALSA model only tracks salinity (not specific gravity), an approximate relationship between specific gravity (SG) and total dissolved solids (TDS) of Salton Sea brines was developed, as shown in Figure H2-1-2. Despite differences in the composition of the Owens Lake brines and those at the Salton Sea, the SG-TDS relationship is similar, as shown in Figure H2-1-3. The final evaporation-TDS relationship used in the SALSA model is that derived from regressions in Figures H2-1-2 and H2-1-3 and is shown in Figure H2-1-4 as Eq 7. This figure indicates considerable reductions in evaporation rates as the salinity increases (up to 30 percent at 350,000 mg/L) and reflects a greater reduction than that used in previous model applications (Eq 3).

Water Quality Algorithm

A generalized water quality algorithm was not available in the basic CALSIM model. As part of this project, however, a conservative constituent water quality algorithm was developed and incorporated into the SALSA model. The algorithm developed is based on a simple mass balance concept and assumes constituents are completely mixed at nodes during each time step. The constituent concentrations are computed for every flow and storage arc in the system as shown in the following equations, in which C_o is the constituent concentration in the flow arcs leaving a node, C_s is the concentration in a storage node, S is the storage in the storage node, Q_i is the flow into the node, Q_o is the flow out of the node, and t is the time step.

$$C_o^t = \frac{\sum Q_i^t C_i^t}{\sum Q_i^t}$$ for non-storage nodes, and

$$C_s^t = \frac{\sum Q_i^t C_i^t + S^{t-1} C_s^{t-1}}{\sum Q_o^t + S^t}$$ for storage nodes:

The SALSA model also include the ability to specify a constituent removal term to approximate the precipitation of the constituent out of the water column. However, no geochemical processes are included in the model and the removal value is specified by the user. At this point in the model development, the re-dissolution of constituents from the inundation of previously dry shoreline areas is not included. While this was undeniably an important process during the flooding of the Salton Sea between 1904 and 1907, it is likely less important in the future as the Salton Sea elevation declines. However, further work in the area may be warranted in the future. There is a high degree of uncertainty in both the precipitation and re-dissolution of salts in the Salton Sea.

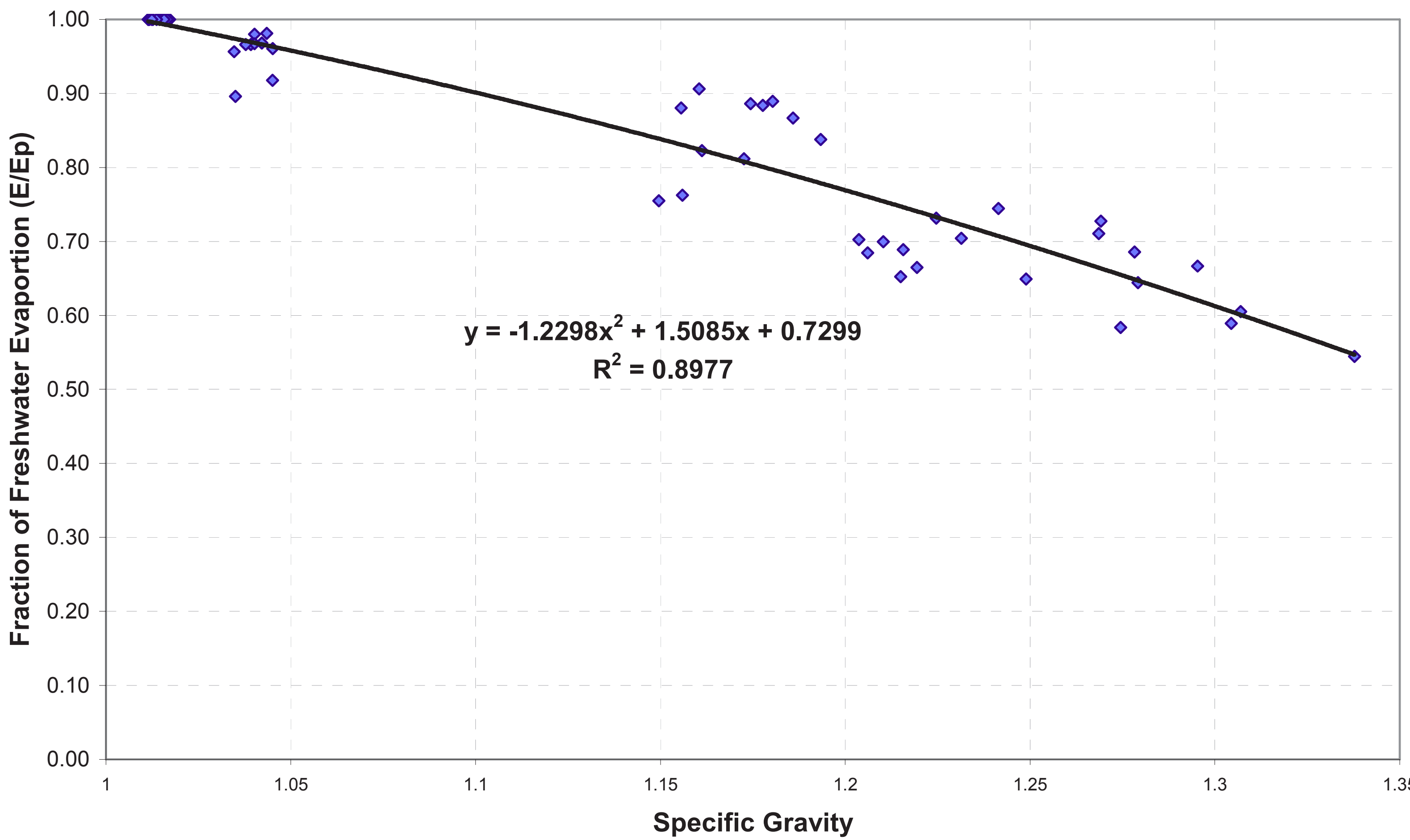
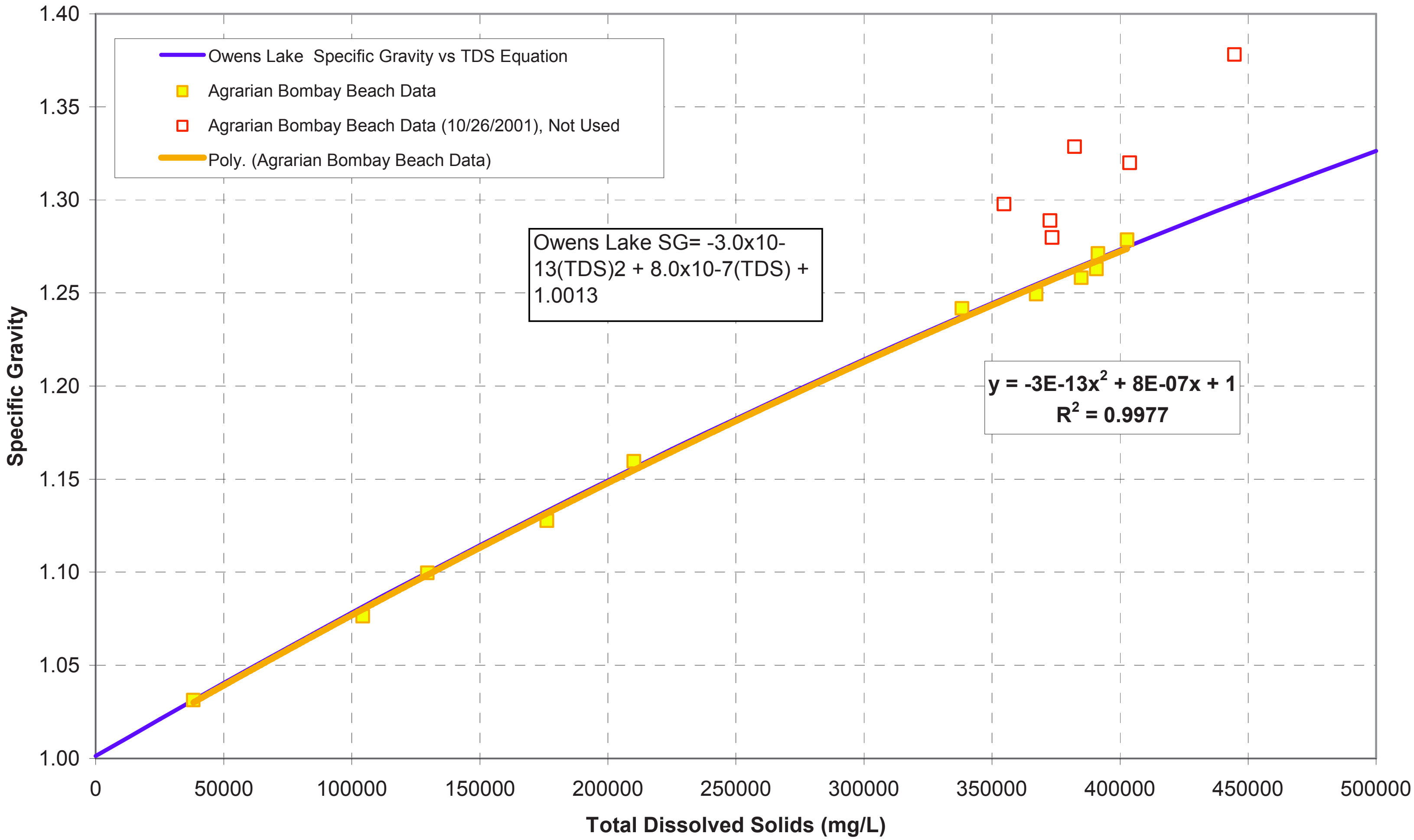


FIGURE H2-1-2
FRACTION OF FRESHWATER EVAPORATION TO SPECIFIC GRAVITY RELATIONSHIP FROM SALINITY CONTROL RESEARCH PROJECT

Note: Salton Sea Test Base Salinity Control Research Project
Equation Shown Developed by Reclamation (P. Weghorst)



Note: Equations Developed from Composite Data by Reclamation (Salton Sea Test Base) and Agrarian (Bombay Beach)

FIGURE H2-1-3
SALTON SEA BRINE SPECIFIC GRAVITY COMPARED TO TOTAL DISSOLVED SOLIDS

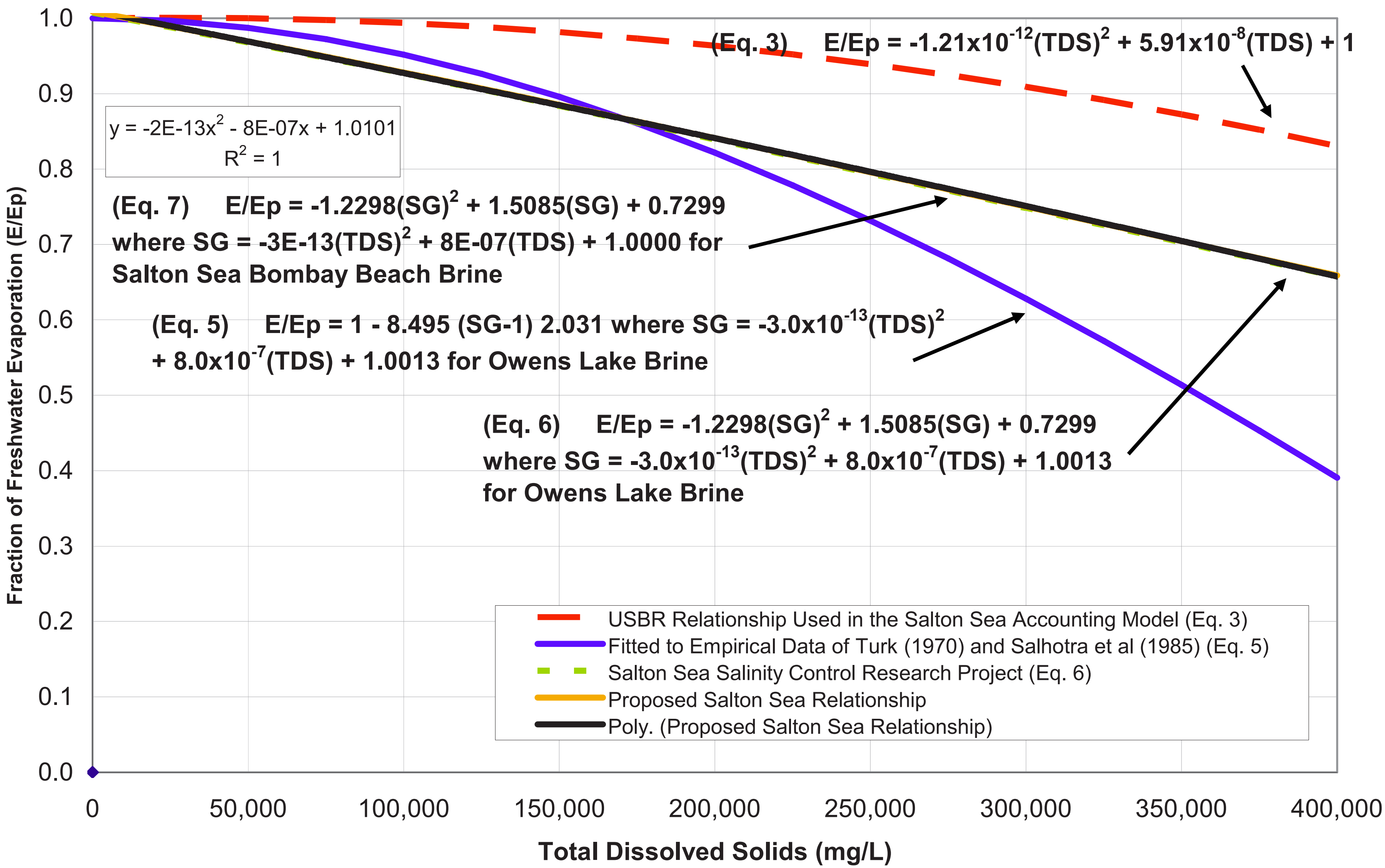


FIGURE H2-1-4
SALTON SEA RELATIVE EVAPORATION AS A FUNCTION OF TOTAL DISSOLVED SOLIDS

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Salinity Targets

Salinity targets may be specified for both lakes and for delivered water to habitat and air quality management areas. The targets are set through a 'soft' constraint on the constituent balance equations shown above. The 'soft' constraint applies a penalty (negative weight in the objective function) for any deviations above or below the target value. Differing penalties may be specified for deviations either above or below the target.

Solution Method

The solution of the constituent concentration requires that the flows be known. SALSA uses an iterative technique similar to that used in MODSIMQ (Dai and Labadie 2001) to solve the nonlinear water quality equations. This technique involves an initial simulation of water allocation. Concentrations are then computed based on water flows and boundary condition concentrations. These updated concentrations are then used to achieve salinity targets. This process is repeated within each time step until the change in concentration between iterations (cycles) is sufficiently small. In most SALSA simulations, convergence was achieved in less than five iterations. The SALSA model, however, forces convergence, by not allowing flow changes from the previous iteration, after nine iterations. While this approach guarantees water and salt mass balance, the solution may not have achieved the optimal result for the time step. This limitation is considered insignificant as the difference between the actual solution and 'optimal' solution is extremely small and is compensated for in the next time step.

Priorities

The SALSA model allocates water and achieves salinity targets based on priority weights assigned to the satisfaction of each goal. If there is sufficient water available in the current time step, all positive weighted goals will be satisfied subject to system constraints. However, if water is insufficient to satisfy all goals, water is then allocated according to priorities and will not achieve the lower priority goals. While the relative weights can be modified by the user, the general priorities were assigned in the following order in this application:

- Satisfy water demands for air quality needs;
- Satisfy water demands for habitat and treatment wetlands;
- Satisfy elevation targets in marine seas, lakes, or rings; and
- Achieve salinity targets in marine seas, lakes, or rings.

Data Requirements

Data requirements for the SALSA model include initial conditions, time varying boundary conditions, and bathymetric data. Initial conditions consist of beginning storage and constituent concentration in all storage nodes. Time varying boundary conditions are primarily in the form of inflows and constituent loads. The bathymetry of lakes, rings, or marine seas are input as tables relating elevation, area, and capacity.

Modes of Operation

The SALSA model can be operated under two different modes as described below.

Deterministic

The deterministic mode of operation simulates the system performance using a single trace (or sequence) of inflow or other boundary condition data. While this is a common form of model simulation in various fields, it assumes that the future climate or hydrologic conditions can be represented by a single sequence.

Stochastic

The stochastic mode of operation allows for consideration of multiple future traces or sequences. In this mode, the SALSA model receives multiple traces of input data, sampled from probability distributions or historic traces, and performs simulations of future Salton Sea conditions for each individual trace. This process may be repeated for hundred or thousands of possible traces and statistics related to the model results are compiled. Typically, the statistics of interest are the mean, median (50th percentile), standard deviation, inter-quartile (25th and 75th percentiles), and the 5th and 95th percentile values. This mode of operation is not standard in the generalized CALSIM software. A Visual Basic stochastic wrapper was developed as part of the PEIR to allow for stochastic simulations.

SALSA MODEL CALIBRATION AND VERIFICATION

The SALSA model was calibrated for the period of 1950 through 2002 as this period contained the most complete flow and salinity data for the Salton Sea. The model was calibrated to measured water surface elevation and average TDS. The calibration was first performed for water surface elevation through a Salton Sea water budget calculation for the unknown evaporation term. Independent verification of the calculated evaporation rates was performed based on adjusted Imperial Valley evaporation pan measurements. Once the historical water budget was estimated, and similar approach was taken to determine the historic salt budget. It was necessary to include a salt precipitation term beginning around 1990 in order to balance the historic salt budget. Greater details on the complete historic water and salt budgets are included in Appendix H-2.

The SALSA model was applied for the 1950 to 2002 period using the estimated inflows, salt loads, evaporation rates, and salt precipitation rates determined from budget closure terms. Observed water surface elevation was obtained from the USGS (2005) and measured salinity was averaged from four, near shore measurements reported by IID.

The SALSA model simulated, on a monthly time step, the Salton Sea water surface elevation and salinity as shown in Figures H2-1-5 and H2-1-6. The simulated water surface elevation is nearly identical to the measured values as the evaporation rate was computed external to the model as a water budget closure term. However, there were are few years, such as 1965, in which the evaporation rate computed from the water budget closure was considered unreasonable. This assessment was made based on a review of pan evaporation trends in the Imperial Valley and deviations from other studies and measurements. The simulated Salton Sea salinity is a direct result of the external salt loading from 1950 through 1989. However, from 1990 through 2002 it was necessary to remove salt in order to achieve a reasonable match with measured data. As discussed in Appendix H-2, the onset of significant salt precipitation is believed to have started in the late 1980s or early 1990s. 1,500,000 tons of salt precipitation (sink) was included in the SALSA model beyond this point in time.

SALSA MODEL APPLICATION FOR PROJECTED CONDITIONS AND PEIR ALTERNATIVES

Modeling Approach and General Assumptions

The analysis of future conditions at the Salton Sea utilizes the Monte Carlo technique for characterizing, quantitatively, the response of a system to uncertainty and variability. For the purposes of this document, the Monte Carlo technique is the method in which the stochastic analysis is performed. Monte Carlo analysis involves the identification of significant variability and uncertainty in the system, characterization of the uncertainty and variability through input probability distributions, random sampling of the input distributions, and multiple simulations with a computer model.

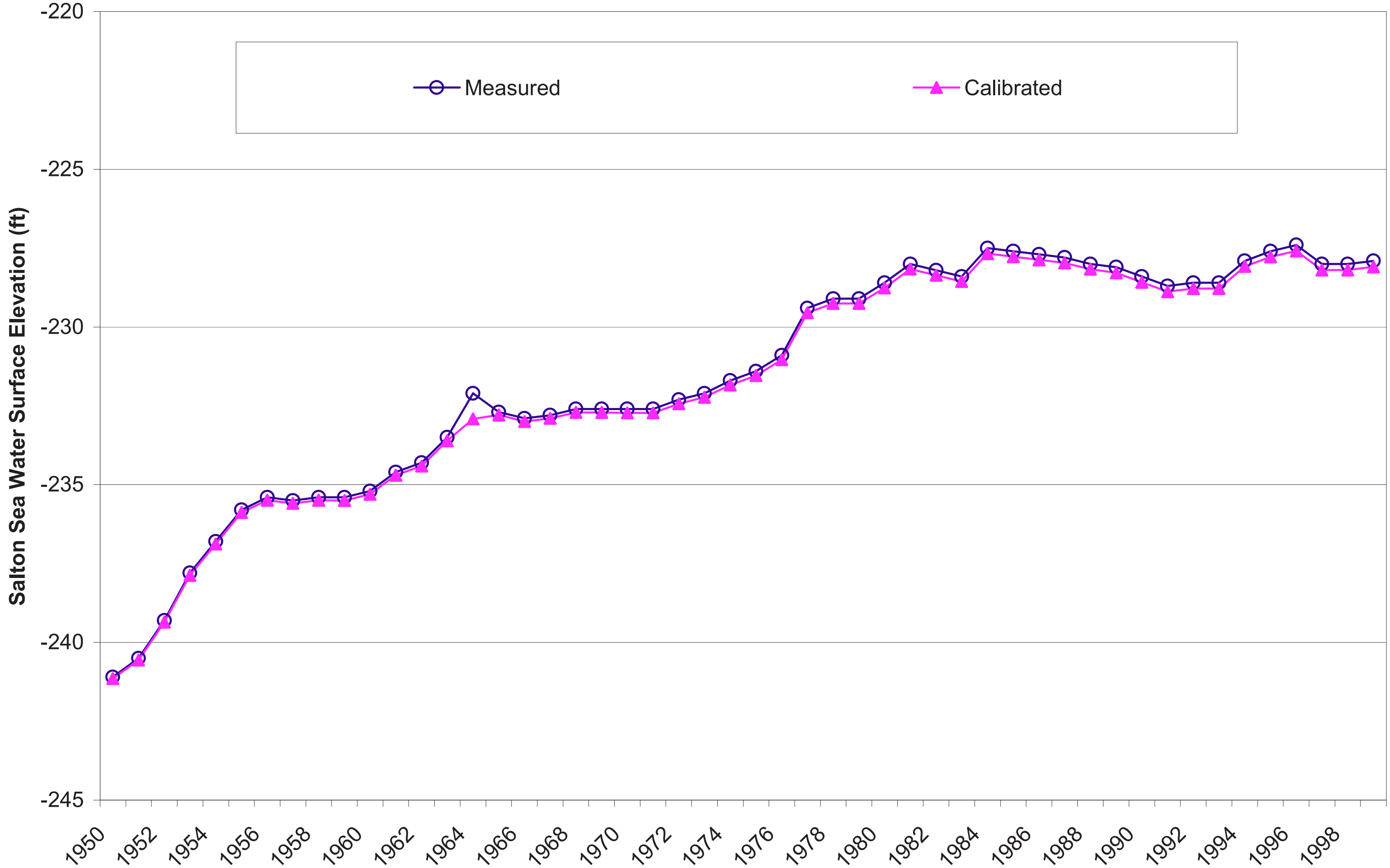

FIGURE H2-1-5
SIMULATED AND MEASURED SALTON SEA WATER SURFACE ELEVATIONS, 1950 TO 2002

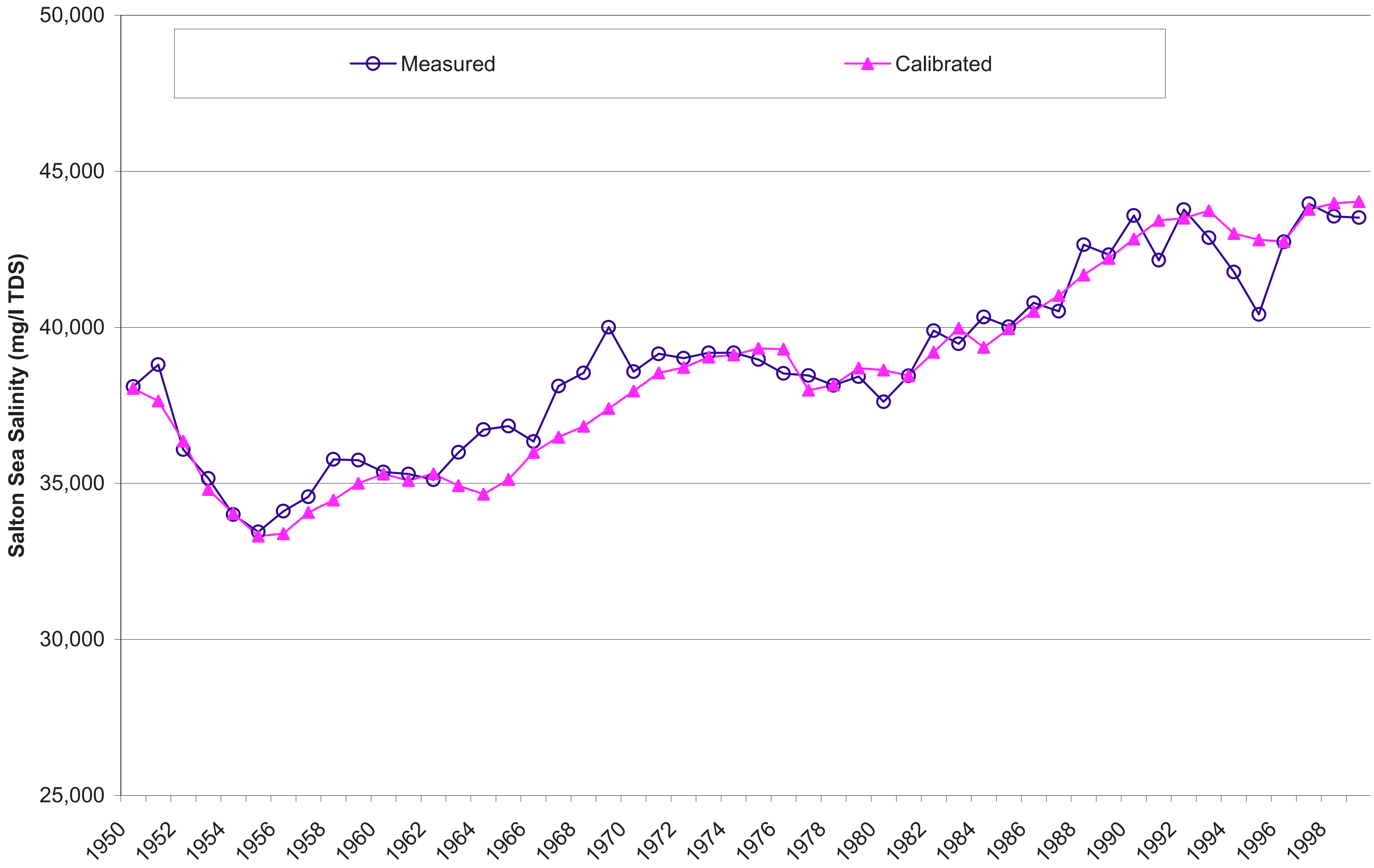

FIGURE H2-1-6
SIMULATED AND MEASURED SALTON SEA SALINITY, 1950 TO 2002

The result of a Monte Carlo, or stochastic, analysis is a distribution of the possible values of a particular simulated response. Descriptive statistics can be generated from the multiple simulation results and the effects of input uncertainty on system response can be analyzed. An abbreviated summary of the Monte Carlo analysis technique is provided by the U.S. Environmental Protection Agency (1997).

The importance of incorporating uncertainty in the analysis of future conditions at the Salton Sea and the input distributions have been previously described in the main body of this appendix. The modeling analysis utilized 1,000 random samplings of the input distributions to generate 1,000 different 72-year traces of possible future inflows, salt loads, and evaporation rates. Correlations in input data, such as rainfall, evaporation, and IID drain flows, were retained in the future projections. The SALSA model was operated in the stochastic mode to simulate the conditions of the Salton Sea for each of the possible input traces. Selected results such as water surface elevation, salinity, and Exposed Playa area are retained from each simulation and descriptive statistics are generated for end of year values based on the results of all simulations. The result is a timeline of the system response to a range of future conditions. No specific trace should be considered a prediction of future conditions, but the suite of model results and associated range of future outcomes is valuable for long range planning at the Salton Sea. The stochastic analysis was prepared for both the No Action Alternative-CEQA Conditions and the No Action Alternative-Variability Conditions.

Time Period for Analysis

Time period of analysis for all projected level simulations is January 2006 through December 2077 (2078 conditions). This period was selected to be consistent with the planning horizon of the PEIR and makes use of the most recent available data on Salton Sea conditions.

Initial Conditions

Initial conditions for the SALSA model are the Salton Sea elevation and salinity for December 31, 2005. The elevation data were obtained from USGS for January 1, 2006 and is recorded at -229 feet mean sea level (msl). The data presented as Existing Conditions in the PEIR represents the 2005 water surface elevation of -228 feet msl. The salinity of the Salton Sea was obtained from the average of surface and bottom total dissolved solids measurements made by Reclamation (Holdren, 2005) at three locations on the Salton Sea on September 27, 2005. The average salinity from these measurements is 46,550 mg/L. These data are believed to be the best available to describe Salton Sea conditions around December 31, 2005.

Inflow and Salt Load Assumptions

The inflow and salt load assumptions used in the SALSA model are consistent with those described in detail in Appendix H-2.

Bathymetry Methods

Bathymetric data was provided by Reclamation based on a 1995 survey of the Salton Sea. The bathymetry for all of the PEIR alternatives was derived from these data. The bathymetry provided by Reclamation was in a TIN format (triangulated irregular network) generated from a collection of bathymetric survey points. The points were collected along paths of the boat survey. The distance between points along the path line is small, however, the distance between paths is about 2,000 feet, as shown in Figure H2-1-7. This data are considered appropriate for planning level analysis of restoration alternatives, but limits the precision of elevation, area, and capacity relationships, particularly at low elevation conditions.

The TIN data were converted to a 800x800ft resolution raster file which represented the sea bathymetry equally well. Figure H2-1-8 shows a comparison between sea volume as a function of elevation for both the TIN and raster bathymetric representations. Elevation-area-capacity curves for different Barrier locations and different open water configurations could be more easily generated with the raster version of the bathymetry than from the TIN. This flexibility was important during the early phases of the PEIR as Barrier locations were investigated.

Tables relating the elevation, water surface area, and capacity were developed from the survey data for all alternatives. Figures H2-1-9 and H2-1-10 show the range of capacities for the different configurations in comparison with the existing Salton Sea. The Concentric Lakes and Concentric Rings are considered to be relatively shallow lakes. Alternative 7 includes a proposed IID reservoir. The storage in this reservoir was not simulated in the SALSA model, but the Brine Sink bathymetry was modified to account for this feature. Figures H2-1-11 and H2-1-12 show the range of water surface area for each of the alternatives. Table H2-1-1 shows the key water volume, surface area, and hydraulic depth for the managed areas of various alternatives. These values were rounded up for use in the PEIR analysis.

Table H2-1-1
Water Volume, Surface Area, and Hydraulic Depth for Managed Water Areas

Alternative	Elevation (ft msl)	Volume (acre-feet)	Hydraulic Depth (Volume/Area as feet)	Saline Habitat Complex Water Surface Area (acres)
Existing Conditions	-229	7,161,000	31.2	—
No Action Alternative-Variability Conditions	-230	6,930,000	30.4	—
Alternative 1 – Saline Habitat Complex I	Various	156,000	6.0	26,000
Alternative 2– Saline Habitat Complex II	Various	324,000	6.0	54,000
Alternative 3 – Concentric Rings	-230 First Ring -240 Second Ring	315,000	5.1	—
Alternative 4 – Concentric Lakes	-230 First Lake -240 Second Lake -255 Third Lake -265 Fourth Lake	308,000	3.3	—
Alternative 5 – North Sea	-230	2,080,000	33.7	33,500
Alternative 6 – North Sea Combined	-230	1,820,000	24.6	21,500
Alternative 7 – Combined North and South Lakes	-230	3,300,000	29.2	6,000
Alternative 8 – South Sea Combined	-230	1,470,000	17.7	13,500

Notes:
Only includes Marine Sea, Concentric Rings, Concentric Lakes, and Saline Habitat Complex.
Existing Conditions was not managed for elevation control. December 2005 elevation shown for Existing Conditions.
Values for No Action Alternative based on elevation of -230 feet msl. Elevation would continue to decrease under No Action Alternative.

FIGURE H2-1-7
ELEVATION DATA POINTS COLLECTED IN THE RECLAMATION 1995 BATHYMETRIC SURVEY

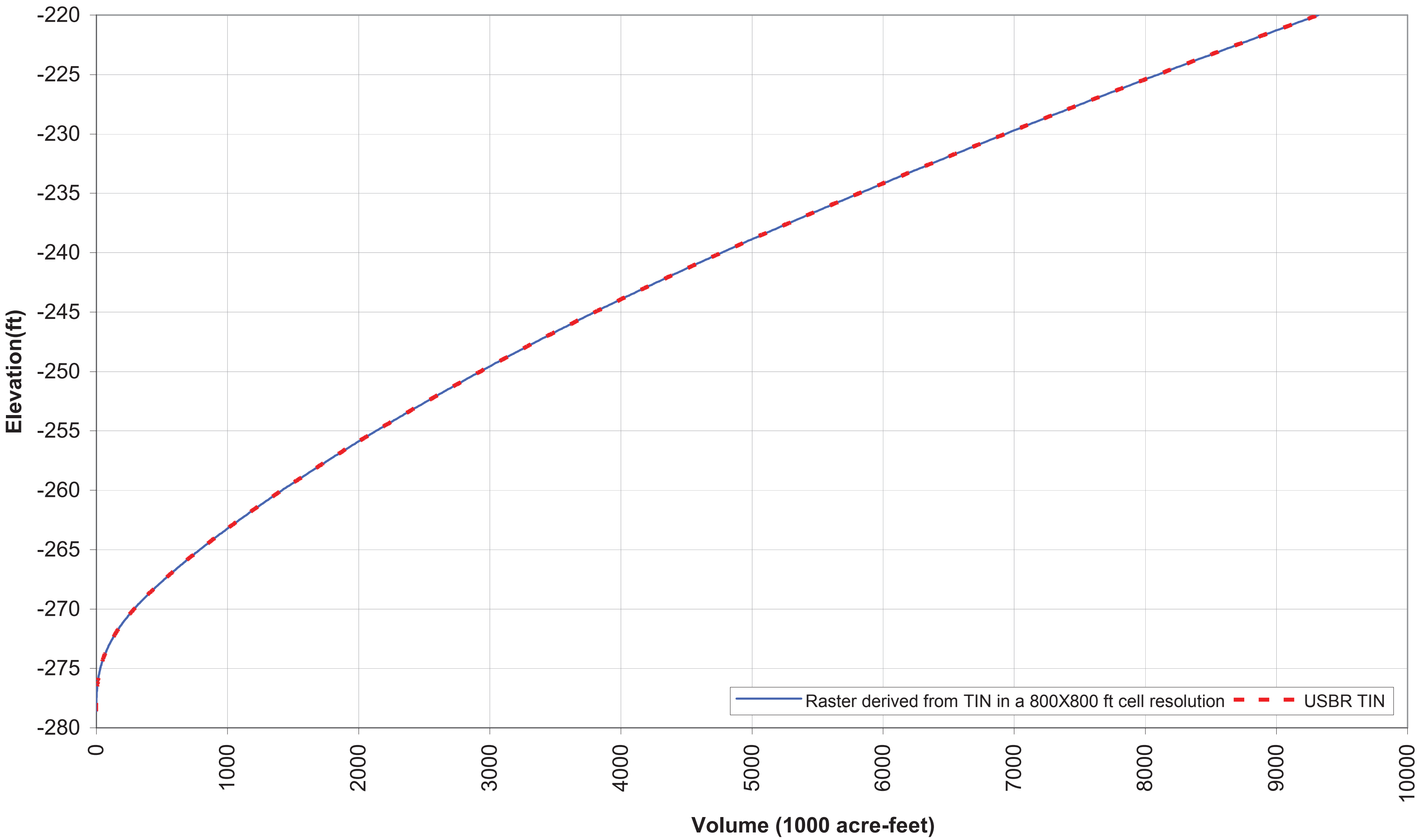

FIGURE H2-1-8
COMPARISON OF TIN AND RASTER REPRESENTATIONS OF THE SALTON SEA BATHYMETRY

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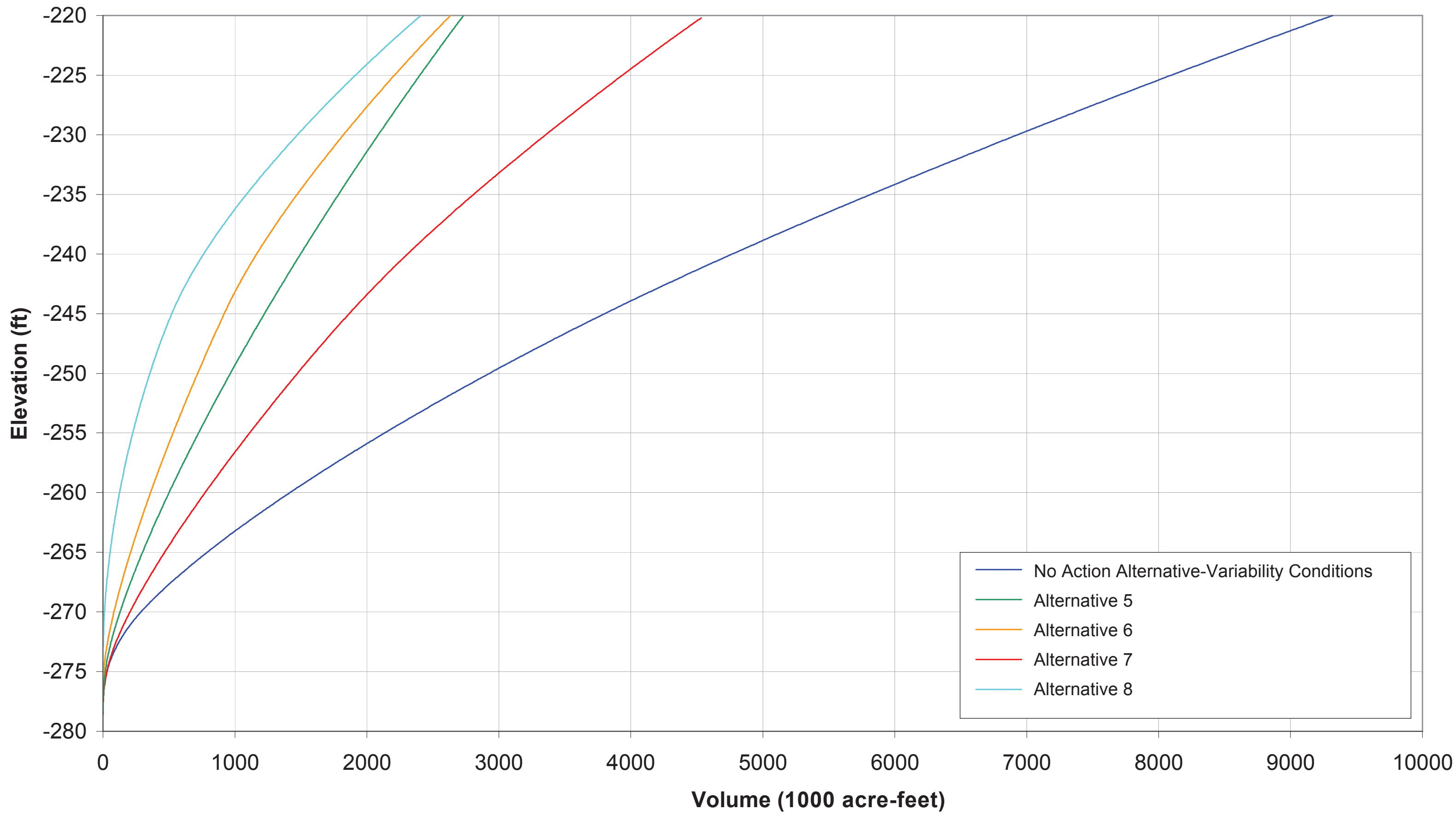
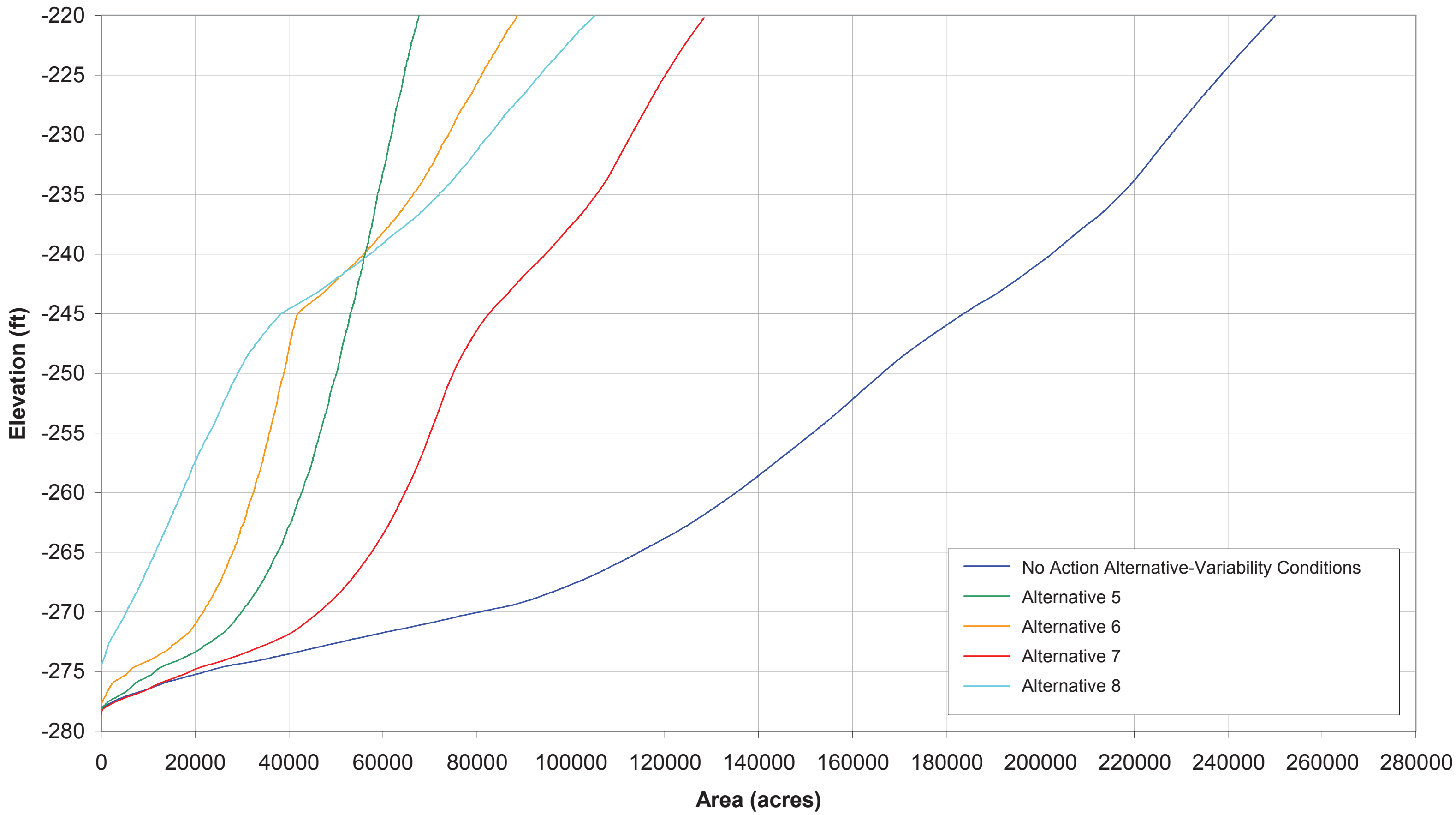


FIGURE H2-1-9
MARINE SEA ELEVATION-CAPACITY RELATIONSHIP



Note: The discontinuity on the combined alternative curves is due to the barrier

FIGURE H2-1-10
MARINE SEA ELEVATION-CAPACITY RELATIONSHIP

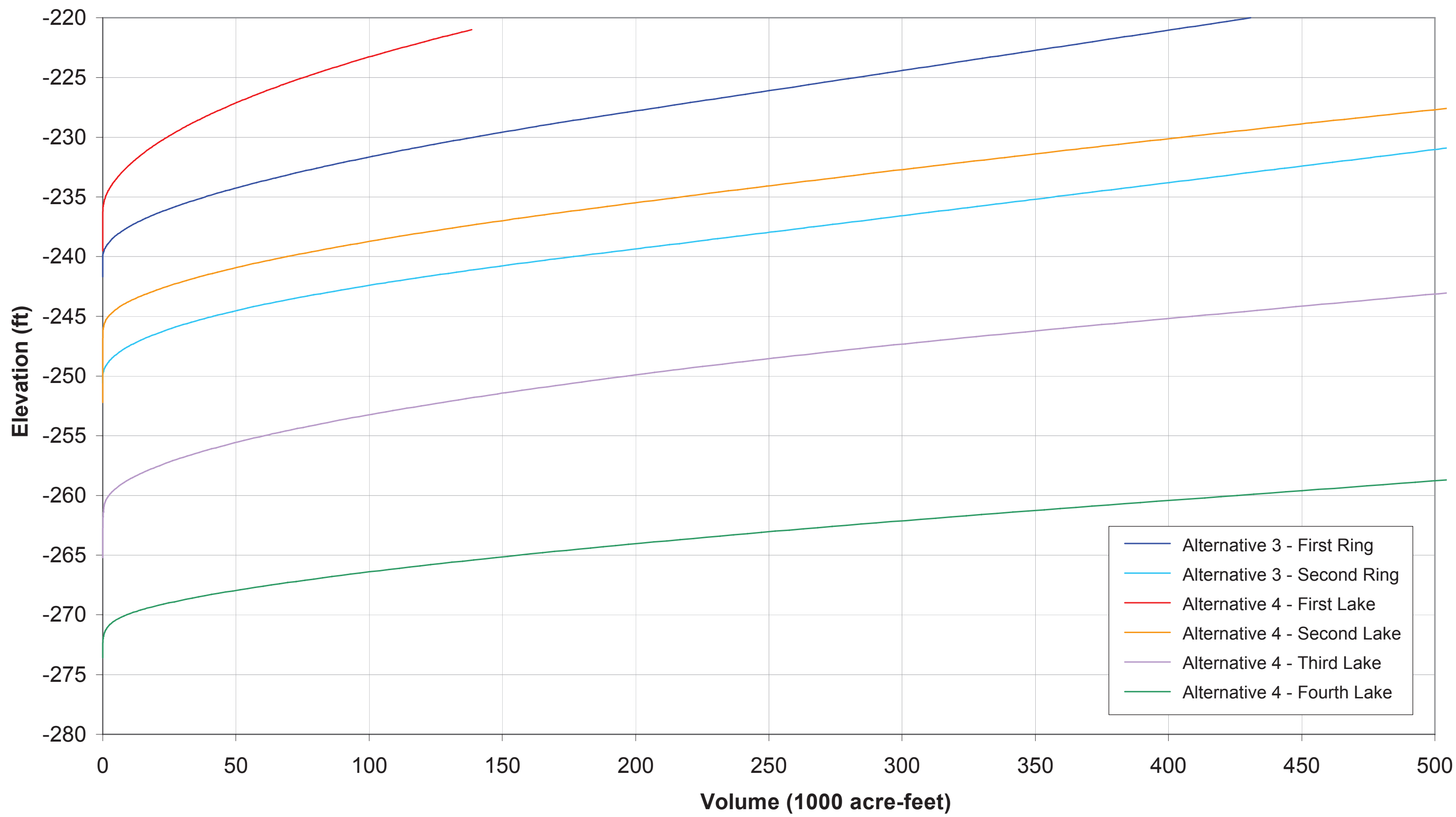


FIGURE H2-1-11
CONCENTRIC RINGS AND CONCENTRIC LAKES
ELEVATION-CAPACITY RELATIONSHIP

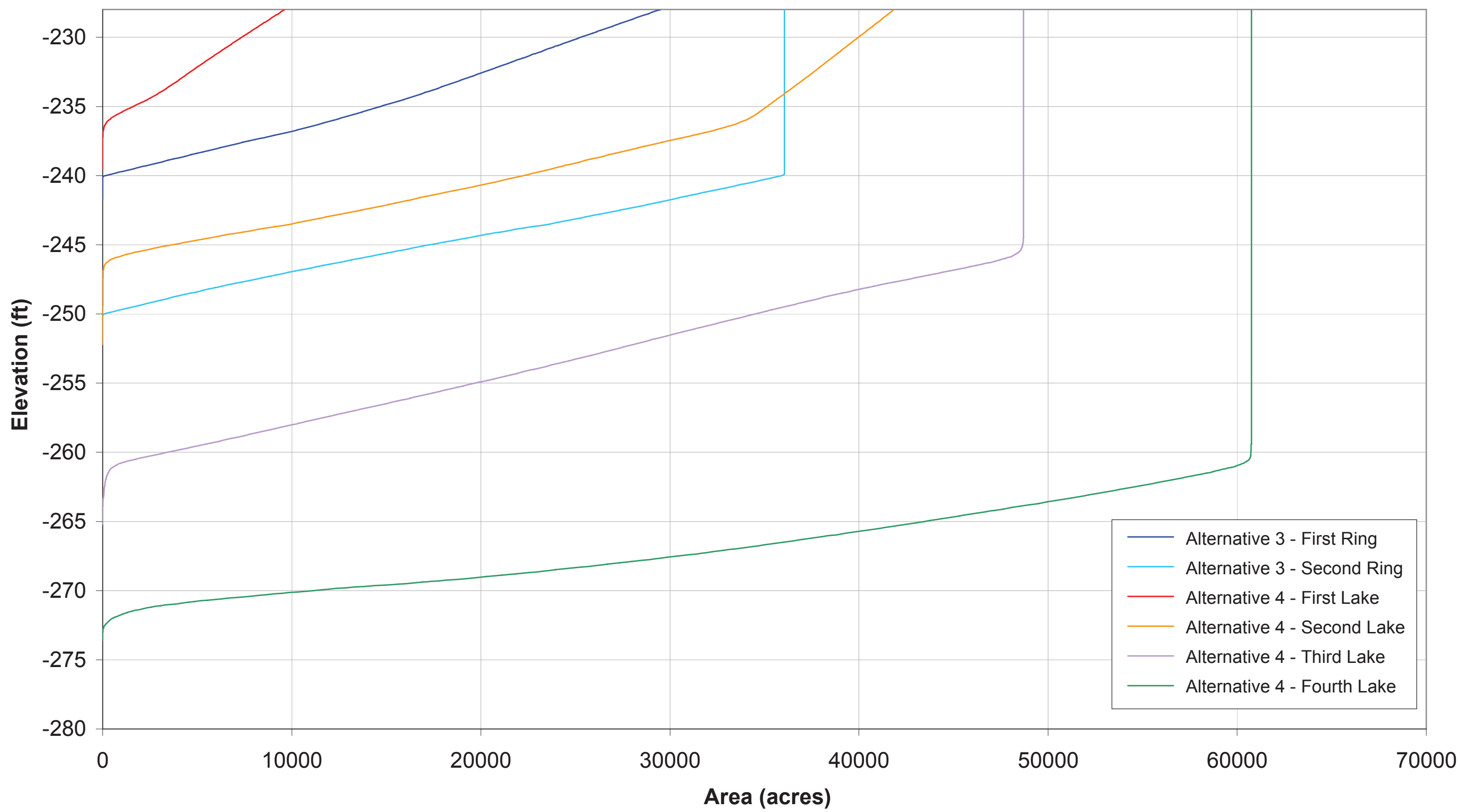


FIGURE H2-1-12
CONCENTRIC RINGS AND CONCENTRIC LAKES
ELEVATION-WATER SURFACE AREA RELATIONSHIP

Model Networks Applied

During the initial SALSA model development for the alternatives, different model networks were developed for each configuration. With multiple networks, the first phases of alternatives with Barriers were analyzed with one model network (without barrier) and the second phases with a second model network (with barrier). As phasing criteria became more established, and also more complex, it became more efficient to develop the ability to simulate all alternatives under a common network. With a single network, the transition between one lake and multiple lakes could be automated and criteria for phasing could be based on the dynamic state of the system (ie. elevation of sea or brine). The common model network is shown in Figure H2-1-1.

The common model network allows for up to five reservoirs, Marine Seas, Concentric Lakes, Concentric Rings, Brine Sinks, Saline Habitat Complex areas, Air Quality Management areas, and other open water areas. Depending on the specific alternative, not all of the elements of the network will be operable. Inactive elements are specified in a user-controlled lookup table. Each alternative has its own set of input tables that dictate the phasing and the implementation of reservoirs connections and demands. The simulation of a specific alternative usually begins a single water body configuration and implements a second water body or other components through time as a function of either a fixed schedule or elevation criteria. The active elements of the model network for specific alternatives are shown in later sections.

Use and Interpretation of Model Results

The SALSA model generates results on a monthly time step for flow and concentration in each arc and storage node of the network. Furthermore, when operated in stochastic mode, the model generates 1,000 possible outcomes on a monthly time step over the 72-year simulation period. Selected output results are retained from each simulation and descriptive statistics are generated from the entire suite of model results. While monthly model results are available, and statistics can be generated, the results of model simulations are presented here as end of year values in order to facilitate understanding of the long term trends as opposed to short term fluctuations.

Graphs presented in this attachment show the median (50th percentile), inter-quartile range (25th to 75th percentile range), and the 5th and 95th percentile range of outcomes from 2006 through 2077 for each alternative, as shown in Figure H2-1-13. The water surface elevation and salinity of the Marine Sea, Concentric Lakes, Concentric Rings, or Brine Sink for each alternative is represented by a separate graph. The Exposed Playa area and Saline Habitat Complex wetted acreage are shown in a similar manner.

It should be noted that a time series based on a statistic such as the 75th percentile is not the result of any one hydrologic trace. Rather the 75th percentile water surface elevation (or other output parameter) for a specific year is the elevation for which 75 percent of the outcomes yielded an elevation that was less. In addition to the statistics, the results of four individual traces are presented on the graphs for Variability conditions. These results are shown to provide additional information to the reader regarding the variability across years and varying levels of long term average annual inflows. Trace 295 represents one possible future with long term average inflows of about 700,000 acre-feet/year. It should be noted that several traces with similar long term average inflows could have been selected and would follow slightly different trajectories and inter-annual variation. Similarly, traces 550, 420, and 821 are shown to indicate possible outcomes at 600,000, 800,000, and 900,000 acre-feet/year average inflows. No specific trace should be considered a prediction of future conditions, but the suite of model results and associated range of future outcomes is valuable for long range planning. For the purposes of comparison of alternatives in the PEIR, the results for a trace (No. 37) roughly matches the mean of all results and were used to develop quantitative descriptions of the alternatives and served as the basis of the impact assessments in the PEIR.

Model and Data Limitations

While the SALSA model is a significant improvement over previous modeling tools for the Salton Sea, there are several limitations associated with the model and/or associated data. The SALSA model is a monthly time step hydrologic, or water allocation, model. As such, it does not incorporate hydraulic calculations for features such as pumps, spillways, or control structures. The model is primarily concerned with the water and salt balance of individual components. The SALSA model assumes complete mixing of water at confluences of channels and within storage nodes over the model time step. Salinity gradients in the existing Salton Sea do not suggest that this is a significant limitation. However, it may be a greater limitation for configurations such as the Concentric Rings and Concentric Lakes where longitudinal mixing may be of greater importance or in the brine sink where freshwater may 'float' on top of the heavier brines for some time. Another significant limitation is with regard to the availability of data and scientific information related to salt precipitation and re-dissolution. A constant value of 1,500,000 tons of salt/year has been assumed to continue to precipitate out of the water column of the Brine Sink. In addition, the ratio of saline water evaporation to freshwater evaporation is computed for salinities up to 350,000 mg/L. The evaporation-salinity relationships are not likely to be valid for salinities beyond this value. The geochemical processes at the Salton Sea are complex and are beyond the scope of this modeling effort.

While the model could incorporate a dynamic interaction term with the Coachella Valley groundwater basin, the ability to characterize this interaction is limited by understanding to the hydraulic connection between these units.

In the dynamic simulation with the SALSA model for alternatives with Barriers, the Brine Sink bathymetry is limited to the area up to the nearest Barrier. This limits the ability of an installed Barrier to be submerged by a rising Brine Sink. This limitation was only a concern for the Fourth Lake of Alternative 4 and only for a few hydrologic scenarios.

SALSA MODELING FOR ALTERNATIVES

Assumptions for Common Components

Some component such as Air Quality Management and Saline Habitat Complex are common to several alternatives. Table H2-1-2 outlines the key assumptions associated affecting the water or salt balance with these common components.

Table H2-1-2
Assumptions for Air Quality Management and Saline Habitat Complex Components

Component	Water Assumptions
Air Quality Management	Only 50 percent of Exposed Playa below -228 ft msl constitutes an irrigated water demand for management. Assumed 1 acre-foot/year/acre water demand with 10 percent drain return flow. Assumed initial infrastructure would allow water delivery by 2009, if required. Delivered water salinity was targeted at a maximum of 7,500 mg/L, but was not strictly enforced.
Saline Habitat Complex	Includes water and land areas specific to each alternative. Water demand computed as evaporation rate times water surface area. Assumed 16 percent flow-through rate. 'Early Start Habitat' of 2,000 acres (1,500 water surface acres) assumed to be in place by 2009. Assumed each new phase of complex could be constructed within two years of meeting elevation criteria. The area of the Shoreline Waterway was incorporated into this component for modeling. Delivered water salinity was targeted at 20,000 mg/L, but was not strictly enforced in the model.

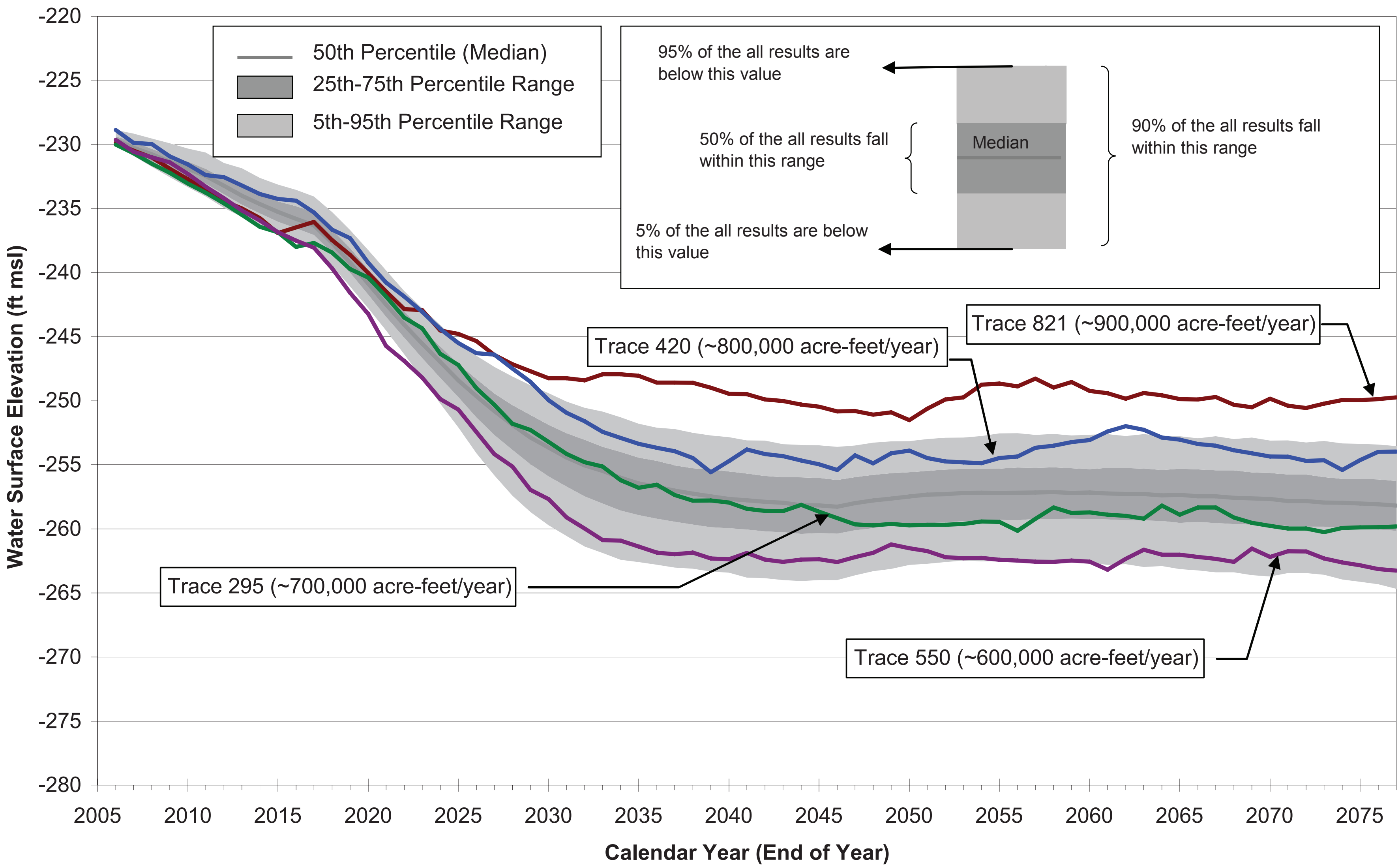


FIGURE H2-1-13
EXAMPLE OF STOCHASTIC RESULTS

Description of Alternatives

The No Action Alternative and Alternatives 1 through 8 are described below.

No Action Alternative

The No Action Alternative is based upon the No Action Alternative-Variability Conditions. Air quality management is included in the No Action Alternative and is assumed to begin no earlier the 2009. Exposed Playa below -235 ft msl is assumed to require a water demand for Air Quality Management. The model network that is active for this alternative is shown in Figure H2-2-1 and consists of single SEA component and a single AQM component. The capability for Saline Habitat Complex implementation was left in place, but not used in this simulation.

Alternative 1 – Saline Habitat Complex I

Alternative 1 includes up to 38,000 acres of Saline Habitat Complex, Air Quality Management for the Exposed Playa, and associated facilities. The Brine Sink elevation would decline, and salinity would increase more rapidly than under the No Action Alternative because water would be provided for the Saline Habitat Complex and Air Quality Management areas. The SALSA model network is the same as that shown in Figure H2-2-1 with active connections to convey water to the Saline Habitat Complex.

Alternative 2 – Saline Habitat Complex II

Alternative 2 includes up to 75,000 acres of Saline Habitat Complex, Air Quality Management for the Exposed Playa, and associated facilities. Air Quality Management would be similar to that described in Alternative 1. The highest course of the Saline Habitat Complex in Alternative 2 is also called a Shoreline Waterway that is used to mix inflows with saline water from other components. The Shoreline Waterway also is used to distribute water to Saline Habitat Complex cells and provided connectivity for desert pupfish.

Alternative 3 – Concentric Rings

Alternative 3 includes two concentric Perimeter Dikes to form two concentric rings. The First Ring was managed in the model for -230 feet msl and 20,000 mg/L salinity. The Second Ring was managed for -240 feet msl and 35,000 mg/L. Air Quality Management would be similar to that described in Alternative 1. The Perimeter Dikes were assumed to be completed as early as 2016, but required the Brine Sink elevation to drop to -235 and -245 feet msl, respectively, before construction. Saline Habitat Complex is not included in this alternative. The SALSA model network that was applied for this alternative is shown in Figure H2-2-3.

Alternative 4 – Concentric Lakes

Alternative 4 would include four concentric lakes formed by Berms. The First Lake was managed in the model with an elevation of -230 feet msl and salinity of 20,000 mg/L. The Second Lake was managed in the model with an elevation of -240 feet msl and salinity of 35,000 mg/L. The Third Lake was managed in the model with an elevation of -255 feet msl and salinity of 45,000 mg/L. The Fourth Lake was managed in the model with an elevation of -265 feet msl and salinity of 60,000 mg/L.

Under the wetter hydrologic conditions of the Monte Carlo simulation, the Third and Fourth lakes would not be constructed due to a high Brine Sink elevations. The Berms for the First Lake were assumed to be completed as early as 2016. Saline Habitat Complex is not included in this alternative. The SALSA model network that was applied for this alternative is shown in Figure H2-2-4.

Alternative 5 – North Sea

Alternative 5 includes up to 45,500 acres of Saline Habitat Complex, Air Quality Management for the Exposed Playa, Marine Sea, Brine Sink, and associated facilities. Air Quality Management would be similar to that described in Alternative 1. The highest course of the Saline Habitat Complex includes a Shoreline Waterway, as described above under Alternative 2.

The Barrier was assumed to be completed in 2022, and the Marine Sea was managed in the model for elevation at -230 feet msl and salinity at 35,000 mg/L. The SALSA model network that was applied to Alternative 5 is shown in Figure H2-2-2.

Alternative 6 – North Sea Combined

Alternative 6 includes up to 29,000 acres of Saline Habitat Complex, Air Quality Management for the Exposed Playa, Marine Sea (including a Marine Sea Mixing Zone), Brine Sink, and associated facilities. Air Quality Management would be similar to that described in Alternative 1. The highest course of the Saline Habitat Complex includes a Shoreline Waterway, as described above under Alternative 2.

The Barrier and Perimeter Dikes were assumed to be completed in 2022, and the Marine Sea (including the Marine Sea Mixing Zone) was managed in the model for elevation at -230 feet msl and salinity at 35,000 mg/L. The SALSA model network that was applied to Alternative 5 is shown in Figure H2-2-2.

Alternative 7 – Combined North and South Lakes

Alternative 6 includes up to 29,000 acres of Saline Habitat Complex, Air Quality Management for the Exposed Playa, Recreational Saltwater Lake (including the Recreational Estuarine Lake), Brine Sink, and associated facilities. The layout and description of this alternative was provided by the Salton Sea Authority, as described in Appendix I. The Barrier was assumed to be completed in 2022. The Recreational Saltwater Lake was managed in the model for an elevation at -230 feet msl and salinity of 35,000 mg/L. This alternative includes up to 12,000 acres of Saline Habitat Complex with 50 percent of this area is assumed to be water surface. The Saline Habitat Complex does not include a Shoreline Waterway.

An IID reservoir would be located within the footprint of the Brine Sink. Treatment wetlands and a phosphorus treatment plant are proposed along the Alamo River. A water treatment plant to treat water from the Recreational Saltwater Lake would be located along the eastern shoreline. Losses from the treatment processes were assumed to be 21,000 acre-feet/year and 25,000 acre-feet/year for the phosphorus and the Recreational Saltwater Lake treatment plants, respectively. The treatment wetlands located along the Alamo River were simulated as a freshwater habitat in the SALSA model with 4,000 acres of water surface. No water demand was assumed for the Air Quality Management of the Exposed Playa. The SALSA model network that was applied for this alternative is shown in Figure H2-2-2.

Alternative 8 – South Sea Combined

Alternative 8 includes up to 16,500 acres of Saline Habitat Complex, Air Quality Management for the Exposed Playa, Marine Sea, Brine Sink, and associated facilities. Air Quality Management would be similar to that described in Alternative 1. The highest course of the Saline Habitat Complex includes a Shoreline Waterway, as described above under Alternative 2.

The Barrier and Perimeter Dikes were assumed to be completed in 2022, and the Marine Sea was managed in the model for elevation at -230 feet msl and salinity at 35,000 mg/L. The SALSA model network that was applied to Alternative 8 is shown in Figure H2-2-2.

