Salton Sea Long-Range Plan

March 2024

SALTON SEA MANAGEMENT PROGRAM

CALIFORNIA NATURAL RESOURCES AGENCY

DEPARTMENT OF WATER RESOURCES STATE OF CALIFORNIA

CALIFORNIA DEPARTMENT OF FISH & WILDLIFE

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Acronyms and Abbreviations

ac	acres
ADA	Americans with Disabilities Act
AFY	Acre-feet per year of water
ARP	Alamo River Project
BACT	Best Available Control Technology
BHP	brake horsepower
CBO	Community-Based Organization
CCI	Construction Cost Index
CDFW	California Department of Fish and Wildlife
CEQA	California Environmental Quality Act
CNRA	California Natural Resources Agency
CRSS	Colorado River Simulation System
CVSC	Coachella Valley Stormwater Channel
CVSWC	Coachella Valley Storm Water Channel
CVWD	Coachella Valley Water District
DCP	Drought Contingency Plan (for the Colorado River)
DWR	California Department of Water Resources
EA	Environmental Assessment
EO	California Executive Order
ET	evapotranspiration
Exceedance Inflow	The estimated recurrence frequency of an annual inflow
FFAP	Salton Sea Funding and Feasibility Action Plan
FW	freshwater
FWR	freshwater reservoir
ft	feet
GHG	Greenhouse gas
IID	Imperial Irrigation District
IRP	Independent Review Panel charged with evaluating water importation concepts
KDI	Kounkuey Design Initiative
KGRA	Known Geothermal Resource Area
IIJA	Infrastructure Investment and Jobs Act
IRA	Inflation Reduction Act

LRP	Long-Range Plan or Plan
LRPC	Salton Sea Long-Range Plan Committee
MAFY	million acre-feet per year
msl	mean sea level based on the North American Vertical Datum (NAVD) of 1988
MW	Megawatts
NAVD 1988	North American Vertical Datum (NAVD) of 1988
NEPA	National Environmental Policy Act
NF	nanofiltration
OMER	Operation, Maintenance, Energy and Replacement
PEIR	Programmatic Environmental Impact Report
PLA	Project Labor Agreement
PPT	parts per thousand
psi	pounds per square inch
QSA	Quantification Settlement Agreement
RO	reverse osmosis
RFI	Request for Information
SCH	Species Conservation Habitat (Project)
SHC	Saline Habitat Complex
SSA	Salton Sea Authority
SSAM	Salton Sea Accounting Model
SSMP	Salton Sea Management Program
SSRA	Salton Sea Recreation Area
Strategy	Community Amenities Strategy
TAFY	Thousand acre-feet per year
TEK	Traditional Ecological Knowledge
Tribes	California Native American Tribes
UCSC	University of California, Santa Cruz
UPL	Updated Perimeter Lake
USACE	U.S. Army Corps of Engineers
USBR	United States Bureau of Reclamation
USGS	United States Geological Survey
VTE	Vertical Tube Evaporation
VTE-MED	Vertical Tube Evaporators – Multi-Effect Distillation

Executive Summary

Introduction

Creating habitat and protecting air quality at the Salton Sea are key priorities for Governor Gavin Newsom and the California Natural Resources Agency. The Sea's continuing decline in elevation and resulting exposure of lakebed negatively impact surrounding communities and reduce remaining habitat for fish and wildlife. The California Natural Resources Agency, the California Department of Water Resources, and the California Department of Fish and Wildlife (together, the SSMP) are focused on executing the Phase I: 10-Year Plan, while simultaneously developing a path forward for long-term restoration and management of the Sea beyond the first decade.

The Salton Sea Management Program (SSMP) prepared this Long-Range Plan (LRP or Plan) to comply with State Water Board Revised Order WR 2002-0013 (Order). Condition 26 of the Order required the California Natural Resources Agency (CNRA) to issue a long-term plan no later than December 31, 2022. The Plan must be consistent with the requirements of the Order and the Salton Sea Restoration Act (Act) (Fish and Game Code § 2930, *et seq.*), including the statutory restoration objectives set forth in Fish and Game Code Section 2931, subdivision (c). The Draft Plan was released for public comment on December 15, 2022, a virtual community meeting was held on March 1, 2023, and the public comment period closed on March 17, 2023. This Plan is considered final and incorporates changes that came from the draft review as well as new air quality modeling that was developed in response to public comments.

The LRP was developed with support and input from Tribal leadership, community-based organizations, local, state, and federal agencies, and other interested parties. The Plan identifies concepts for long-term restoration of the Sea beyond the scope of the SSMP's Phase 1: 10-Year Plan, which aims to establish at least 14,900 acres of aquatic habitat and up to 14,900 acres of dust suppression projects by the year 2028.

The goal of the LRP is to protect or improve air quality, water quality, and wildlife habitat to prevent or reduce health and environmental consequences anticipated from the long-term recession of the Salton Sea shoreline. To achieve this goal, the following objectives must be met:

- Protect or improve air quality to reduce public health consequences.
- Protect or improve water quality to provide opportunities for beneficial uses and reduce environmental consequences.
- Restore long-term stable aquatic and shoreline habitat to historic levels and diversity of fish and wildlife that depend on the Salton Sea.

Meeting the aforementioned suite of objectives should be accomplished in a way that is acceptable to the region by being consistent with Tribal, local, State, and Federal policy and initiatives. In addition to numerous other factors described throughout the document, any solution should be shaped by Tribal knowledge and expertise, preserve Tribal heritage, enhance the local economy, and achieve environmental justice.

Overview of Restoration Concepts and Strategies

The restoration of the Salton Sea has been under study for more than two decades, and a wide range of concepts have been evaluated. This Plan builds upon these prior efforts while also acknowledging current, rapidly changing conditions in the Sea. The restoration concepts discussed in this Plan include long-range solutions that do and do not involve water importation. The concepts that do not involve water importation expand on current and past Federal, State, and local studies and the restoration plans developed in previous investigations. The concepts have been updated to meet current habitat objectives and to include Phase 1:10-Year Plan projects. In developing the Plan, the SSMP team has also sought the engagement of California Native American Tribes (Tribes) to align with their goals for the restoration of the Sea. In addition, the concepts have been modeled using the latest projections for future water inflows, and earlier cost estimates have been updated to express costs in 2022 dollars. The following documents served as the basis for the first four concepts considered in this LRP:

- CNRA Salton Sea Ecosystem Restoration Program Programmatic Environmental Impact Report (PEIR), Draft (2006) and Final (2007).
- US Bureau of Reclamation (USBR) Final Report: Restoration of the Salton Sea, 2007
- Salton Sea Authority (SSA) Funding and Feasibility Action Plan (FFAP), 2016
- The Salton Sea Management Plan (SSMP) Phase 1: 10-Year Plan Imperial and Riverside Counties, California, Draft Environmental Assessment, 2022.

The initial concepts were presented to the Salton Sea Long-Range Plan Committee (LRPC) and the public in March 2022. The LRPC and the public were given the opportunity to comment on these concepts as well as to submit other concepts. Based on feedback from this process, new concepts were added, and variations of the original concepts were developed to accommodate various strategies.

The Independent Review Panel (IRP) convened by the University of California at Santa Cruz was commissioned by the SSMP to review concepts for water importation to the Salton Sea for its long-term restoration. The IRP reviewed 18 proposals from outside groups. Three of the 18 proposals did not involve water importation and were referred to the SSMP team and are discussed herein. Of the remaining 15 proposals received, the IRP identified three import concepts which met their criteria. Because of similarities across these three external proposals, the IRP created a merged importation concept, pulling features from each. In addition, the IRP proposed a different importation concept, involving an exchange of Colorado River water with desalination in Mexico. In this scenario, the desalinated water is used in Mexico and an equivalent amount of water is left in the Colorado River to augment flows to the Salton Sea. Finally, the IRP developed another concept with no importation, that involved fallowing of land and the resulting conserved Colorado River water would flow to the Sea. These three concepts are further discussed in this document.

From the above-described process, the following concepts emerged for consideration in this Plan:

- **The SSMP Phase 1: 10-Year Plan** serves as a foundation for the concepts that are part of Phase 2. The Phase 1: 10-Year Plan includes four large habitat projects, multiple smaller habitat projects, and several revegetation projects designed to mitigate dust emissions.
- **Restoration Concept 1:** North/South Marine Sea that builds on concepts presented in the Ecosystem Restoration PEIR. The concept includes a north/south trending marine sea (meaning salinity like that of the ocean), maintained at an elevation close to historic levels before reductions of inflows over the past 20 years. Three variations of this concept are considered in this document.

- **Restoration Concept 2:** Divided Lake/Marine Sea South that builds on a concept presented by USBR for a divided lake with no elevation control and a marine sea in the south that would support a fishery. Four variations of this concept are considered in this document.
- **Restoration Concept 3:** Updated Perimeter Lake that builds on the perimeter lake concept published in the SSA Funding and Feasibility Action Plan (SSA, 2016). Two variations of this concept are considered in this document.
- **Restoration Concept 4:** Pump Out Options that would create an artificial outlet for the Salton Sea by pumping Salton Sea water from the Sea and using it for dust control, pumping Salton Sea water to the Sea of Cortez, or a combination of the two. Creating an artificial outlet would ultimately return the Sea to marine salinity. Pump-out options were investigated in the SSA Funding and Feasibility Action Plan. Four variations of this concept are considered in this document (SSA, 2016).
- **Restoration Concept 5:** Water Optimization, proposed by a representative of the Pacific Institute and a member of the LRPC, would capture water in two or more interceptor canals. Water would be distributed via gravity around the historic Salton Sea shoreline, creating shallow habitat cells and dust suppression projects. The cells would have a wide range of salinities, with salinity increasing in downslope cells.
- **Restoration Concept 6:** Southlake Restoration and Enhanced Vegetation, proposed by AGESS, Inc., would involve enhanced vegetation and phytoremediation that could be installed in the New and Alamo rivers and their deltas on floating islands to provide water quality improvements. A dredged gravity fed irrigation ditch would provide water for wetlands and a crescent shaped Southlake.
- **Restoration Concept 7:** Water Recycling, proposed by Sephton Water Technology, would involve construction of five desalination plants using evaporative distillation technology supplemented with groundwater pumping to reduce the salinity in the Sea.
- **Restoration Concept 8:** Reclamation of Native Desert and Agriculture was submitted to the IRP but referred to the SSMP team because it did not involve water importation. This proposal involves using less than 100 acre-feet per year (AFY) of Colorado River water to create small, shallow pools of oases around the exposed lakebed to help provide drinking water for wildlife and help provide a catalyst for the revegetation of the lakebed.
- **Restoration Concept 9:** Floating Solar and Water Generation System was submitted to the IRP but referred to the SSMP team because it did not involve water importation. Many floating solar systems would cover the water surface and slow evaporation, while generating electrical energy used to generate freshwater.
- **Restoration Concept 10:** Save the Coachella Valley Basin plan was submitted to the IRP but referred to the SSMP team because it did not involve water importation. Exposed lakebed areas close to the Salton Sea shore would be developed into mudflats and ponds. The habitat restoration projects would include 20 to 60 fish "rest areas."
- **Restoration Concept 11:** Water Importation was proposed by the IRP (from merging three external proposals received) and would involve importation of desalinated water from the Sea of Cortez, Mexico. Between 860,000 and 1 million AFY of water would be extracted from the Sea of Cortez, desalinated at an ocean water desalination facility on the western shore of the Sea of Cortez near San Felipe, Baja California, Mexico. Roughly half the resulting low-salinity water produced would be transported by pipeline to the Salton Sea. In addition, a remediation desalination facility near the Salton Sea was proposed to remove salts and further decrease the salinity of the Sea.
- **Restoration Concept 12:** Water Exchange proposed by the IRP would involve moving between 90,000 to 112,000 AFY of desalinated water from a desalination plant on the eastern shore of the

Sea of Cortez to the Canal Alimentador Central, which delivers water to the reservoir behind Morelos Dam on the Colorado River. Through agreement with Colorado River users, an equivalent amount of water would be delivered via the All-American Canal to the Salton Sea. This concept would also include a remediation desalination facility near the Salton Sea to remove salts and further decrease the salinity of the Sea.

- **Restoration Concept 13:** Colorado River Water Transfer proposed by the IRP would involve voluntary fallowing of land in the Salton Basin using financial incentives provided by the State of California to result in a net additional input of 100,000 AFY to the Salton Sea. Water from voluntary transfers could stabilize the Sea's elevation, and paired with remediation desalination, the Salton Sea salinity levels would be reduced.

Not all the above concepts are considered in detail in this Plan. Table ES-1 provides a summary of the status of the restoration concepts. Concepts 6, 8, 9, and 10 were not considered to be full restoration concepts, and therefore, were not included in the comparison with other full restoration concepts. However, components of these concepts are being retained for future consideration as elements of larger restoration plans during the next phase of environmental and engineering analysis.

Table ES-1. Evaluation Status of Restoration Concepts.

Number	Name	Original Source	Status
1	North/South Marine Sea	CNRA (2006)	Three variations evaluated in this Plan (A, B, and C)
2	Divided Lake/Marine Sea South	USBR (2007)	Four variations evaluated in this Plan (A, B, C, and D)
3	Updated Perimeter Lake	SSA (2016)	Two variations evaluated in this Plan (A and B)
4	Pump Out	SSA (2016)	Four variations evaluated in this Plan (A, B, C, and D)
5	Water Optimization	Salton Sea LRPC	Evaluated in this Plan
6	Southlake Restoration and Enhanced Vegetation	Salton Sea LRPC	Components retained for future consideration
7	Water Recycling	Salton Sea LRPC	Evaluated in this Plan
8	Reclamation of Native Desert and Agriculture	Submission to IRP	Components retained for future consideration
9	Floating Solar and Water Generation System	Submission to IRP	Components retained for future consideration
10	Save the Coachella Valley Basin	Submission to IRP	Components retained for future consideration
11	Water Importation	IRP Proposal	Evaluated in this Plan
12	Water Exchange	IRP Proposal	Evaluated in this Plan
13	Colorado River Water Transfer	IRP Proposal	Evaluated in this Plan

Salton Sea Long-Range Plan Amenities

Over the last decade, community members and organizations have advocated for multi-benefit infrastructure projects to address a range of community health and environmental concerns, and economic needs. Limitations on the use of bond funding, and regulatory, technological, cost, and landownership challenges have posed barriers to integrating these into the project design of SSMP projects. The development and implementation of the LRP presents a unique opportunity to incorporate these critical community amenities into the long-term vision for the Salton Sea.

Preliminary research and review of materials to date, including from State and community-based organization (CBO)-led processes, identified a range of community infrastructure and other needs to support the vision of a healthy and sustainable Salton Sea region. While some of the needs identified may be able to be incorporated into SSMP projects, others may fall outside of the SSMP and within the planning authority and funding of other governmental agencies and programs. CNRA is committed to supporting and advancing these efforts where possible. Needs identified to date include the following:

- **Partnerships opportunities with Tribes:** Community members and advocates identified needs to improve the quality of life for members of Tribes, develop tailored restoration projects on Tribal lands, host conservation and education programs led by Tribes, and advance economic development and contract opportunities to support the economic resiliency of Tribes and Tribal communities, as described in Executive Orders (EO) B10-11 and N15-19.
- **Recreational and outdoor access infrastructure at the Sea:** Community members and advocates at and around the Sea surfaced recreational and outdoor access infrastructure opportunities that make the Sea more accessible, welcoming, and usable for communities, such as bathrooms, shaded areas, picnic tables and barbeques, lighting, drinking fountains, benches, gathering spaces like recreational or community centers, multilingual wayfinding and culturally-appropriate signage, parks, pedestrian paths and hiking trails, boardwalks along the shore, biking trails, campgrounds, wildlife viewing platforms, and boat ramps. All should comply with existing regulations for accessibility, be ergonomically suitable, and be operated and maintained in necessary working conditions such as running water, electricity, and cleanliness.
- **Climate resilience infrastructure:** Benefits identified for advancing climate resilience and environmental health include climate resiliency hubs including cooling centers, parks, green spaces, operations and maintenance funding for SSMP projects, electric bus and electric vehicle charging infrastructure, and stable energy and water infrastructure.
- **Access to environmental health protections, and improved public health:** In addition to public health objectives of the SSMP, community members and advocates prioritize access to health benefits, including new health and mobile clinics near communities at the Sea; improved medical services and specialized care; improved pollution exposure research; monitoring and mitigation measures with real-time data and notification features, such as air quality monitors near communities; indoor air filters, reduced pesticide use and runoff diversion; improved air quality; ending unauthorized and hazardous waste dumping; affordable and safe drinking water; improved public and environmental health outreach to communities; improved housing; healthy food access and community gardens; and updated public health assessments and plans.
- **Expanded and enhanced transportation infrastructure:** Unmet transportation needs of the region include frequent and reliable public transportation services, electric buses, safe pedestrian paths and complete sidewalks, bike lanes and paths, safe roads, parking lots, lighting, and replacing high-polluting on and off-road vehicles. People have also requested direct connections to the Sea via public transportation.

- **Broadband access for all communities:** Community members surfaced lack of broadband to be a key constraint for engaging in SSMP or related planning processes. Benefits of broadband that cannot currently be met due to lack of infrastructure include access to virtual health, education, and commerce platforms.
- **Workforce benefits:** Community members and advocates want to see their communities employed for programs and investments at the Salton Sea. Potential opportunities identified here include: commitments to local hiring, and hiring underrepresented communities and Tribes for SSMP and other regional projects; investments in STEM (for science, technology, engineering and math) and green jobs educational programs, services, certification, and training for residents, including for Lithium Valley jobs; youth education and improved higher learning; support for local entrepreneurship; and a career center for the Salton Sea.
- **Education and programming at the Sea:** Community members identified a need for improved education and programming at the Sea, such as cultural education and programming, environmental education and signage, recreational programming, youth education, reduced fee programs, STEM and community science projects, and multilingual education centers and way-finding.

Although recreational and equitable access amenities are the focus of this Plan, the SSMP recognizes that additional needs highlighted by communities are important to incorporate into project design and planning. The acceptability criteria, used to evaluate restoration concepts, reflect the recognition that restoration projects at the Salton Sea must achieve multiple values, including fulfilling the State's commitments to Tribes, equitable outdoor access, and environmental justice. Most of the concepts identified in the LRP are too early in design to be fully analyzed using these acceptability criteria; it is the hope of the SSMP that these criteria will be foundational in the next stage of environmental review and alternative development.

Evaluation of Concepts and Strategies

The evaluation criteria developed for the Salton Sea LRP use federal planning process guidance: *Principles and Requirements for Federal Investments in Water Resources*, March 2013. Following these Principles and Requirements, the criteria for evaluating restoration concepts were formulated in the following four categories:

- Effectiveness
- Acceptability
- Completeness
- Efficiency

These categories were used to evaluate expected performance of 18 Phase 2 restoration concepts, including variations, that were carried forward for analysis at this stage of the planning process. The 18 concepts include 15 concepts that were proposed by the SSMP team, the LRPC, or the public and three concepts that were selected from the process facilitated by the Independent Review Panel (IRP). In addition, the Phase 1: 10-Year Plan was evaluated using the same methodology. The scoring for all concepts followed these general guidelines:

Criteria Category	Scoring Guidelines				
Effectiveness	Highly Effective	Very Effective	Effective	Somewhat Effective	Not Effective
Acceptability	Acceptable	Mostly Acceptable	Somewhat Acceptable	Minimally Acceptable	Not Acceptable
Completeness	Complete				Not Complete
Efficiency	Highly Efficient	Very Efficient	Efficient	Somewhat Efficient	Not Efficient
Scores >>	5	4	3	2	1

Effectiveness: Effectiveness measured how well a concept accomplished the following key objective areas:

- Air Quality/Public Health:
  - Ability to reduce dust emissions from exposed lakebed with the intent to protect or improve air quality
  - Ability to protect or improve air quality
- Habitat:
  - Area of shallow habitat (0-6 inches)
  - Area of medium-depth habitat (6 inches to 6 feet)
  - Deep-water habitat (greater than 6 feet)
  - Salinity
  - Pupfish habitat and connectivity
- Water Quality:
  - Ability to meet selenium standards
  - Ability to improve water quality

Acceptability: Acceptability was measured across the following ten criteria:

- Tribal Access to Natural Resources, Cultural Resources, and Tribal Cultural Resources
- Protection of Natural Resources, Cultural Resources, and Tribal Cultural Resources (Based on overall area)
- Protection of Natural Resources, Cultural Resources, and Tribal Cultural Resources (Based on location)
- Incorporation of Tribal Expertise
- Environmental Justice and Equity
- Do No Harm
- Equitable Outdoor Access
- Minimize GHG Emissions
- Workforce Development
- Sustainable Economic Development

Completeness: Completeness was assessed on whether a restoration concept satisfies all three of the Salton Sea LRP objectives.

Efficiency: Efficiency measured a concept's benefits and risks across the following 10 criteria:

- Timeframe for Complete Solution
- Capital Cost

- Operation, Maintenance, Energy, and Replacement (OMER) Cost
- Incremental Benefits with Incremental Funding
- Proven Technology/Reduced Risk
- Water Supply Risk
- Earthquake Risk
- Climate Change Related to Extreme Weather
- Regulatory Compliance
- Local, State, and Federal Water Rights and Agreements

All restoration concepts were evaluated for a range of three inflow scenarios to the Salton Sea. The scenarios were developed through an evaluation of flows on the Colorado River with consideration of the ongoing long-term drought in the west, the possible effect of climate change on evapotranspiration in the Imperial Valley, possible reductions of flows from Mexico, and several other factors. The three inflow scenarios are illustrated in Figure ES-1.

Summary of Findings

Based on the evaluations completed as part of this Plan, the most reasonably foreseeable average annual future inflow, barring any significant future policy changes, is estimated at 889,000 AFY, shown as the High Probability Inflow Scenario in Figure ES-1. This estimate is approximately 201,000 AFY less than the current 7-year average (1,090,000). SSMP measured the performance of concepts across all metrics using this inflow. However, as discussed in Chapter 4, Areas of Key Uncertainty, future Salton Sea Inflow is difficult to predict because of unknown future potential water policy changes on the Colorado River. To address this uncertainty for this Plan, we also measured the performance of concepts with inflows representing drier than expected future conditions and major water policy changes. These future inflows are 684,000 AFY and 444,000 AFY.

