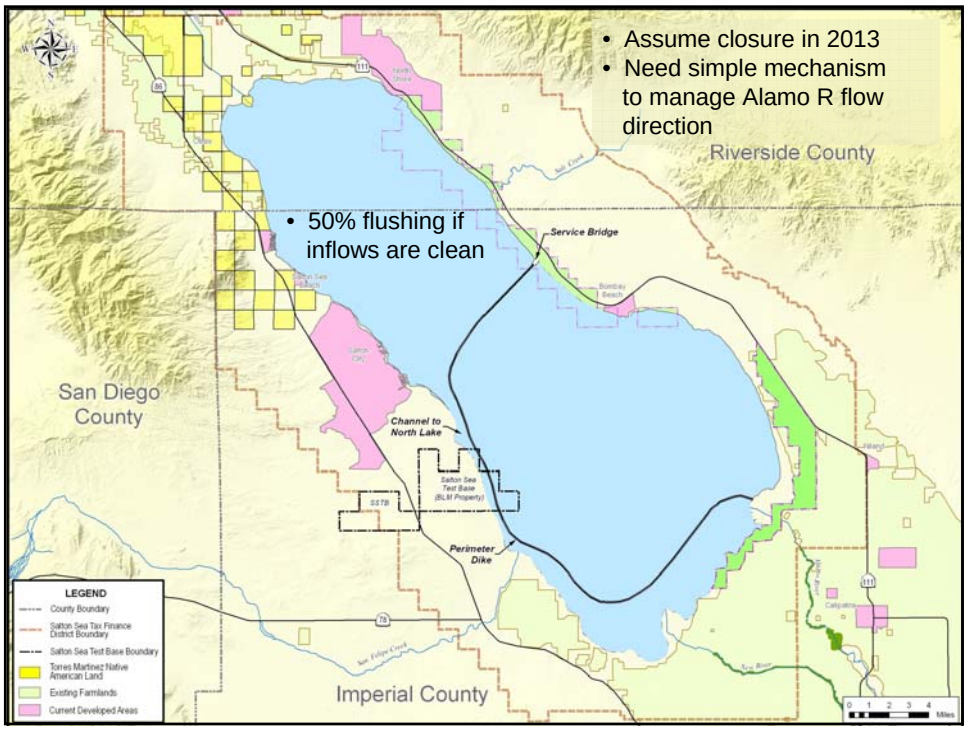
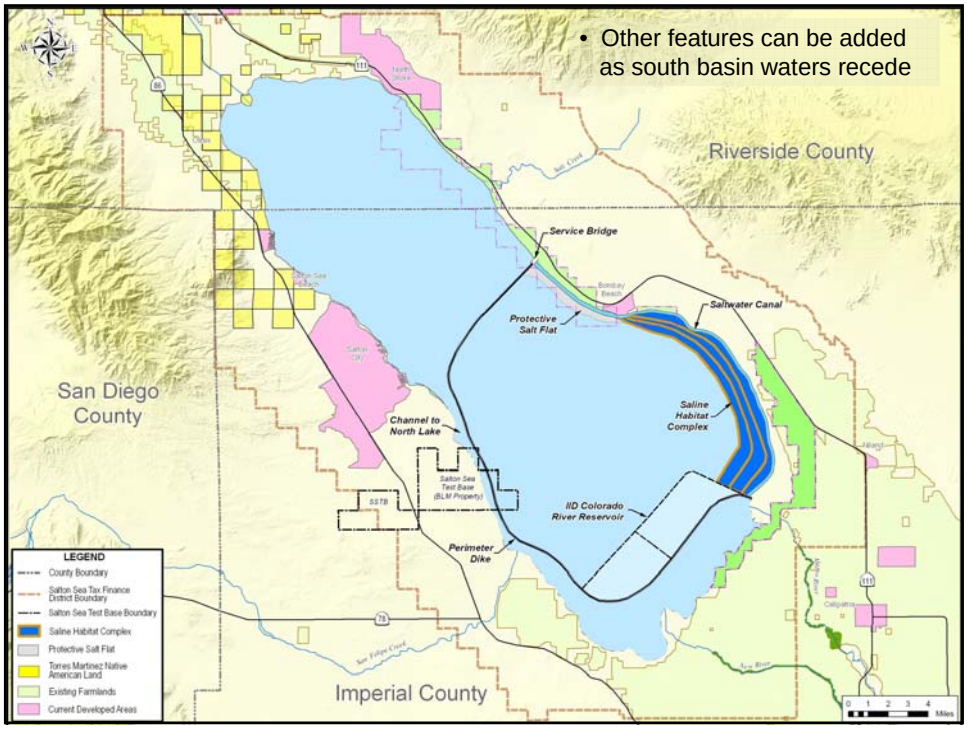
Salton Sea Authority Plan: Air Quality