Results of the Model Simulations

The results of the model simulations included in the figures in Attachment 1 of Appendix H-2 are based upon the ***50th percentile*** (median) water surface elevation and salinity modeling results for the Marine Sea, Concentric Rings, Concentric Lakes, and Brine Sink, as well as the area of Exposed Playa for each alternative, assuming inflows as described under the No Action Alternative-Variability Conditions. More detailed modeling results, including the full stochastic results for each alternative based upon inflows as described in the No Action Alternative-CEQA Conditions and the No Action Alternative-Variability Conditions are included in Attachment 2 of Appendix H-2.

The modeling results used in the impact analyses for the PEIR were based on a simulation of the SALSA model in the deterministic mode for a single hydrologic trace that approximated the mean inflow over the 2018 to 2078 period. The SALSA model simulation results based on this trace were available prior to the development of the stochastic simulation mode for the SALSA model. This hydrologic trace contains variability that is unique to this particular trace, while the 50^{th} percentile results are the ‘middle’ values resulting from one thousand model simulations. The percentile results are therefore smoother over time and do not exhibit the inter-annual variations, but rather, they display the central tendency of the long term results. The impact assessments could have been performed on either the single hydrologic trace model result or on a statistic (50^{th}, 75^{th}, and 90^{th} percentile values) generated from multiple hydrologic trace results. Specific values from the model simulation results for the impact assessment traces, as well as the 50^{th} percentile, are also included in Attachment 2 of Appendix H-2.

No Action Alternative

The No Action Alternative-Variability Conditions does not include management of water surface elevation or salinity in the Salton Sea. The water surface elevation would decline gradually in the initial years of the model simulation as the reduced inflows would be somewhat offset by the provision of ‘c(2) mitigation water,’ as shown in Figure H2-1-14. After the cessation of ‘mitigation water’, the water surface elevation would decline rapidly until a new quasi-equilibrium would be attained when evaporation would be in approximate balance with inflows. The median water surface elevation would be -258 feet msl by 2045 and remains relatively stable after this time. The minor increase in water surface elevation after 2046 is attributed to a small increase in inflows of 50,000 acre-feet/year under the IID Water Conservation and Transfer Project. During this latter period, the inter-quartile range (25th to 75th percentile range) is about +/- 2.5 feet about the median, suggesting a range of possible outcomes. The Exposed Playa would increase as shown in Figure H2-1-15.

As the water surface elevation declines, the salinity continues to increase. The SALSA modeling suggests that the median salinity would be greater than 200,000 mg/L by 2045, as shown in Figure H2-1-16. During the last period, the inter-quartile range is about +/- 50,000 mg/L about the median, suggesting a wide range of possible outcomes.

Alternative 1 – Saline Habitat Complex I

Similar to the No Action Alternative, Alternative 1 does not include management of water surface elevation or salinity in the Brine Sink. Saline Habitat Complex cells would be constructed and managed to provide stable water surface elevations and salinities. The amount of acreage that could be developed for Saline Habitat Complex cells would be determined by land availability between the declining Brine Sink elevation and the shoreline. Under the No Action Alternative-Variability Conditions inflow assumptions, it is expected that 38,000 acres of Saline Habitat Complex would be constructed, in phases, as shown in Figure H2-2-6d.

The Brine Sink water surface elevation would decline gradually in the first years as in the No Action Alternative, as shown in Figure H2-1-14. After the cessation of ‘mitigation water’ and the diversion of water to Saline Habitat Complex cells, the Brine Sink water surface elevation would decline rapidly to a median water surface elevation of -262 feet msl by 2045 and remain relatively stable after this time. As the water surface elevation declines, the salinity would increase. The SALSA modeling suggests that the median salinity would be greater than 300,000 mg/L by 2045 and greater than 350,000 mg/L by 2078, as shown in Figure H2-1-16. The ability to predict the salinity in the highly-saline brine with the SALSA model is limited due to the possibility of significant salt precipitation beyond that already included in the model. The dynamics of geochemical processes are not included in the SALSA model. The amount of Exposed Playa is shown in Figure H2-1-15.

Alternative 2 – Saline Habitat Complex II

Similar to the No Action Alternative, Alternative 2 does not include management of water surface elevation or salinity in the Brine Sink. Saline Habitat Complex cells would be constructed and managed to provide stable water surface elevations and salinities. Under the No Action Alternative-Variability Conditions inflow assumptions, it is expected that 75,000 acres of Saline Habitat Complex would be constructed, in phases, as shown in Figure H2-2-7d.

The Brine Sink water surface elevation would decline gradually in the first years as in the No Action Alternative, as shown in Figure H2-1-14. The Brine Sink water surface elevation would decline to a median water surface elevation of -269 feet msl by 2045. As the water surface elevation declines, the salinity would increase. The SALSA modeling suggests that the median salinity would be greater than 350,000 mg/L by 2045, as shown in Figure H2-1-16. The amount of Exposed Playa is shown in Figure H2-1-15.

Alternative 3 – Concentric Rings

In Alternative 2, the first Perimeter Dike was assumed to be completed as early as 2016, but the water surface elevation was required to decline to -235 feet msl before full operations. The First Ring could stabilize at an elevation of -230 feet msl by 2016 and the Second Ring could stabilize at -240 feet msl by 2019, as shown in Figure H2-1-17. Since the volume of these rings is relatively small compared to the inflows, the salinity attained the targets in the model of 20,000 mg/L in the First Ring and 35,000 mg/L in the Second Ring occurs within the same year that elevation control was achieved, as shown in Figure H2-1-18.

The Brine Sink water surface elevation would decline gradually at first and stabilize by 2045, as shown in Figure H2-1-14. The SALSA modeling suggests that the median salinity would be greater than 350,000 mg/L by 2045, as shown in Figure H2-1-16. The area of Exposed Playa is shown in Figure H2-1-15.

Alternative 4 – Concentric Lakes

In Alternative 4, the first Berm was assumed to be completed as early as 2016, but the water surface elevation was required to decline to -235 feet msl before full operations. The First Lake could stabilize at the an elevation of -230 feet msl by 2016, the Second Lake could stabilize at -240 feet msl by 2019, the Third Lake could stabilize at -255 feet msl by 2026, and the Fourth Lake could stabilize at -260 feet msl by 2040, as shown in Figure H2-1-17. Under many hydrologic scenarios, however, the Fourth Lake would not be constructed due to the high elevation of the Brine Sink and the possibility of inundation. The salinity targets could be achieved within one year of achieving the elevation targets, as shown in Figure H2-1-18.

The Brine Sink water surface elevation would decline gradually at first and attain a median water surface elevation of -274 feet msl by year 2045, as shown in Figure H2-1-14. The SALSA modeling suggests that the median TDS concentration would be greater than 350,000 mg/L by 2045, as shown in Figure H2-1-16. The area of Exposed Playa is shown in Figure H2-1-15.

FIGURE H2-1-14 BRINE SINK WATER SURFACE ELEVATION UNDER 50TH PERCENTILE WITH NO ACTION ALTERNATIVES-VARIABILITY CONDITIONS INFLOWS

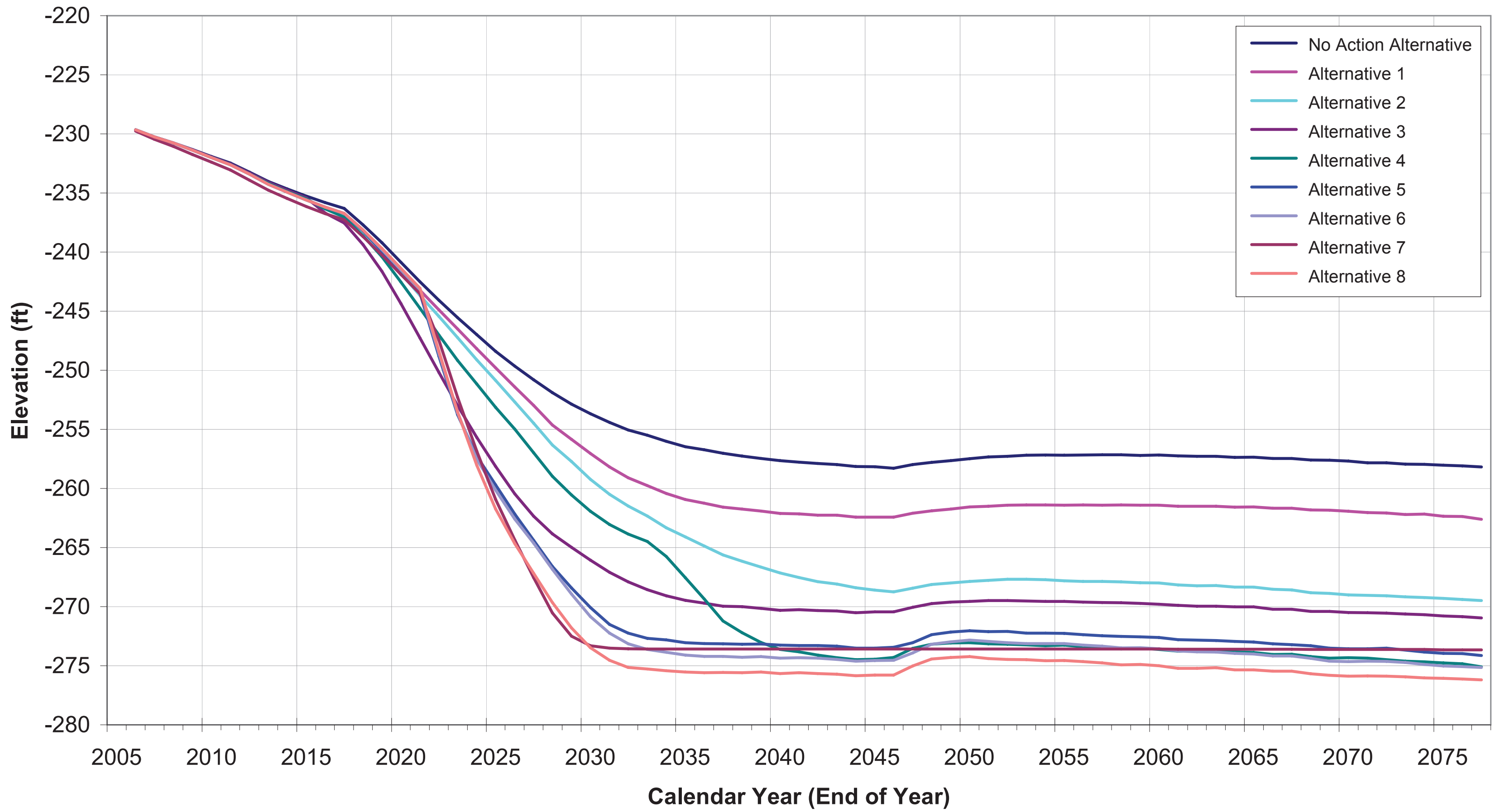


FIGURE H2-1-14
BRINE SINK WATER SURFACE ELEVATION UNDER THE 50TH PERCENTILE WITH NO ACTION ALTERNATIVE-VARIABILITY CONDITIONS INFLOWS

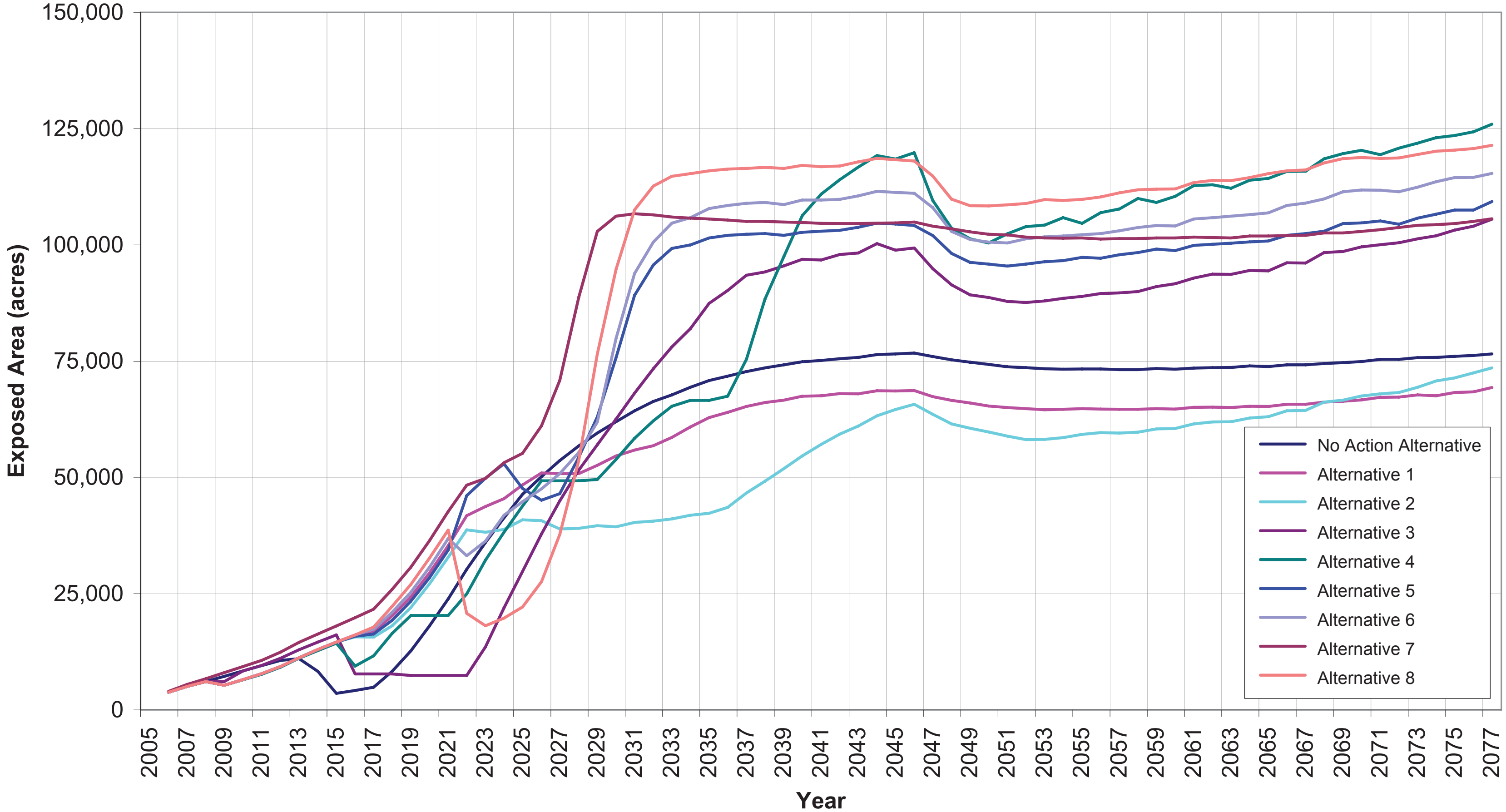


FIGURE H2-1-15
EXPOSED PLAYA UNDER THE 50TH PERCENTILE WITH NO ACTION ALTERNATIVE-VARIABILITY CONDITIONS INFLOWS

ES112005003SAC figure_H2-1-15.ai 08-15-06 tdaus

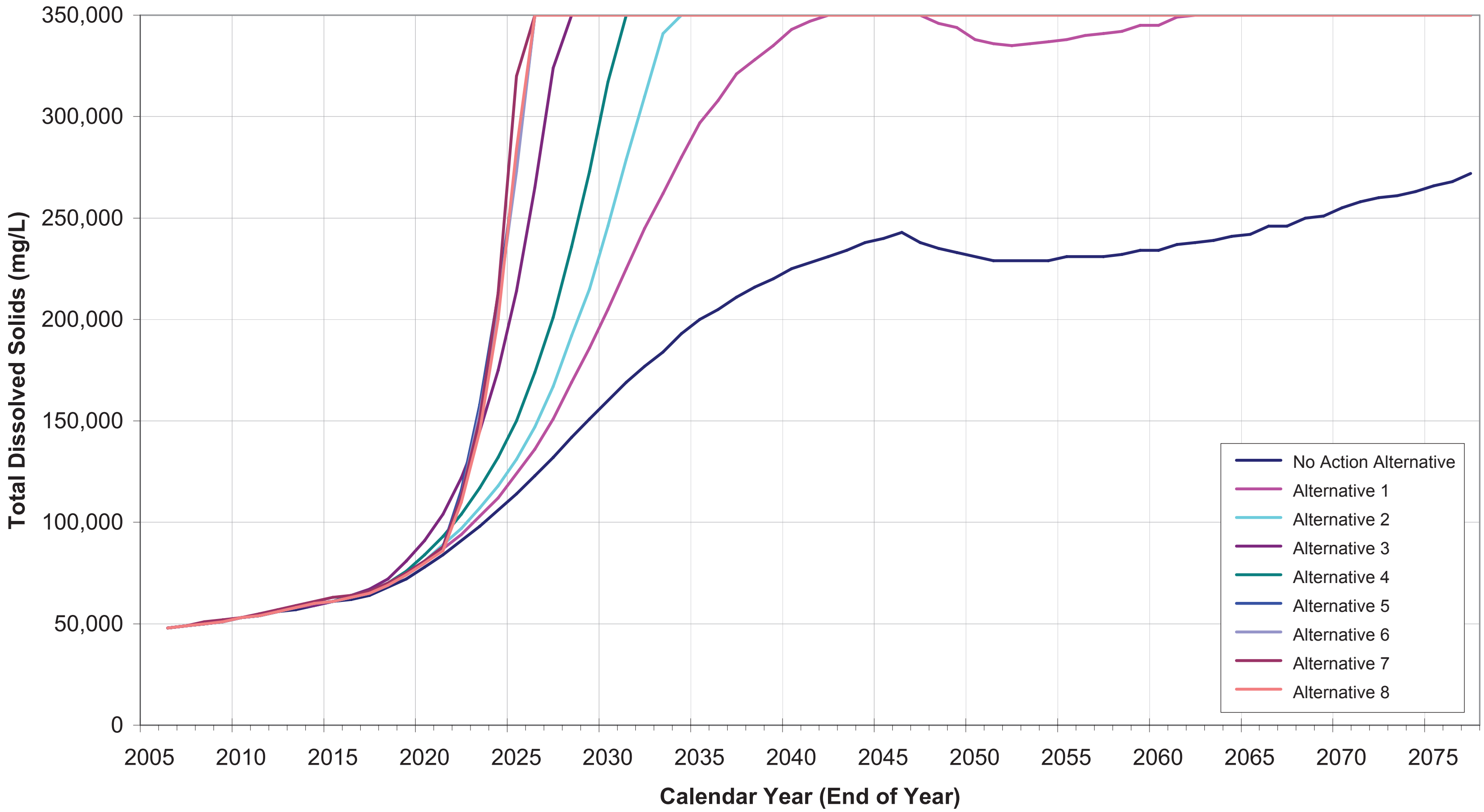


FIGURE H2-1-16
BRINE SINK SALINITY UNDER THE 50TH PERCENTILE WITH NO ACTION ALTERNATIVE-VARIABILITY CONDITIONS INFLOWS

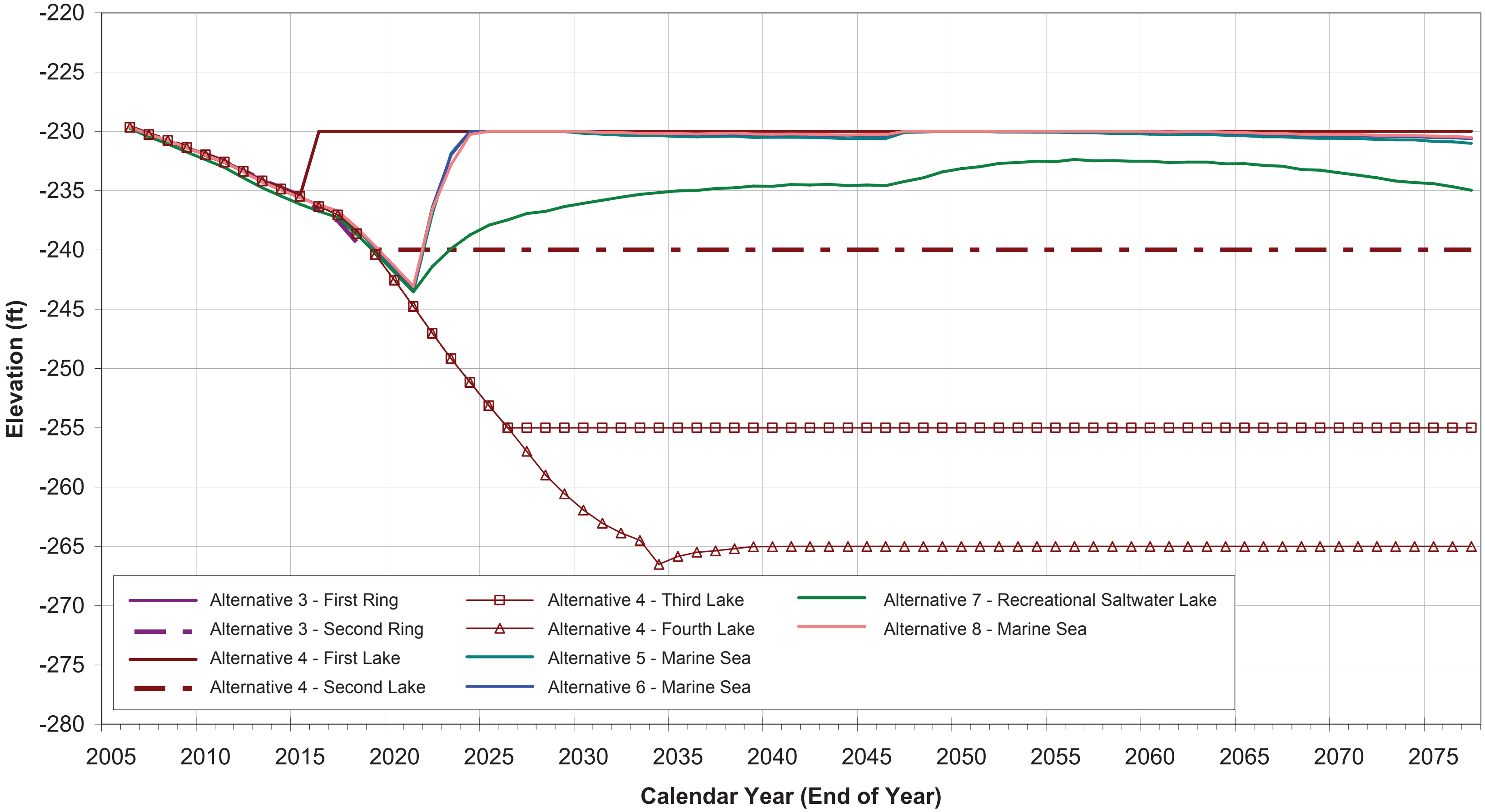


FIGURE H2-1-17
WATER SURFACE ELEVATION UNDER THE 50^{TH} PERCENTILE WITH NO ACTION ALTERNATIVE-VARIABILITY CONDITIONS INFLOWS

ES112005003SAC figure_H2-1-17.ai 08-15-06 tdaus

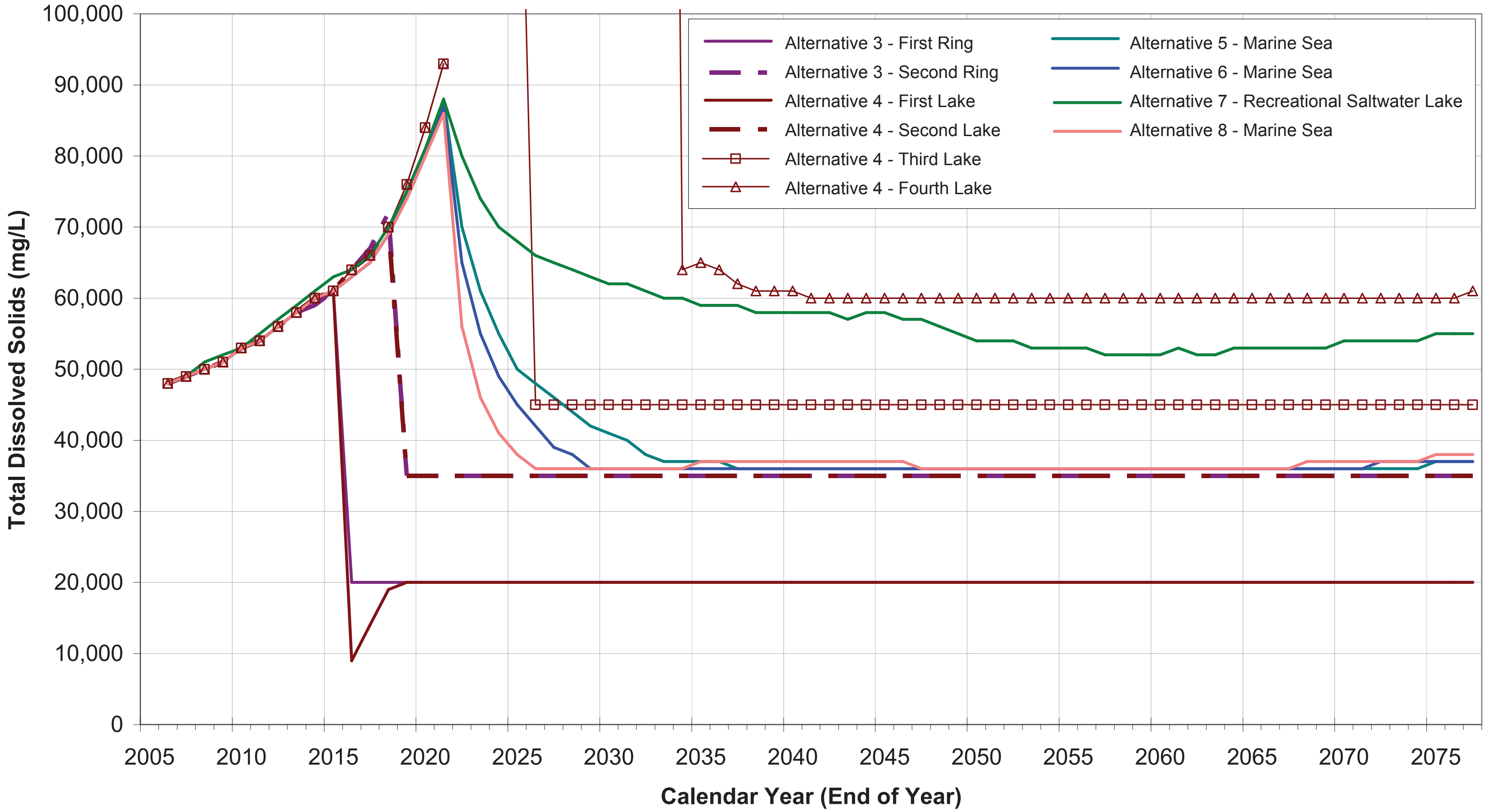


FIGURE H2-1-18
SALINITY UNDER THE 50TH PERCENTILE WITH NO ACTION ALTERNATIVE-VARIABILITY CONDITIONS INFLOWS

ES112005003SAC figure_H2-1-18.ai 08-15-06 tdaus

Alternative 5 – North Sea

In Alternative 5, the Barrier was assumed to be completed by 2022. The Marine Sea water surface elevation was simulated to increase from -244 feet msl at 2021 to the target elevation of -230 feet msl by 2024, as shown in Figure H2-1-17. The salinity would decline from 88,000 mg/L in 2021 to the target level of 35,000 mg/L by 2032, as shown in Figure H2-1-18.

The Brine Sink water surface elevation would decline gradually at first and attain a median water surface elevation of -274 feet msl by year 2045, as shown in Figure H2-1-14. The SALSA modeling suggests that the median TDS concentration would be greater than 350,000 mg/L by 2045, as shown in Figure H2-1-16. The area of Exposed Playa is shown in Figure H2-1-15.

Up to 45,500 acres of Saline Habitat Complex cells would be constructed, as shown in Figure H2-2-10f.

Alternative 6 – North Sea Combined

In Alternative 6, the Barrier was assumed to be completed by 2022. The Marine Sea water surface elevation was simulated to increase from -243 feet msl at 2021 to the target elevation of -230 feet msl by 2024, as shown in Figure H2-1-17. The salinity would decline from 87,000 mg/L in 2021 to the target level of 35,000 mg/L by 2028, as shown in Figure H2-1-18.

The Brine Sink water surface elevation would decline gradually at first and attain a median water surface elevation of -275 feet msl by year 2045, as shown in Figure H2-1-14. The SALSA modeling suggests that the median TDS concentration would be greater than 350,000 mg/L by 2045, as shown in Figure H2-1-16. The area of Exposed Playa is shown in Figure H2-1-15.

Up to 29,000 acres of Saline Habitat Complex cells would be constructed, as shown in Figure H2-2-11f.

Alternative 7 – Combined North and South Lakes

In Alternative 7, the Barrier was assumed to be completed by 2022. The Recreational Saltwater Lake water surface elevation was simulated to increase from -244 feet msl at 2021 to -235 feet msl by 2030, as shown in Figure H2-1-17, however the target elevation of -230 feet msl could not be maintained under the modeling assumptions that assumed inflows as under the No Action Alternative-Variability Conditions. As with elevation, the target salinity of 35,000 mg/L also could not be maintained under these modeling assumptions. The salinity would decrease from 88,000 mg/L in 2021 to a minimum of 55,000 mg/L by 2050, as shown in Figure H2-1-18.

The Brine Sink water surface elevation would decline gradually at first and attain a median water surface elevation of -274 feet msl by year 2045, as shown in Figure H2-1-14. The SALSA modeling suggests that the median TDS concentration would be greater than 350,000 mg/L by 2045, as shown in Figure H2-1-16. The area of Exposed Playa is shown in Figure H2-1-15. The model did no simulate use of the brine for Air Quality Management or the introduction of water treatment plant sludge into the Brine Sink.

Up to 12,000 acres of Saline Habitat Complex cells would be constructed along the eastern shoreline, as shown in Figure H2-2-12f. This alternative assumed that the additional Saline Habitat Complex cells would be constructed by displacement berms near the confluence of the Whitewater River and the Recreational Saltwater Lake.

Alternative 8 – South Sea Combined

In Alternative 8, the Barrier was assumed to be completed by 2022. The Marine Sea water surface elevation was simulated to increase from -243 feet msl at 2021 to the target elevation of -230 feet msl by 2024, as shown in Figure H2-1-17. The salinity would decline from 86,000 mg/L in 2021 to the target level of 35,000 mg/L by 2027, as shown in Figure H2-1-18.

The Brine Sink water surface elevation would decline gradually at first and attain a median water surface elevation of -276 feet msl by year 2045, as shown in Figure H2-1-14. The SALSA modeling suggests that the median TDS concentration would be greater than 350,000 mg/L by 2045, as shown in Figure H2-1-16. The area of Exposed Playa is shown in Figure H2-1-15.

Up to 16,500 acres of Saline Habitat Complex cells would be constructed, as shown in Figure H2-2-13f.

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APPENDIX H-2, ATTACHMENT 2

SALSA Model Results

2006

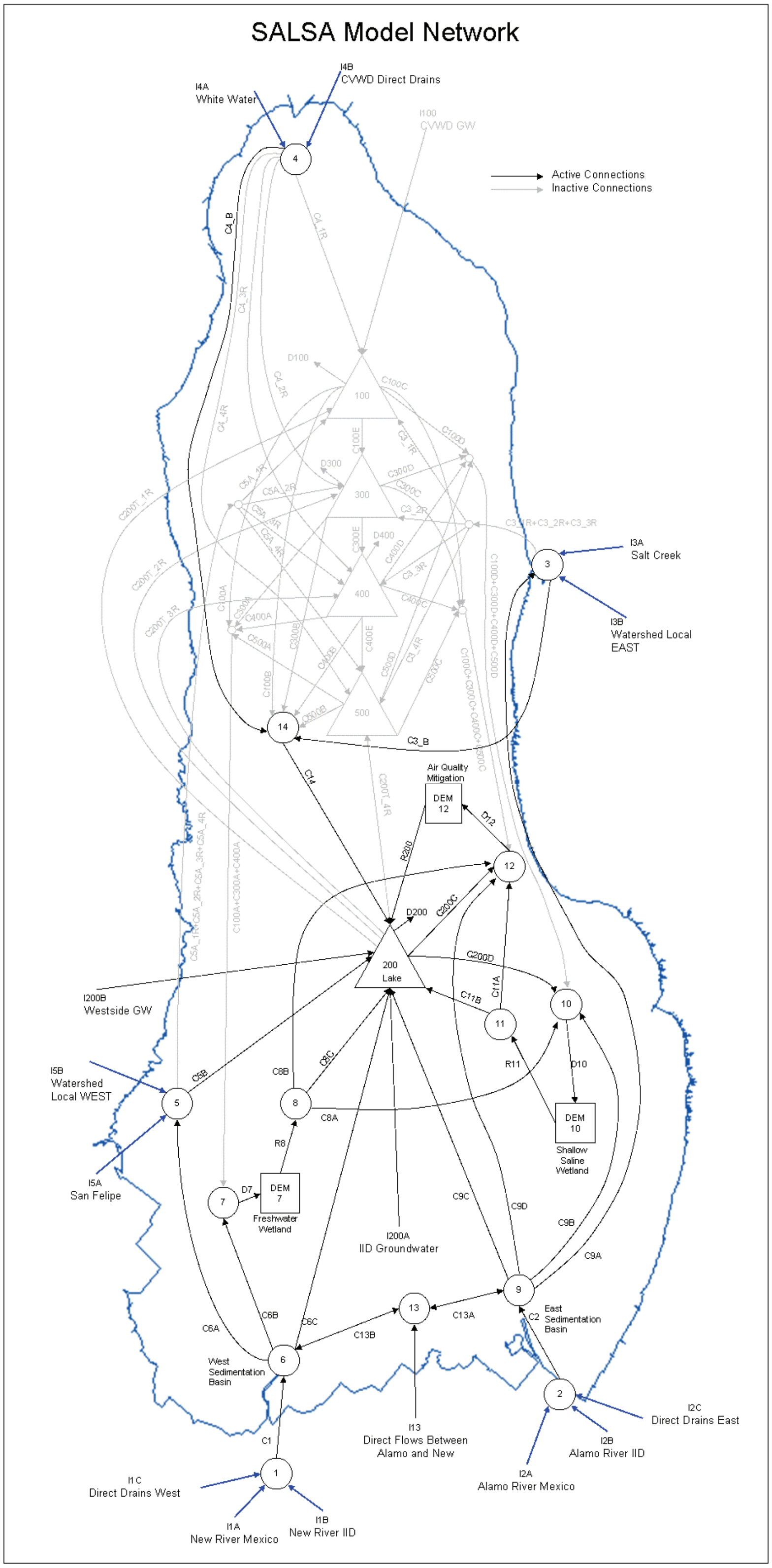


FIGURE H2-2-1
SALSA MODEL NETWORK APPLIED FOR NO ACTION, SALINE HABITAT COMPLEX I, AND SALINE HABITAT COMPLEX II ALTERNATIVES

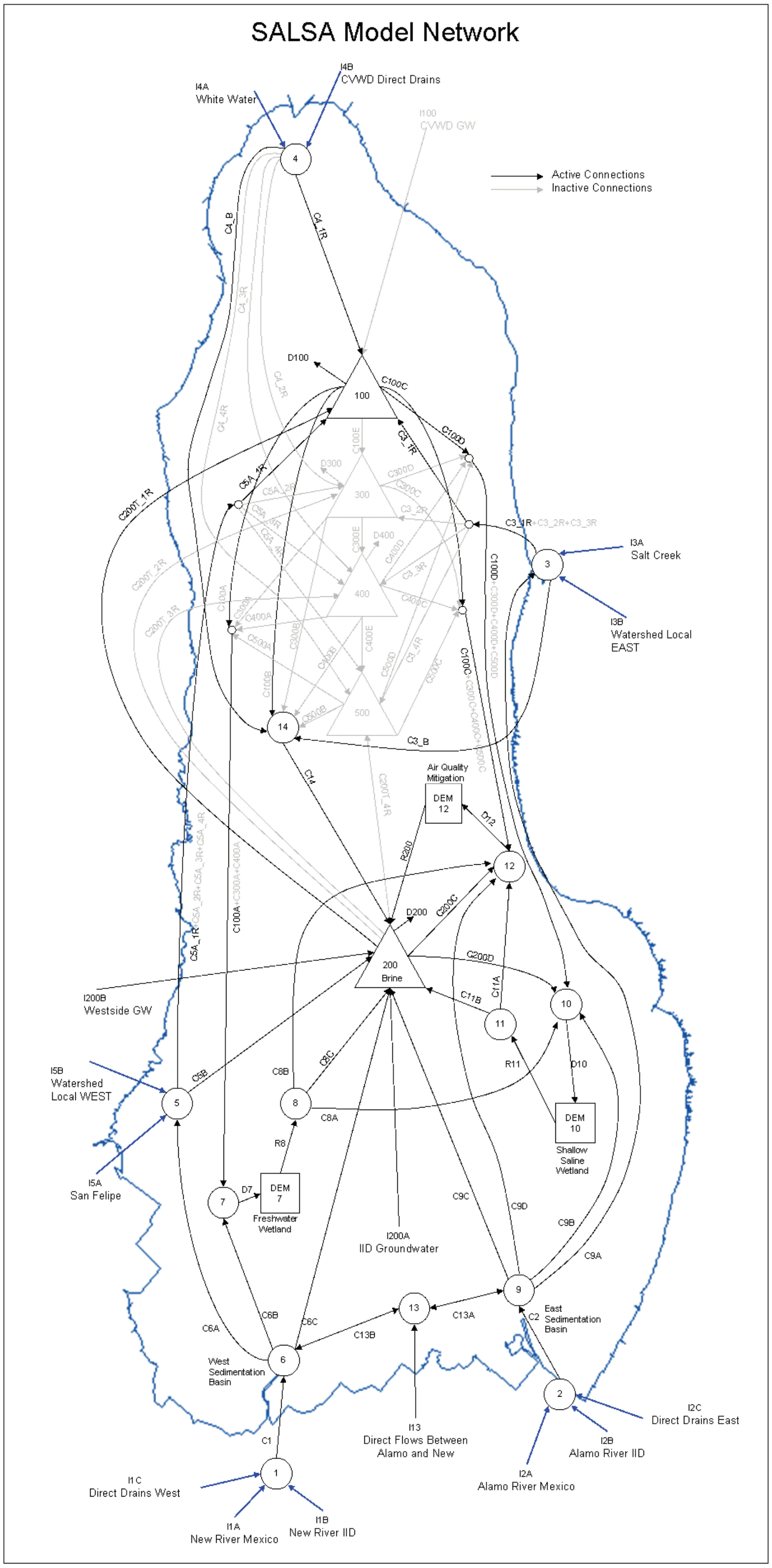


FIGURE H2-2-2
SALSA MODEL NETWORK APPLIED FOR NORTH SEA, NORTH SEA COMBINED, COMBINED NORTH AND SOUTH LAKES, AND SOUTH SEA COMBINED ALTERNATIVES

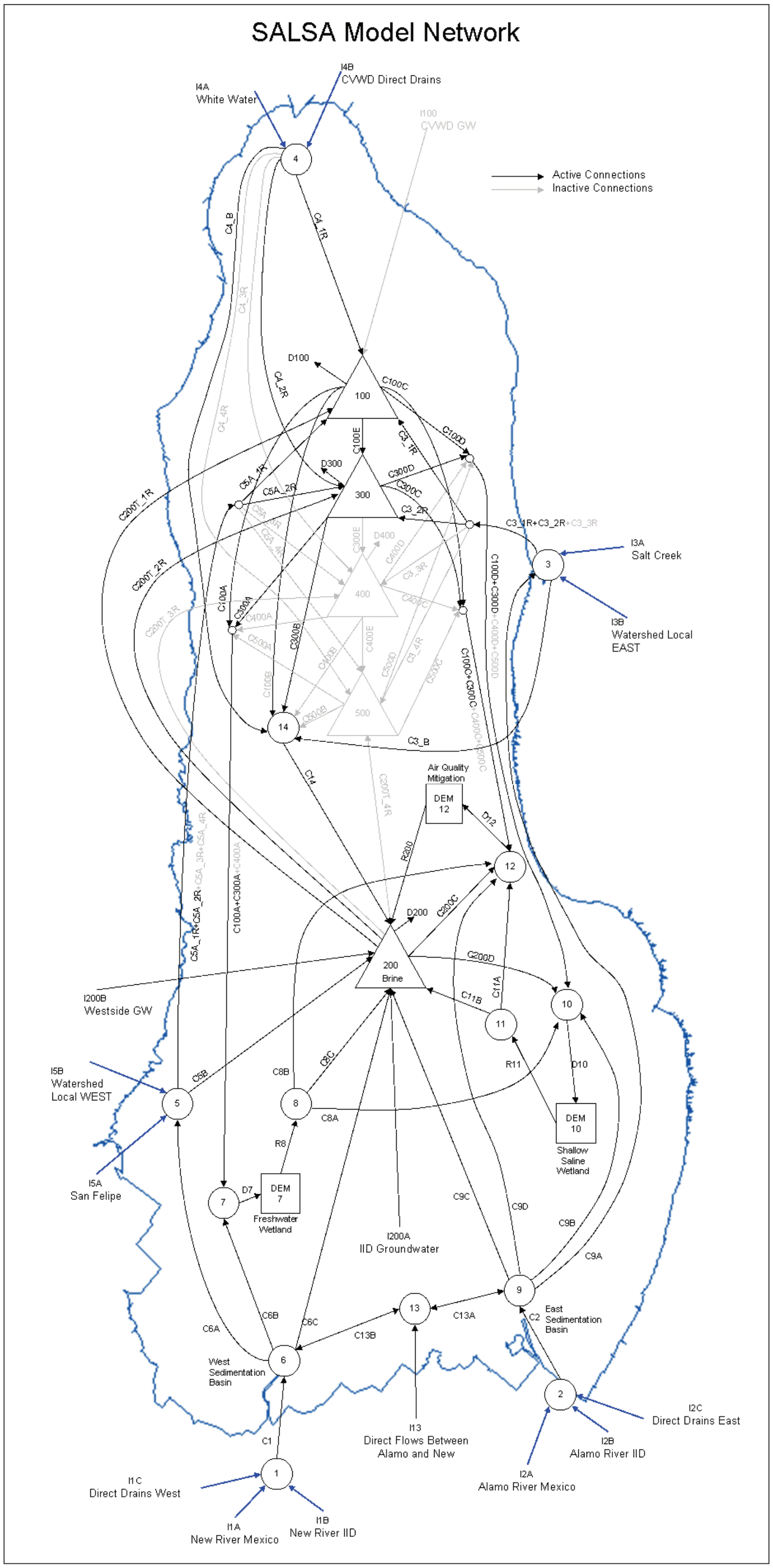


FIGURE H2-2-3
SALSA MODEL NETWORK APPLIED FOR CONCENTRIC RINGS ALTERNATIVE

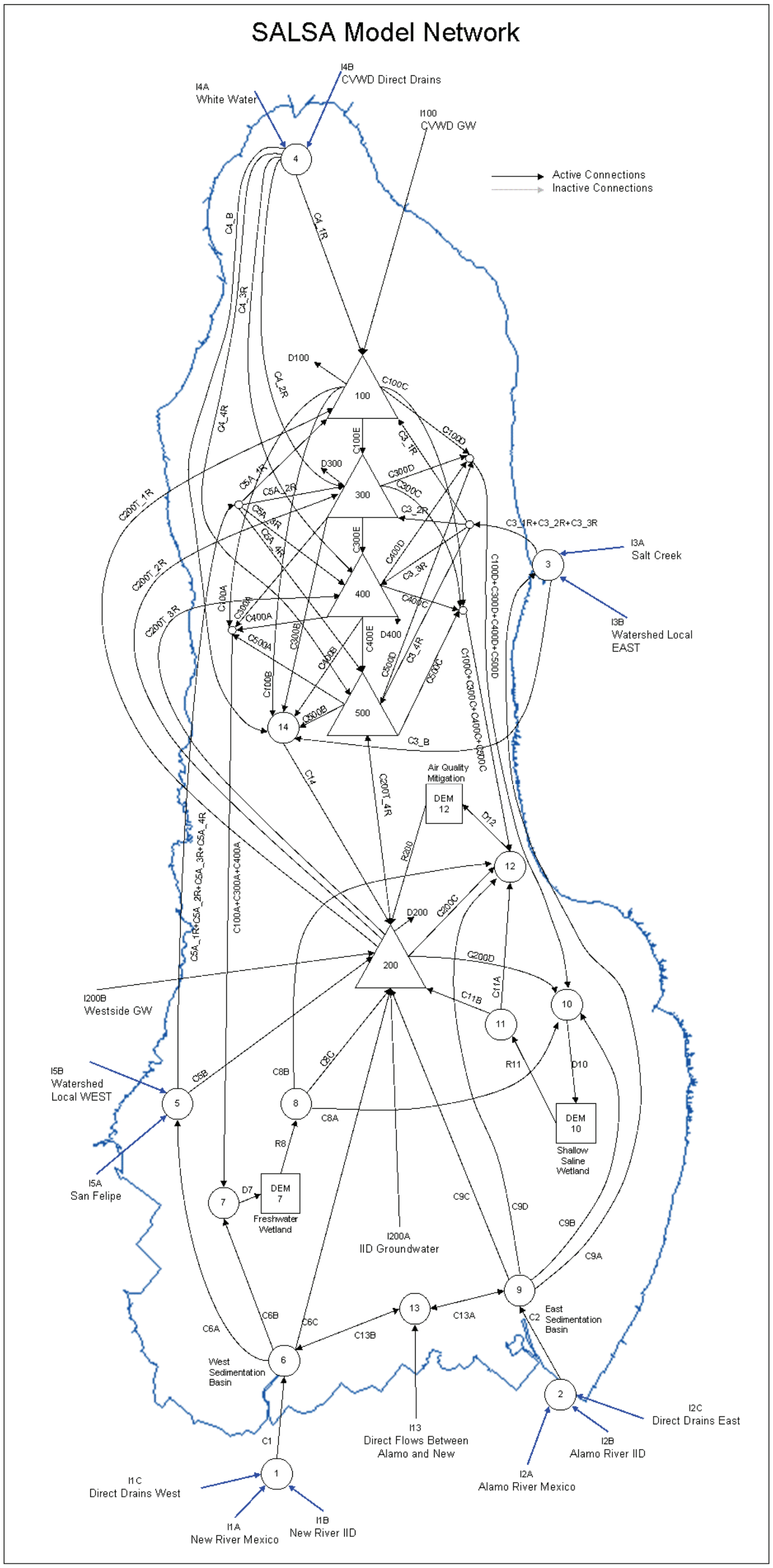


FIGURE H2-2-4
SALSA MODEL NETWORK APPLIED FOR CONCENTRIC LAKES ALTERNATIVE

SUMMARY TABLES FOR 50TH PERCENTILE SALSA MODELING RESULTS

Variability Conditions

Table H2-2-1
Simulated Marine Sea, Concentric Ring, or Concentric Ring End of Year Water Surface Elevation (ft above MSL) – 50th Percentile

Year	Conc Rings (1)	Conc Rings (2)	Conc Lakes (1)	Conc Lakes (2)	Conc Lakes (3)	Conc Lakes (4)	North Sea	North Sea Comb	Comb North and South	South Sea Comb
2006	-229.7	-229.7	-229.7	-229.7	-229.7	-229.7	-229.7	-229.7	-229.8	-229.7
2007	-230.3	-230.3	-230.3	-230.3	-230.3	-230.3	-230.3	-230.3	-230.5	-230.3
2008	-230.8	-230.8	-230.8	-230.8	-230.8	-230.8	-230.8	-230.8	-231.1	-230.8
2009	-231.4	-231.4	-231.4	-231.4	-231.4	-231.4	-231.4	-231.4	-231.7	-231.4
2010	-231.9	-231.9	-232.0	-232.0	-232.0	-232.0	-232.0	-232.0	-232.4	-232.0
2011	-232.5	-232.5	-232.6	-232.6	-232.6	-232.6	-232.6	-232.6	-233.0	-232.6
2012	-233.3	-233.3	-233.4	-233.4	-233.4	-233.4	-233.4	-233.4	-233.9	-233.4
2013	-234.1	-234.1	-234.2	-234.2	-234.2	-234.2	-234.2	-234.2	-234.8	-234.2
2014	-234.8	-234.8	-234.9	-234.9	-234.9	-234.9	-234.9	-234.9	-235.5	-234.9
2015	-235.4	-235.4	-235.5	-235.5	-235.5	-235.5	-235.6	-235.6	-236.1	-235.6
2016	-230.0	-236.7	-230.0	-236.4	-236.4	-236.4	-236.2	-236.2	-236.7	-236.2
2017	-230.0	-237.5	-230.0	-237.0	-237.0	-237.0	-236.7	-236.7	-237.3	-236.7
2018	-230.0	-239.4	-230.0	-238.6	-238.6	-238.6	-238.2	-238.1	-238.7	-238.1
2019	-230.0	-240.0	-230.0	-240.0	-240.4	-240.4	-239.9	-239.8	-240.3	-239.7
2020	-230.0	-240.0	-230.0	-240.0	-242.5	-242.5	-241.7	-241.5	-241.9	-241.4
2021	-230.0	-240.0	-230.0	-240.0	-244.8	-244.8	-243.5	-243.3	-243.5	-243.1
2022	-230.0	-240.0	-230.0	-240.0	-247.0	-247.0	-237.0	-236.4	-241.4	-236.6
2023	-230.0	-240.0	-230.0	-240.0	-249.2	-249.2	-231.9	-232.0	-239.9	-232.8
2024	-230.0	-240.0	-230.0	-240.0	-251.2	-251.2	-230.0	-230.0	-238.7	-230.2
2025	-230.0	-240.0	-230.0	-240.0	-253.1	-253.1	-230.0	-230.0	-237.9	-230.0
2026	-230.0	-240.0	-230.0	-240.0	-255.0	-255.0	-230.0	-230.0	-237.5	-230.0
2027	-230.0	-240.0	-230.0	-240.0	-255.0	-257.0	-230.0	-230.0	-236.9	-230.0
2028	-230.0	-240.0	-230.0	-240.0	-255.0	-259.0	-230.0	-230.0	-236.7	-230.0
2029	-230.0	-240.0	-230.0	-240.0	-255.0	-260.6	-230.0	-230.0	-236.4	-230.0
2030	-230.0	-240.0	-230.0	-240.0	-255.0	-261.9	-230.2	-230.0	-236.1	-230.0
2031	-230.0	-240.0	-230.0	-240.0	-255.0	-263.0	-230.2	-230.1	-235.8	-230.1
2032	-230.0	-240.0	-230.0	-240.0	-255.0	-263.9	-230.3	-230.1	-235.6	-230.1
2033	-230.0	-240.0	-230.0	-240.0	-255.0	-264.5	-230.4	-230.2	-235.3	-230.2
2034	-230.0	-240.0	-230.0	-240.0	-255.0	-266.5	-230.4	-230.2	-235.2	-230.2
2035	-230.0	-240.0	-230.0	-240.0	-255.0	-265.8	-230.4	-230.2	-235.0	-230.2
2036	-230.0	-240.0	-230.0	-240.0	-255.0	-265.5	-230.5	-230.3	-235.0	-230.2
2037	-230.0	-240.0	-230.0	-240.0	-255.0	-265.4	-230.5	-230.3	-234.8	-230.2
2038	-230.0	-240.0	-230.0	-240.0	-255.0	-265.2	-230.4	-230.2	-234.8	-230.1
2039	-230.0	-240.0	-230.0	-240.0	-255.0	-265.0	-230.5	-230.3	-234.6	-230.2
2040	-230.0	-240.0	-230.0	-240.0	-255.0	-265.0	-230.5	-230.3	-234.6	-230.2
2041	-230.0	-240.0	-230.0	-240.0	-255.0	-265.0	-230.5	-230.3	-234.5	-230.2
2042	-230.0	-240.0	-230.0	-240.0	-255.0	-265.0	-230.5	-230.3	-234.5	-230.2
2043	-230.0	-240.0	-230.0	-240.0	-255.0	-265.0	-230.6	-230.3	-234.5	-230.3
2044	-230.0	-240.0	-230.0	-240.0	-255.0	-265.0	-230.6	-230.4	-234.6	-230.3
2045	-230.0	-240.0	-230.0	-240.0	-255.0	-265.0	-230.6	-230.3	-234.5	-230.3
2046	-230.0	-240.0	-230.0	-240.0	-255.0	-265.0	-230.6	-230.3	-234.6	-230.3
2047	-230.0	-240.0	-230.0	-240.0	-255.0	-265.0	-230.1	-230.0	-234.2	-230.0
2048	-230.0	-240.0	-230.0	-240.0	-255.0	-265.0	-230.0	-230.0	-233.9	-230.0
2049	-230.0	-240.0	-230.0	-240.0	-255.0	-265.0	-230.0	-230.0	-233.4	-230.0
2050	-230.0	-240.0	-230.0	-240.0	-255.0	-265.0	-230.0	-230.0	-233.1	-230.0
2051	-230.0	-240.0	-230.0	-240.0	-255.0	-265.0	-230.0	-230.0	-233.0	-230.0
2052	-230.0	-240.0	-230.0	-240.0	-255.0	-265.0	-230.0	-230.0	-232.7	-230.0
2053	-230.0	-240.0	-230.0	-240.0	-255.0	-265.0	-230.1	-230.0	-232.6	-230.0
2054	-230.0	-240.0	-230.0	-240.0	-255.0	-265.0	-230.1	-230.0	-232.5	-230.0
2055	-230.0	-240.0	-230.0	-240.0	-255.0	-265.0	-230.1	-230.0	-232.5	-230.0
2056	-230.0	-240.0	-230.0	-240.0	-255.0	-265.0	-230.1	-230.0	-232.4	-230.0
2057	-230.0	-240.0	-230.0	-240.0	-255.0	-265.0	-230.1	-230.0	-232.5	-230.0
2058	-230.0	-240.0	-230.0	-240.0	-255.0	-265.0	-230.2	-230.0	-232.5	-230.0
2059	-230.0	-240.0	-230.0	-240.0	-255.0	-265.0	-230.2	-230.0	-232.5	-230.0
2060	-230.0	-240.0	-230.0	-240.0	-255.0	-265.0	-230.2	-230.1	-232.5	-230.0
2061	-230.0	-240.0	-230.0	-240.0	-255.0	-265.0	-230.3	-230.1	-232.6	-230.0
2062	-230.0	-240.0	-230.0	-240.0	-255.0	-265.0	-230.2	-230.1	-232.6	-230.0
2063	-230.0	-240.0	-230.0	-240.0	-255.0	-265.0	-230.3	-230.1	-232.6	-230.0
2064	-230.0	-240.0	-230.0	-240.0	-255.0	-265.0	-230.3	-230.1	-232.7	-230.1
2065	-230.0	-240.0	-230.0	-240.0	-255.0	-265.0	-230.4	-230.2	-232.7	-230.1
2066	-230.0	-240.0	-230.0	-240.0	-255.0	-265.0	-230.5	-230.2	-232.9	-230.2
2067	-230.0	-240.0	-230.0	-240.0	-255.0	-265.0	-230.5	-230.2	-232.9	-230.2
2068	-230.0	-240.0	-230.0	-240.0	-255.0	-265.0	-230.6	-230.3	-233.2	-230.2
2069	-230.0	-240.0	-230.0	-240.0	-255.0	-265.0	-230.6	-230.3	-233.3	-230.3
2070	-230.0	-240.0	-230.0	-240.0	-255.0	-265.0	-230.6	-230.3	-233.5	-230.2
2071	-230.0	-240.0	-230.0	-240.0	-255.0	-265.0	-230.6	-230.4	-233.7	-230.3
2072	-230.0	-240.0	-230.0	-240.0	-255.0	-265.0	-230.7	-230.4	-233.9	-230.3
2073	-230.0	-240.0	-230.0	-240.0	-255.0	-265.0	-230.7	-230.4	-234.2	-230.3
2074	-230.0	-240.0	-230.0	-240.0	-255.0	-265.0	-230.7	-230.4	-234.3	-230.4
2075	-230.0	-240.0	-230.0	-240.0	-255.0	-265.0	-230.8	-230.5	-234.4	-230.4
2076	-230.0	-240.0	-230.0	-240.0	-255.0	-265.0	-230.9	-230.5	-234.7	-230.4
2077	-230.0	-240.0	-230.0	-240.0	-255.0	-265.0	-231.0	-230.6	-234.9	-230.5

Table H2-2-2
Simulated Marine Sea, Concentric Ring, or Concentric Ring End of Year Water Salinity (mg/L) – 50th Percentile

Year	Conc Rings (1)	Conc Rings (2)	Conc Lakes (1)	Conc Lakes (2)	Conc Lakes (3)	Conc Lakes (4)	North Sea	North Sea Comb	Comb North and South	South Sea Comb
2006	48000	48000	48000	48000	48000	48000	48000	48000	48000	48000
2007	49000	49000	49000	49000	49000	49000	49000	49000	49000	49000
2008	50000	50000	50000	50000	50000	50000	50000	50000	51000	50000
2009	51000	51000	51000	51000	51000	51000	51000	51000	52000	51000
2010	53000	53000	53000	53000	53000	53000	53000	53000	53000	53000
2011	54000	54000	54000	54000	54000	54000	54000	54000	55000	54000
2012	56000	56000	56000	56000	56000	56000	56000	56000	57000	56000
2013	58000	58000	58000	58000	58000	58000	58000	58000	59000	58000
2014	59000	59000	60000	60000	60000	60000	60000	60000	61000	60000
2015	61000	61000	61000	61000	61000	61000	61000	61000	63000	61000
2016	20000	64000	9000	64000	64000	64000	63000	63000	64000	63000
2017	20000	67000	14000	66000	66000	66000	65000	65000	66000	65000
2018	20000	72000	19000	70000	70000	70000	69000	69000	70000	69000
2019	20000	35000	20000	35000	76000	76000	75000	74000	75000	74000
2020	20000	35000	20000	35000	84000	84000	81000	80000	81000	80000
2021	20000	35000	20000	35000	93000	93000	88000	87000	88000	86000
2022	20000	35000	20000	35000	104000	104000	70000	65000	80000	56000
2023	20000	35000	20000	35000	117000	117000	61000	55000	74000	46000
2024	20000	35000	20000	35000	132000	132000	55000	49000	70000	41000
2025	20000	35000	20000	35000	150000	150000	50000	45000	68000	38000
2026	20000	35000	20000	35000	45000	174000	48000	42000	66000	36000
2027	20000	35000	20000	35000	45000	201000	46000	39000	65000	36000
2028	20000	35000	20000	35000	45000	236000	44000	38000	64000	36000
2029	20000	35000	20000	35000	45000	273000	42000	36000	63000	36000
2030	20000	35000	20000	35000	45000	317000	41000	36000	62000	36000
2031	20000	35000	20000	35000	45000	350000	40000	36000	62000	36000
2032	20000	35000	20000	35000	45000	350000	38000	36000	61000	36000
2033	20000	35000	20000	35000	45000	350000	37000	36000	60000	36000
2034	20000	35000	20000	35000	45000	64000	37000	36000	60000	36000
2035	20000	35000	20000	35000	45000	65000	37000	36000	59000	37000
2036	20000	35000	20000	35000	45000	64000	37000	36000	59000	37000
2037	20000	35000	20000	35000	45000	62000	36000	36000	59000	37000
2038	20000	35000	20000	35000	45000	61000	36000	36000	58000	37000
2039	20000	35000	20000	35000	45000	61000	36000	36000	58000	37000
2040	20000	35000	20000	35000	45000	61000	36000	36000	58000	37000
2041	20000	35000	20000	35000	45000	60000	36000	36000	58000	37000
2042	20000	35000	20000	35000	45000	60000	36000	36000	58000	37000
2043	20000	35000	20000	35000	45000	60000	36000	36000	57000	37000
2044	20000	35000	20000	35000	45000	60000	36000	36000	58000	37000
2045	20000	35000	20000	35000	45000	60000	36000	36000	58000	37000
2046	20000	35000	20000	35000	45000	60000	36000	36000	57000	37000
2047	20000	35000	20000	35000	45000	60000	36000	36000	57000	36000
2048	20000	35000	20000	35000	45000	60000	36000	36000	56000	36000
2049	20000	35000	20000	35000	45000	60000	36000	36000	55000	36000
2050	20000	35000	20000	35000	45000	60000	36000	36000	54000	36000
2051	20000	35000	20000	35000	45000	60000	36000	36000	54000	36000
2052	20000	35000	20000	35000	45000	60000	36000	36000	54000	36000
2053	20000	35000	20000	35000	45000	60000	36000	36000	53000	36000
2054	20000	35000	20000	35000	45000	60000	36000	36000	53000	36000
2055	20000	35000	20000	35000	45000	60000	36000	36000	53000	36000
2056	20000	35000	20000	35000	45000	60000	36000	36000	53000	36000
2057	20000	35000	20000	35000	45000	60000	36000	36000	52000	36000
2058	20000	35000	20000	35000	45000	60000	36000	36000	52000	36000
2059	20000	35000	20000	35000	45000	60000	36000	36000	52000	36000
2060	20000	35000	20000	35000	45000	60000	36000	36000	52000	36000
2061	20000	35000	20000	35000	45000	60000	36000	36000	53000	36000
2062	20000	35000	20000	35000	45000	60000	36000	36000	52000	36000
2063	20000	35000	20000	35000	45000	60000	36000	36000	52000	36000
2064	20000	35000	20000	35000	45000	60000	36000	36000	53000	36000
2065	20000	35000	20000	35000	45000	60000	36000	36000	53000	36000
2066	20000	35000	20000	35000	45000	60000	36000	36000	53000	36000
2067	20000	35000	20000	35000	45000	60000	36000	36000	53000	36000
2068	20000	35000	20000	35000	45000	60000	36000	36000	53000	37000
2069	20000	35000	20000	35000	45000	60000	36000	36000	53000	37000
2070	20000	35000	20000	35000	45000	60000	36000	36000	54000	37000
2071	20000	35000	20000	35000	45000	60000	36000	36000	54000	37000
2072	20000	35000	20000	35000	45000	60000	36000	37000	54000	37000
2073	20000	35000	20000	35000	45000	60000	36000	37000	54000	37000
2074	20000	35000	20000	35000	45000	60000	36000	37000	54000	37000
2075	20000	35000	20000	35000	45000	60000	37000	37000	55000	38000
2076	20000	35000	20000	35000	45000	60000	37000	37000	55000	38000
2077	20000	35000	20000	35000	45000	61000	37000	37000	55000	38000

Table H2-2-3
Simulated Brine Sink End of Year Water Surface Elevation (ft above MSL) – 50th percentile

Year	No Action	SHCI	SHCII	Conc Rings	Conc Lakes	North Sea	North Sea Comb	Comb North and South	South Sea Comb
2006	-229.7	-229.7	-229.7	-229.7	-229.7	-229.7	-229.7	-229.8	-229.7
2007	-230.3	-230.3	-230.3	-230.3	-230.3	-230.3	-230.3	-230.5	-230.3
2008	-230.8	-230.8	-230.8	-230.8	-230.8	-230.8	-230.8	-231.1	-230.8
2009	-231.3	-231.4	-231.4	-231.4	-231.4	-231.4	-231.4	-231.7	-231.4
2010	-231.9	-232.0	-232.0	-231.9	-232.0	-232.0	-232.0	-232.4	-232.0
2011	-232.5	-232.6	-232.6	-232.5	-232.6	-232.6	-232.6	-233.0	-232.6
2012	-233.2	-233.4	-233.4	-233.3	-233.4	-233.4	-233.4	-233.9	-233.4
2013	-234.0	-234.2	-234.2	-234.1	-234.2	-234.2	-234.2	-234.8	-234.2
2014	-234.7	-234.9	-234.9	-234.8	-234.9	-234.9	-234.9	-235.5	-234.9
2015	-235.3	-235.6	-235.6	-235.4	-235.5	-235.6	-235.6	-236.1	-235.6
2016	-235.8	-236.2	-236.2	-236.7	-236.4	-236.2	-236.2	-236.7	-236.2
2017	-236.3	-236.7	-236.7	-237.5	-237.0	-236.7	-236.7	-237.3	-236.7
2018	-237.7	-238.1	-238.2	-239.4	-238.6	-238.2	-238.1	-238.7	-238.1
2019	-239.2	-239.8	-240.0	-241.6	-240.4	-239.9	-239.8	-240.3	-239.7
2020	-240.9	-241.5	-241.8	-244.4	-242.5	-241.7	-241.5	-241.9	-241.4
2021	-242.5	-243.2	-243.7	-247.3	-244.8	-243.5	-243.3	-243.5	-243.1
2022	-244.1	-244.9	-245.4	-250.2	-247.0	-248.8	-248.6	-247.5	-248.4
2023	-245.6	-246.5	-247.2	-253.0	-249.2	-253.8	-253.6	-252.3	-253.5
2024	-247.0	-248.2	-249.1	-255.7	-251.2	-257.3	-257.5	-256.8	-258.0
2025	-248.4	-249.8	-250.9	-258.1	-253.1	-259.7	-260.1	-260.9	-261.7
2026	-249.7	-251.4	-252.7	-260.5	-255.0	-262.2	-262.6	-264.3	-264.7
2027	-250.8	-253.0	-254.5	-262.3	-257.0	-264.4	-264.6	-267.6	-267.2
2028	-251.9	-254.6	-256.3	-263.8	-259.0	-266.6	-266.8	-270.5	-269.6
2029	-252.9	-255.8	-257.7	-265.0	-260.6	-268.4	-268.9	-272.5	-271.8
2030	-253.7	-257.0	-259.2	-266.1	-261.9	-270.1	-270.8	-273.3	-273.5
2031	-254.4	-258.2	-260.5	-267.1	-263.0	-271.5	-272.2	-273.5	-274.5
2032	-255.0	-259.1	-261.5	-267.9	-263.9	-272.2	-273.1	-273.6	-275.1
2033	-255.5	-259.8	-262.3	-268.6	-264.5	-272.7	-273.6	-273.6	-275.3
2034	-256.0	-260.4	-263.3	-269.1	-265.7	-272.8	-273.9	-273.6	-275.4
2035	-256.5	-260.9	-264.1	-269.5	-267.6	-273.0	-274.1	-273.6	-275.5
2036	-256.7	-261.2	-264.9	-269.7	-269.4	-273.1	-274.2	-273.6	-275.6
2037	-257.0	-261.6	-265.6	-270.0	-271.2	-273.1	-274.2	-273.6	-275.5
2038	-257.3	-261.8	-266.2	-270.0	-272.2	-273.2	-274.3	-273.6	-275.6
2039	-257.5	-261.9	-266.6	-270.1	-273.0	-273.2	-274.2	-273.6	-275.5
2040	-257.7	-262.1	-267.1	-270.3	-273.6	-273.3	-274.4	-273.6	-275.6
2041	-257.8	-262.1	-267.5	-270.2	-273.8	-273.3	-274.3	-273.6	-275.6
2042	-257.9	-262.3	-267.9	-270.3	-274.1	-273.3	-274.3	-273.6	-275.6
2043	-258.0	-262.3	-268.1	-270.4	-274.3	-273.4	-274.5	-273.6	-275.7
2044	-258.1	-262.4	-268.4	-270.5	-274.5	-273.5	-274.6	-273.6	-275.8
2045	-258.2	-262.4	-268.6	-270.4	-274.4	-273.5	-274.6	-273.6	-275.8
2046	-258.3	-262.4	-268.7	-270.5	-274.3	-273.5	-274.5	-273.6	-275.8
2047	-258.0	-262.1	-268.4	-270.0	-273.5	-273.1	-273.9	-273.6	-275.0
2048	-257.8	-261.9	-268.1	-269.7	-273.2	-272.4	-273.2	-273.6	-274.4
2049	-257.6	-261.7	-268.0	-269.6	-273.1	-272.1	-273.0	-273.6	-274.3
2050	-257.5	-261.6	-267.9	-269.5	-273.0	-272.0	-272.8	-273.6	-274.2
2051	-257.3	-261.5	-267.8	-269.5	-273.1	-272.1	-272.9	-273.6	-274.4
2052	-257.3	-261.4	-267.7	-269.5	-273.2	-272.1	-273.0	-273.6	-274.5
2053	-257.2	-261.4	-267.7	-269.5	-273.2	-272.2	-273.1	-273.6	-274.5
2054	-257.2	-261.4	-267.7	-269.6	-273.3	-272.2	-273.1	-273.6	-274.6
2055	-257.2	-261.4	-267.8	-269.6	-273.3	-272.2	-273.1	-273.6	-274.6
2056	-257.2	-261.4	-267.9	-269.6	-273.4	-272.4	-273.3	-273.6	-274.7
2057	-257.1	-261.4	-267.9	-269.7	-273.5	-272.5	-273.4	-273.6	-274.8
2058	-257.1	-261.4	-267.9	-269.7	-273.6	-272.5	-273.5	-273.6	-274.9
2059	-257.2	-261.4	-268.0	-269.7	-273.5	-272.5	-273.5	-273.6	-274.9
2060	-257.2	-261.4	-268.0	-269.8	-273.6	-272.6	-273.6	-273.6	-275.0
2061	-257.2	-261.5	-268.2	-269.9	-273.8	-272.8	-273.7	-273.6	-275.2
2062	-257.3	-261.5	-268.2	-270.0	-273.8	-272.8	-273.8	-273.6	-275.2
2063	-257.3	-261.5	-268.2	-270.0	-273.7	-272.9	-273.8	-273.6	-275.2
2064	-257.4	-261.6	-268.4	-270.0	-273.8	-272.9	-273.9	-273.6	-275.4
2065	-257.3	-261.6	-268.4	-270.0	-273.9	-273.0	-274.0	-273.6	-275.3
2066	-257.5	-261.7	-268.5	-270.2	-274.0	-273.1	-274.2	-273.6	-275.5
2067	-257.5	-261.7	-268.6	-270.2	-274.0	-273.2	-274.2	-273.6	-275.5
2068	-257.6	-261.8	-268.8	-270.4	-274.2	-273.3	-274.4	-273.6	-275.7
2069	-257.6	-261.8	-268.9	-270.4	-274.4	-273.5	-274.6	-273.6	-275.8
2070	-257.7	-261.9	-269.0	-270.5	-274.3	-273.6	-274.7	-273.6	-275.9
2071	-257.8	-262.1	-269.0	-270.5	-274.3	-273.6	-274.6	-273.6	-275.9
2072	-257.8	-262.1	-269.1	-270.5	-274.5	-273.5	-274.6	-273.6	-275.9
2073	-257.9	-262.2	-269.2	-270.6	-274.6	-273.7	-274.7	-273.6	-275.9
2074	-258.0	-262.2	-269.2	-270.7	-274.7	-273.8	-274.9	-273.6	-276.0
2075	-258.0	-262.4	-269.3	-270.8	-274.8	-273.9	-275.0	-273.6	-276.1
2076	-258.1	-262.4	-269.4	-270.8	-274.8	-274.0	-275.1	-273.7	-276.1
2077	-258.2	-262.6	-269.5	-271.0	-275.1	-274.1	-275.2	-273.7	-276.2