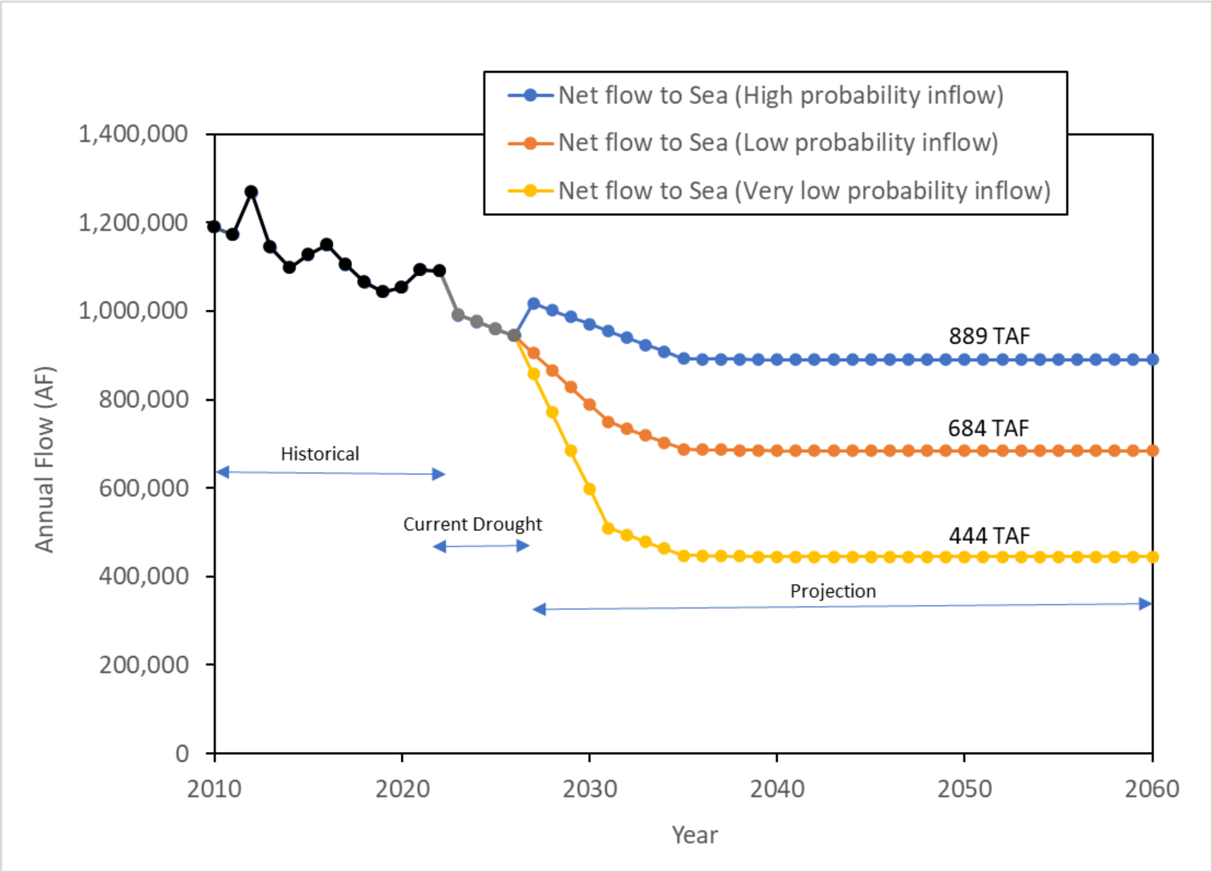

Figure ES-1. Inflow Scenarios Developed as Part of the Long-Range Plan (TAF = thousand acre-feet per year).

Fifteen of the 18 Phase 2 concepts have been deemed “Complete,” which means they meet a minimum standard of “Effective” for Air Quality, Habitat, and Water Quality metrics. Concepts 3A, 3B, and 5 have been deemed “Incomplete” because of their inability to provide sufficient deep-water habitat. However, our scoring rubric for deep-water habitat is based on a linear relationship as compared to historical conditions, which doesn’t account for density dependent effects of habitat on species. SSMP recommends using a population-based model for future evaluations to better understand the value of deep-water habitat.

Concept 11 scored the best for “Effectiveness” primarily because it offers more deep-water area habitat and covers the most amount of exposed lakebed when compared to other concepts. Other concepts that scored high for Effectiveness include concepts 2A, 2B, 2C, 2D, 4A, 4B, 4C, 4D, and 7. These concepts were “Very Effective” in providing deep-water habitat, which set them apart from the remaining concepts.

Concepts that scored the highest for the “Acceptability” include concepts 2A, 2B, 2C, 2D, and 3B. These concepts all scored well for their potential to develop local workforce and deliver sustainable economic development. Additionally, they offer the highest potential for equitable outdoor access. Finally, these concepts all scored well for minimizing GHG emissions.

Concepts that scored the highest for “Efficiency” include Concepts 2A, 2B, 2C, 2D, 3A, 3B and 5. These concepts established themselves as more efficient than other concepts for scoring well under the criteria for capital costs, operational costs, and proven technology.

The concepts that performed best across all four categories for the High Probability Inflow are Concepts 2A, 2B, 2C, and 2D, all variations of the Divided Sea Concept. Specific metrics where 2A, 2B, 2C, and 2D, did not score well include water supply risk. A low score in this category indicates that air quality, habitat, or water quality scores drop when the hydrologic regime changes from High Probability Inflow to Low Probability Inflow. Despite this drop in habitat scores, Concepts 2B, 2C, and 2D still register as "Very Effective" for their overall scores for the Low Probability Inflow scenario.

Concepts 3A, 3B, and 5 scored well across nearly all categories except for deep-water habitat. This result underscores the importance of a more detailed scoring metric for aquatic habitat based on population dynamics and ecological outcomes rather than a linear relationship.

Discussions of findings associated with the other inflow scenarios can be found in Chapter 8 of this Plan.

Recommendations

Concepts Recommended for Further Evaluation: The following concepts are recommended for further evaluation and for a subsequent feasibility study and environmental review process:

- Concepts 2B, 2C, and 2D performed best across all categories for both the High Probability Inflow and Low Probability Inflow scenarios. These and other variations of Divided Sea concepts should receive further consideration with a focus on improving resilience in the event hydrology performs worse than anticipated.
- Concepts 3A and 3B score well but are limited in their ability to provide deep-water habitat. Because they utilize less water than other concepts, they provide low risk in terms of future water supply concerns. Variations of Concepts 3A and 3B should receive further consideration with a focus on maximizing deep-water habitat.
- Concepts 4A and 4D score well for "Effectiveness" and only reasonably well for "Acceptability." While they are deemed incomplete by this analysis due to insufficient deep-water habitat, this metric will be replaced with a more appropriate biologically based measure in a subsequent review phase. Variations of these concepts should move forward for further consideration with a focus on improving acceptability measures.
- Concept 5 generally performs well except for lacking sufficient deep-water habitat, and for lesser recreational opportunities. A variation of Concept 5 should receive further consideration with a focus on adding recreational opportunities.
- Concept 6 was not fully analyzed in this document. However, components of the concept, including phytoremediation for improving water quality of inflowing river water, are recommended for future consideration as components of other concepts during the next phase of environmental review.
- Concept 7 generally scores well for "Effectiveness" criteria, reasonably well for "Acceptability" criteria, but relatively poorly for "Efficiency" criteria. A variation of Concept 7 should receive further consideration either 1) as a stand-alone concept with a focus on reducing cost and accelerating the timeframe to a complete solution, or 2) combined with other concepts with a focus on delivering greater overall value.
- Concept 10 was not fully analyzed because it primarily focuses on new processes. It involves lakebed shore cleanup, waste removal, and beautification. Community outreach would include social media and public meetings and the formation of a "Save the Salton Sea Clean Up Committee" as a short-term initiative. The long-term goal would be to work directly with the community to make improvements around the Sea. The plan does not involve control of salinity or lake surface.

However, community involvement would be beneficial to restoration efforts. The community could be directly involved in all phases of the project to design educational and habitat restoration opportunities. Variations of concept 10 that allow for greater community involvement is recommended for further consideration.

- Concept 11 was the most effective concept for all hydrologic scenarios and was the only concept to meet completeness for the Very Low Probability Inflow. This concept is also the most expensive and requires the longest time to implement. This concept should move forward for future consideration with a focus on identifying cost-saving measures and delivering greater value. While this concept has already received significant review and conceptual iteration from the IRP, it is possible that variations of this concept can be combined with other concepts to deliver greater value.
- Concepts 12 and 13 are too expensive for the benefits provided as currently configured, when compared to in-basin concepts. However, smaller variations of these concepts should be considered for their potential to be combined with other concepts in the event hydrology is worse than expected.

Concepts Not Recommended for Further Evaluation: The following concepts are not recommended for further evaluation:

- Concepts 1A, 1B, and 1C carry significant costs and risk without adding significant benefits. Constructability and potential catastrophic damage from earthquakes are risks that preclude us from recommending these concepts for further consideration.
- Concepts 4B and 4C provide similar benefits to Concepts 4A and 4D, but with added unnecessary costs and risks. We recommend that 4B and 4C be removed from further consideration as standalone concepts.
- Concept 8 uses 100 AFY of Colorado River water to develop vegetated habitat. It was not fully evaluated because it does not involve control of salinity or creation of habitat. Similar strategies already exist like revegetation projects being implemented on exposed lakebed to control dust. These projects are expected to continue and be incorporated with all other restoration concepts. Due to its similarity, there is no need for Concept 8 to receive further consideration.
- Concept 9 would involve solar modules on racking supported by floats with an industrial atmospheric water generation unit as illustrated in Figure 5-32. The floating solar system would cover the water surface and slow evaporation, while generating electrical energy. The concept would reduce salinity from decreased evaporation by covering parts of the Salton Sea and adding freshwater. Several technical issues existed that made this concept impractical. 6,000,000 or more of these units would be required to have only a 10 percent benefit in reducing evaporation. Other floating systems have been tested in the Sea and with the high salinity, large temperature extremes, and high wave activity, they are generally not practical. The operating life expectancy of individual units would be on the order of one to three years. Furthermore, having 6,000,000 of these units would be an impediment to recreational boating. This concept is not recommended for further consideration due to the technical challenges.

Changes Made between the Draft and Final Long-Range Plan

The SSMP program received 173 comments on the Draft LRP that was released for review on December 15, 2022 (supplemented by an air quality appendix, Appendix E, on February 15, 2023). All comments and responses are provided in Appendix I to this document.

Several changes have been incorporated into the Final LRP as a result of comments received on the Draft LRP. Additionally, the Final LRP incorporates new analyses that were started at the time of the Draft LRP but were not complete at the time of the draft publication. Updates to the Draft LRP that are included in the Final LRP include:

- Updates to the Methods of Analysis Sections *3.4 Air Quality Evaluation* and *3.5.1 Landscape Processes* (which is a subsection of *3.5 Greenhouse Gas Analysis*).
- Updates to the Areas of Uncertainty Sections *4.1.1 Uncertainty in Future Inflow*, *4.1.2 Uncertainty in Air Quality Analysis as it Relates to Public Health*, and *4.2.1 Uncertainty in Water Quality*.
- Updates to the introduction to Section *5.2 Phase 1: 10-Year Plan*.
- Added discussion regarding revenue from salt under Section *5.9 Restoration Concept 7: Water Recycling (Desalination)* within Subsection *5.9.2 Performance, Expected Benefits, and Recreational Opportunities*.
- Updates to the description of the criteria for evaluation of the “Ability to Protect or Improve Air Quality” within Section *7.1.1 Air Quality/Public Health*.
- New Section *7.5 Evaluation Summary*. This section provides summary tables for each of the inflow scenarios, showing the complete set of scores for all restoration concepts under each inflow scenario.
- New Subsection *8.2.3 Consideration of Air Quality in Scoring Restoration Concepts* within Section *8.2 Recommendations*.
- Added discussion in Section *5.2.2.1 Using Coupled Model Intercomparison Project (CMIP3) Projections for future climate and Resampled 2000–2018 Hydrology as Colorado River Simulation System (CRSS) Input* and added Section *6.2 Water Use for Lithium Production* in Appendix B: Hydrology and Climate Change.
- Completed *Appendix E: Air Quality Evaluation*, which was first released on February 15, 2023, with model output for different restoration concepts.
- Updates to *Appendix F: Greenhouse Gas Emissions* throughout the document in response to public comments provided.
- New *Appendix H: Independent Review Panel Water Import Feasibility Analysis (released September 2022)* which provides an overview of Independent Review Panel activities and links to their documents.
- New *Appendix I: Public Comments and Responses*, as discussed above.
- Multiple minor editorial corrections in the main document and appendices.

Next Steps

In 2023, the SSMP invested significant time and effort to advance work with the US Army Corps of Engineers (USACE) and SSA on the Imperial Streams and Salton Sea Ecosystem Restoration Feasibility Study (Feasibility Study). This Feasibility Study is a continuation of SSMP’s effort on the Long-Range Plan. The restoration strategies and concepts described in the Long-Range Plan are necessarily ambitious. Any combination of concepts within the Plan will require significant federal and local support to deliver. The SSMP views our partnership with USACE and SSA as essential for identifying and implementing a preferred alternative for the long-term restoration of the Salton Sea.

In December 2022, the California Department of Water Resources, SSA, and USACE Los Angeles District entered into a Feasibility Cost Share Agreement, effectively kicking off the Feasibility Study. Acknowledging the extensive work completed by the SSMP and other agencies and organizations to develop the Draft LRP, USACE adopted the restoration concepts set forth in the Long-Range Plan to evaluate in the Feasibility Study. The USACE study team plans to refine and build upon the LRP concepts to align with USACE policy and procedures and then apply their standard planning process as required by federal regulation.

During 2023, the three agencies worked together to develop a shared understanding of the scope of challenges and opportunities surrounding the Salton Sea. This scope was heavily informed by the Draft Long-Range Plan document, process, and public comments. Through this scoping effort, in August 2023, USACE affirmed the LRP restoration concepts that were recommended for further evaluation as alternatives in the Feasibility Study. USACE also developed a proposed scope, schedule, and budget to complete the Feasibility Study. The scope and schedule incorporate preferred hydrologic, hydraulic, and ecological models, data collection needs, public involvement plans, and review plans to complete the study. Under this preferred scope, the study is anticipated to cost between $12-16 million.

Currently, USACE and the State of California have secured funding to cover $3 million of the Study's scope. This Cost Share Agreement allows the USACE and its partners to split the cost of the study and work collaboratively on possible solutions. Work is underway to secure the additional funds needed to complete the Feasibility Study.

1 Introduction

The Salton Sea, located in Imperial and Riverside Counties, is California's largest inland water body and arguably the most unique. The low-lying elevation (currently more than 235 feet below sea level) and high salinity are primary characteristics that set the Salton Sea apart from most California lakes. Additionally, the Salton Sea is a terminal lake, which means it has no outlet to transport incoming flow and salts out of the lake. As water evaporates, salts continue to accumulate, leading to an increasingly saltier lake over time.

The Salton Sea relies on inflow from several sources to maintain its volume. The majority of inflow comes indirectly from the Colorado River, by way of drainage from agricultural fields. Due to changes in water policy over the past 20 years, inflows have dropped from 1.3 million acre-feet per year (AFY) of water to 1.1 million AFY. Further reductions in inflow are likely because of continued drought and changing water policy in the Western Basin States.

Over the past 2,000 years a large lake, fed by the Colorado River and historically referred to as Lake Cahuilla, has periodically existed in the Salton Sea area. This historic lake last dried up in 1580, and prior to that period, supported a rich biota and human populations around its shores. Archaeological evidence of that habitation can still be found today across the region and is the basis of the importance of the Salton Sea to Tribal communities.

More recently, in the early 20th century, the Salton Sea was formed by high flood flows from the Colorado River that had been diverted for agriculture in the Imperial Valley. The modern Salton Sea formed during that event and was subsequently maintained with irrigation drainage inflows, which initially provided exceptional ecological and recreational value. As the lake level has dropped and salinity has increased in recent years, however, the lake has become less accessible for recreation and less habitable for fish and birds. Additionally, and importantly, with lesser inflows, the Salton Sea has begun to recede, exposing thousands of acres of lakebed. This exposed lakebed can be emissive, posing air quality concerns and public health risks. This is of particular importance as existing rates of air-quality related illnesses in communities surrounding the Salton Sea are higher than the statewide rate (Farzan et al., 2019).

Currently, the SSMP is working with local, State, Tribal and Federal partners to implement the first phase of habitat restoration projects (Phase 1: 10-year Plan projects) on lakebed that becomes exposed due to a receding Salton Sea. These projects seek to establish at least 14,900 acres of aquatic habitat and up to 14,900 acres of vegetated habitat by the year 2028, with the purpose of suppressing dust emissions and improving ecological conditions.

The LRP intends to address future recession of the Salton Sea, beyond the year 2028. The SSMP prepared this draft LRP to comply with State Water Board Revised Order WR 2002-0013 (Order). Condition 26 of the Order requires the California Natural Resources Agency (CNRA) to develop a long-term plan (Plan) no later than December 31, 2022. The Plan must be consistent with the requirements of the Order and the Salton Sea Restoration Act (Act) (Fish and Game Code § 2930, et seq.), including the statutory restoration objectives set forth in Fish and Game Code Section 2931, subdivision (c).

1. Introduction

The Act identifies the intent of the California Legislature to "undertake restoration of the Salton Sea ecosystem and the permanent protection of wildlife dependent on that ecosystem." To meet this intent, the LRP establishes the following specific goal and supporting objectives aligned with the Fish and Game Code (§ 2931, subdivision (c):

The goal of the Plan is to protect or improve air quality, water quality, and wildlife habitat to prevent or reduce health and environmental consequences anticipated from the long-term recession of the Salton Sea. To achieve this goal, the following objectives must be met:

- Protect or improve air quality to reduce public health consequences.
- Protect or improve water quality to provide opportunities for beneficial uses and reduce environmental consequences.
- Restore long-term stable aquatic and shoreline habitat to historic levels and diversity of fish and wildlife that depend on the Salton Sea.

Meeting these objectives should be accomplished in a way that is acceptable to the region by being consistent with Tribal, local, State, and Federal policy and initiatives. In addition to numerous other factors described later in the document, any solution should be shaped by Tribal knowledge and expertise, preserve Tribal heritage, enhance the local economy, and achieve environmental justice.

The Salton Sea is primarily fed through the drainage of other water rights holders in its basin. Under current policies, its inflows and thus its size is dependent on the delivery of water to those water rights holders. The long-term challenges facing the Salton Sea will continue to be driven by water availability in the Lower Colorado River, which will be further exacerbated by climate change and growing demands in the Upper Colorado River basin. The ability to predict future inflows is confounded by the uncertainty in future water policy decisions as the Western Basin of the United States and Mexico grapple with unprecedented water supply shortages on the Colorado River. The region is dealing with a major 23-year drought as this Plan is being prepared and must also contend with a longer-term decline in river flows as a consequence of warmer temperatures in future decades. Any solution to these challenges will likely require a significant investment in new water infrastructure at a large scale. This habitat restoration effort has potential to be the largest in California's history. Any potential project, or suite of projects, that addresses these challenges will require extensive environmental review and an extended planning process. This LRP establishes an evaluation framework for future alternatives by investigating a range of project concepts. Additionally, the LRP identifies key uncertainties within the evaluation framework where more rigorous scientific study is necessary. Finally, the LRP documents key drivers that lead to greater benefits and reduced risks. This LRP is intended to inform the scope of a future Environmental Impact Report/Environmental Impact Statement.

The LRP was prepared with support from the LRP Committee (LRPC) and input solicited through public workshops. This public process resulted in the refinement of evaluation criteria, the inclusion of additional evaluation criteria, new concepts, and identification of key uncertainties. While the LRPC provided vital input and feedback during the drafting of this document, the evaluations and recommendations presented in this version of the draft Plan are those of the SSMP team.

The LRP considers restoration concepts using two distinct fundamental approaches:

1) Concepts **without** water importation: projects that are based solely on projected inflows into the Sea from its surrounding watershed (basin); and

2) <u>Concepts **with** water importation</u>: projects that include water importation to the Sea from sources that originate beyond its watershed.

The SSMP team, with support from the Committee, focused its evaluation on concepts that do not involve water importation.

An Independent Review Panel (IRP) was commissioned by the SSMP to evaluate concepts that do involve water importation. The SSMP contracted with the University of California, Santa Cruz (UCSC), to establish the IRP to perform the investigation and prepare a Feasibility Report. This evaluation was conducted independently of State direct involvement in response to public requests to thoroughly evaluate importation concepts. The IRP was independent in that communication between panelists and State employees and contractors was limited to coordination of public meetings, and tracking of budget and task completion. The IRP's research, analysis, deliberations, findings, and reports were produced independently with the assistance of a support team consisting of consultants and UCSC research staff. The IRP work products are in the public domain.

Note: The concepts evaluated in this LRP are not intended to be exactly the same as alternatives that could be evaluated in a subsequent environmental review process. Some revisions to the concepts could occur, with potential new alternatives being considered, to incorporate any new knowledge gained during the LRP or IRP evaluation.

1.1 Restoration Concepts and Strategies

The development and analysis of concepts without water importation and with water importation proceeded on parallel tracks. The analysis of water importation concepts was provided in a set of public reports through September 2022.[1]

1.1.1 Development of Concepts <u>Without</u> Water Importation

The restoration concepts that did not involve water importation were developed as long-range solutions that would be sustained by local water sources. These concepts do not involve bringing water in from the Sea of Cortez or the Pacific Ocean. The concepts evaluated in this document build upon current and past Federal, State, and local studies and the restoration plans developed in previous investigations. While these concepts are derived from previous ideas, they have been updated to meet current habitat objectives, use the latest projections for future water inflows, and align with current cost estimates. Appendix A to this Plan describes previous alternatives from the following four documents that serve as the origin for the concepts considered in this Plan:

- Salton Sea Ecosystem Restoration Program Draft Programmatic Environmental Impact Report (PEIR), 2006
- US Bureau of Reclamation (USBR) Summary Report: Restoration of the Salton Sea, 2007
- Salton Sea Authority (SSA) Funding and Feasibility Action Plan, 2016
- Salton Sea Management Program Phase 1: 10-Year Plan Imperial and Riverside Counties, California, Draft Environmental Assessment (EA), 2022.