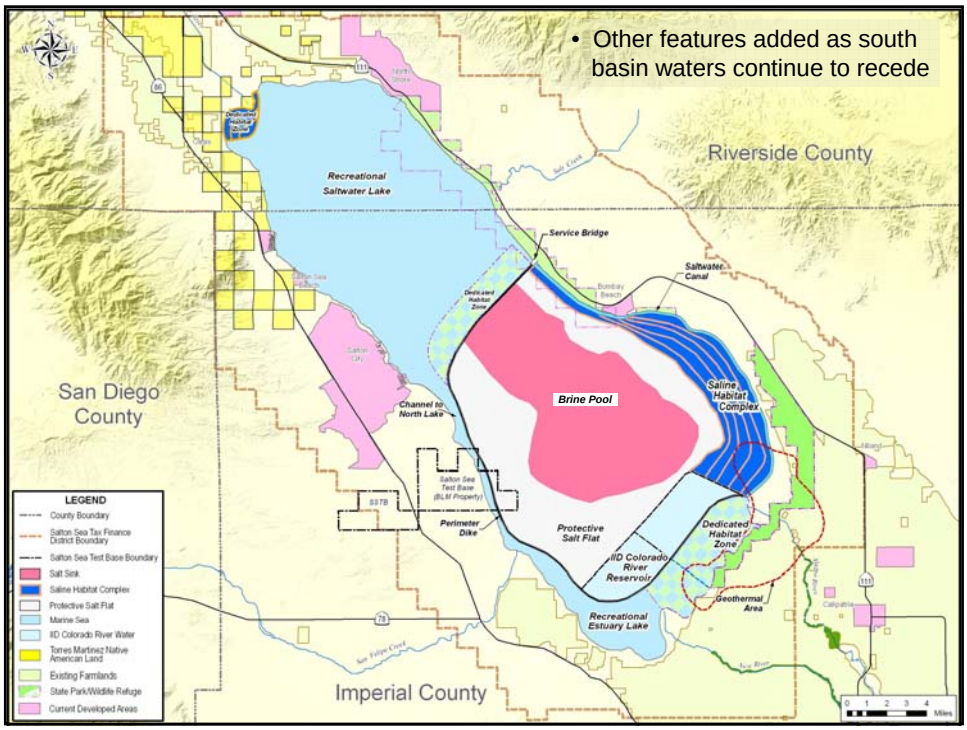
Salton Sea Authority

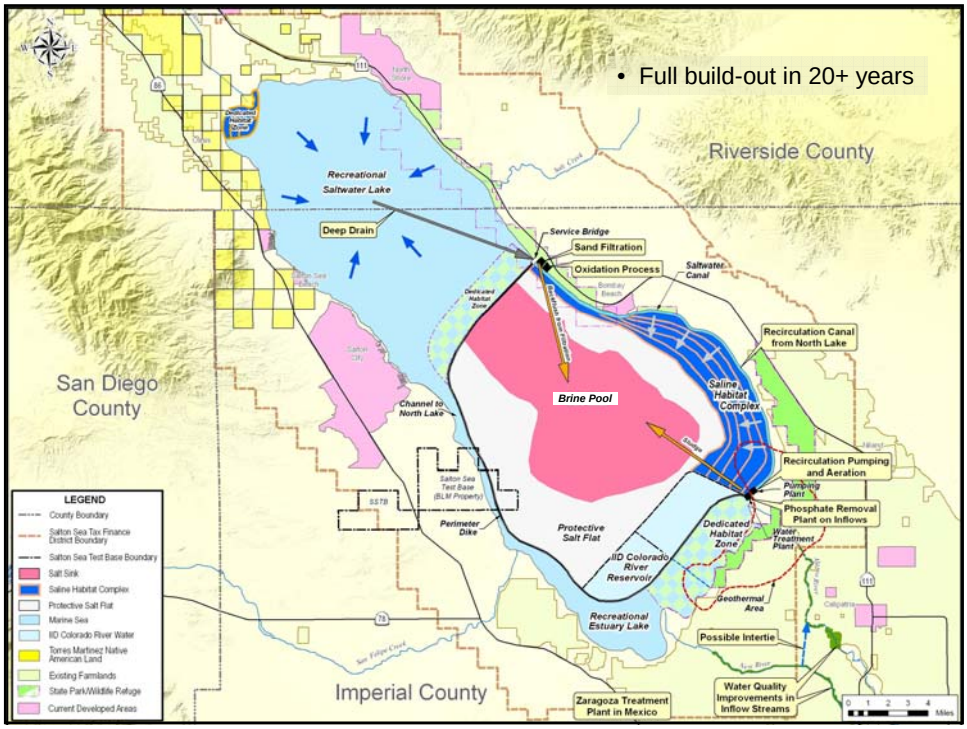
Air Quality Workshop

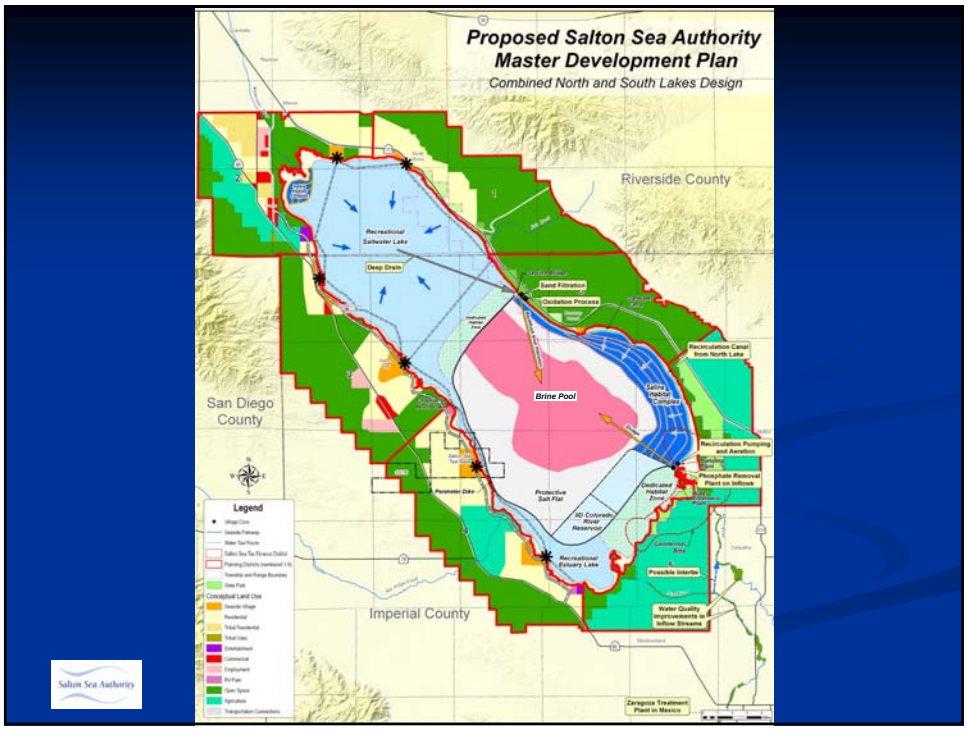
March 14, 2006

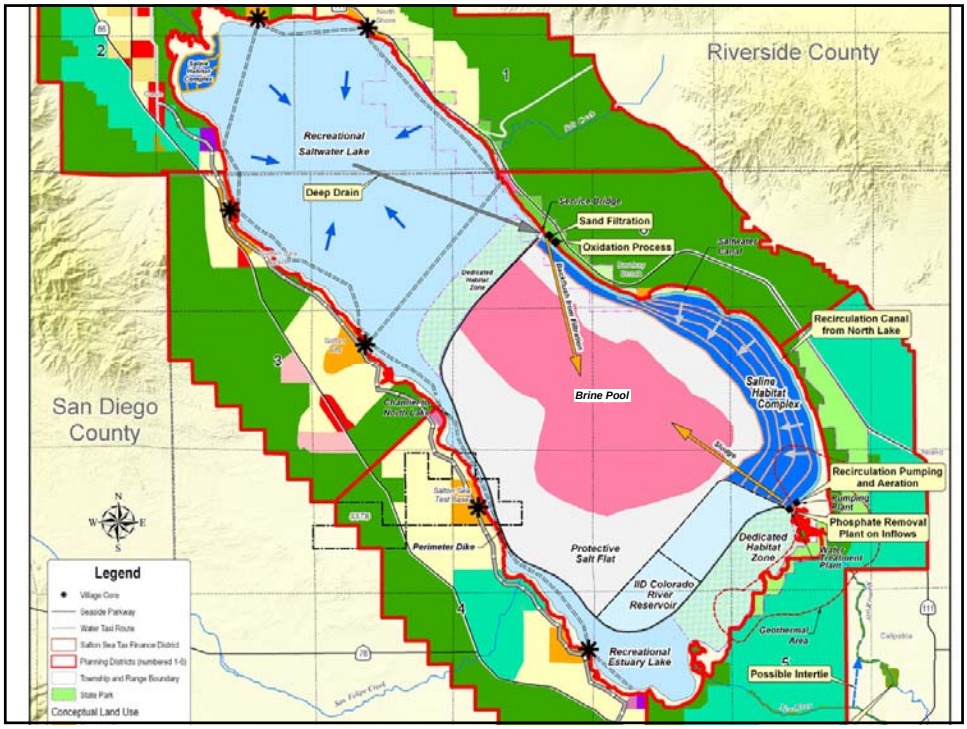



• Other features can be added as south basin waters recede
Riverside County
San Diego County
Imperial County
Service Bridge
Saltwater Canal
Protective Salt Flat
Saline Habitat Complex
Channel to North Lake
Salton Sea Test Base (BLM Property)
SSTB
IID Colorado River Reservoir
Perimeter Dike
LEGEND
County Boundary
Salton Sea Tax Finance District Boundary
Salton Sea Test Base Boundary
Saline Habitat Complex
Protective Salt Flat
Torres Martinez Native American Land
Existing Farmlands
Current Developed Areas
Miles


• Other features added as south basin waters continue to recede
Riverside County
San Diego County
Imperial County
Recreational Saltwater Lake
Service Bridge
Saltwater Canal
Dedicated Habitat Zone
Brine Pool
Saline Habitat Complex
Channel to North Lake
Salton Sea Test Base (BLM Property)
SSTB
Perimeter Dike
Protective Salt Flat
IID Colorado River Reservoir
Dedicated Habitat Zone
Geothermal Area
Recreational Estuary Lake
LEGEND
County Boundary
Salton Sea Tax Finance District Boundary
Salton Sea Test Base Boundary
Salt Sink
Saline Habitat Complex
Protective Salt Flat
Marine Sea
IID Colorado River Water
Torres Martinez Native American Land
Existing Farmlands
State Park/Wildlife Refuge
Current Developed Areas
Miles


• Full build-out in 20+ years
Riverside County
San Diego County
Imperial County
Recreational Saltwater Lake
Deep Drain
Service Bridge
Sand Filtration
Oxidation Process
Saltwater Canal
Recirculation Canal from North Lake
Brine Pool
Saline Habitat Complex
Channel to North Lake
Recirculation Pumping and Aeration
Pumping Plant
Phosphate Removal Plant on Inflows
Dedicated Habitat Zone
Water Treatment Plant
Salton Sea Test Base (BLM Property)
SSTB
Perimeter Dike
Protective Salt Flat
IID Colorado River Reservoir
Geothermal Area
Recreational Estuary Lake
Possible Intertie
Water Quality Improvements in Inflow Streams
Zaragoza Treatment Plant in Mexico
LEGEND
County Boundary
Salton Sea Tax Finance District Boundary
Salton Sea Test Base Boundary
Salt Sink
Saline Habitat Complex
Protective Salt Flat
Marine Sea
IID Colorado River Water
Torres Martinez Native American Land
Existing Farmlands
State Park/Wildlife Refuge
Current Developed Areas
Miles


Proposed Salton Sea Authority
Master Development Plan
Combined North and South Lakes Design
Riverside County
San Diego County
Imperial County
Recreational Saltwater Lake
Deep Drain
Sand Filtration
Oxidation Process
Recirculation Canal from North Lake
Brine Pool
Saline Habitat Complex
Recirculation Pumping and Aeration
Phosphate Removal Plant on Inflows
Dedicated Habitat Zone
Protective Salt Flat
IID Colorado River Reservoir
Recreational Estuary Lake
Possible Intertie
Water Quality Improvements in Inflow Streams
Zaragoza Treatment Plant in Mexico
Legend
Salton Sea Authority