Table H2-2-4
Simulated Brine Sink End of Year Salinity (mg/L) – 50th Percentile

Year	No Action	SHCI	SHCII	Conc Rings	Conc Lakes	North Sea	North Sea Comb	Comb North and South	South Sea Comb
2006	48000	48000	48000	48000	48000	48000	48000	48000	48000
2007	49000	49000	49000	49000	49000	49000	49000	49000	49000
2008	50000	50000	50000	50000	50000	50000	50000	51000	50000
2009	51000	51000	51000	51000	51000	51000	51000	52000	51000
2010	53000	53000	53000	53000	53000	53000	53000	53000	53000
2011	54000	54000	54000	54000	54000	54000	54000	55000	54000
2012	56000	56000	56000	56000	56000	56000	56000	57000	56000
2013	57000	58000	58000	58000	58000	58000	58000	59000	58000
2014	59000	60000	60000	59000	60000	60000	60000	61000	60000
2015	61000	61000	61000	61000	61000	61000	61000	63000	61000
2016	62000	63000	63000	64000	64000	63000	63000	64000	63000
2017	64000	65000	65000	67000	66000	65000	65000	66000	65000
2018	68000	69000	69000	72000	70000	69000	69000	70000	69000
2019	72000	74000	75000	81000	76000	75000	74000	75000	74000
2020	78000	80000	81000	91000	84000	81000	80000	81000	80000
2021	84000	87000	89000	104000	93000	88000	87000	88000	86000
2022	91000	94000	97000	122000	104000	116000	113000	113000	110000
2023	98000	103000	107000	145000	117000	158000	154000	151000	145000
2024	106000	112000	118000	175000	132000	212000	207000	213000	200000
2025	114000	124000	131000	214000	150000	276000	273000	320000	284000
2026	123000	136000	147000	265000	174000	350000	350000	350000	350000
2027	132000	151000	167000	324000	201000	350000	350000	350000	350000
2028	142000	169000	192000	350000	236000	350000	350000	350000	350000
2029	151000	186000	215000	350000	273000	350000	350000	350000	350000
2030	160000	205000	246000	350000	317000	350000	350000	350000	350000
2031	169000	225000	279000	350000	350000	350000	350000	350000	350000
2032	177000	245000	310000	350000	350000	350000	350000	350000	350000
2033	184000	262000	341000	350000	350000	350000	350000	350000	350000
2034	193000	280000	350000	350000	350000	350000	350000	350000	350000
2035	200000	297000	350000	350000	350000	350000	350000	350000	350000
2036	205000	308000	350000	350000	350000	350000	350000	350000	350000
2037	211000	321000	350000	350000	350000	350000	350000	350000	350000
2038	216000	328000	350000	350000	350000	350000	350000	350000	350000
2039	220000	335000	350000	350000	350000	350000	350000	350000	350000
2040	225000	343000	350000	350000	350000	350000	350000	350000	350000
2041	228000	347000	350000	350000	350000	350000	350000	350000	350000
2042	231000	350000	350000	350000	350000	350000	350000	350000	350000
2043	234000	350000	350000	350000	350000	350000	350000	350000	350000
2044	238000	350000	350000	350000	350000	350000	350000	350000	350000
2045	240000	350000	350000	350000	350000	350000	350000	350000	350000
2046	243000	350000	350000	350000	350000	350000	350000	350000	350000
2047	238000	350000	350000	350000	350000	350000	350000	350000	350000
2048	235000	346000	350000	350000	350000	350000	350000	350000	350000
2049	233000	344000	350000	350000	350000	350000	350000	350000	350000
2050	231000	338000	350000	350000	350000	350000	350000	350000	350000
2051	229000	336000	350000	350000	350000	350000	350000	350000	350000
2052	229000	335000	350000	350000	350000	350000	350000	350000	350000
2053	229000	336000	350000	350000	350000	350000	350000	350000	350000
2054	229000	337000	350000	350000	350000	350000	350000	350000	350000
2055	231000	338000	350000	350000	350000	350000	350000	350000	350000
2056	231000	340000	350000	350000	350000	350000	350000	350000	350000
2057	231000	341000	350000	350000	350000	350000	350000	350000	350000
2058	232000	342000	350000	350000	350000	350000	350000	350000	350000
2059	234000	345000	350000	350000	350000	350000	350000	350000	350000
2060	234000	345000	350000	350000	350000	350000	350000	350000	350000
2061	237000	349000	350000	350000	350000	350000	350000	350000	350000
2062	238000	350000	350000	350000	350000	350000	350000	350000	350000
2063	239000	350000	350000	350000	350000	350000	350000	350000	350000
2064	241000	350000	350000	350000	350000	350000	350000	350000	350000
2065	242000	350000	350000	350000	350000	350000	350000	350000	350000
2066	246000	350000	350000	350000	350000	350000	350000	350000	350000
2067	246000	350000	350000	350000	350000	350000	350000	350000	350000
2068	250000	350000	350000	350000	350000	350000	350000	350000	350000
2069	251000	350000	350000	350000	350000	350000	350000	350000	350000
2070	255000	350000	350000	350000	350000	350000	350000	350000	350000
2071	258000	350000	350000	350000	350000	350000	350000	350000	350000
2072	260000	350000	350000	350000	350000	350000	350000	350000	350000
2073	261000	350000	350000	350000	350000	350000	350000	350000	350000
2074	263000	350000	350000	350000	350000	350000	350000	350000	350000
2075	266000	350000	350000	350000	350000	350000	350000	350000	350000
2076	268000	350000	350000	350000	350000	350000	350000	350000	350000
2077	272000	350000	350000	350000	350000	350000	350000	350000	350000

Table H2-2-5
Simulated End of Year Exposed Playa Area (acres) – 50th Percentile

Year	No Action	SHCI	SHCII	Conc Rings	Conc Lakes	North Sea	North Sea Comb	Comb North and South	South Sea Comb
2006	4000	4000	4000	4000	4000	4000	4000	4000	4000
2007	5000	5000	5000	5000	5000	5000	5000	5000	5000
2008	6000	6000	6000	6000	6000	6000	6000	7000	6000
2009	7000	5000	5000	6000	5000	5000	5000	8000	5000
2010	8000	7000	7000	8000	6000	7000	7000	9000	7000
2011	9000	8000	8000	10000	8000	8000	8000	11000	8000
2012	11000	9000	9000	11000	9000	9000	9000	12000	9000
2013	11000	11000	11000	13000	11000	11000	11000	15000	11000
2014	8000	13000	13000	15000	13000	13000	13000	16000	13000
2015	4000	15000	15000	16000	14000	15000	15000	18000	15000
2016	4000	16000	16000	8000	9000	16000	16000	20000	16000
2017	5000	17000	16000	8000	12000	16000	17000	22000	18000
2018	8000	20000	18000	8000	16000	19000	21000	26000	22000
2019	13000	24000	22000	7000	20000	23000	25000	31000	27000
2020	18000	29000	27000	7000	20000	28000	31000	36000	33000
2021	24000	35000	33000	7000	20000	34000	37000	43000	39000
2022	30000	42000	39000	7000	25000	46000	33000	48000	21000
2023	36000	44000	38000	14000	32000	50000	36000	50000	18000
2024	41000	45000	39000	22000	38000	53000	42000	53000	20000
2025	46000	48000	41000	30000	44000	48000	45000	55000	22000
2026	50000	51000	41000	38000	49000	45000	47000	61000	28000
2027	54000	51000	39000	45000	49000	47000	51000	71000	38000
2028	57000	51000	39000	52000	49000	54000	55000	89000	54000
2029	60000	53000	40000	57000	50000	63000	62000	103000	76000
2030	62000	55000	39000	63000	54000	76000	80000	106000	95000
2031	64000	56000	40000	68000	58000	89000	94000	107000	108000
2032	66000	57000	41000	73000	62000	96000	101000	106000	113000
2033	68000	59000	41000	78000	65000	99000	105000	106000	115000
2034	69000	61000	42000	82000	67000	100000	106000	106000	115000
2035	71000	63000	42000	87000	67000	101000	108000	106000	116000
2036	72000	64000	44000	90000	67000	102000	108000	105000	116000
2037	73000	65000	47000	93000	75000	102000	109000	105000	116000
2038	74000	66000	49000	94000	88000	102000	109000	105000	117000
2039	74000	67000	52000	96000	98000	102000	109000	105000	116000
2040	75000	67000	55000	97000	106000	103000	110000	105000	117000
2041	75000	68000	57000	97000	111000	103000	110000	105000	117000
2042	75000	68000	59000	98000	114000	103000	110000	105000	117000
2043	76000	68000	61000	98000	117000	104000	111000	105000	118000
2044	76000	69000	63000	100000	119000	105000	112000	105000	119000
2045	77000	69000	65000	99000	118000	104000	111000	105000	118000
2046	77000	69000	66000	99000	120000	104000	111000	105000	118000
2047	76000	67000	64000	95000	110000	102000	108000	104000	115000
2048	75000	67000	61000	91000	104000	98000	103000	103000	110000
2049	75000	66000	61000	89000	101000	96000	101000	103000	108000
2050	74000	65000	60000	89000	100000	96000	101000	102000	108000
2051	74000	65000	59000	88000	102000	95000	100000	102000	109000
2052	74000	65000	58000	88000	104000	96000	101000	102000	109000
2053	73000	65000	58000	88000	104000	96000	102000	101000	110000
2054	73000	65000	59000	88000	106000	97000	102000	101000	110000
2055	73000	65000	59000	89000	105000	97000	102000	101000	110000
2056	73000	65000	60000	90000	107000	97000	102000	101000	110000
2057	73000	65000	60000	90000	108000	98000	103000	101000	111000
2058	73000	65000	60000	90000	110000	98000	104000	101000	112000
2059	73000	65000	60000	91000	109000	99000	104000	101000	112000
2060	73000	65000	61000	92000	110000	99000	104000	101000	112000
2061	73000	65000	61000	93000	113000	100000	106000	102000	113000
2062	74000	65000	62000	94000	113000	100000	106000	102000	114000
2063	74000	65000	62000	94000	112000	100000	106000	101000	114000
2064	74000	65000	63000	95000	114000	101000	107000	102000	114000
2065	74000	65000	63000	94000	114000	101000	107000	102000	115000
2066	74000	66000	64000	96000	116000	102000	108000	102000	116000
2067	74000	66000	64000	96000	116000	102000	109000	102000	116000
2068	75000	66000	66000	98000	119000	103000	110000	103000	118000
2069	75000	66000	67000	99000	120000	105000	111000	103000	119000
2070	75000	67000	67000	100000	120000	105000	112000	103000	119000
2071	75000	67000	68000	100000	119000	105000	112000	103000	119000
2072	75000	67000	68000	100000	121000	104000	111000	104000	119000
2073	76000	68000	69000	101000	122000	106000	112000	104000	119000
2074	76000	68000	71000	102000	123000	107000	114000	104000	120000
2075	76000	68000	71000	103000	124000	107000	114000	105000	120000
2076	76000	68000	72000	104000	124000	107000	115000	105000	121000
2077	77000	69000	74000	106000	126000	109000	115000	106000	121000

SUMMARY TABLES FOR IMPACT ASSESSMENT
TRACE SALSA MODELING RESULTS

Variability Conditions

Table H2-2-6
Simulated Marine Sea, Concentric Ring, or Concentric Ring End of Year Water Surface Elevation (ft above MSL) – Trace 37d

Year	Conc Rings (1)	Conc Rings (2)	Conc Lakes (1)	Conc Lakes (2)	Conc Lakes (3)	Conc Lakes (4)	North Sea	North Sea Comb	Comb North and South	South Sea Comb
2006	-229.9	-229.9	-229.9	-229.9	-229.9	-229.9	-230.2	-230.2	-230.2	-230.2
2007	-230.4	-230.4	-230.4	-230.4	-230.4	-230.4	-230.7	-230.7	-230.7	-230.7
2008	-231.7	-231.7	-231.7	-231.7	-231.7	-231.7	-231.9	-231.9	-231.9	-231.9
2009	-231.7	-231.7	-231.7	-231.7	-231.7	-231.7	-232.1	-232.1	-232.0	-232.1
2010	-231.7	-231.7	-231.7	-231.7	-231.7	-231.7	-232.1	-232.1	-232.1	-232.1
2011	-232.2	-232.2	-232.2	-232.2	-232.2	-232.2	-232.5	-232.5	-232.4	-232.5
2012	-232.2	-232.2	-232.2	-232.2	-232.2	-232.2	-232.6	-232.6	-232.4	-232.6
2013	-232.9	-232.9	-232.9	-232.9	-232.9	-232.9	-233.2	-233.2	-233.0	-233.2
2014	-233.8	-233.8	-233.8	-233.8	-233.8	-233.8	-234.0	-234.0	-233.8	-234.0
2015	-233.8	-233.8	-233.8	-233.8	-233.8	-233.8	-234.2	-234.2	-233.9	-234.2
2016	-230.0	-235.8	-230.0	-235.1	-235.1	-235.1	-235.2	-235.2	-234.8	-235.2
2017	-230.0	-236.4	-230.0	-235.3	-235.3	-235.3	-235.4	-235.4	-235.1	-235.4
2018	-230.0	-238.3	-230.0	-237.3	-237.3	-237.3	-237.0	-237.0	-236.6	-237.0
2019	-230.0	-240.5	-230.0	-239.0	-239.0	-239.0	-238.7	-238.7	-238.3	-238.7
2020	-230.0	-240.0	-230.0	-241.2	-241.2	-241.2	-240.8	-240.8	-240.2	-240.8
2021	-230.0	-240.0	-230.0	-240.0	-243.1	-243.1	-242.3	-242.2	-241.6	-242.2
2022	-230.0	-240.0	-230.0	-240.0	-245.4	-245.4	-241.4	-244.0	-241.0	-241.1
2023	-230.0	-240.0	-230.0	-240.0	-247.8	-247.8	-235.1	-235.0	-239.3	-235.4
2024	-230.0	-240.0	-230.0	-240.0	-249.9	-249.9	-230.3	-231.2	-238.4	-232.1
2025	-230.0	-240.0	-230.0	-240.0	-251.6	-251.6	-230.1	-230.2	-237.5	-230.2
2026	-230.0	-240.0	-230.0	-240.0	-254.2	-254.2	-231.1	-230.9	-237.6	-231.0
2027	-230.0	-240.0	-230.0	-240.0	-256.0	-256.0	-230.9	-230.7	-237.6	-230.7
2028	-230.0	-240.0	-230.0	-240.0	-255.0	-257.2	-230.5	-230.4	-236.8	-230.3
2029	-230.0	-240.0	-230.0	-240.0	-255.0	-259.6	-231.6	-231.2	-236.5	-231.1
2030	-230.0	-240.0	-230.0	-240.0	-255.0	-261.2	-231.3	-231.5	-236.6	-231.0
2031	-230.0	-240.0	-230.0	-240.0	-255.0	-262.1	-230.9	-231.2	-236.0	-230.8
2032	-230.0	-240.0	-230.0	-240.0	-255.0	-262.8	-231.1	-231.3	-235.6	-230.8
2033	-230.0	-240.0	-230.0	-240.0	-255.0	-263.8	-231.4	-231.7	-235.5	-231.1
2034	-230.0	-240.0	-230.0	-240.0	-255.0	-264.3	-231.3	-231.5	-235.3	-231.0
2035	-230.0	-240.0	-230.0	-240.0	-255.0	-264.7	-231.1	-231.5	-235.0	-230.9
2036	-230.0	-240.0	-230.0	-240.0	-255.0	-264.3	-230.5	-231.0	-234.2	-230.5
2037	-230.0	-240.0	-230.0	-240.0	-255.0	-265.2	-231.6	-231.7	-234.2	-231.1
2038	-230.0	-240.0	-230.0	-240.0	-255.0	-267.0	-231.7	-231.9	-234.5	-231.3
2039	-230.0	-240.0	-230.0	-240.0	-255.0	-265.1	-232.3	-232.6	-235.4	-231.7
2040	-230.0	-240.0	-230.0	-240.0	-255.0	-265.0	-232.5	-232.9	-236.0	-231.7
2041	-230.0	-240.0	-230.0	-240.0	-255.0	-265.0	-232.2	-232.8	-236.2	-231.4
2042	-230.0	-240.0	-230.0	-240.0	-255.0	-265.0	-232.0	-232.9	-236.5	-231.5
2043	-230.0	-240.0	-230.0	-240.0	-255.0	-265.0	-231.9	-232.8	-236.8	-231.4
2044	-230.0	-240.0	-230.0	-240.0	-255.0	-265.0	-231.9	-232.7	-237.0	-231.4
2045	-230.0	-240.0	-230.0	-240.0	-255.0	-265.0	-231.9	-232.4	-237.2	-231.4
2046	-230.0	-240.0	-230.0	-240.0	-255.0	-265.0	-231.7	-232.1	-237.2	-231.3
2047	-230.0	-240.0	-230.0	-240.0	-255.0	-265.0	-231.6	-231.7	-237.0	-231.2
2048	-230.0	-240.0	-230.0	-240.0	-255.0	-265.6	-232.4	-232.4	-237.6	-231.8
2049	-230.0	-240.0	-230.0	-240.0	-255.0	-265.0	-231.0	-231.1	-236.9	-230.6
2050	-230.0	-240.0	-230.0	-240.0	-255.0	-265.0	-230.4	-230.7	-235.5	-230.4
2051	-230.0	-240.0	-230.0	-240.0	-255.0	-265.0	-231.6	-231.7	-235.1	-231.1
2052	-230.0	-240.0	-230.0	-240.0	-255.0	-265.0	-231.2	-231.5	-234.9	-231.0
2053	-230.0	-240.0	-230.0	-240.0	-255.0	-265.0	-231.5	-231.8	-235.0	-231.1
2054	-230.0	-240.0	-230.0	-240.0	-255.0	-265.0	-231.5	-231.7	-235.0	-231.1
2055	-230.0	-240.0	-230.0	-240.0	-255.0	-265.0	-231.7	-231.9	-235.3	-231.3
2056	-230.0	-240.0	-230.0	-240.0	-255.0	-265.0	-230.5	-230.9	-234.6	-230.5
2057	-230.0	-240.0	-230.0	-240.0	-255.0	-265.2	-232.1	-232.2	-234.8	-231.5
2058	-230.0	-240.0	-230.0	-240.0	-255.0	-265.0	-230.8	-231.2	-234.3	-230.7
2059	-230.0	-240.0	-230.0	-240.0	-255.0	-265.0	-231.3	-231.5	-234.0	-230.9
2060	-230.0	-240.0	-230.0	-240.0	-255.0	-265.4	-232.2	-232.3	-234.7	-231.6
2061	-230.0	-240.0	-230.0	-240.0	-255.0	-265.1	-232.3	-232.6	-235.4	-231.6
2062	-230.0	-240.0	-230.0	-240.0	-255.0	-265.0	-232.0	-232.5	-235.8	-231.4
2063	-230.0	-240.0	-230.0	-240.0	-255.0	-265.0	-231.9	-232.3	-236.1	-231.4
2064	-230.0	-240.0	-230.0	-240.0	-255.0	-265.0	-231.5	-232.0	-236.1	-231.2
2065	-230.0	-240.0	-230.0	-240.0	-255.0	-265.2	-231.9	-232.3	-236.4	-231.4
2066	-230.0	-240.0	-230.0	-240.0	-255.0	-265.0	-231.2	-231.9	-236.1	-230.9
2067	-230.0	-240.0	-230.0	-240.0	-255.0	-265.0	-231.5	-231.8	-236.0	-231.1
2068	-230.0	-240.0	-230.0	-240.0	-255.0	-265.0	-231.6	-231.8	-236.0	-231.2
2069	-230.0	-240.0	-230.0	-240.0	-255.0	-265.0	-231.8	-231.8	-236.2	-231.3
2070	-230.0	-240.0	-230.0	-240.0	-255.0	-265.0	-231.2	-231.4	-235.8	-231.0
2071	-230.0	-240.0	-230.0	-240.0	-255.0	-265.0	-231.3	-231.4	-235.5	-231.0
2072	-230.0	-240.0	-230.0	-240.0	-255.0	-265.0	-232.0	-232.1	-235.8	-231.5
2073	-230.0	-240.0	-230.0	-240.0	-255.0	-265.5	-232.4	-232.6	-236.5	-231.7
2074	-230.0	-240.0	-230.0	-240.0	-255.0	-265.0	-232.0	-232.4	-236.8	-231.4
2075	-230.0	-240.0	-230.0	-240.0	-255.0	-265.0	-232.0	-232.3	-237.0	-231.5
2076	-230.0	-240.0	-230.0	-240.0	-255.0	-265.0	-232.0	-232.3	-237.2	-231.5
2077	-230.0	-240.0	-230.0	-240.0	-255.0	-265.4	-232.3	-232.8	-237.7	-231.7

Table H2-2-7
Simulated Marine Sea, Concentric Ring, or Concentric Ring End of Year Water Salinity (mg/L) – Trace 37d

Year	Conc Rings (1)	Conc Rings (2)	Conc Lakes (1)	Conc Lakes (2)	Conc Lakes (3)	Conc Lakes (4)	North Sea	North Sea Comb	Comb North and South	South Sea Comb
2006	48000	48000	48000	48000	48000	48000	49000	49000	49000	49000
2007	49000	49000	49000	49000	49000	49000	50000	50000	50000	50000
2008	52000	52000	52000	52000	52000	52000	52000	52000	52000	52000
2009	52000	52000	52000	52000	52000	52000	53000	53000	52000	53000
2010	52000	52000	52000	52000	52000	52000	53000	53000	53000	53000
2011	53000	53000	53000	53000	53000	53000	54000	54000	54000	54000
2012	54000	54000	54000	54000	54000	54000	54000	54000	54000	54000
2013	55000	55000	55000	55000	55000	55000	56000	56000	55000	56000
2014	57000	57000	57000	57000	57000	57000	58000	58000	57000	58000
2015	58000	58000	58000	58000	58000	58000	58000	58000	58000	58000
2016	20000	62000	16000	61000	61000	61000	61000	61000	60000	61000
2017	20000	64000	20000	61000	61000	61000	62000	62000	61000	62000
2018	20000	69000	20000	66000	66000	66000	66000	66000	65000	66000
2019	20000	76000	20000	72000	72000	72000	71000	71000	69000	71000
2020	20000	35000	20000	79000	79000	79000	77000	77000	76000	77000
2021	20000	35000	20000	35000	86000	86000	83000	83000	81000	83000
2022	20000	35000	20000	35000	96000	96000	81000	91000	79000	85000
2023	20000	35000	20000	35000	109000	109000	65000	61000	73000	58000
2024	20000	35000	20000	35000	122000	122000	57000	53000	70000	49000
2025	20000	35000	20000	35000	136000	136000	51000	47000	67000	43000
2026	20000	35000	20000	35000	161000	161000	46000	43000	66000	40000
2027	20000	35000	20000	35000	184000	184000	43000	40000	65000	39000
2028	20000	35000	20000	35000	45000	204000	41000	38000	63000	36000
2029	20000	35000	20000	35000	45000	249000	36000	36000	62000	37000
2030	20000	35000	20000	35000	45000	292000	36000	37000	62000	37000
2031	20000	35000	20000	35000	45000	322000	35000	36000	60000	36000
2032	20000	35000	20000	35000	45000	350000	35000	36000	58000	37000
2033	20000	35000	20000	35000	45000	350000	35000	36000	58000	37000
2034	20000	35000	20000	35000	45000	350000	35000	36000	57000	37000
2035	20000	35000	20000	35000	45000	350000	35000	36000	56000	37000
2036	20000	35000	20000	35000	45000	350000	35000	35000	55000	36000
2037	20000	35000	20000	35000	45000	350000	36000	36000	54000	37000
2038	20000	35000	20000	32000	45000	350000	36000	36000	55000	38000
2039	19000	35000	20000	32000	45000	98000	36000	37000	56000	39000
2040	20000	35000	20000	32000	45000	55000	36000	37000	57000	39000
2041	20000	35000	20000	32000	45000	48000	35000	37000	57000	39000
2042	20000	35000	20000	32000	45000	43000	35000	37000	57000	38000
2043	20000	35000	20000	32000	45000	40000	35000	37000	58000	38000
2044	20000	35000	20000	33000	45000	39000	35000	36000	58000	38000
2045	20000	35000	20000	33000	45000	39000	35000	36000	58000	38000
2046	20000	35000	20000	33000	45000	40000	35000	36000	57000	38000
2047	20000	35000	20000	33000	45000	41000	35000	35000	56000	37000
2048	19000	35000	20000	33000	45000	42000	36000	36000	57000	39000
2049	20000	35000	20000	32000	45000	44000	34000	35000	56000	36000
2050	20000	35000	20000	33000	45000	53000	35000	35000	53000	36000
2051	20000	35000	20000	33000	45000	50000	36000	36000	51000	37000
2052	20000	35000	20000	33000	45000	48000	35000	36000	51000	37000
2053	20000	35000	20000	33000	45000	44000	35000	36000	51000	37000
2054	20000	35000	20000	33000	45000	44000	35000	36000	51000	37000
2055	20000	35000	20000	33000	45000	42000	35000	36000	51000	38000
2056	20000	35000	20000	33000	45000	50000	35000	35000	49000	36000
2057	20000	35000	20000	33000	45000	47000	36000	37000	49000	38000
2058	20000	35000	20000	33000	45000	51000	35000	36000	48000	36000
2059	20000	35000	20000	33000	45000	49000	35000	36000	48000	37000
2060	20000	35000	20000	33000	45000	47000	36000	37000	49000	38000
2061	20000	35000	20000	34000	45000	38000	36000	37000	50000	38000
2062	20000	35000	20000	34000	45000	37000	35000	37000	50000	38000
2063	20000	35000	20000	34000	45000	37000	35000	36000	51000	38000
2064	20000	35000	20000	34000	45000	40000	35000	36000	50000	37000
2065	20000	35000	20000	34000	45000	40000	35000	36000	51000	38000
2066	20000	35000	20000	34000	45000	44000	35000	36000	50000	37000
2067	20000	35000	20000	34000	45000	44000	35000	36000	50000	37000
2068	20000	35000	20000	34000	45000	43000	35000	36000	49000	37000
2069	20000	35000	20000	35000	45000	41000	36000	36000	49000	38000
2070	20000	35000	20000	35000	45000	45000	35000	36000	49000	37000
2071	20000	35000	20000	35000	45000	47000	35000	36000	48000	37000
2072	20000	35000	20000	35000	45000	42000	36000	36000	48000	38000
2073	19000	35000	20000	35000	45000	40000	36000	37000	49000	39000
2074	20000	35000	20000	35000	45000	36000	35000	37000	49000	38000
2075	20000	35000	20000	35000	45000	37000	35000	36000	50000	38000
2076	20000	35000	20000	35000	45000	37000	35000	36000	50000	38000
2077	19000	35000	20000	35000	45000	39000	36000	37000	51000	38000

Table H2-2-8
Simulated Brine Sink End of Year Water Surface Elevation (ft above MSL) – Trace 37d

Year	No Action	SHCI	SHCII	Conc Rings	Conc Lakes	North Sea	North Sea Comb	Comb North and South	South Sea Comb
2006	-230.2	-230.2	-230.2	-229.9	-229.9	-230.2	-230.2	-230.2	-230.2
2007	-230.7	-230.7	-230.7	-230.4	-230.4	-230.7	-230.7	-230.7	-230.7
2008	-231.9	-231.9	-231.9	-231.7	-231.7	-231.9	-231.9	-231.9	-231.9
2009	-232.0	-232.1	-232.1	-231.7	-231.7	-232.1	-232.1	-232.0	-232.1
2010	-232.1	-232.1	-232.1	-231.7	-231.7	-232.1	-232.1	-232.1	-232.1
2011	-232.4	-232.5	-232.5	-232.2	-232.2	-232.5	-232.5	-232.4	-232.5
2012	-232.4	-232.6	-232.6	-232.2	-232.2	-232.6	-232.6	-232.4	-232.6
2013	-233.0	-233.2	-233.2	-232.9	-232.9	-233.2	-233.2	-233.0	-233.2
2014	-233.8	-234.0	-234.0	-233.8	-233.8	-234.0	-234.0	-233.8	-234.0
2015	-233.9	-234.2	-234.2	-233.8	-233.8	-234.2	-234.2	-233.9	-234.2
2016	-234.8	-235.2	-235.2	-235.8	-235.1	-235.2	-235.2	-234.8	-235.2
2017	-235.1	-235.4	-235.4	-236.4	-235.3	-235.4	-235.4	-235.1	-235.4
2018	-236.6	-237.0	-237.0	-238.3	-237.3	-237.0	-237.0	-236.6	-237.0
2019	-238.3	-238.7	-238.7	-240.5	-239.0	-238.7	-238.7	-238.3	-238.7
2020	-240.3	-240.8	-240.8	-243.8	-241.2	-240.8	-240.8	-240.2	-240.8
2021	-241.6	-242.2	-242.4	-246.3	-243.1	-242.3	-242.2	-241.6	-242.2
2022	-243.3	-244.0	-244.3	-249.4	-245.4	-247.6	-244.0	-246.3	-247.4
2023	-245.1	-245.9	-246.3	-252.5	-247.8	-252.7	-252.6	-251.0	-252.6
2024	-246.6	-247.6	-248.2	-255.2	-249.9	-256.0	-256.7	-255.3	-257.3
2025	-247.8	-249.1	-249.9	-257.6	-251.6	-258.0	-259.1	-259.1	-260.4
2026	-249.7	-251.3	-252.2	-260.6	-254.2	-261.3	-262.4	-262.8	-263.9
2027	-251.1	-253.2	-254.4	-262.8	-256.0	-263.8	-265.0	-265.7	-267.0
2028	-251.7	-254.2	-255.6	-263.7	-257.2	-265.2	-266.3	-268.4	-268.8
2029	-253.0	-256.1	-257.6	-265.4	-259.6	-267.3	-268.5	-270.9	-271.4
2030	-254.0	-257.4	-259.4	-266.8	-261.2	-269.9	-270.8	-272.1	-273.9
2031	-254.6	-258.3	-260.5	-267.5	-262.1	-271.5	-272.7	-272.6	-274.9
2032	-255.1	-259.1	-261.4	-268.1	-262.8	-271.8	-273.3	-272.8	-274.9
2033	-255.7	-260.0	-262.4	-269.0	-263.8	-272.4	-273.9	-272.8	-275.3
2034	-256.3	-260.7	-263.5	-269.7	-264.3	-273.2	-274.7	-272.8	-275.7
2035	-256.6	-261.1	-264.2	-269.9	-264.7	-273.0	-274.8	-272.8	-275.4
2036	-256.4	-260.9	-264.3	-269.4	-264.3	-272.2	-274.3	-272.7	-274.7
2037	-256.9	-261.5	-265.2	-270.1	-265.2	-272.2	-273.7	-272.9	-274.9
2038	-257.4	-262.1	-266.2	-271.0	-267.0	-273.3	-274.9	-272.9	-275.9
2039	-258.3	-263.0	-267.6	-272.2	-269.9	-274.5	-275.8	-272.9	-276.6
2040	-258.9	-263.5	-268.7	-272.8	-272.6	-275.1	-276.3	-272.9	-276.9
2041	-259.2	-263.7	-269.3	-272.6	-274.1	-275.5	-276.4	-273.0	-276.9
2042	-259.5	-263.9	-269.9	-272.7	-275.7	-275.7	-276.6	-272.9	-276.7
2043	-259.7	-264.1	-270.3	-272.7	-275.7	-275.0	-276.7	-273.0	-276.7
2044	-259.9	-264.2	-270.5	-272.7	-275.9	-274.8	-276.7	-273.0	-276.6
2045	-260.0	-264.3	-270.7	-272.6	-275.8	-274.7	-276.8	-273.1	-276.6
2046	-259.9	-264.2	-270.6	-272.4	-275.2	-274.7	-276.8	-273.0	-276.6
2047	-259.8	-264.1	-270.4	-272.1	-274.6	-274.5	-276.3	-273.1	-276.5
2048	-260.2	-264.5	-270.9	-272.8	-276.3	-274.6	-276.0	-273.1	-276.5
2049	-259.6	-263.9	-269.8	-271.3	-272.8	-275.1	-276.5	-272.8	-276.5
2050	-258.5	-262.6	-268.4	-269.9	-271.6	-271.8	-273.3	-272.9	-273.9
2051	-258.4	-262.5	-268.7	-270.4	-273.5	-271.7	-273.1	-272.9	-274.3
2052	-258.4	-262.5	-268.8	-270.6	-273.6	-272.9	-274.4	-272.9	-275.4
2053	-258.5	-262.6	-269.0	-271.0	-274.2	-273.0	-274.6	-272.9	-275.6
2054	-258.6	-262.7	-269.3	-271.3	-274.3	-273.6	-275.1	-273.0	-276.0
2055	-258.8	-262.9	-269.7	-271.7	-275.1	-273.9	-275.2	-273.0	-276.1
2056	-258.2	-262.2	-268.7	-270.4	-272.2	-273.9	-275.3	-272.7	-276.1
2057	-258.5	-262.6	-269.4	-271.4	-274.9	-272.6	-274.2	-273.0	-275.2
2058	-258.2	-262.2	-268.9	-270.7	-273.0	-274.0	-275.2	-272.9	-275.8
2059	-258.0	-262.0	-268.8	-270.6	-273.3	-272.5	-274.0	-272.9	-275.0
2060	-258.6	-262.7	-269.7	-271.8	-275.6	-273.4	-275.0	-273.0	-275.9
2061	-259.0	-263.2	-270.3	-272.5	-276.5	-274.7	-275.8	-273.0	-276.9
2062	-259.2	-263.4	-270.6	-272.6	-275.9	-275.5	-276.6	-273.1	-276.8
2063	-259.4	-263.6	-270.7	-272.6	-275.7	-274.9	-276.7	-273.1	-276.7
2064	-259.3	-263.5	-270.5	-272.2	-274.9	-274.7	-276.7	-272.9	-276.5
2065	-259.4	-263.7	-270.6	-272.4	-275.9	-274.6	-276.6	-272.8	-276.4
2066	-259.1	-263.4	-270.2	-271.8	-274.1	-274.6	-276.5	-272.7	-276.3
2067	-259.0	-263.3	-270.0	-271.6	-274.3	-273.6	-276.0	-272.8	-275.8
2068	-259.0	-263.2	-270.1	-271.7	-274.4	-273.7	-275.7	-273.0	-276.0
2069	-259.0	-263.3	-270.3	-272.0	-274.8	-274.0	-275.5	-273.2	-276.3
2070	-258.7	-263.0	-269.9	-271.4	-273.7	-274.1	-275.6	-273.2	-276.1
2071	-258.5	-262.7	-269.6	-271.1	-273.5	-273.2	-274.6	-273.1	-275.5
2072	-258.7	-263.0	-270.2	-271.8	-275.5	-273.5	-274.9	-273.1	-276.0
2073	-259.2	-263.6	-270.8	-272.8	-276.5	-274.9	-275.9	-273.1	-276.8
2074	-259.3	-263.7	-270.9	-272.7	-275.5	-275.6	-276.7	-273.2	-276.9
2075	-259.4	-263.9	-271.0	-272.7	-275.9	-274.9	-276.8	-273.2	-276.8
2076	-259.5	-264.1	-271.0	-272.7	-276.3	-274.8	-276.7	-273.1	-276.6
2077	-259.7	-264.5	-271.3	-273.2	-276.6	-275.5	-276.7	-273.1	-276.9

Table H2-2-9
Simulated Brine Sink End of Year Salinity (mg/L) – Trace 37d

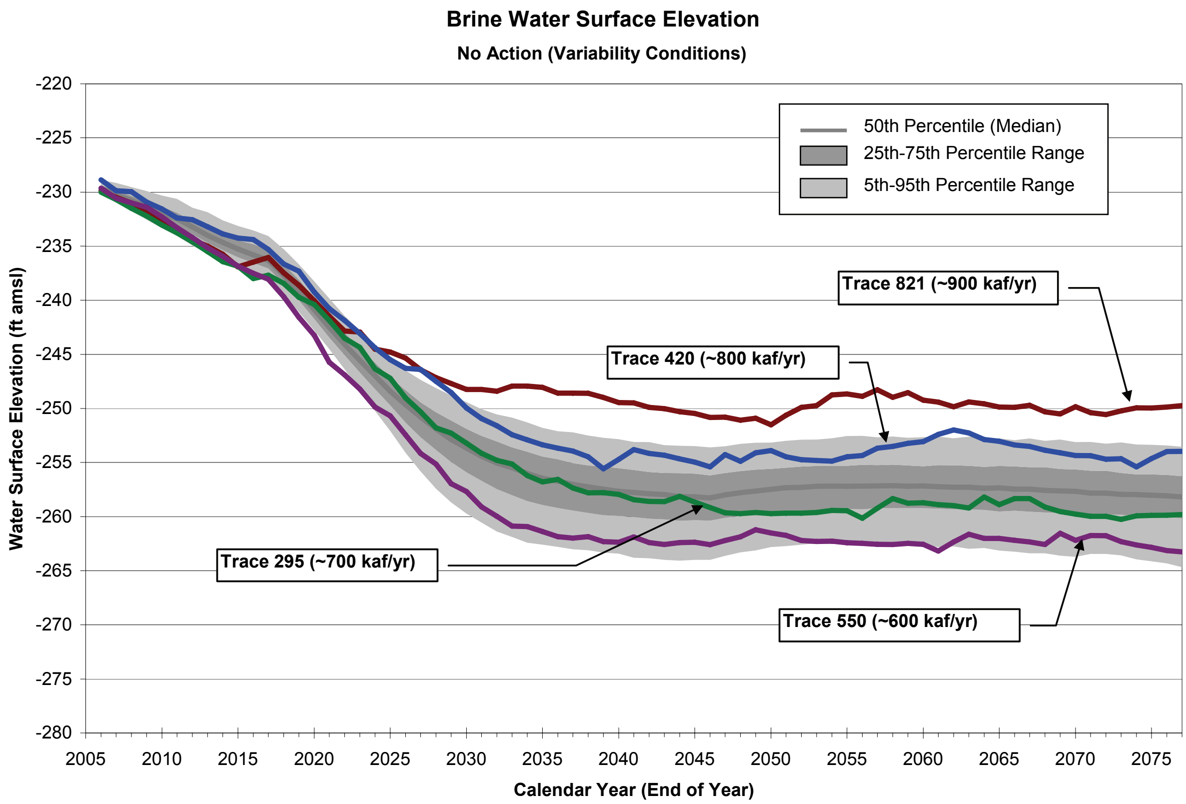
Year	No Action	SHCI	SHCII	Conc Rings	Conc Lakes	North Sea	North Sea Comb	Comb North and South	South Sea Comb
2006	49000	49000	49000	48000	48000	49000	49000	49000	49000
2007	50000	50000	50000	49000	49000	50000	50000	50000	50000
2008	52000	52000	52000	52000	52000	52000	52000	52000	52000
2009	52000	53000	53000	52000	52000	53000	53000	52000	53000
2010	53000	53000	53000	52000	52000	53000	53000	53000	53000
2011	54000	54000	54000	53000	53000	54000	54000	54000	54000
2012	54000	54000	54000	54000	54000	54000	54000	54000	54000
2013	55000	56000	56000	55000	55000	56000	56000	55000	56000
2014	57000	58000	58000	57000	57000	58000	58000	57000	58000
2015	58000	58000	58000	58000	58000	58000	58000	58000	58000
2016	60000	61000	61000	62000	61000	61000	61000	60000	61000
2017	61000	62000	62000	64000	61000	62000	62000	61000	62000
2018	65000	66000	66000	69000	66000	66000	66000	65000	66000
2019	70000	71000	71000	76000	72000	71000	71000	69000	71000
2020	76000	78000	78000	88000	79000	77000	77000	76000	77000
2021	81000	83000	84000	99000	86000	83000	83000	81000	83000
2022	88000	91000	92000	116000	96000	109000	91000	103000	114000
2023	96000	100000	102000	140000	109000	148000	144000	136000	150000
2024	103000	109000	113000	170000	122000	193000	194000	186000	208000
2025	111000	119000	124000	204000	136000	241000	247000	264000	273000
2026	123000	135000	143000	270000	161000	345000	350000	350000	350000
2027	134000	153000	166000	344000	184000	350000	350000	350000	350000
2028	140000	165000	181000	350000	204000	350000	350000	350000	350000
2029	152000	188000	213000	350000	249000	350000	350000	350000	350000
2030	164000	210000	249000	350000	292000	350000	350000	350000	350000
2031	171000	228000	278000	350000	322000	350000	350000	350000	350000
2032	178000	246000	308000	350000	350000	350000	350000	350000	350000
2033	187000	268000	344000	350000	350000	350000	350000	350000	350000
2034	195000	288000	350000	350000	350000	350000	350000	350000	350000
2035	201000	301000	350000	350000	350000	350000	350000	350000	350000
2036	199000	297000	350000	350000	350000	350000	350000	350000	350000
2037	207000	317000	350000	350000	350000	350000	350000	350000	350000
2038	218000	341000	350000	350000	350000	350000	350000	350000	350000
2039	236000	350000	350000	350000	350000	350000	350000	350000	350000
2040	249000	350000	350000	350000	350000	350000	350000	350000	350000
2041	257000	350000	350000	350000	350000	350000	350000	350000	350000
2042	265000	350000	350000	350000	350000	350000	350000	350000	350000
2043	271000	350000	350000	350000	350000	350000	350000	350000	350000
2044	276000	350000	350000	350000	350000	350000	350000	350000	350000
2045	280000	350000	350000	350000	350000	350000	350000	350000	350000
2046	280000	350000	350000	350000	350000	350000	350000	350000	350000
2047	278000	350000	350000	350000	350000	350000	350000	350000	350000
2048	289000	350000	350000	350000	350000	350000	350000	350000	350000
2049	273000	350000	350000	350000	350000	350000	350000	350000	350000
2050	249000	350000	350000	350000	350000	350000	350000	350000	350000
2051	250000	350000	350000	350000	350000	350000	350000	350000	350000
2052	250000	350000	350000	350000	350000	350000	350000	350000	350000
2053	253000	350000	350000	350000	350000	350000	350000	350000	350000
2054	256000	350000	350000	350000	350000	350000	350000	350000	350000
2055	262000	350000	350000	350000	350000	350000	350000	350000	350000
2056	248000	350000	350000	350000	350000	350000	350000	350000	350000
2057	257000	350000	350000	350000	350000	350000	350000	350000	350000
2058	250000	350000	350000	350000	350000	350000	350000	350000	350000
2059	248000	350000	350000	350000	350000	350000	350000	350000	350000
2060	261000	350000	350000	350000	350000	350000	350000	350000	350000
2061	273000	350000	350000	350000	350000	350000	350000	350000	350000
2062	279000	350000	350000	350000	350000	350000	350000	350000	350000
2063	283000	350000	350000	350000	350000	350000	350000	350000	350000
2064	282000	350000	350000	350000	350000	350000	350000	350000	350000
2065	286000	350000	350000	350000	350000	350000	350000	350000	350000
2066	280000	350000	350000	350000	350000	350000	350000	350000	350000
2067	278000	350000	350000	350000	350000	350000	350000	350000	350000
2068	278000	350000	350000	350000	350000	350000	350000	350000	350000
2069	281000	350000	350000	350000	350000	350000	350000	350000	350000
2070	275000	350000	350000	350000	350000	350000	350000	350000	350000
2071	270000	350000	350000	350000	350000	350000	350000	350000	350000
2072	277000	350000	350000	350000	350000	350000	350000	350000	350000
2073	290000	350000	350000	350000	350000	350000	350000	350000	350000
2074	293000	350000	350000	350000	350000	350000	350000	350000	350000
2075	296000	350000	350000	350000	350000	350000	350000	350000	350000
2076	300000	350000	350000	350000	350000	350000	350000	350000	350000
2077	308000	350000	350000	350000	350000	350000	350000	350000	350000

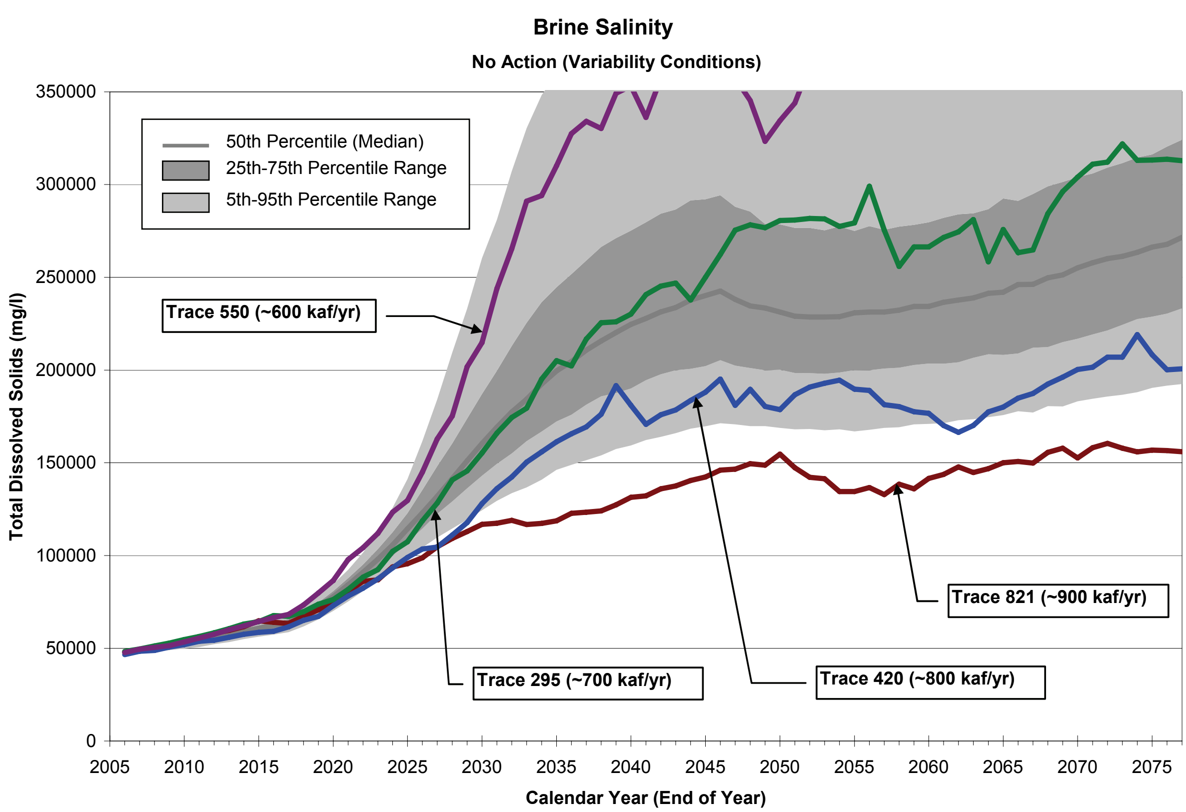
Table H2-2-10
Simulated End of Year Exposed Playa Area (acres) – Trace 37d

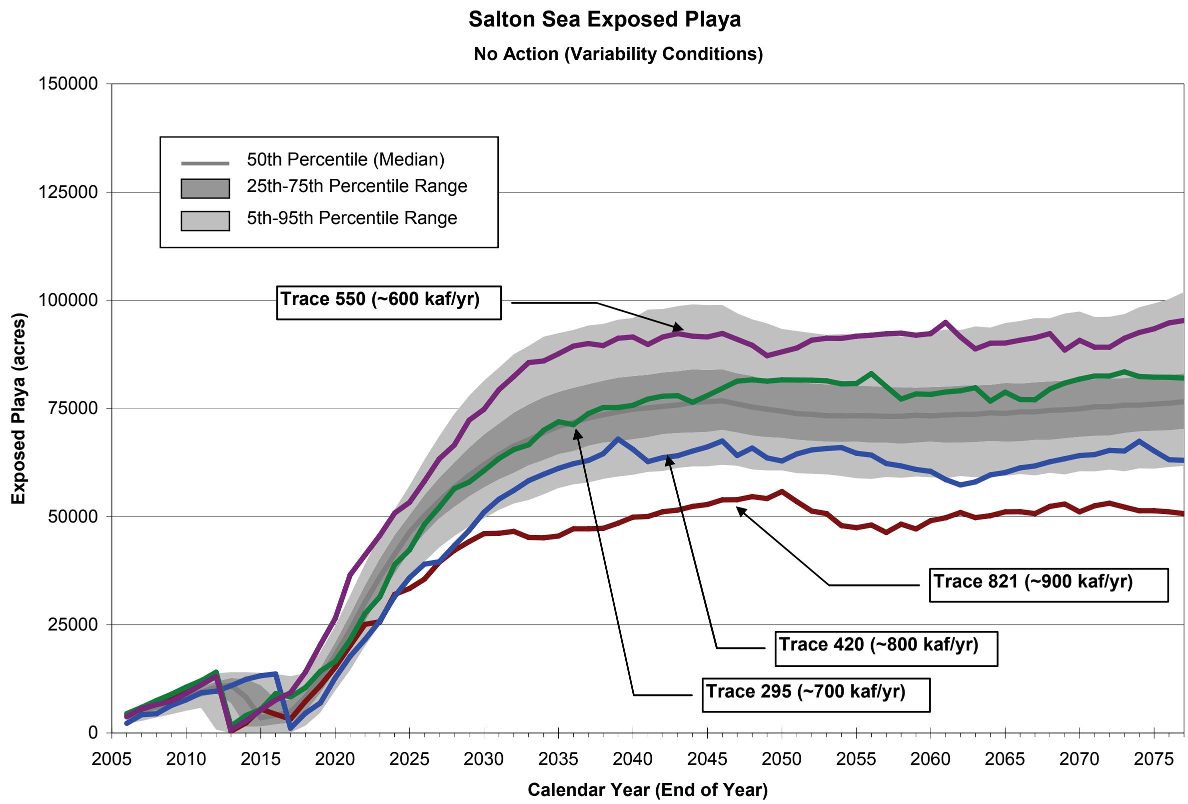
Year	No Action	SHCI	SHCII	Conc Rings	Conc Lakes	North Sea	North Sea Comb	Comb North and South	South Sea Comb
2006	0	5000	5000	5000	4000	5000	5000	5000	5000
2007	0	6000	6000	6000	5000	6000	6000	6000	6000
2008	0	8000	8000	8000	8000	8000	8000	8000	8000
2009	0	6000	6000	6000	6000	6000	6000	8000	6000
2010	0	7000	7000	7000	6000	7000	7000	8000	7000
2011	0	7000	7000	7000	7000	7000	7000	9000	7000
2012	0	7000	7000	7000	7000	7000	7000	9000	7000
2013	0	9000	9000	9000	8000	9000	9000	10000	9000
2014	0	10000	10000	10000	10000	10000	10000	12000	10000
2015	0	11000	11000	11000	10000	11000	11000	12000	11000
2016	0	13000	13000	12000	0	13000	13000	14000	13000
2017	0	14000	14000	4000	0	14000	14000	15000	14000
2018	4000	18000	18000	4000	4000	18000	18000	19000	18000
2019	10000	24000	24000	6000	9000	24000	24000	24000	24000
2020	16000	30000	30000	6000	16000	30000	30000	30000	30000
2021	20000	31000	27000	4000	12000	30000	33000	35000	35000
2022	27000	38000	35000	4000	12000	43000	40000	30000	32000
2023	34000	46000	43000	12000	19000	52000	35000	34000	18000
2024	40000	41000	33000	20000	26000	47000	40000	33000	16000
2025	44000	46000	38000	27000	31000	52000	46000	37000	22000
2026	50000	52000	45000	38000	39000	45000	51000	45000	25000
2027	54000	44000	32000	46000	44000	54000	60000	54000	36000
2028	56000	47000	35000	50000	40000	48000	61000	60000	45000
2029	60000	53000	42000	58000	40000	57000	72000	80000	71000
2030	63000	57000	34000	65000	42000	73000	86000	89000	96000
2031	64000	53000	38000	69000	45000	88000	103000	91000	108000
2032	66000	56000	41000	73000	48000	91000	108000	91000	108000
2033	68000	59000	45000	79000	52000	96000	113000	91000	112000
2034	70000	61000	35000	85000	55000	102000	120000	91000	116000
2035	71000	63000	39000	89000	57000	101000	119000	90000	116000
2036	70000	62000	39000	83000	55000	99000	118000	88000	108000
2037	72000	64000	43000	92000	59000	94000	112000	89000	108000
2038	74000	67000	48000	101000	56000	103000	121000	89000	119000
2039	76000	70000	56000	116000	60000	112000	128000	91000	126000
2040	78000	72000	63000	123000	79000	115000	130000	92000	128000
2041	79000	73000	69000	121000	103000	118000	129000	93000	127000
2042	80000	74000	75000	122000	114000	118000	130000	93000	125000
2043	81000	75000	80000	122000	118000	115000	131000	94000	125000
2044	82000	76000	83000	122000	118000	113000	131000	95000	125000
2045	82000	76000	84000	121000	118000	113000	132000	95000	125000
2046	82000	76000	83000	118000	116000	112000	132000	95000	124000
2047	81000	75000	81000	115000	114000	112000	128000	95000	122000
2048	83000	77000	87000	124000	122000	113000	128000	97000	125000
2049	81000	75000	79000	113000	84000	115000	130000	94000	124000
2050	78000	70000	63000	90000	72000	91000	114000	90000	96000
2051	77000	68000	63000	94000	92000	90000	107000	90000	102000
2052	77000	68000	64000	97000	98000	100000	117000	90000	114000
2053	77000	68000	66000	101000	106000	101000	119000	90000	116000
2054	77000	69000	68000	105000	108000	105000	122000	91000	119000
2055	78000	70000	72000	110000	113000	107000	124000	91000	121000
2056	77000	68000	66000	99000	79000	106000	123000	88000	120000
2057	77000	68000	69000	106000	108000	98000	116000	90000	112000
2058	76000	67000	65000	98000	88000	107000	122000	89000	118000
2059	75000	66000	64000	97000	93000	97000	117000	89000	110000
2060	77000	69000	72000	111000	114000	104000	122000	90000	120000
2061	79000	71000	81000	119000	121000	113000	128000	92000	127000
2062	79000	72000	83000	120000	119000	117000	130000	93000	126000
2063	80000	73000	85000	120000	118000	114000	130000	93000	125000
2064	79000	72000	82000	116000	114000	113000	131000	92000	123000
2065	80000	73000	83000	118000	116000	112000	129000	92000	122000
2066	79000	72000	78000	111000	105000	113000	130000	92000	122000
2067	79000	71000	77000	109000	108000	110000	127000	92000	119000
2068	78000	71000	77000	110000	110000	106000	125000	93000	119000
2069	79000	72000	81000	113000	115000	108000	125000	94000	121000
2070	78000	70000	75000	106000	100000	107000	125000	93000	121000
2071	77000	69000	72000	103000	98000	104000	121000	92000	115000
2072	78000	70000	78000	112000	113000	104000	121000	93000	120000
2073	79000	73000	86000	122000	123000	114000	129000	94000	127000
2074	80000	73000	87000	121000	120000	118000	130000	95000	128000
2075	80000	74000	88000	121000	118000	114000	130000	95000	125000
2076	80000	75000	88000	122000	119000	114000	130000	96000	125000
2077	81000	77000	91000	127000	123000	117000	131000	97000	127000

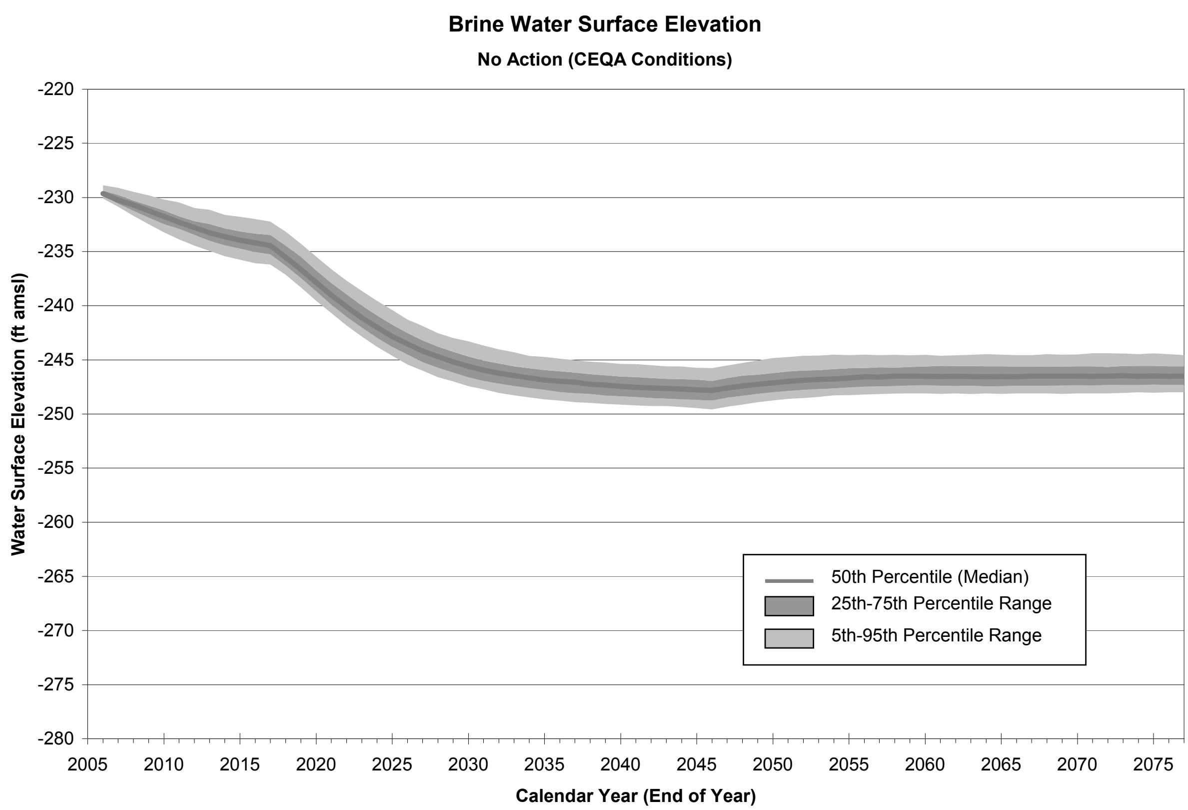
ACTION ALTERNATIVE

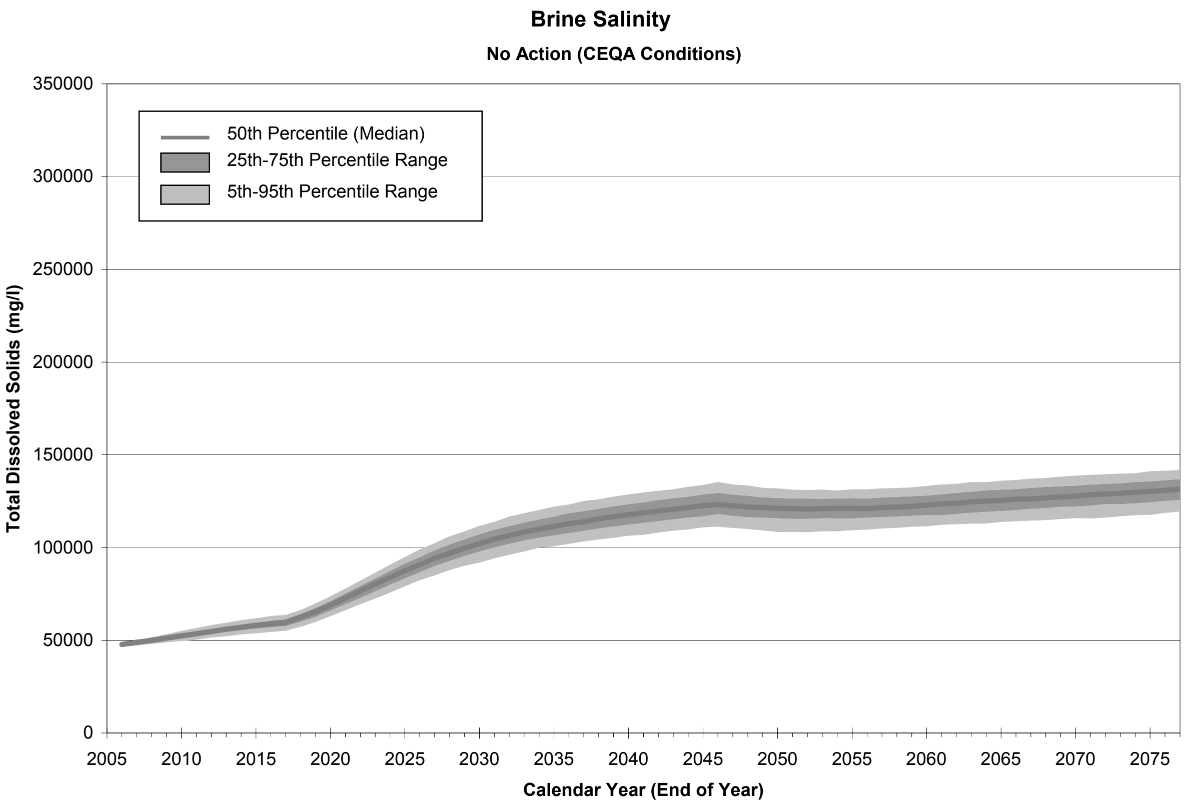
SALSA Modeling Results (Figures H2-2-5a through H2-2-5f)

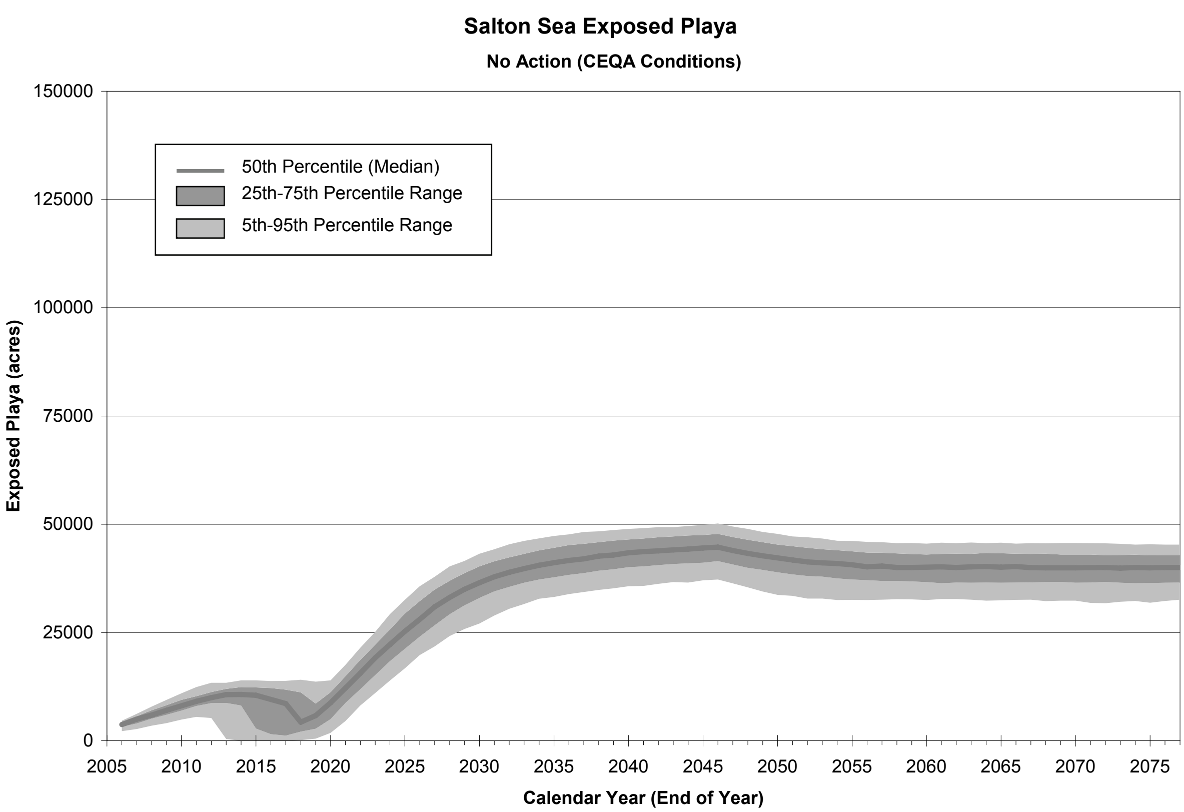

Brine Water Surface Elevation
No Action (Variability Conditions)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range
Trace 821 (~900 kaf/yr)
Trace 420 (~800 kaf/yr)
Trace 295 (~700 kaf/yr)
Trace 550 (~600 kaf/yr)
Water Surface Elevation (ft amsl)
-220
-225
-230
-235
-240
-245
-250
-255
-260
-265
-270
-275
-280
2005 2010 2015 2020 2025 2030 2035 2040 2045 2050 2055 2060 2065 2070 2075
Calendar Year (End of Year)