[1] https://saltonsea.ca.gov/planning/water-importation-independent-review-panel/

These documents provided the basis for the initial four concepts developed early in the planning process, plus the Phase 1: 10-Year Plan. The initial concepts were presented to the Salton Sea LRPC and the public in March 2022. The LRPC and the public were given the opportunity to comment on these concepts as well as to submit other concepts. Based on feedback from this process, new concepts were added, and variations of the original concepts were developed to accommodate various strategies. The strategies and their sources are as follows:

- Increased drought and climate resiliency: Feedback from LRPC and the public
- Enhanced accommodation for geothermal and lithium production: Feedback from the Imperial Irrigation District (IID) and industry
- Enhanced community access: Early feedback from multiple sources
- Reclaiming exposed lakebed for farmland: Suggestion from the public during an LRPC meeting
- Phytoremediation or other means to improve inflow water quality: LRPC member presentation
- Use of different or alternate technologies: Feedback from LRPC and the public

This process also resulted in some ideas that will be retained for further analysis and the next stage of more detailed analysis. In addition, at least one proposed concept was investigated and determined to not be feasible and was therefore eliminated from further consideration.

1.1.2 Development of Concepts with Water Importation

The IRP was established in October 2021 to evaluate water importation concepts submitted pursuant to two Requests for Information (RFIs) issued in 2018 and 2021. The RFIs were made available to all interested parties to identify approaches to water importation to meet the long-range objectives of the SSMP. A total of 18 ideas were submitted which are available for public review.[2] The IRP invited all submitters to give 30-minute presentations during a public forum to explain the components of their concepts. The IRP also held one on-line public meeting and two on-site meetings (one in Riverside County and one in Imperial County) to gather public input, while also managing two websites that provided guidance on giving input via email.

After screening the 18 submitted concepts for consistency with the RFIs, 5 submissions were removed because they were non-conformant with the RFI objectives, leaving 13, as described in the IRP's Screening Report. These screening criteria required that the submissions have a water import component, have a clear identification of the project team and how the submission would improve the Salton Sea, and provide a cost estimate and funding plan. Some of the 5 screened concepts without a water import component were provided to the SSMP team working on this Plan, and they have been considered in the broader review presented here.

The remaining 13 concepts were further assessed for their ability to address the needs of Salton Sea restoration. The IRP then generated a list of five "fatal flaws," which if included in any approach to importing water, would remove that project from further evaluation (). Following an initial review, all submissions were found to have fatal flaws, and the submitters were given an opportunity to fix them and resubmit. The subsequent review resulted in three approaches moving forward, as described in the IRP's Fatal Flaw Report.

[2] https://saltonsea.ca.gov/planning/

Table 1-1. Fatal Flaw Criteria Developed by the IRP for Evaluating Water Import Concepts.

No.	Fatal Flaw Criteria
1	The submission is technically sound and utilizes established, non-speculative technologies.
2	The submission will not create significant risk of catastrophic flooding.
3	The submission is consistent with the objectives of the Salton Sea Restoration Act.
3a	The submission results in improved air quality (1) through reduction of exposed playa to levels consistent with those prior to 2018, or (2) through reduction of dust emissions by employing other mechanisms over an equivalent area.
3b	The submission's stated salinity goals should not exceed 70,000 mg/L, which is above identified salinity tolerance ranges for Protected Species and Species of Importance.
4	No extraction or infrastructure being proposed will cause significant ecological impacts to the Biosphere Reserve and Ramsar wetlands of international importance located within the Upper Gulf of California and Lower Colorado River Delta.
5	Solutions must be viable for the project duration (until 2078).

The three approaches that passed the fatal flaw criteria had several similarities. They all assumed water intake at the Sea of Cortez and desalination by reverse osmosis (RO) at that location. Water conveyance was using either a pipeline or pipeline/canal combination, with delivery to the Salton Sea or other locations that would flow into the Sea by gravity. All assumed some form of salt remediation at the Salton Sea. Based on the overall similarities, the IRP combined the three alternatives into a single Sea of Cortez Import Concept. This single concept underwent a detailed feasibility study, including cost, permitting, engineering, geotechnical, and benefits analyses. The selection of one set of approaches in this combined concept was not intended to be an endorsement of a specific approach by the IRP, and future analysis during a detailed design phase could be used to refine the approaches that form the Sea of Cortez Import Concept.

The IRP was charged to take a "long-term" perspective. While its cost and benefit analyses stop at 2078, its overall perspective extends beyond that point, such as expecting restoration benefits to last far beyond 2078. The Sea of Cortez Import Concept was deemed technically feasible but would face substantially high costs and extensive environmental concerns, minimal benefits to Mexico beyond construction and operations jobs, and the potential that benefits would not be realized.

During its evaluation, the IRP identified two alternative approaches to importation and subjected them to the same feasibility analysis as Sea of Cortez Import Concept. This was done to provide the State with some options for consideration. The first alternative involved desalination with water provided to Mexico in exchange for an equivalent amount of water that would be diverted from the Colorado River to the Salton Sea through existing canal infrastructure. The second alternative assumed that additional water would be generated through fallowing of agricultural land and would flow to the Sea. It is recognized that this second alternative, as proposed by the IRP, is not technically an import concept and would not have passed the screening criteria developed by the IRP earlier in their process. However, as part of the broader analysis presented in this Plan, it is important to consider all three alternatives in an objective manner as to their ability to address the needs of Salton Sea Restoration. For this reason, all three alternatives described as feasible in the IRP report, are included in the analysis in this Plan.

All IRP documents discussed above are available for download at the following website: https://saltonsea.ca.gov/planning/water-importation-independent-review-panel/

1.2 Community Engagement Opportunities and Events

Throughout the preparation of this document, the SSMP team placed a strong focus on community engagement. Local community engagement was fostered through coordination with the Community Engagement Committee, community focused meetings, and the LRPC.[3]. Throughout the course of preparing this Plan, more than a dozen meetings were held, and draft sections of the document were made available for review and comment by the LRPC. Meetings were held over Zoom at different times during the day to maximize participation. LPRC meetings were open to the public with public comments taken at the end of each meeting. A live question and answer function allowed members of the public to have questions answered in real time, if possible. The SSMP followed up with answers to more technical questions. Committee members asked questions throughout the meetings, while members of the public who attended the meetings gave public comments at the end of each meeting. Comments received at all LRPC meetings were logged and responses were prepared. Comment logs were posted on the SSMP's website.

The initial kickoff meetings for the LRPC were held via Zoom on Tuesday, December 14, 2021, at 9 a.m., and Tuesday, December 21, 2021, at 9 a.m. After those meetings, a working draft of Appendix A to this Plan, Summary of Reference Material Used to Develop Initial Concepts, was issued in February 2022, for review and comment by the Committee. The initial concepts were then presented at the March 2, 2022, LRPC Meeting.

While the IRP continued their feasibility assessment of water importation concepts, on March 2, 2022, the SSMP team released a Salton Sea Restoration Concept Information Template requesting restoration ideas or concepts that did not involve water importation. The request went to the LRPC and the public. Parties interested in submitting restoration ideas or concepts not involving water importation were invited to submit them using the template. Members of the LRPC submitted three concepts, which they presented at the LRPC Meeting on May 4, 2022. Those concepts are described in Sections 5.7, 5.8, and 5.9 of this Plan.

Topics presented in English and Spanish and discussed (with Spanish interpretation) at LRPC meetings during the preparation of this document included:

- **December 14, 2021, and December 21, 2021:** Initial kickoff meetings--Topics included introductions, LRP goals and objectives, LRPC charge, Long Range Plan Work Plan, and community engagement.
- **March 2, 2022:** Topics included preliminary restoration concepts, draft evaluation criteria, and the SSMP LRP community engagement process.

[3] Membership of the LRPC is provided here: https://saltonsea.ca.gov/wp-content/uploads/2022/02/Long-Range-Planning-Committee-Membership-030722.pdf

- **May 4, 2022:** Topics included an update on hydrology, a review of material submitted by the LRPC and the public in response to a call for ideas, and presentations by LRPC members of three proposed concepts to be included in the plan (see Sections 3.7, 3.8, and 3.9).
- **July 6, 2022:** Topics included a summary update of restoration concepts and strategies and a presentation of draft evaluation criteria and metrics.
- **September 7, 2022:** Topics included an update on evaluation criteria, a summary of concept variations and strategies, and a preliminary cost evaluation for all concepts that did not involve water importation.
- **October 12, 2022:** Topics included an update on hydrology and preliminary scoring of concepts.
- **November 2, 2022:** Topics included proposed hydrology to be used in the concept evaluations, a presentation of greenhouse gas (GHG) analysis and scoring, and an update on effectiveness scoring.

1.3 Government to Government Consultation

California Native American Tribes (Tribes) have sovereign authority over their members and territory and a unique relationship with California's resources. Tribes and Tribal communities, as described in EOs B-10-11 and N-15-19, have distinct cultural, spiritual, environmental, economic, and public health interests and valuable traditional cultural knowledge about California resources. Respect for Tribal sovereignty is in the inclusion and engagement of Tribes as governmental entities. Tribal engagement opportunities have been developed of Tribes throughout the development of LRP and was crucial for timely engagement to respectfully seek feedback and input into the LRP.

The determination of Tribal involvement and Tribal outreach was guided through best practices and outreach, starting with obtaining a list of Tribes with interest in the Salton Sea region and with ancestral ties to the region.

Representatives of Tribal governments participated on the LRPC. Additionally, on March 16, 2022, SSMP presented a proposal of the LRP process during a "Tribal Roundtable" meeting. During this presentation SSMP extended invitations for interested Tribal governments to join the LRPC. Lastly, an initial joint Tribal meeting was held on November 4, 2022. Tribal feedback and comments have been incorporated into the LRP, primarily relating to acceptability criteria. Based on feedback, more information is needed to analyze the concepts. Primarily, site-specific information is needed to evaluate potential impacts to the access and protection of natural resources, cultural resources, and Tribal cultural resources and landscapes.

1.4 Timeline and Next Steps

The overall timeline for proceeding with the environmental restoration of the Salton Sea can be expected to proceed over seven key phases:

1. **Public Draft Long-Range Plan Review and Finalizing Long-Range Plan.** Comments can be made upon release of this public draft. (Instructions for commenting available immediately following cover page). A Spanish version of this document is in progress and expected in early January 2023. The comment period for the LRP will close 45 days after the Spanish version is uploaded to the CNRA website. This document is a living document, so comments will be reviewed and incorporated as appropriate. As substantive updates are completed, a revised document will be published. A final update is anticipated in Spring of 2023. Note: Comments made on this draft

Plan, will be compiled as part of the administrative record for a subsequent environmental review phase.

2. **Feasibility and Environmental Review and Analysis.** The following step is starting the feasibility analysis and environmental documentation in compliance with the California Environmental Quality Act (CEQA) and the National Environmental Policy Act (NEPA). This phase is expected to take three years, beginning in January 2023, and concluding with a recommended action.

3. **Funding.** The recommended action would receive consideration of funding through state and federal budget approval processes.

4. **Design.** Adoption of the recommended action would trigger the final phase of engineering design and initiate the permitting phase. During this phase, detailed engineering designs would be prepared for the recommended action. In addition, the suite of required permits would be prepared and submitted for approval to the permitting agencies. The timeframe for design and permitting would depend on the action selected. Based on the evaluations presented in this Plan, the design and permitting phase could last from 2 to 10 years.

5. **Construction.** During the construction phase, facilities that were part of the recommended action would be constructed and commissioned. As with the design phase, the timeframe for construction would vary with the alternative selected.

6. **Transition.** During the transition phase, saltwater areas identified for habitat restoration would be transitioned from current high salinity levels to salinities of 20 to 40 parts per thousand (PPT). Water with salinity in this range is expected to be able to support a healthy fishery that would provide a food source for a piscivorous bird population. Some fish can tolerate higher salinities, but at a greater risk to the stability and health of the fishery and for fish die-offs. The timeframe for the transition would depend on the efficiency of the restoration concept. The transition time for the most efficient concepts is 2 years and over 30 years for the least efficient concepts.

7. **Operation and Maintenance.** The activities to operate and maintain restoration facilities would begin upon completion of construction. However, for most concepts, activities to operate and maintain facilities would change as the project transitions from partially functional to completely functional. At that time, routine maintenance would be required, and for some of the concepts, the cost of routine operation, maintenance, energy, and replacement (OMER) would be reduced.

Figure 1-1 illustrates the timelines of the most efficient and least efficient of the concepts under consideration (based on the High Probability Inflow scenario discussed in Chapter 3 of this Plan).

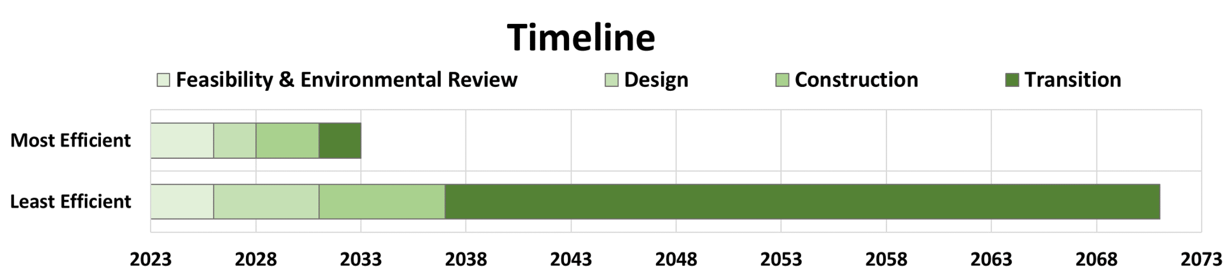

Figure 1-1. Range of Timelines for the Restoration Concepts.

1.5 Overview of this Document

The remainder of this Plan provides the following information:

- Chapter 2 describes the criteria used to evaluate restoration concepts. It also includes a discussion of the core commitments for the development of the evaluation criteria and the program goals. By establishing the goals and criteria at the outset, restoration concepts could be tuned to meet program goals and satisfy as many criteria as possible.
- Chapter 3 presents the means and methods that were used to perform technical evaluations of the restoration concepts. Chapter 3 begins with a description of the inflow hydrology, which includes the methods and models used to project future inflows to the Sea. The model used to project future elevation and salinity of the Salton Sea and how the projected inflow hydrology was used as a key model input are described. Chapter 3 also discusses habitat provisions of the restoration concepts and the methods used to evaluate the effects of the concepts on air quality. Chapter 3 concludes with a discussion of GHG emissions.
- Chapter 4 discusses areas of uncertainty related to future environmental conditions and to analyses performed to evaluate the different restoration concepts.
- Chapter 5 describes each of the restoration concepts that are being considered at this stage of the planning process. It describes concepts both with and without water importation.
- Chapter 6 includes background and recommendations for how the LRP can support and incorporate recreation, equitable access, and associated infrastructure at the Sea. Chapter 7 describes the evaluation for the restoration concepts. The evaluations are divided into the four categories: effectiveness, acceptability, completeness, and efficiency. Draft evaluations were presented to the LRPC, and their comments have been considered in evaluations presented in Chapter 6.
- Chapter 7 presents an evaluation of the restoration concepts.
- Chapter 8 presents a summary of the findings and recommended next steps, and references are provided in Chapter 9.

In addition to the material in the chapters discussed above, there are seven appendices that provide technical backup to the summary level information provided in the main document:

- Appendix A: Summary of Reference Material Used to Develop Initial Concepts
- Appendix B: Hydrology and Climate Change
- Appendix C: Water Use and Availability for Lithium Extraction
- Appendix D: Salton Sea Salinity and Elevation Modeling
- Appendix E: Air Quality Evaluation
- Appendix F: Greenhouse Gas Emissions
- Appendix G: Investigation of Desalination Methods
- Appendix H: Independent Review Panel Water Import Feasibility Analysis (released September 2022)
- Appendix I: Public Comments and Responses on Draft Long-Range Plan

2 Evaluation Criteria

Evaluation criteria are standards that can be applied to a range of restoration concepts to determine which concepts would be expected to perform best. The evaluation criteria developed for the Salton Sea LRP are based on federal planning process guidance*: Principles and Requirements for Federal Investments in Water Resources*, March 2013. These Principles and Requirements, and the supporting Guidelines, are intended to provide a common framework for analyzing a diverse range of water resources projects, programs, activities, and related actions as identified by the agencies in the context of their missions and authorities.

Following these guidelines, plans, strategies, or actions are to be formulated systematically to ensure that a range of reasonable concepts is evaluated. The final analysis should, at a minimum, support full disclosure and promote transparency in the decision-making process.

The LRP will be formulated to consider the following four categories:

- Effectiveness
- Acceptability
- Completeness
- Efficiency

Each of these categories will include several criteria to evaluate expected performance.

2.1 Core Commitments for the Development of Evaluation Criteria

The Salton Sea Management Program (SSMP) developed criteria to align with broader State commitments to equity, Tribal partnerships, and economic prosperity. The Criteria are designed to advance and be shaped by three core commitments; (1) advancing justice, equity, diversity, and inclusion; (2) strengthening Tribal partnerships; and (3) sustainable economic development. The SSMP follows the Tribal Consultation Policy and Environmental Justice Policy of the CNRA and its overall commitment to embedding equity in all we do.

Implementing the CNRA Tribal Consultation Policy requires the State to engage in early, often, and meaningful government-to-government consultation with all Tribes as described in EOs B-10-11 and N-15-19 and identified on the Native American Heritage Commission contact list for the Salton Sea area.

Implementing the CNRA Environmental Justice Policy requires that in our planning, development, and implementation of all CNRA programs, policies, and activities, we seek out input and participation of underserved, underrepresented, and impacted populations. This also includes the extent to which a restoration concept or strategy incorporates feedback, social advancement, health, and wellbeing of regional underrepresented and underserved populations and Tribes.

Embedding equity within our long-range planning efforts means that the criteria will be shaped by the three core commitments, and proposed projects will be evaluated through a lens toward advancing these commitments.

2.2 Criteria for the Salton Sea Long-Range Plan

The goal of the LRP is to protect or improve air quality, water quality, and wildlife habitat to prevent or reduce health and environmental consequences anticipated from the long-term recession of the Salton Sea. To achieve this goal, the following objectives must be met:

- Protect or improve air quality to reduce public health consequences.
- Protect or improve water quality to provide opportunities for beneficial uses and reduce environmental consequences.
- Restoration of long-term stable aquatic and shoreline habitat to historic levels and diversity of fish and wildlife that depend on the Salton Sea (Fish and Game Code [F&GC] 2931).

Evaluation criteria are intended to determine which concepts would be expected to best achieve the objectives and overarching goal. The criteria used to evaluate restoration concepts in the LRP were developed with input from the LRPC and members of the Salton Sea Science Committee. Each of the four categories and the specific criteria within each is described below:

Effectiveness: Effectiveness will measure how well a restoration concept accomplishes an individual objective from the aforementioned suite of Salton Sea LRP objectives. Table 2-1 describes the specific criteria that were used to evaluate the effectiveness of restoration concepts. Climate resiliency is a foundational element in the analysis of each of the effectiveness measures and therefore is not explicitly called out in Table 2-1. Thus, restoration concepts will be evaluated on their ability to meet the effectiveness measures under a range of future climatic conditions being considered for the State of California planning efforts, including extreme events such as droughts and heat waves.

Acceptability: Acceptability of a restoration concept will be measured by its compatibility with State law and policies applicable to the Salton Sea, such as the potential to protect natural resources, cultural resources and Tribal cultural resources, provide equitable outdoor access to recreational opportunities, sustainably enhance local economies, address environmental justice, and minimize GHG emissions.

Acceptability shall also include how well a proposed restoration concept considers and incorporates locally led values and goals, including those of underserved populations experiencing environmental injustice in the region. Table 2-2 describes the specific criteria that were used to evaluate the acceptability of restoration concepts.

Completeness: Completeness will be assessed on whether a restoration concept satisfies all of the aforementioned suite of Salton Sea LRP objectives. Table 2-3 describes the specific criteria that were used to evaluate the completeness of restoration concepts.

Efficiency: Efficiency will be measured by the estimated costs of the restoration concept, the timeline for its implementation, the benefits achieved, and direct and indirect risks. Table 2-4 describes the specific criteria that were used to evaluate the efficiency of restoration concepts.

Table 2-1. Effectiveness Criteria

Criterion	Description	Metrics
Air Quality/Public Health Ability to Reduce Dust Emissions from Exposed Lakebed with the Intent to Protect and Improve Air Quality	Exposed lakebed areas are expected to be a source of wind-blown dust. The ability of a restoration concept to minimize dust emissions from exposed lakebed and thus protect and improve air quality was evaluated and compared to the Phase 1: 10-Year Plan. The lakebed was divided into zones of variable emissivity based on sediment characteristics. Annual emissions were then estimated from each area. The total unmitigated emissions from each concept were compared with the unmitigated emissions from the Phase 1: 10-Year Plan.	It is expected that emissions from exposed lakebed would be mitigated by implementing enhanced vegetation or other dust mitigation programs. It is assumed that dust mitigation on concepts that have greater estimated dust emissions than the Phase 1: 10-Year Plan alone would be mitigated. However, scoring is based on dust emission prior to mitigation, and, therefore, these concepts were assigned a score of 1 or 2 depending on the amount of mitigation required. The costs for dust mitigation above that of the Phase 1: 10-Year Plan have been estimated and included in the OMER costs for those concepts. Concepts that are expected to have lower emissions than the unmitigated Phase 1: 10-Year Plan have been assigned a score of at least 4, and those with less than half the estimated emissions than the Phase 1: 10-Year Plan have been assigned a score of 5.
Air Quality/Public Health Ability to Protect or Improve Air Quality	Air quality modeling was conducted to evaluate air quality effects at communities around the Sea. At this stage of the analysis, these model outputs are not used to provide numeric scores to restoration concepts.	
Habitat Shallow Habitat (0-6 inches)	The objective of restoring habitat is to re-establish the historic levels and diversity of fish and wildlife that depend on the Salton Sea. Salinities in the target range of 20 to 40 parts per thousand (PPT) at a variety of water depths are the most able to support the abundance and diversity of fish and wildlife that have depended on the Salton Sea in the past. This metric evaluates the area of shallow habitat that would support a fish and invertebrate population as a food source for wading birds, expected to be the area between the shoreline and the six-inch depth contour. All habitat features are expected to change over time. The year 2050 has been selected as a point of comparison for all habitat criteria using three possible future inflow scenarios.	For each of the depth criteria, the area of habitat in a particular depth class was compared to historical water surface elevations when the greatest abundance and diversity of wildlife existed at the Sea. The area in each depth category was calculated for a historical Sea elevation of -230 ft msl, which existed in 1999 and earlier. For each depth range, concepts that could restore 50 percent or more of the habitat area were assigned a score of 5. Areas between 25 and 50 percent of historical areas were assigned a score of 4. Similar reductions were made for lower scores. This scale is only a means to compare the habitat areas provided by different concepts. At the next stage of analysis habitat modeling will be needed to better estimate how increases in habitat area would result in improved ecological outcomes.