Projected Salton Sea Inflows for No Action Alternative

	Mexico				Imperial Valley			Coache
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)
2003	119,082	-10,667	0	108,415	952,178	0	952,178	72,561
2004	120,213	-10,667	0	109,546	1,053,354	0	1,053,354	78,079
2005	120,879	-10,667	0	110,212	1,019,665	0	1,019,665	79,792
2006	121,866	-10,667	-15,342	95,857	980,000	0	980,000	76,887
2007	122,508	-10,667	-16,237	95,604	949,340	0	949,340	76,818
2008	123,300	-10,667	-17,132	95,501	940,522	-4,000	936,522	72,165
2009	124,250	-10,667	-18,027	95,556	934,397	-8,000	926,397	72,781
2010	125,942	-10,667	-18,922	96,353	1,027,601	-12,000	1,015,601	73,777
2011	127,264	-10,667	-19,816	96,781	938,780	-16,000	922,780	75,531
2012	128,544	-10,667	-20,711	97,166	976,357	-21,000	955,357	78,110
2013	129,236	-10,667	-21,606	96,963	940,652	-16,000	924,652	77,121
2014	130,723	-10,667	-22,501	97,555	1,096,364	-11,000	1,085,364	80,827
2015	131,307	-10,667	-22,501	98,139	1,102,122	-6,000	1,096,122	84,281
2016	132,184	-10,667	-22,501	99,016	1,035,992	-1,000	1,034,992	87,687
2017	132,400	-10,667	-22,501	99,232	1,015,039	5,000	1,020,039	90,933
2018	132,774	-10,667	-22,501	99,606	1,057,841	-193,000	864,841	97,406
2019	132,745	-10,667	-22,501	99,577	958,137	-228,000	730,137	101,218
2020	132,344	-10,667	-22,501	99,176	1,097,408	-268,000	829,408	105,150
2021	132,302	-10,667	-22,501	99,134	970,489	-288,000	682,489	109,366
2022	132,149	-10,667	-22,501	98,981	1,102,483	-288,000	814,483	113,687
2023	132,552	-10,667	-22,501	99,384	933,630	-288,000	645,630	113,475
2024	132,524	-10,667	-22,501	99,356	1,018,457	-293,000	725,457	118,647
2025	132,814	-10,667	-22,501	99,646	984,430	-298,000	686,430	123,826
2077	120,863	-10,667	-22,501	87,695	1,000,653	-250,000	750,653	129,805
Avg (2003-77)	129,366	-10,667	-21,171	97,527	995,413	-217,960	777,453	125,756
Avg (2018-77)	130,212	-10,667	-22,501	97,044	994,894	-270,950	723,944	137,573
Min	119,082	-10,667	-22,501	87,695	850,081	-303,000	581,449	72,165
Max	133,883	-10,667	0	110,212	1,114,332	5,000	1,096,122	158,352

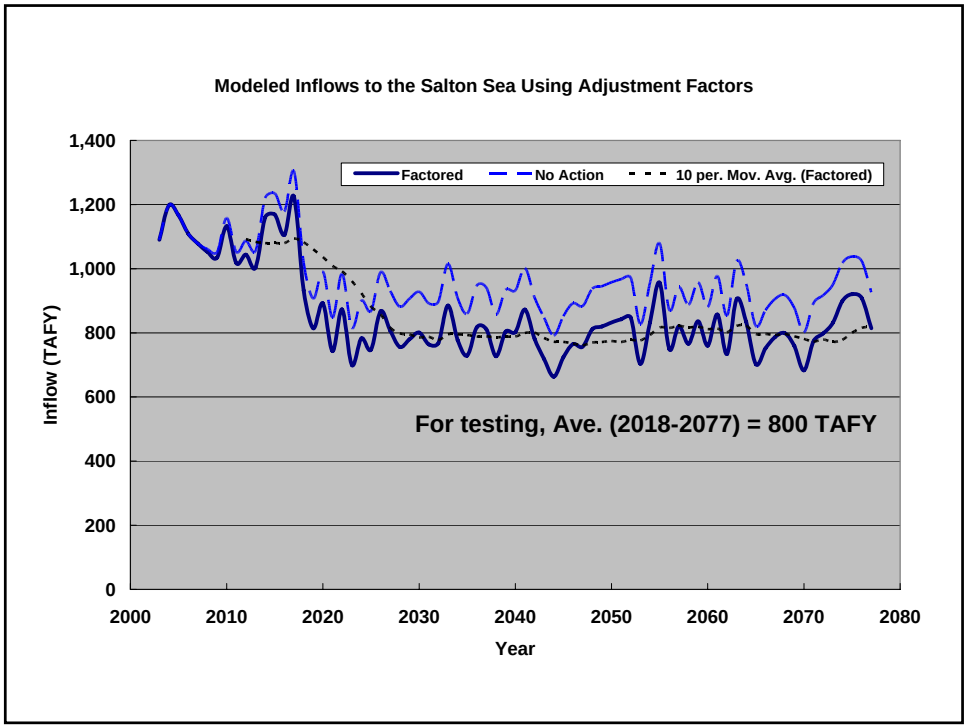
Source: DWR Inflow/Modeling Working Group Preliminary Draft Report, January 13, 2006.

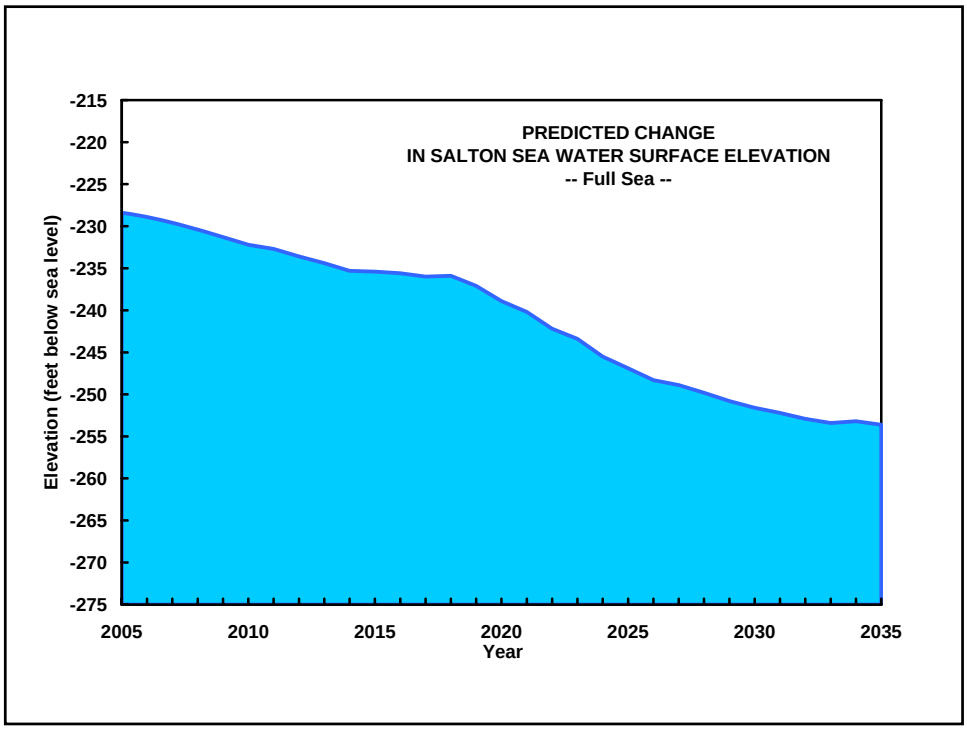
a Inflows for No Action Alternative-CEQA Conditions