Brine Salinity
No Action (Variability Conditions)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range
Trace 550 (~600 kaf/yr)
Trace 821 (~900 kaf/yr)
Trace 295 (~700 kaf/yr)
Trace 420 (~800 kaf/yr)
Total Dissolved Solids (mg/l)
350000
300000
250000
200000
150000
100000
50000
0
2005 2010 2015 2020 2025 2030 2035 2040 2045 2050 2055 2060 2065 2070 2075
Calendar Year (End of Year)


Salton Sea Exposed Playa
No Action (Variability Conditions)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range
Trace 550 (~600 kaf/yr)
Trace 821 (~900 kaf/yr)
Trace 420 (~800 kaf/yr)
Trace 295 (~700 kaf/yr)
Exposed Playa (acres)
Calendar Year (End of Year)

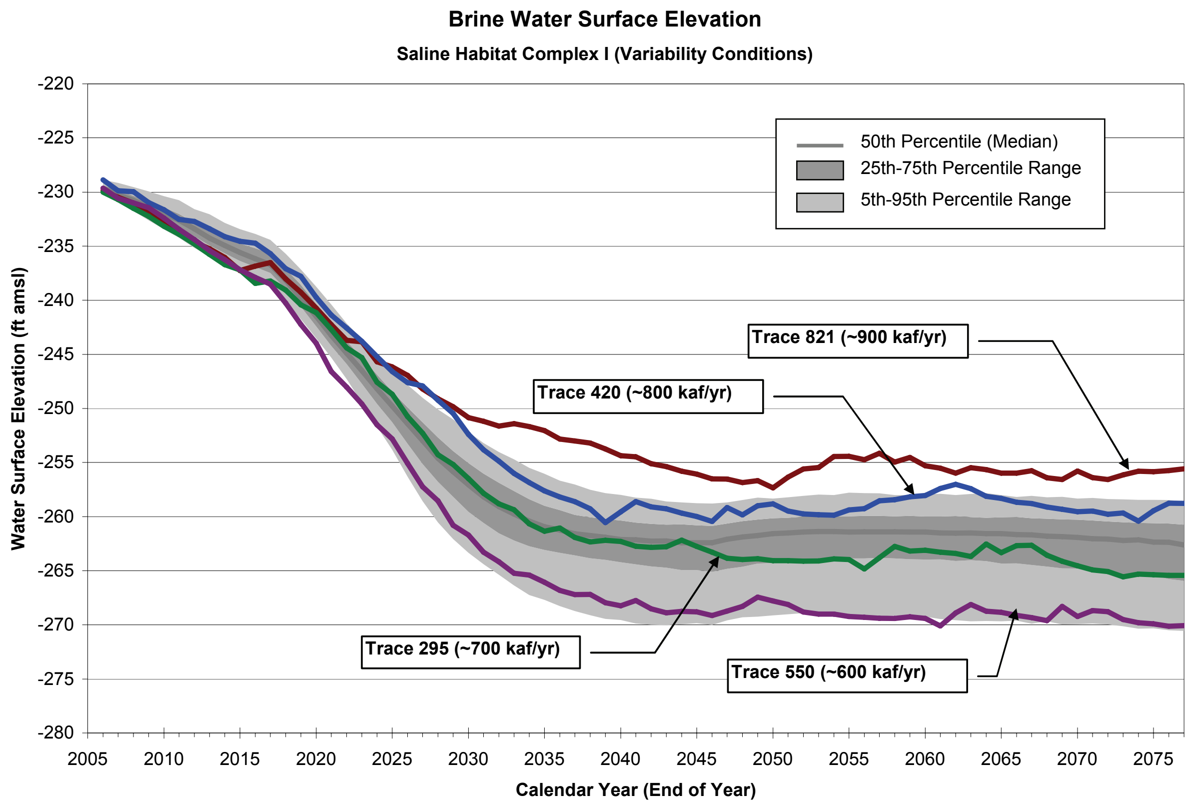

Brine Water Surface Elevation
No Action (CEQA Conditions)
Water Surface Elevation (ft amsl)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range
Calendar Year (End of Year)

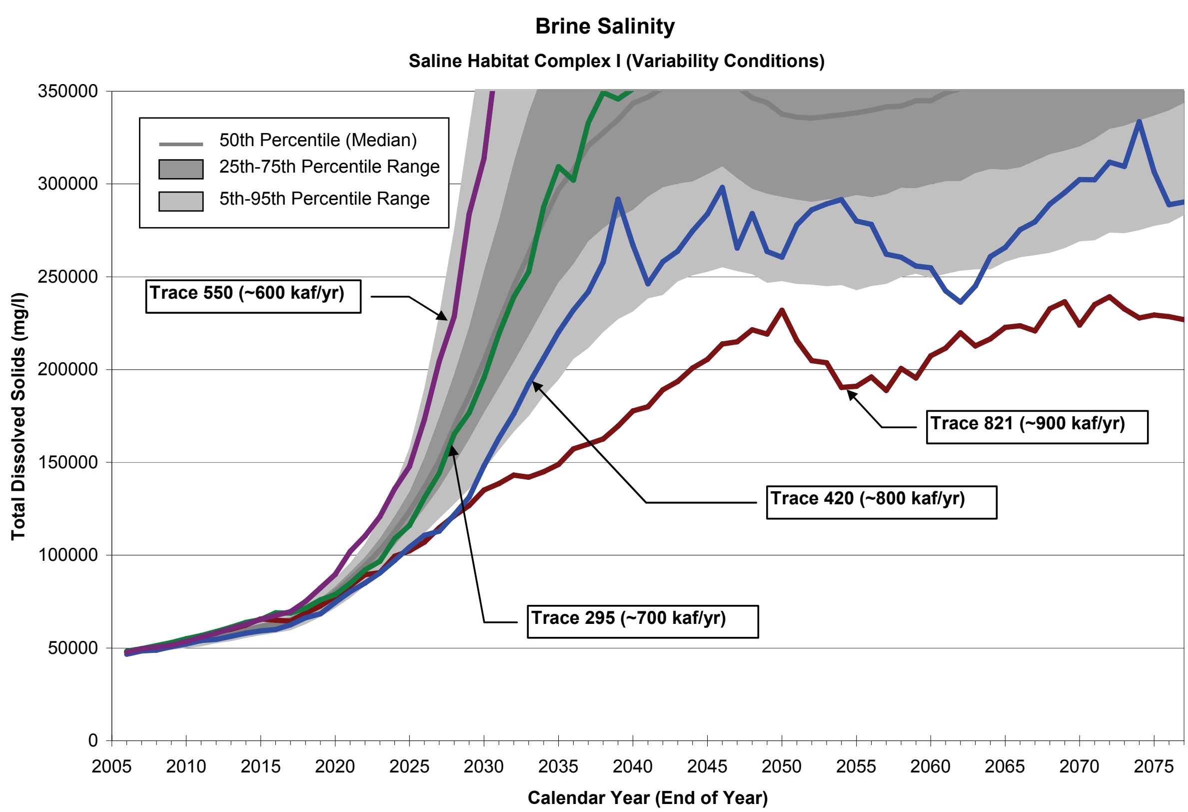

Brine Salinity
No Action (CEQA Conditions)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range
Total Dissolved Solids (mg/l)
350000
300000
250000
200000
150000
100000
50000
0
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075
Calendar Year (End of Year)

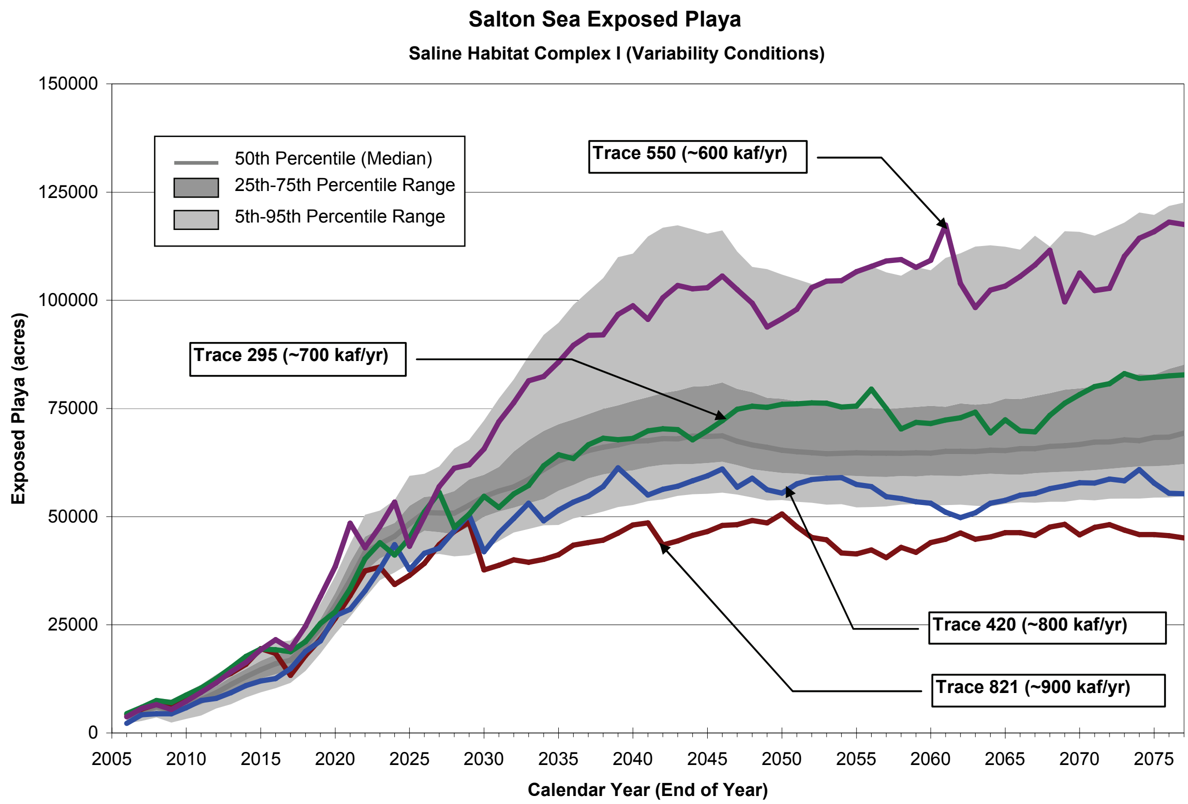

Salton Sea Exposed Playa
No Action (CEQA Conditions)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range
Exposed Playa (acres)
150000
125000
100000
75000
50000
25000
0
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075
Calendar Year (End of Year)

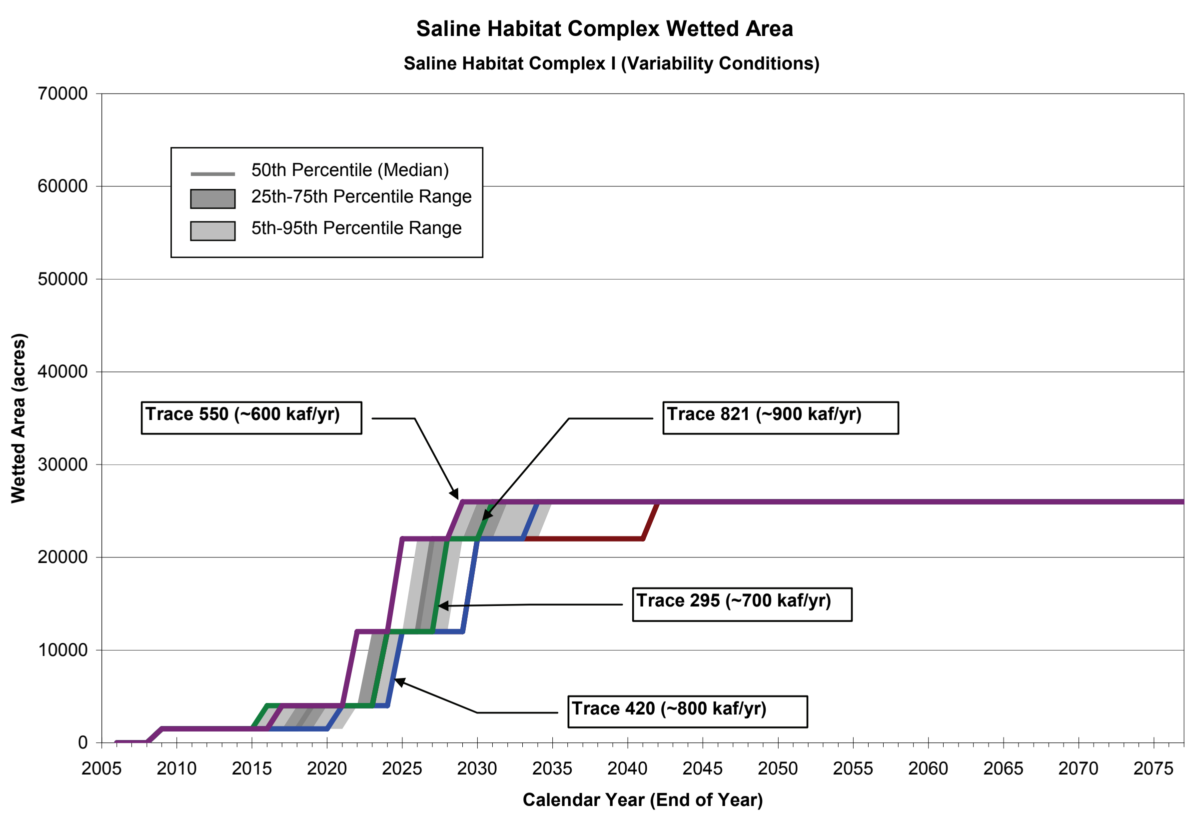
ALTERNATIVE 1 – SALINE HABITAT COMPLEX I

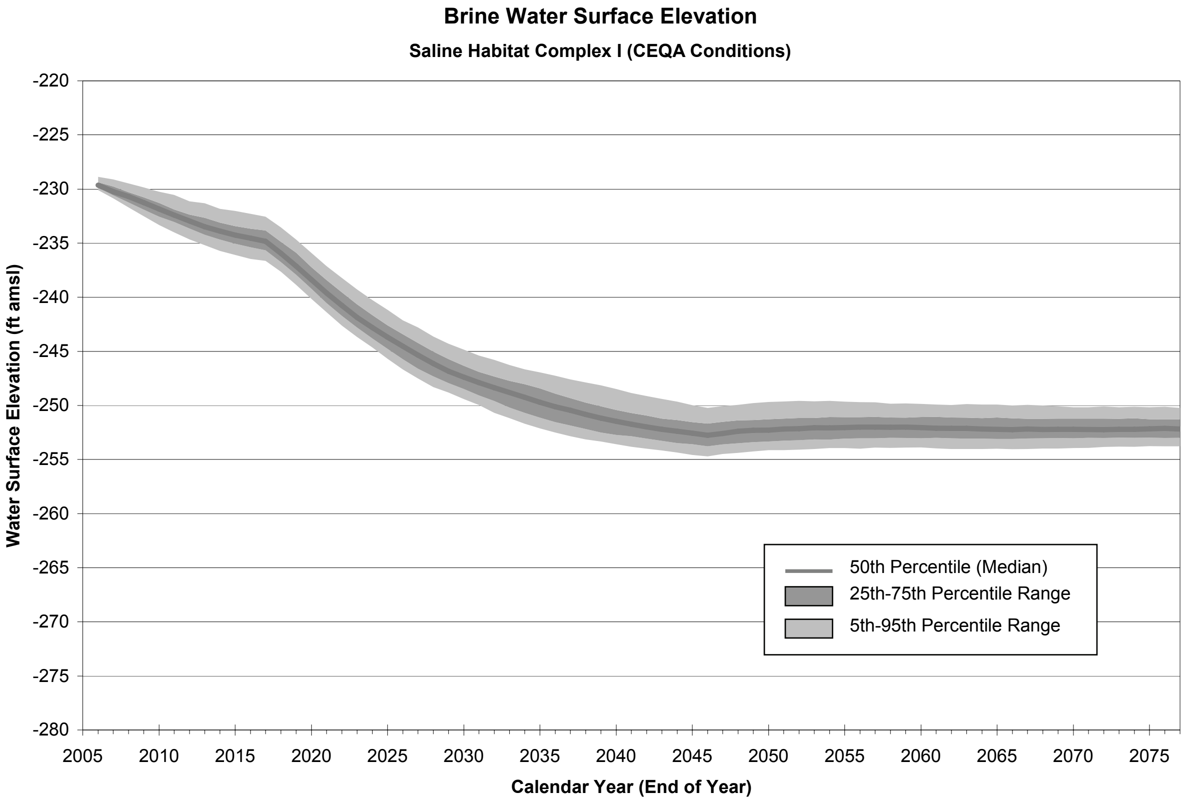
SALSA Modeling Results
(Figures H2-2-6a through H2-2-6h)

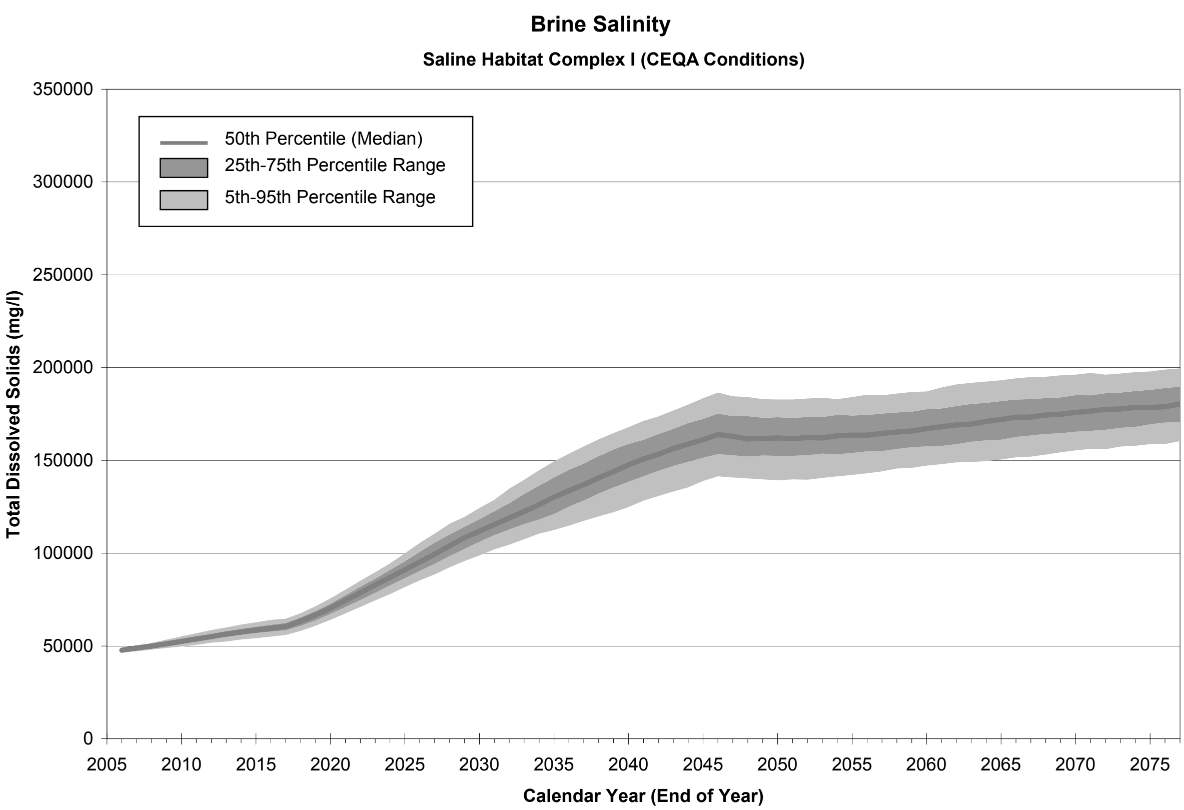

Brine Water Surface Elevation
Saline Habitat Complex I (Variability Conditions)
Water Surface Elevation (ft amsl)
Calendar Year (End of Year)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range
Trace 821 (~900 kaf/yr)
Trace 420 (~800 kaf/yr)
Trace 295 (~700 kaf/yr)
Trace 550 (~600 kaf/yr)
-220
-225
-230
-235
-240
-245
-250
-255
-260
-265
-270
-275
-280
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075

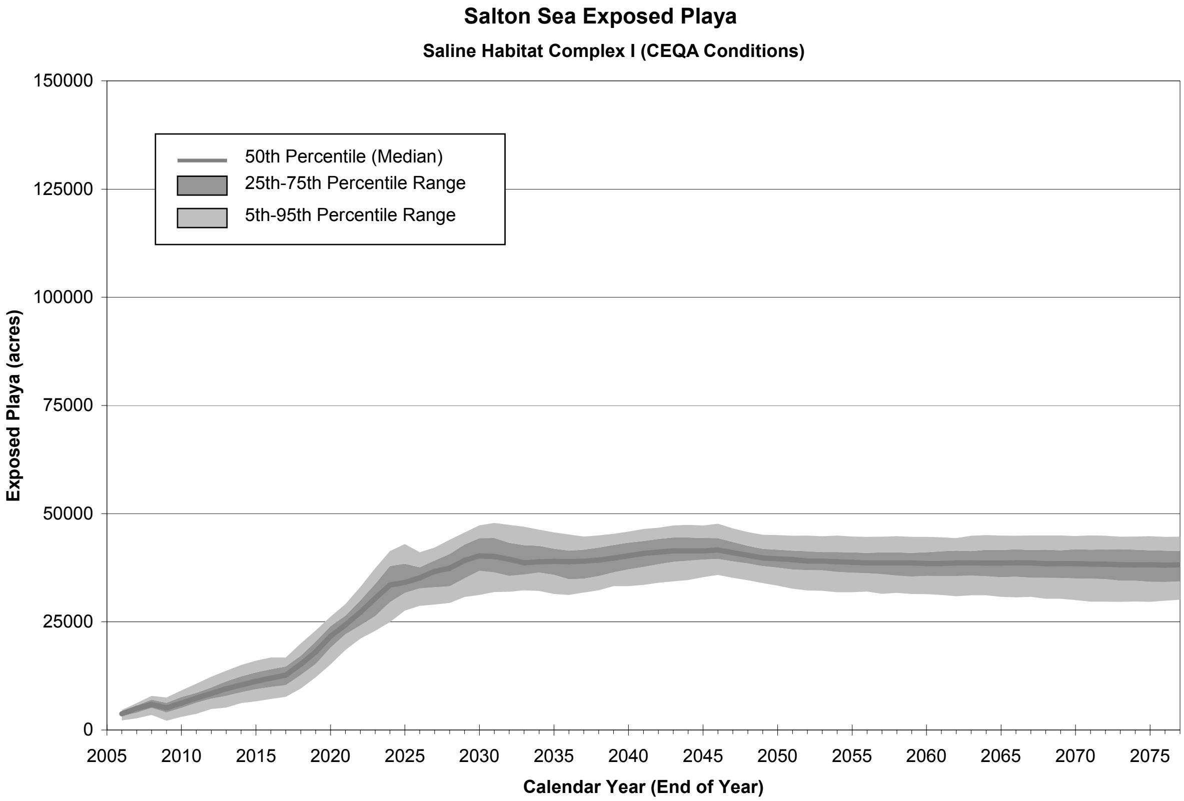

Brine Salinity
Saline Habitat Complex I (Variability Conditions)
Total Dissolved Solids (mg/l)
Calendar Year (End of Year)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range
Trace 550 (~600 kaf/yr)
Trace 821 (~900 kaf/yr)
Trace 420 (~800 kaf/yr)
Trace 295 (~700 kaf/yr)
350000
300000
250000
200000
150000
100000
50000
0
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075

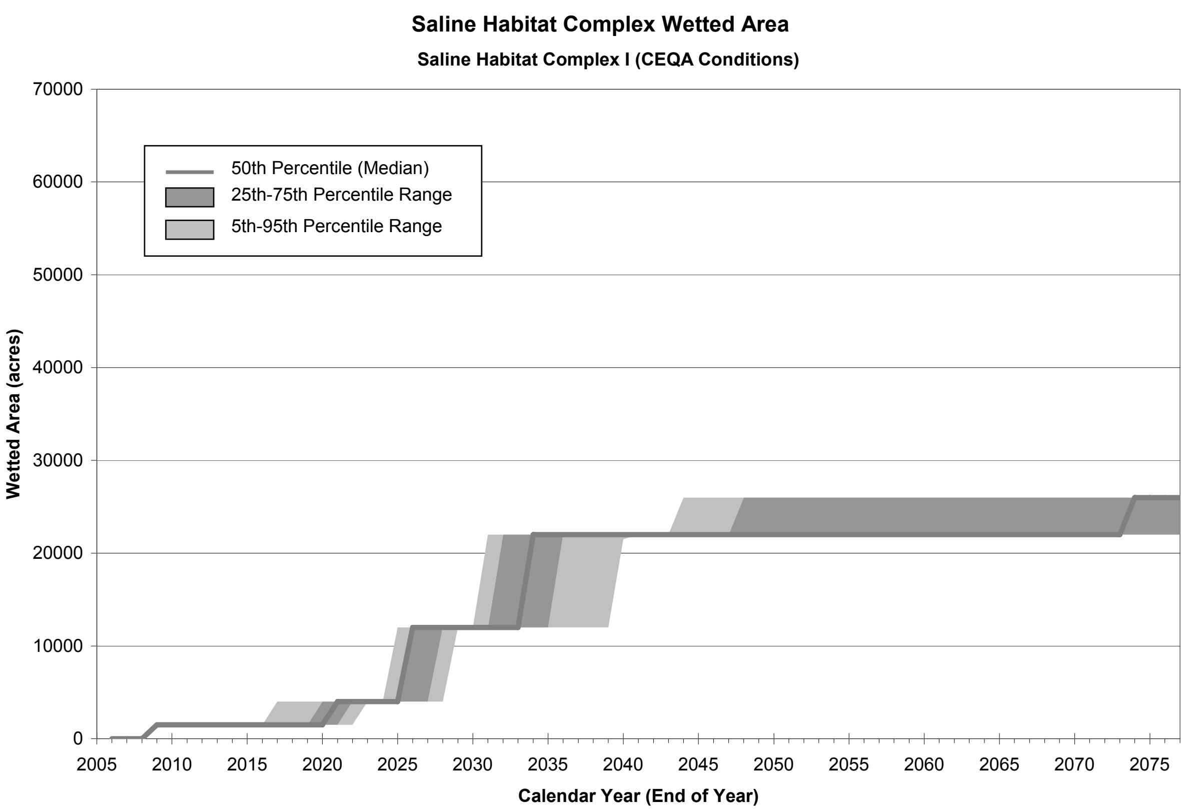

Salton Sea Exposed Playa
Saline Habitat Complex I (Variability Conditions)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range
Trace 550 (~600 kaf/yr)
Trace 295 (~700 kaf/yr)
Trace 420 (~800 kaf/yr)
Trace 821 (~900 kaf/yr)
Exposed Playa (acres)
150000
125000
100000
75000
50000
25000
0
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075
Calendar Year (End of Year)


Saline Habitat Complex Wetted Area
Saline Habitat Complex I (Variability Conditions)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range
Trace 550 (~600 kaf/yr)
Trace 821 (~900 kaf/yr)
Trace 295 (~700 kaf/yr)
Trace 420 (~800 kaf/yr)
Wetted Area (acres)
70000
60000
50000
40000
30000
20000
10000
0
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075
Calendar Year (End of Year)


Brine Water Surface Elevation
Saline Habitat Complex I (CEQA Conditions)
Water Surface Elevation (ft amsl)
-220
-225
-230
-235
-240
-245
-250
-255
-260
-265
-270
-275
-280
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075
Calendar Year (End of Year)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range

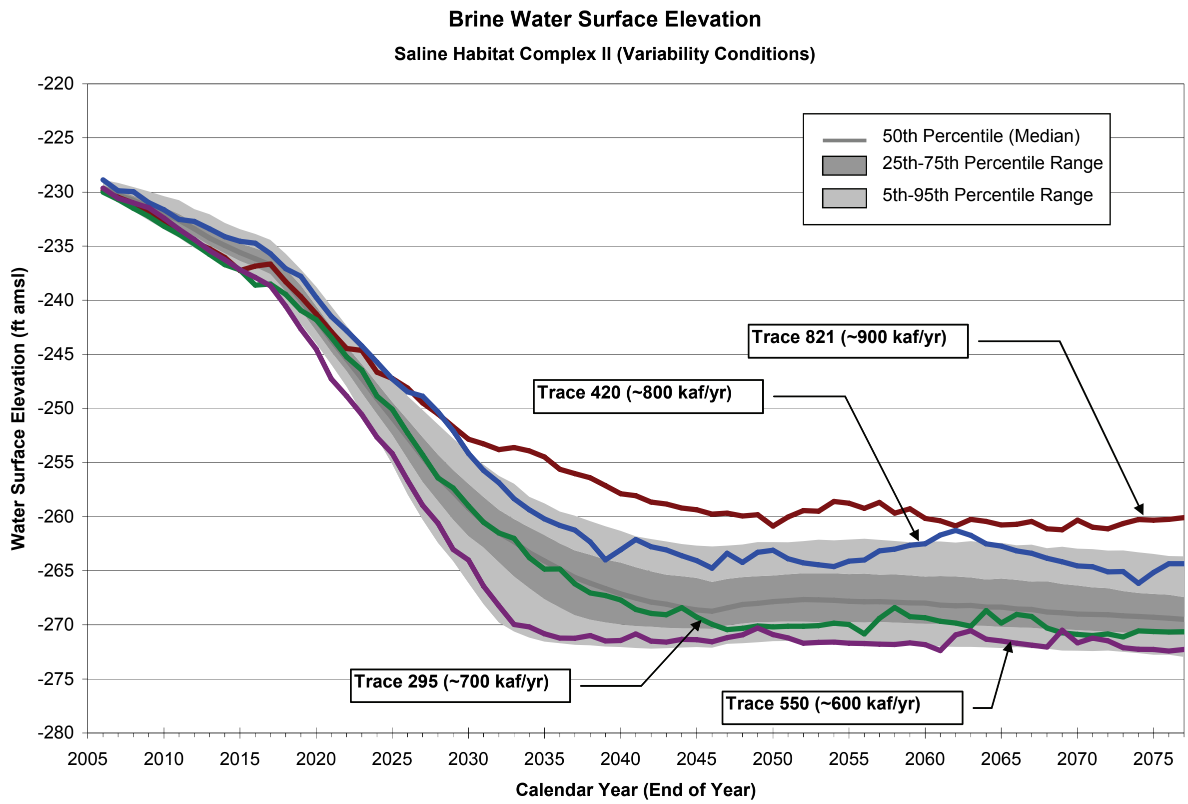

Brine Salinity
Saline Habitat Complex I (CEQA Conditions)
Total Dissolved Solids (mg/l)
350000
300000
250000
200000
150000
100000
50000
0
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075
Calendar Year (End of Year)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range

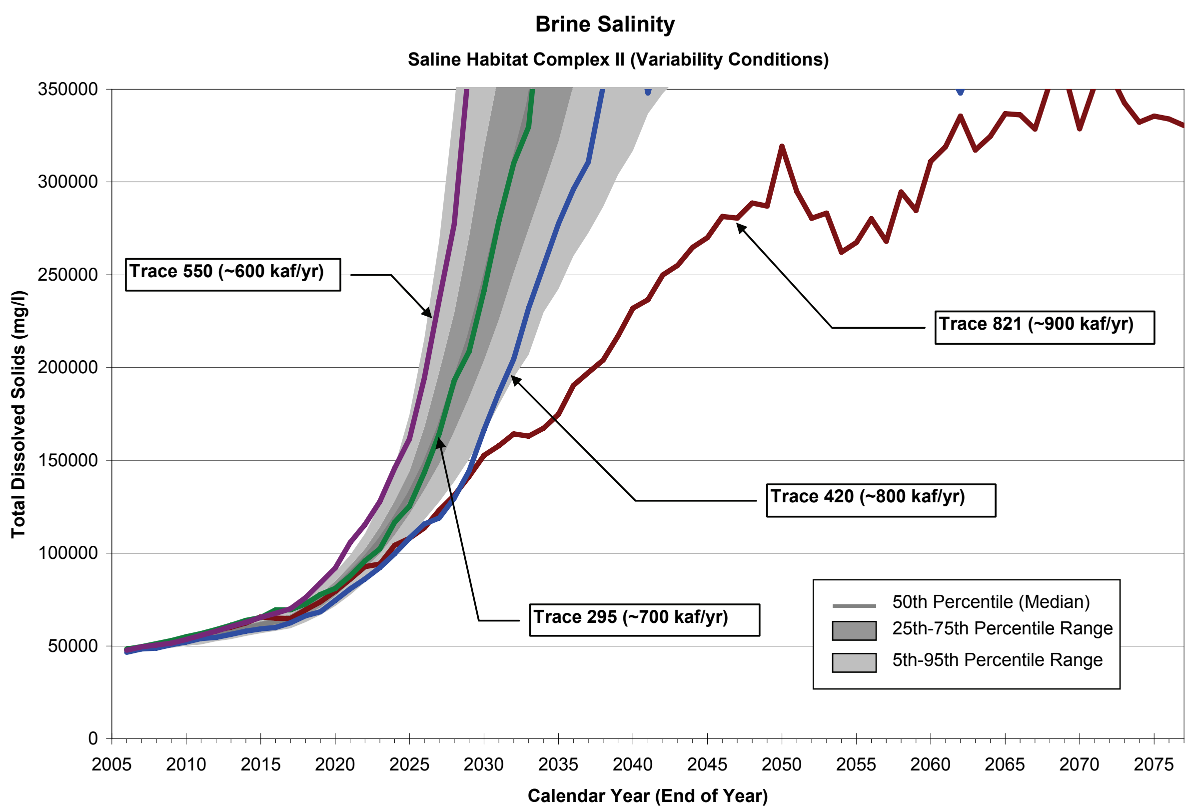

Salton Sea Exposed Playa
Saline Habitat Complex I (CEQA Conditions)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range
Exposed Playa (acres)
Calendar Year (End of Year)
150000
125000
100000
75000
50000
25000
0
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075

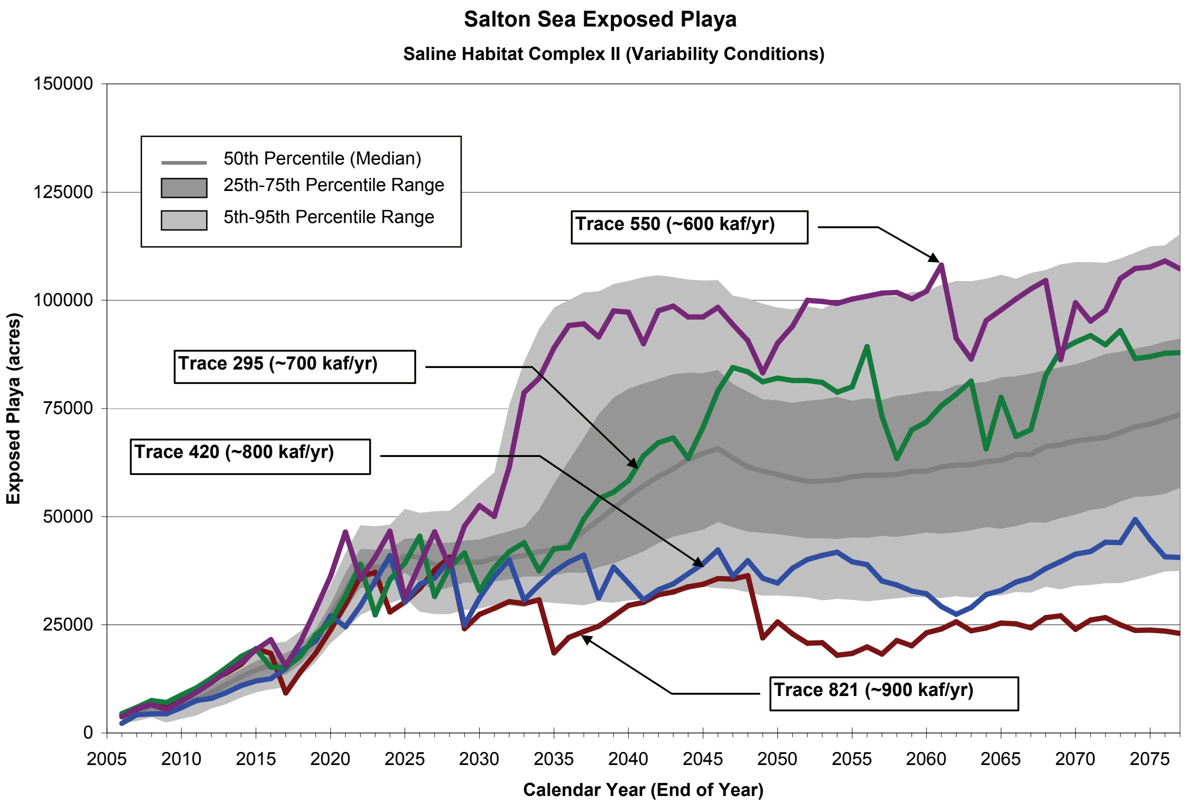

Saline Habitat Complex Wetted Area
Saline Habitat Complex I (CEQA Conditions)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range
Wetted Area (acres)
Calendar Year (End of Year)
70000
60000
50000
40000
30000
20000
10000
0
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075

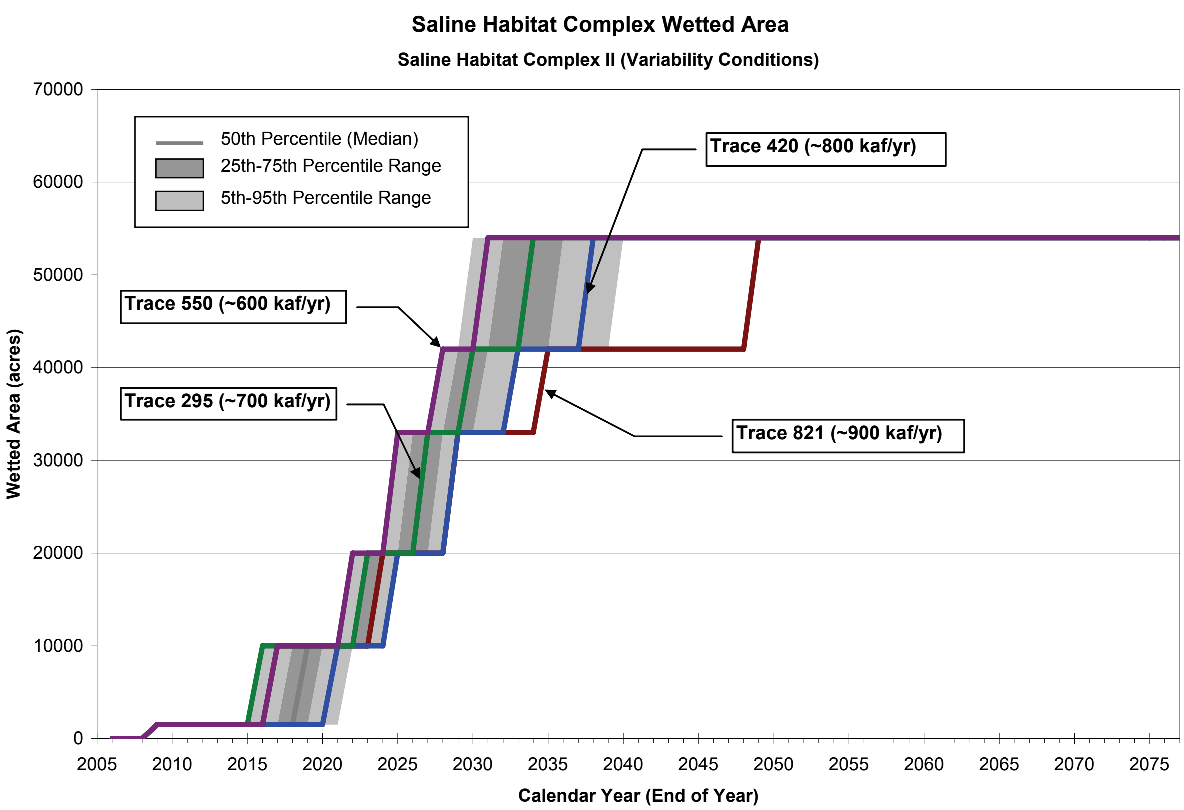
ALTERNATIVE 2 – SALINE HABITAT COMPLEX II

SALSA Modeling Results
(Figures H2-2-7a through H2-2-7h)


Brine Water Surface Elevation
Saline Habitat Complex II (Variability Conditions)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range
Trace 821 (~900 kaf/yr)
Trace 420 (~800 kaf/yr)
Trace 295 (~700 kaf/yr)
Trace 550 (~600 kaf/yr)
Water Surface Elevation (ft amsl)
-220
-225
-230
-235
-240
-245
-250
-255
-260
-265
-270
-275
-280
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075
Calendar Year (End of Year)

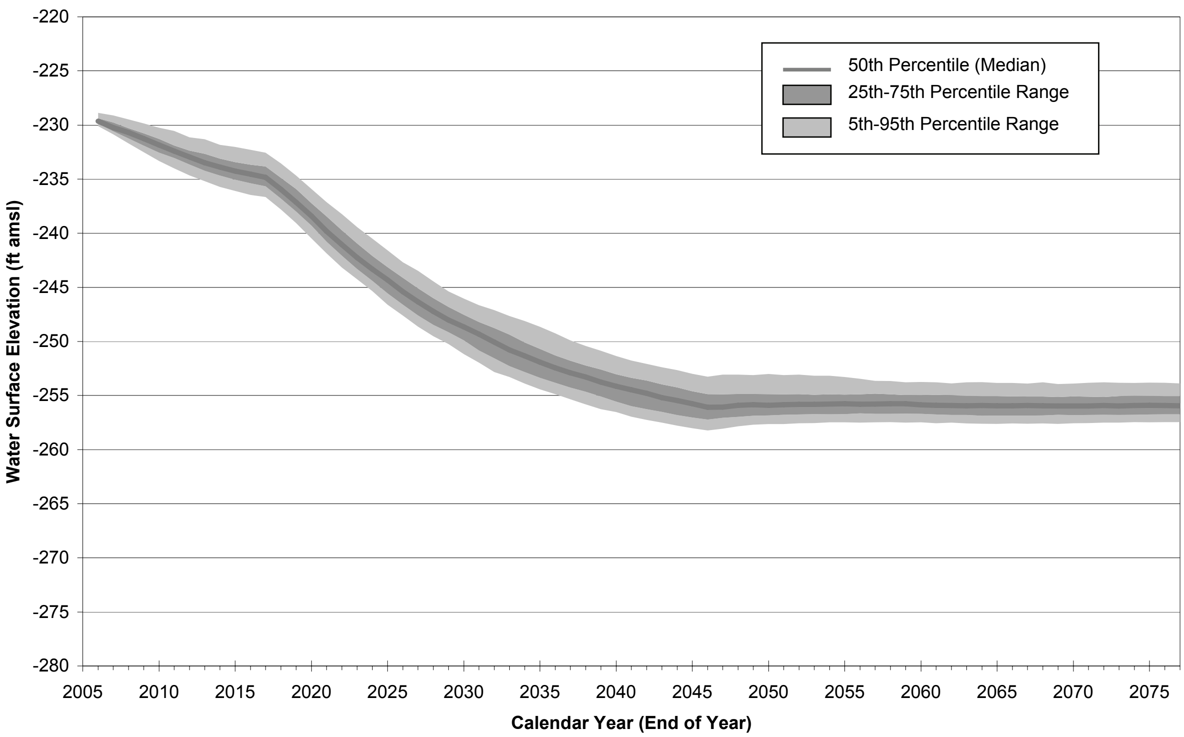

Brine Salinity
Saline Habitat Complex II (Variability Conditions)
Trace 550 (~600 kaf/yr)
Trace 821 (~900 kaf/yr)
Trace 420 (~800 kaf/yr)
Trace 295 (~700 kaf/yr)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range
Total Dissolved Solids (mg/l)
350000
300000
250000
200000
150000
100000
50000
0
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075
Calendar Year (End of Year)


Salton Sea Exposed Playa
Saline Habitat Complex II (Variability Conditions)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range
Trace 550 (~600 kaf/yr)
Trace 295 (~700 kaf/yr)
Trace 420 (~800 kaf/yr)
Trace 821 (~900 kaf/yr)
Exposed Playa (acres)
150000
125000
100000
75000
50000
25000
0
2005 2010 2015 2020 2025 2030 2035 2040 2045 2050 2055 2060 2065 2070 2075
Calendar Year (End of Year)


Saline Habitat Complex Wetted Area
Saline Habitat Complex II (Variability Conditions)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range
Trace 420 (~800 kaf/yr)
Trace 550 (~600 kaf/yr)
Trace 295 (~700 kaf/yr)
Trace 821 (~900 kaf/yr)
Wetted Area (acres)
70000
60000
50000
40000
30000
20000
10000
0
2005 2010 2015 2020 2025 2030 2035 2040 2045 2050 2055 2060 2065 2070 2075
Calendar Year (End of Year)

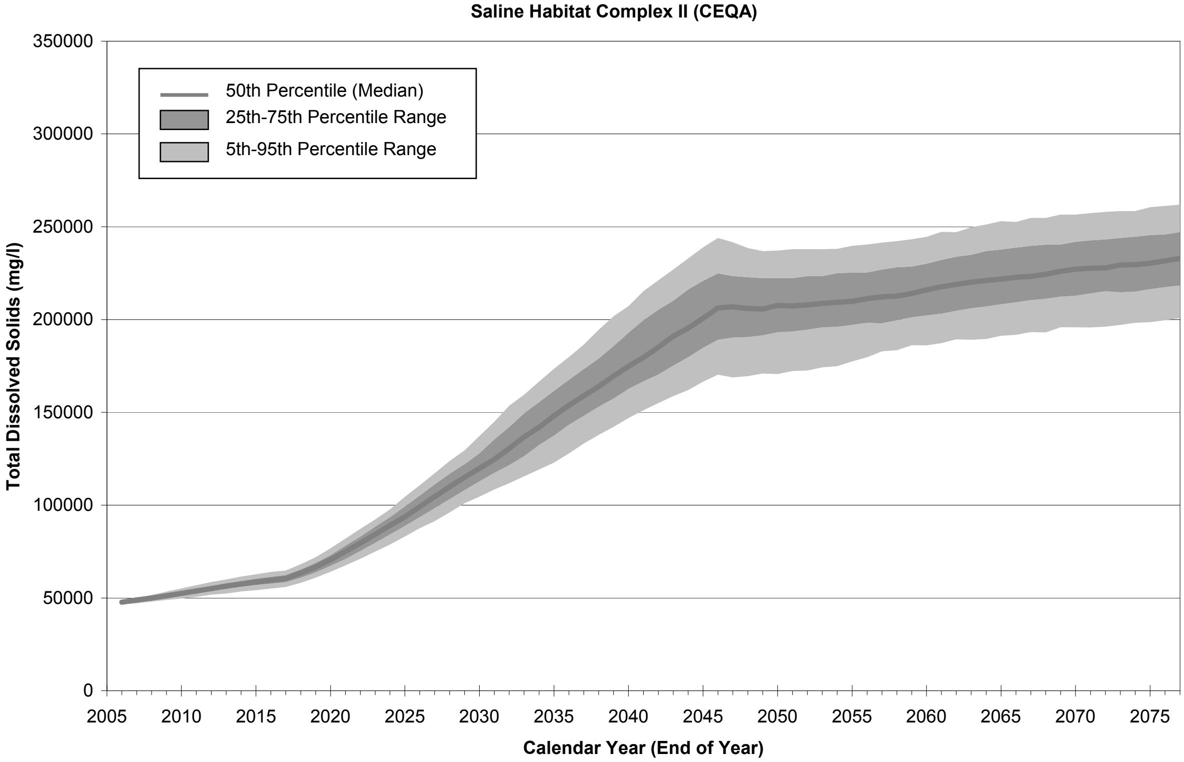
Brine Water Surface Elevation

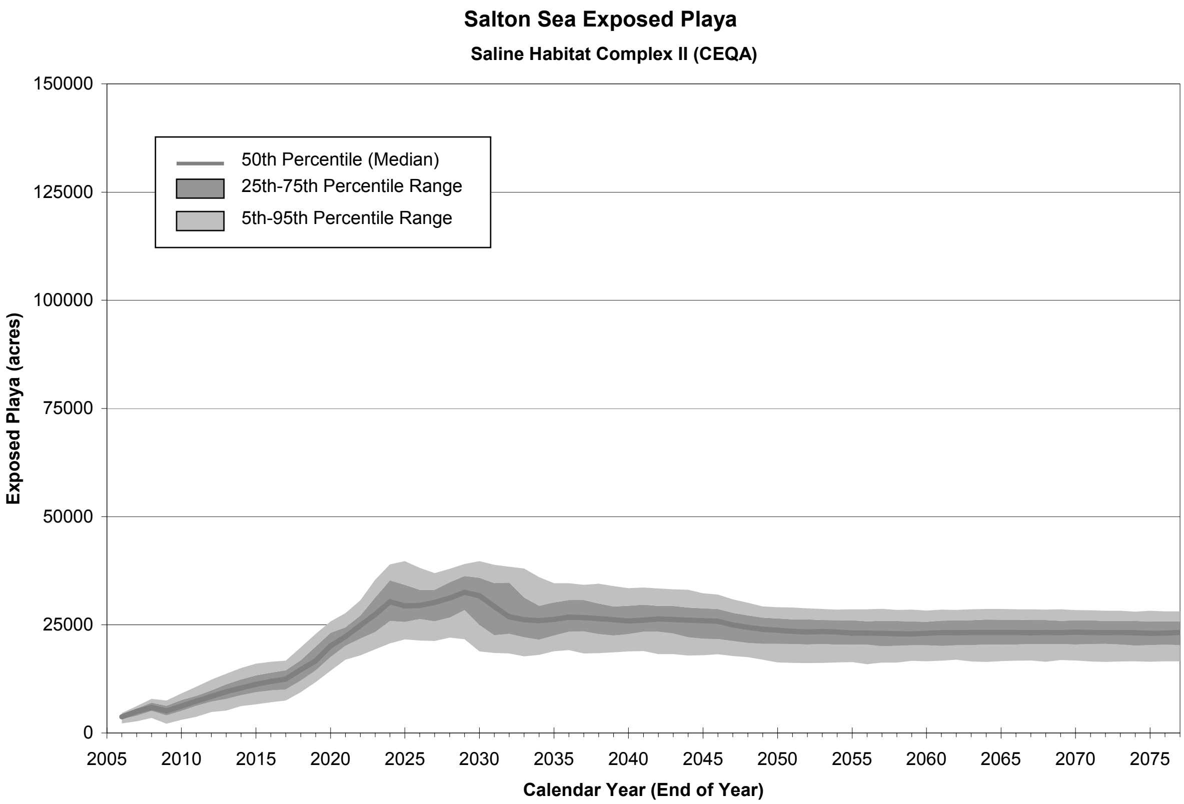
Saline Habitat Complex II (CEQA)

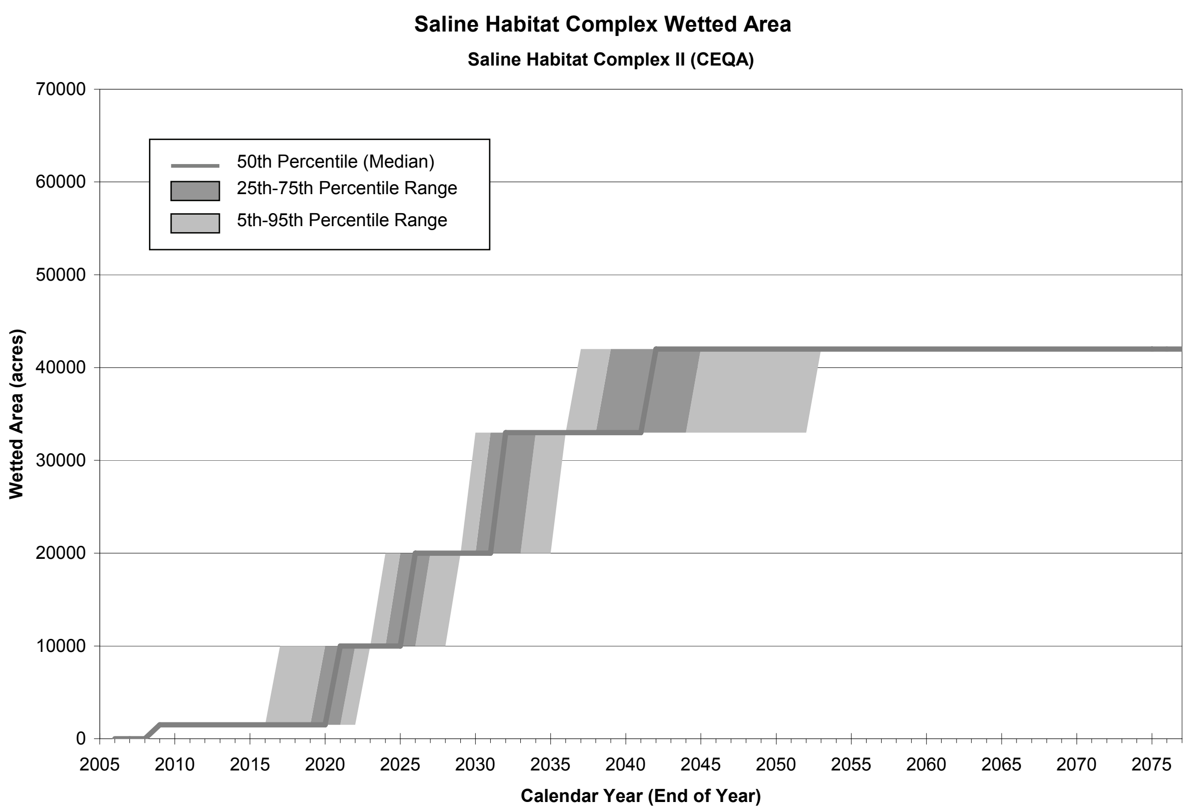


Brine Salinity

Saline Habitat Complex II (CEQA)

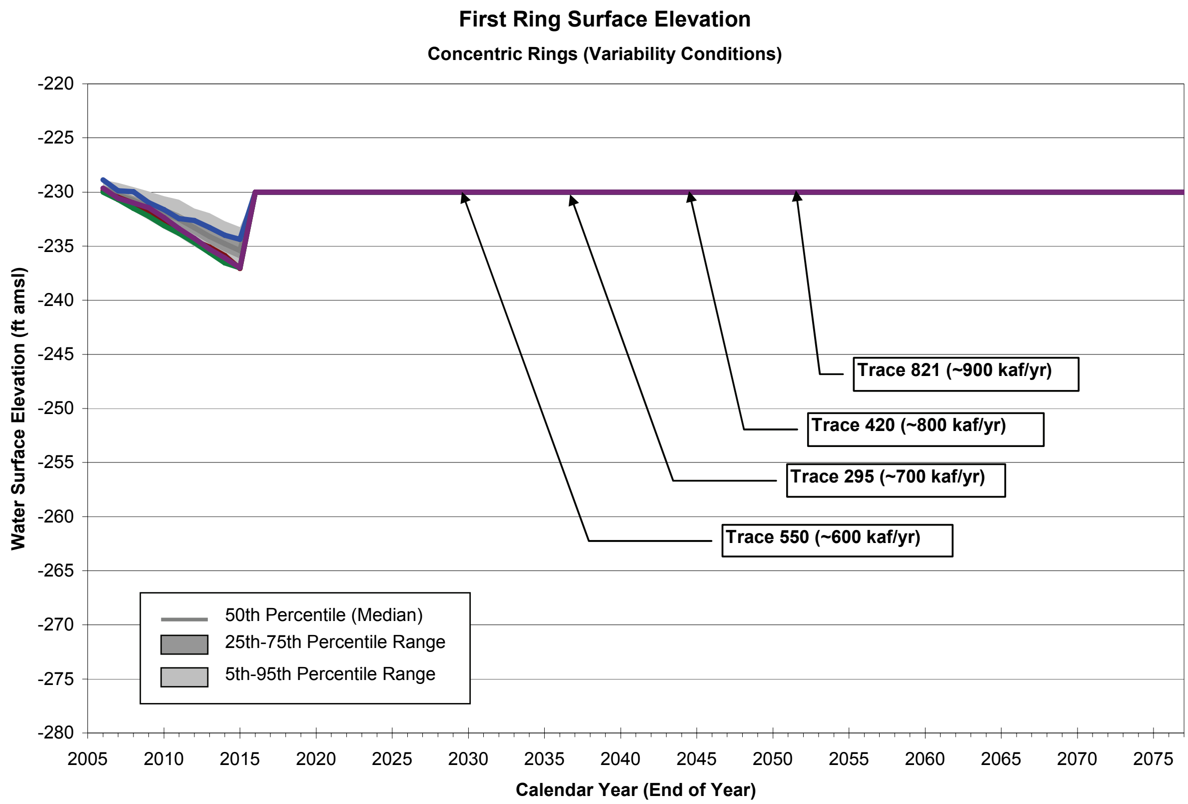


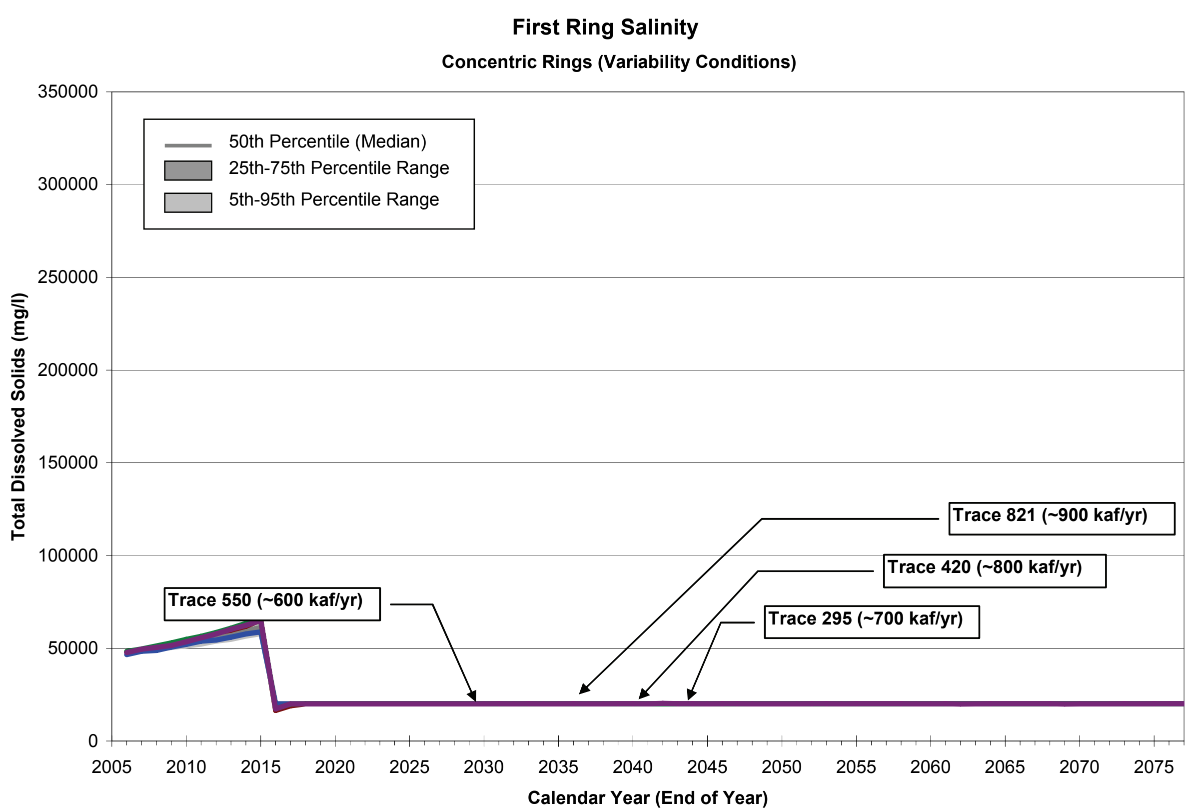

Salton Sea Exposed Playa
Saline Habitat Complex II (CEQA)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range
Exposed Playa (acres)
150000
125000
100000
75000
50000
25000
0
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075
Calendar Year (End of Year)

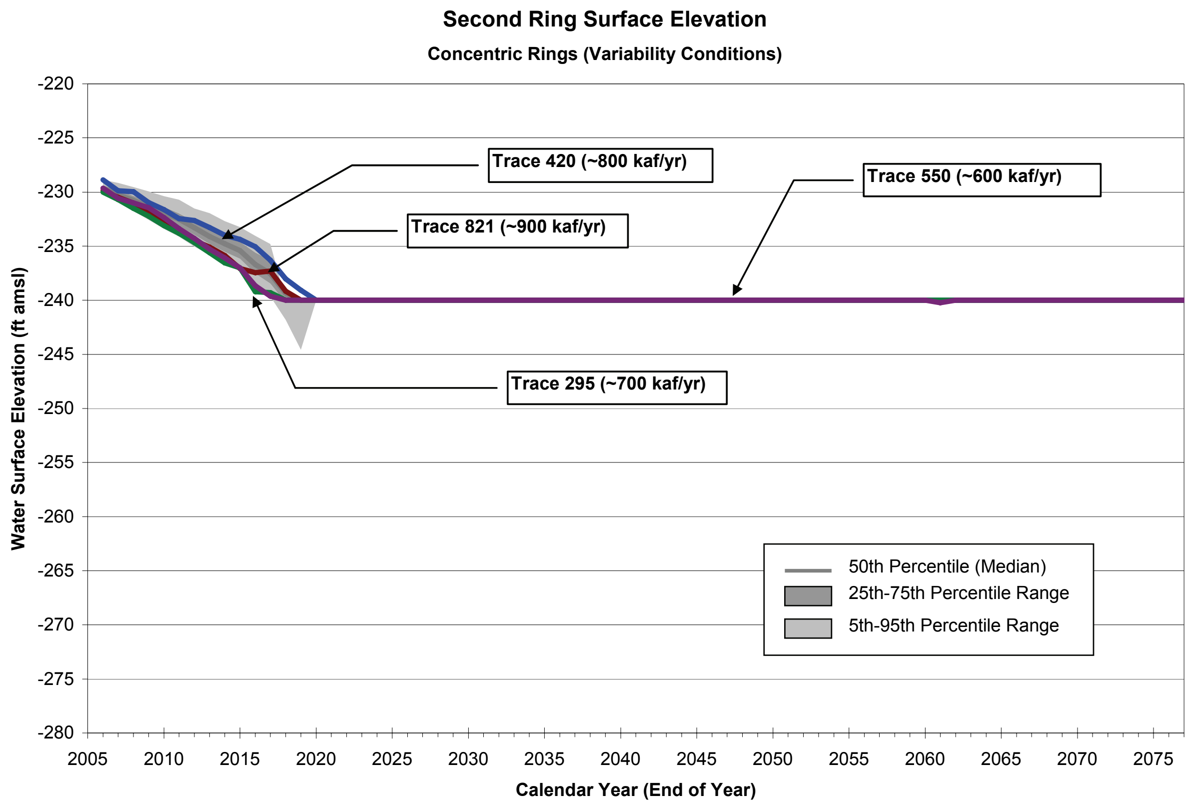

Saline Habitat Complex Wetted Area
Saline Habitat Complex II (CEQA)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range
Wetted Area (acres)
70000
60000
50000
40000
30000
20000
10000
0
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075
Calendar Year (End of Year)

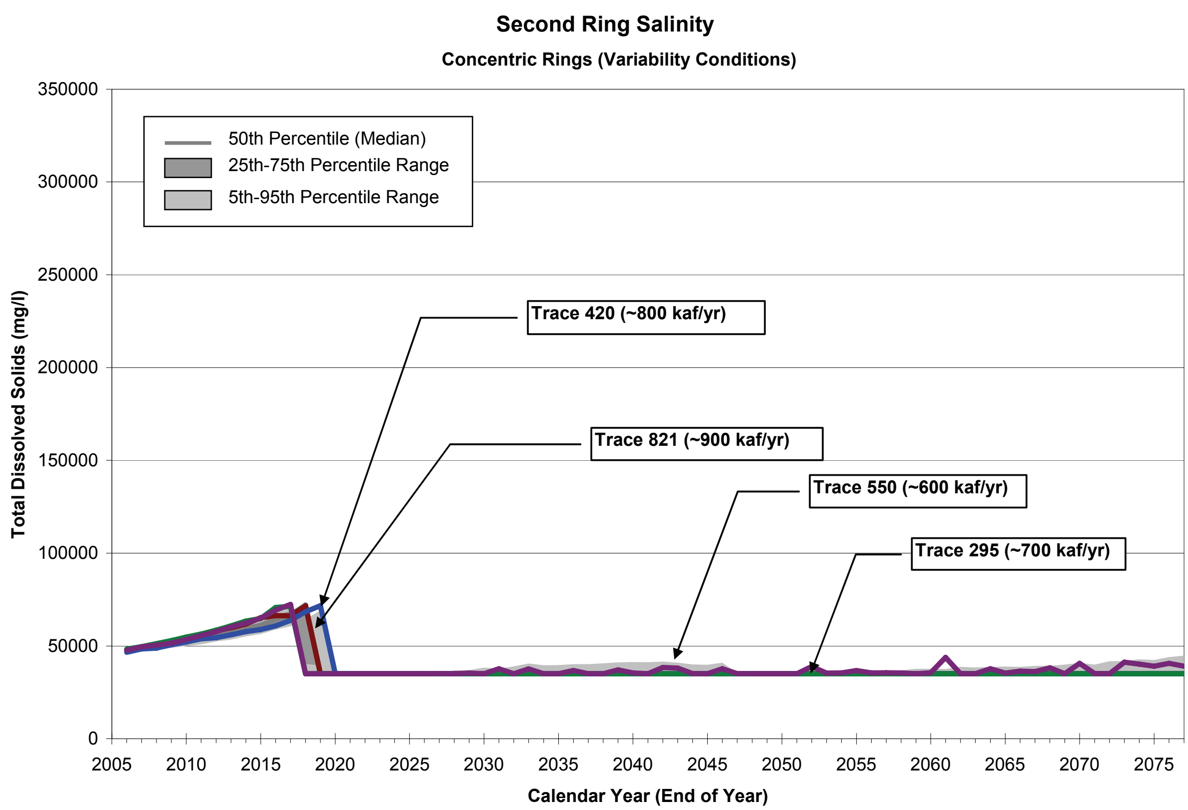
ALTERNATIVE 3 – CONCENTRIC RINGS

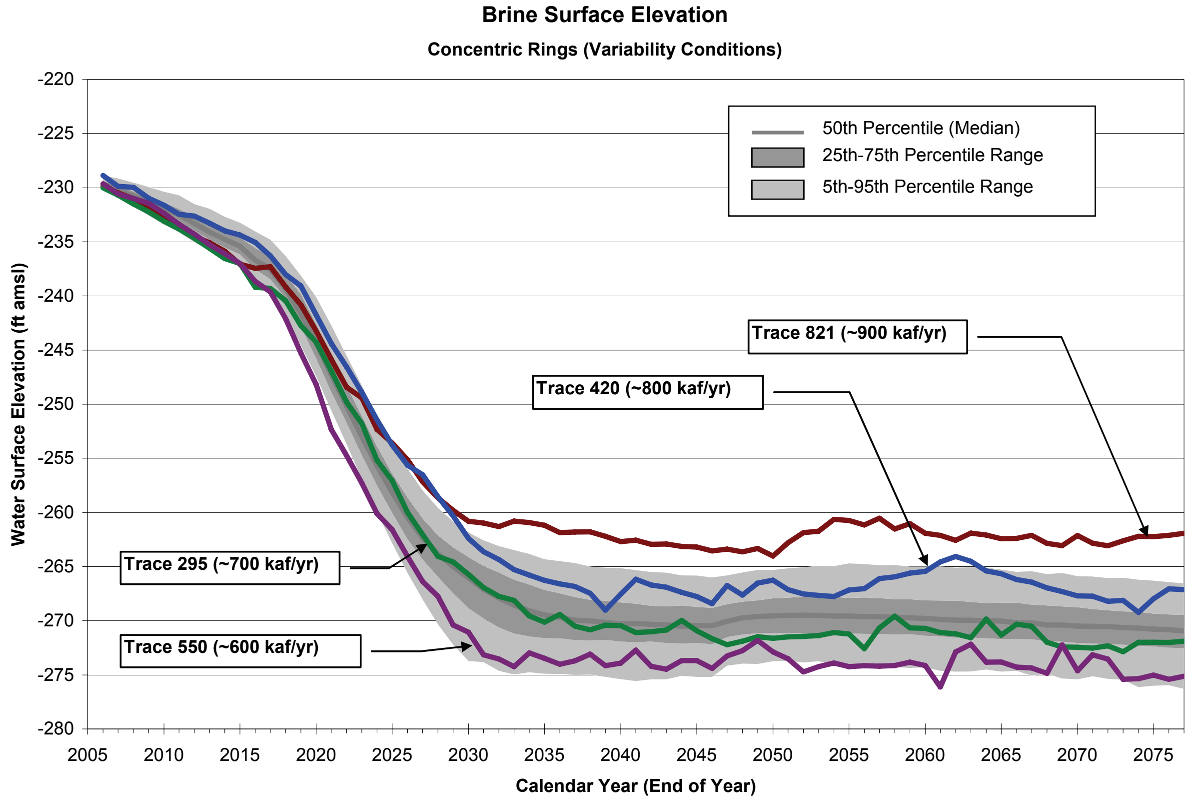
SALSA Modeling Results
(Figures H2-2-8a through H2-2-8o)