Criterion	Description	Metrics
Habitat Medium-Depth Habitat (6 inches to 6 feet)	The objective of restoring habitat is to re-establish the historic levels and diversity of fish and wildlife that depend on the Salton Sea. Salinities in the target range of 20 to 40 PPT at a variety of water depths are the most able to support the abundance and diversity of fish and wildlife that have depended on the Salton Sea in the past. This metric evaluates the area of medium-depth habitat that would support a fish population as a food source for birds such as egrets, dabbling ducks, pelicans, and terns that typically feed in medium depth areas between six inches and six feet.	See above for Shallow Habitat.
Habitat Deep-Water Habitat (>6 feet)	The objective of restoring habitat is to re-establish the historic levels and diversity of fish and wildlife that depend on the Salton Sea. Salinities in the target range of 20 to 40 PPT at a variety of water depths are the most able to support the abundance and diversity of fish and wildlife that have depended on the Salton Sea in the past. This metric evaluates the area of deep-water habitat that would support a fish population as a food source for diving birds, expected to feed in areas deeper than six feet.	See above for Shallow Habitat.
Habitat Salinity	The objective of restoring habitat is to re-establish the historic levels and diversity of fish and wildlife that depend on the Salton Sea. Salinities in the target range of 20 to 40 PPT at a variety of water depths are the most able to support the abundance and diversity of fish and wildlife that have depended on the Salton Sea in the past. This metric evaluates salinity in the primary habitat area of a concept.	Concepts that have primary habitat areas in the target salinity range were assigned a score of 5 for this habitat criterion. This scoring was applied for all inflow scenarios.
Habitat Pupfish Habitat and Connectivity	The extent of pupfish connectivity between drains and inlets with water quality that can support pupfish; restoration concepts that maintain the highest amount of suitable connectivity would score highest.	Scores were assigned based on the ability of concepts to provide pupfish connectivity under different inflow scenarios.

Criterion	Description	Metrics
Water Quality Ability to Meet Selenium Standards	The ability of a restoration concept to create or maintain habitats where selenium concentrations are below levels that cause wildlife risk.	Scores were assigned based on the ability of a habitat area to mirror the Sea's ability to sequester selenium or that use water resources with extremely low levels of selenium using the metrics as follows. Concepts with high probability to achieve such conditions would be assigned a value of 5. Habitat areas that would have a managed risk for selenium would be assigned a value of 3, and areas with the potential to have selenium risks to wildlife would be assigned a value of 1.
Water Quality Ability to Improve Water Quality	The extent that a restoration concept improves water quality parameters other than salinity either in the inflowing waters or within the water bodies or habitat areas within the Salton Sea footprint to provide opportunities for beneficial uses (designated in the Regional Water Board Basin Plan) and reduce environmental consequences.	Concepts were evaluated on their ability to provide water quality improvements based on features that will improve water quality of inflowing waters or within the water bodies.

Table 2-2. Acceptability Criteria

Criterion	Description	Metrics
Tribal Access to Natural Resources, Cultural Resources, and Tribal Cultural Resources	The ability for a concept or strategy to identify opportunities for Tribal access and management of ancestral lands, the lake, and other Natural Resources, Cultural Resources, and Tribal Cultural Resources.	Evaluation of this criterion is informed through ongoing government-to-government consultation between the California Native American Tribes (Tribes) and the State At this point, no score was assigned.

Criterion	Description	Metrics
Protection of Natural Resources, Cultural Resources, and Tribal Cultural Resources (Based on overall area)	The ability for a potential concept to avoid adverse effects to Natural Resources, Cultural Resources, and Tribal Cultural Resources and landscapes, including but not limited to sacred places, archeological sites, ceremonial and burial grounds, village sites, and cultural sites, will be assessed in detail at the next phase of technical and environmental analysis. For this stage of analysis, the overall size of footprints of the different concepts have been evaluated as an early indicator of the possibility that resources could be affected. No specific project areas have been identified at this time, and it is expected that sensitive areas would be avoided during detailed analysis and design. Therefore, this is only a preliminary indicative analysis to rank potential risk.	Based on an evaluation of the total potential extent of land disturbance (in acres) associated with a concept, scores will range from 1 to 5. Concepts with potential disturbance: Less than 8,000 acres would receive a score of 5 Greater than 8,000 acres, but less than 16,000 acres would receive a score of 4 Greater than 16,000 acres, but less than 24,000 acres would receive a score of 3 Greater than 24,000 acres, but less than 32,000 acres would receive a score of 2 Greater than 32,000 acres would receive a score of 1
Protection of Natural Resources, Cultural Resources, and Tribal Cultural Resources (Based on location)	In order to evaluate whether a potential concept can avoid adverse effects to Natural Resources, Cultural Resources, and Tribal Cultural Resources and landscapes, including but not limited to sacred places, archeological sites, ceremonial and burial grounds, village sites, and cultural sites, we require specific information that would be obtained through Tribal engagement based on location of concept features. At this phase, we have not identified site specific locations. As concepts proceed to the next phase of development, this site-specific analysis will supersede the “Protection of Natural Resources, Cultural Resources, and Tribal Cultural Resources (Based on overall area)” analysis.	This metric will be assessed in detail during the feasibility study and environmental review through the government-to-government consultation process. For this stage of analysis, no score was assigned.

Criterion	Description	Metrics
Incorporation of Tribal Expertise	This criterion addresses the ability for a concept to integrate or incorporate Tribal subject matter expertise, including Traditional Ecological Knowledge (TEK) and indigenous science.	SSMP is committed to integrating Tribal subject matter expertise, including TEK and indigenous science as concepts are developed to higher level detailed designs. At this time, concepts lack sufficient detail for this participatory process. However, this commitment will be met through ensuring that Tribal subject matter experts are part of a design technical team during future more detailed feasibility studies and environmental review. Because of this commitment, every concept will achieve acceptability and be assigned as score of 3 for its ability to incorporate Tribal expertise.
Environmental Justice and Equity	The extent to which a restoration concept directly or indirectly includes locally led initiatives, reflects local values, has already undertaken significant local outreach or furthers the needs, input, and values of underrepresented regional populations in and around the Salton Sea. It could similarly demonstrate this by establishing the extent to which a proposed restoration scenario or strategy provides equitable access to state or federal funding for regionally identified and supported restoration or remediation projects, or the extent to which a proposed strategy or scenario promotes regionally led management and shared decision-making opportunity for underrepresented populations.	At this stage of the conceptual design, all LRP concepts lack the detail to fully incorporate locally led values, design, and initiatives. Further stages of design can more fully integrate community input and tools including participatory budgeting. Therefore, all concepts were given a score of 3 to reflect that community-led design and decision making will be further incorporated as the long-range planning process continues.

Criterion	Description	Metrics
Do No Harm	The extent that a restoration concept prevents, reduces, and controls the risk of environmental harm to environmental justice communities. A concept would score highly if it avoided disproportionate pollution, contamination, air and water quality burdens, or existing hazards to environmental justice communities. In addition, projects that include the deterrence, reduction, and elimination of pollution burdens, including air and water quality burdens or existing hazards, could also meet this standard. A concept could demonstrate this by expanding healthy environments for regional populations, and in particular for environmental justice communities.	Scores will range from 3 to 5, with 5 being assigned to concepts that avoid harm. For any concept, the temporary nuisance of construction is likely an acceptable long-term tradeoff, so long as all other environmental harms identified at later stages of design are avoided. Therefore, we are assigning a lowest possible score of 3 to the concepts that would take the longest to construct.
Equitable Outdoor Access	The extent to which a restoration concept expands or advances outdoor access to regional environmental justice communities and California Native American Tribes. Restoration concepts that would score high under this criterion include those which could expand equitable access by creating or enhancing open space infrastructure in proximity to these communities. Examples of open space infrastructure include parks and trails, beaches, fishing piers, new community gathering spaces, recreational or educational facilities, as well as those which would expand ADA and public access and safety, through features such as lighting, transportation access, safety elements, and facilities.	Scores will range from 1 to 5, with 5 being assigned to concepts that have the greatest potential to expand equitable outdoor access.

Criterion	Description	Metrics
Minimize Greenhouse Gas (GHG) Emissions	Concepts should be evaluated for their contributions to GHG emissions. This evaluation will focus on direct impacts from construction, operations, maintenance, and landscape changes. For this evaluation, "landscape changes" refers to the shift from an inundated area to a non-inundated area, or vice-versa. This evaluation will compare direct system-wide differences from baseline conditions. For this evaluation, "system-wide" refers to reservoirs, water bodies, or landscapes directly linked to the Salton Sea. Examples include Lake Mead and Lake Powell. To the extent feasible, concepts should incorporate measures to minimize GHG emissions. Beyond this, concepts should identify the extent of carbon offsetting through nature-based solutions, carbon sequestration, and renewable energies.	Concepts were modeled to assess their contributions to GHG emissions. The modeling focused on the following three factors: (1) Emissions from construction equipment, (2) Landscape emissions, and (3) Energy use during operations. This evaluation compared direct differences from baseline conditions which were taken at the lake surface and shoreline as it existed in 1999.
Workforce Development	The extent to which a restoration concept increases the likelihood that a local workforce would be used on the project, encourages the employment of a local workforce, and ensures that a local workforce can participate. A restoration concept that increases the likelihood a local workforce would be used for construction and ongoing maintenance or would provide for local production of materials and technology to create and maintain restoration infrastructure, as well as those that provide training or educational opportunities for local residents, including youth, would score well under this criterion.	Scores range from 2 to 5, with 5 being assigned to concepts that have the greatest potential to support local workforce development.
Sustainable Economic Development	The extent to which a restoration concept directly or indirectly provides or allows for sustainable economic development benefits. Restoration concepts that utilize local materials and technologies to create and maintain restoration infrastructure would score well under this criterion.	Scores were assigned in a range from 1 to 5, with 5 being assigned to concepts that have the greatest potential to support sustainable economic development and the local economy.

Table 2-3. Completeness Criteria

Criterion	Description	Metrics
Completeness: Meets all individual objectives	A concept that achieves all the following objectives would receive a "complete" score: protection or improvement of air quality to reduce public health consequences; protection or improvement of water quality to provide opportunities for beneficial uses and reduce environmental consequences; and restoration of long-term stable aquatic and shoreline habitat for the historic levels and diversity of fish and wildlife that depend on the Salton Sea (F&GC 2931);	Concepts were scored with the following metrics. Those that receive a score of at least 3 for all effectiveness categories would be considered complete and assigned a score of 5. Concepts that do not receive a score of at least 3 for all effectiveness categories would be deemed not complete and would be assigned a score of 1.

Table 2-4. Efficiency Criteria

Criterion	Description	Metrics
Timeframe for Complete Solution	The timeframe for a restoration concept to be completed and commissioned; a shorter timeframe would score higher.	The concept with the shortest timeframe to achieve full project objectives received a 5. One point was deducted for each additional five years to achieve full project objectives, down to a minimum of 1.
Capital Cost	The estimated total capital construction costs in 2022 dollars for a restoration concept.	Any concept with Phase 2 cost less than the full suite of Phase 1 actions, would be deemed highly efficient and receive a score of 5. This efficiency scale is applied in a non-linear fashion, such that each time the cost basis is doubled, the efficiency score drops by 1.
Operation, Maintenance, Energy, and Replacement (OMER) Cost	The estimated total annual OMER costs in 2022 dollars for a restoration concept (i.e., the amount needed now to pay for OMER over a 75-year planning horizon), accounting for possible revenues generated from a concept.	A linear scale is used for this metric such that a score of 5 requires OMER costs for the LRP to remain within 50% of costs of the Phase 1 Actions. The level of efficiency drops in a linear fashion each time the cost basis increases by half of the Phase 1 OMER costs.
Provides Incremental Benefits with Incremental Funding	The extent to which incremental funding for a restoration concept can result in incremental benefits. A concept that delivers significant benefits the earliest would score the highest, whereas a concept that delivers significant benefits the latest would score the lowest.	Scores were assigned from 1 to 5 considering funding requirements for each component, time to achieve habitat objectives, and the habitat area achieved with construction of each component. Concepts with the greatest number of incremental benefits would be assigned a score of 5.

Criterion	Description	Metrics
Proven Technology/Reduced Risk	Whether a restoration concept uses untested technologies or technologies that have a high measure of construction and operational risk; a proven, widely used technology would score higher.	Concepts that employ standard technologies, with proven low-risk performance, were given the highest score of 5. Concepts that have technologies that have been used elsewhere but not necessarily in highly seismic areas such as that of the Salton Basin or on such a large scale as at the Salton Sea were given an intermediate score of 3. Concepts that have technologies that have not been widely used elsewhere and not used on any large scale like that needed at the Salton Sea were given the lowest score of 1. Concepts that employ a mix of technologies with varying maturity may be assigned intermediate scores.
Water Supply Risk	The extent to which a restoration concept can provide benefits under a wide range of future inflows, including under variable conditions due to climate change and drought. Restoration concepts that can perform as planned under a wider range of future inflow conditions would score higher than those that have a narrower range with a higher minimum water requirement.	The score for water supply risk was based on modeling. Concepts that provide the greatest habitat and dust control benefits over the widest range of future inflow assumptions were given a score of 5. Others were scaled down accordingly.
Earthquake Risk	The potential for concepts to be damaged by earthquakes. This measure was used to evaluate how susceptible individual concept elements, such as berms, gates, and pipelines, are to potential earthquakes. Time and cost to restore functionality after a potential failure was considered for this criterion, as was limited functionality if parts of the concept could still function.	All concepts would be designed to withstand a design earthquake event based on seismic conditions in the area. However, some seismic risk would remain, and concepts were scored using the following metrics. For concepts with earth embankments, the concept with the lowest combination of embankment structure height/head differential and water retention volume would receive a score of 5. The concept with the highest combination of embankment structure height/head differential and water retention would receive a score of 1. Others would be scored proportionally between these extremes. Scores were adjusted to account for other components such as pumps and pipelines that could be damaged and cause flooding and property damage.

Criterion	Description	Metrics
Climate Change Related to Extreme Weather	The ability for concepts to remain effective during conditions of extreme weather resulting from climate change, such as extreme heat, wind pattern changes, and monsoonal changes. Note that climate change was considered as part of the inflow hydrology scenarios and the effects of changing inflows was evaluated as part of the efficiency criteria (under Water Supply Risk).	Because of the long north-south fetch of the Sea, high wave activity can be expected at the Sea without climate change. Such conditions may be more frequent with climate change. Concepts that could be designed to withstand these conditions were assigned a score of 5. Concepts that involve lower technology berms and channels for shallow habitat and dust control may be more subject to erosion and may need higher levels of maintenance and repair under climate change conditions and were assigned a score of 4.
Regulatory Compliance - Permits and Environmental Documentation	The complexity of regulatory compliance based on factors such as the number of jurisdictions affected, including all local, state, federal, tribal, and international permits, certifications, and other approval necessary for the construction and operation of the project. The scoring considered the complexity of the environmental documents required and the likelihood of the acquisition of the required permits.	The evaluation of regulatory compliance was based on factors such as the number of jurisdictions affected, including all local, state, federal, tribal, and international permits, certifications, and other approval necessary for the construction and operation of the project. The scoring considered the complexity of the environmental documents required and the likelihood of the acquisition of the required permits.
Local, State, and Federal Water Rights and Agreements	The evaluation of local, state, and federal water rights agreements involves the complexity of amending existing water rights or agreements, including changes to existing water policy or law transferring water across the international border.	A score of 5 was assigned to concepts that do not require amendment to existing water rights or agreements, or changes to existing water policy or law. Other concepts were assigned lower scores, based on the complexity of expected local, state, and federal water rights and agreements.

3 Methods of Analysis

The methods described in this chapter were developed to achieve objective and reliable analyses for evaluating the technical aspects of restoration concepts. The modeling approaches employed here are supported by scientific research. Additionally, empirical data were used whenever possible to verify potential outcomes. The methods of analysis used in the technical evaluation include the following approaches:

- **Projected Hydrology.** Projected hydrology refers to the suite of data and models used to project future inflows to the Sea. An overview of the analysis is presented in this chapter, and additional information can be found in Appendix B. Water use associated with lithium production, a new and growing use of Colorado River water, is discussed in Appendix C.
- **Projected Salinity and Elevation.** The Salton Sea Accounting Model, modified from a model first developed by the USBR in 2000 (Modified SSAM) was used to project future elevation and salinity of the Salton Sea. The projected inflow hydrology was used as the key model input. The modeling process is summarized in this chapter, and additional details are provided in Appendix D.
- **Habitat Evaluation.** Habitat evaluation of the restoration concepts are summarized in this chapter and are primarily related to water depth and salinity.
- **Air Quality Evaluation.** The methods and models used to evaluate the effects of the concepts on air quality are summarized in this chapter with additional information provided in Appendix E.
- **GHG Analysis.** The evaluation of how the restoration concepts would affect estimated GHG emissions is discussed in this chapter with additional details on landscape emissions provided in Appendix F.

3.1 Projected Hydrology

Long-term management of the Salton Sea requires an understanding of historical and future hydrology at the Sea and the connected IID and CVWD operations. The following section includes a summary of historical hydrology, the expected impacts of climate change, and other factors that could potentially affect inflows. An assessment of these factors allows us to project future conditions at the Salton Sea, which can be used to inform long-term management and planning. Detailed analysis is presented in Appendix B.

3.1.1 Historical Inflows

Agriculture in the IID and CVWD service areas, as well as smaller non-agricultural uses, are sustained by Colorado River water diverted at the Imperial Dam and delivered via the All American and Coachella Canals. In recent years, total diversions of approximately 2.8 million acre-feet per year (MAFY) at the Imperial Dam support irrigated agriculture and communities in the Imperial and Coachella Valleys.

The Salton Basin is the northern arm of the former Colorado River delta system. Agricultural return flows and drainage from these valleys and parts of the Mexicali Valley, in addition to municipal and industrial discharges in the watershed, feed the major rivers flowing to the Salton Sea. The Salton Sea watershed encompasses an area of approximately 8,000 square miles from San Bernardino County in the north to the Mexicali Valley (Republic of Mexico) to the south.

The principal sources of inflow to the Salton Sea are the Alamo and New Rivers in the south, the Coachella Valley Stormwater Channel to the north, and direct return flows from agricultural drains in the Imperial and Coachella Valleys. The riverine sources of inflow are recorded by USGS gage stations situated at the river mouths, with some observations dating back to the 1960's. There are also smaller inflows from surrounding creeks and from groundwater, generally constituting less than 5% of the total inflow to the Sea.

Prior to 2002, California received approximately 5.2 MAF/year of Colorado River water. Under the Quantification Settlement Agreement (QSA), an agreement between several California water districts and the Department of the Interior, California agreed to reduce its use to 4.4 million AF/year under the Law of the River. This was achieved through conservation efforts, such as lining the All-American Canal to reduce seepage and increase usable supplies and providing for several large-scale long-term agriculture-to-urban water transfers. As specified in the QSA, IID will transfer nearly 415,000 AF annually over a 35-year or longer period. QSA transfers from IID to San Diego, Los Angeles, and Coachella Valley began in 2003. Since the signing of the QSA, approximately 777,000 AF of water was delivered to mitigate salinity at the Salton Sea. Under the terms of the agreement, mitigation water ended in 2017.

Over the past 20 years, inflows to the Sea have declined from 1.3 million AFY to approximately 1.1 million AFY, primarily related to California's reduced usage of Colorado River water. Table 3-1 provides a summary of recent inflows to the Sea and the information used in their derivation.

Table 3-1. Summary of Inflows from 2015 - 2021 (units: acre-feet per year).

Year	Imperial Valley Flow Gaged (1)	Imperial Valley Estimated Ungaged (2)	Mexico Flows (3)	CVSC Gaged (4)	Coachella Valley Drain Flow (5)	Local Watershed (6)	Ground-water (7)	Total Inflow to Sea (8)
2015	885,643	79,708	75,252	42,980	27,779	4,279	11,000	1,127,000
2016	902,053	81,185	69,562	46,643	33,325	4,425	11,500	1,149,000
2017	864,193	77,777	68,548	45,730	31,528	4,729	11,800	1,104,000
2018	837,531	75,378	60,509	44,971	29,779	4,748	12,200	1,065,000
2019	810,277	72,925	63,926	52,324	27,359	4,964	12,300	1,044,000
2020	817,934	73,614	63,332	51,154	30,350	4,927	12,300	1,054,000
2021	856,862	77,118	61,866	46,548	34,172	4,710	12,300	1,094,000
AVG 2015-2021	**853,000**	**76,800**	**66,100**	**47,200**	**30,600**	**4,680**	**11,900**	**1,090,000**

Notes:
1. New River near Westmorland (USGS Station ID: 10255550) + Alamo River near Niland (USGS Station ID: 10254730) – New River at International Boundary (USGS Station ID: 10254970); see Appendix B Section 5.3.2
2. 9% of Column 1; see Appendix B Section 5.3.2

(Table 3-1 Notes, continued)
3. New River at International Boundary (USGS Station ID: 10254970); See Appendix B Section 5.3.1
4. Whitewater River near Mecca (USGS Station ID: 10259540); See Appendix B Section 5.3.3
5. Drain flow other than the gaged CVSC. See Appendix B Section 5.3.3.
6. See Appendix B Section 5.3.4
7. See Appendix B Section 5.3.5
8. Sum of columns 1 to 7

From 2015 to 2021, Imperial Valley's estimated contribution was approximately 85% of the flow. This relationship is a clear indicator the Colorado River water allocations and management of that water source in Imperial Valley are the primary drivers of Salton Sea inflow.

3.1.2 Climate Change

Climate change effects on the hydrology of the Salton Sea were examined using two methodologies. The first analyzed the climate change impacts on Colorado River inflows to the Imperial Valley. The second examined climate change impacts on evapotranspiration, which affects water consumption for agriculture and thus the residual flows to the Salton Sea.

CLIMATE CHANGE EFFECTS ON COLORADO RIVER INFLOWS – Water deliveries to IID are based on the Colorado River Simulation System (CRSS) model and resampling hydrology from 2000-2018 (information from Wheeler et al. 2022), as presented in Table 3-2. The inflows are the 50th percentile (2.535 MAF), 90th percentile (2.33 MAF), and 95th percentile (2.09 MAF). This assumes that the current dry conditions in the 21st century will continue over the following four decades.