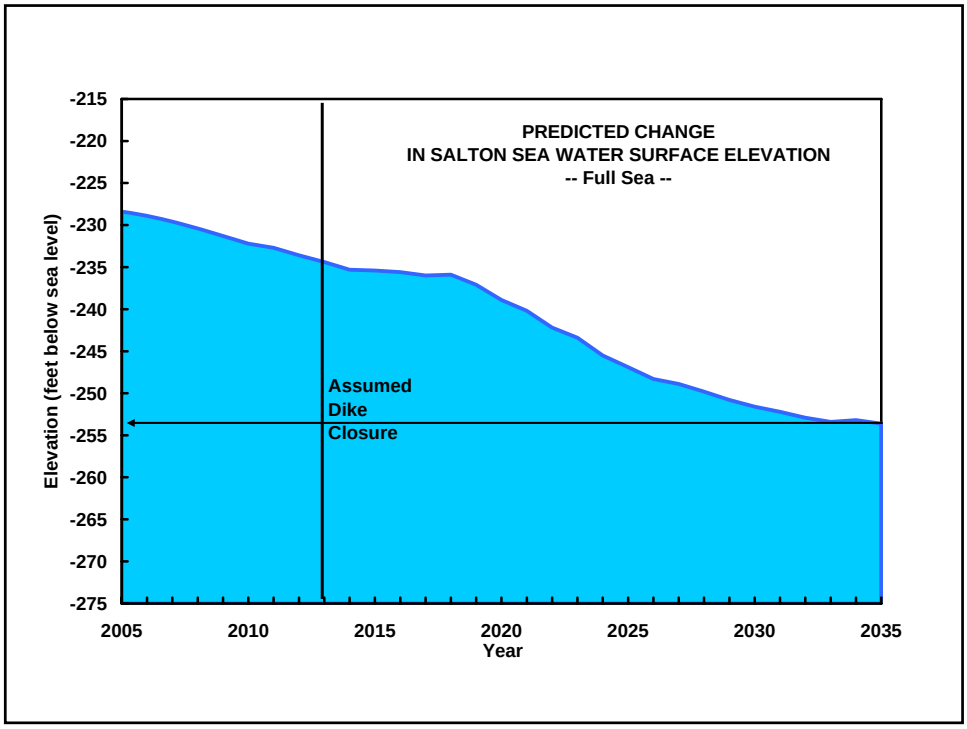
	Coachella Valley				Local Watershed				
Adjusted Imperial Valley Discharge to Sea (af/yr)	Adjusted Coachella Valley Surface Flows to Sea (af/yr)	Adjusted Coachella Valley Aquifer Flows to/from Sea (af/yr)	Total Coachella Valley Discharge to Sea (af/yr)	IOPP (af/yr)	San Felipe Creek (af/yr)	Salt Creek (af/yr)	Ungaged Watershed Inflows (af/yr)	Local Groundwater Inflows (af/yr)	Total Inflow to Sea (af/yr)
952,178	72,561	-630	71,930	-56,856	2,834	623	1,057	10,000	1,090,181
1,053,354	78,079	-671	77,408	-56,856	2,834	623	1,057	10,000	1,197,966
1,019,665	79,792	-709	79,082	-56,856	2,834	623	1,057	10,000	1,166,617
980,000	76,887	-745	76,142	-56,856	2,834	623	1,057	10,000	1,109,657
949,340	76,818	-779	76,039	-56,856	2,834	623	1,057	10,000	1,078,641
936,522	72,165	-808	71,357	-56,856	2,834	623	1,057	10,000	1,061,038
926,397	72,781	-828	71,953	-56,856	2,834	623	1,057	10,000	1,051,564
1,015,601	73,777	-843	72,934	-56,856	11,197	3,161	5,913	10,000	1,158,303
922,780	75,531	-852	74,680	-56,856	2,834	623	1,057	10,000	1,051,899
955,357	78,110	-853	77,256	-56,856	2,834	623	1,057	10,000	1,087,437
924,652	77,121	-847	76,274	-56,856	2,834	623	1,057	10,000	1,055,547
1,085,364	80,827	-833	79,994	-56,856	2,834	623	1,057	10,000	1,220,571
1,096,122	84,281	-809	83,471	-56,856	2,834	623	1,057	10,000	1,235,390
1,034,992	87,687	-782	86,905	-56,856	2,834	623	1,057	10,000	1,178,571
1,020,039	90,933	-745	90,187	-56,856	92,453	8,444	39,836	10,000	1,303,335
864,841	97,406	-696	96,709	-56,856	2,834	623	1,057	10,000	1,018,814
730,137	101,218	-636	100,582	-56,856	13,156	3,438	6,833	10,000	906,867
829,408	105,150	-567	104,583	-56,856	2,834	623	1,057	10,000	990,825
682,489	109,366	-501	108,865	-56,856	2,834	623	1,057	10,000	848,146
814,483	113,687	-417	113,269	-56,856	2,834	623	1,057	10,000	984,391
645,630	113,475	-280	113,195	-56,856	2,834	623	1,057	10,000	815,867
725,457	118,647	-107	118,540	-56,856	2,834	623	1,057	10,000	901,011
686,430	123,826	82	123,908	-56,856	2,834	623	1,057	10,000	867,642
750,653	129,805	1,158	130,963	-56,856	2,834	623	1,057	10,000	926,969
777,453	125,756	542	126,298	-56,856	6,064	1,316	2,736	10,000	964,539
723,944	137,573	873	138,446	-56,856	5,238	1,317	2,429	10,000	921,562
581,449	72,165	-853	71,357	-56,856	2,834	623	1,057	10,000	791,672
1,096,122	158,352	1,158	159,411	-56,856	92,453	13,153	39,836	10,000	1,303,335

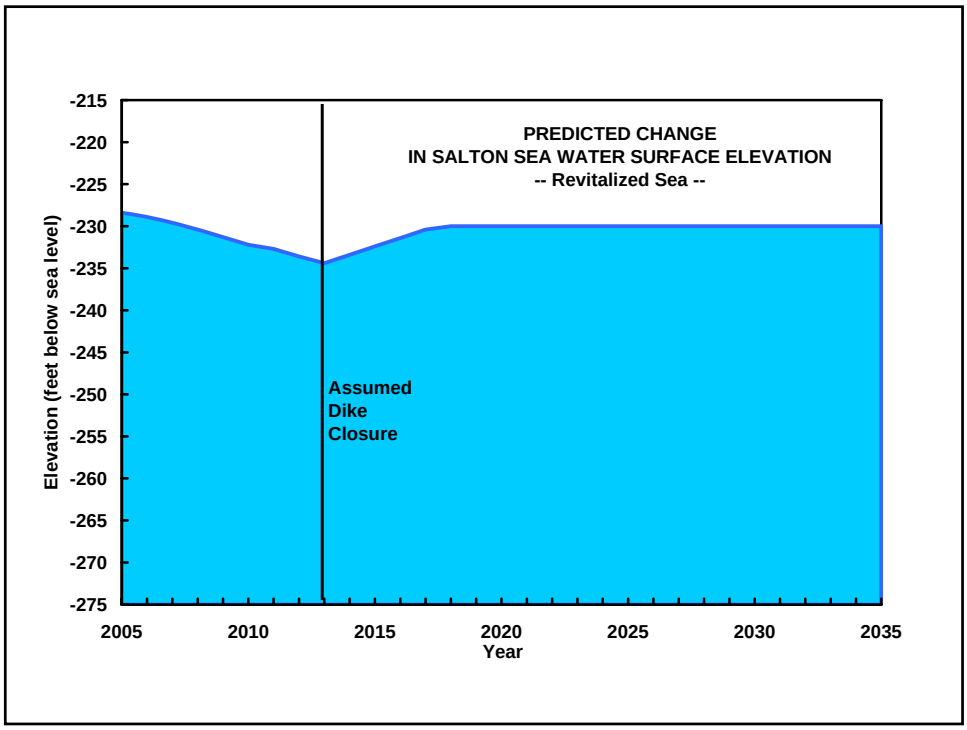
Adjusted Salton Sea Inflows for Analysis Purposes