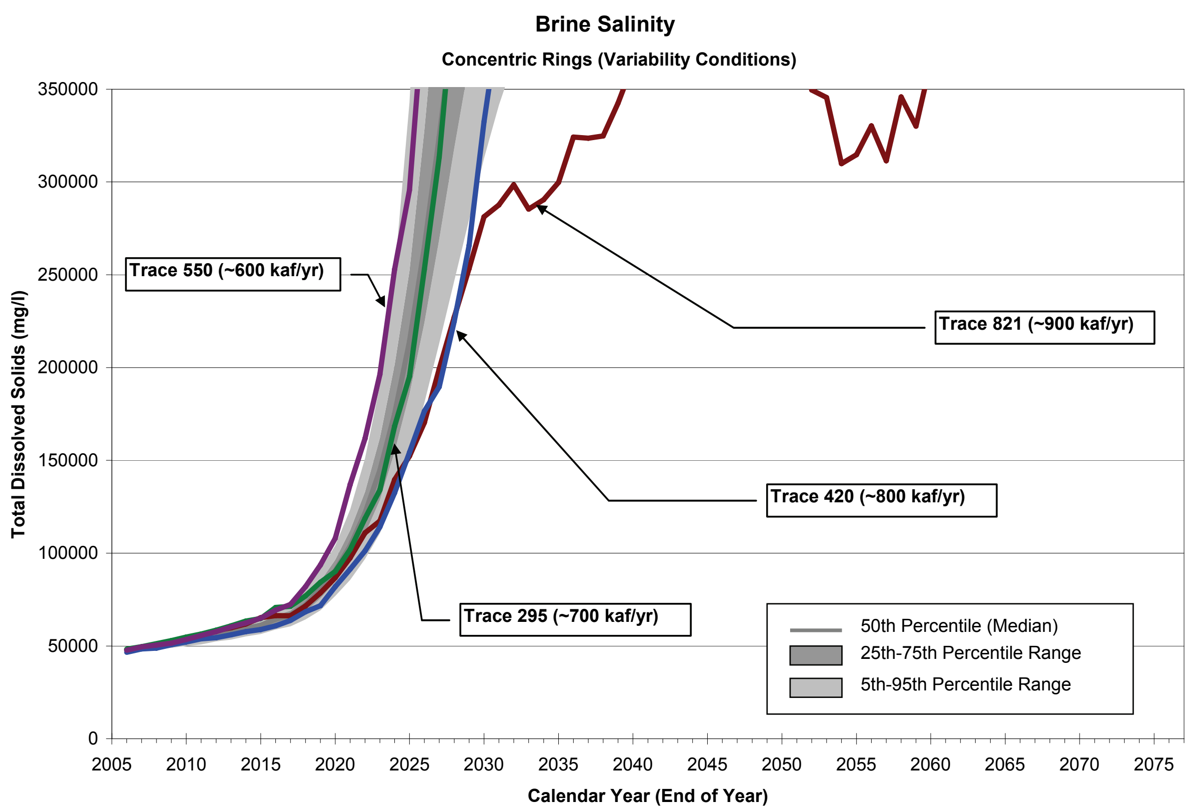

First Ring Surface Elevation
Concentric Rings (Variability Conditions)
Water Surface Elevation (ft amsl)
-220
-225
-230
-235
-240
-245
-250
-255
-260
-265
-270
-275
-280
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075
Calendar Year (End of Year)
Trace 821 (~900 kaf/yr)
Trace 420 (~800 kaf/yr)
Trace 295 (~700 kaf/yr)
Trace 550 (~600 kaf/yr)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range

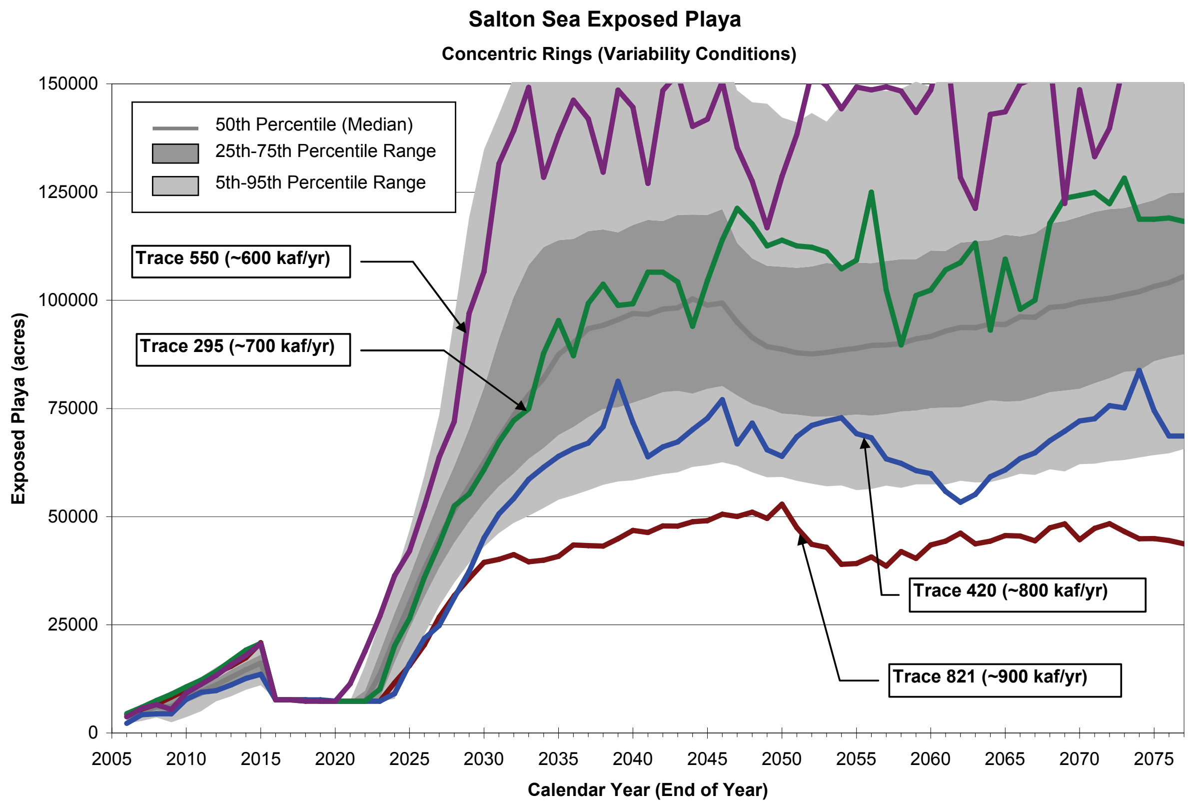

First Ring Salinity
Concentric Rings (Variability Conditions)
Total Dissolved Solids (mg/l)
350000
300000
250000
200000
150000
100000
50000
0
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075
Calendar Year (End of Year)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range
Trace 821 (~900 kaf/yr)
Trace 420 (~800 kaf/yr)
Trace 295 (~700 kaf/yr)
Trace 550 (~600 kaf/yr)

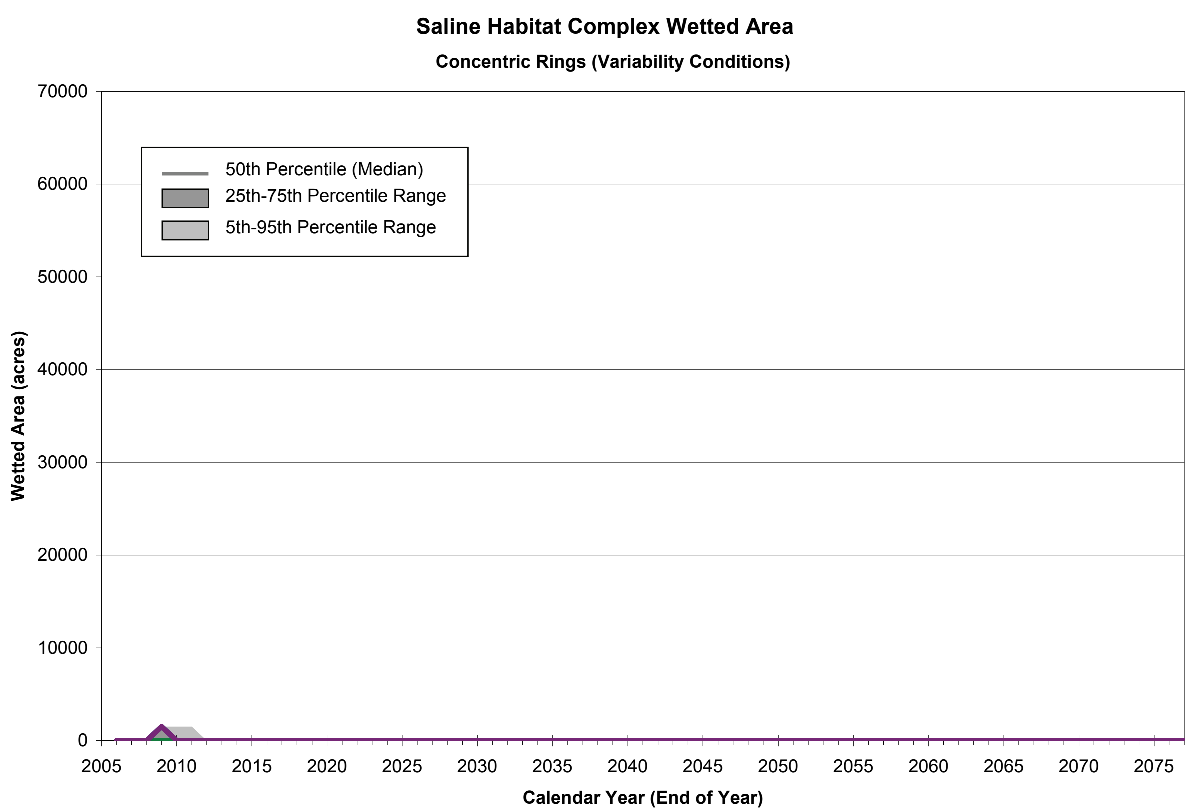

Second Ring Surface Elevation
Concentric Rings (Variability Conditions)
Water Surface Elevation (ft amsl)
-220
-225
-230
-235
-240
-245
-250
-255
-260
-265
-270
-275
-280
Trace 420 (~800 kaf/yr)
Trace 550 (~600 kaf/yr)
Trace 821 (~900 kaf/yr)
Trace 295 (~700 kaf/yr)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075
Calendar Year (End of Year)

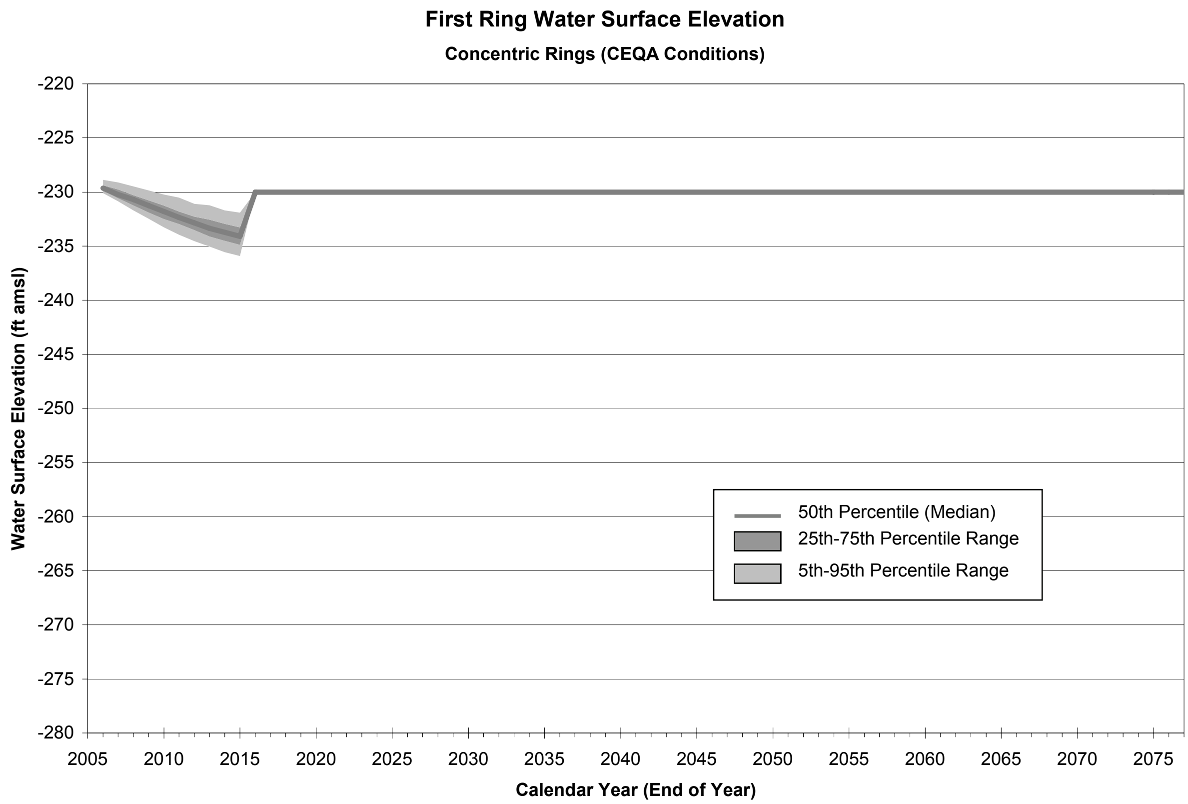

Second Ring Salinity
Concentric Rings (Variability Conditions)
Total Dissolved Solids (mg/l)
350000
300000
250000
200000
150000
100000
50000
0
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range
Trace 420 (~800 kaf/yr)
Trace 821 (~900 kaf/yr)
Trace 550 (~600 kaf/yr)
Trace 295 (~700 kaf/yr)
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075
Calendar Year (End of Year)

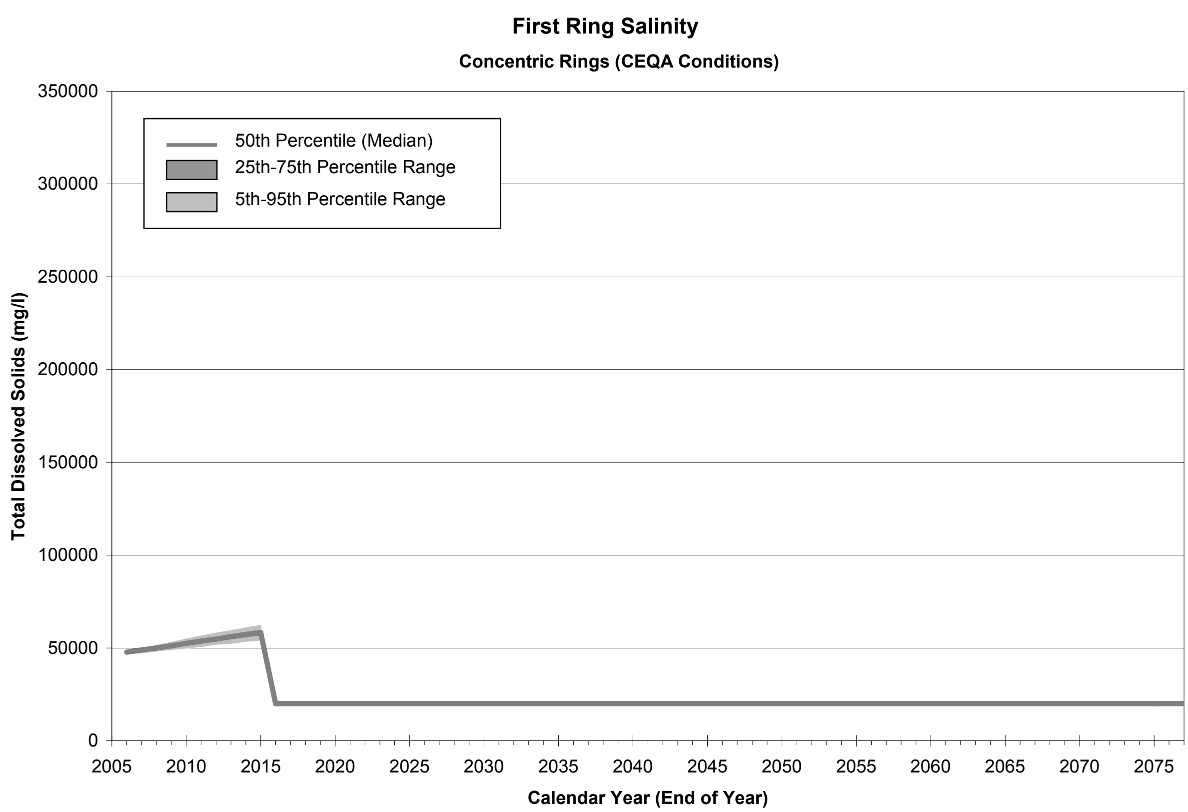

Brine Surface Elevation
Concentric Rings (Variability Conditions)
Water Surface Elevation (ft amsl)
-220
-225
-230
-235
-240
-245
-250
-255
-260
-265
-270
-275
-280
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075
Calendar Year (End of Year)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range
Trace 821 (~900 kaf/yr)
Trace 420 (~800 kaf/yr)
Trace 295 (~700 kaf/yr)
Trace 550 (~600 kaf/yr)

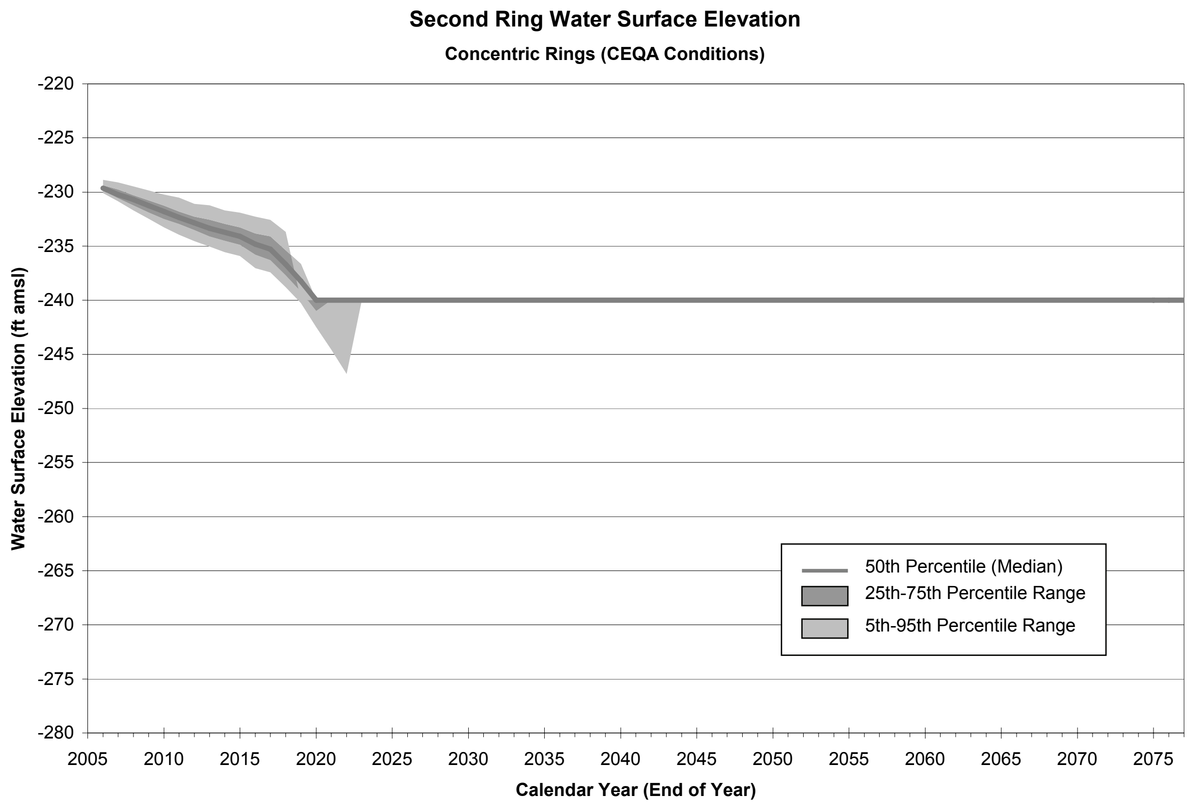

Brine Salinity
Concentric Rings (Variability Conditions)
Total Dissolved Solids (mg/l)
350000
300000
250000
200000
150000
100000
50000
0
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075
Calendar Year (End of Year)
Trace 550 (~600 kaf/yr)
Trace 821 (~900 kaf/yr)
Trace 420 (~800 kaf/yr)
Trace 295 (~700 kaf/yr)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range

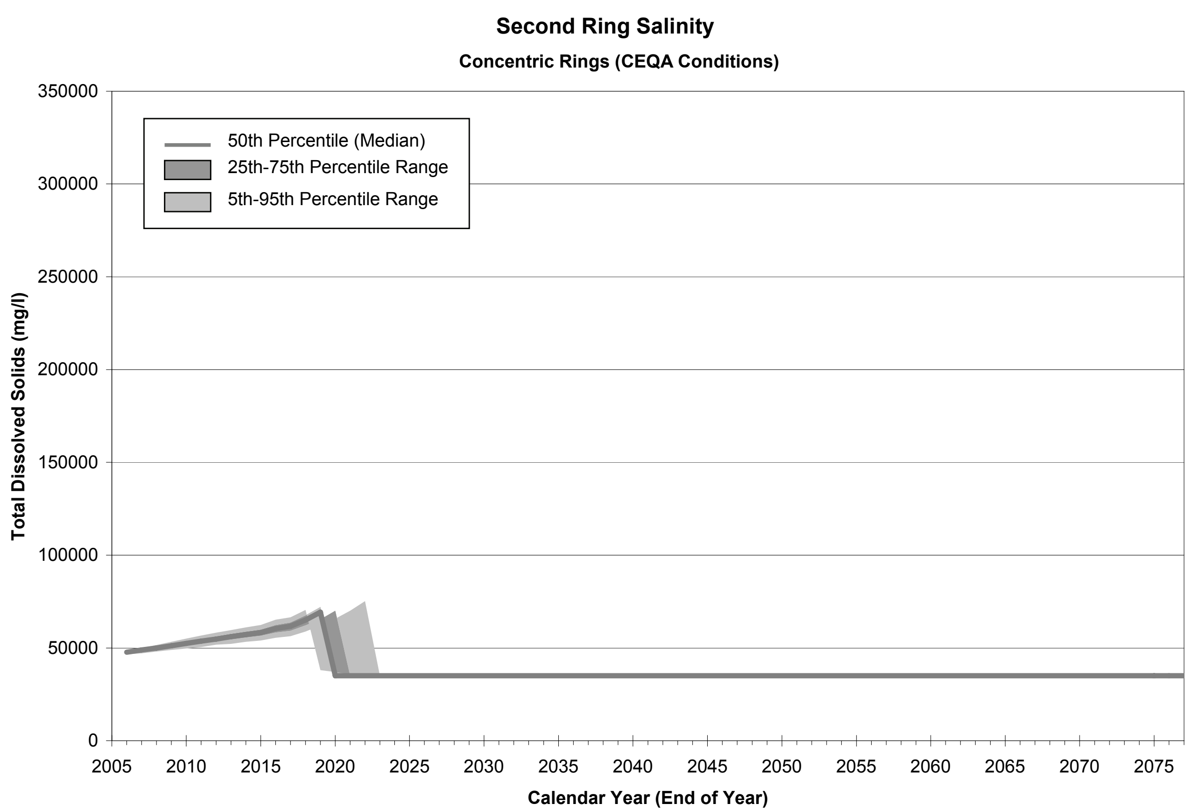

Salton Sea Exposed Playa
Concentric Rings (Variability Conditions)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range
Trace 550 (~600 kaf/yr)
Trace 295 (~700 kaf/yr)
Trace 420 (~800 kaf/yr)
Trace 821 (~900 kaf/yr)
Exposed Playa (acres)
150000
125000
100000
75000
50000
25000
0
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075
Calendar Year (End of Year)

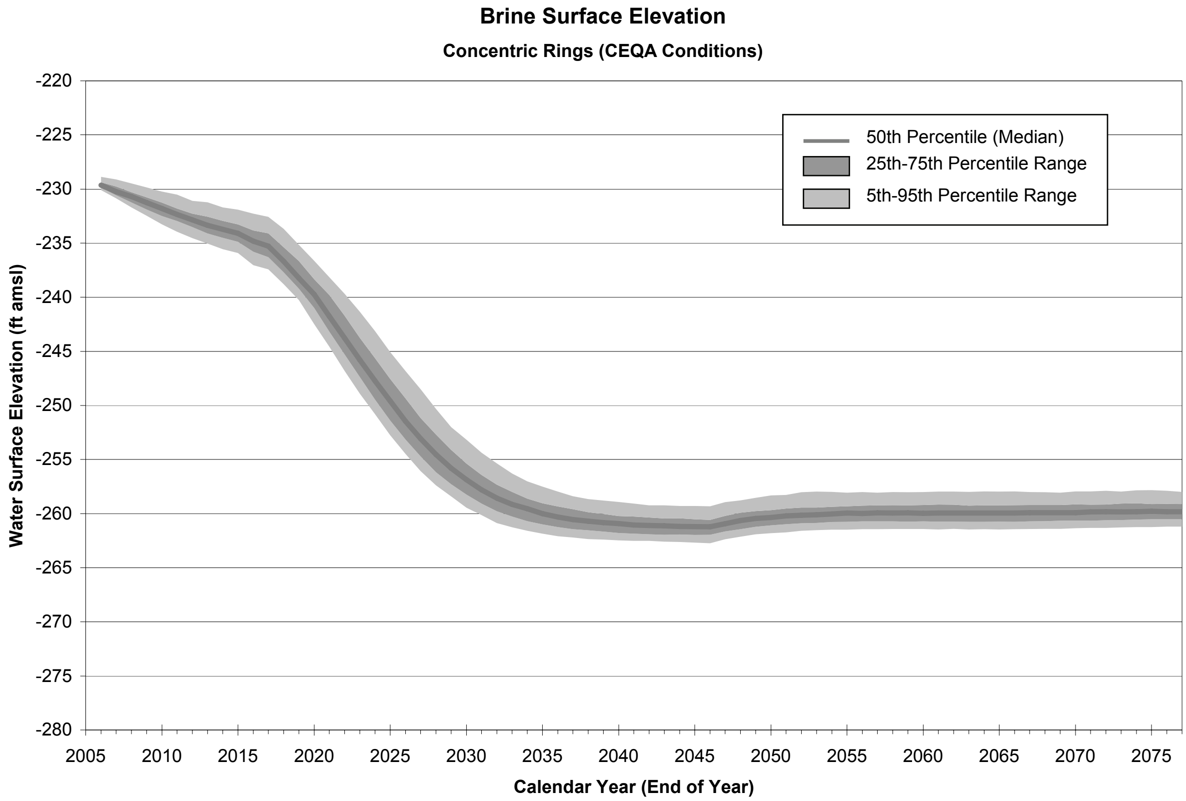

Saline Habitat Complex Wetted Area
Concentric Rings (Variability Conditions)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range
Wetted Area (acres)
70000
60000
50000
40000
30000
20000
10000
0
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075
Calendar Year (End of Year)

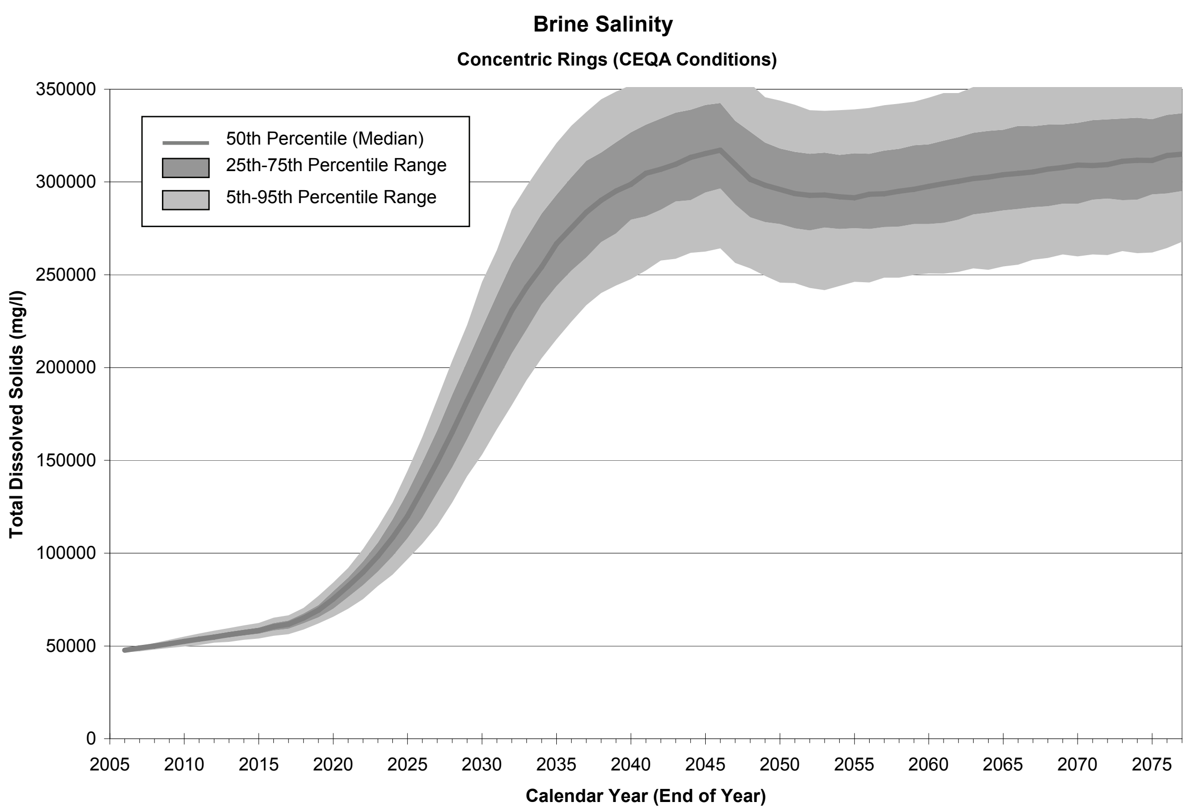

First Ring Water Surface Elevation
Concentric Rings (CEQA Conditions)
Water Surface Elevation (ft amsl)
-220
-225
-230
-235
-240
-245
-250
-255
-260
-265
-270
-275
-280
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075
Calendar Year (End of Year)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range

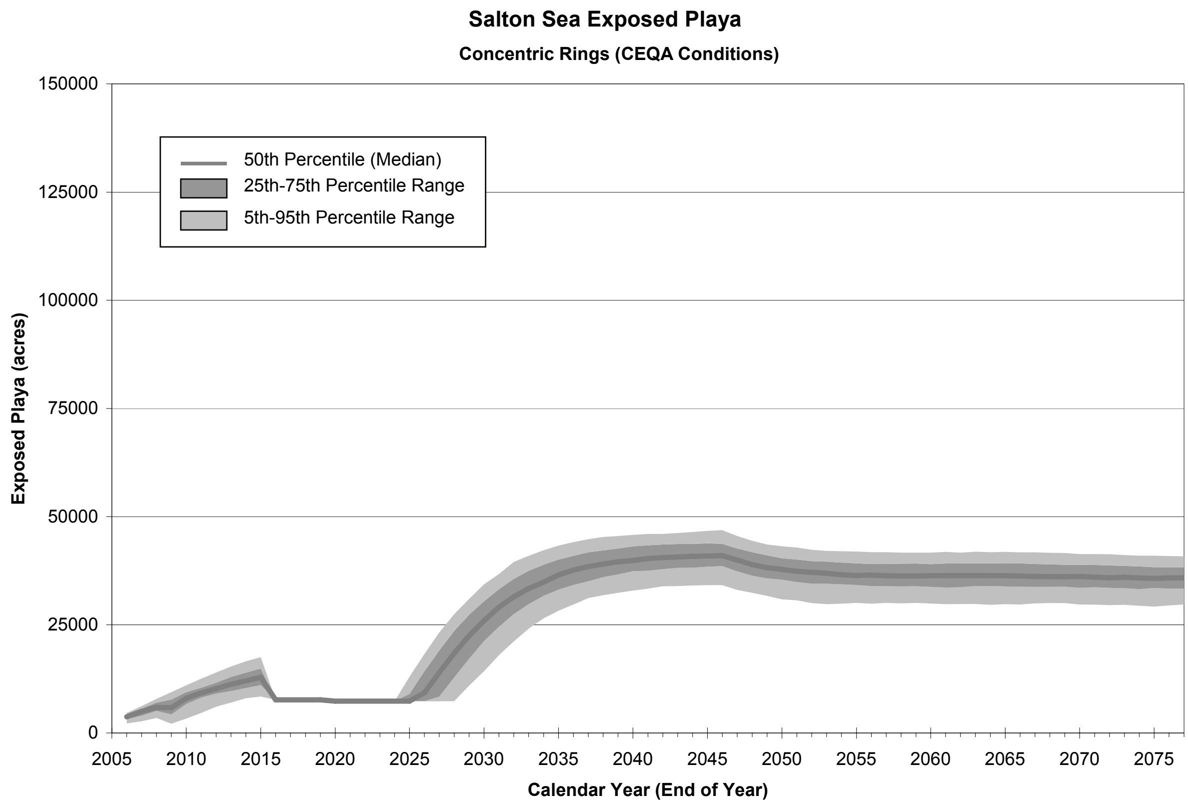

First Ring Salinity
Concentric Rings (CEQA Conditions)
Total Dissolved Solids (mg/l)
350000
300000
250000
200000
150000
100000
50000
0
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075
Calendar Year (End of Year)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range


Second Ring Water Surface Elevation
Concentric Rings (CEQA Conditions)
Water Surface Elevation (ft amsl)
-220
-225
-230
-235
-240
-245
-250
-255
-260
-265
-270
-275
-280
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075
Calendar Year (End of Year)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range


Second Ring Salinity
Concentric Rings (CEQA Conditions)
Total Dissolved Solids (mg/l)
350000
300000
250000
200000
150000
100000
50000
0
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075
Calendar Year (End of Year)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range


Brine Surface Elevation
Concentric Rings (CEQA Conditions)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range
Water Surface Elevation (ft amsl)
-220
-225
-230
-235
-240
-245
-250
-255
-260
-265
-270
-275
-280
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075
Calendar Year (End of Year)

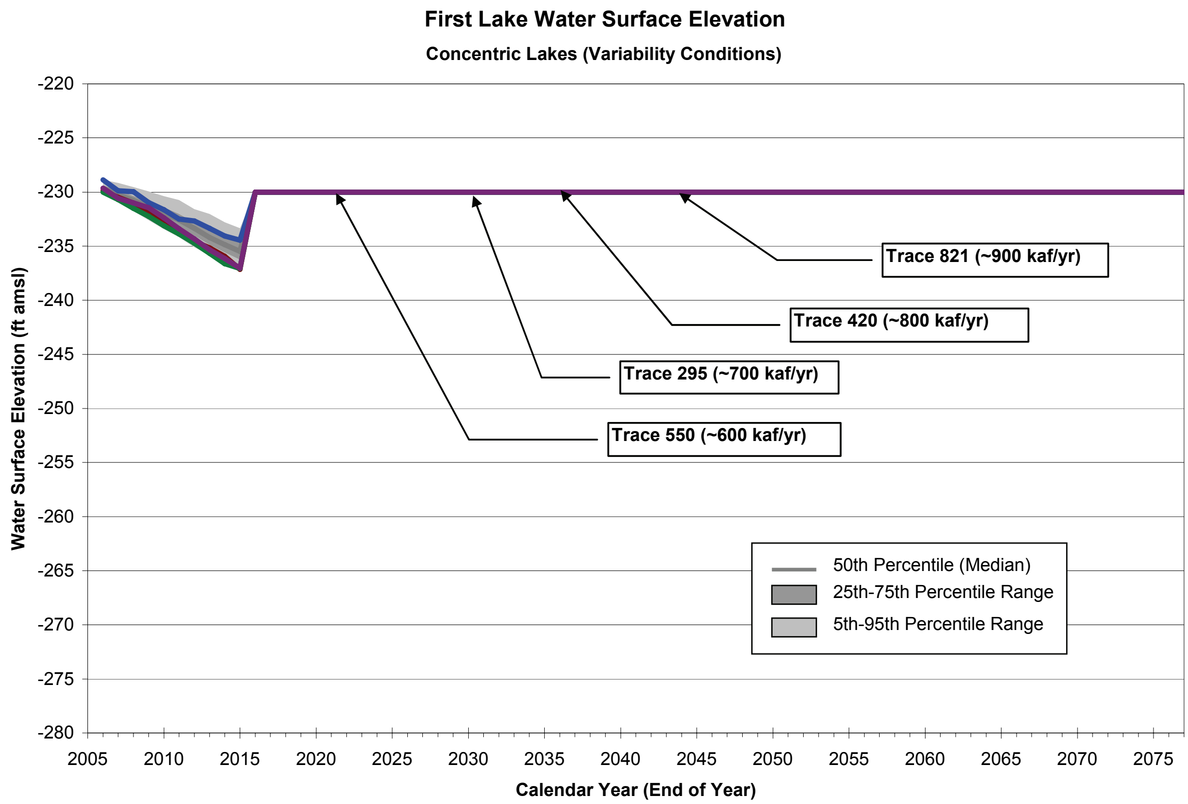

Brine Salinity
Concentric Rings (CEQA Conditions)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range
Total Dissolved Solids (mg/l)
350000
300000
250000
200000
150000
100000
50000
0
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075
Calendar Year (End of Year)

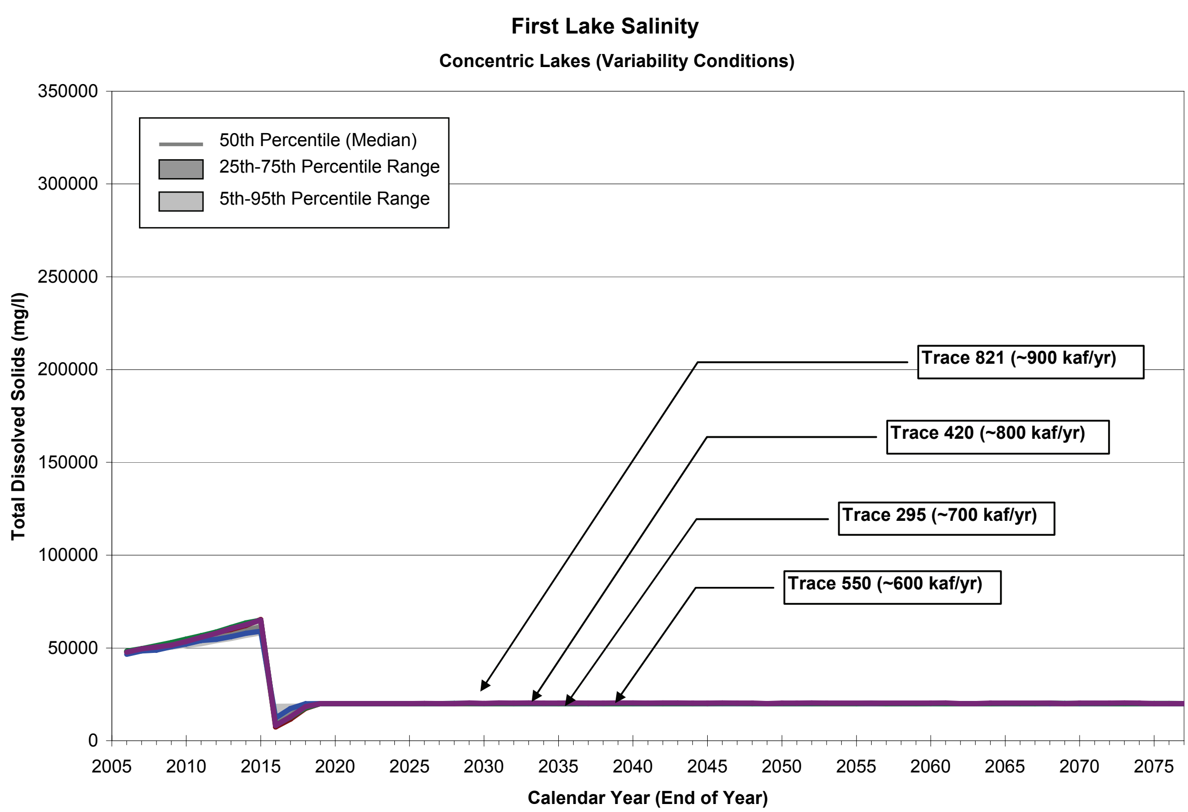

Salton Sea Exposed Playa
Concentric Rings (CEQA Conditions)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range
Exposed Playa (acres)
150000
125000
100000
75000
50000
25000
0
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075
Calendar Year (End of Year)

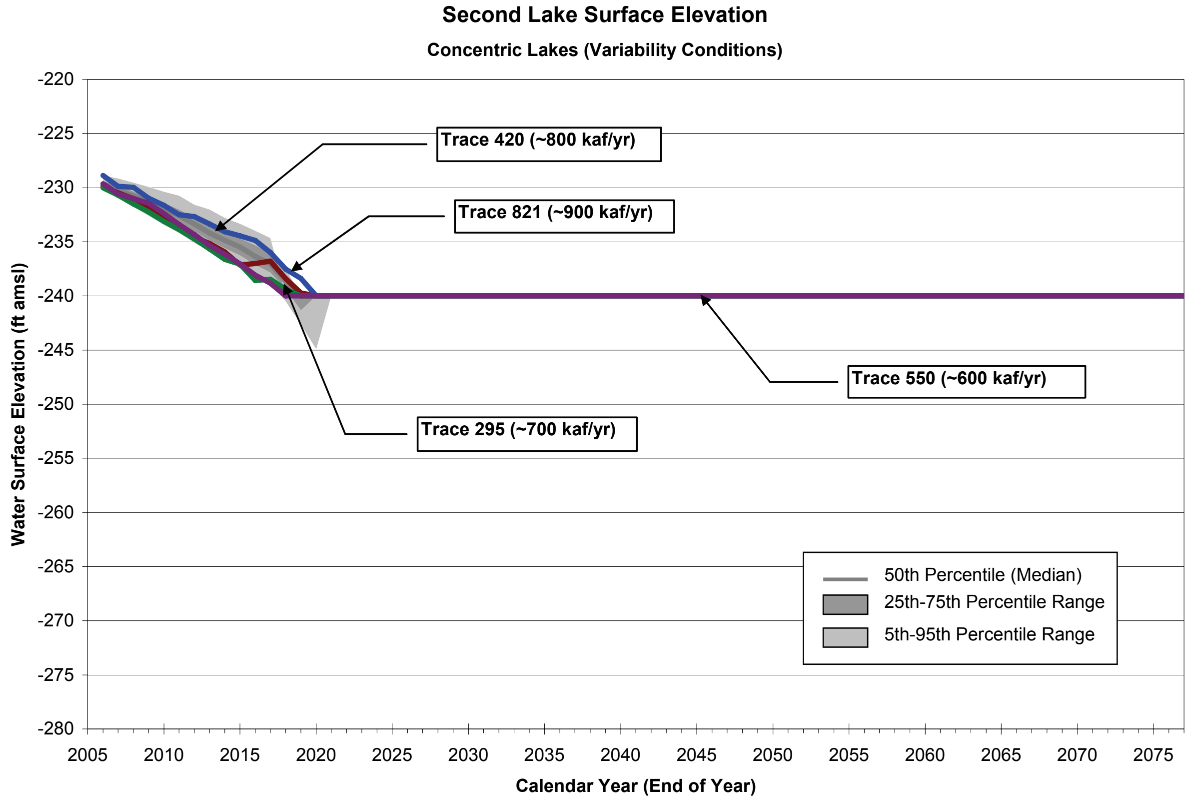

Salton Sea Habitat Complex Wetted Area
Concentric Rings (CEQA Conditions)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range
Wetted Area (acres)
70000
60000
50000
40000
30000
20000
10000
0
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075
Calendar Year (End of Year)

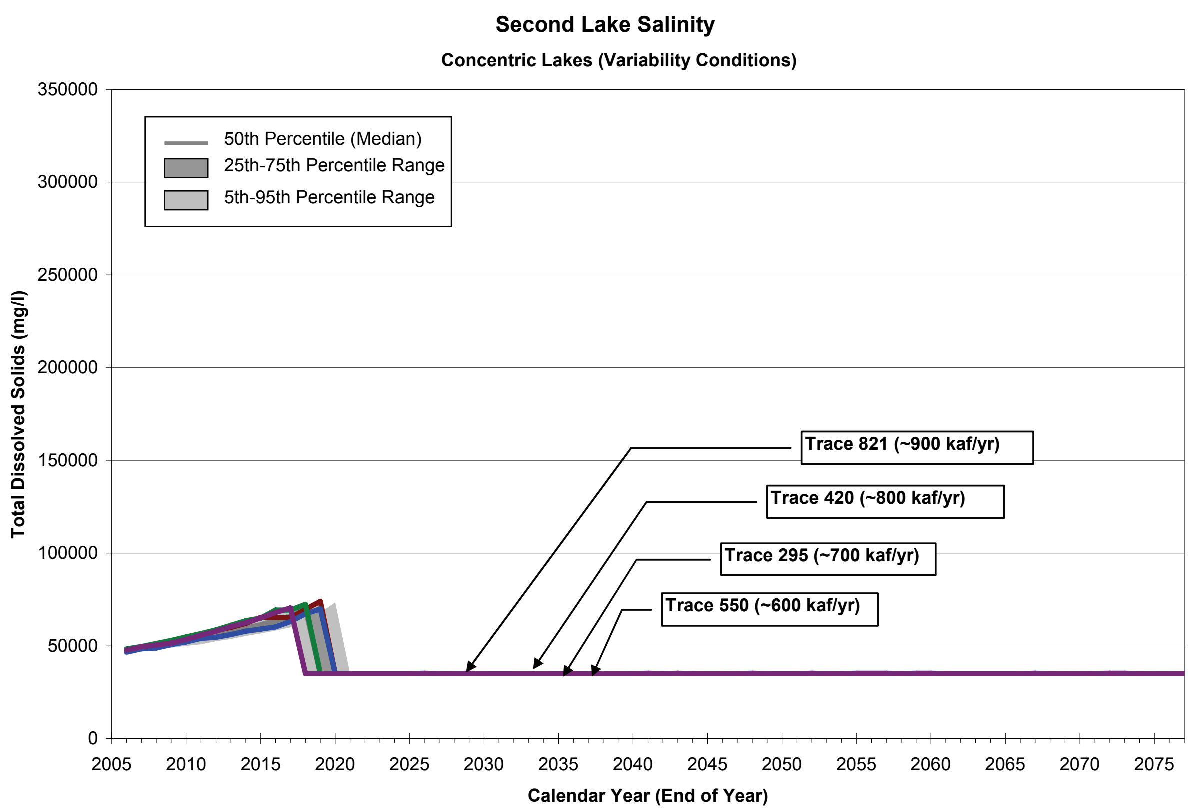
ALTERNATIVE 4 – CONCENTRIC LAKES

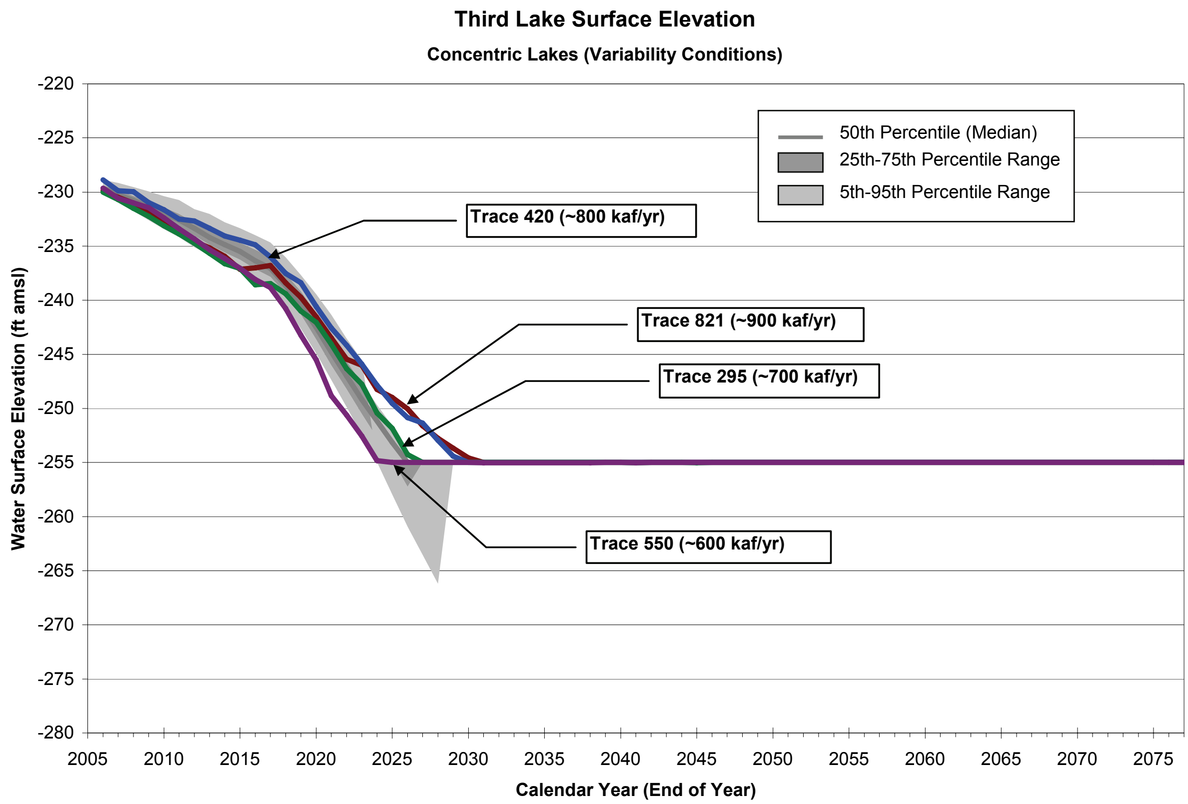
SALSA Modeling Results
(Figures H2-2-9a through H2-2-9v)

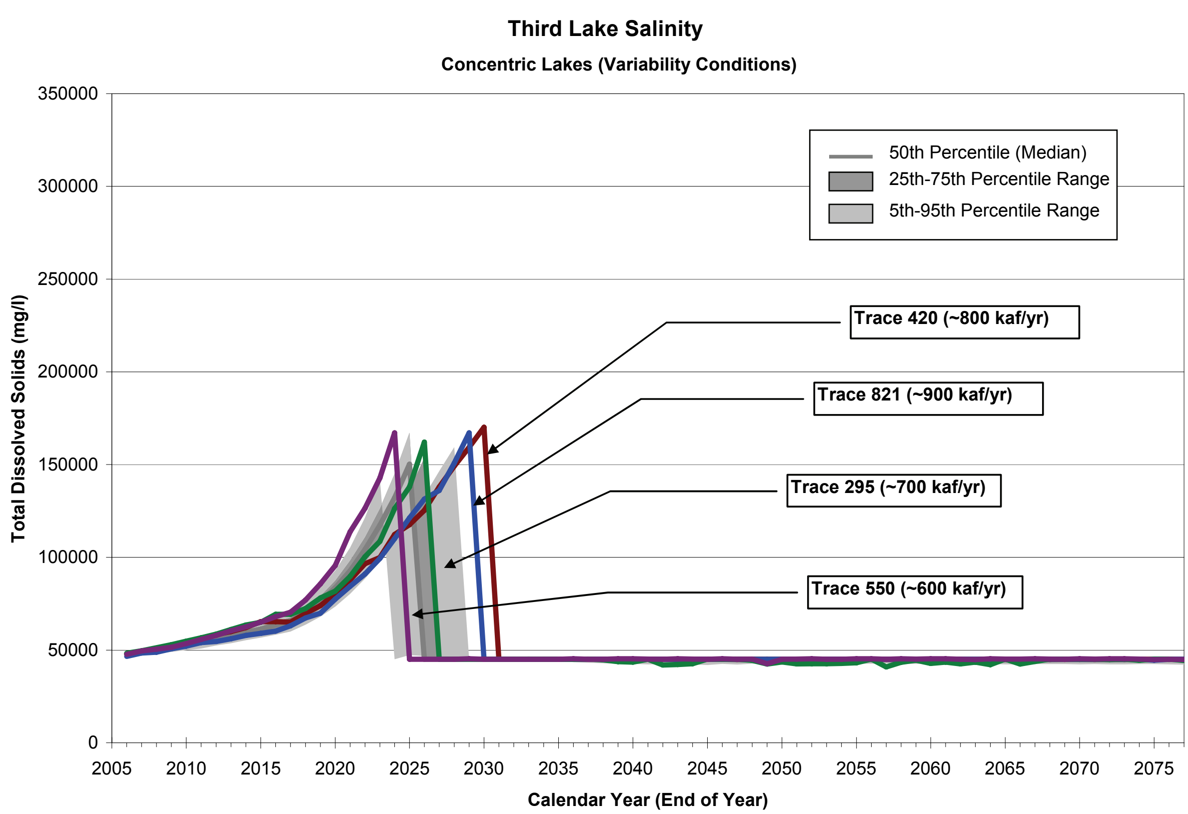

First Lake Water Surface Elevation
Concentric Lakes (Variability Conditions)
Water Surface Elevation (ft amsl)
-220
-225
-230
-235
-240
-245
-250
-255
-260
-265
-270
-275
-280
Trace 821 (~900 kaf/yr)
Trace 420 (~800 kaf/yr)
Trace 295 (~700 kaf/yr)
Trace 550 (~600 kaf/yr)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075
Calendar Year (End of Year)

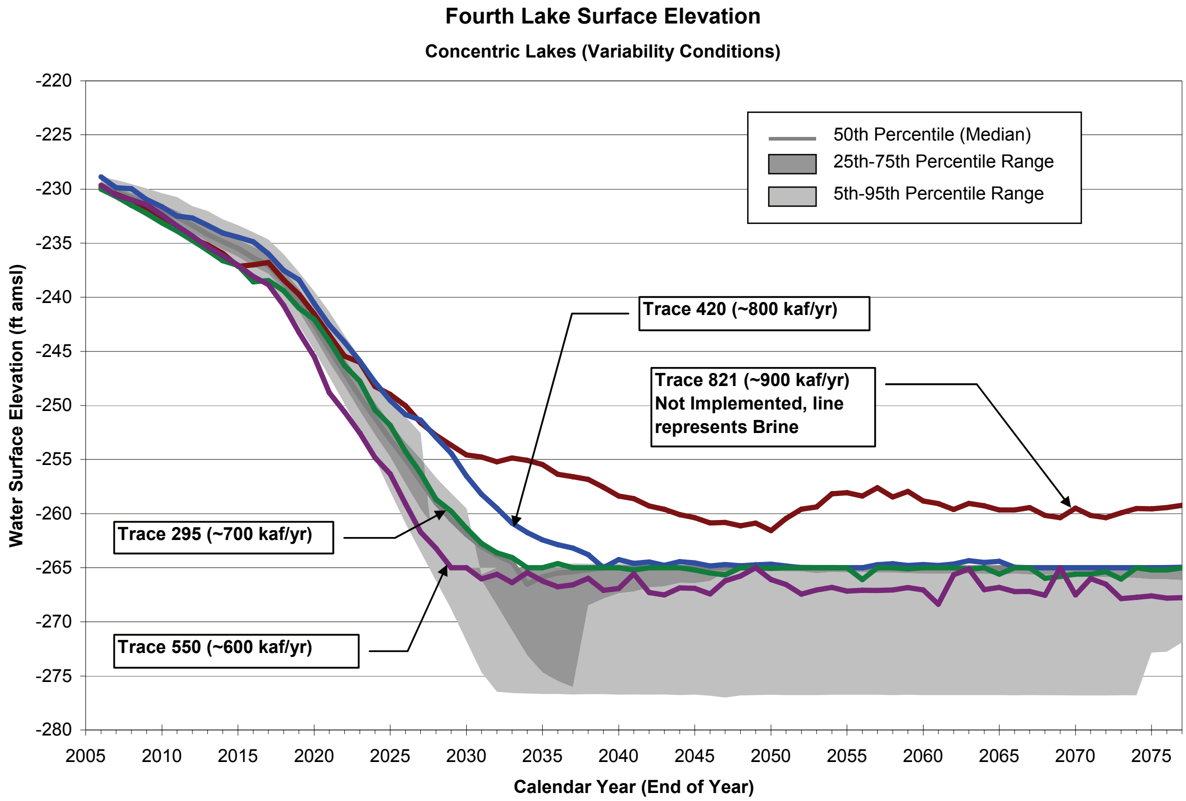

First Lake Salinity
Concentric Lakes (Variability Conditions)
Total Dissolved Solids (mg/l)
350000
300000
250000
200000
150000
100000
50000
0
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range
Trace 821 (~900 kaf/yr)
Trace 420 (~800 kaf/yr)
Trace 295 (~700 kaf/yr)
Trace 550 (~600 kaf/yr)
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075
Calendar Year (End of Year)

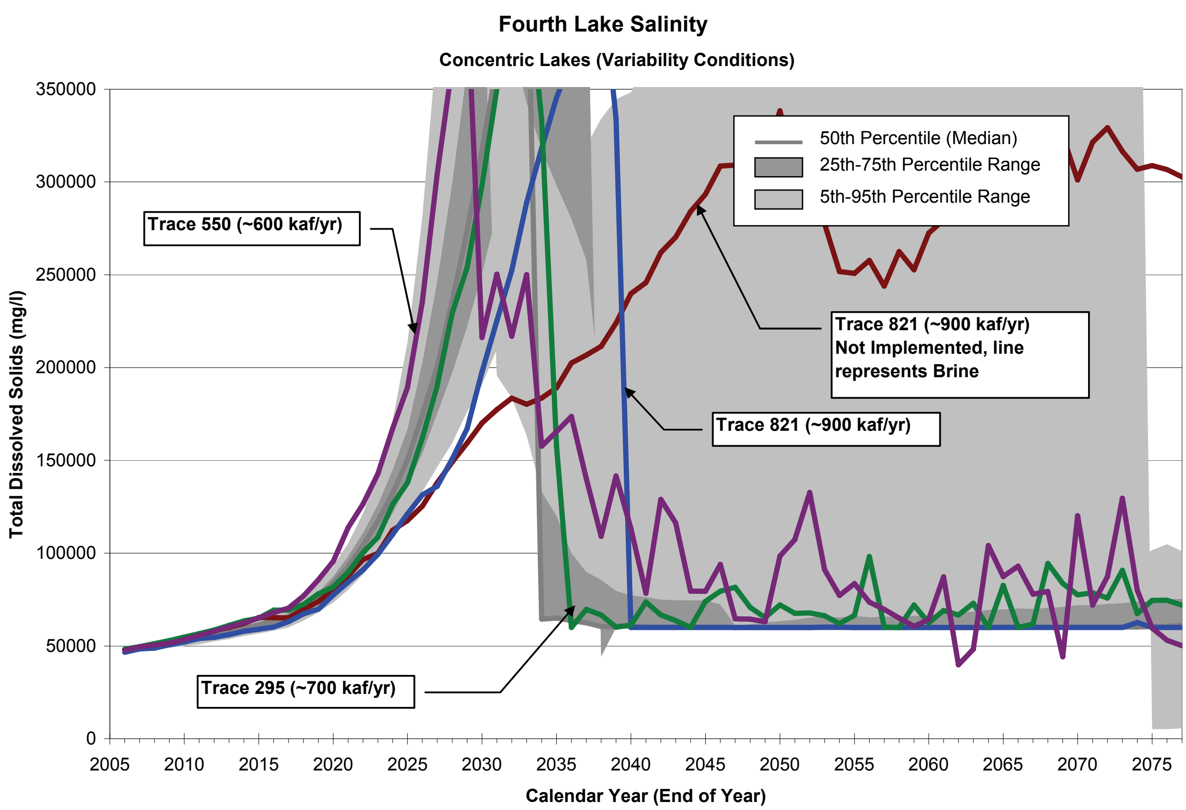

Second Lake Surface Elevation
Concentric Lakes (Variability Conditions)
Water Surface Elevation (ft amsl)
Calendar Year (End of Year)
Trace 420 (~800 kaf/yr)
Trace 821 (~900 kaf/yr)
Trace 550 (~600 kaf/yr)
Trace 295 (~700 kaf/yr)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range
-220
-225
-230
-235
-240
-245
-250
-255
-260
-265
-270
-275
-280
2005 2010 2015 2020 2025 2030 2035 2040 2045 2050 2055 2060 2065 2070 2075

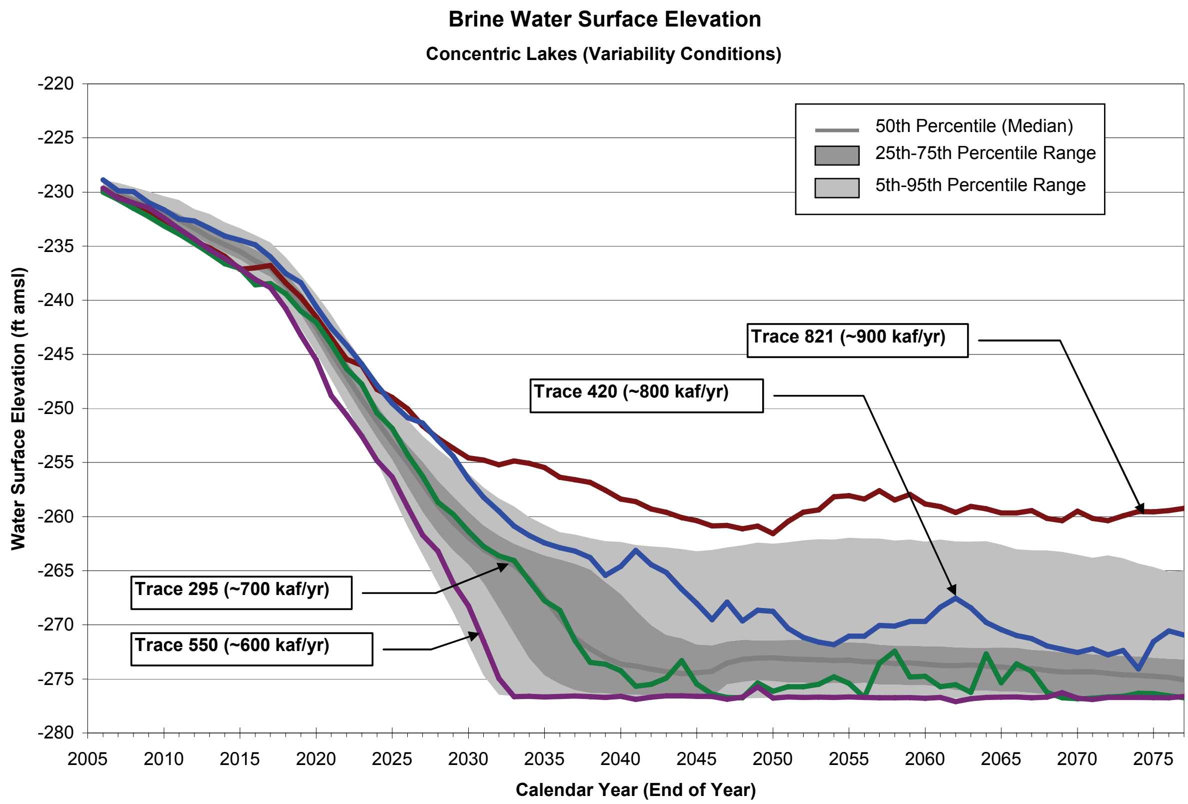

Second Lake Salinity
Concentric Lakes (Variability Conditions)
Total Dissolved Solids (mg/l)
Calendar Year (End of Year)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range
Trace 821 (~900 kaf/yr)
Trace 420 (~800 kaf/yr)
Trace 295 (~700 kaf/yr)
Trace 550 (~600 kaf/yr)
350000
300000
250000
200000
150000
100000
50000
0
2005 2010 2015 2020 2025 2030 2035 2040 2045 2050 2055 2060 2065 2070 2075