The CRSS modeling is based on current rules for Colorado River flow allocations and does not reflect any potential upcoming changes to Colorado River policy. However, the current Drought Contingency Plan (DCP) will expire in 2026, and ongoing drought conditions as a result of climate change make policy reductions even more likely. While drier hydrologic conditions for the Colorado River are prudent to plan for, the resulting changes to policy over the next several decades are unknown. Given the uncertainty around water policy and at the request of the LRPC, we have added the Very Low Probability Inflow condition, which represents the 95th percentile flow to IID, or the flow that would occur on average once in 20 years. The assignment of this flow as the delivery to IID every year over the simulation period to 2050 represents an extremely dire hydrological condition and is outside the norm of hydrological modeling protocols. Given that policy changes that may reduce inflows are unknown, this Very Low Probability Inflow is used to test potential drastic reductions to inflows in the future. By presenting this range of inflow in the LRP and evaluating the performance of restoration concepts to these inflows, we hope to set the foundation for future analyses as policy changes unfold over the next several years.

Table 3-2. Probabilities of IID Water Delivery below Different Thresholds and Delivery Thresholds Given Different Probabilities Based on the Resampled 2000–2018 Hydrology.

Delivery thresholds (MAF/year)	**2.5**	**2**	**1.5**	**1**	**0.5**
Probabilities below thresholds	14.4%	4.1%	2.0%	0.7%	0.1%
Probabilities of delivery below thresholds	**50%**	**25%**	**10%**	**5%**	**1%**
Delivery thresholds (MAF/year)	2.61	2.61	2.33	2.09	1.22

Climate Change Effects on Evapotranspiration – Climate change is estimated to increase evapotranspiration by 5% in the Imperial Valley from current conditions, based on average temperatures projected over the 30-year window from 2035-2064 (additional details on this calculation are provided in Appendix B). For the purposes of the hydrologic modeling performed for the LRP, evapotranspiration is assumed to reach this increased value by 2035 and remain at this level for the rest of the simulation period.

3.1.3 Other Factors Affecting Inflows

On October 5, 2022, California users of Colorado River water released a statement proposing to conserve 400,000 AF of water each year from 2023 to 2026 to contribute towards stabilizing elevations in Lake Mead. [4] IID voluntarily contributed up to 250,000 AFY of additional storage, depending on environmental conditions, and contingent on federal funding and voluntary participation of water users.[5] Other California users of Colorado River Water that signed the statement were the Metropolitan Water District, Coachella Valley Water District, and Palo Verde Irrigation District.

The Colorado River Basin is in the 23rd year of a historic drought. Both Lake Powell and Lake Mead are at historically low levels with a combined storage of 28 percent of capacity. Looking to the future, USBR is preparing to develop new operating guidelines given that the 2007 Interim Guidelines expire in 2026. USBR is also targeting the initiation of a formal NEPA process in early 2023.[6]

3.1.4 Summary of Inflow Projections

Future inflows are difficult to project due to potential policy changes affecting Colorado River water management, many of which are outside the State of California's ability to influence. As water demand increases in the Western Basin United States and Mexico, and as water supply remains critically low on the Colorado River, difficult decisions will have to be made regarding the priority of water. USBR is currently evaluating new operational guidelines to avoid catastrophic disruptions in water diversions.

In smaller less managed systems, projecting hydrology is straightforward. In those cases, one would simply multiply the watershed area times that average annual rainfall and then incorporate an adjustment factor for climate change and increased evapotranspiration. Next, a forward-looking hydrograph is developed based on historical variability. A common next step in the more straightforward approach in designing habitat restoration projects involves identifying the flow that is expected to occur 50% of the time. This flow is used as an average condition when designing projects to ensure that projects will function best during conditions that occur the most. Typically, a flow that occurs 1% of the time is also evaluated so that the project can be designed to withstand very high flows.

In this large, highly managed system, subject to uncertain policy changes, we will take a different approach. First, we evaluate concepts based on an expected average annual inflow. The most likely outcome for inflow any given year is one that would occur 50% of the time. This inflow is described as the High Probability Inflow. We estimate this inflow at 889,000 AFY. For added clarity, in the future we expect

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[4] http://crb.ca.gov/2022/10/california-water-agencies-pledge-to-conserve-additional-water-to-stabilize-the-colorado-river-basin/
[5] https://calmatters.org/environment/2022/10/california-colorado-river-water/
[6] Statement of Camille Calimlim Touton, Commissioner, Bureau of Reclamation, U.S. Department of the Interior, Before the Senate Committee on Energy and Natural Resources, June 14, 2022: https://www.energy.senate.gov/services/files/6CB52BDD-57B8-4358-BF6B-72E40F86F510 [6] Statement of Camille Calimlim Touton, Commissioner, Bureau of Reclamation, U.S. Department of the Interior, Before the Senate Committee on Energy and Natural Resources, June 14, 2022: https://www.energy.senate.gov/services/files/6CB52BDD-57B8-4358-BF6B-72E40F86F510

inflow will surpass 889,000 AFY every 1 out of 2 years. This flow estimate incorporates projected climate change, but it does not incorporate future speculative policy changes. This inflow is then used to determine how concepts would perform over a long-term average condition. For additional technical information on how inflow was estimated, please refer to Appendix B.

Common feedback received during LRPC meetings was that the High Probability Inflow value was too optimistic, primarily because of concerns related to unknown future policy changes. In response to this concern, SSMP added two additional hydrologic scenarios: a Low Probability Inflow, and a Very Low Probability Inflow.

If no future major policy changes took effect, we would expect an inflow of 684,000 AFY to be surpassed in 90% of years. Likewise, we would expect an inflow of 444,000 AFY to be exceeded in 95% of years. To replicate a potential stressful future condition, we assume that every year looking forward receives these relatively rare-expected occurrences in inflow. Note, absent an effect of policy change, it is exceedingly unlikely Salton Sea average inflow would drop to 684,000 AFY, and even more unlikely it would drop to 444,000 AFY. However, we have represented these hydrologic conditions to test concept performance against stressful conditions, should extreme policy changes impact future inflow to that degree.

For clarity throughout the document, these inflow scenarios will be referred to by their relative probability: High Probability Inflow, Low Probability Inflow, and Very Low Probability Inflow. By examining these three hydrologic scenarios, we can identify the extent to which concepts are resilient to future water policy changes. An approach for how to resolve uncertainty regarding potential future policy changes is described in Section 4.1.1.

Table 3-3 provides a summary of inflow scenarios considered for use in evaluating concepts described in this Plan. The three inflow scenarios were used as input for the elevation and salinity modeling, as further described in Section 3.2. Time series of the three inflow scenarios are presented graphically in Figure 3-1.

Table 3-3. Summary of projected future inflow scenarios to the Salton Sea (units: acre-feet per year).

Inflow Scenario Name	Imperial Valley Inflow	Mexico Inflow[1]	Coachella Valley Inflow	Local Watershed Inflow	Groundwater Inflow	Total Inflow[2]
High Probability Inflow	852,900	0	70,000	4,680	11,900	**889,000**
Low Probability Inflow	647,900	0	70,000	4,680	11,900	**684,000**
Very Low Probability Inflow	407,900	0	70,000	4,680	11,900	**444,000**

Notes:
1. Inflows from Mexico gradually decrease from the baseline value of 66,100 AFY to 0, as further described in Appendix B.
2. The three inflow scenarios include 50,000 AFY inflow reduction due to lithium allocation.

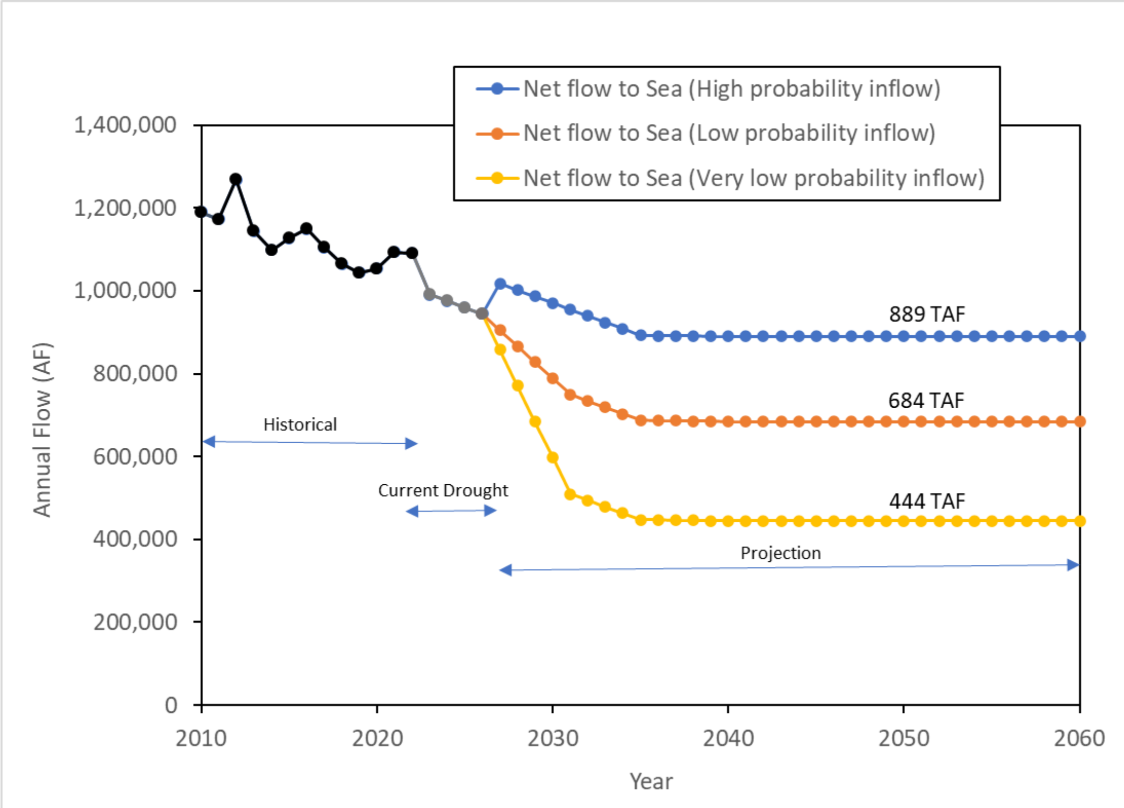

Figure 3-1. Inflow Scenarios Developed as Part of the LRP.

3.2 Elevation and Salinity Modeling

The model chosen to evaluate salt and water balance in LRP concepts is an updated version of SSAM. It is a spreadsheet model of the Sea's primary water and salt balance, originally developed by USBR in 2000. Since the mid-2010s, Tetra Tech has been using updated versions of the SSAM to model various Salton Sea conservation alternatives. The updates have included the most recently available sources of relevant data (bathymetry measurements, freshwater inflows to the sea); implementations of effects conservation projects have on the Sea's water volume and salinity; updated calibration of unknown/estimated inputs; and additional features to implement the impacts of the types of projects envisioned by the LRP, such as Mid-Sea barriers, desalination facilities, and water imports/exports from outside the basin. The necessity of these latter modifications is the primary reason the SSAM model was chosen instead of alternatives such as the SALSA2 model (IID, 2018), the full source code of which is not available to the public.

The model makes predictions of the future state of the Sea via mass balance of water volume and salt mass on an annual timestep: freshwater inflows add water and salt to the sea, direct precipitation and evaporation add/remove water but not salt, and salt precipitation removes salt but not water. The other major component of the model is the handling of water usage of the various types of conservation efforts being considered or implemented near the Salton Sea. Habitat, wetland, and vegetation project areas are implemented by reserving a portion of the total available inflow (6 AF, 5 AF, and 0.5 AF of water use per acre per year, respectively) after they become completed. Similarly, concepts with a fixed-footprint marine sea component offset 6 AF/acre/year of diverted inflow volume to meet their evaporation requirements. Concepts that involve pumping out water from the Sea do so at a specified volume at salinity of the current timestep. Desalination remediation is implemented as pumping out a specified volume at the current salinity and returning a fraction of that water at fixed low salinity (200 mg/L). The Divided Sea of Concept 2 is implemented in the model by first routing all the freshwater inflow into the southern half of the sea, and then any overflow is redirected to the brine sink while keeping the elevation difference between the two halves relatively small. For the purposes of dust suppression, all concepts use 1 AF of water per year for any area within the 2003 shoreline that isn't currently covered by the remaining sea or other conservation projects.

The model inputs for any given concept run are the sequence of freshwater inflows, the annual direct evaporation and precipitation rates, and the specific schedule under which conservation projects are activated. The model was run with three separate future hydrology scenarios; the development of those scenarios is described in Section 3.1. Direct precipitation was set to 2.5 inches annually, a number close to the historical average observed values from 2000-2021 near Imperial, CA. Direct evaporation from the sea is more difficult to measure directly and was treated as a calibration parameter against observed sea elevation and salinity data from 2004-2022; the average of the calibrated values (69.9 inches annually) was used for all future years. The specific project schedule for each variant of the model being run was derived from estimates of the length of time needed to design, permit, and construct the planned projects, described in more detail in Chapter 7.

The wide variety of combinations of inflow hydrology and specific restoration concepts was run by implementing two template SSAM Excel spreadsheets (one for the divided sea concepts, one for all other concepts), which are able to express the range of possible conditions being modeled. Scripts were then used to copy those templates and fill in the appropriate inputs for each restoration concept.

Model output includes time series of elevation and salinity, which are presented in Chapter 5. The modeled Sea elevations in 2050 were used to prepare the concept maps in Chapter 5. Bathymetric data was used along with predicted sea elevations to determine the area of shallow and deep habitat and shoreline length, which were further used in Concept scoring. Further details about the model can be found in Appendix D.

3.3 Habitat Provisions

Aquatic habitat conditions for birds can be defined through different characteristics, including, but not limited to, water depth, salinity and other water quality, vegetation cover and type, nesting site locations, prey density, and sediment composition. Many of these characteristics are expected to be defined at a future date as more detailed designs are developed for a selected restoration concept. At this stage of the planning process, the primary avian habitat considerations that can be evaluated are areas with different water depths and the salinity of water in the newly created habitats. As defined in Chapter 2, Evaluation Criteria, the three depths that are evaluated across each restoration concept are as follows:

- 0-6 inches (shallow): This depth range evaluates the area of shallow habitat that will support a fish and invertebrate population as a food source for wading birds, expected to be the area between the shoreline and the six-inch depth contour.
- 6 inches to 6 feet (medium depth): This depth range evaluates the area of habitat that will support a fish population as a food source for birds such as egrets, dabbling ducks, pelicans, and terns, which typically feed in medium depth areas between six inches and six feet.
- Greater than 6 feet (deep): This depth range evaluates the area of habitat that will support a fish population as a food source for diving birds, expected to feed in areas deeper than six feet.

The primary salinity goals across all habitat types are from 20-40 ppt, with lower scores assigned to higher salinities.

In addition to characteristics that focus on bird habitat and availability of suitable prey for different species, restoration concepts also must address the needs of the endangered desert pupfish. Pupfish currently exist in drains and inlets to the Sea, and a goal of the restoration concepts is to provide connectivity across these habitats to allow sustainable pupfish populations to exist.

3.4 Air Quality Evaluation

The primary long-term air quality concern with the Salton Sea relates to the exposure of lakebed and the resulting emissions of dust during windy periods. Dust emissions from the exposed lakebed are an added burden to the particulate concentrations in the air in nearby communities. Furthermore, there is concern that Salton Sea dust is more harmful than other dust sources in the region. To quantify estimated regional air quality effects, with a focus on exposed lakebed, the air quality evaluation was performed using a two-phased approach: 1) dust emissivity modeling from exposed lakebed, and 2) meteorological and atmospheric transport modeling from the lakebed to surrounding communities.

For the first phase, the quantity of dust emitted was modeled for each restoration concept, based on the emissivity of the different exposed lakebed areas and the historical wind speed record for 2020. In the second phase, dust emission modeling was conducted using a coupled meteorological and atmospheric transport modeling system (CALMET for meteorology and CALPUFF for particulate transport) to estimate the change in particulate matter levels at selected receptor locations as a consequence of exposed lakebed emissions. Both models are widely used for this type of regional atmospheric transport calculation. The first phase was used in the evaluation of concepts presented in Chapter 7 of this Plan. The second phase, the CALMET/CALPUFF modeling, is presented in Appendix E and is provided as an alternative framework to predict air impacts from each of the restoration concepts.

The dust emission modeling (the first part of the air quality evaluation) was performed as follows: Based on surface characteristics reported in IID (2020), the exposed area of the Salton Sea was divided into 17 discrete "pie-slices" (Figure 3-2). For each of these areas, there was a quantified response of emissivity as a function of wind speed through direct field measurements (IID, 2021). There was significant variation in emissivity depending on the surface characteristics of each pie slice. Wind speeds have been reported hourly at six air quality monitoring stations maintained by IID for more than a decade. Using a year's worth of wind speed data for a typical year (calendar year 2020), interpolated from the six measurement locations, annual emissions per unit area expressed as tons of sediment per km^2 can be calculated for each pie slice. Total annual emissions, expressed as tons of sediment per year can be calculated for each restoration concept depending on the amount of exposed lakebed that intersects each of the pie slices in Figure 3-2. The emission estimates were performed using the projected exposed lakebed areas in 2050 for each of the three inflow scenarios: high probability, low probability, and very low probability inflow.

The second phase of the modeling, presented in Appendix E, was performed using the CALPUFF system, a widely used tool for non-steady-state meteorological and air quality modeling for regulatory purposes. The main components of the modeling system are CALMET (a three-dimensional meteorological model) and CALPUFF (an air quality transport model). As part of this work the CALMET meteorological model was set up over a 100-km by 100-km area with the Salton Sea at its center. This model has been used to generate one year of three-dimensional meteorological data to drive the CALPUFF model; using the hourly emissions of particulates performed in the first phase, CALPUFF modeling established the baseline conditions. This quantified the PM_{10} fraction at selected receptor locations driven by fine-scale meteorology over a one-year period (the year 2020). Receptors were established throughout the modeling area and include the communities immediately adjacent to the seashore as well as more distant communities such as Westmorland, Calipatria, Niland, and Brawley near the southern end of the Sea, and communities in the Coachella Valley reaching as far north as Indio. Appendix E illustrates that the CALPUFF modeling framework can be used for prediction of PM_{10} concentrations at receptor locations. It is recommended that the CALPUFF modeling framework be utilized for a future phase of restoration concept design, to help plan dust suppression projects on areas of exposed lakebed which contribute to air quality impacts.

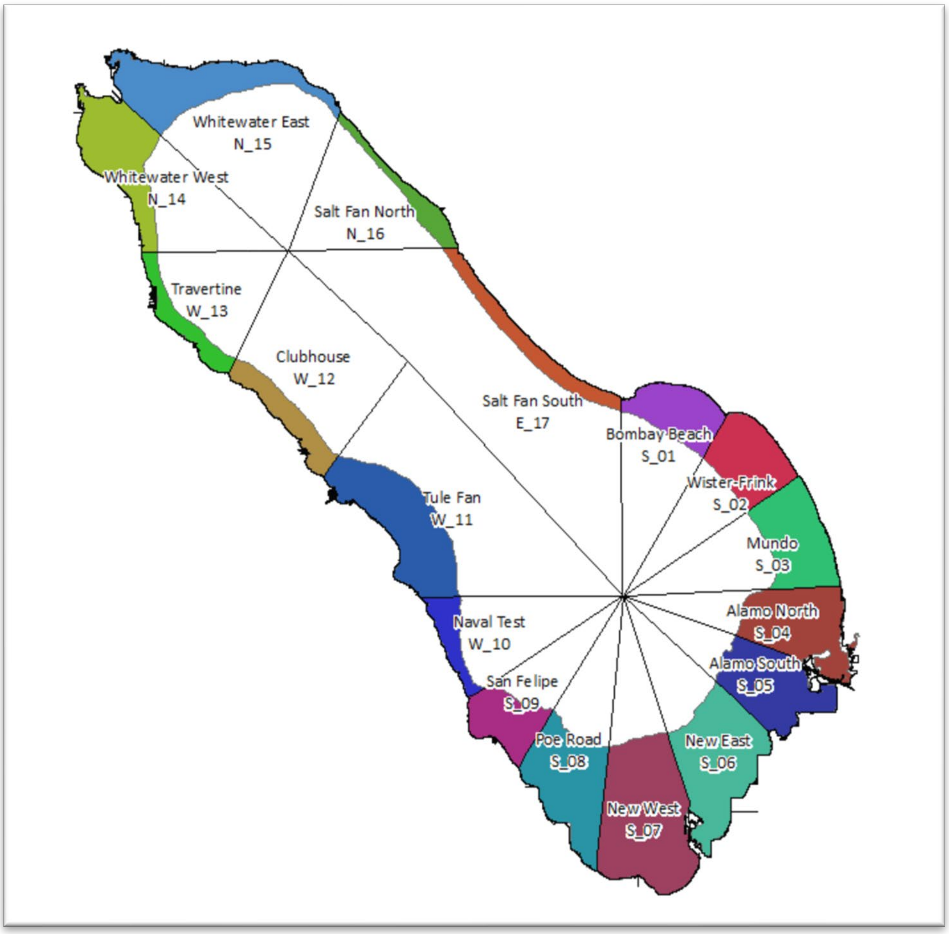

Figure 3-2. Defined Areas with Similar Emissivity Characteristics (Based on IID, 2021).

3.5 Greenhouse Gas Analysis

GHG emissions are a contributor to global climate change, and it is a policy of the State of California to lower these emissions from human activities. GHG emissions are a potential concern for this Plan given the large-scale changes envisioned for most restoration concepts. GHG emissions originate from three sources: (1) landscape processes, (2) operational energy use, and (3) use of construction equipment. These three components are described in the following sections. For concept scoring, annual estimates were developed for each of the three components and summed to provide the total annual GHG emissions.

3.5.1 Landscape Processes

The analysis of landscape processes that emit GHG used published literature sources and field observations to draw conclusions about carbon burial, cycling, and emissions while also factoring in expected changes in such processes in future years due to enhanced eutrophication, salinity increases, and general warming and drying of the lakebed and surface waters (Figure 3-3). The full analysis is presented in Appendix F.