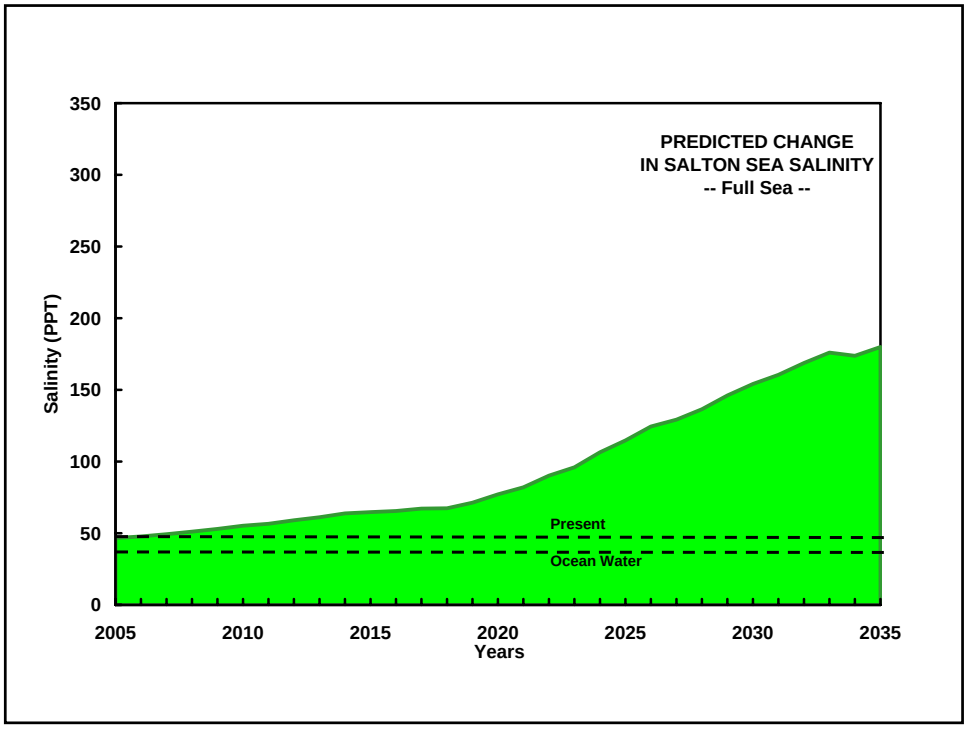
	Projected No Action Conditions			Factors and Adjustments					
Year	Adjusted Mexico Inflow (af/yr)	Total Coachella Valley Discharge to Sea (af/yr)	Total No Action Inflow to Sea (af/yr)	Adjusted Mexico Inflow Factor	Factored Mexico Inflow (af/yr)	Adjusted Coachella Valley Surface Flows to Sea Factor	Factored Coachella Valley Surface Flows to Sea (af/yr)	Adjusted Total Inflow to Sea (af/yr)	Adjusted Inflow to South Basin (af/yr)
2003	108,415	71,930	1,090,181	1.00	108,415	1.00	71,930	1,090,181	523,287
2004	109,546	77,408	1,197,966	1.00	109,546	1.00	77,408	1,197,966	587,003
2005	110,212	79,082	1,166,617	1.00	110,212	1.00	79,082	1,166,617	583,309
2006	95,857	76,142	1,109,657	1.00	95,857	1.00	76,142	1,109,657	554,829
2007	95,604	76,039	1,078,641	1.00	95,604	1.00	76,039	1,078,641	539,321
2008	95,501	71,357	1,061,038	0.95	90,726	0.95	67,789	1,052,695	532,664
2009	95,556	71,953	1,051,564	0.90	86,000	0.90	64,758	1,034,813	523,615
2010	96,353	72,934	1,158,303	0.85	81,900	0.85	61,994	1,132,910	573,252
2011	96,781	74,680	1,051,899	0.80	77,425	0.80	59,744	1,017,607	508,803
2012	97,166	77,256	1,087,437	0.75	72,875	0.75	57,942	1,043,832	521,916
2013	96,963	76,274	1,055,547	0.70	67,874	0.70	53,392	1,003,576	501,788
2014	97,555	79,994	1,220,571	0.65	63,411	0.65	51,996	1,158,429	438,429
2015	98,139	83,471	1,235,390	0.60	58,883	0.60	50,083	1,162,746	442,746
2016	99,016	86,905	1,178,571	0.55	54,459	0.55	47,798	1,094,907	374,907
2017	99,232	90,187	1,303,335	0.50	49,616	0.50	45,094	1,208,626	488,626
2018	99,606	96,709	1,018,814	0.45	44,823	0.45	43,519	910,841	290,841
2019	99,577	100,582	906,867	0.40	39,831	0.40	40,233	786,772	166,772
2020	99,176	104,583	990,825	0.35	34,712	0.35	36,604	858,382	238,382
2021	99,134	108,865	848,146	0.30	29,740	0.30	32,660	702,547	82,547
2022	98,981	113,269	984,391	0.25	24,745	0.25	28,317	825,204	205,204
2023	99,384	113,195	815,867	0.20	19,877	0.20	22,639	645,804	25,804
2024	99,356	118,540	901,011	0.20	19,871	0.20	23,708	726,694	106,694
2025	99,646	123,908	867,642	0.20	19,929	0.20	24,782	688,799	68,799
2077	87,695	130,963	926,969	0.20	17,539	0.20	26,193	752,043	132,043
Avg (2003-77)	97,527	126,298	964,539		32,825		35,721	809,260	195,549
Avg (2018-77)	97,044	138,446	921,562		20,651		28,965	735,688	116,194
Min	87,695	71,357	791,672		17,539		22,639	589,620	0
Max	110,212	159,411	1,303,335		110,212		79,082	1,208,626	587,003
		Yearly Reduction Factor		5%		5%			
		Final Reduction Factor		20%		20%			

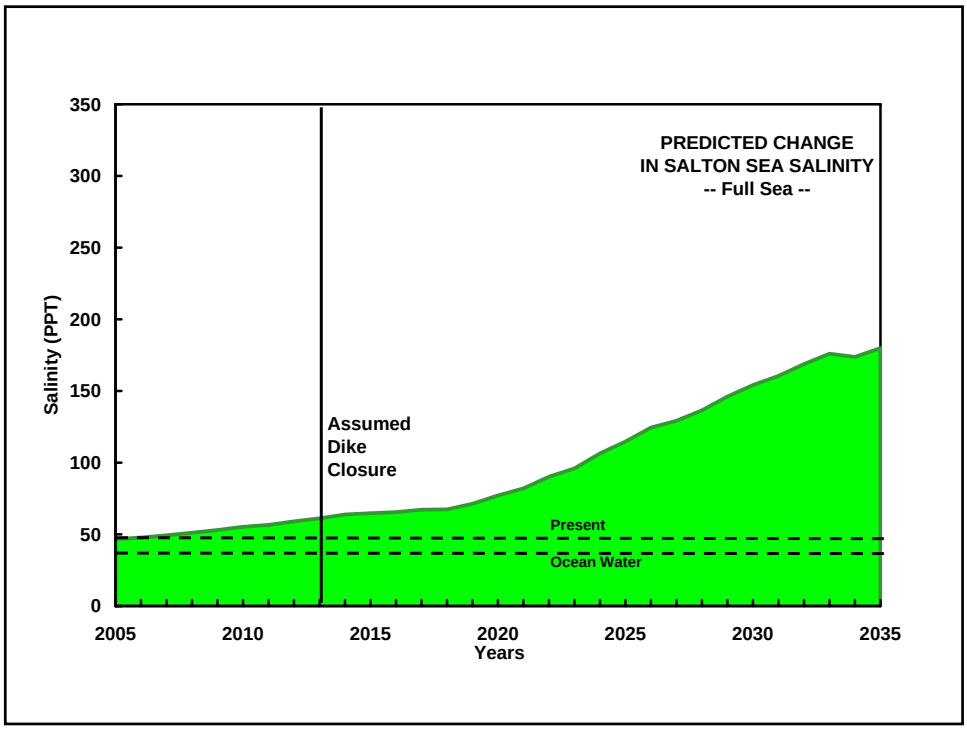

Modeled Inflows to the Salton Sea Using Adjustment Factors
Factored
No Action
10 per. Mov. Avg. (Factored)
Inflow (TAFY)
1,400
1,200
1,000
800
600
400
200
0
2000
2010
2020
2030
2040
2050
2060
2070
2080
Year
For testing, Ave. (2018-2077) = 800 TAFY

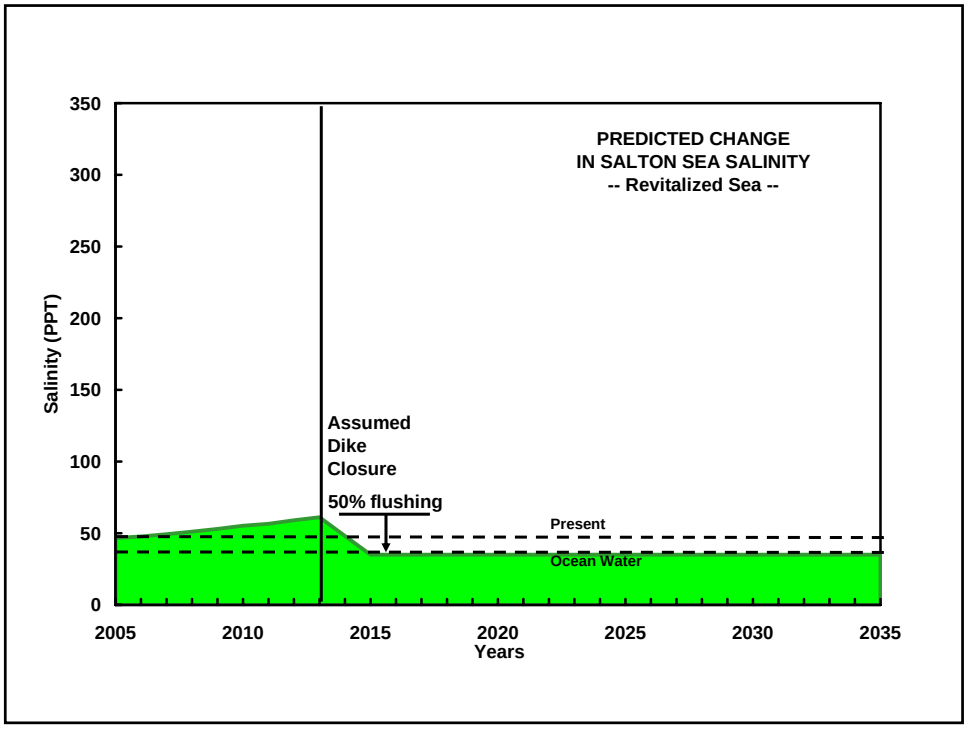

PREDICTED CHANGE
IN SALTON SEA WATER SURFACE ELEVATION
-- Full Sea --
Elevation (feet below sea level)
-215
-220
-225
-230
-235
-240
-245
-250
-255
-260
-265
-270
-275
2005
2010
2015
2020
2025
2030
2035
Year