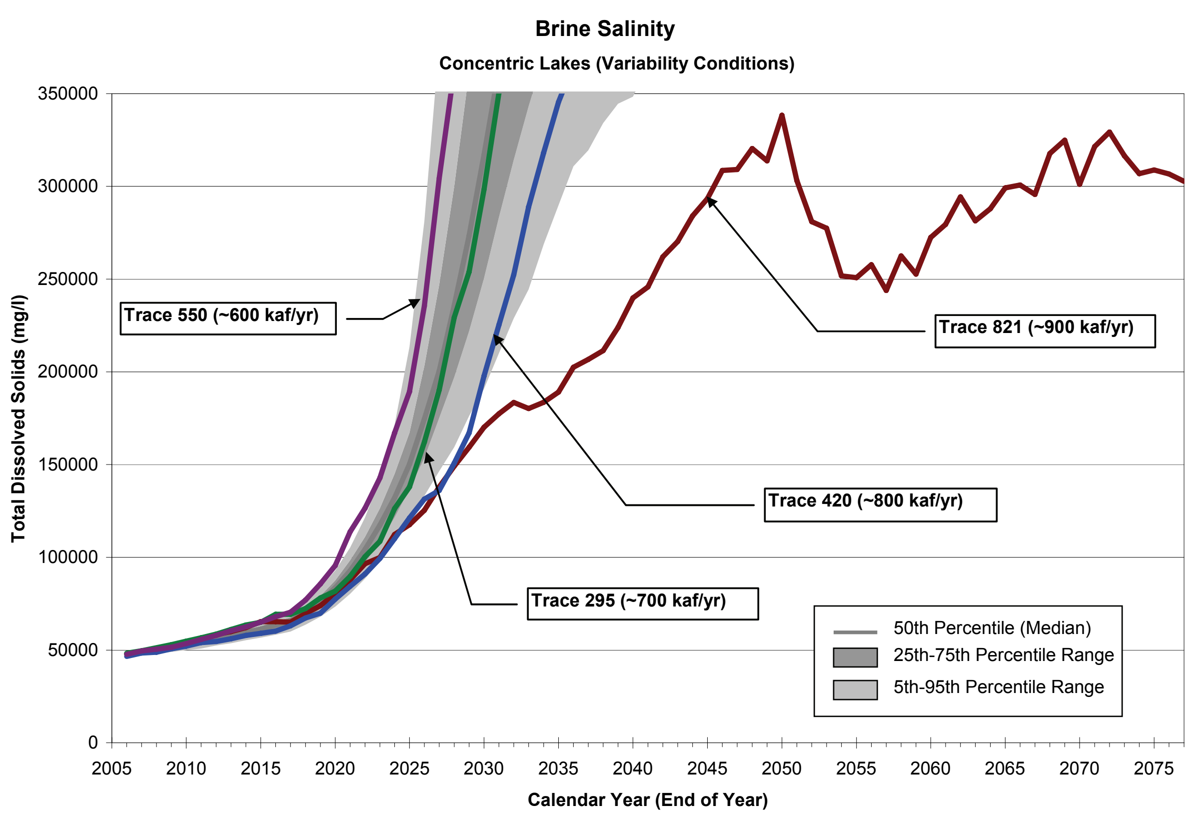

Third Lake Surface Elevation
Concentric Lakes (Variability Conditions)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range
Trace 420 (~800 kaf/yr)
Trace 821 (~900 kaf/yr)
Trace 295 (~700 kaf/yr)
Trace 550 (~600 kaf/yr)
Water Surface Elevation (ft amsl)
-220
-225
-230
-235
-240
-245
-250
-255
-260
-265
-270
-275
-280
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075
Calendar Year (End of Year)

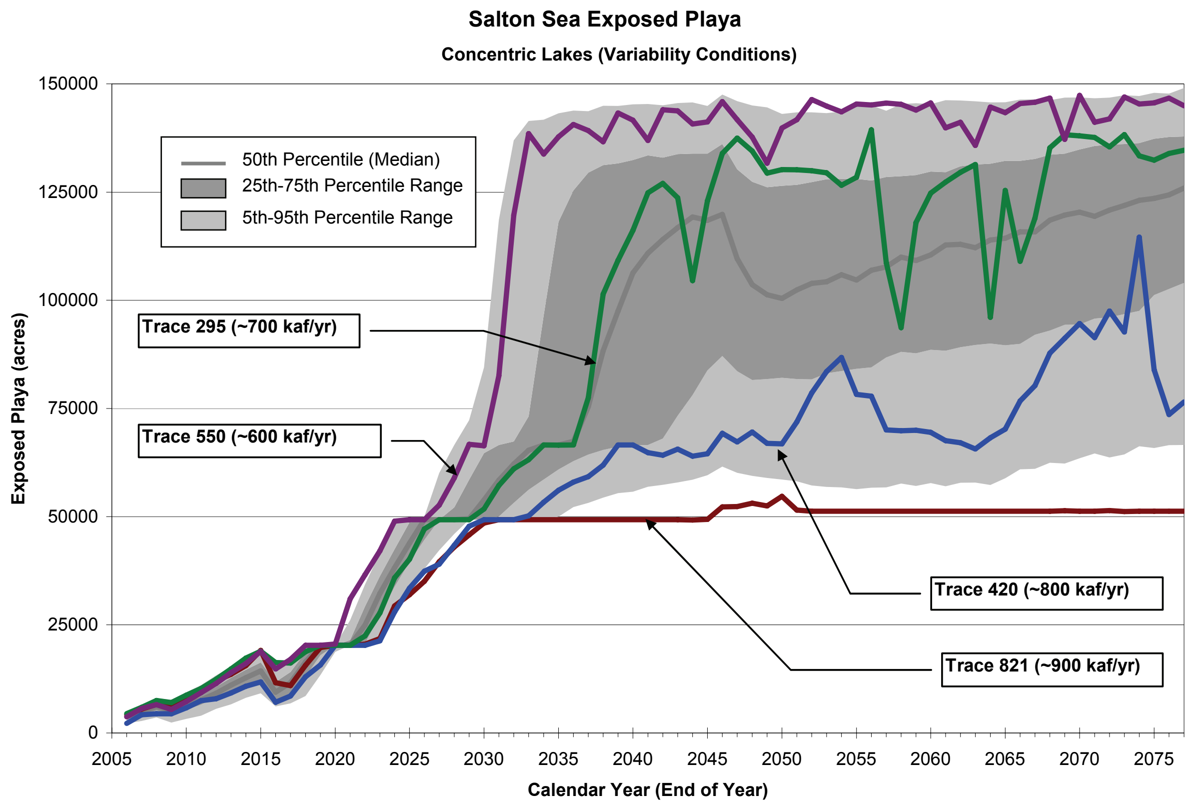

Third Lake Salinity
Concentric Lakes (Variability Conditions)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range
Trace 420 (~800 kaf/yr)
Trace 821 (~900 kaf/yr)
Trace 295 (~700 kaf/yr)
Trace 550 (~600 kaf/yr)
Total Dissolved Solids (mg/l)
350000
300000
250000
200000
150000
100000
50000
0
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075
Calendar Year (End of Year)


Fourth Lake Surface Elevation
Concentric Lakes (Variability Conditions)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range
Trace 420 (~800 kaf/yr)
Trace 821 (~900 kaf/yr) Not Implemented, line represents Brine
Trace 295 (~700 kaf/yr)
Trace 550 (~600 kaf/yr)
Water Surface Elevation (ft amsl)
Calendar Year (End of Year)


Fourth Lake Salinity
Concentric Lakes (Variability Conditions)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range
Trace 550 (~600 kaf/yr)
Trace 821 (~900 kaf/yr) Not Implemented, line represents Brine
Trace 821 (~900 kaf/yr)
Trace 295 (~700 kaf/yr)
Total Dissolved Solids (mg/l)
Calendar Year (End of Year)


Brine Water Surface Elevation
Concentric Lakes (Variability Conditions)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range
Trace 821 (~900 kaf/yr)
Trace 420 (~800 kaf/yr)
Trace 295 (~700 kaf/yr)
Trace 550 (~600 kaf/yr)
Water Surface Elevation (ft amsl)
Calendar Year (End of Year)
-220
-225
-230
-235
-240
-245
-250
-255
-260
-265
-270
-275
-280
2005 2010 2015 2020 2025 2030 2035 2040 2045 2050 2055 2060 2065 2070 2075


Brine Salinity
Concentric Lakes (Variability Conditions)
Trace 550 (~600 kaf/yr)
Trace 821 (~900 kaf/yr)
Trace 420 (~800 kaf/yr)
Trace 295 (~700 kaf/yr)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range
Total Dissolved Solids (mg/l)
Calendar Year (End of Year)
350000
300000
250000
200000
150000
100000
50000
0
2005 2010 2015 2020 2025 2030 2035 2040 2045 2050 2055 2060 2065 2070 2075


Salton Sea Exposed Playa
Concentric Lakes (Variability Conditions)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range
Trace 295 (~700 kaf/yr)
Trace 550 (~600 kaf/yr)
Trace 420 (~800 kaf/yr)
Trace 821 (~900 kaf/yr)
Exposed Playa (acres)
Calendar Year (End of Year)
150000
125000
100000
75000
50000
25000
0
2005
2010
2015
2020
2025
2030
2035
2040
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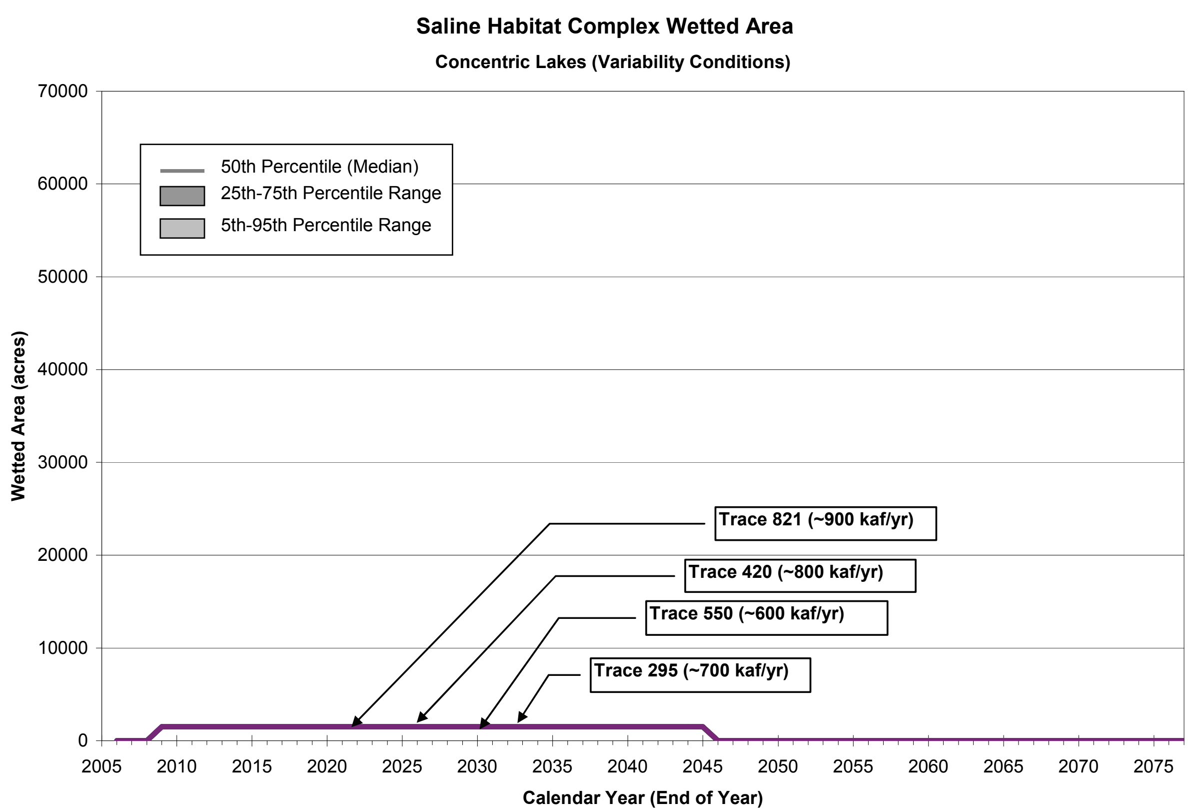
2050
2055
2060
2065
2070
2075


Saline Habitat Complex Wetted Area
Concentric Lakes (Variability Conditions)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range
Trace 821 (~900 kaf/yr)
Trace 420 (~800 kaf/yr)
Trace 550 (~600 kaf/yr)
Trace 295 (~700 kaf/yr)
Wetted Area (acres)
Calendar Year (End of Year)
70000
60000
50000
40000
30000
20000
10000
0
2005
2010
2015
2020
2025
2030
2035
2040
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2050
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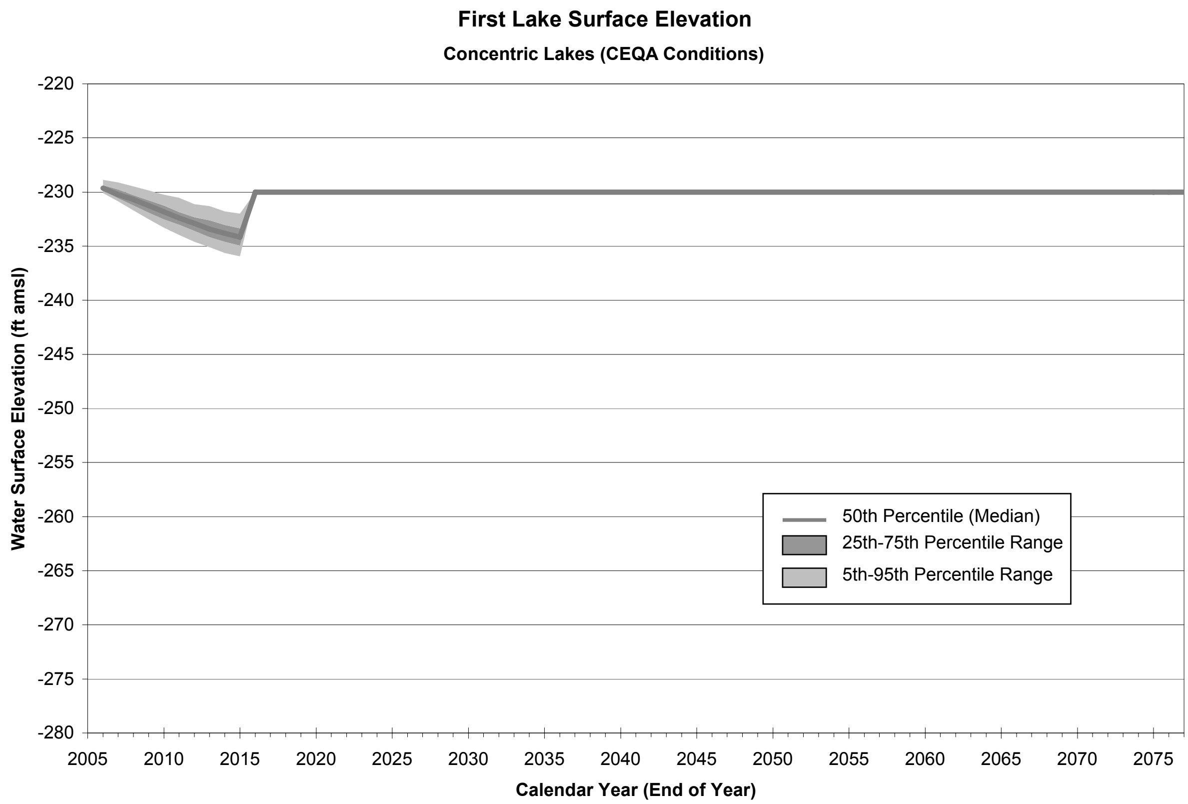
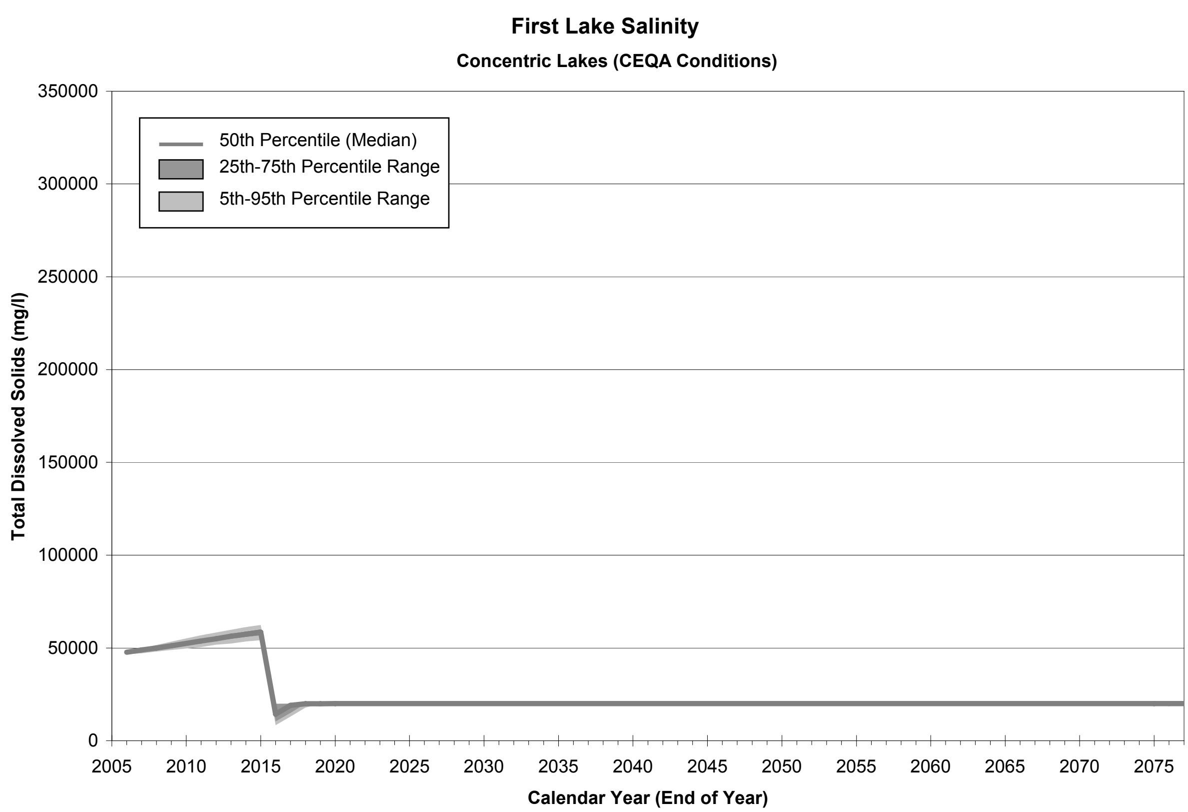
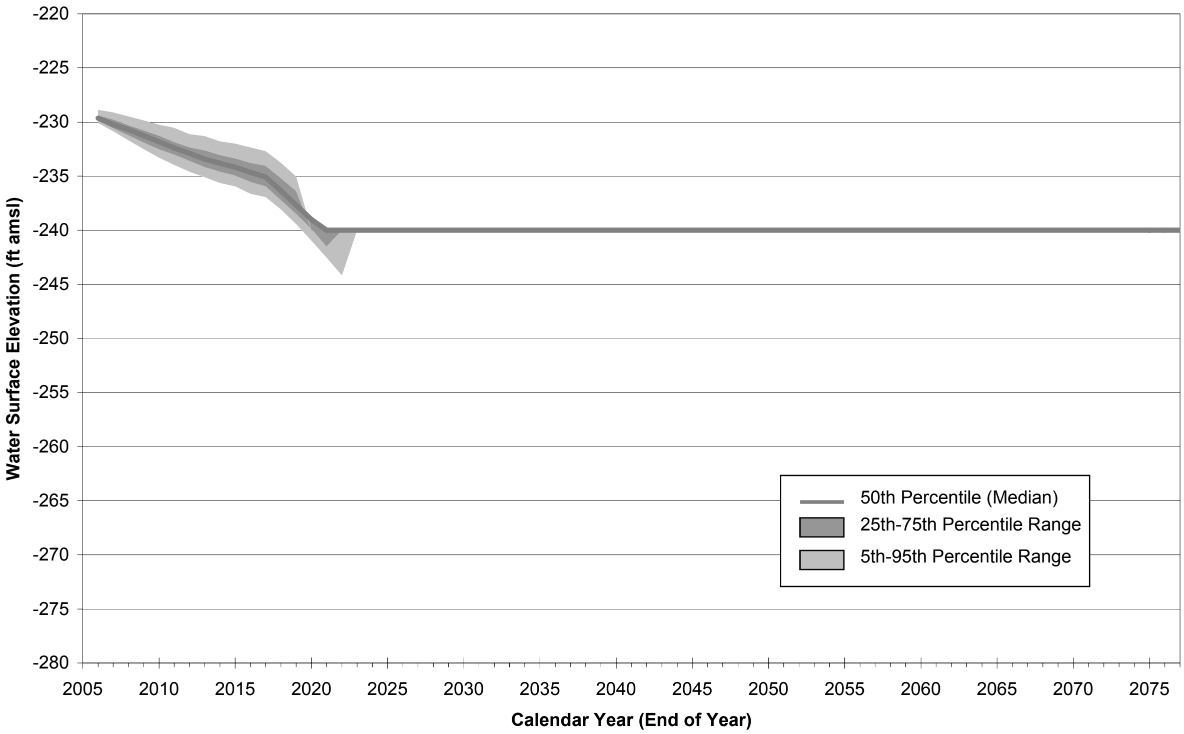
2060
2065
2070
2075


First Lake Surface Elevation
Concentric Lakes (CEQA Conditions)
Water Surface Elevation (ft amsl)
-220
-225
-230
-235
-240
-245
-250
-255
-260
-265
-270
-275
-280
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075
Calendar Year (End of Year)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range


First Lake Salinity
Concentric Lakes (CEQA Conditions)
Total Dissolved Solids (mg/l)
350000
300000
250000
200000
150000
100000
50000
0
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075
Calendar Year (End of Year)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range

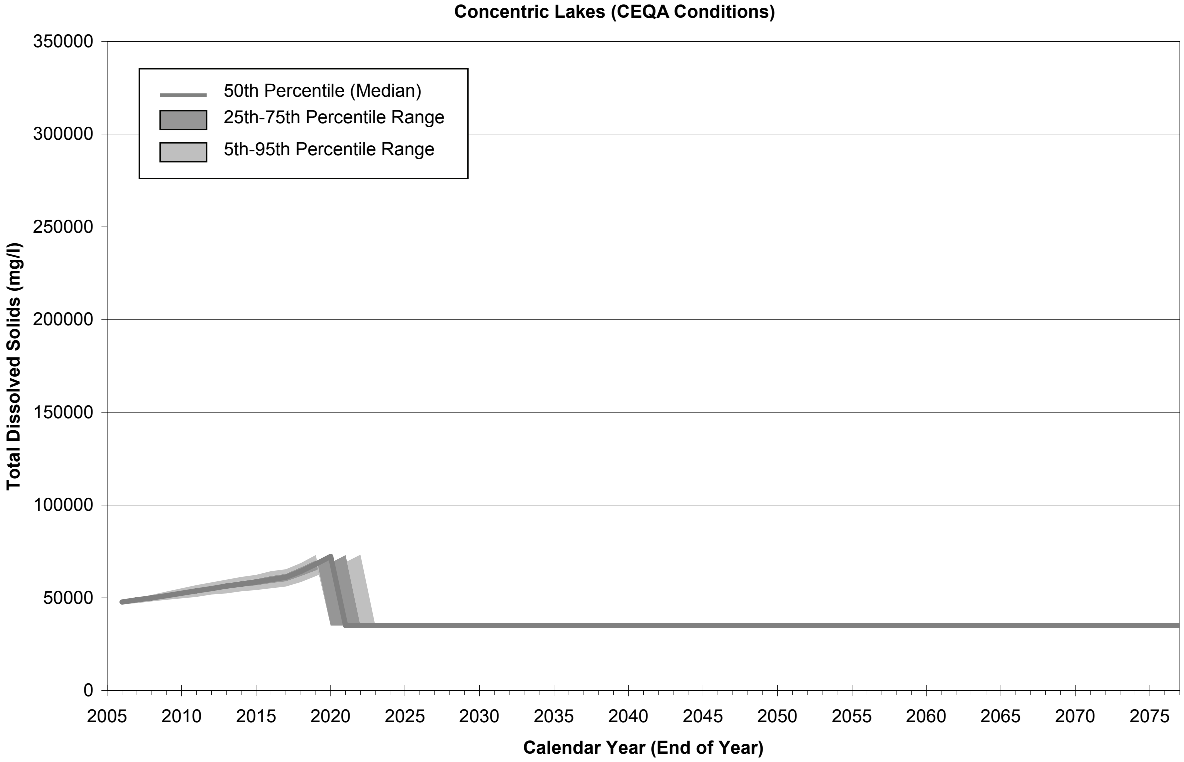
Second Lake Surface Elevation

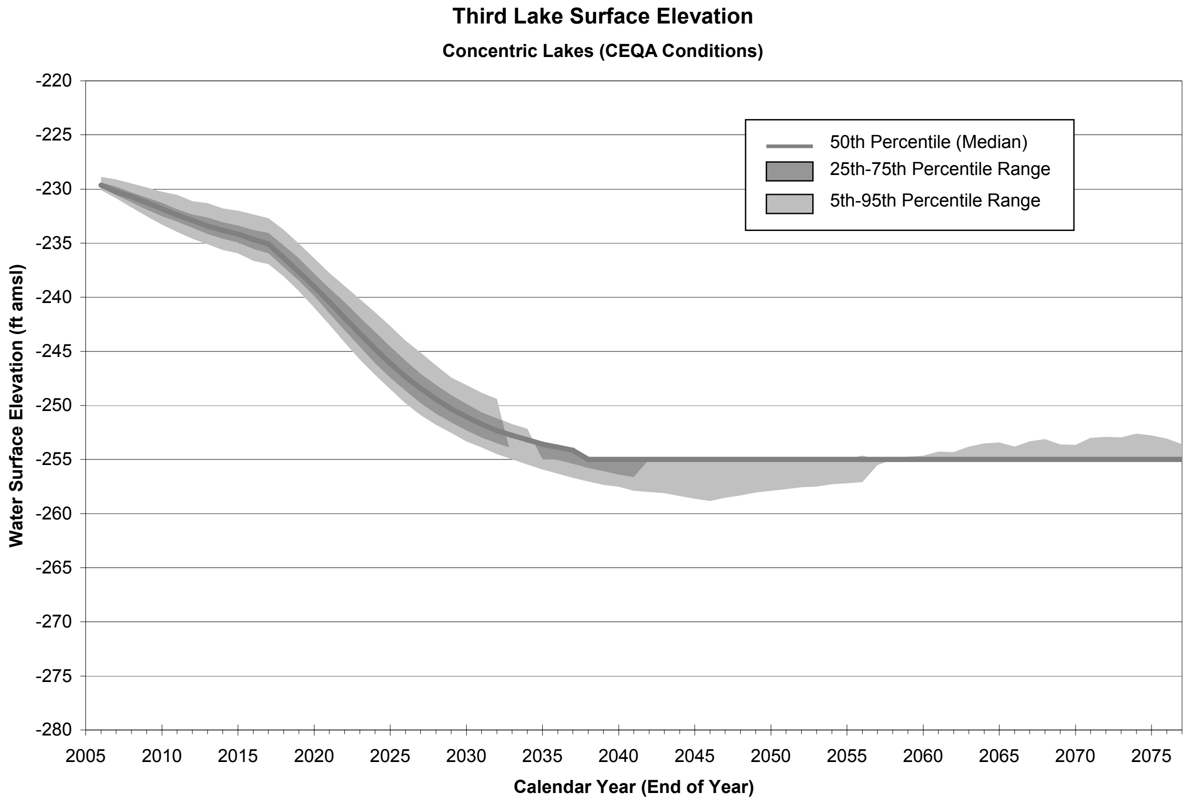
Concentric Lakes (CEQA Conditions)

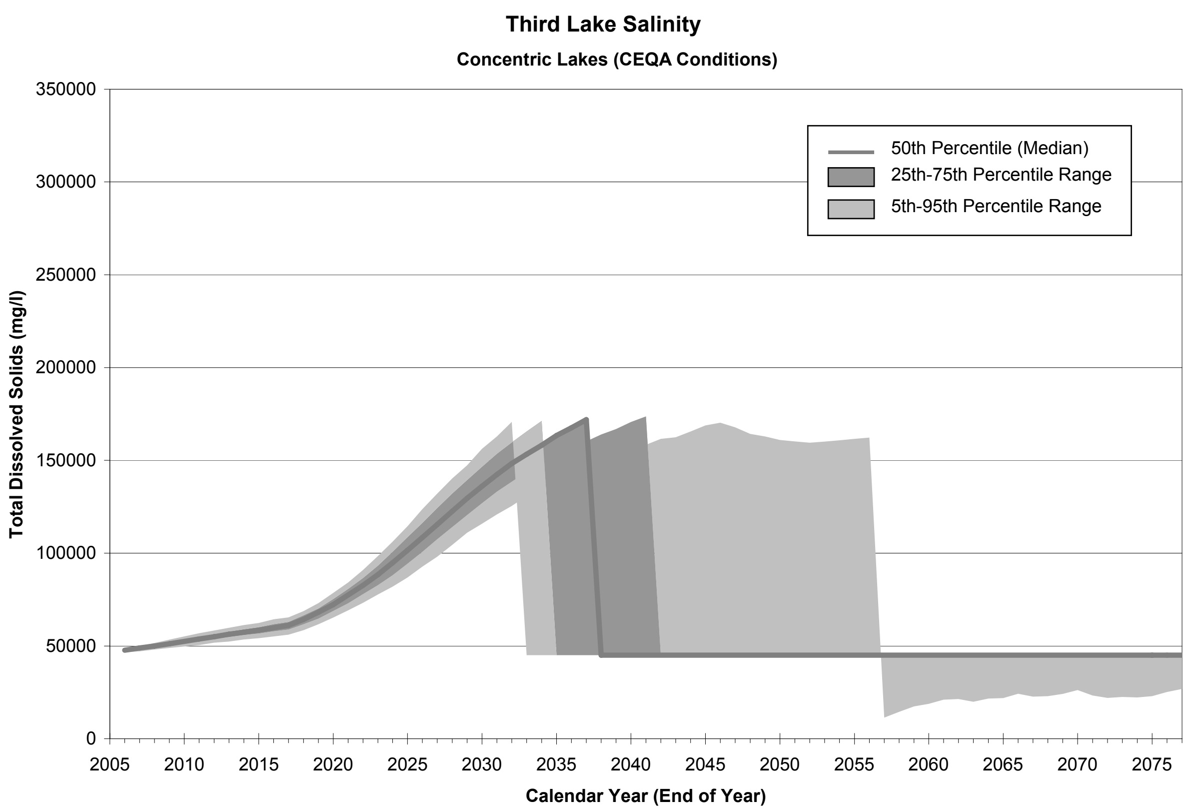


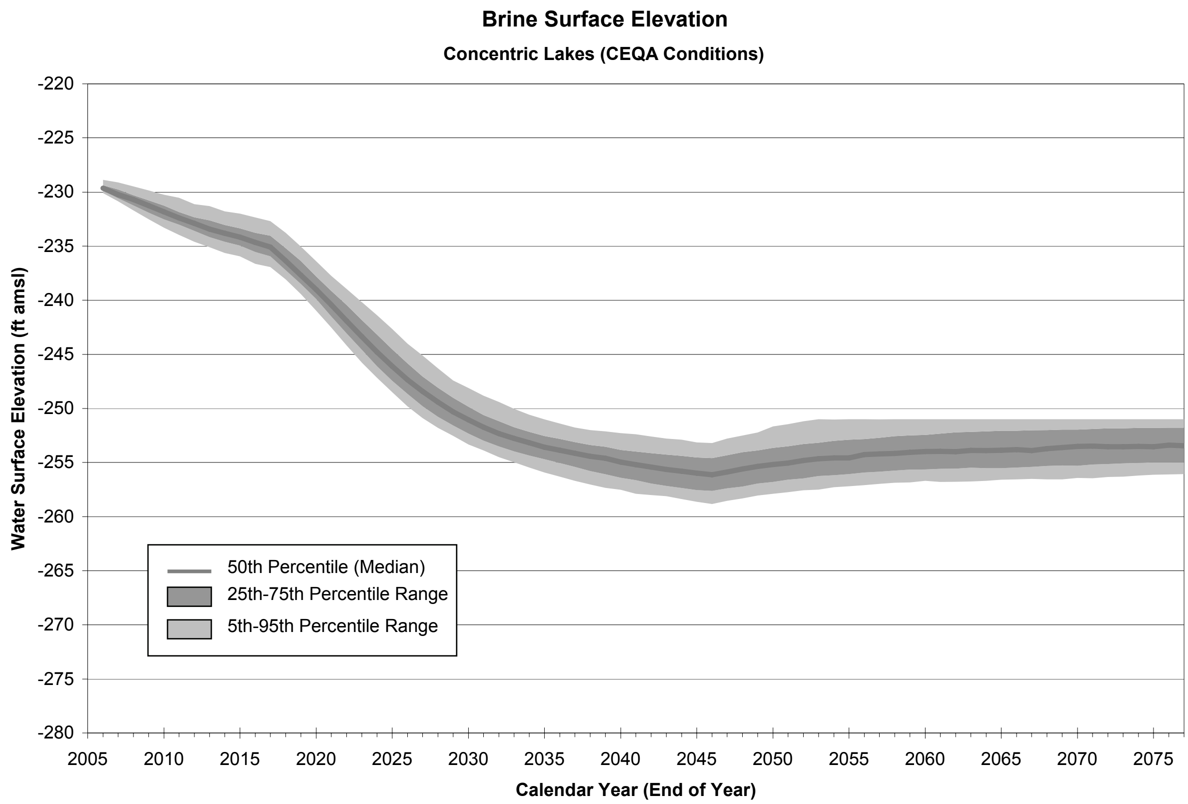
Second Lake Salinity

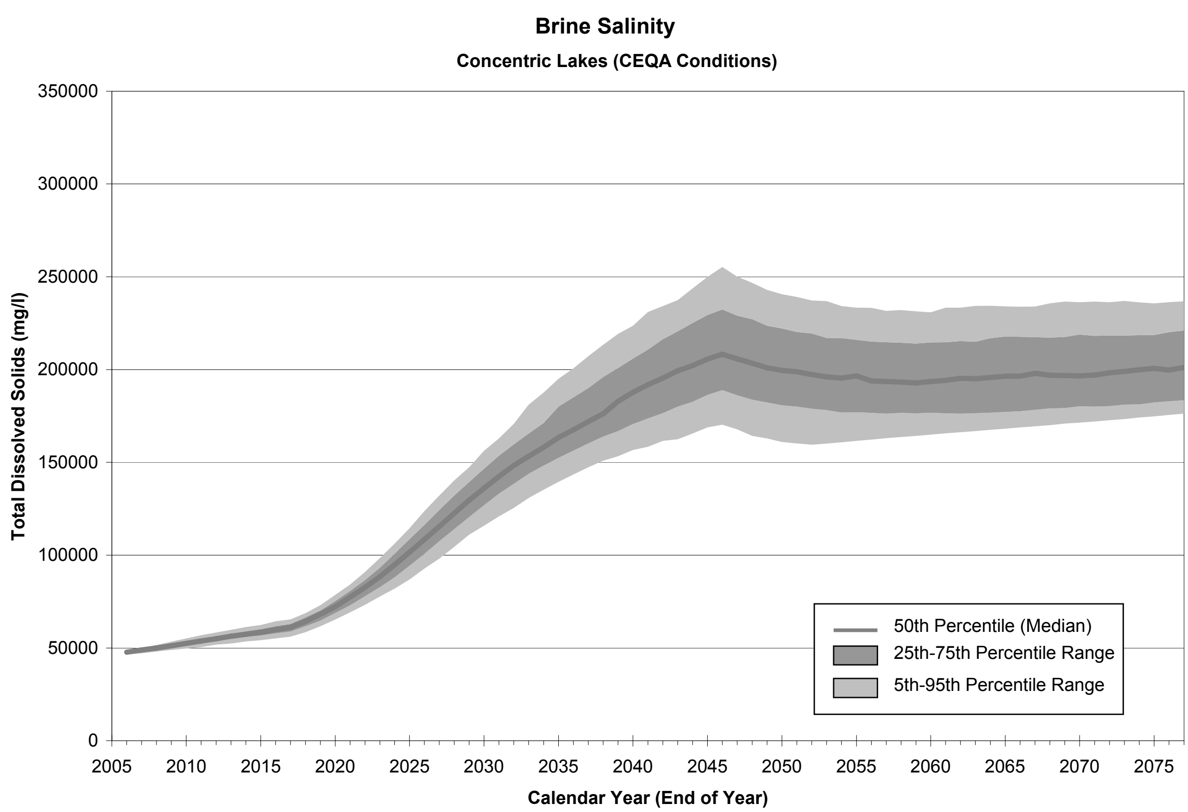
Concentric Lakes (CEQA Conditions)




Third Lake Surface Elevation
Concentric Lakes (CEQA Conditions)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range
Water Surface Elevation (ft amsl)
-220
-225
-230
-235
-240
-245
-250
-255
-260
-265
-270
-275
-280
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075
Calendar Year (End of Year)

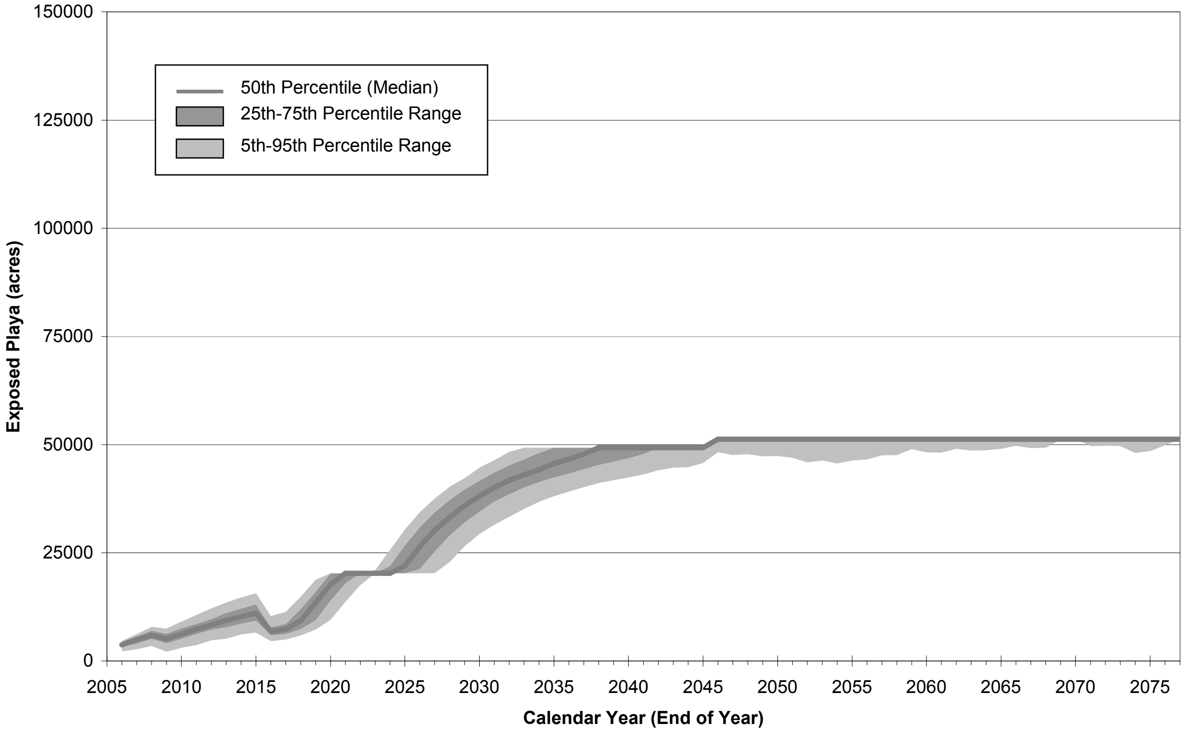

Third Lake Salinity
Concentric Lakes (CEQA Conditions)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range
Total Dissolved Solids (mg/l)
350000
300000
250000
200000
150000
100000
50000
0
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075
Calendar Year (End of Year)


Brine Surface Elevation
Concentric Lakes (CEQA Conditions)
Water Surface Elevation (ft amsl)
-220
-225
-230
-235
-240
-245
-250
-255
-260
-265
-270
-275
-280
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075
Calendar Year (End of Year)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range


Brine Salinity
Concentric Lakes (CEQA Conditions)
Total Dissolved Solids (mg/l)
350000
300000
250000
200000
150000
100000
50000
0
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075
Calendar Year (End of Year)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range

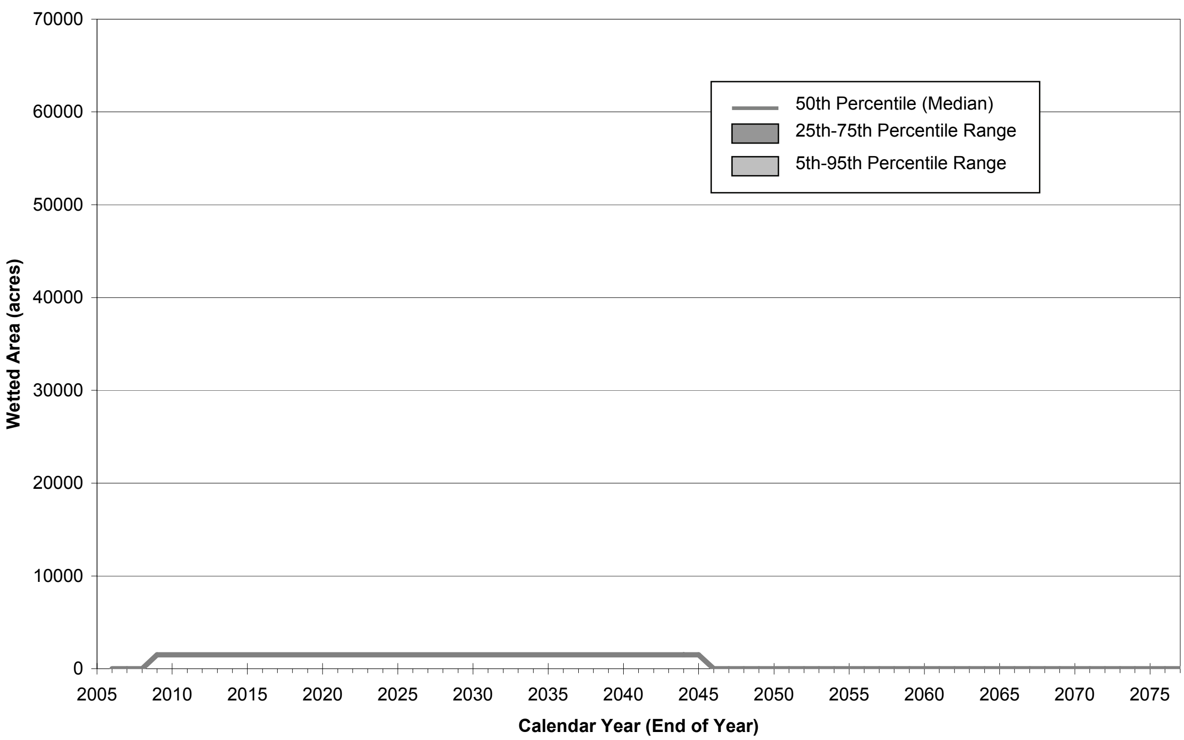
Salton Sea Exposed Playa

Concentric Lakes (CEQA Conditions)



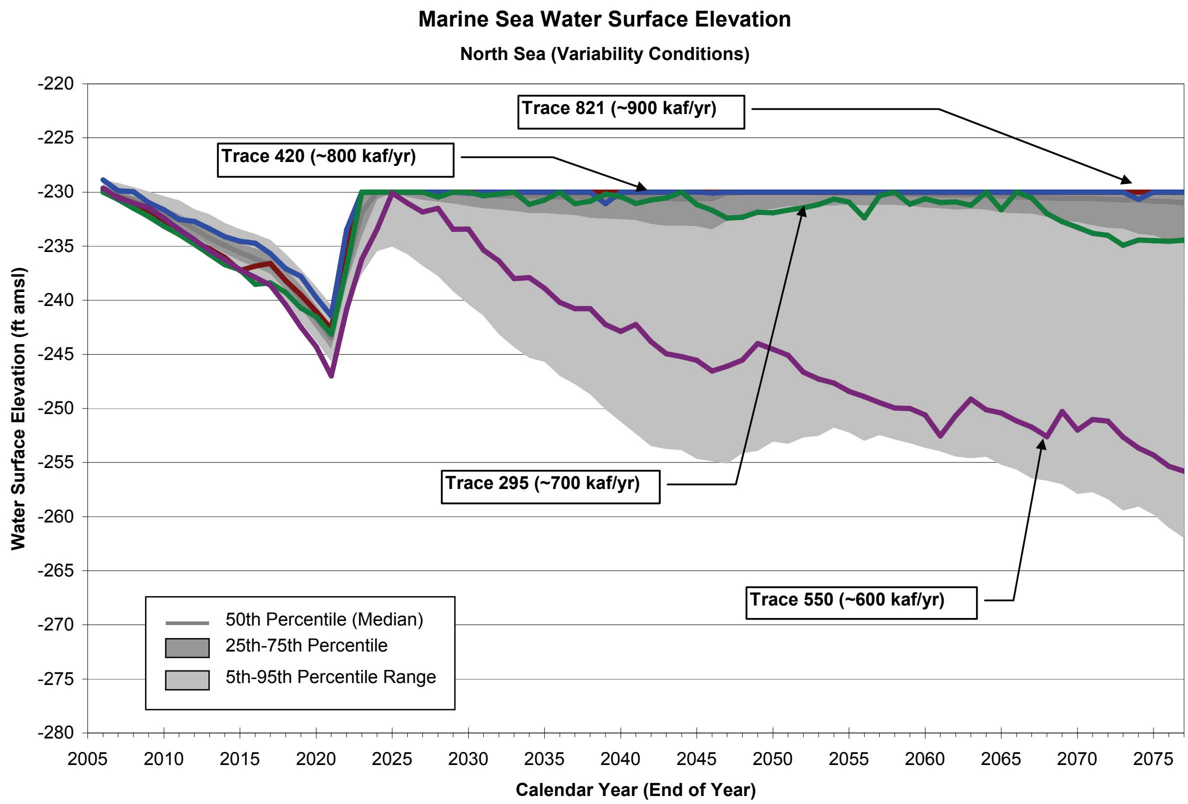
Saline Habitat Complex Wetted Area

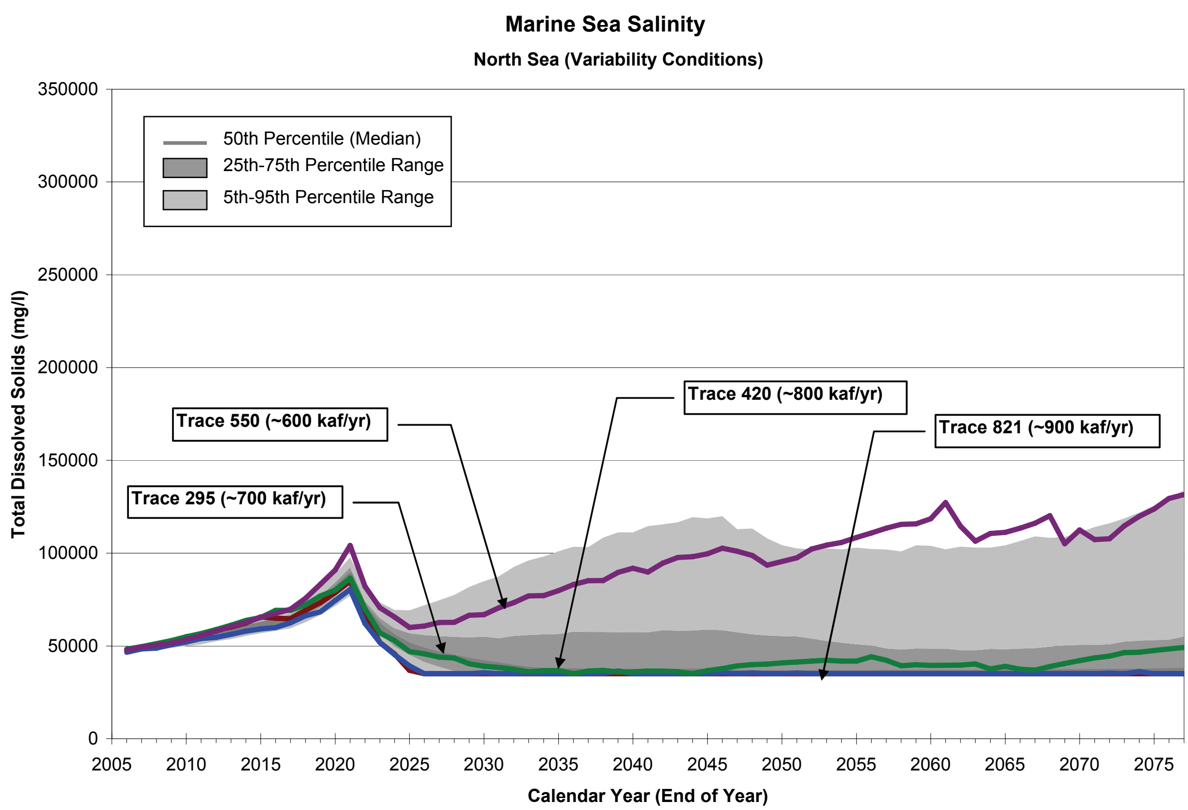
Concentric Lakes (CEQA Conditions)

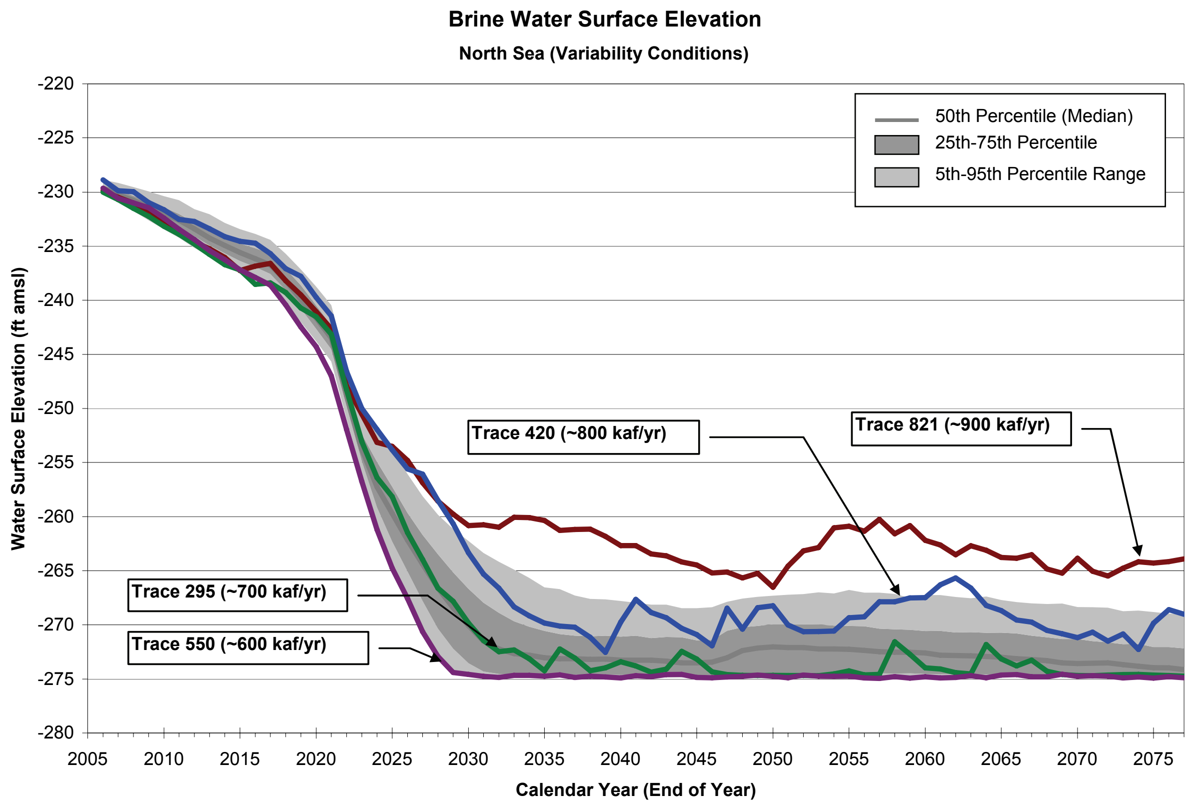


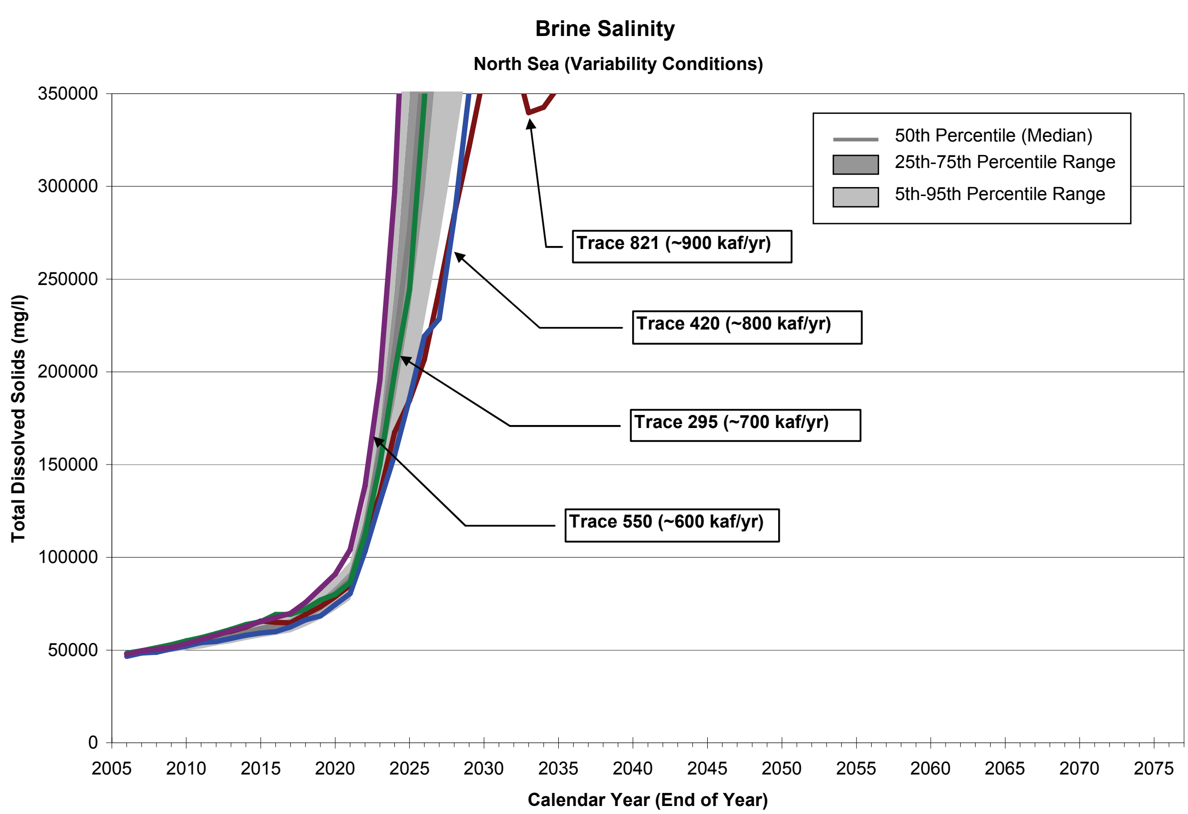
ALTERNATIVE 5 – NORTH SEA

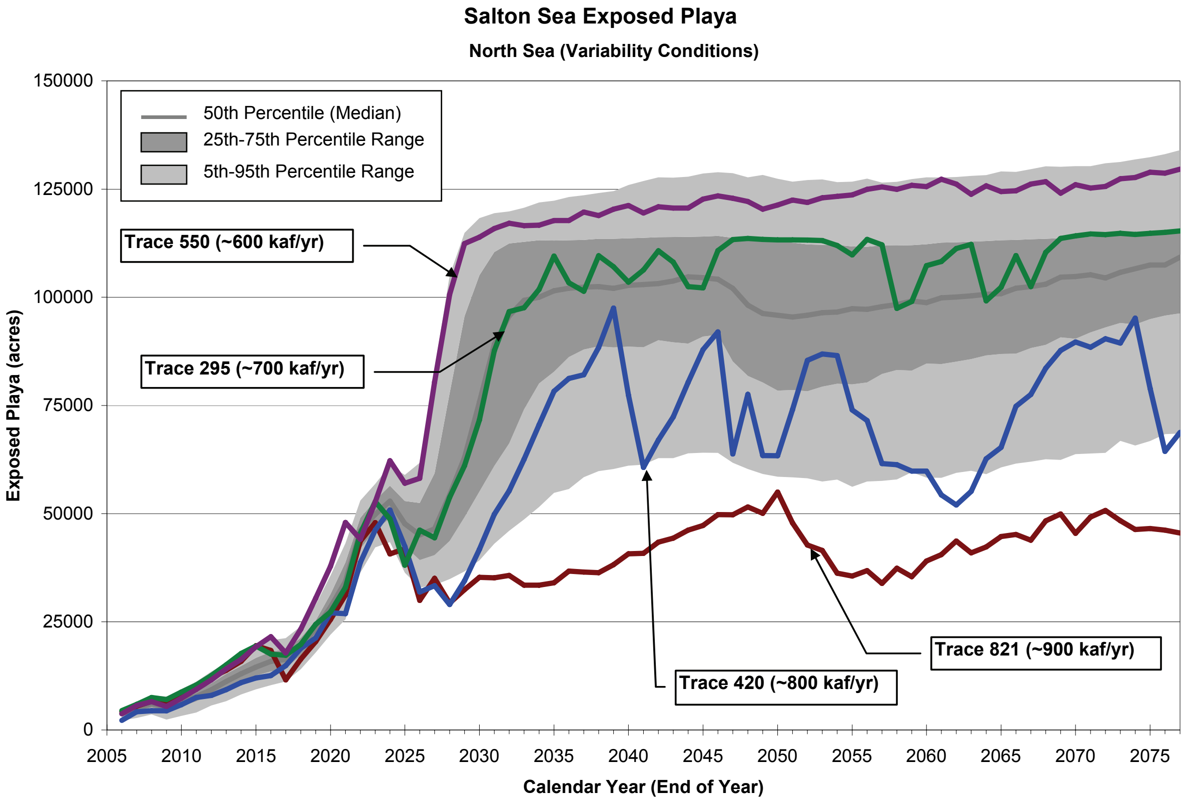
SALSA Modeling Results
(Figures H2-2-10a through H2-2-10l)

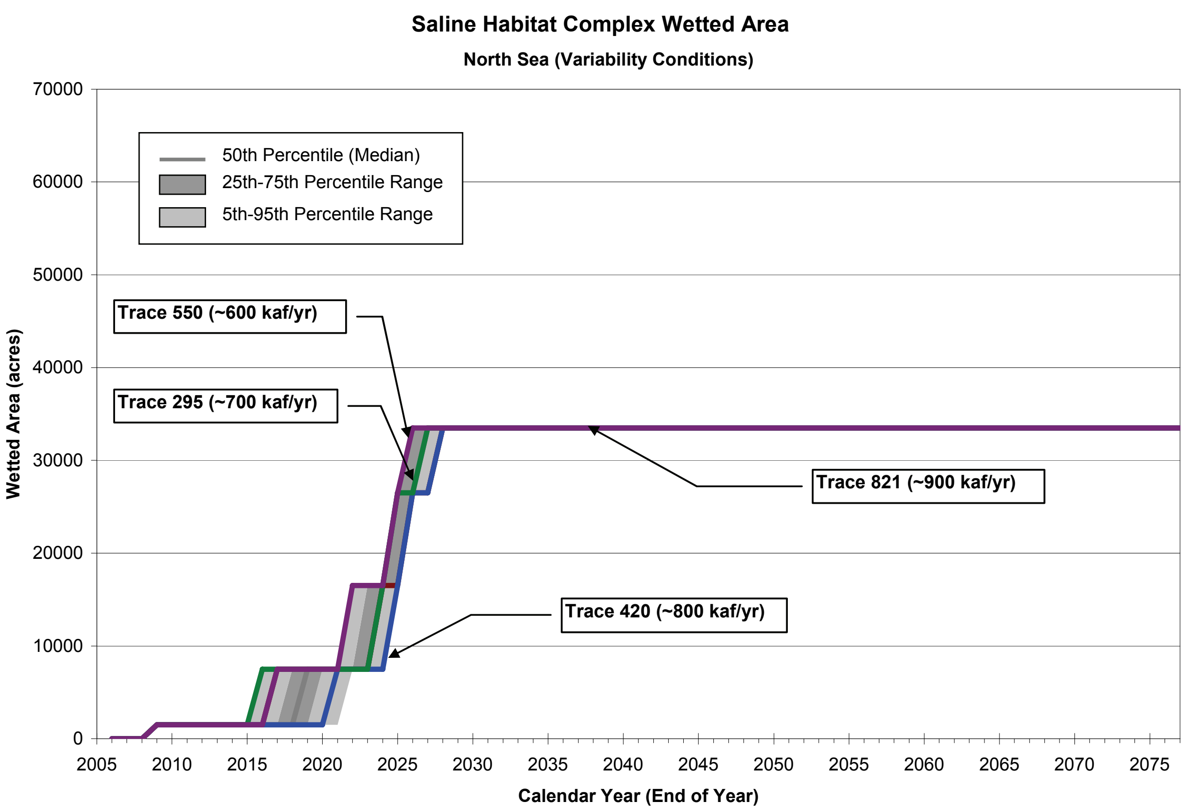

Marine Sea Water Surface Elevation
North Sea (Variability Conditions)
Trace 821 (~900 kaf/yr)
Trace 420 (~800 kaf/yr)
Trace 295 (~700 kaf/yr)
Trace 550 (~600 kaf/yr)
50th Percentile (Median)
25th-75th Percentile
5th-95th Percentile Range
Water Surface Elevation (ft amsl)
-220
-225
-230
-235
-240
-245
-250
-255
-260
-265
-270
-275
-280
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075
Calendar Year (End of Year)

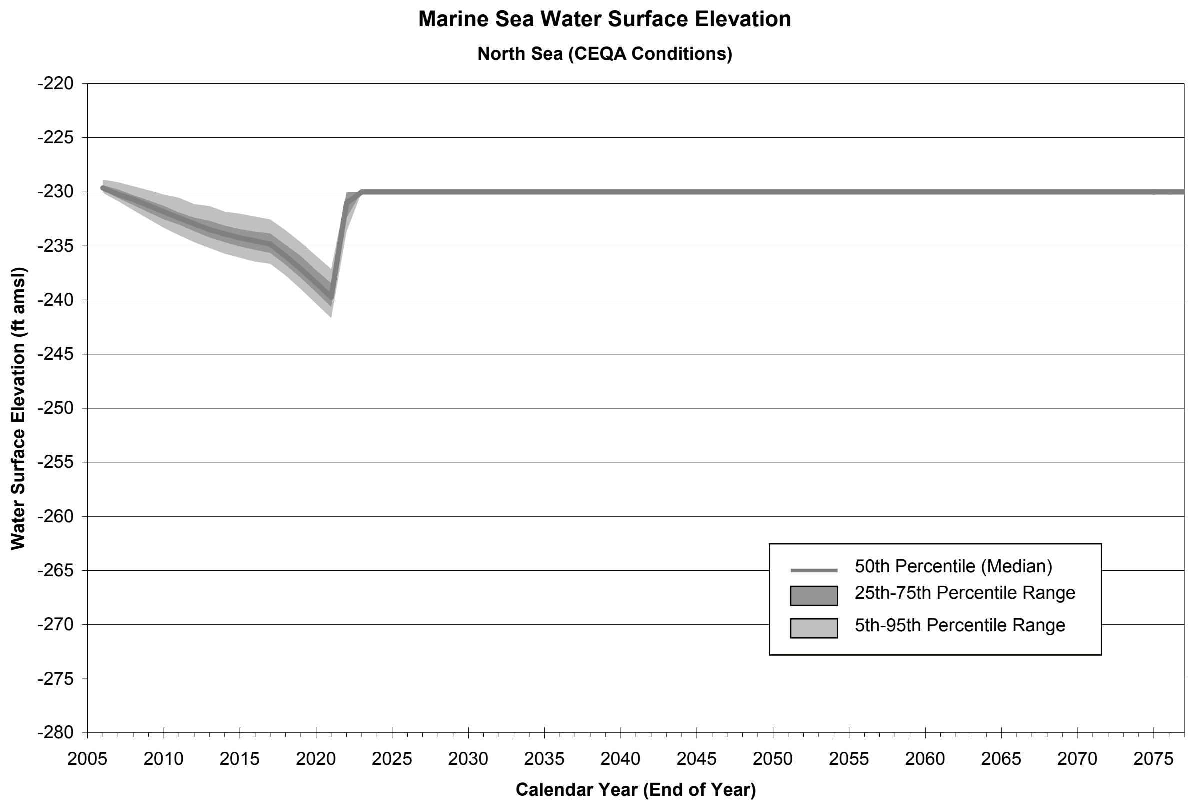

Marine Sea Salinity
North Sea (Variability Conditions)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range
Trace 420 (~800 kaf/yr)
Trace 550 (~600 kaf/yr)
Trace 821 (~900 kaf/yr)
Trace 295 (~700 kaf/yr)
Total Dissolved Solids (mg/l)
350000
300000
250000
200000
150000
100000
50000
0
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075
Calendar Year (End of Year)

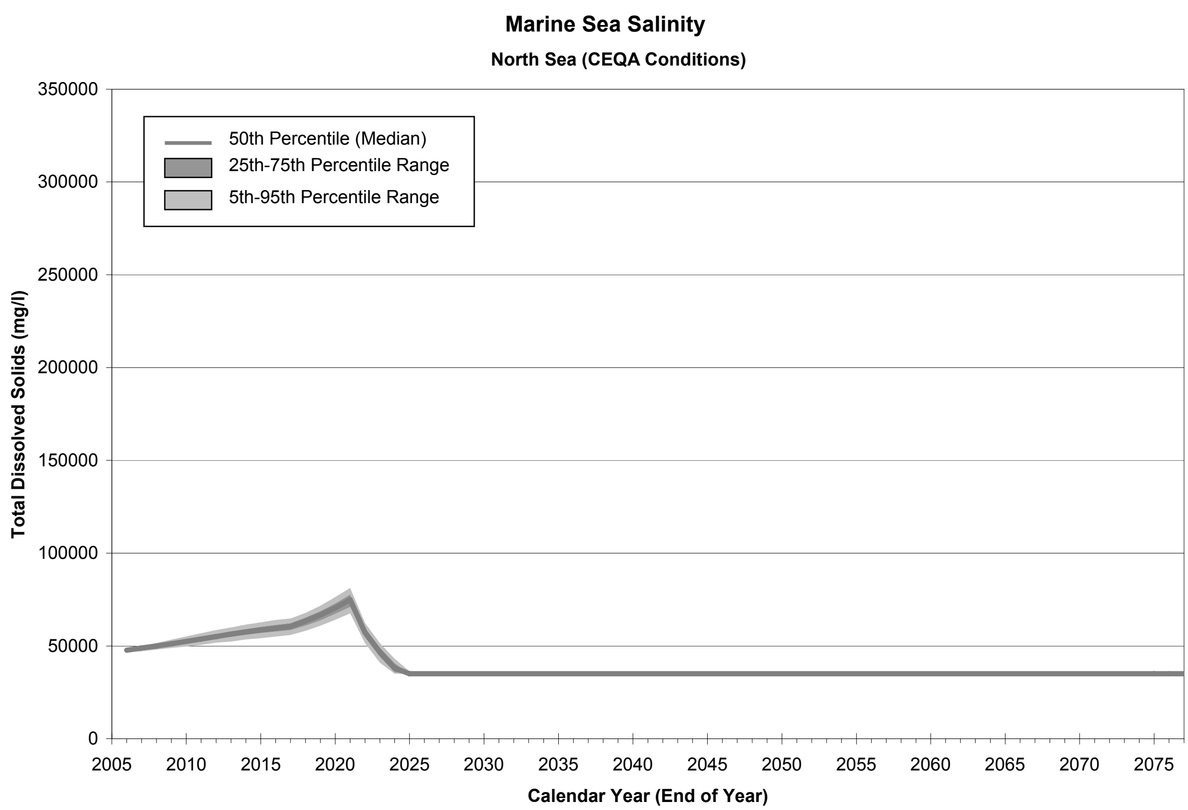

Brine Water Surface Elevation
North Sea (Variability Conditions)
50th Percentile (Median)
25th-75th Percentile
5th-95th Percentile Range
Trace 420 (~800 kaf/yr)
Trace 821 (~900 kaf/yr)
Trace 295 (~700 kaf/yr)
Trace 550 (~600 kaf/yr)
Water Surface Elevation (ft amsl)
Calendar Year (End of Year)