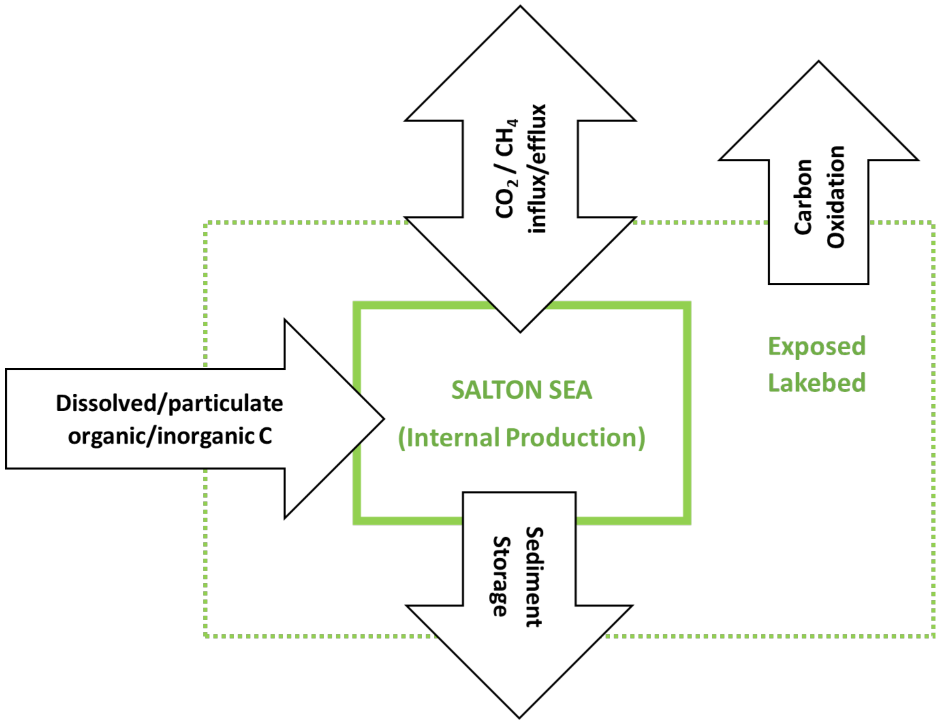

Figure 3-3. Overview of Greenhouse Gas Processes at the Salton Sea.

For each concept, the wetted area calculations incorporate projects elements coming online over varying timelines and reflect the shrinking surface area of the Sea over time, as predicted by SSAM. Similarly, exposed lakebed is also a function of both the shrinking Sea surface area and project elements covering exposed lakebed over time. Both the wetted area and exposed lakebed area are consistent with the SSAM implementation of each restoration concept. For each restoration concept, the wetted area and exposed lakebed area are multiplied by the corresponding emission rate, as described in Appendix F. The process was repeated for each of the three inflow scenarios discussed in Section 3.1.

Table 3-4 presents the annual GHG emissions in 2050 from landscape processes for each of the concepts for the High Probability Inflow Scenario. Note that where the lakebed emissions are zero (in 2050), the lakebed has completed its drying process and is no longer emitting GHGs by 2050 because the carbon in the lakebed has been fully oxidized. The table shows that wetted area emissions dominate the GHG estimates for each of the concepts.

Table 3-4. Greenhouse Gas Emissions from Landscape Processes for the High Probability Inflow Scenario.

Concept	2050 Wetted Area Emissions (metric tons CO_2-eq/year)	2050 Exposed Lakebed Emissions (metric tons CO_2-eq/year)	Total 2050 GHG Emissions (metric tons CO_2-eq/year)
Phase 1: 10 Year Projects	1,290,000	0	1,290,000
1A N/S Marine Sea with Saline Habitat Complex (SHC)	1,495,000	255,000	1,750,000
1B N/S Marine Sea Without SHC	1,434,000	64,000	1,498,000
1C N/S Marine Sea Without SHC, with Freshwater Reservoir	1,456,000	20,000	1,475,000
2A Divided Sea with Full 10-Yr Plan	1,292,000	48,000	1,341,000
2B Divided Sea Without Alamo River Project	1,288,000	12,000	1,300,000
2C Divided Sea Without Alamo/with 2 Perimeter Lake Cells	1,290,000	22,800	1,313,000
2D Divided Sea Without Alamo/with 2 Perimeter Lake Cells and Freshwater Reservoir	1,342,000	2,000	1,343,000
3A Updated Perimeter Lake (UPL)	1,429,000	0	1,429,000
3B UPL Without Alamo Project and 3 Cells/with FW Reservoir	1,366,000	14,000	1,381,000
4A Pump Out with Dust Control	1,261,000	222,000	1,484,000
4B Pump Out with Pipeline	1,124,000	223,000	1,347,000
4C Pump Out with Dust Control and Pipeline	1,293,000	214,000	1,507,000
4D Pump Out with Dust Control/Without Alamo/with FW Reservoir	1,332,000	212,000	1,544,000
5 Water Optimization	1,437,000	0	1,437,000
7 Water Recycling	1,175,000	182,000	1,358,000
11 IRP Water Importation	1,380,000	0	1,380,000
12 IRP Water Exchange	1,041,000	12,000	1,053,000
13 IRP Colorado River Water Transfer	1,124,000	267,000	1,391,000

3.5.2 Operational energy

From an operational standpoint, GHG emissions are from energy used to pump water to higher elevations and for desalination. Pumping alone is a small contributor; however, the desalination associated with the water import projects is a large user of energy, in excess of 1 million metric tons of CO_2-equivalent per year (University of California, Santa Cruz, 2022).

Table 3-5 presents the calculations for GHG emissions from Phase 1: 10-Year projects and the additional emissions generated from pump out projects (4A, 4B, 4C, and 4D). Table 3-6 summarizes the GHG emissions for each project concept. For in-basin concepts other than pump out concepts, operational energy emits 111 metric tons of CO_2-eq/year of GHG. Pump out projects add 163 metric tons of CO_2-eq/year of GHG for a total of 274 metric tons of CO_2-eq/year. Emissions from the IRP concepts (11, 12, and 13) were taken directly from the IRP Feasibility Report (University of California, Santa Cruz, 2022).

Table 3-5. Calculations for Greenhouse Gas Emissions.

Component	Project Pumping	Energy Usage[1] kwh/year	GHG Emissions[2] (metric tons CO_2-eq/year)
Phase 1: 10-Year Projects	34,000 AF	510,000	111
Additional for Pump Out Projects	50,000 AF	750,000	163

Notes:
1. Energy usage is 15,000 kwh/year for each 1000 AF/year.
2. GHG emissions are 217 metric tons of CO_2-eq per 1,000,000 kwh (University of California, Santa Cruz, 2022).

Table 3-6. Summary of Greenhouse Gas Emissions from Operational Energy Use at the Salton Sea.

Concept	CO_2 Emissions (metric tons/yr)
Phase 1: 10 Year Projects	111
1A N/S Marine Sea with Saline Habitat Complex (SHC)	111
1B N/S Marine Sea Without SHC	111
1C N/S Marine Sea Without SHC, with Freshwater Reservoir	111
2A Divided Sea with Full 10-Yr Plan	111
2B Divided Sea Without Alamo River Project	111
2C Divided Sea Without Alamo/with 2 Perimeter Lake Cells	111
2D Divided Sea Without Alamo/with 2 Perimeter Lake Cells and FW Reservoir	111
3A Updated Perimeter Lake (UPL)	111
3B UPL Without Alamo Project and 3 Cells/with FW Reservoir	111
4A Pump Out with Dust Control	274

Concept	CO_2 Emissions (metric tons/yr)
4B Pump Out with Pipeline	274
4C Pump Out with Dust Control and Pipeline	274
4D Pump Out with Dust Control/Without Alamo/with FW Reservoir	274
5 Water Optimization	111
7 Water Recycling	111
11 IRP Water Importation	1,263,000
12 IRP Water Exchange	452,000
13 IRP Colorado River Water Transfer	131,000

3.5.3 Construction Equipment

For emissions from construction equipment, the amount of diesel fuel used at the SCH project was obtained from Kiewit staff. This volume (834,670 gallons per year) equates to 8,488 metric tons CO_2 per year.[7] Based on the per year cost of the SCH project, a scaling factor was calculated (123 tons CO_2 per $1 million construction cost). This scaling factor was multiplied by the cost of each concept and divided by a 50-year project life to determine the annual values for GHG emissions from construction equipment presented in Table 3-7.

Table 3-7. Summary of Greenhouse Gas Emissions from Construction Equipment Use at the Salton Sea.

Concept	CO_2 Emissions (metric tons/yr)
Phase 1: 10 Year Projects	3,200
1A N/S Marine Sea with Saline Habitat Complex (SHC)	43,000
1B N/S Marine Sea Without SHC	20,000
1C N/S Marine Sea Without SHC, with Freshwater Reservoir	20,000
2A Divided Sea with Full 10-Yr Plan	6,200
2B Divided Sea Without Alamo River Project	5,300
2C Divided Sea Without Alamo/with 2 Perimeter Lake Cells	6,000
2D Divided Sea Without Alamo/with 2 Perimeter Lake Cells and Freshwater Reservoir	6,900
3A Updated Perimeter Lake (UPL)	7,800

[7] 10,180 grams of CO_2/gallon of diesel = 10.180 × 10-3 metric tons CO_2/gallon of diesel (https://www.epa.gov/energy/greenhouse-gases-equivalencies-calculator-calculations-and-references)

Concept	CO_2 Emissions (metric tons/yr)
3B UPL Without Alamo Project and 3 Cells/with Freshwater Reservoir	6,800
4A Pump Out with Dust Control	4,800
4B Pump Out with Pipeline	7,400
4C Pump Out with Dust Control and Pipeline	9,000
4D Pump Out with Dust Control/Without Alamo/with Freshwater Reservoir	4,800
5 Water Optimization	5,100
7 Water Recycling	10,500
11 IRP Water Importation	196,000
12 IRP Water Exchange	115,000
13 IRP Colorado River Water Transfer	45,000

3.5.4 Summary of Greenhouse Gas Emissions

Figure 3-4 presents a summary of the annual GHG emissions for the High Probability Inflow and Low Probability Inflow Scenarios for each restoration concept. As shown in the figure, GHG emissions from landscape processes dominate the total emissions for most concepts for both inflow scenarios. For Concept 11 (IRP Water Importation), landscape processes are approximately equal to emissions from operational energy.

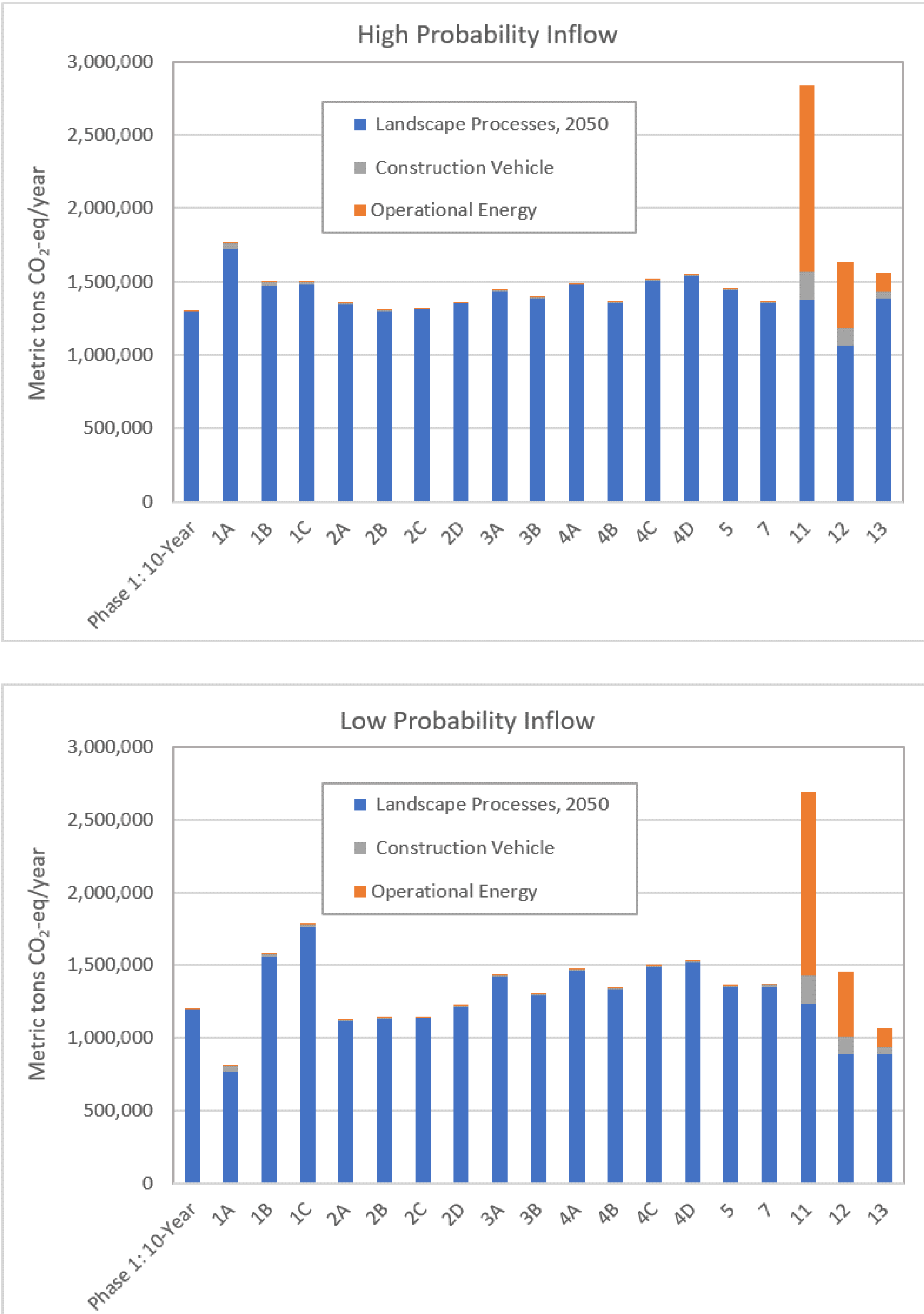

Figure 3-4. Greenhouse Gas Emissions for the High Probability Inflow (top) and Low Probability Inflow (bottom) Scenarios for the Restoration Concepts.

4 Areas of Uncertainty

In developing and evaluating concepts for the restoration of the Salton Sea, the SSMP team, members of the LRPC, and members of the public identified areas of uncertainty that should be considered for future decision-making. Uncertainties in developing this Plan include:

- Uncertainty in future environmental conditions; and
- Uncertainty in the analysis.

The primary uncertainty in future environmental conditions is related to water inflows to the Sea. Water inflows will be affected by changes in climate and policy, as well as short-term droughts.

Uncertainties in the analyses exist because at this stage of the planning process, where several different types of concepts are being considered, certain detailed evaluations would be inefficient to complete. More detailed evaluations will take place during the next phase of environmental review to reduce analytical uncertainty, but ideally this analysis would be limited to a smaller suite of similar concepts to minimize the time required to develop results.

Technical uncertainties in the analysis also arise from the need for more detailed air quality modeling, evaluations of habitat population dynamics to better understand ecological outcomes, and more developed engineering analysis for individual concepts. Habitat population dynamics, characterizing the large-scale needs of key avian species, has been identified as an important need through the LRP development process and will need to be developed at a future date to support the Plan. Engineering analysis included in this work is typical of such planning-level documents, and uncertainties in such analysis are expected to be resolved in future phases of LRP implementation.

Some of the above uncertainties are classified as key uncertainties for future decision-making. Key uncertainties include those related to future inflows, air quality as it relates to public health, and ecological outcomes. Other relevant uncertainties include those related to water quality in the Sea, level of design, cost analysis, and restoration technologies.

4.1 Key Areas of Uncertainty

Future inflows to the Salton Sea, air quality as it relates to public health, ecological outcomes, and sustainable economic development are the four key areas of uncertainty identified for this Plan. The areas of uncertainty in analysis primarily stem from the planning-level of detail developed for concepts. Working with a planning-level of detail allowed for the investigation of a broader range of concepts. However, in doing so, we made assumptions about hydrology, air quality, habitat, and other considerations.

4.1.1 Uncertainty in Future Inflow

The Salton Sea is located within a highly regulated watershed. Less than 5 percent of the Sea's inflow comes from unregulated surface drainage around the Sea and from groundwater inflows. The other 95 percent of the inflow to the Salton Sea comes indirectly from the Colorado River, through discharges from agricultural lands in the Imperial and Coachella Valleys and from Mexico. Colorado River water supply is primarily stored at Lake Powell and Lake Mead and released as operational demands require. Colorado

River water is diverted at Imperial Dam and flows through the All-American Canal and into the Imperial and Coachella Valleys. From there, the water is used to irrigate crops and for municipal use. The water that enters the Sea comes primarily from agricultural runoff, an operational effect of irrigating crops. This agricultural runoff then primarily drains through the New or Alamo Rivers.

Over the past decade, the Salton Sea has seen relatively modest variation in annual inflow (Figure 3-1, and additional details in Appendix B). This is related to fairly uniform water deliveries from Lake Mead to the Imperial and Coachella Valleys. However, because of an unprecedented 23-year drought in the Western Basin States, the Department of Interior is revisiting their operational guidelines, in an effort to avoid critically low water levels at Lake Mead and Lake Powell. If the drought continues, or if changes in policy occur, IID and CVWD could forgo future deliveries, and thus the annual inflow into the Salton Sea could be significantly lower than at present. As evidence of the current dire situation, IID and CVWD have committed to storing a combined 275 TAFY of their expected water deliveries at Lake Mead and Lake Powell, as needed over the next four years (2023 to 2026) as one part of a more comprehensive plan to protect system-wide deliveries.

This short-term voluntary policy consideration could mean an inflow reduction to the Sea of approximately 119 TAFY. Reductions of this magnitude of inflow will have a large effect on environmental conditions at the Salton Sea, including increases in salinity, reduction in aquatic habitat, and increases in exposed lakebed.

If drought conditions don't abate to the point where the Department of Interior can confidently deliver the current water allocation, the Salton Sea would likely face future reductions in inflow, both in the near-term as well as in the longer-term. This uncertainty in hydrology propagates through most of our analysis. There are two distinct concept types within this Plan, 1) those without water importation, and 2) those with water importation. Concepts without water importation are more susceptible to changes in water policy on the Colorado River system. Concepts with water importation face other challenges. Therefore, it is key to establish confidence in a hydrologic forecast that is grounded in anticipated policy changes.

To reduce uncertainty in future analysis, SSMP recommends that a technical and policy team be formed to select a hydrologic scenario, or a range of scenarios, as a foundation for other analysis. This team should be comprised of hydrologists, climatologists, and policy experts. This team should be used to inform evaluations performed as part of environmental review.

For this process, we addressed uncertainty in future inflow by evaluating concepts against three future hydrologic scenarios, all with varying degrees of probability of occurring based purely on current policy and climactic factors. The three scenarios selected are a High Probability Inflow, a Low Probability Inflow, and a Very Low Probability inflow. These scenarios are described in greater detail in section 3.1.4.

The most likely outcome for inflow any given year is one that would occur 50% of the time. This inflow is described as the High Probability Inflow. We estimate this inflow at 889,000 AFY. For added clarity, in the future we expect inflow will surpass 889,000 AFY every 1 out of 2 years. This flow estimate incorporates projected climate change, but it does not incorporate future speculative policy changes. This inflow is then used to determine how concepts would perform over a long-term average condition.

Common feedback received during LRPC meetings was that the High Probability Inflow value was too optimistic, primarily because of concerns related to unknown future policy changes. In response to this concern, SSMP added two additional hydrologic scenarios: a Low Probability Inflow, and a Very Low Probability Inflow.

If no future major policy changes took effect, we would expect an inflow of 684,000 AFY to be surpassed in 90% of years. Likewise, we would expect an inflow of 444,000 AFY to be exceeded in 95% of years. In order to replicate a potential stressful future condition, we assume that every year looking forward receives these relatively rare-expected occurrences in inflow. Note, absent an effect of policy change, it is exceedingly unlikely Salton Sea average inflow would drop to 684,000 AFY, and even more unlikely it would drop to 444,000 AFY. However, we have represented these hydrologic conditions to test concept performance against stressful conditions, should extreme policy changes impact future inflow to that degree.

By examining these three hydrologic scenarios, we can identify the extent to which concepts are resilient to future water policy changes. While the largest amount of uncertainty may come from policy decisions at the federal level, uncertainty in Salton Sea inflows also stems from potential changes in land use around the Salton Sea, notably from agricultural production to urban development in response to population increase or urbanization.

4.1.2 Uncertainty in Air Quality Analysis as it Relates to Public Health

To meet the air quality objective, projects developed in the LRP must protect or improve air quality to reduce public health consequences (Table 2-1). To do this, for each restoration concept, we need to quantify the area of exposed lakebed, the emissivity of the exposed lakebed (a function of surface characteristics and wind speed), and the transport of wind-blown dust to community locations around the Sea. A further consideration is accounting for the chemistry and toxicity of the lakebed dust, because of concerns that lakebed dust is of greater human health risk than other types of wind-blown dust in the region.

A simple conceptual diagram illustrates the evaluation of the air quality objective for the different restoration concepts (Figure 4-1). Air quality has been analyzed through a set of models as described in Chapter 3. The lakebed exposure in the future (year 2050 for this analysis) is based on the restoration concept design and the expected future hydrology (see Box 1 in Figure 4-1). The particulate emissions are computed using a simple model of the surface type and range of hourly wind speeds observed during a typical year (2020) (Box 2). The emissivity varies by location and is highly dependent on wind speed. This time variable model of emissions is then input into a meteorological and atmospheric transport model to estimate the quantity of particulate PM_{10} at individual receptor locations around the Sea (Box 3 and 4). The chemistry of the exposed lakebed can be used to assess the human health risk associated with inhalation of this PM_{10} (Box 5). Part of the risk is due to the particulate material and part of it is due to the constituents of the particulates.

At this stage of the planning process, the lakebed exposure, the emissions, and the particulate concentrations in communities have been characterized for each restoration concept (Boxes 1 through 4). We recommend that the transport model, described in Appendix E, be used to help plan dust suppression projects on areas of exposed lakebed which contribute to air quality impacts. The transport model provides a basis to compare the benefits of particulate transport to communities across different restoration concepts. However, there are limited published data on the lakebed sediment and transported particulate chemistry. This is a key area of uncertainty, and to better understand the impact of restoration concepts on public health, future work will need to be performed to better characterize the chemistry of the particulates (Box 5).