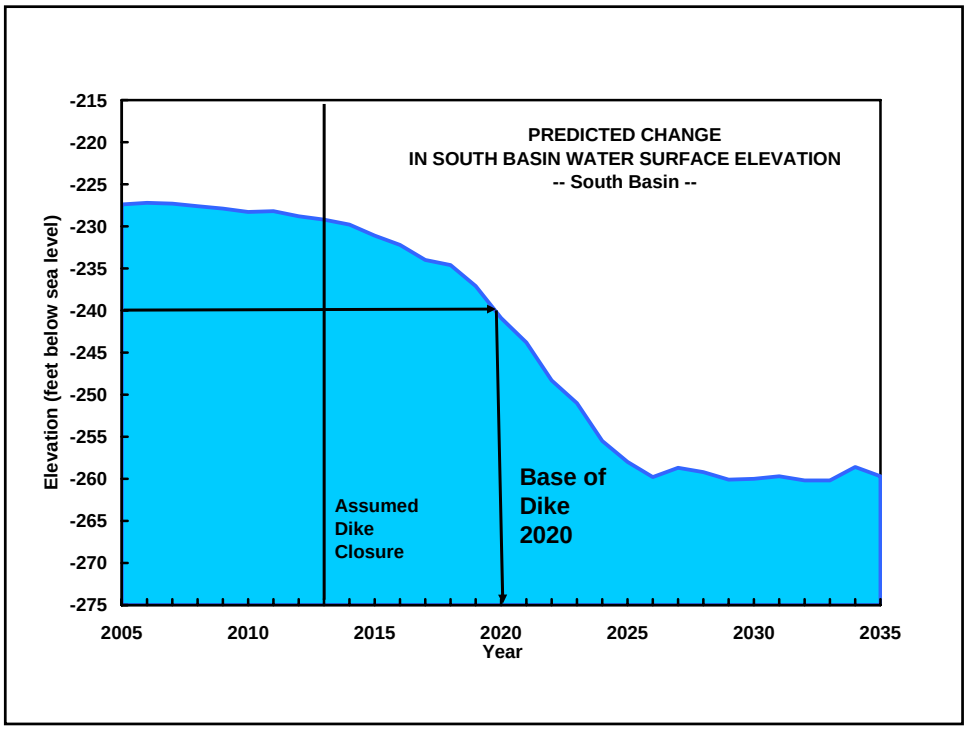

PREDICTED CHANGE
IN SALTON SEA WATER SURFACE ELEVATION
-- Full Sea --
Assumed
Dike
Closure
Elevation (feet below sea level)
-215
-220
-225
-230
-235
-240
-245
-250
-255
-260
-265
-270
-275
2005
2010
2015
2020
2025
2030
2035
Year

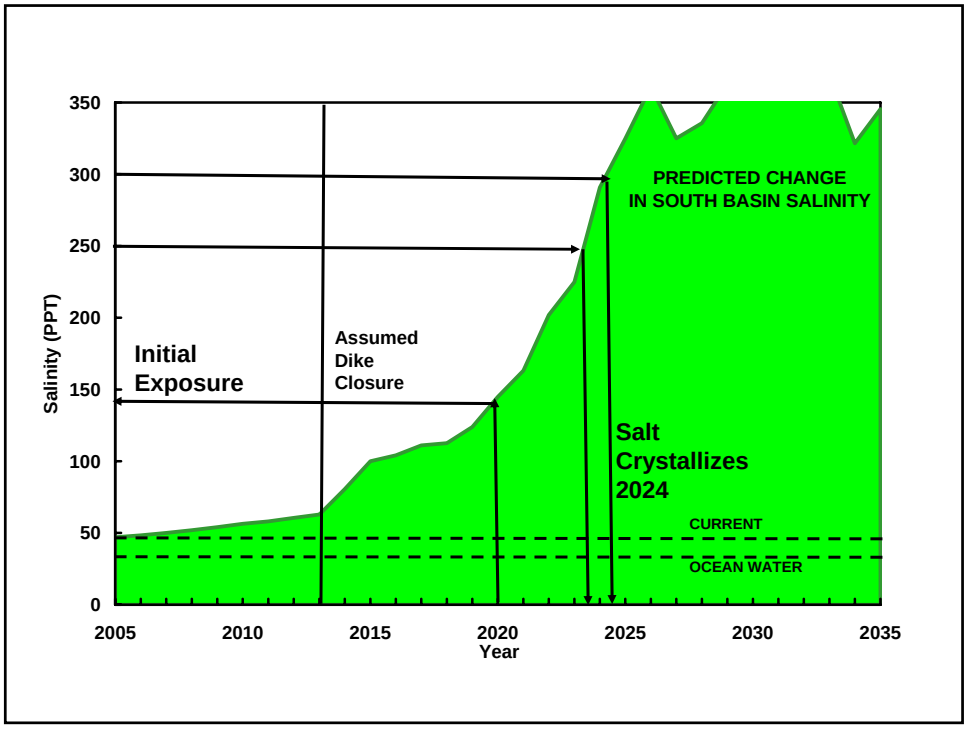

PREDICTED CHANGE
IN SALTON SEA WATER SURFACE ELEVATION
-- Revitalized Sea --
Assumed
Dike
Closure
Elevation (feet below sea level)
-215
-220
-225
-230
-235
-240
-245
-250
-255
-260
-265
-270
-275
2005
2010
2015
2020
2025
2030
2035
Year

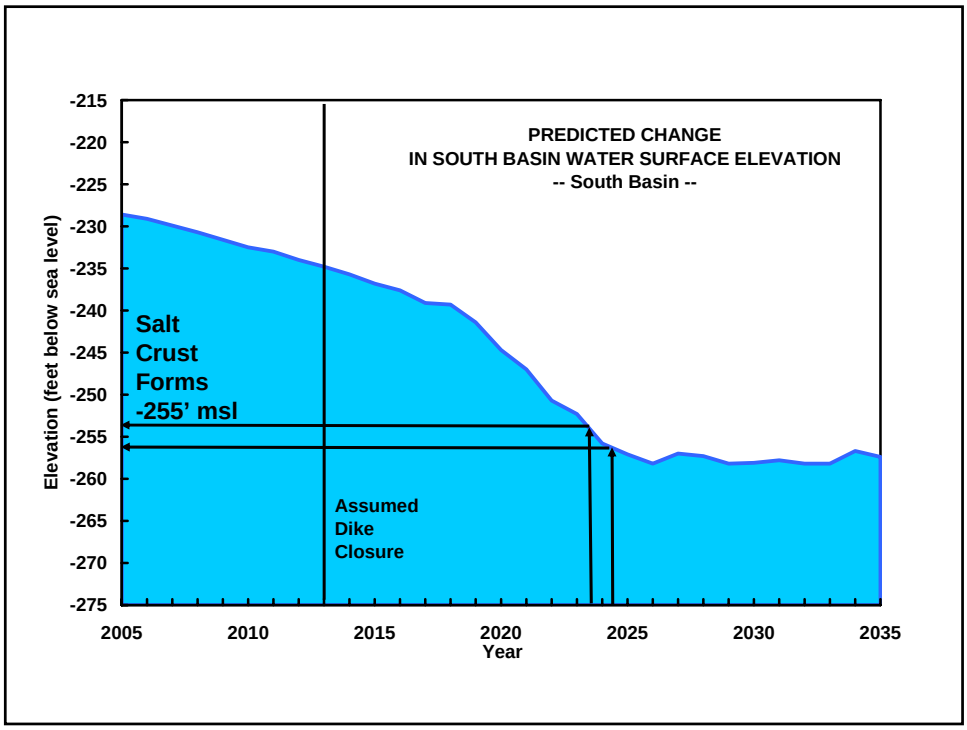

PREDICTED CHANGE
IN SALTON SEA SALINITY
-- Full Sea --
Salinity (PPT)
350
300
250
200
150
100
50
0
Present
Ocean Water
2005
2010
2015
2020
2025
2030
2035
Years