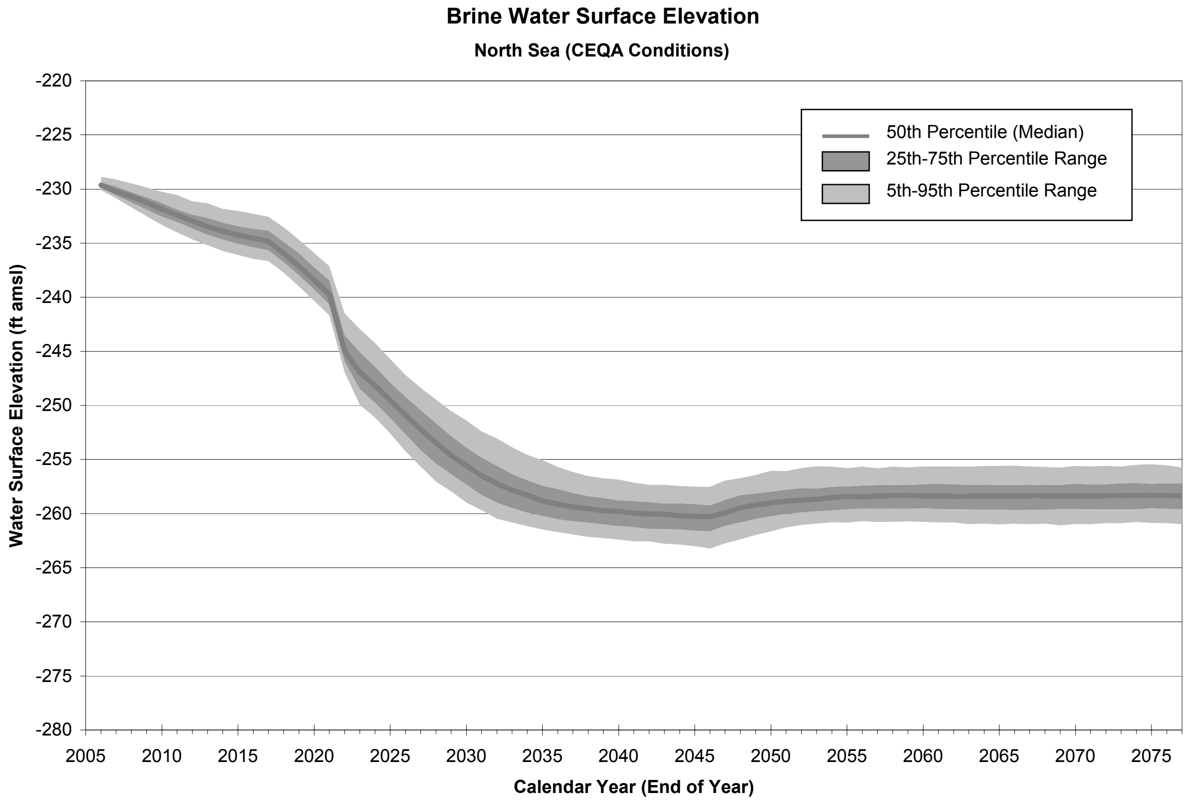

Brine Salinity
North Sea (Variability Conditions)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range
Trace 821 (~900 kaf/yr)
Trace 420 (~800 kaf/yr)
Trace 295 (~700 kaf/yr)
Trace 550 (~600 kaf/yr)
Total Dissolved Solids (mg/l)
Calendar Year (End of Year)

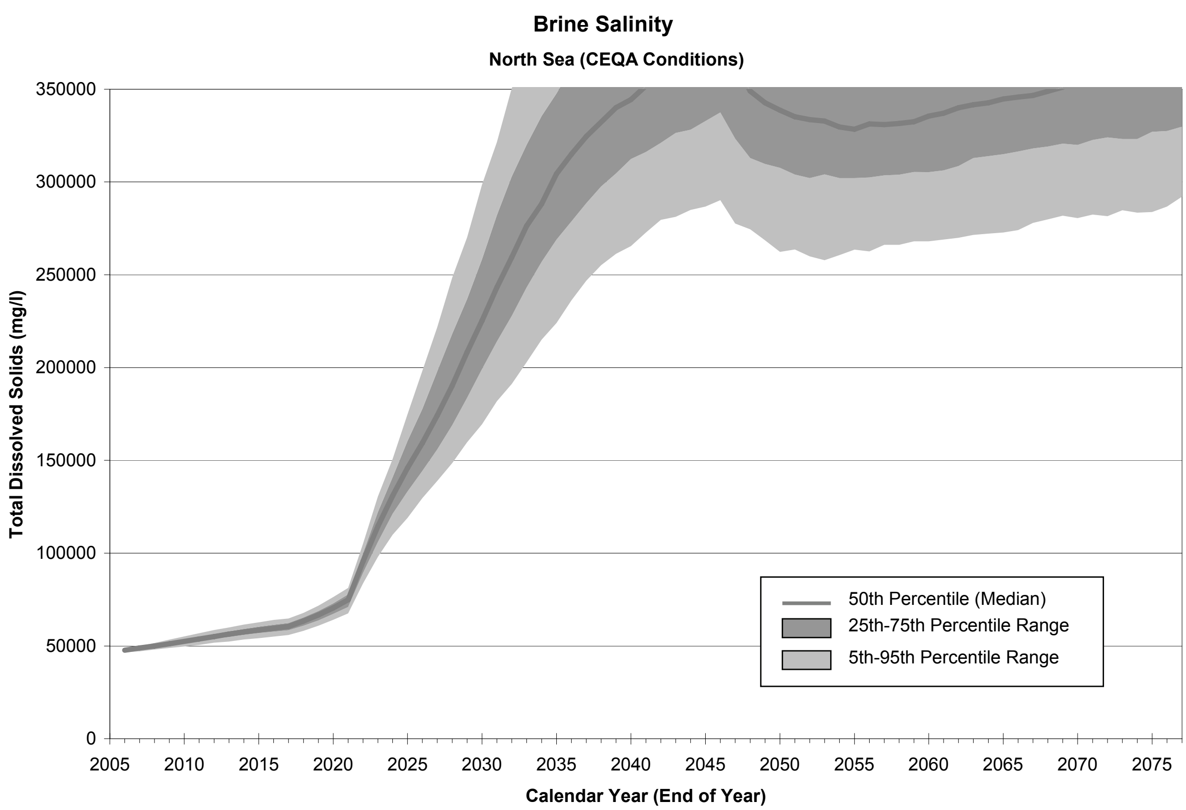

Salton Sea Exposed Playa
North Sea (Variability Conditions)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range
Trace 550 (~600 kaf/yr)
Trace 295 (~700 kaf/yr)
Trace 821 (~900 kaf/yr)
Trace 420 (~800 kaf/yr)
Exposed Playa (acres)
Calendar Year (End of Year)
0
25000
50000
75000
100000
125000
150000
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075

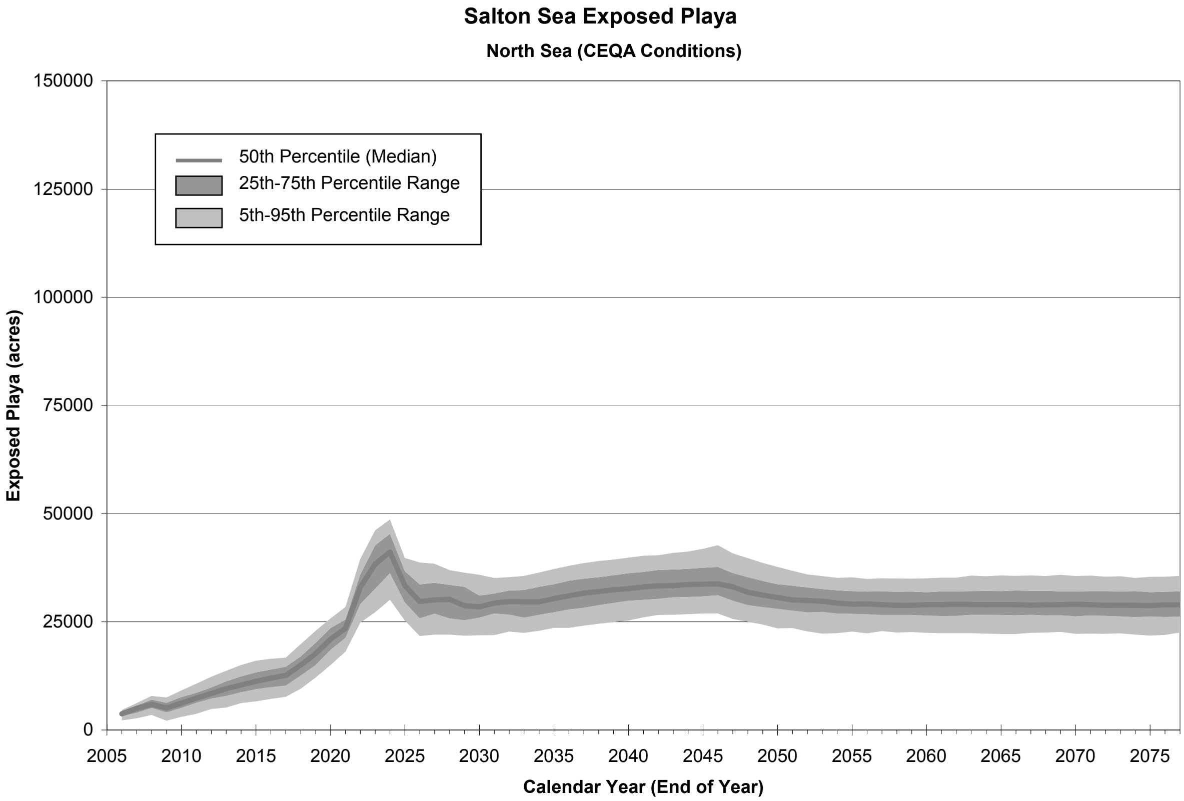

Saline Habitat Complex Wetted Area
North Sea (Variability Conditions)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range
Trace 550 (~600 kaf/yr)
Trace 295 (~700 kaf/yr)
Trace 821 (~900 kaf/yr)
Trace 420 (~800 kaf/yr)
Wetted Area (acres)
Calendar Year (End of Year)
0
10000
20000
30000
40000
50000
60000
70000
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075

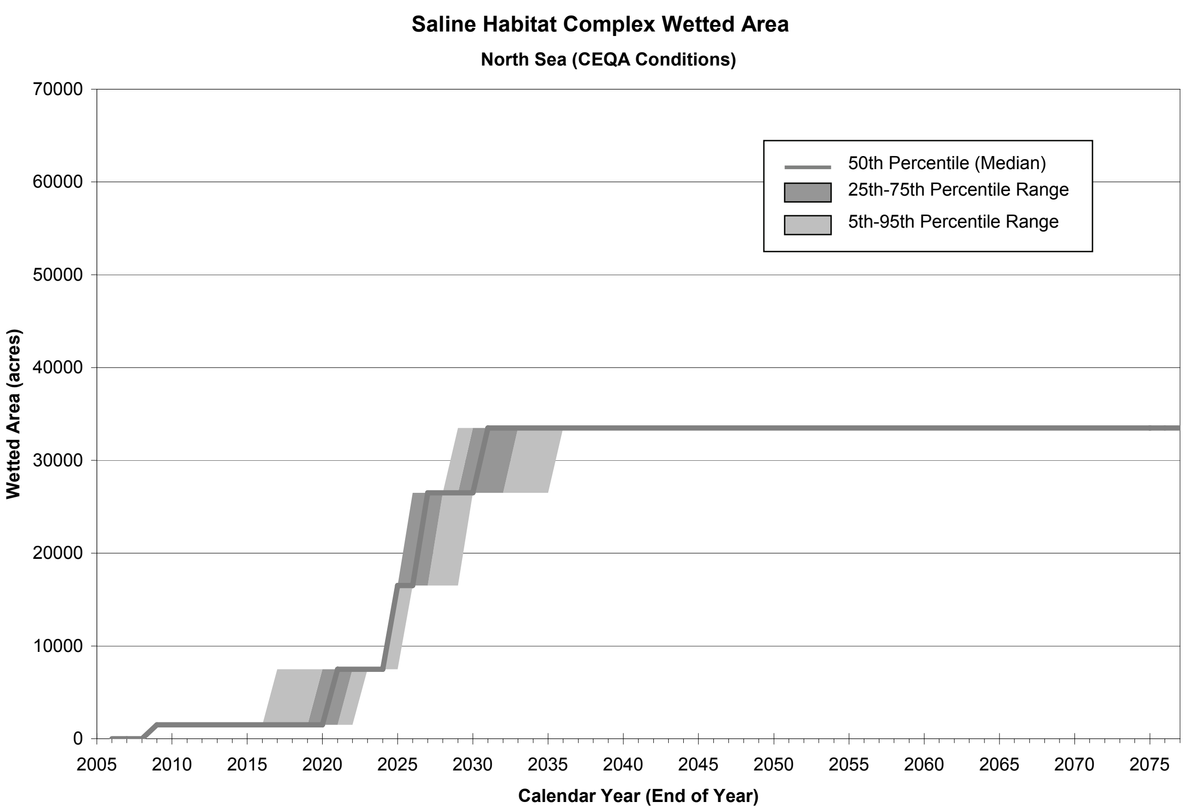

Marine Sea Water Surface Elevation
North Sea (CEQA Conditions)
Water Surface Elevation (ft amsl)
-220
-225
-230
-235
-240
-245
-250
-255
-260
-265
-270
-275
-280
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range
2005 2010 2015 2020 2025 2030 2035 2040 2045 2050 2055 2060 2065 2070 2075
Calendar Year (End of Year)


Marine Sea Salinity
North Sea (CEQA Conditions)
Total Dissolved Solids (mg/l)
350000
300000
250000
200000
150000
100000
50000
0
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range
2005 2010 2015 2020 2025 2030 2035 2040 2045 2050 2055 2060 2065 2070 2075
Calendar Year (End of Year)


Brine Water Surface Elevation
North Sea (CEQA Conditions)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range
Water Surface Elevation (ft amsl)
-220
-225
-230
-235
-240
-245
-250
-255
-260
-265
-270
-275
-280
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075
Calendar Year (End of Year)

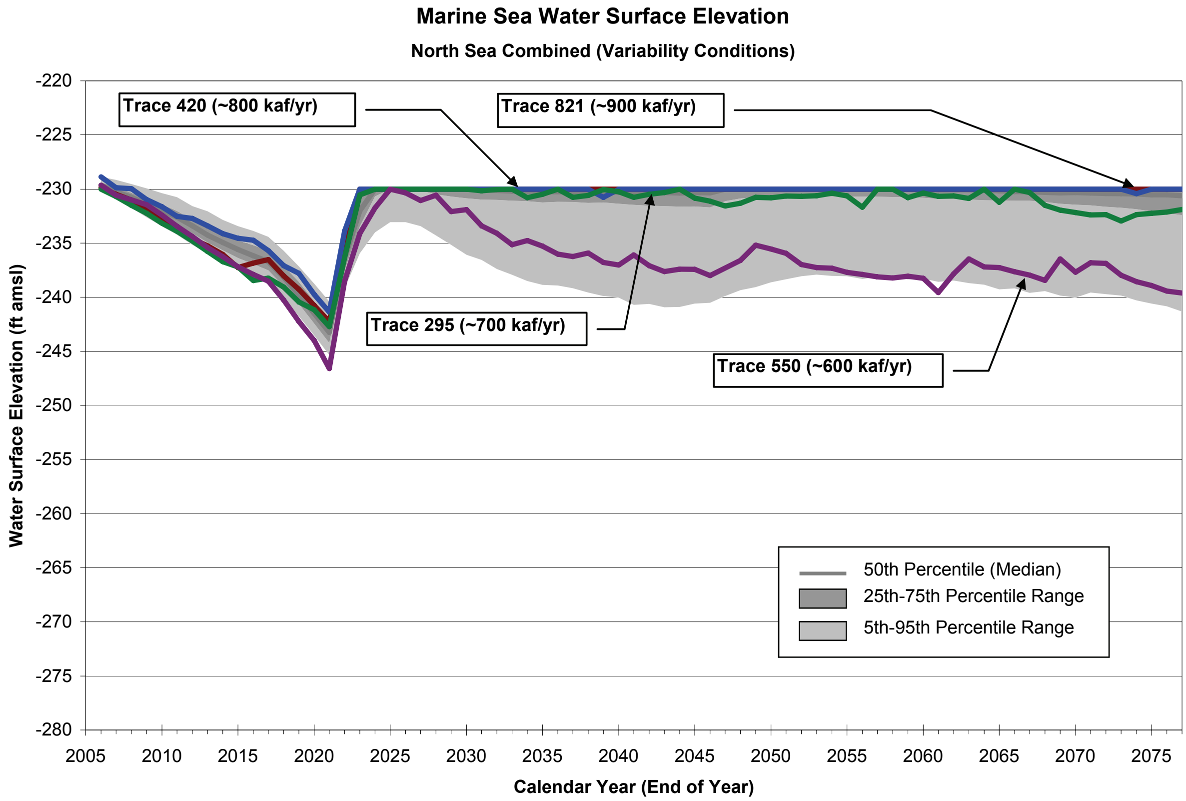

Brine Salinity
North Sea (CEQA Conditions)
Total Dissolved Solids (mg/l)
350000
300000
250000
200000
150000
100000
50000
0
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075
Calendar Year (End of Year)

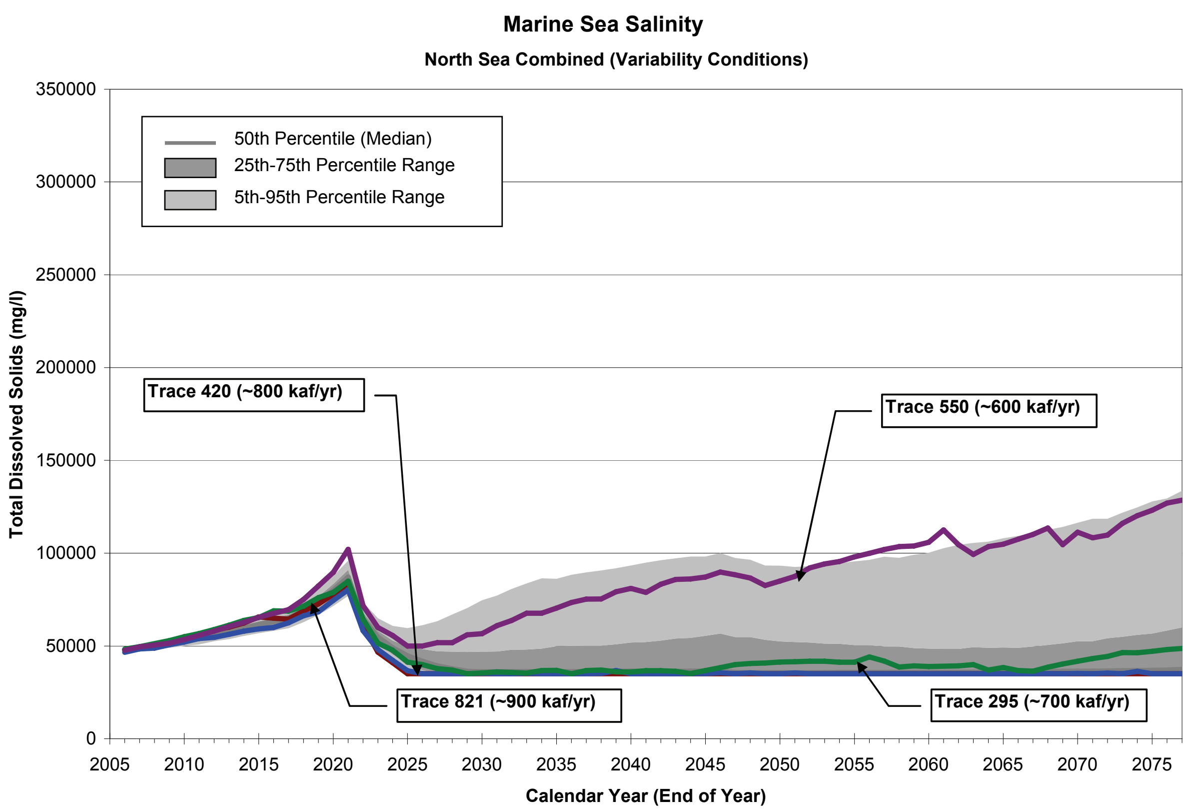

Salton Sea Exposed Playa
North Sea (CEQA Conditions)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range
Exposed Playa (acres)
150000
125000
100000
75000
50000
25000
0
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075
Calendar Year (End of Year)

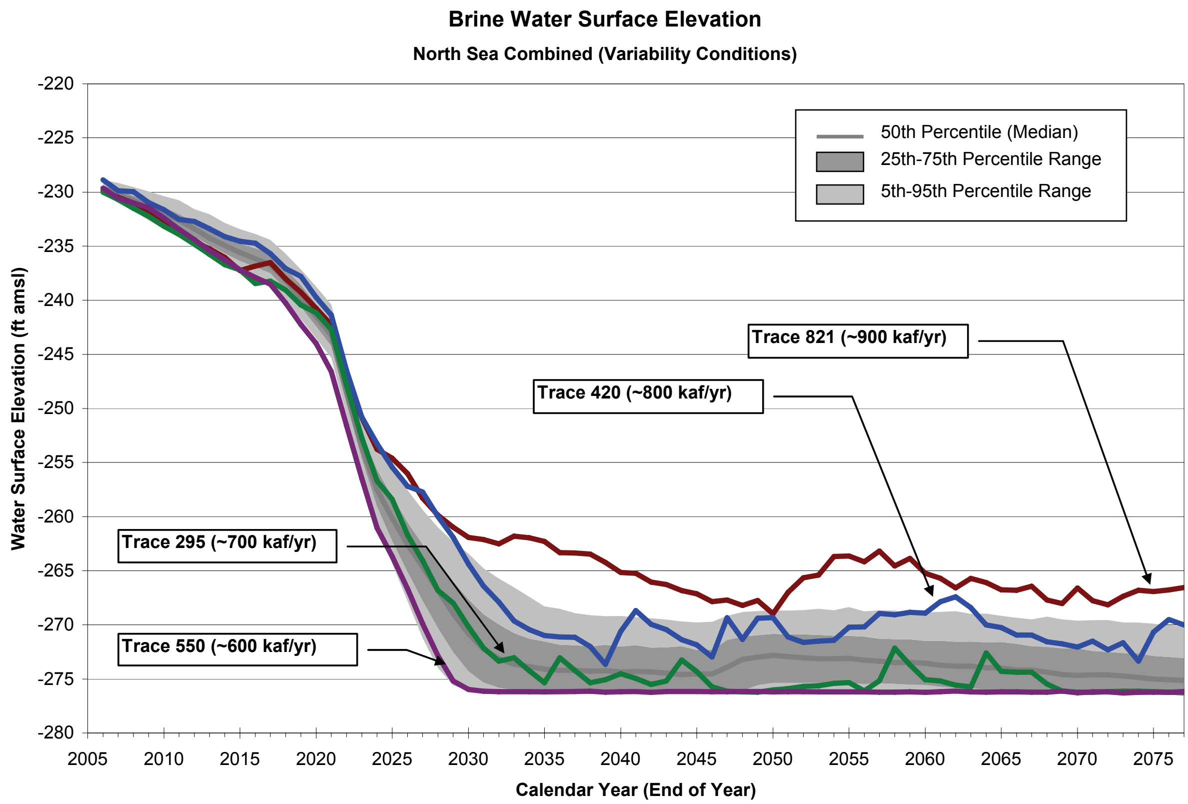

Saline Habitat Complex Wetted Area
North Sea (CEQA Conditions)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range
Wetted Area (acres)
70000
60000
50000
40000
30000
20000
10000
0
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075
Calendar Year (End of Year)

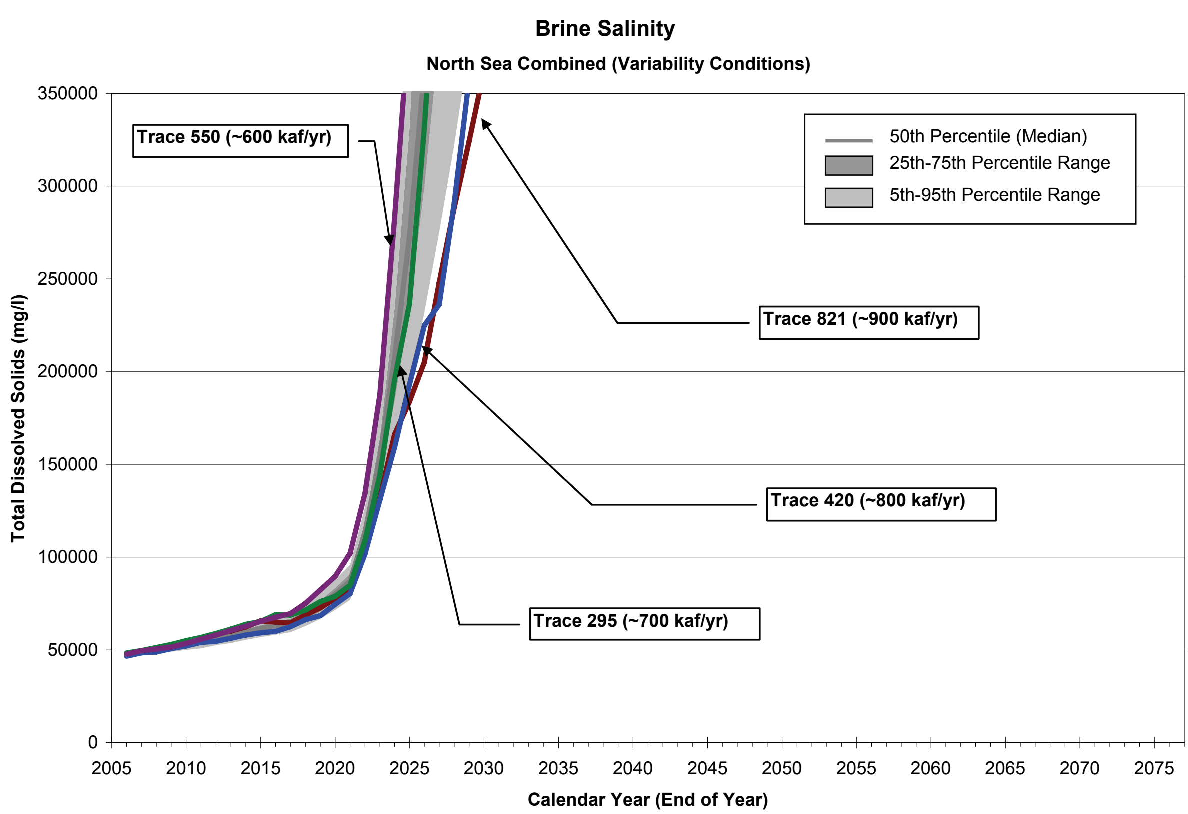
ALTERNATIVE 6 – NORTH SEA COMBINED

SALSA Modeling Results
(Figures H2-2-11a through H2-2-11l)


Marine Sea Water Surface Elevation
North Sea Combined (Variability Conditions)
Trace 420 (~800 kaf/yr)
Trace 821 (~900 kaf/yr)
Trace 295 (~700 kaf/yr)
Trace 550 (~600 kaf/yr)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range
Water Surface Elevation (ft amsl)
-220
-225
-230
-235
-240
-245
-250
-255
-260
-265
-270
-275
-280
2005 2010 2015 2020 2025 2030 2035 2040 2045 2050 2055 2060 2065 2070 2075
Calendar Year (End of Year)


Marine Sea Salinity
North Sea Combined (Variability Conditions)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range
Trace 420 (~800 kaf/yr)
Trace 550 (~600 kaf/yr)
Trace 821 (~900 kaf/yr)
Trace 295 (~700 kaf/yr)
Total Dissolved Solids (mg/l)
350000
300000
250000
200000
150000
100000
50000
0
2005 2010 2015 2020 2025 2030 2035 2040 2045 2050 2055 2060 2065 2070 2075
Calendar Year (End of Year)


Brine Water Surface Elevation
North Sea Combined (Variability Conditions)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range
Trace 821 (~900 kaf/yr)
Trace 420 (~800 kaf/yr)
Trace 295 (~700 kaf/yr)
Trace 550 (~600 kaf/yr)
Water Surface Elevation (ft amsl)
Calendar Year (End of Year)
-220
-225
-230
-235
-240
-245
-250
-255
-260
-265
-270
-275
-280
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075


Brine Salinity
North Sea Combined (Variability Conditions)
Trace 550 (~600 kaf/yr)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range
Trace 821 (~900 kaf/yr)
Trace 420 (~800 kaf/yr)
Trace 295 (~700 kaf/yr)
Total Dissolved Solids (mg/l)
Calendar Year (End of Year)
350000
300000
250000
200000
150000
100000
50000
0
2005
2010
2015
2020
2025
2030
2035
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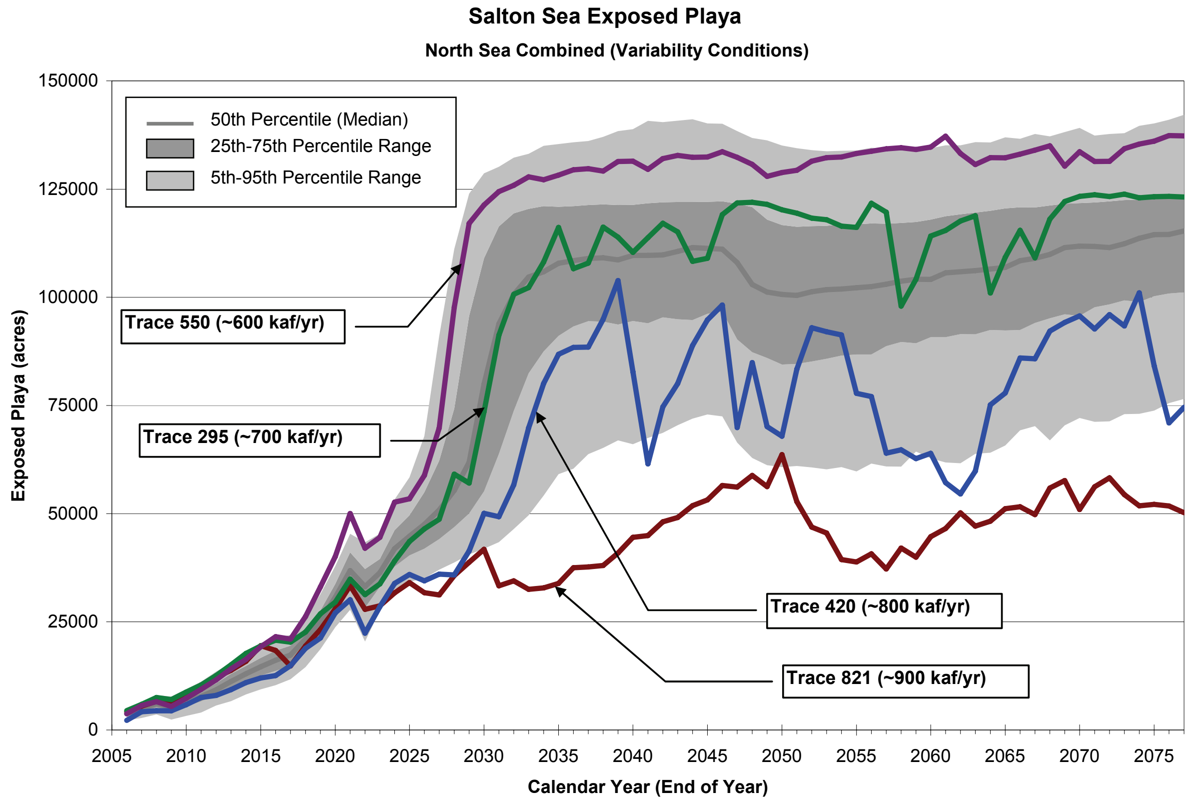
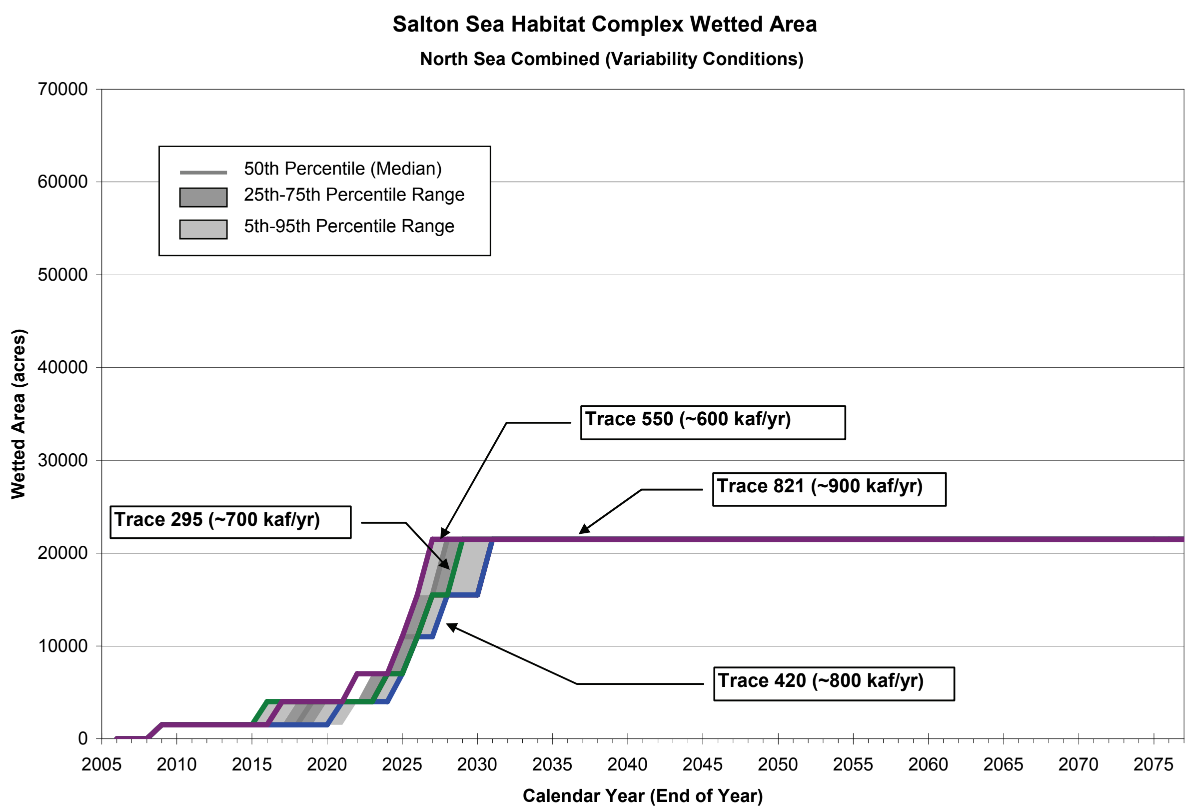
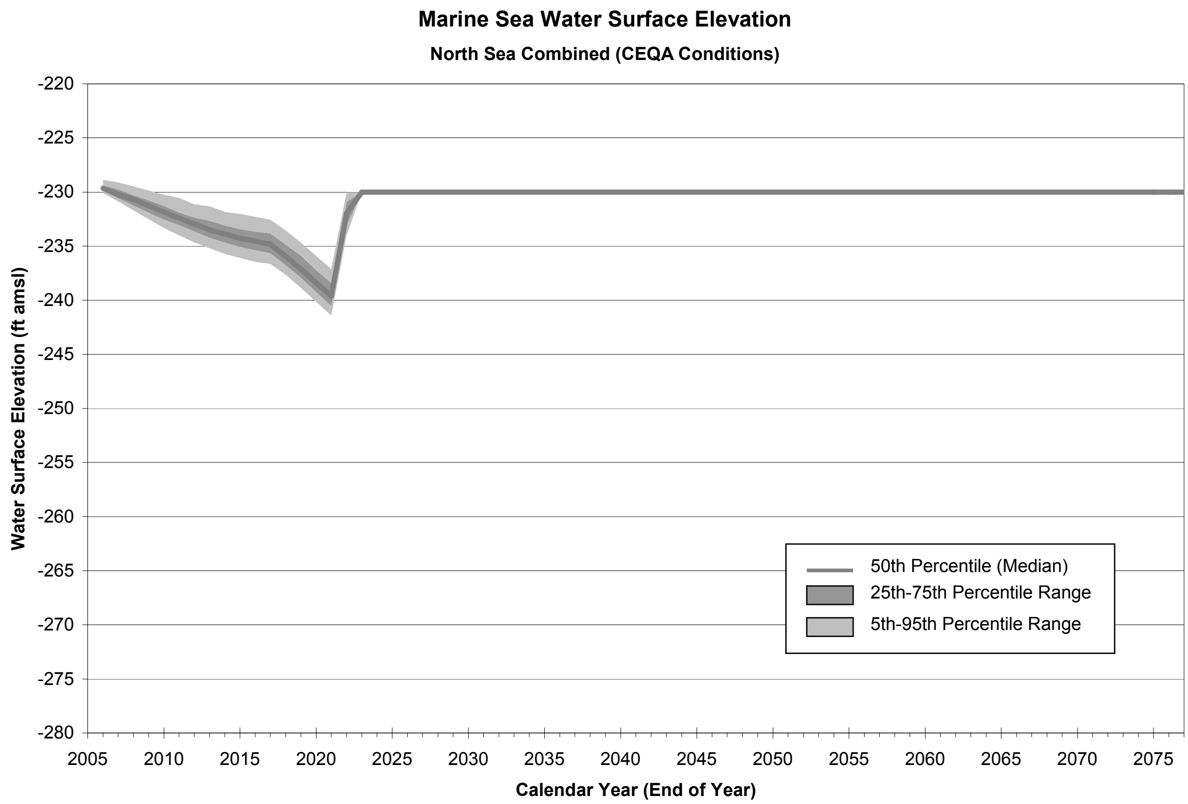
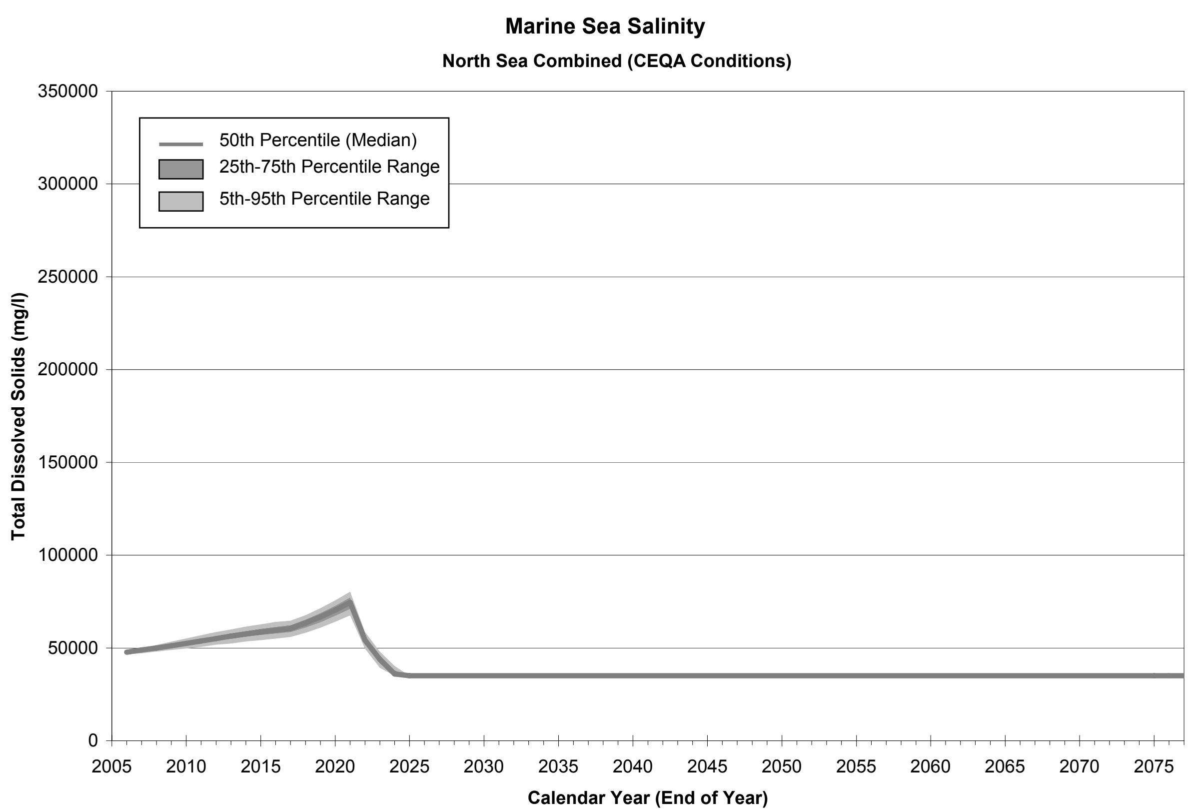
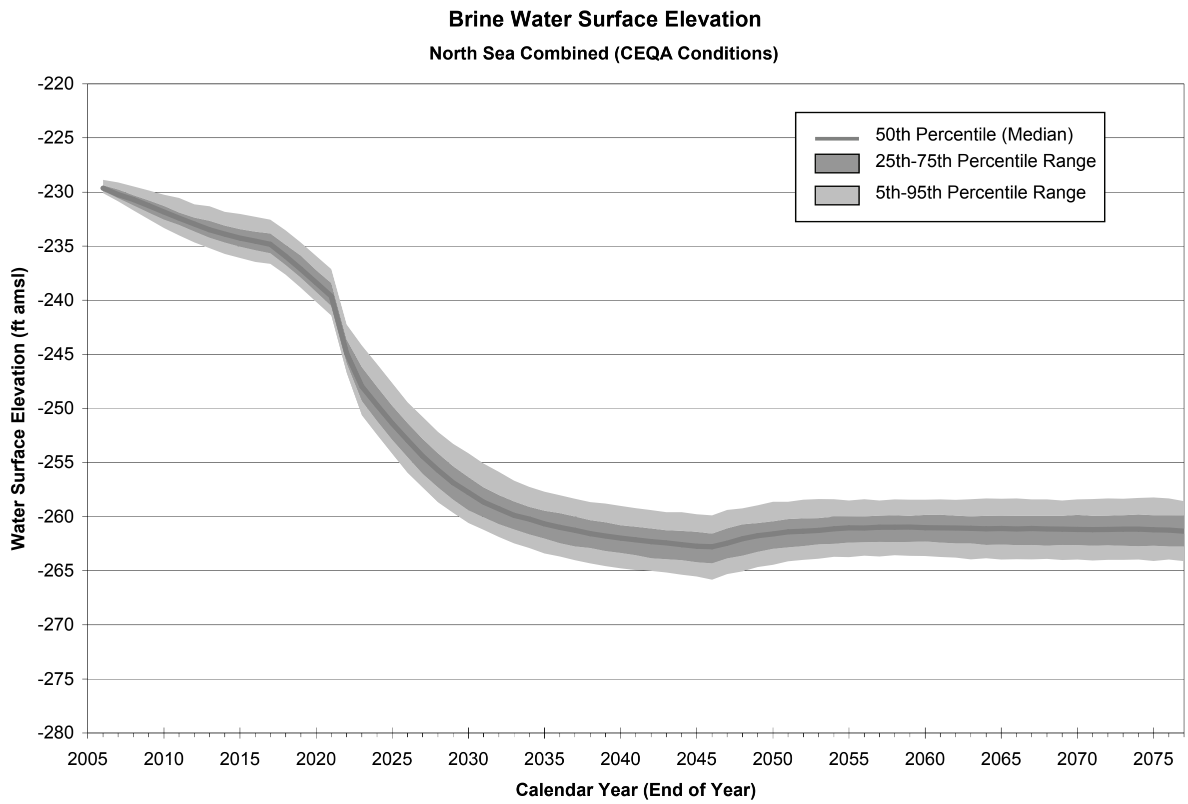
2060
2065
2070
2075

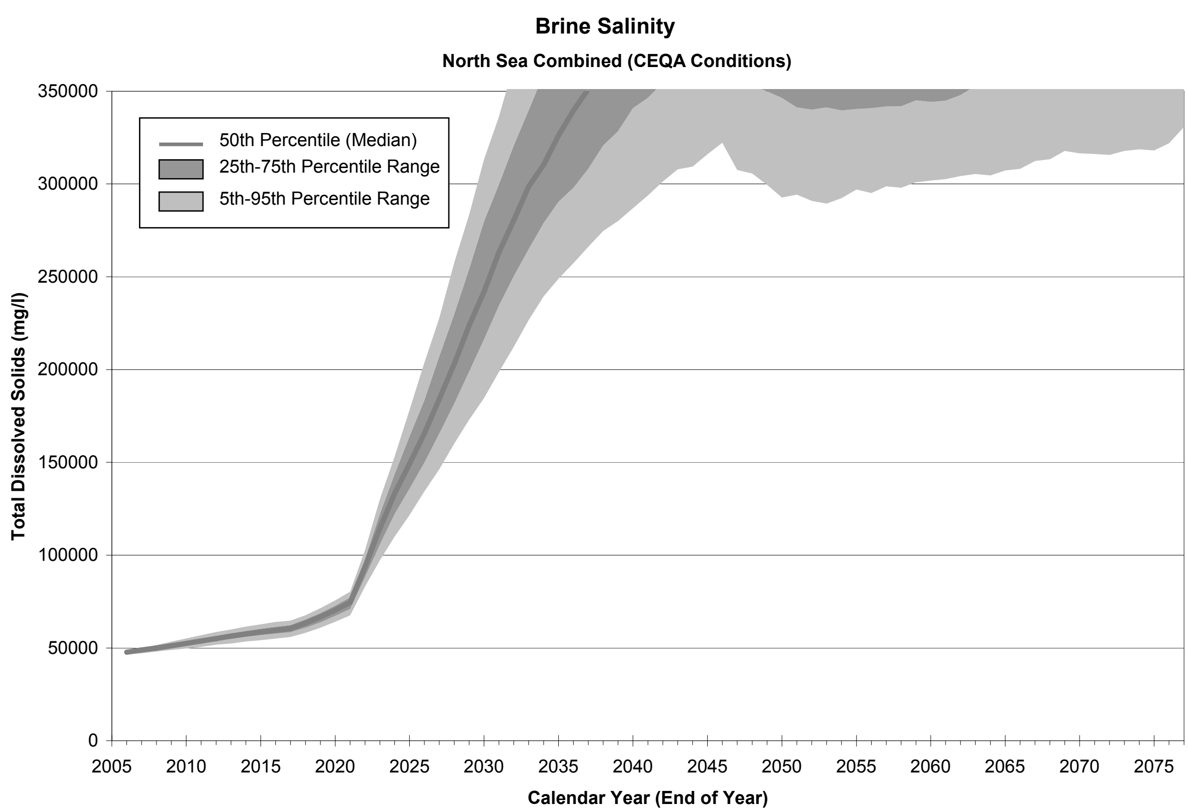

Salton Sea Exposed Playa
North Sea Combined (Variability Conditions)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range
Trace 550 (~600 kaf/yr)
Trace 295 (~700 kaf/yr)
Trace 420 (~800 kaf/yr)
Trace 821 (~900 kaf/yr)
Exposed Playa (acres)
Calendar Year (End of Year)
0
25000
50000
75000
100000
125000
150000
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075

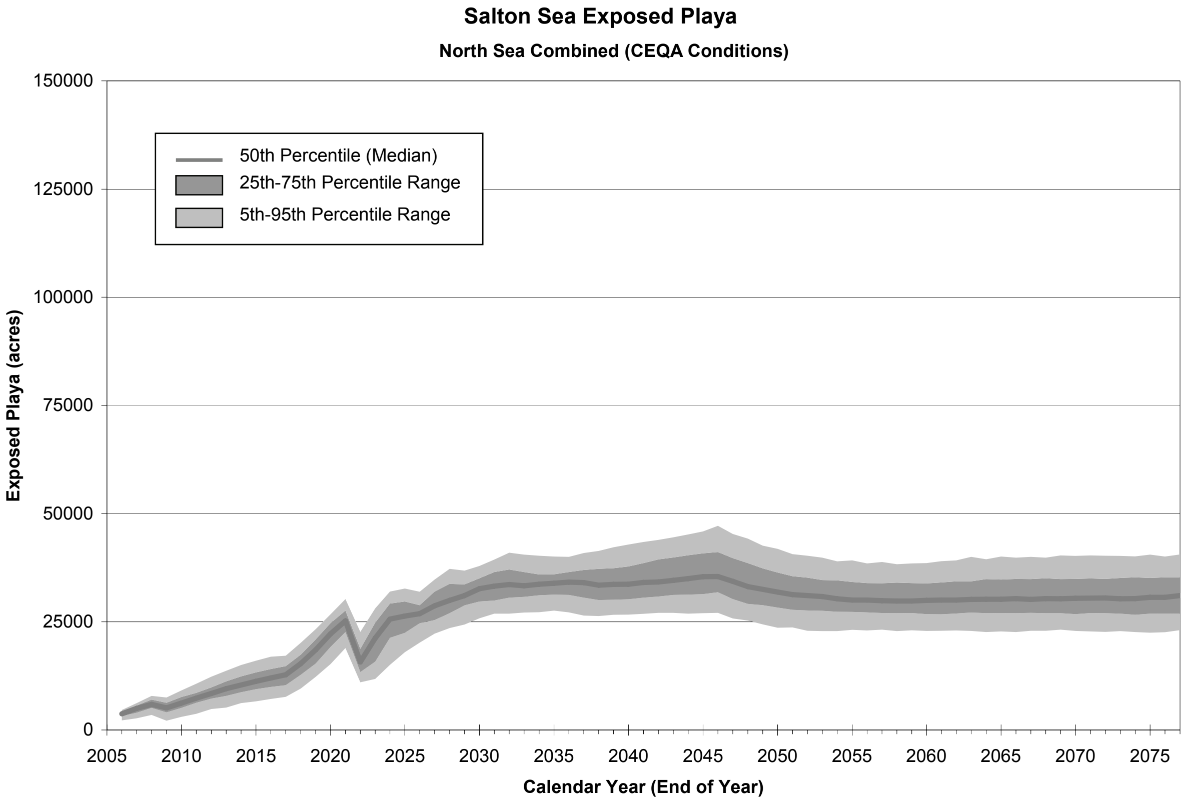

Salton Sea Habitat Complex Wetted Area
North Sea Combined (Variability Conditions)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range
Trace 550 (~600 kaf/yr)
Trace 821 (~900 kaf/yr)
Trace 295 (~700 kaf/yr)
Trace 420 (~800 kaf/yr)
Wetted Area (acres)
Calendar Year (End of Year)
0
10000
20000
30000
40000
50000
60000
70000
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075

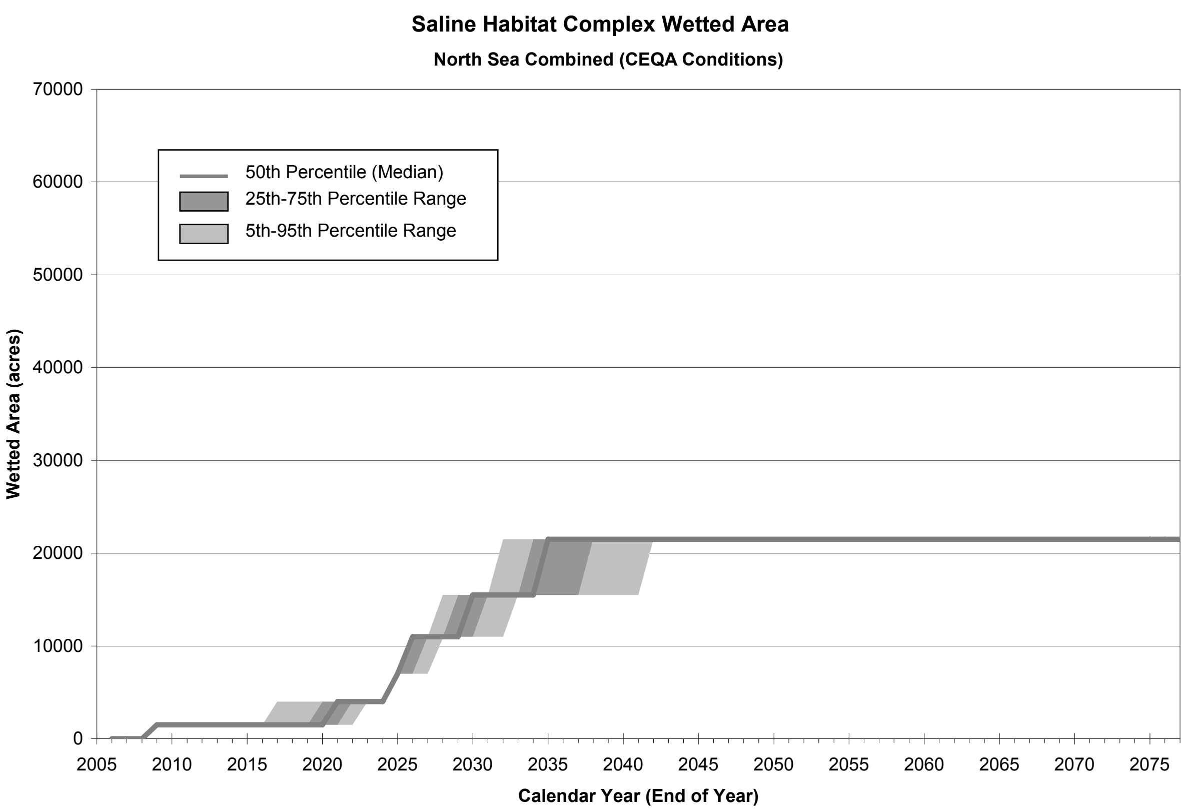

Marine Sea Water Surface Elevation
North Sea Combined (CEQA Conditions)
Water Surface Elevation (ft amsl)
-220
-225
-230
-235
-240
-245
-250
-255
-260
-265
-270
-275
-280
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075
Calendar Year (End of Year)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range


Marine Sea Salinity
North Sea Combined (CEQA Conditions)
Total Dissolved Solids (mg/l)
350000
300000
250000
200000
150000
100000
50000
0
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075
Calendar Year (End of Year)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range


Brine Water Surface Elevation
North Sea Combined (CEQA Conditions)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range
Water Surface Elevation (ft amsl)
Calendar Year (End of Year)
-220
-225
-230
-235
-240
-245
-250
-255
-260
-265
-270
-275
-280
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075

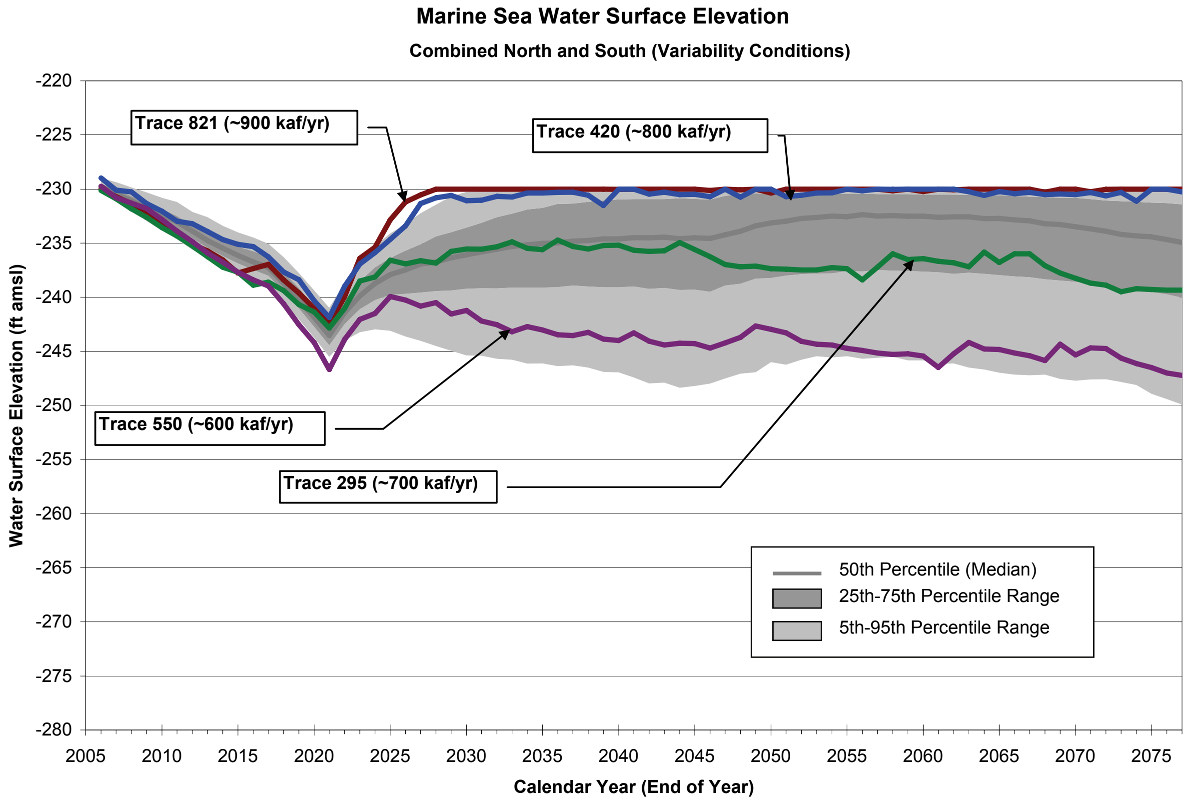

Brine Salinity
North Sea Combined (CEQA Conditions)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range
Total Dissolved Solids (mg/l)
Calendar Year (End of Year)
350000
300000
250000
200000
150000
100000
50000
0
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075

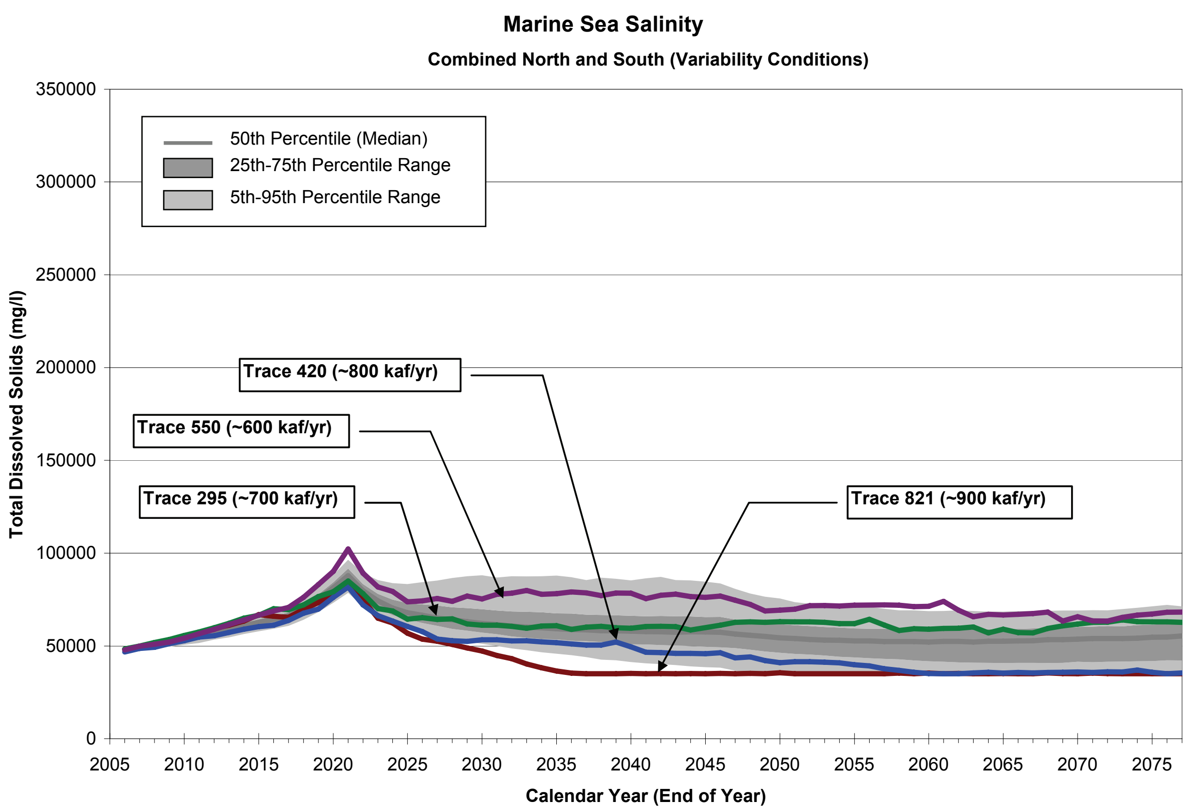

Salton Sea Exposed Playa
North Sea Combined (CEQA Conditions)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range
Exposed Playa (acres)
150000
125000
100000
75000
50000
25000
0
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075
Calendar Year (End of Year)

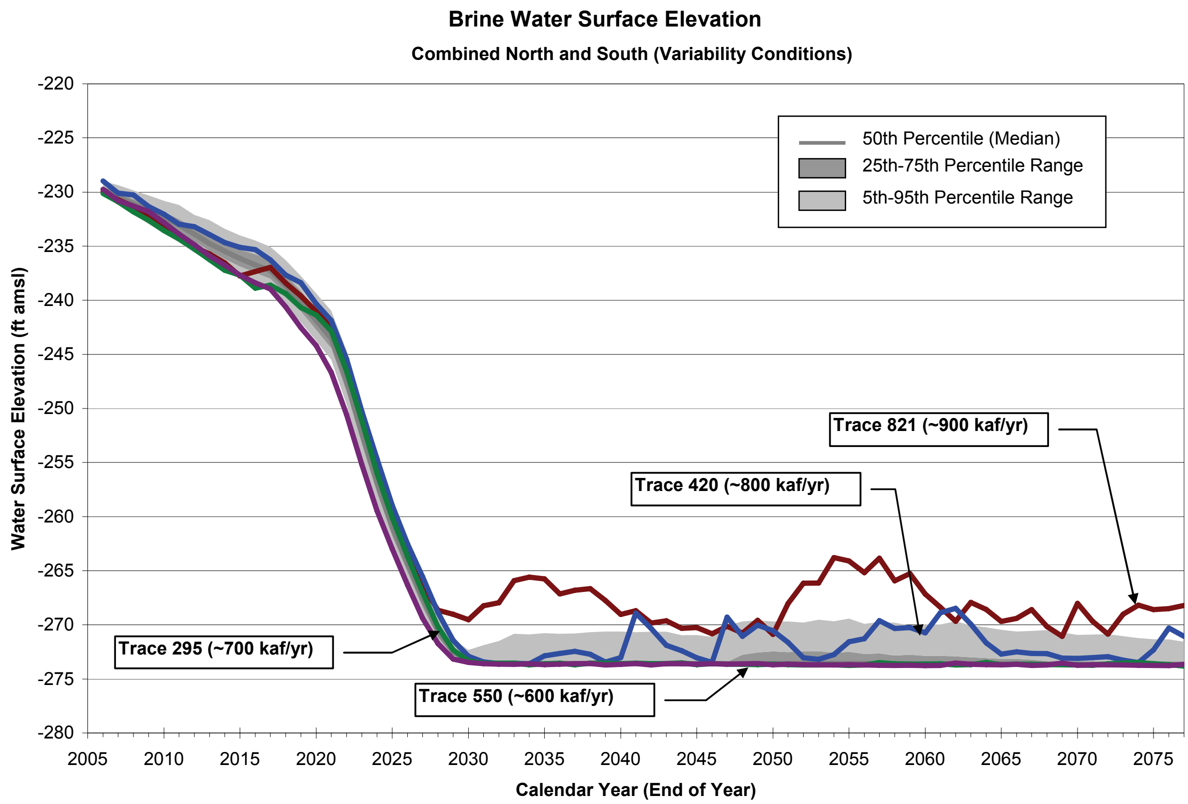

Saline Habitat Complex Wetted Area
North Sea Combined (CEQA Conditions)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range
Wetted Area (acres)
70000
60000
50000
40000
30000
20000
10000
0
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075
Calendar Year (End of Year)

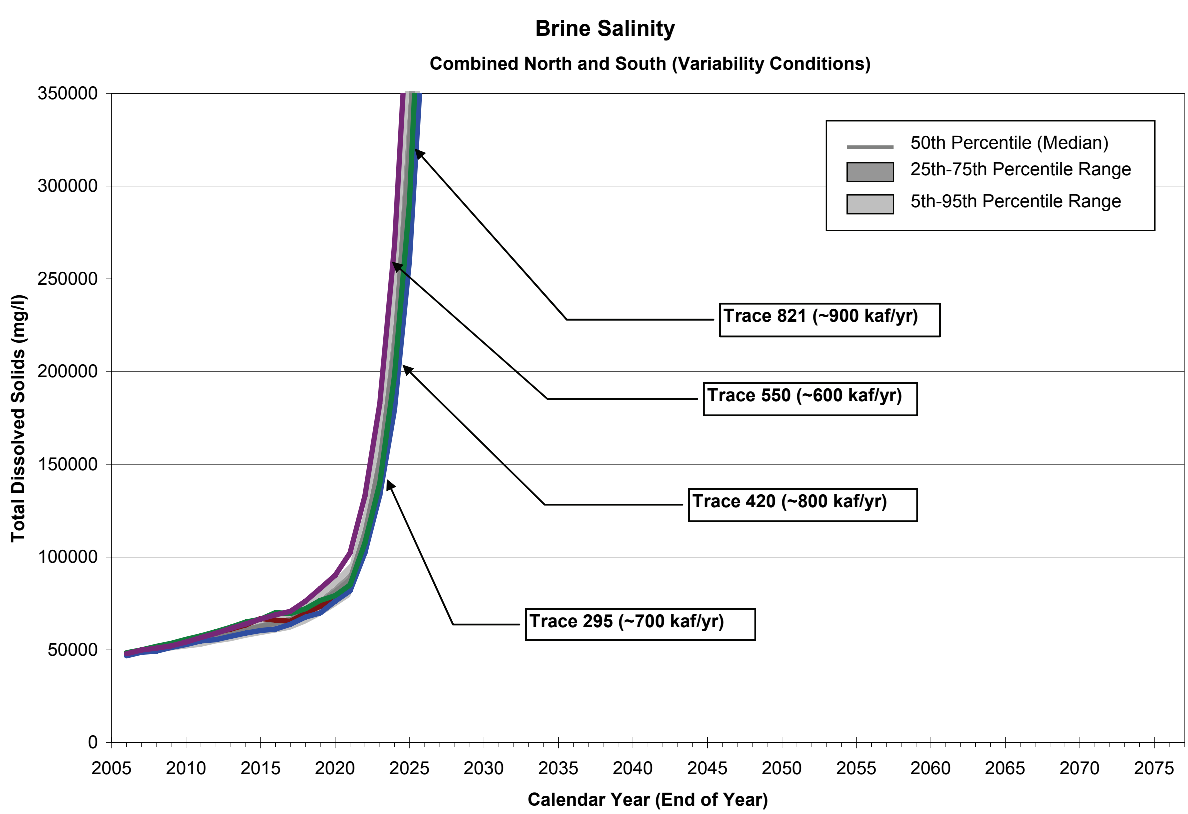
ALTERNATIVE 7 – COMBINED NORTH AND SOUTH LAKES