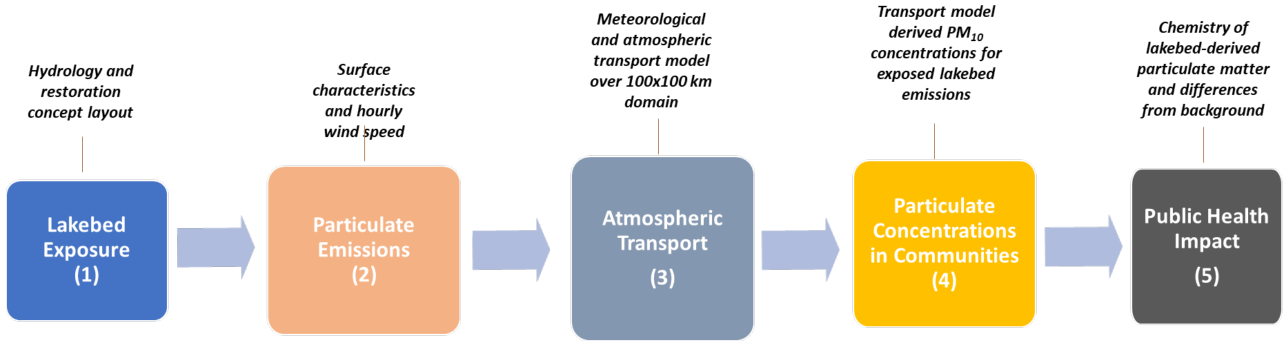

Figure 4-1. Conceptual Representation of Analysis of Air Quality for Different Restoration Concepts.

4.1.3 Uncertainty in Ecological Outcomes

The objective of restoring aquatic habitat is to re-establish the historic levels and diversity of fish and wildlife that depend on the Salton Sea. Additionally, most of the concepts evaluated in this Plan have a primary aquatic habitat restoration area (largest contiguous water bodies) with salinities in the target range of 20 to 40 PPT at a variety of water depths. These areas are expected to be the most able to support the abundance and diversity of fish and wildlife that have depended on the Salton Sea in the past. Several concepts also have supplemental areas with salinities over a much wider range (20 to 200 PPT), which could provide additional diversity. There are five criteria focused on assessing a concept's ability to restore habitat. The first three assess a concept's primary habitat restoration area's ability to restore habitat in different water depth ranges: shallow, medium, and deep. The fourth criterion is salinity, and the final criterion is pupfish connectivity.

For each of the depth criteria, the area of habitat in a particular depth class was compared to historic water surface elevations when the greatest abundance and diversity of wildlife existed at the Sea. The area in each depth category was calculated for a historic Sea elevation of about -230 ft msl, which existed in 1999 and earlier. It is recognized that this comparison is only a means to compare the habitat areas provided by different concepts, and that at the next stage of analysis, habitat modeling will be needed to better estimate how increases in habitat area would result in improved ecological outcomes.

Salinities in the target range of 20 to 40 PPT are expected to be able to support healthy and diverse fish populations that would serve as a food source for piscivorous fish. Habitat areas that providing water in this range of salinity at a variety of water depths would be the most able to support the abundance and diversity of fish and wildlife that have depended on the Salton Sea in the past.

The pupfish habitat and connectivity were evaluated as the extent of pupfish connectivity between drains and inlets with water quality that can support pupfish. While recognizing that this is an uncertainty, at this stage of analysis, it is expected that all concepts would be able to be designed to provide pupfish connectivity. At a more detailed stage of design, some concepts may be determined to have better connectivity than others.

Finally, the objective in itself carries uncertainty due to the ambiguous phrasing. Further specificity is required to identify desired fish and wildlife composition. We recommend a technical team led by CDFW and USFWS facilitate a process to further define the ecological outcome desired.

4.1.4 Uncertainty in Sustainable Economic Development specifically related to Lithium Production

Currently investments are underway to develop new extraction technologies to produce lithium from geothermal plants at Salton Sea. Lithium reserves at the Sea are thought to be so large that they could supply up to 40% of the world's needs. Given the lack of design detail in site specific locations, it's difficult to predict how specific concepts will need to be altered to accommodate for future lithium work. However, given the importance of this industry to the potential sustainable economic development of the region, we assume that projects that overlap with known geothermal resource areas would be designed in such a way to support the extraction process and still achieve multiple benefits towards accomplishing our objectives.

One provision that is clear is the demand for an added water source. In this plan we have incorporated a component of a 100,000 Acre-feet reservoir to be located on exposed lakebed. This reservoir would provide habitat, recreation, and water supply for industries, including lithium.

4.2 Other Relevant Areas of Uncertainty

Other relevant areas of uncertainty include water quality, level of design, cost analysis, and certain restoration technologies.

4.2.1 Uncertainty in Water Quality

There is uncertainty about the extent to which restoration concepts considered in this Plan will improve water quality. The evaluation of water has been divided into two components: selenium and other water quality parameters not including salinity. Management of salinity has been evaluated as part of the habitat evaluation.

SELENIUM – The future selenium level in restored areas of the Sea is another source of uncertainty. Historically, natural processes in the Sea have sequestered selenium in sediments. Several research projects have been conducted in the past to better understand the phenomenon. A recent study (MacFarlane, 2018) concluded that "The results suggest that microbial selenate reduction remains relatively unaffected by rising salinity levels though further work would be necessary to provide more clear evidence."

While selenium concentrations in the waters that flow into the Sea have often been in the range of 5 to 10 micrograms per liter or greater, selenium concentrations in the Sea have typically been measured at around 1 microgram per liter. In 2016, USEPA adopted chronic water-column criteria of 3.1 micrograms per liter in flowing freshwater bodies and 1.6 micrograms per liter in freshwater lakes, with additional targets for tissue concentrations in fish eggs, ovaries, and muscle tissue (USEPA, 2016). Saltwater selenium criteria are much higher (71 micrograms per liter) and have not been recently updated. Based on the history of selenate reduction in the Sea over the past 100+ years, it is anticipated that maintaining large water bodies at 20 to 40 PPT salinity and with similar general water quality would preserve the ability of the Sea to sequester selenium and maintain selenium levels below the EPA criteria. However, this will need to be managed through continued monitoring of water column and tissue concentrations in the larger and smaller water bodies envisioned as part of the different restoration concepts.

Some concern has been expressed that, with a smaller and shallower Sea, wave activity in shallow areas could re-entrain selenium. However, significant wave activity has always been present in the Sea, and large shallow areas in the south and north would have been disturbed by this activity. Despite this wave activity, selenium levels in the Sea remain low (Salton Sea Authority, Benchmark 2 Report, 2016). Given the significance of selenium to ecological receptors in the region, further study of selenium loads and in-Sea transport and transformation processes is recommended for the future.

Other Water Quality Parameters – The extent to which a restoration concept could improve additional water quality parameters other than salinity and selenium is also an uncertainty factor. These parameters include constituents such as nutrients, pesticides, and pathogens. Water quality improvements could occur either in the inflowing waters or within the water bodies or habitat areas within the Salton Sea footprint. Water quality improvements would provide opportunities for beneficial uses designated in the Regional Water Board Basin Plan and reduce environmental consequences. Indicators considered include the ability to reduce loads of potentially contaminated sediments and the control of total phosphorus, total nitrogen, and other contaminants in inflows.

Detailed water quality modeling could be conducted of select concepts at the next stage of analysis to reduce uncertainties at the next level of analysis. At the current level of analysis, it is assumed that features included in various restoration concepts would provide water quality improvements. Features included in various concepts that would be designed to improve water quality include:

- Sedimentation basins that would remove suspended sediment particles that often have contaminants attached to them;
- Flow through pond systems like SCH that will filter nutrients and discharge cleaner water into downstream systems;
- Outlets from primary habitat areas in deep water bodies including those used in Concepts 1, 2, 3, 4, and 7, which would provide an outlet for constituents that have built up in the Salton Sea water since the Sea was formed over 100 years ago; and
- Features, such as phytoremediation or treatment wetlands, that could be added-on to any of the restoration concepts to improve the water quality of inflowing rivers.

At this time, it is not possible to quantify the water quality benefits that could occur with each restoration concept. However, it is reasonable to conclude that benefits will occur, and that some concepts may have greater benefits than others.

4.2.2 Level of Design and Cost Analysis

Uncertainties exist in both the level of conceptual design and the cost assessments. For the most part, conceptual designs have been taken from other sources as discussed in Chapter 1. More information on the source material for Concepts 1 through 4 can be found in Appendix A. Cost assessments for these concepts are also based on this source information updated to 2022 dollars. Conceptual designs and cost estimates for Concepts 11 through 13 are based on the feasibility analysis conducted by the IRP. A higher level of design will be needed to inform and refine several areas of acceptability, particularly certain areas identified as important to the LRPC.

Uncertainty in the level of design impacts several acceptability criteria, due to the current preliminary stage of design of the restoration concepts. These criteria include environmental justice and equity, do no harm, workforce development, and sustainable economic development. The SSMP recognizes the importance of the acceptability criteria to the LRPC and understands the need for these criteria to align with CNRA's mission and values. The refinement of these scoring criteria will remain as a high priority as higher-level designs are completed, which will inform further analysis.

Uncertainty in the cost analysis exists due to the complex nature of the restoration concepts, particularly the IRP Water Importation concept and the IRP Water Exchange concept. Opportunities to reduce cost can be investigated as the next phase of design unfolds, including the exploration of differing methods and processes to achieve greater value for the importation concepts.

4.2.3 Uncertainties in Restoration Technologies

Technologies associated with some restoration concepts have uncertainties that would need further investigation or pilot testing before they can be taken to a higher level of design. The SCH Project will serve as a large-scale proof of concept for the other habitat projects with similar features planned as part of the Phase 1: 10-Year Plan. A full monitoring and evaluation program is planned for SCH that will inform the designs of other similar projects. The IRP proposed local desalination plants as part of Concepts 11 through 13. Uncertainties about the efficiencies of these technologies over the range of salinities that could be present in the Salton Sea exist. Finally, Concept 7 incorporates several technologies that would need to work together under the range of salinities that could be expected at the Sea. Furthermore, five plants would need to be sited and have sufficient steam to power the processes. A pilot project could be needed to inform final design. A similar pilot project is underway, but results are still pending. Finally, A groundwater investigation is needed to verify the sources and sustainability of the groundwater component of Concept 7.

5 Restoration Concepts

5.1 Introduction

The restoration concepts discussed in this chapter include those developed as long-range solutions that do not involve water importation plus concepts proposed by the Independent Review Panel (IRP), which was charged with investigating concepts that do involve water importation.

These concepts build upon current and past Federal, State, and local studies and the restoration plans developed in previous investigations. While these concepts were derived from previous ideas, they have been updated to meet current habitat objectives and to include Phase 1:10-Year Plan projects. In addition, they have been modeled using the latest projections for future water inflows, and earlier cost estimates have been updated to express costs in 2022 dollars. Appendix A to this Plan describes the restoration concepts that were presented in the following four documents, which serve as the origin for the first four concepts considered in this long-range plan:

- Salton Sea Ecosystem Restoration Program Draft Programmatic Environmental Impact Report (PEIR), 2006
- US Bureau of Reclamation (USBR) Final Report: Restoration of the Salton Sea, 2007
- Salton Sea Authority (SSA) Funding and Feasibility Action Plan, 2016
- The Salton Sea Management Plan (SSMP) Phase 1: 10-Year Plan Imperial and Riverside Counties, California, Draft Environmental Assessment, 2022.

The initial concepts were presented to the Salton Sea LRPC and the public in March 2022. The LRPC and the public were given the opportunity to comment on these concepts as well as to submit other concepts. Based on feedback from this process, new concepts were added, and variations of the original concepts were developed to accommodate various strategies.

The Independent Review Panel (IRP) convened by the University of California at Santa Cruz was commissioned by the SSMP to review concepts for water importation to the Salton Sea for its long-term restoration. The IRP reviewed 18 proposals from outside groups. Three of the 18 proposals did not involve water importation and were referred to the SSMP team and are discussed herein. Of the remaining 15 proposals received, the IRP identified three import concepts which met their criteria. Because of similarities across these three external proposals, the IRP created a merged importation concept, pulling features from each. In addition, the IRP proposed a different importation concept, involving an exchange of Colorado River water with desalination in Mexico. In this scenario, the desalinated water is used in Mexico and an equivalent amount of water is left in the Colorado River to augment flows to the Salton Sea. Finally, the IRP developed a third concept with no importation, that involved fallowing of land and flow of the resulting Colorado River water to the Sea. These three concepts are further discussed in this document.

The remainder of this chapter describes the following:

- **The SSMP Phase 1: 10-Year Plan** serves as a foundation for the concepts that are part of Phase 2. The Phase 1: 10-Year Plan includes four large habitat projects, multiple smaller habitat projects, and several revegetation projects designed to mitigate dust emissions.

- **Restoration Concept 1:** North/South Marine Sea that builds on concepts presented in the 2006 Ecosystem Restoration PEIR. The concept includes a north/south trending marine sea (meaning salinity like that of the ocean) maintained at an elevation close to historic levels before reductions of inflows over the past 20 years. Three variations of this concept are considered in this document.
- **Restoration Concept 2:** Divided Lake/Marine Sea South that builds on a concept presented in 2007 by USBR for a divided lake with no elevation control and a marine sea in the south that would support a fishery. Four variations of this concept are considered in this document.
- **Restoration Concept 3:** Updated Perimeter Lake that builds on the perimeter lake concept published in the SSA Funding and Feasibility Action Plan (SSA, 2016). Two variations of this concept are considered in this document.
- **Restoration Concept 4:** Pump Out Options that would create an artificial outlet for the Salton Sea by pumping water from the Sea and using it for dust control, pumping Salton Sea water to the Sea of Cortez, or a combination of the two. Creating an artificial outlet would ultimately return the Sea to marine salinity. Pump-out options were investigated in the SSA Funding and Feasibility Action Plan. Four variations of this concept are considered in this document (SSA, 2016).
- **Restoration Concept 5:** Water Optimization, proposed by Michael Cohen of the Pacific Institute and a member of the LRPC, would capture water in two or more interceptor canals. Water would be distributed via gravity around the historic Salton Sea shoreline, creating shallow habitat cells and dust suppression projects. The cells would have a wide range of salinities, with salinity increasing in downslope cells.
- **Restoration Concept 6:** Southlake Restoration and Enhanced Vegetation, proposed by AGESS, Inc., would involve enhanced vegetation and phytoremediation that could be installed in the New and Alamo rivers and their deltas on floating islands to provide water quality improvements. A dredged gravity fed irrigation ditch would provide water for wetlands and a crescent shaped south lake.
- **Restoration Concept 7:** Water Recycling, proposed by Sephton Water Technology, would involve construction of five desalination plants using evaporative distilling technology supplemented with groundwater pumping to reduce the salinity in the Sea.
- **Restoration Concept 8:** Reclamation of Native Desert and Agriculture was submitted to the IRP but referred to the SSMP team because it did not involve water importation. The proposal involves using less than 100 AFY of Colorado River water to create small shallow pools of oases around the exposed lakebed to help provide drinking water for wildlife and help provide a catalyst for the revegetation of the lakebed.
- **Restoration Concept 9:** Floating Solar and Water Generation System was submitted to the IRP but referred to the SSMP team because it did not involve water importation. A large number of floating solar systems would cover the water surface and slow evaporation, while generating electrical energy used to generate freshwater.
- **Restoration Concept 10:** Save the Coachella Valley Basin was submitted to the IRP but referred to the SSMP team because it did not involve water importation. Exposed lakebed areas close to the Salton Sea shore would be developed into mudflats and ponds. The habitat restoration projects would include 20 to 60 fish "rest areas."
- **Restoration Concept 11:** Water Importation was proposed by the IRP and would involve importation of desalinated water from the Sea of Cortez, Mexico. Between 860,000 and 1 million

AFY of water would be extracted from the Sea of Cortez, desalinated at an ocean water desalination facility on the western shore of the Sea of Cortez near San Felipe, Baja California, Mexico. In addition, a remediation desalination facility near the Salton Sea was proposed to remove salts and further decrease the salinity of the Sea.

- **Restoration Concept 12:** Water Exchange proposed by the IRP would involve moving between 90,000 to 112,000 AFY of desalinated water from a desalination plant on the eastern shore of the Sea of Cortez to the Canal Alimentador Central, which delivers water to the reservoir behind Morelos Dam on the Colorado River. Through agreement with Colorado River users, an equivalent amount of water would be delivered via the All-American Canal to the Salton Sea. This concept would also include a remediation desalination facility near the Salton Sea to remove salts and further decrease the salinity of the Sea.
- **Restoration Concept 13:** Colorado River Water Transfer proposed by the IRP would involve voluntary fallowing of land in the Salton Basin using financial incentives provided by the State of California to result in a net additional input of 100,000 AFY to the Salton Sea. Water from voluntary transfers could stabilize the Sea's elevation, and paired with remediation desalination, the Salton Sea salinity levels would be reduced.

5.2 Phase 1: 10-Year Plan

In June 2022, CNRA, working as a cooperating agency with the US Army Corps of Engineers, issued a Draft Environmental Assessment (EA) in compliance with NEPA for the SSMP Phase 1: 10-Year Plan (SSMP Phase 1). The EA presents multiple project alternatives and describes a broad range of project elements to be considered the outer limit of project design. However, it is not intended to describe a specific design or a specific commitment to a given design.

The SSMP Phase 1: 10-Year Plan elements described below serve as a reasonably foreseeable baseline condition for evaluating concepts that are part of the LRP. As a starting point, it was assumed that all components described in Section 5.2.1 would be incorporated in all LRP restoration concepts. However, for the purpose of evaluating the widest range of possible outcomes, variations of some concepts have been developed where some components of the 10-Year Plan have been modified or eliminated to achieve specific strategies. Where a specific element of the 10-Year Plan has been modified or eliminated for an individual concept, the reason or strategy is explained under that concept's description. For example, a project footprint may be reduced in size to accommodate an LRP concept feature, or removed to further a regional goal (e.g., access to geothermal energy resources).

5.2.1 Components of the Phase 1: 10-Year Plan

The 10-Year plan would be implemented primarily within the exposed lakebed areas surrounding the Salton Sea. The planning area for the proposed project is 63,008 acres between the 2003 and projected 2028 water surface elevations. Within the planning area, opportunity areas have been identified which cover approximately 42,780 acres and further refine the potential locations of aquatic habitat restoration and dust suppression projects. The opportunity areas will help determine a regional analysis in the NEPA process and allow for design and permitting within the larger area. Under the Proposed Project, individual projects that would be implemented to meet the State's goal of 29,800 acres would be located within the opportunity areas according to the greatest need and best opportunity. Projects would generally be placed on available land at elevations below -228 feet mean sea level (msl) based on the North American Vertical Datum (NAVD) of 1988 (NAVD 1988).

Projects would be implemented at various locations around the perimeter of the Salton Sea in Riverside and Imperial counties as shown in Figure 5-1. The amounts, types, and locations of aquatic habitat and dust suppression projects would be based on location and availability of a water supply, land access, suitable soils, landscape/habitat compatibility, and the emissions from the exposed lakebed. To the extent feasible, naturally forming wetlands along the exposed lakebed at the outlets of drains and other drainage would be avoided or enhanced. Construction of habitat projects would begin in areas of exposed lakebed near water sources and would move downslope as the Sea recedes and more lakebed becomes exposed over time. Construction of habitat and dust suppression projects in areas that eventually become exposed lakebed, but are currently under water, would begin when portions of those areas are dry enough to allow equipment access.

To the extent that public amenities (as described in Chapter 6) do not conflict with the overall purpose and need of the proposed SSMP Project, they will be prioritized in the design of individual projects.

Some opportunity areas are within the Salton Sea Known Geothermal Resource Area (KGRA). This area has the potential to be developed with geothermal uses, and future geothermal power plants may be in areas that are currently submerged by the Salton Sea. SSMP projects would be designed to be compatible with existing geothermal facilities. It is anticipated that aquatic habitat and dust suppression projects could be adapted, as needed, to accommodate future geothermal facilities such as well pads and access roads. Modifications to aquatic habitat and dust suppression projects to accommodate this future development would be the responsibility of the geothermal developers, and analysis of such development is outside the scope of this document.

Certain sites within the SSMP Phase 1 will be implemented in accordance with the conservation practices described in the National Watershed Program Manual, as required by the NRCS to receive technical and financial assistance for project implementation through the Watershed Protection and Flood Prevention Act of 1954. A Watershed Plan is included as a subset of potential projects in the EA. Watershed Plan projects can occur on non-federal and Tribal lands.

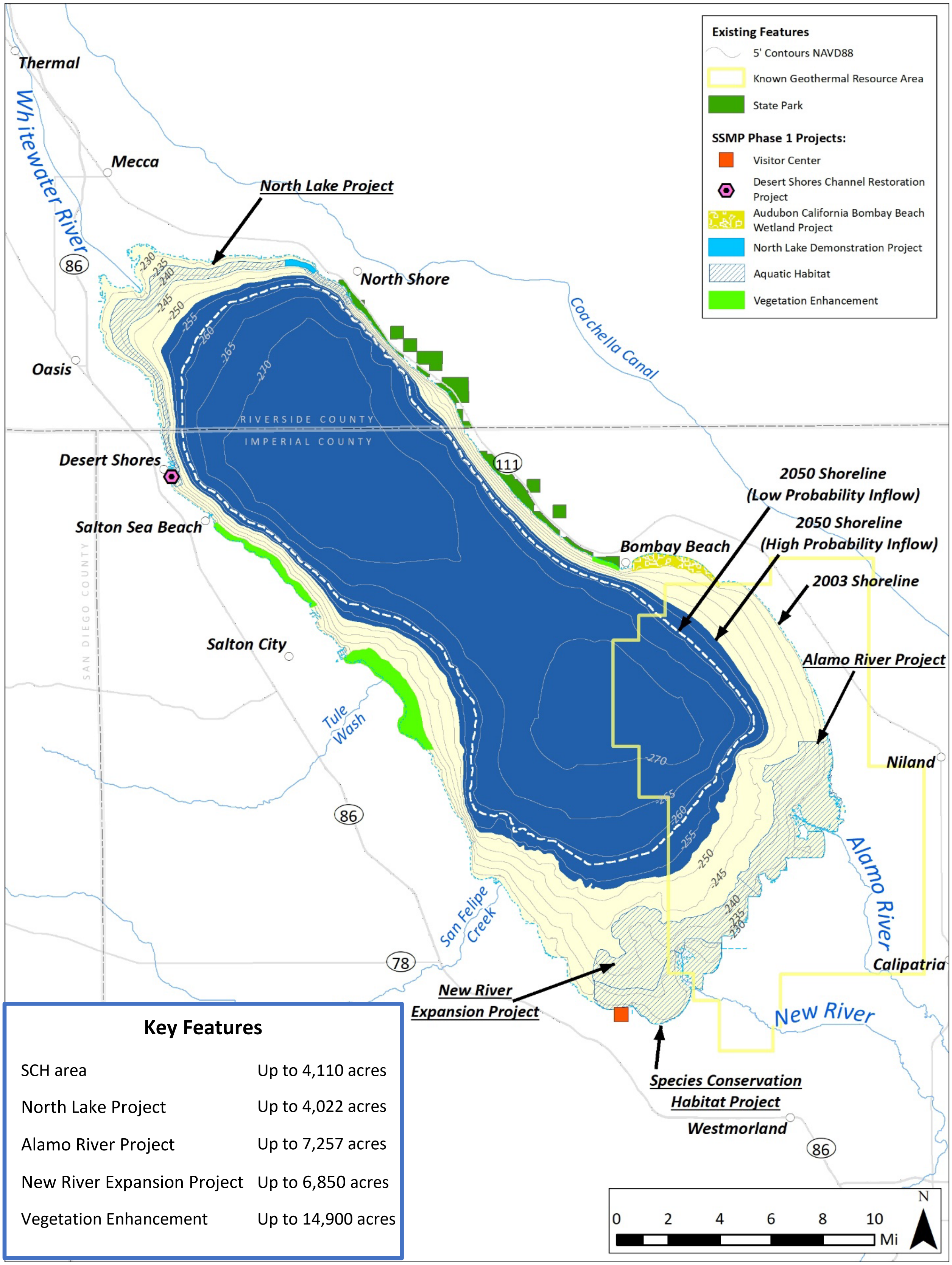

Figure 5-1. Phase 1: 10-Year Program.