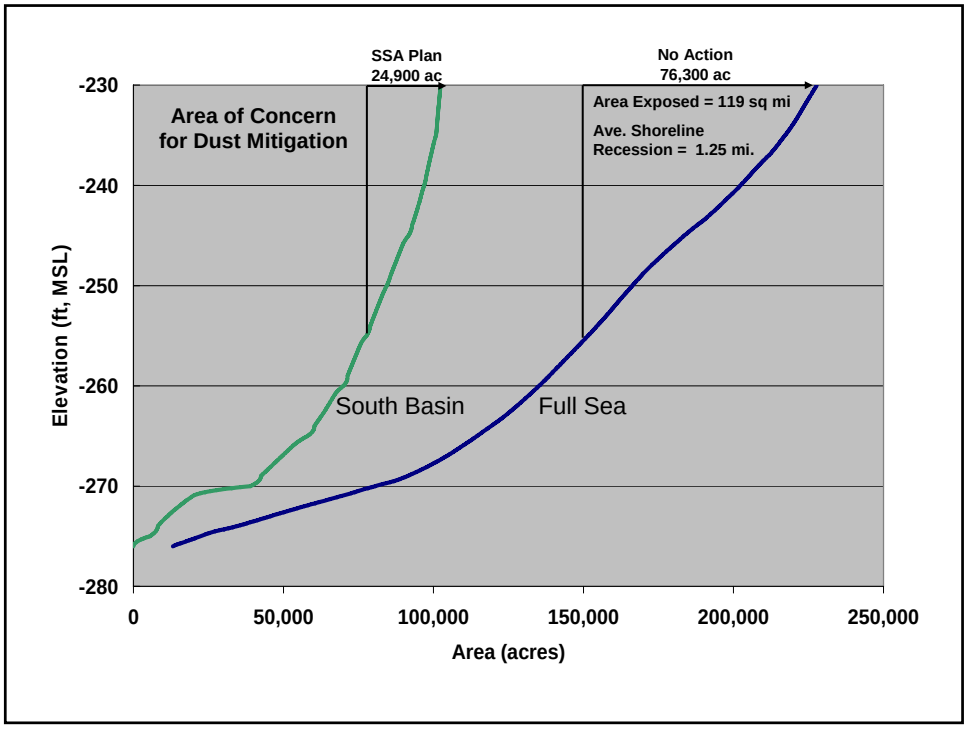

PREDICTED CHANGE
IN SALTON SEA SALINITY
-- Full Sea --
Salinity (PPT)
350
300
250
200
150
100
50
0
Assumed
Dike
Closure
Present
Ocean Water
2005
2010
2015
2020
2025
2030
2035
Years

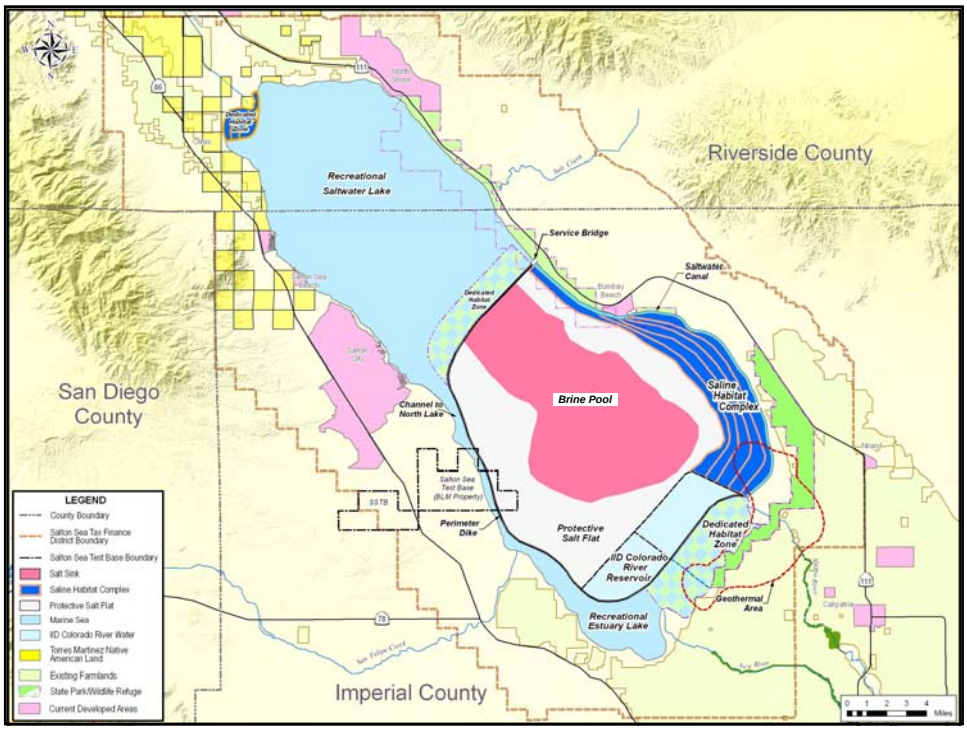

PREDICTED CHANGE
IN SALTON SEA SALINITY
-- Revitalized Sea --
Salinity (PPT)
350
300
250
200
150
100
50
0
Assumed
Dike
Closure
50% flushing
Present
Ocean Water
2005
2010
2015
2020
2025
2030
2035
Years

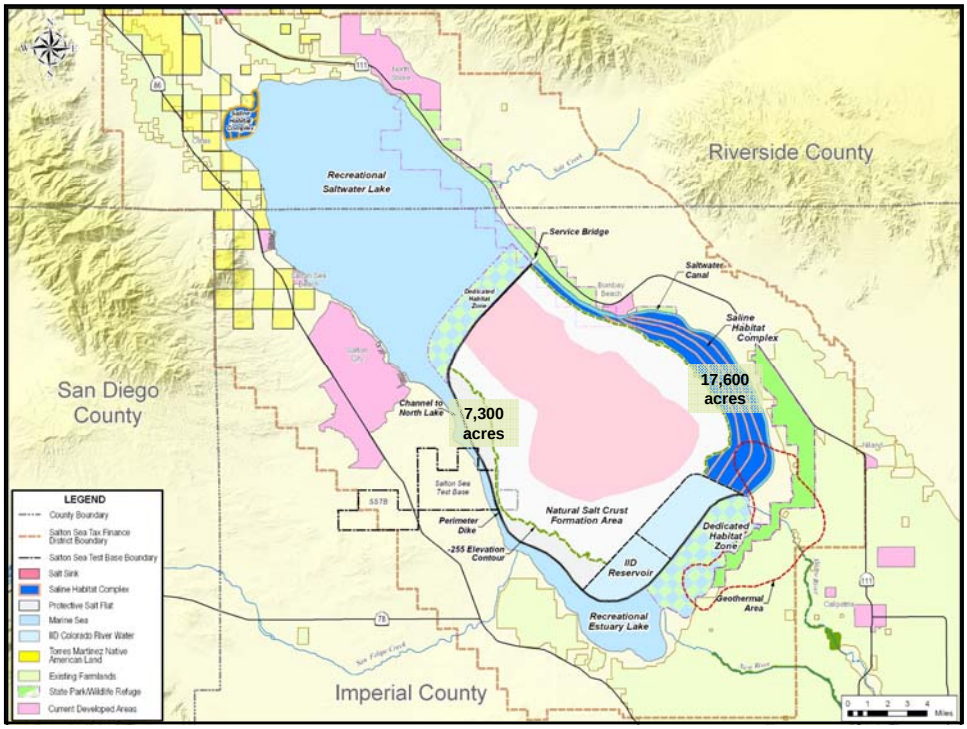

PREDICTED CHANGE
IN SOUTH BASIN WATER SURFACE ELEVATION
-- South Basin --
Elevation (feet below sea level)
-215
-220
-225
-230
-235
-240
-245
-250
-255
-260
-265
-270
-275
Assumed
Dike
Closure
Base of
Dike
2020
2005
2010
2015
2020
2025
2030
2035
Year


350
300
250
200
150
100
50
0
Salinity (PPT)
PREDICTED CHANGE
IN SOUTH BASIN SALINITY
Initial
Exposure
Assumed
Dike
Closure
Salt
Crystallizes
2024
CURRENT
OCEAN WATER
2005
2010
2015
2020
2025
2030
2035
Year


-215
-220
-225
-230
-235
-240
-245
-250
-255
-260
-265
-270
-275
Elevation (feet below sea level)
PREDICTED CHANGE
IN SOUTH BASIN WATER SURFACE ELEVATION
-- South Basin --
Salt
Crust
Forms
-255' msl
Assumed
Dike
Closure
2005
2010
2015
2020
2025
2030
2035
Year


SSA Plan
24,900 ac
No Action
76,300 ac
Area of Concern
for Dust Mitigation
Area Exposed = 119 sq mi
Ave. Shoreline
Recession = 1.25 mi.
South Basin
Full Sea
Elevation (ft, MSL)
-230
-240
-250
-260
-270
-280
0
50,000
100,000
150,000
200,000
250,000
Area (acres)