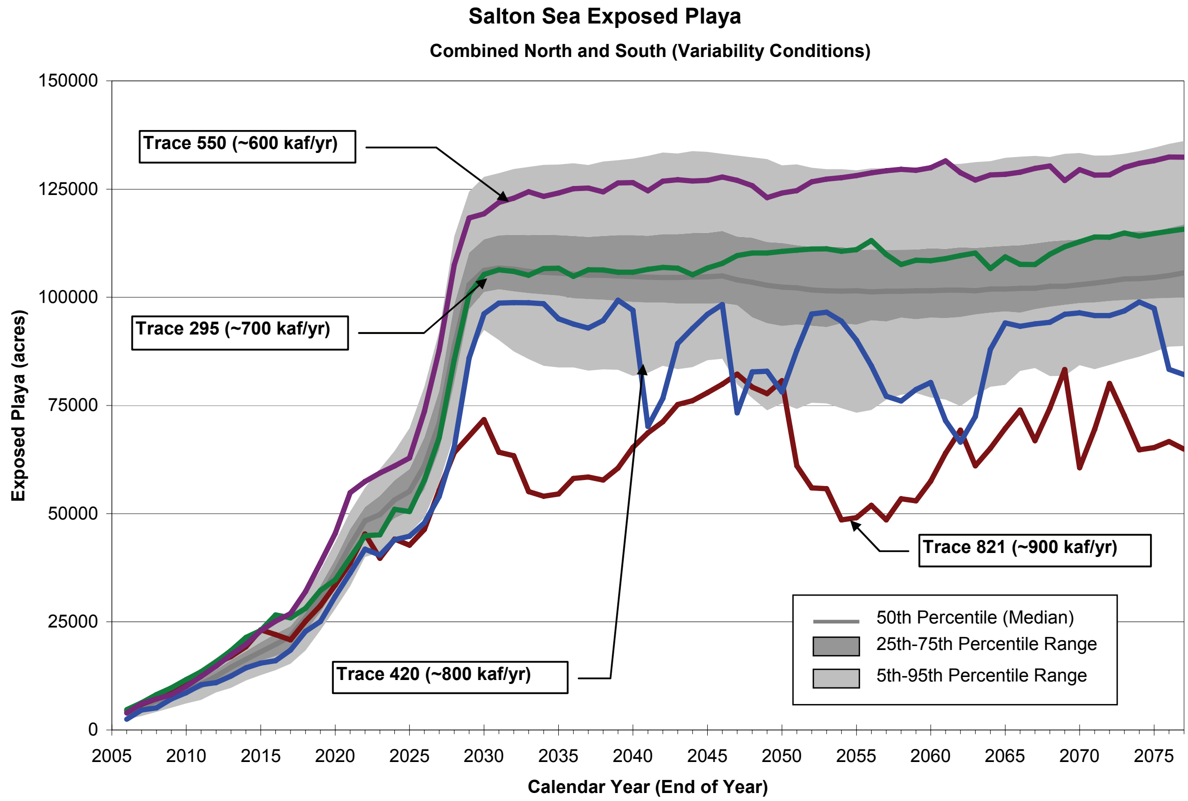
SALSA Modeling Results
(Figures H2-2-12a through H2-2-12l)

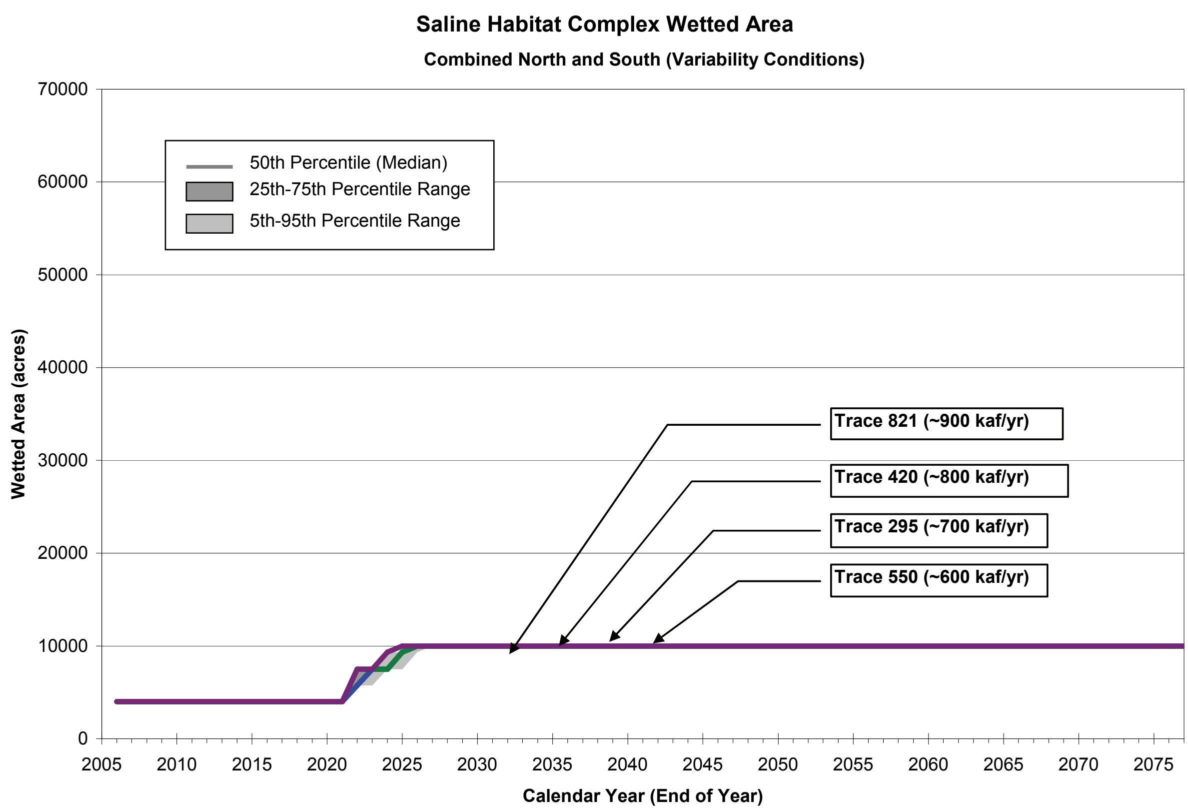

Marine Sea Water Surface Elevation
Combined North and South (Variability Conditions)
Water Surface Elevation (ft amsl)
-220
-225
-230
-235
-240
-245
-250
-255
-260
-265
-270
-275
-280
Trace 821 (~900 kaf/yr)
Trace 420 (~800 kaf/yr)
Trace 550 (~600 kaf/yr)
Trace 295 (~700 kaf/yr)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075
Calendar Year (End of Year)

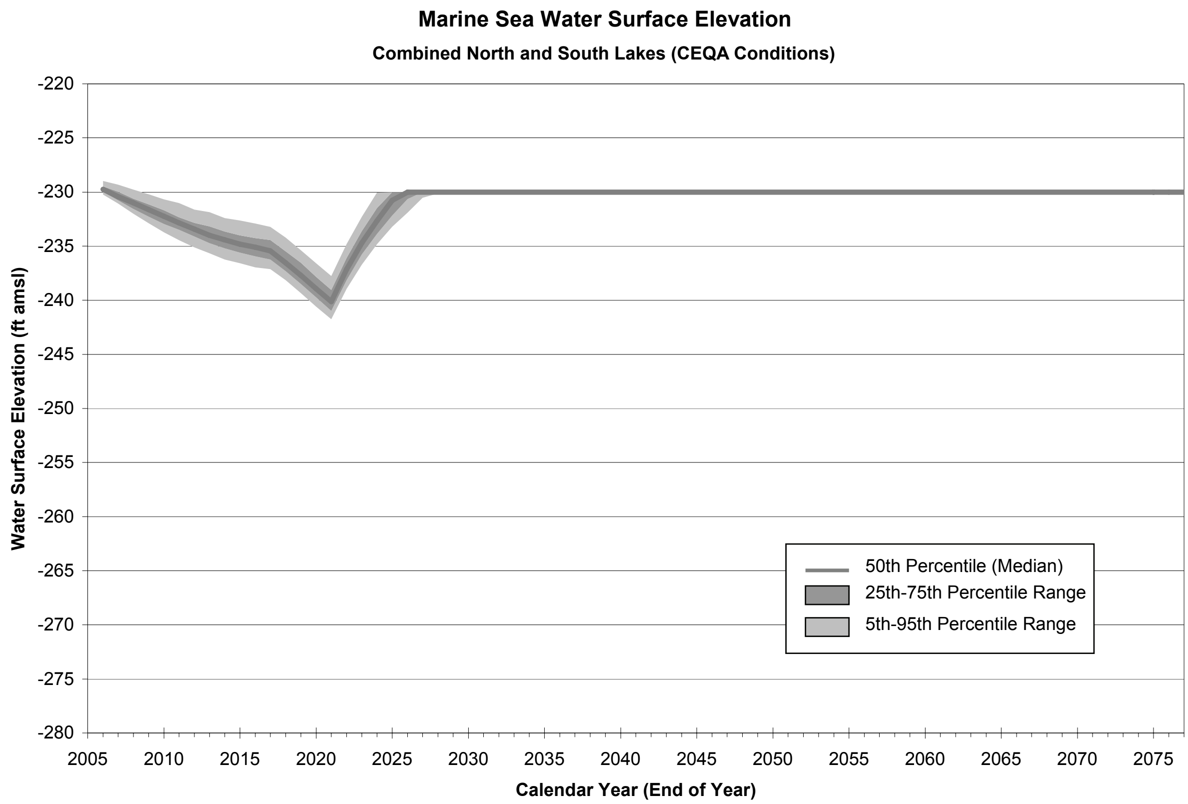

Marine Sea Salinity
Combined North and South (Variability Conditions)
Total Dissolved Solids (mg/l)
350000
300000
250000
200000
150000
100000
50000
0
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range
Trace 420 (~800 kaf/yr)
Trace 550 (~600 kaf/yr)
Trace 295 (~700 kaf/yr)
Trace 821 (~900 kaf/yr)
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075
Calendar Year (End of Year)

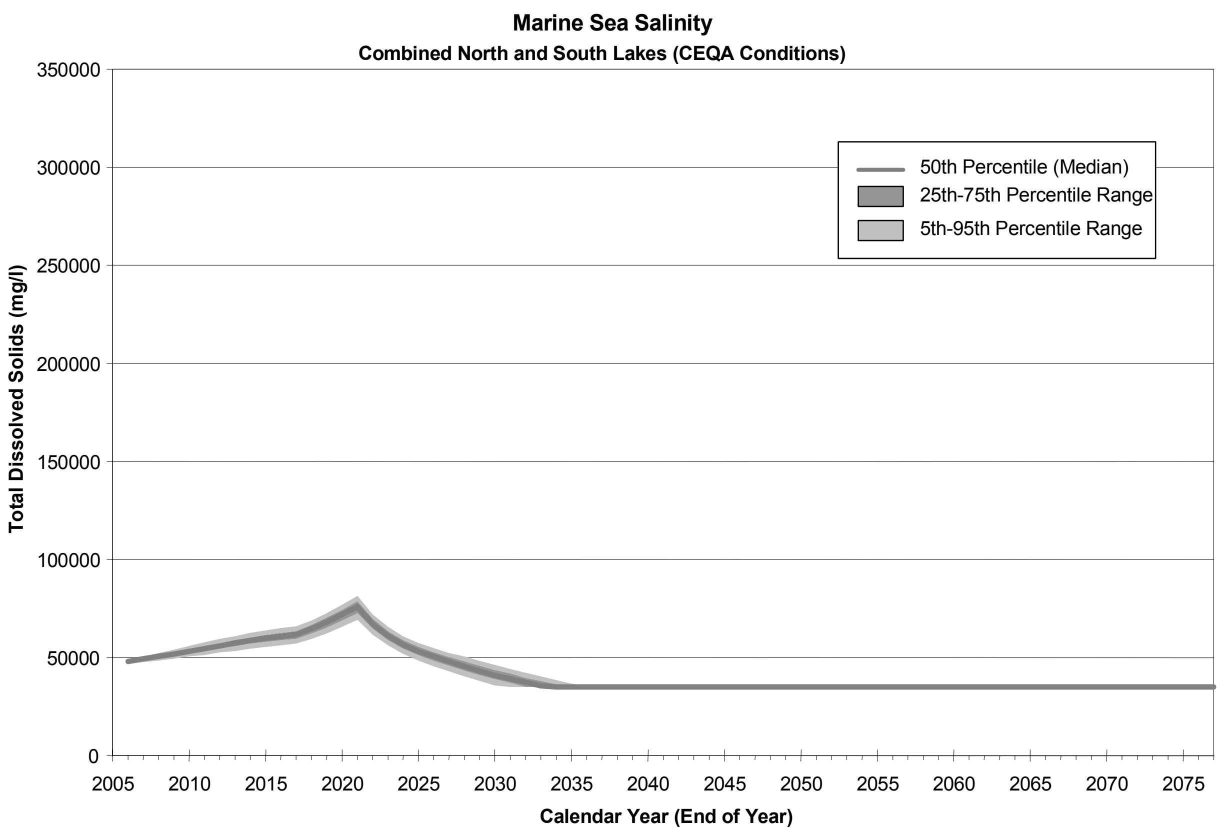

Brine Water Surface Elevation
Combined North and South (Variability Conditions)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range
Trace 821 (~900 kaf/yr)
Trace 420 (~800 kaf/yr)
Trace 295 (~700 kaf/yr)
Trace 550 (~600 kaf/yr)
Water Surface Elevation (ft amsl)
Calendar Year (End of Year)


Brine Salinity
Combined North and South (Variability Conditions)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range
Trace 821 (~900 kaf/yr)
Trace 550 (~600 kaf/yr)
Trace 420 (~800 kaf/yr)
Trace 295 (~700 kaf/yr)
Total Dissolved Solids (mg/l)
Calendar Year (End of Year)

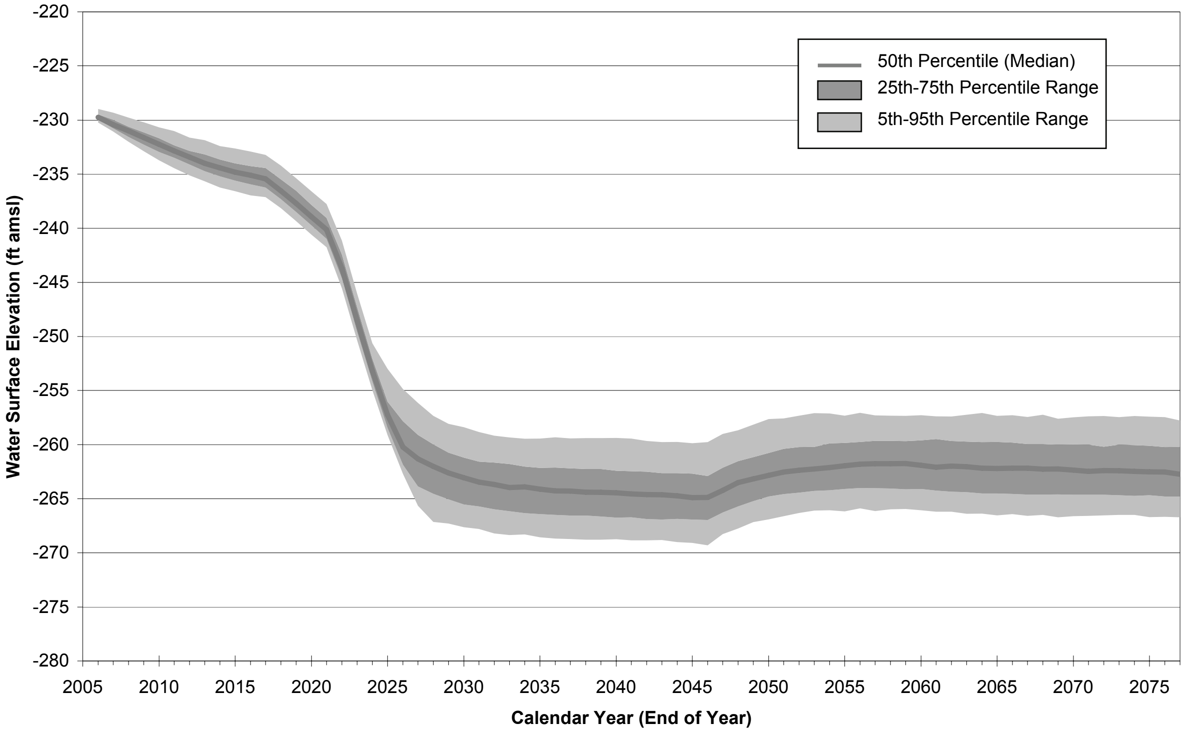

Salton Sea Exposed Playa
Combined North and South (Variability Conditions)
Exposed Playa (acres)
150000
125000
100000
75000
50000
25000
0
Trace 550 (~600 kaf/yr)
Trace 295 (~700 kaf/yr)
Trace 821 (~900 kaf/yr)
Trace 420 (~800 kaf/yr)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075
Calendar Year (End of Year)


Saline Habitat Complex Wetted Area
Combined North and South (Variability Conditions)
Wetted Area (acres)
70000
60000
50000
40000
30000
20000
10000
0
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range
Trace 821 (~900 kaf/yr)
Trace 420 (~800 kaf/yr)
Trace 295 (~700 kaf/yr)
Trace 550 (~600 kaf/yr)
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075
Calendar Year (End of Year)

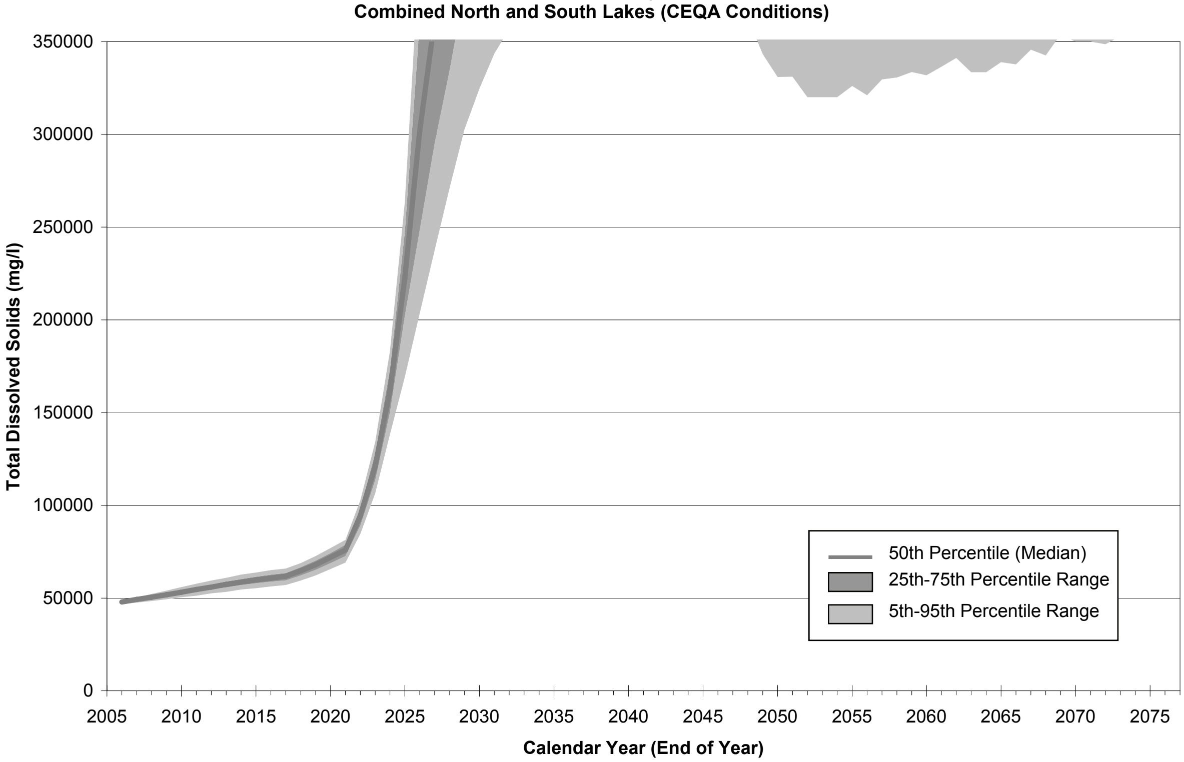

Marine Sea Water Surface Elevation
Combined North and South Lakes (CEQA Conditions)
Water Surface Elevation (ft amsl)
-220
-225
-230
-235
-240
-245
-250
-255
-260
-265
-270
-275
-280
2005 2010 2015 2020 2025 2030 2035 2040 2045 2050 2055 2060 2065 2070 2075
Calendar Year (End of Year)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range

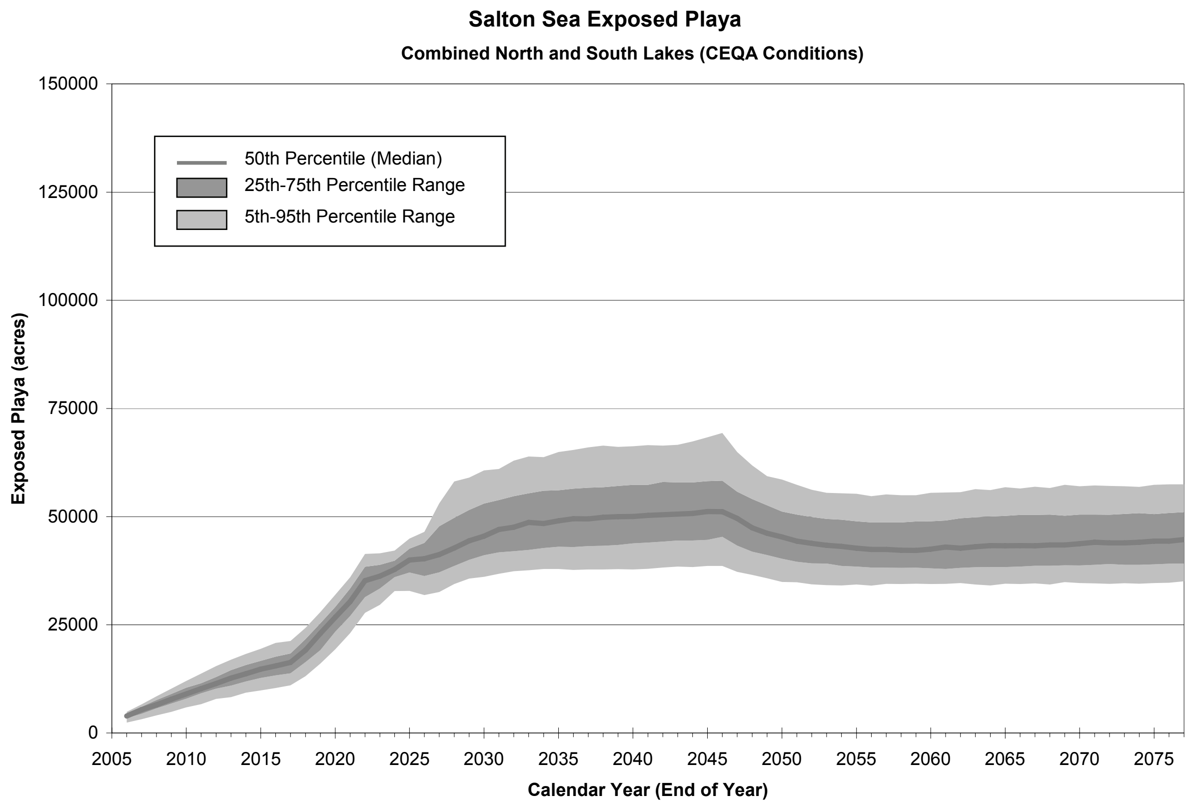

Marine Sea Salinity
Combined North and South Lakes (CEQA Conditions)
Total Dissolved Solids (mg/l)
350000
300000
250000
200000
150000
100000
50000
0
2005 2010 2015 2020 2025 2030 2035 2040 2045 2050 2055 2060 2065 2070 2075
Calendar Year (End of Year)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range

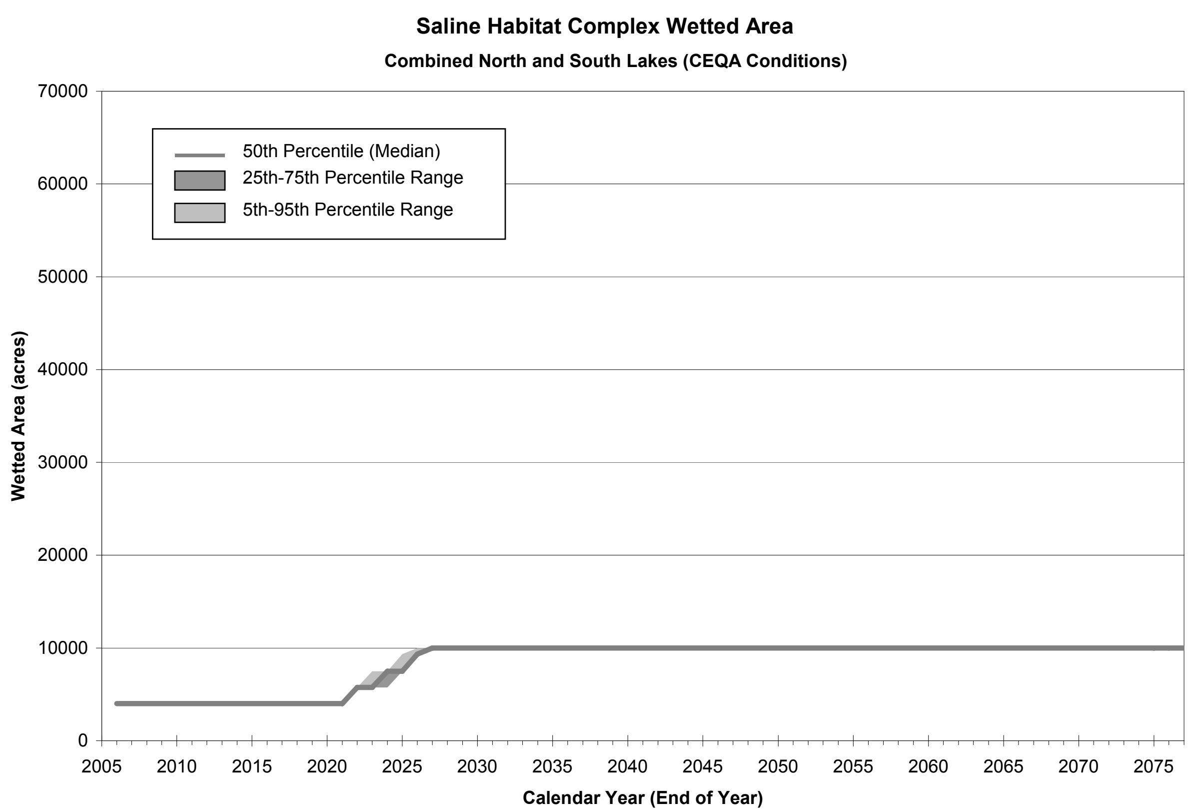
Brine Water Surface Elevation
Combined North and South Lakes (CEQA Conditions)



Brine Salinity
Combined North and South Lakes (CEQA Conditions)

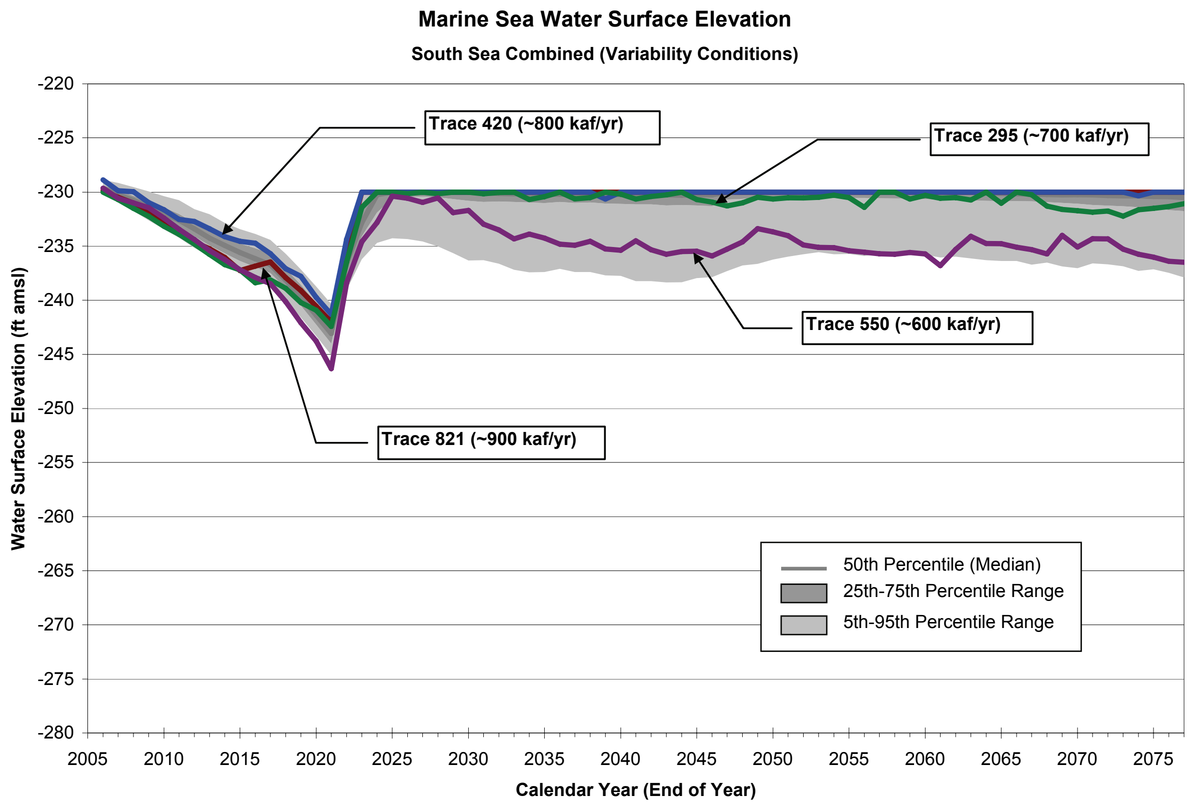


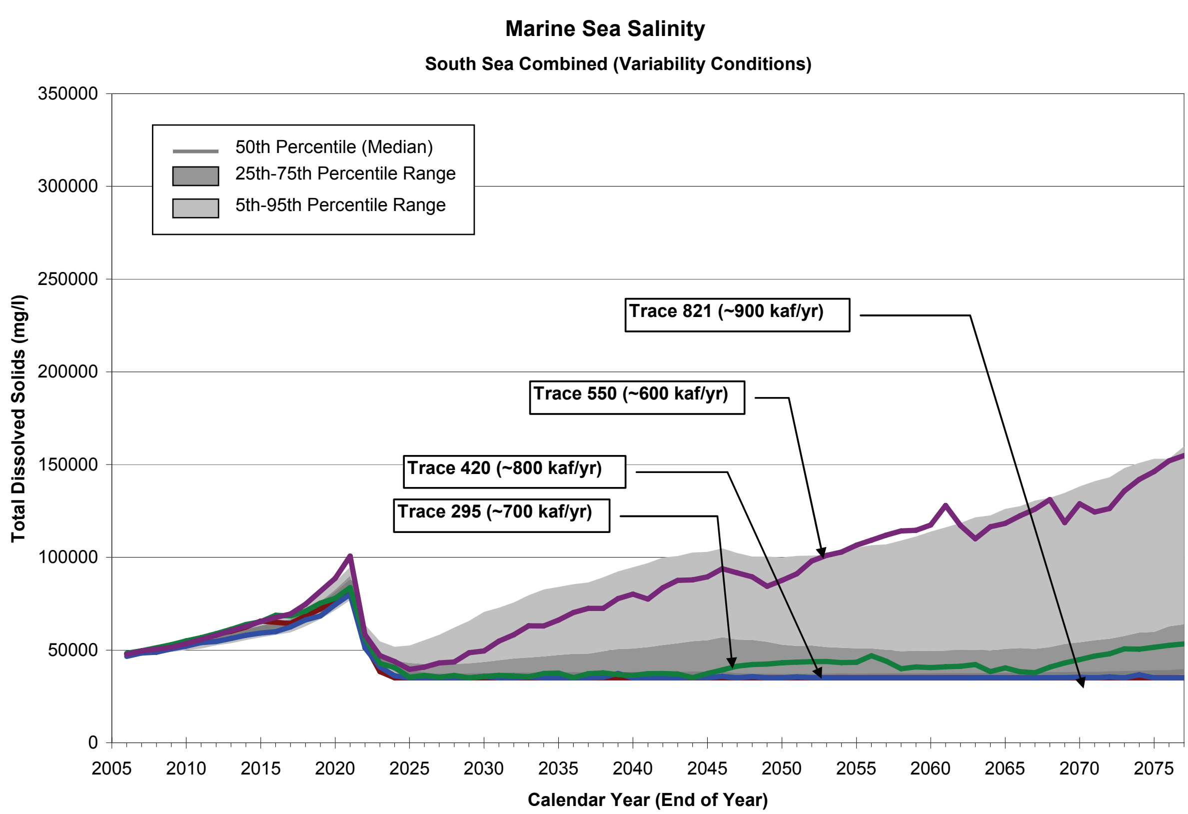

Salton Sea Exposed Playa
Combined North and South Lakes (CEQA Conditions)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range
Exposed Playa (acres)
150000
125000
100000
75000
50000
25000
0
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075
Calendar Year (End of Year)

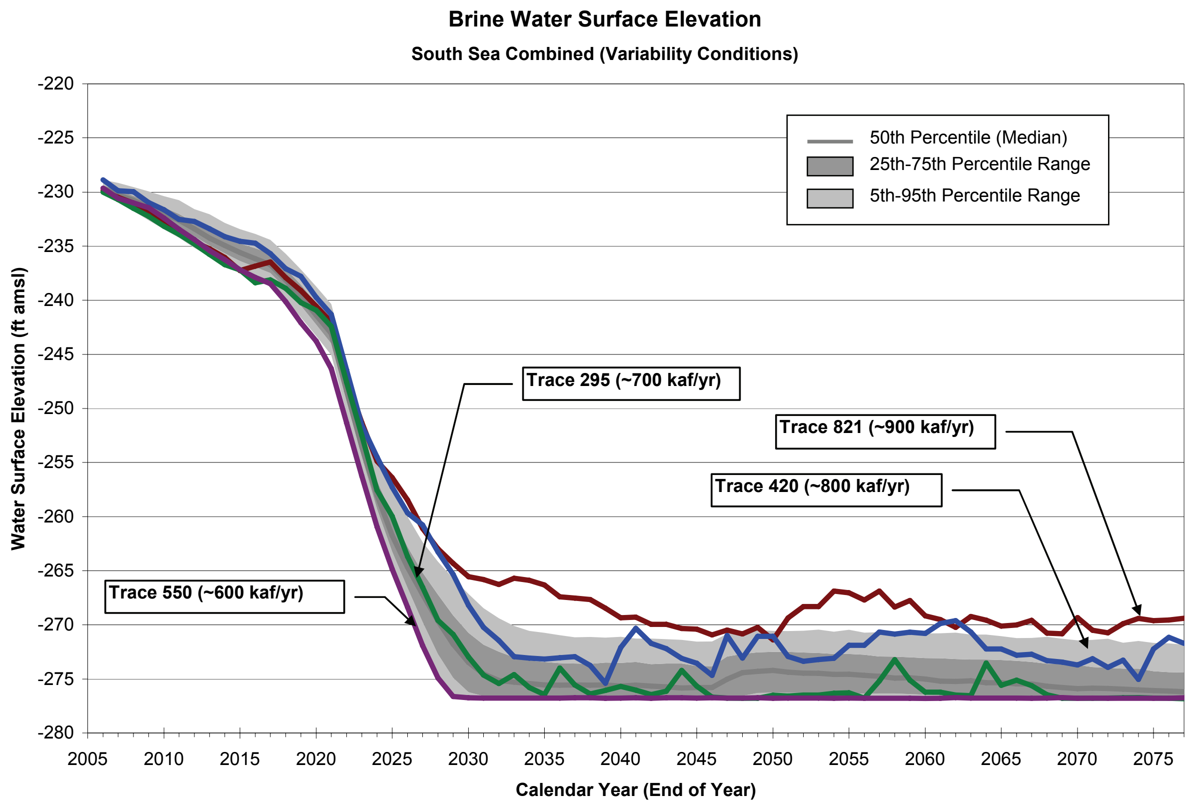

Saline Habitat Complex Wetted Area
Combined North and South Lakes (CEQA Conditions)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range
Wetted Area (acres)
70000
60000
50000
40000
30000
20000
10000
0
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075
Calendar Year (End of Year)

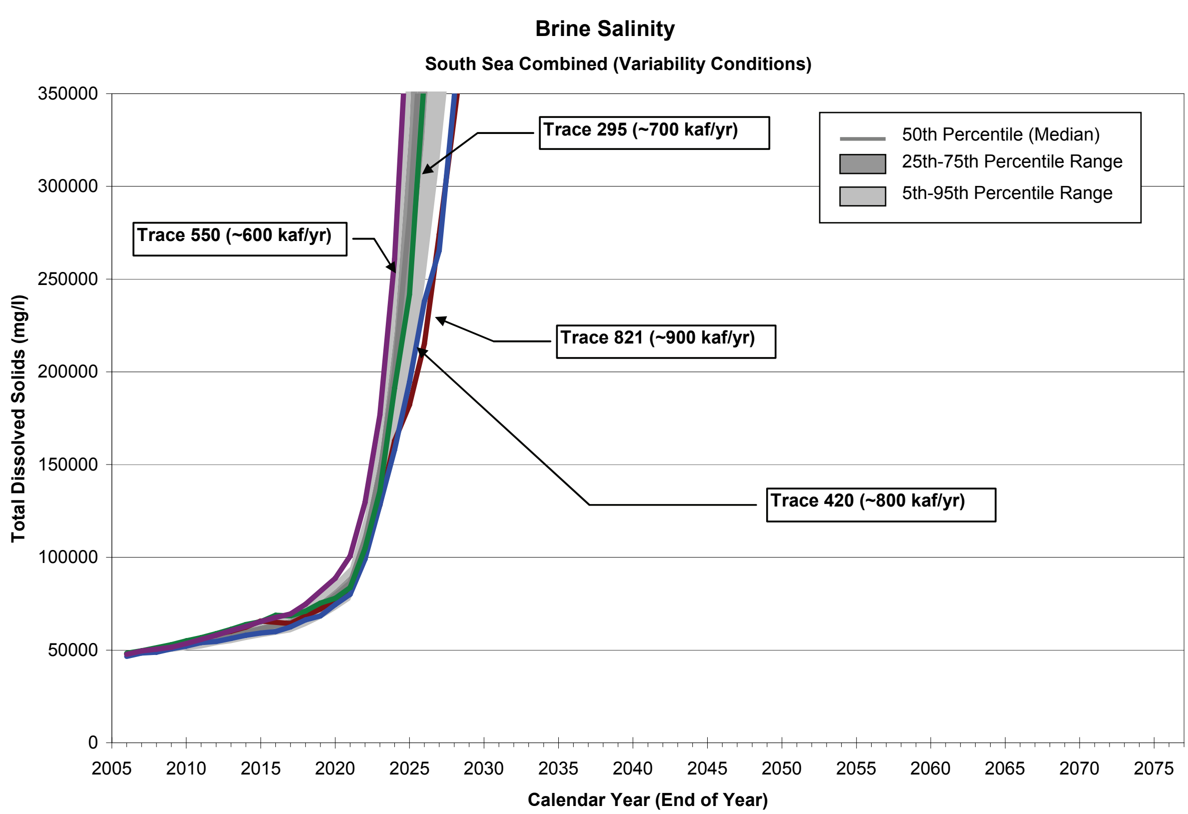
ALTERNATIVE 8 – SOUTH SEA COMBINED

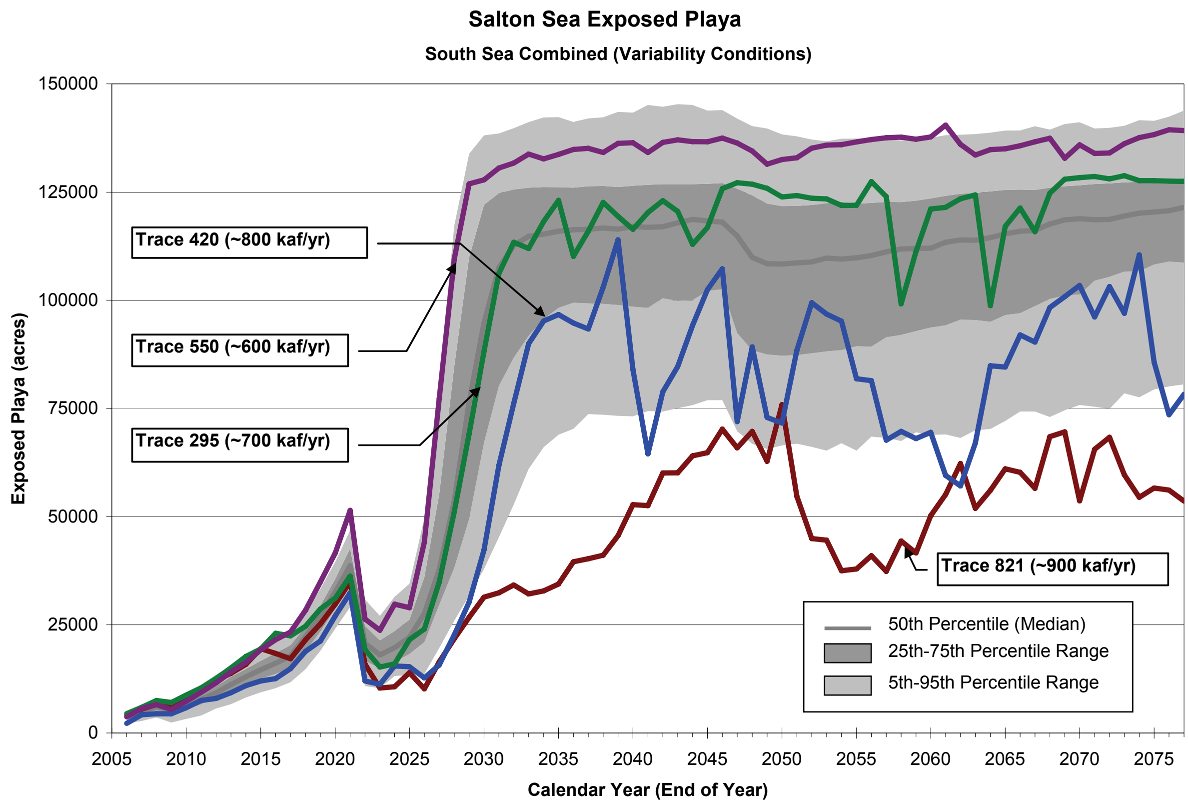
SALSA Modeling Results
(Figures H2-2-13a through H2-2-13l)

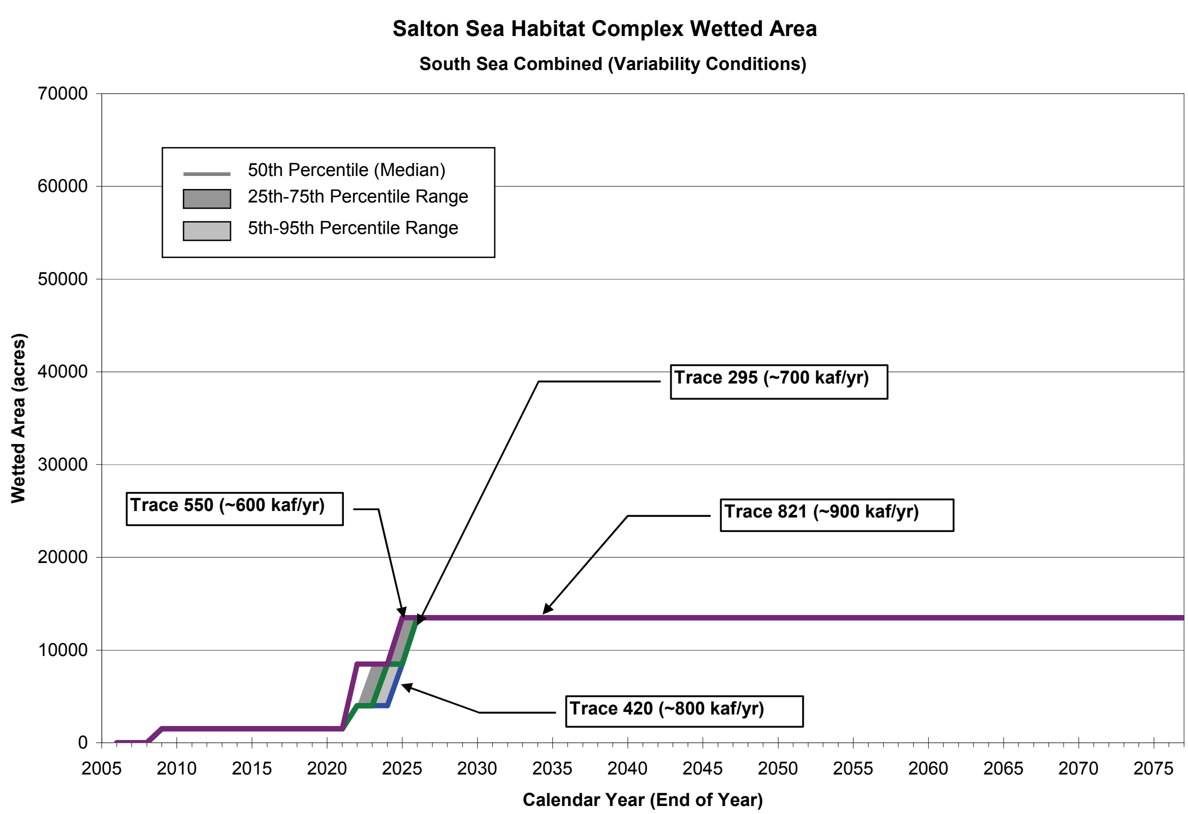

Marine Sea Water Surface Elevation
South Sea Combined (Variability Conditions)
Water Surface Elevation (ft amsl)
Calendar Year (End of Year)
Trace 420 (~800 kaf/yr)
Trace 295 (~700 kaf/yr)
Trace 550 (~600 kaf/yr)
Trace 821 (~900 kaf/yr)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range
-220
-225
-230
-235
-240
-245
-250
-255
-260
-265
-270
-275
-280
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075

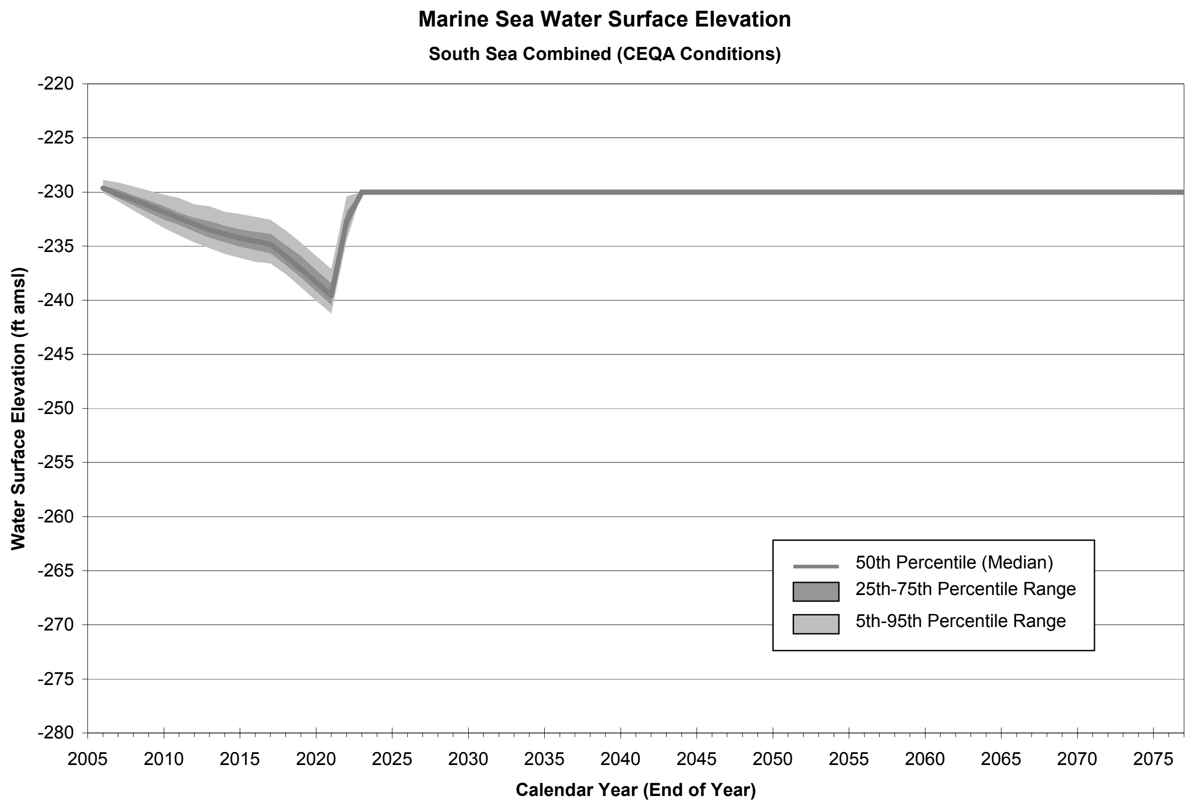

Marine Sea Salinity
South Sea Combined (Variability Conditions)
Total Dissolved Solids (mg/l)
Calendar Year (End of Year)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range
Trace 821 (~900 kaf/yr)
Trace 550 (~600 kaf/yr)
Trace 420 (~800 kaf/yr)
Trace 295 (~700 kaf/yr)
350000
300000
250000
200000
150000
100000
50000
0
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075

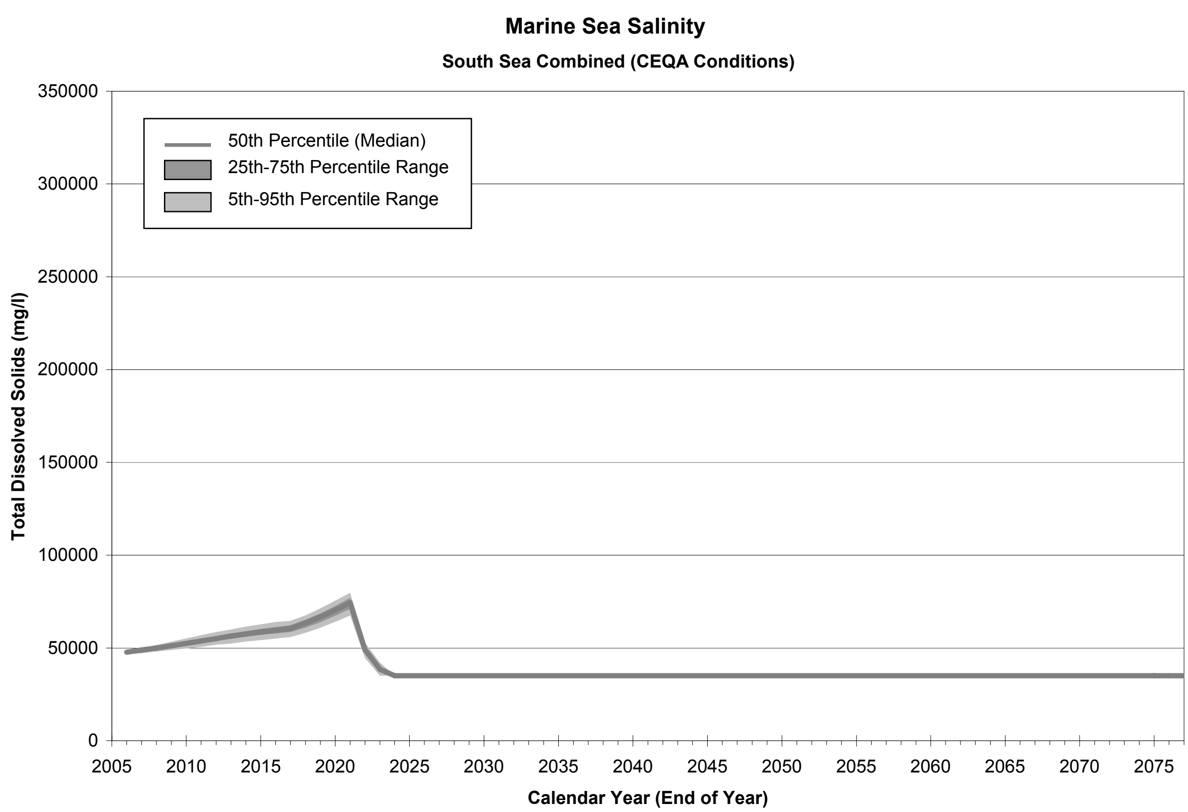

Brine Water Surface Elevation
South Sea Combined (Variability Conditions)
Water Surface Elevation (ft amsl)
-220
-225
-230
-235
-240
-245
-250
-255
-260
-265
-270
-275
-280
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075
Calendar Year (End of Year)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range
Trace 295 (~700 kaf/yr)
Trace 821 (~900 kaf/yr)
Trace 420 (~800 kaf/yr)
Trace 550 (~600 kaf/yr)

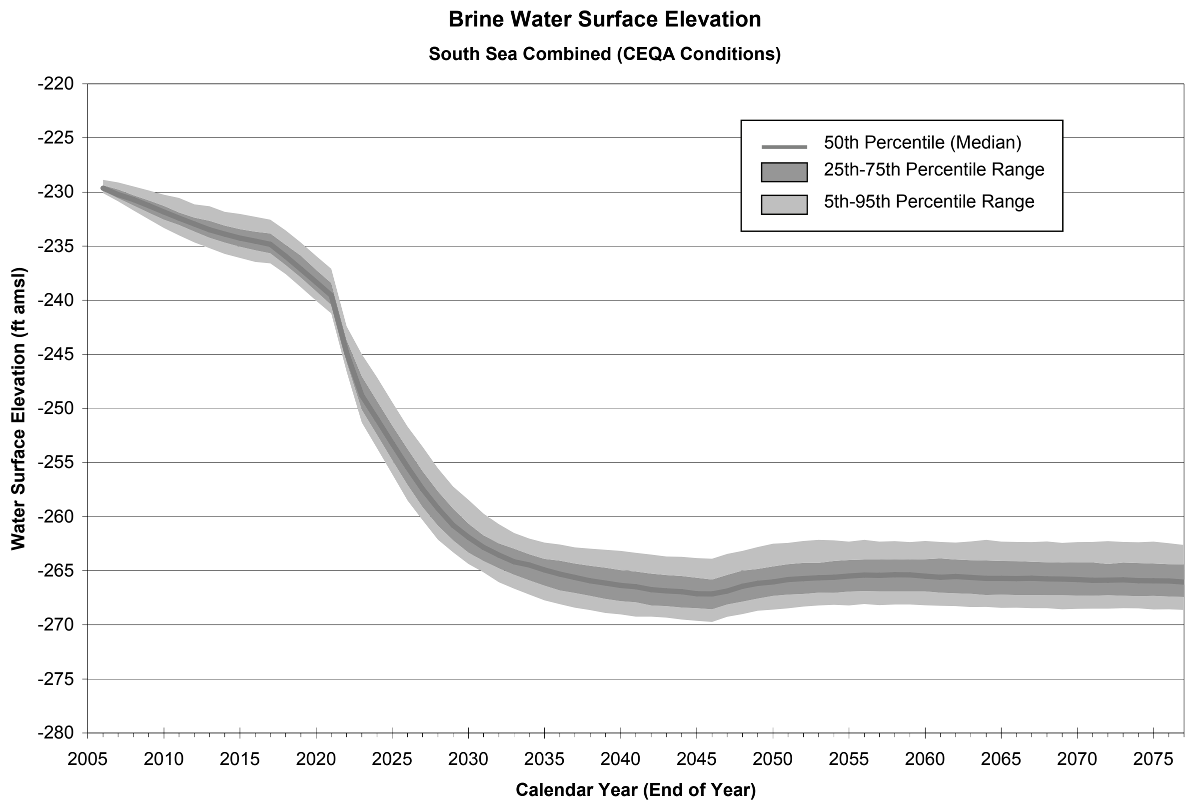

Brine Salinity
South Sea Combined (Variability Conditions)
Total Dissolved Solids (mg/l)
350000
300000
250000
200000
150000
100000
50000
0
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075
Calendar Year (End of Year)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range
Trace 295 (~700 kaf/yr)
Trace 550 (~600 kaf/yr)
Trace 821 (~900 kaf/yr)
Trace 420 (~800 kaf/yr)

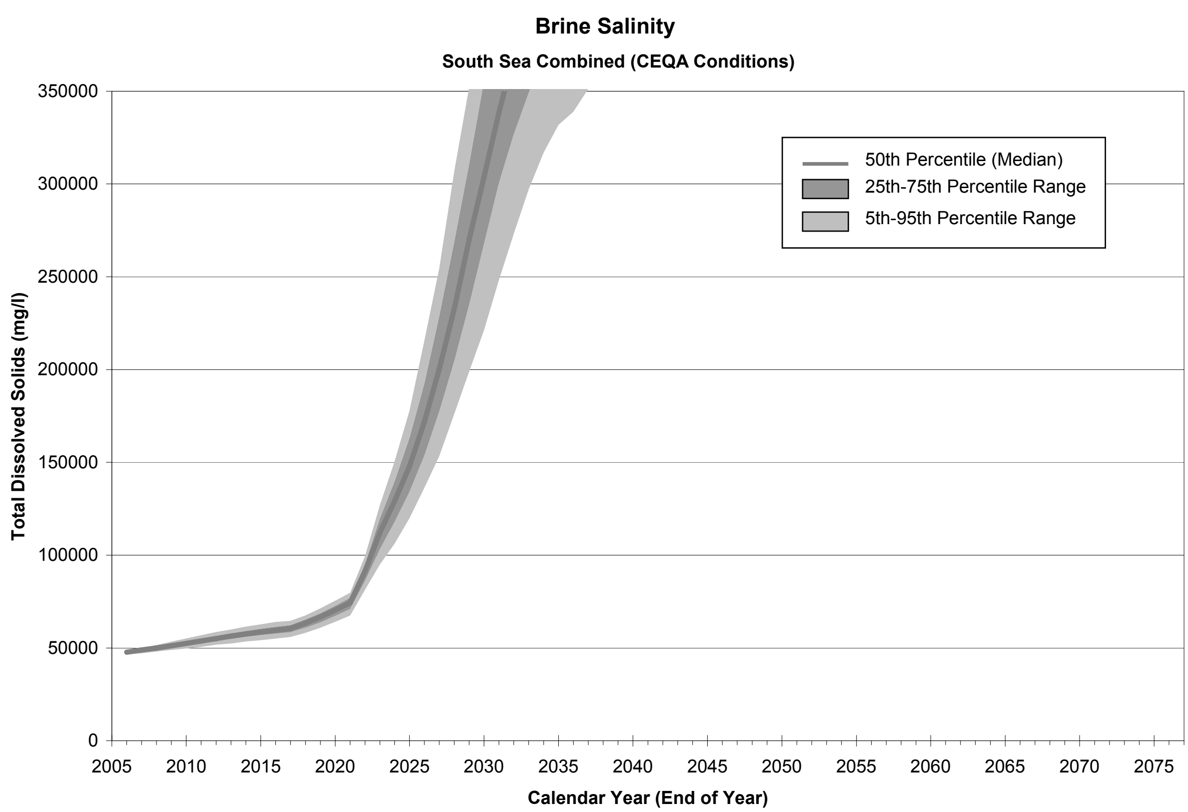

Salton Sea Exposed Playa
South Sea Combined (Variability Conditions)
Exposed Playa (acres)
150000
125000
100000
75000
50000
25000
0
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075
Calendar Year (End of Year)
Trace 420 (~800 kaf/yr)
Trace 550 (~600 kaf/yr)
Trace 295 (~700 kaf/yr)
Trace 821 (~900 kaf/yr)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range

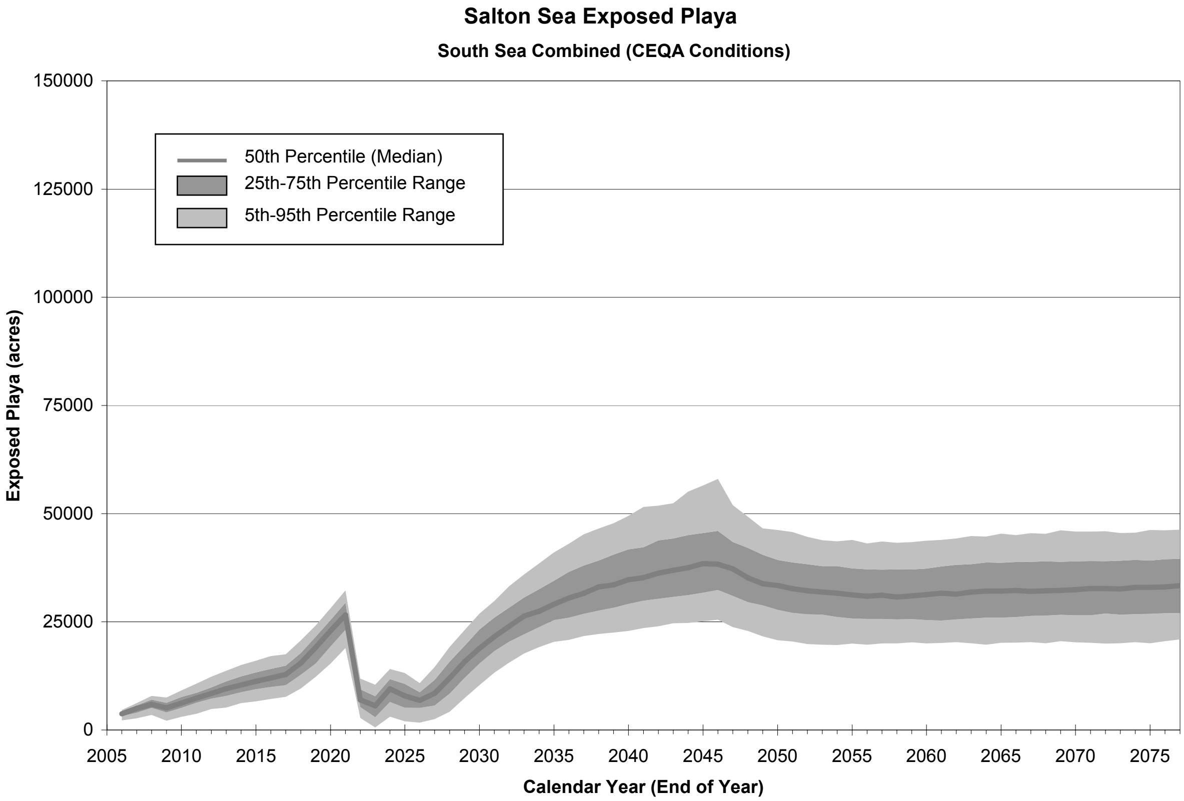

Salton Sea Habitat Complex Wetted Area
South Sea Combined (Variability Conditions)
Wetted Area (acres)
70000
60000
50000
40000
30000
20000
10000
0
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075
Calendar Year (End of Year)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range
Trace 295 (~700 kaf/yr)
Trace 550 (~600 kaf/yr)
Trace 821 (~900 kaf/yr)
Trace 420 (~800 kaf/yr)

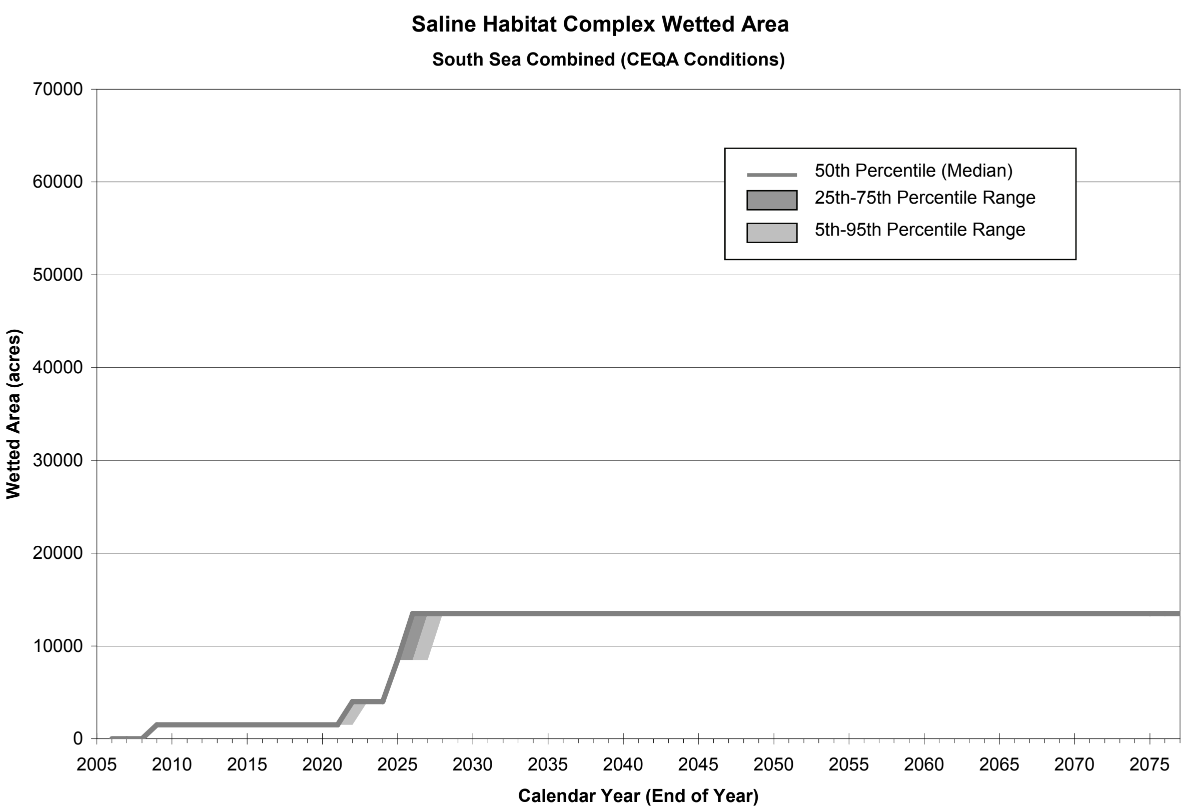

Marine Sea Water Surface Elevation
South Sea Combined (CEQA Conditions)
Water Surface Elevation (ft amsl)
-220
-225
-230
-235
-240
-245
-250
-255
-260
-265
-270
-275
-280
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075
Calendar Year (End of Year)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range


Marine Sea Salinity
South Sea Combined (CEQA Conditions)
Total Dissolved Solids (mg/l)
350000
300000
250000
200000
150000
100000
50000
0
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075
Calendar Year (End of Year)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range


Brine Water Surface Elevation
South Sea Combined (CEQA Conditions)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range
Water Surface Elevation (ft amsl)
-220
-225
-230
-235
-240
-245
-250
-255
-260
-265
-270
-275
-280
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075
Calendar Year (End of Year)


Brine Salinity
South Sea Combined (CEQA Conditions)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range
Total Dissolved Solids (mg/l)
350000
300000
250000
200000
150000
100000
50000
0
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075
Calendar Year (End of Year)


Salton Sea Exposed Playa
South Sea Combined (CEQA Conditions)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range
Exposed Playa (acres)
150000
125000
100000
75000
50000
25000
0
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075
Calendar Year (End of Year)


Saline Habitat Complex Wetted Area
South Sea Combined (CEQA Conditions)
50th Percentile (Median)
25th-75th Percentile Range
5th-95th Percentile Range
Wetted Area (acres)
70000
60000
50000
40000
30000
20000
10000
0
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075
Calendar Year (End of Year)