Riverside County
San Diego County
Imperial County
Recreational Saltwater Lake
Service Bridge
Saltwater Canal
Brine Pool
Saline Habitat Complex
Channel to North Lake
Perimeter Dike
Protective Salt Flat
IID Colorado River Reservoir
Recreational Estuary Lake
Dedicated Habitat Zone
Geothermal Area
LEGEND
County Boundary
Salton Sea Tax Finance District Boundary
Salton Sea Test Base Boundary
Salt Sink
Saline Habitat Complex
Protective Salt Flat
Marine Sea
IID Colorado River Water
Torres Martinez Native American Land
Existing Farmlands
State Park/Wildlife Refuge
Current Developed Areas



Dust Issue

- **Potential Concern**
  - Habitat area = 17,600 acres
  - Toe of west dike = 7,300 acres
- **Water for habitat (assume $^1/_2$ wetted)**
  - Assume 3 ft/ac x 17,600 ac = 52,800 AFY
  - Water availability depends on source

Water Requirments

SSA Plan Water Requirements			
Feature	**Option 1**	**Option 2**	**Option 3**
Evaporative Losses in the Lake	634,000	634,000	634,000
Sludge from Lake Water Treatment	22,000	22,000	22,000
Sludge from River Water Treatment	21,000	21,000	21,000
Wetlands	25,000	25,000	25,000
Saline Habitat Complex*			
o If supplied from north basin	30,000		
o If supplied from south basin		68,000	
o If suply by 50-50 north/south blend			50,000
Discharge to Brine Pool	8,000	8,000	8,000
TOTAL	740,000	778,000	760,000

Dust Issue (cont.)

- **Potential Concern**
  - Habitat area = 17,600 acres
  - Toe of west dike = 7,300 acres
- **Dust concerns at toe of west dike**
  - Lower elevation isolated from public by water
  - Manage ponding of brine to form crust
  - Possible use of geotubes: prelim. est. $5K/acre
  - $3.5M/year for ten years to treat all
- **Compare: No Action concern for 76,300 ac upslope of water features near people**

How Thick Would the Salt Crust Be If the Sea Simply Dried Up & the Salt Were Evenly Spread?

Line			
1	**427,354,401**	tons	about how much salt is in Sea
2	2,000	lb/ton	conversion factor
3	2.2	lb/kg	conversion factor
4	388,504,001,025	kg	weight of salt in Sea
5	**2,450**	kg/m3	average density of salt in Se
6	158,573,062	m3	volume of Salt in Sea
7	35.3	ft3/m3	conversion factor
8	**5,597,629,076**	ft3	volume of Salt in Sea
9	43,560	ft2/acre	conversion factor
10	**220,000**	acres	current surface area of Sea
11	9,583,200,000	ft2	current surface area of Sea
12	0.58	ft	depth of Salt if spread evenly

Densities

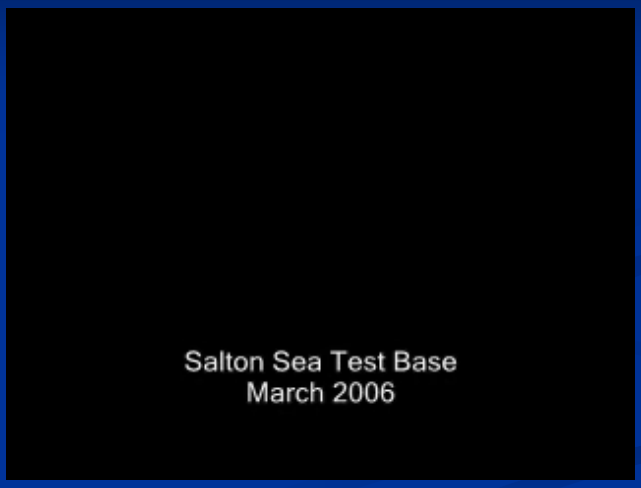
1	2,200	kg/m3	NaCl	60%
2	2,970	kg/m3	CaSO4	20%
3	2,680	kg/m3	NaSO4	20%
4	**2,450**	kg/m3	Average	

Volume

1	**7,000,000**	acre feet	approximate volume of water in Sea
2	325,851	gal/acre feet	conversion factor
3	2,280,957,000,000	gallons	volume of water in Sea
4	3.785	L/gal	conversion factor
5	8,633,422,245,000	L	volume of water in Sea
6	**45.0**	g/L	salinty of Seawater
7	388,504,001,025	kg	weight of Salt in Sea
8	2.2	lb/kg	conversion factor
9	2,000	lb/ton	conversion factor
10	**427,354,401**	tons	weight of Salt in Sea

RJE 1/24/06

Windy Conditions at Salton Sea Test Base



Emissive “Beach Area” Adjacent to New River Extension Peninsula that Experience Seasonal Wet & Dry Cycles

Other Exposed “Beach Areas” Near New River Extension Peninsula (background) that are Non-Emissive

Natural Non-Emissive Salt Crust &
Vegetation off Johnson Road

Example of “Impoundment Basin” in Wister Unit

Salt Crust in Impoundment Basin

Close-up of Salt Layer Covering Sediments

Cost Estimates ($M) for Dikes

- **Construction contract costs***

Central dam	400
Southern area dikes	530
Drain/appurtenances	20
Unlined channel	15
Total	965

- **Owners costs ** 145**
- **Requesting Reclamation funds for more design & geotech work**

* Includes materials, placement, mob. (5%), unlisted items (10%) & contingencies (25%).
** Includes design, permitting, CM & PM.

Other Preliminary Costs

- **Pumping plant**
  - Based on previous BOR estimates = $15M
  - Prelim. independent estimate = $29M
  - OMER Est. = $0.75M/yr
- **Water Treatment**
  - Working with budget of $200M
  - Requesting Reclamation funds to evaluate treatment technologies & costs

Phosphorous Loading to Salton Sea & Source Control Plan

rough analysis from various data sources

		IID- Alamo	IID-New	IID-Direct	Mexico	Whitewater	Other	TOTALS	%Original Load
Total Current Phosphorous Loading & Inflows (estimates for 2005 water year)									
Flow	acre-feet/yr	643,000	289,000	94,000	155,000	82,000	14,500	**1,277,500**	
Concentration	mg/L	0.72	0.5	0.72	1.9	0.87	0.1		
Load	tons/year	628	196	92	400	97	2.0	**1,414**	100%
Distribution	% of total	*44%*	*14%*	*6%*	*28%*	*7%*	*0.1%*		
1. IID Tailwater Reduction to Produce Conserved Water for San Diego & CVWD Transfers									
Flow	acre-feet/yr	450,100	202,300	65,800	155,000	120,000	14,500	**1,007,700**	
Concentration	mg/L	0.72	0.5	0.72	1.9	0.6	0.1		
Load	tons/year	440	137	64	400	98	2.0	**1,140**	81%
Distribution	% of total	*39%*	*12%*	*6%*	*35%*	*9%*	*0.2%*		
2. Anticipated Loss of Municipal Effluent & Ag Drainage Inflows from Mexico									
Flow	acre-feet/yr	450,100	202,300	65,800	20,000	120,000	14,500	**872,700**	
Concentration	mg/L	0.72	0.5	0.72	0.1	0.6	0.1		
Load	tons/year	440	137	64	3	98	2.0	**743**	53%
Distribution	% of total	*59%*	*18%*	*9%*	*0%*	*13%*	*0.3%*		
3. BMPs on Remaining IID Flows (50%) & TMDLs on Wastewater Treatment Plants (90%)									
Flow	acre-feet/yr	450,100	202,300	65,800	20,000	120,000	14,500	**872,700**	
Concentration	mg/L	0.36	0.25	0.36	0.1	0.06	0.1		
Load	tons/year	220	69	32	3	10	2.0	**335**	24%
Distribution	% of total	*66%*	*20%*	*10%*	*1%*	*3%*	*0.6%*		
4. Further Reduction in IID Drainage Flows to 600,000 AFY via Tailwater Elimination									
Flow	acre-feet/yr	378,084	169,932	55,272	20,000	120,000	14,500	**757,788**	
Concentration	mg/L	0.36	0.25	0.18	0.1	0.06	0.1		
Load	tons/year	185	58	13	3	10	2.0	**270**	19%
Distribution	% of total	*68%*	*21%*	*5%*	*1%*	*4%*	*0.7%*		
5. Chemical Treatment on Alamo River Flows (@ 90% effectiveness)									
Flow	acre-feet/yr	378,084	169,932	55,272	20,000	120,000	14,500	**757,788**	
Concentration	mg/L	0.036	0.25	0.18	0.1	0.06	0.1		
Load	tons/year	18	58	13	3	10	2.0	**104**	7%
Distribution	% of total	*18%*	*55%*	*13%*	*3%*	*9%*	*1.9%*		

RJE - 11/9/05