Aquatic Habitat Restoration Opportunity Areas – Aquatic habitat restoration opportunity areas are proposed near the New, Alamo, and Whitewater rivers. The aquatic habitat restoration projects would consist of one or more large, ponded units that may be subdivided into one or more smaller ponds created by internal subdivision berms. Depending on site characteristics, projects would be designed to consist of suitable deep-, mid- and shallow-aquatic habitat to support fish and piscivorous birds. The primary water supply for the ponds would be a combination of brackish river water and hypersaline water from the Sea, but other sources may be used as well. Aquatic habitat restoration projects could also include mudflats and permanent vegetated wetlands in conjunction with the ponds to support shorebird and marsh bird foraging and nesting.

Between 10,790 and 19,062 acres of aquatic habitat restoration projects will be analyzed for coverage as part of the proposed SSMP Phase 1 Project. The 10,790 acres represent the minimum required habitat acreage of 14,900 acres minus the already approved 4,110-acre SCH Project under development. The high end of the range represents the total amount of aquatic habitat that could be created within all proposed aquatic habitat restoration opportunity areas and would be in addition to the SCH Project.

Cumulatively, the projects included within the SSMP Phase 1 would provide habitat for invertebrates, fish (including desert pupfish), and a variety of bird species. Development of pond habitat around the Sea would be designed to support robust fish populations, which would in turn provide food for piscivorous birds. Some of the projects would also provide habitat and connectivity for desert pupfish. Projects being proposed are summarized below and include the North Lake Demonstration Project, the North Lake Project, the New River Expansion, and the Alamo River Project. In addition, proposed aquatic habitat restoration projects would include one or more aquatic habitat types and features as described in the sections below.

Salton Sea Species Conservation Habitat (SCH) Project – The SCH Project met CEQA and NEPA compliance through past documentation. Design and construction of the SCH Project began under a design-build contract in Fall 2020. Approximately 4,110 acres of ponds will be constructed to restore piscivorous bird habitat lost due to the Salton Sea's increasing salinity and reduced area. The SCH ponds will be located below the -228 feet msl in areas near the outlet of the New River. SCH ponds will include berms and channels to manage water movement in the newly created habitat areas. The water supply will be a mix of brackish river water and hypersaline water from the Sea to produce salinity levels suitable for fish and other wildlife.

North Lake Projects – The North Lake Demonstration Project consists of an approximately 160-acre lake located at the northern end of the Sea in Riverside County northwest of the Salton Sea State Recreation Area. The demonstration project is proposed as a stand-alone, first-phase component of a larger North Lake Project. It would be considered the first phase of a project in the Whitewater Area identified in the SSMP 10-Year Plan. The proposed demonstration project is located near the existing North Shore Yacht Club. The lake would have shallow- and deep-water fish and bird habitat, which would also support recreation. Water would be supplied to the project via agricultural drainage, well water, canal water, or temporary use of canal water in the required amount of 1,900–2,650 AFY. Additional recreation opportunities would be provided with the construction of a concrete boat ramp and a trail with interpretive signage.

The North Lake Project would include a proposed area of up to 3,862 ac and be designed to be compatible with the North Lake Demonstration Project. Three or more interconnecting ponds would be constructed on both sides of the mouth of the Whitewater River/Coachella Valley Storm Water Channel

(CVSWC) Delta in the north Salton Sea. The shoreline of the North Lake ponds would run from near Desert Shores on the west to near the northern portion of the Salton Sea State Recreation Area on the east.

An allowance would be made to pass flood flows from the CVSWC into the Salton Sea. Several methods are being investigated to provide this flood protection. The ponds would provide shallow- and deep-water fish and bird habitat, dust control, and possible public use activities. The habitat would be brackish to saline, and the deep-water habitat area would be 8- to 12-feet deep. Three sources of water may be available to sustain these ponds: (1) the Whitewater River/CVSWC; (2) local agricultural drains; and (3) the Salton Sea. For the 3,862-ac lake area, the estimated inflow required is about 50,000 AFY, of which 20 percent, or 10,000 AFY, would need to be from saline water pumped from the Salton Sea, and the remaining 40,000 AFY would need to be supplied by local surface water flows. Ponds would be created by constructing berms 10 to 15 feet high along the -245 to -250 feet elevation contours, with the water surface in the ponds planned at -237 feet below sea level.

Alamo River Project – Up to approximately 8,310 acres of aquatic habitat restoration opportunity area is proposed for aquatic habitat ponds at the Alamo River. The features of the Alamo River Project would be like those described for the New River Expansion Project. This project would include shallow- and deep-water brackish and saline habitat, and likely would include features such as bird islands. Water would be supplied from the Alamo River and combined with saltwater pumped from the Sea. The aquatic habitat ponds would likely be located on either side of the river mouth and could run west toward Red Hill Bay and east in the direction of the Wister Unit of the Imperial Wildlife Area. Like the SCH Project, the Alamo River habitat area would be constructed with a series of berms.

New River Expansion Project – Up to approximately 6,850 acres of aquatic habitat restoration area are proposed for habitat ponds near the outlet of the New River and surrounding the SCH Project. The New River Expansion Project would be similar to the planned habitat within the SCH Project, including both shallow- and deep-water brackish and saline habitats. Water from the SCH ponds could be released down gradient to the expanded area and likely be combined with water directly from the New River and saltwater pumped from the Salton Sea. The expanded area could run west and north in the direction of the former Salton Sea Navy Test Base, east toward Red Hill Bay, and down slope toward elevations lower than the SCH Project. Like the SCH Project, the proposed expansion habitat area would be designed and constructed with a series of berms to form tiers of ponds and include multiple bird islands.

Future and Other Smaller Projects – Should inflows to the Sea decline further in the future and expose additional lakebed, additional habitat projects could be developed. In addition, several smaller projects are currently planned, either as stand-alone or pilot projects, including smaller projects near the planned North Lake Project, at Desert Shores, and near Bombay Beach.

Aquatic Habitat Restoration Types and Features – Proposed aquatic habitat ponds would provide suitable water quality and physical conditions to support a variety of aquatic habitats. These ponds would incorporate fresh and saline water in amounts that provide salinity ranges to support fish species not able to survive in an increasingly saline Sea.

Aquatic habitat ponds would have different water depths to provide fish refugia and accommodate shoreline habitat in the project location. Desert pupfish habitat would be designed into projects where connectivity and habitat benefits could be achieved.

Several available technical reports and habitat mapping efforts identify types and locations of habitats around the Sea. The United States Geological Survey (USGS) prepared a Salton Sea Ecosystem Monitoring and Assessment Plan (USGS 2013) which outlines habitat types and biological monitoring protocols. The State also contracted with Audubon California to develop the technical report, *Quantifying Bird Habitat at the Salton Sea* (Audubon California 2016). The report identifies and quantifies the current acreage of each habitat type, comparing it to the amount of habitat in previous years. The State used the information from this report to inform habitat types needed for the SSMP Project.

The development of the habitat types listed below would provide habitat diversity across projects to support the fish and wildlife dependent on the Salton Sea ecosystem. Each aquatic habitat restoration project would be designed based on site conditions and feasibility. Therefore, all habitat types would not necessarily be proposed for each project. The following are descriptions of habitat types comprising the aquatic habitat restoration projects:

Mudflats and Shallow-Water Habitat. Water depth less than 6 inches. The shallow-water habitat would contain areas of this habitat type along the shallower end of each pond. The mudflats and shallow-water habitats would support shorebirds.

Mid-Depth Habitat. Water depth 6 inches up to 4.5 feet. While there is a considerable amount of mid- to deep-water habitat at the Sea, the increases in salinity will likely render it unsuitable for fish. Mid-depth habitat would range in depth from 6 inches up to 4.5 feet deep and support habitat for a broad range of aquatic and bird species.

Deep-Water Habitat. Water depth 4.5 feet and above. These ponds would be designed with varying depths with the deepest portions designed as fish refugia areas. This habitat supports plunging and diving birds that are mainly piscivorous, such as double crested cormorants (*Phalacrocorax auritus*), brown pelicans (*Pelecanus occidentalis*), and American white pelicans (*Pelecanus erythrorhynchos*). The habitat would support other groups of birds that may feed on the edges of the pond and use the structures, such as islands.

Permanent Vegetated Wetlands. Water depth less than 3 feet. These wetland areas would support habitat for California black rail (*Laterallus jamaicensis coturniculus*), Yuma Ridgway's rail (*Rallus obsoletus yumanensis*), fulvous whistling-duck (*Dendrocyna bicolor*), and other secretive marsh birds, waterfowl, and shorebirds. The marshes would utilize water with less than 20 ppt of salinity to develop suitable wetland vegetation communities. Wetlands could be unmanaged wetlands or managed to be seasonally or permanently wet.

Interim dust suppression measures could be implemented within the habitat project footprints. Interim dust suppression measures, such as temporary surface roughening, could be used to control dust until habitat projects are completed.

AVIAN HABITAT FEATURES – The proposed habitat ponds would provide suitable water quality and physical conditions to support a productive bird community. The ponds would incorporate habitat features to increase foraging, nesting, and roosting. The type and placement of such features would depend on the habitat needs of different species, site conditions, and feasibility, and would be varied to test performance of different techniques. Examples of habitat features being considered for potential inclusion include:

Islands. Islands for roosting, nesting, and foraging would provide habitat for birds that is relatively protected from land-based predators. Habitat ponds would be designed to include zero to several islands, which could be designed as roosting islands or large or small nesting islands. The number and placement of islands would be determined by the pond size, shape, and depth. Islands would be placed at least 900 feet from the shore and in at least 2.5 feet of water to discourage access by land-based predators such as coyotes and raccoons.

The islands would be constructed by excavating and mounding up existing lakebed sediments to create a low-profile embankment approximately 1 to 4 feet above the waterline and covered with appropriate substrate for the targeted species. The islands may also be constructed by mounding sediments to create a tall profile (up to 10 feet) and armored with riprap to create rocky terraces.

An alternative to this island habitat technique could be constructing islands that would float on the pond's surface rather than using conventional excavation and placement of lakebed sediment. Floating islands could be made of mats of vegetation, or human-made floating objects.

Snags or Other Vertical Structures. Snags or other vertical structures could be installed in the ponds to provide roosting or nesting sites. Options for such structures include dead branches or artificial branching structures mounted on power poles. These structures would be optional pond features, depending on the presence of existing snags and roosts, availability of materials, and cost feasibility.

Seasonal Flooding. Seasonal flooding may be used to manage water use at some of the pond areas. This would be achieved by flooding ponds during the migration and/or nesting season to provide bird habitat. During off-seasons, inflows could be reduced to levels just sufficient to keep soils saturated. This technique may be most feasible at the north end of the Salton Sea, where groundwater levels are closer to the surface (CNRA 2018).

FISH HABITAT FEATURES – The proposed habitat ponds would provide suitable water quality and physical conditions to support a productive aquatic community including fish and invertebrates. The ponds would incorporate habitat features to increase microhabitat diversity and provide cover and attachment sites (e.g., for barnacles). The type and placement of such features would depend on habitat needs of different species, site conditions, and feasibility, and would be varied to test performance of different techniques. Examples of habitat features being considered for potential inclusion include:

Swales or Channels. These features would be excavated through the middle of ponds to the exterior berm approximately 2 to 4 feet below the surface of the pond bottom and approximately 20 to 150 feet wide. The channels would be sloped toward the exterior berm to be self-draining if a pond's water level was lowered or the pond was emptied for emergency purposes. The width of the swales might be larger depending on the soil conditions and the need to prevent sloughing of soil into the channel during pond operation. The swales or channels would create variable depths to enhance habitat diversity and would provide connectivity along a depth gradient from shallower habitat to deeper areas toward the Salton Sea. Swales could be created along the sides of the pond as a result of excavation and construction of berms.

Hard Substrate on Berms. Berms would be armored with riprap to protect the toe, spanning approximately a 1- to 2-foot depth at the waterline. This rocky substrate would also provide diverse microhabitat amid the interstitial spaces and hard attachment points for algae or invertebrates.

Bottom hard substrate – The projects could include some patches of submerged hard substrate (e.g., rip rap, concrete) in certain ponds to increase the amount of cover and attachment sites for sessile or benthic organisms (e.g., benthic macroinvertebrates and algae) that support food for fish.

Dust Suppression and Vegetation Enhancement – Projects would be considered dust suppression and vegetation enhancement projects because they would both (1) suppress dust and (2) enhance vegetation and habitat values for birds and other species. These projects would be located in opportunity areas to target the most emissive exposed lakebed areas as the Sea recedes. Dust suppression projects can be constructed with and without the use of water. The current proposed dust suppression areas include Wister-Frink, Kane Spring, Bombay Beach, West Bombay Beach, San Felipe Fan, Tule Wash, Clubhouse, Coachella Exposed Lakebed, and North Shore.

Water-reliant dust suppression techniques would include vegetation establishment, shallow-water habitat and freshwater wetlands, shallow flooding, and stormwater spreading. Vegetation establishment would use different plant communities that vary in their tolerance to salinity and drought. Water requirements would vary by plant community and soil type for use in soil reclamation, irrigation needed to establish vegetation, and to ensure long-term vegetation survival.

Waterless dust suppression techniques depend on soil type. Treatments include temporary surface roughening, dust suppressant applications, sand fencing, engineered roughening, gravel or other cover, and soil crust enhancement. These waterless techniques may require an initial application of water, but they generally do not depend on periodic surface water application. Project sites with initial waterless dust control methods, such as temporary surface roughening, would transition in the future to more sustainable treatments such as vegetation planting and shallow-water habitat as water becomes available and infrastructure is developed. The Proposed Project would strive to provide projects that combine dust suppression with habitat values such as freshwater wetlands, vegetation establishment, and water spreading to create shallow-water habitat.

5.2.2 Performance, Expected Benefits, and Recreational Opportunities

To the extent practicable, the Phase 1: 10-Year Plan would strive to provide multiple benefits that combine dust suppression with habitat restoration. At least 14,900 acres of projects implemented under the SSMP are planned to be aquatic habitat restoration projects that convert exposed lakebed areas to pond habitat suitable for fish and wildlife. Dust suppression projects, on the remaining acres, may also have habitat benefits by establishing vegetation or creating freshwater wetlands on exposed areas.

As stated in the EA, 10-Year Plan projects will prioritize including public amenities, such as picnic areas and walking trails, provided that the amenities do not conflict with the project's overall purpose and need. Specific recreational opportunities and community public amenities associated with the Phase 1: 10-Year Plan include the following:

- A Visitor Center included as part of the SCH Project will provide educational information about the SCH Project, the wildlife of the area, and the Salton Sea in general. It will also provide bird watching opportunities.
- The North Lake is expected to be open to the public for boating, fishing, and possibly water contact activities.
- The Audubon Bombay Beach project will provide opportunities for recreational use, education, and community involvement.

Other possible public amenities could include picnic areas, walking trails, parking, launch features for non-motorized boats, areas for bird watching, shelter, and information displays or other passive recreation access compatible with an authorized aquatic resource habitat restoration or dust suppression project. Projections of future elevation and salinity performance for the Phase 1: 10-Year Plan are provided in Figure 5-2.

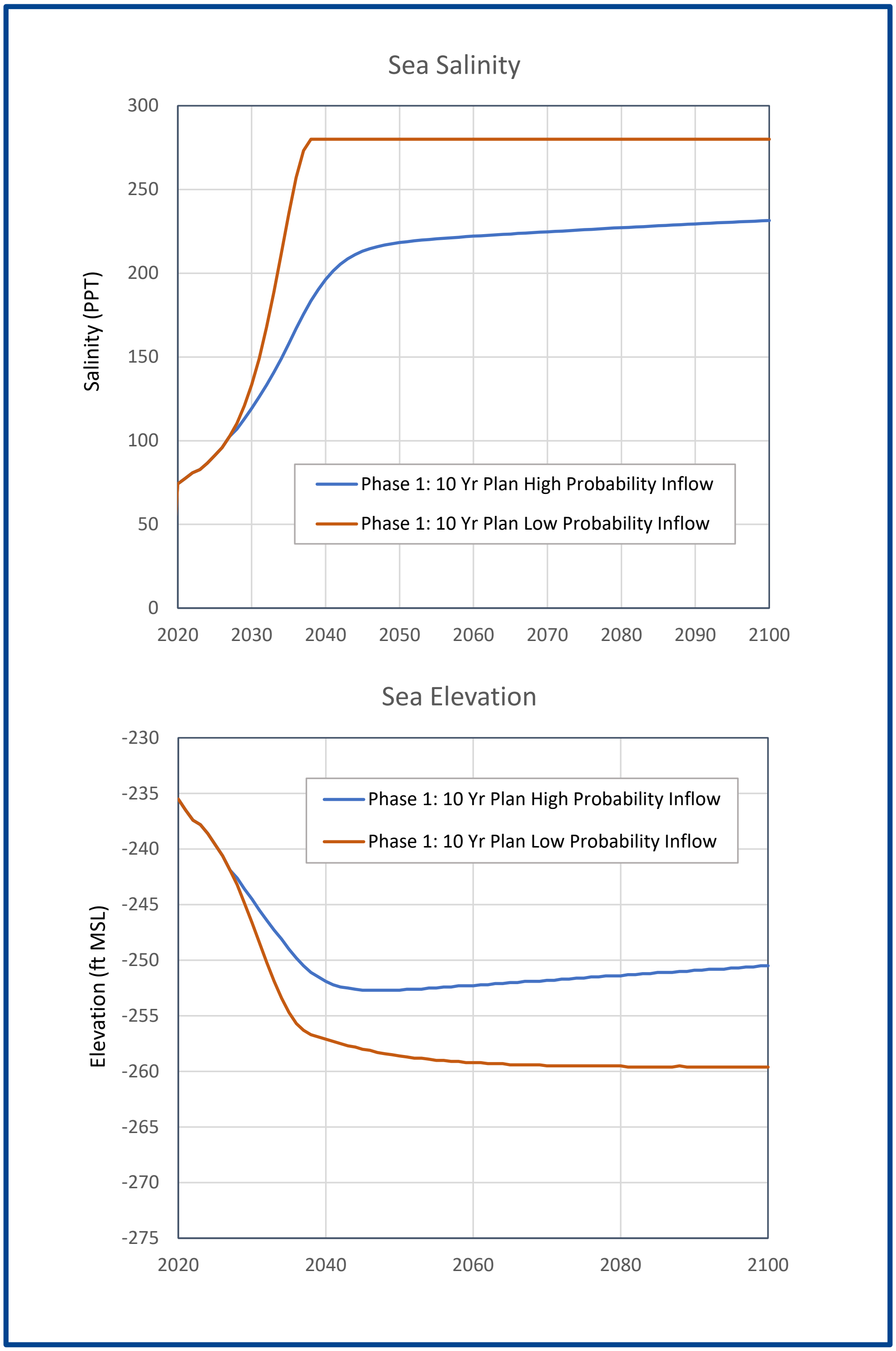

Figure 5-2. Salinity and Elevation Projections for the Phase 1: 10-Year Plan.

5.2.3 Status and Cost Estimate

Status – The Phase 1: 10-Year Plan serves as a baseline from which Phase 2 concepts can be compared.

Cost Estimate – The estimated cost for the full Phase 1: 10-Year Plan is based on the following factors:

- The actual cost for the construction of the SCH Project, which is based on the contracted cost of the design-build program.
- The costs for other habitat projects estimated by per-acre costs from SCH and scaling by acreage of the other projects.
- State budget estimates for the smaller projects.

Costs for operation, maintenance, energy, and replacement (OMER) have been estimated at 5 percent of capital construction costs. The estimated costs for the Phase 1: 10-Year Plan are shown in Table 5-1.

Table 5-1. Phase 1: 10-Year Plan Cost Estimate

Plan Features	Full 10-Yr Plan	w Perimeter Lake	Limited 10-Yr Plan
North Lake Demonstration Project	$19,250,000	$19,250,000	$19,250,000
North Lake Project	$200,000,000		$120,000,000
SCH	$206,500,000	$206,500,000	$206,500,000
SCH Vegetation Project	$30,000,000	$30,000,000	$30,000,000
Alamo River Project	$365,000,000	$365,000,000	
New River Expansion	$374,000,000		$374,000,000
Audubon Bombay Beach Wetland	$37,500,000	$37,500,000	$37,500,000
San Felipe Fan Restoration	$33,000,000	$33,000,000	$33,000,000
Wister Marsh Restoration	$8,000,000	$8,000,000	$8,000,000
Other Smaller Projects	$20,000,000	$20,000,000	$20,000,000
Estimated Total Capital Costs	**$1,293,250,000**	**$719,250,000**	**$848,250,000**
Annual OMER @5%	$64,662,500	$35,962,500	$42,412,500

5.3 Restoration Concept 1: North/South Marine Sea

The North/South Marine Sea concept took aspects from many of the alternatives evaluated in the October 2006 CNRA Draft PEIR. This concept includes a Saline Habitat Complex in the northern and southern seabed, a Marine Sea that extends around the northern shoreline from San Felipe Creek to Bombay Beach in a "horseshoe" shape, Air Quality Management facilities to reduce particulate emissions from the exposed lakebed, brine sink for discharge of salts, Sedimentation/Distribution facilities, and Early Start Habitat to provide habitat prior to construction of the habitat components. This concept could also be configured to accommodate future geothermal development. The North/South Marine Sea concept is illustrated in Figure 5-3 and the components of the concept are described below.

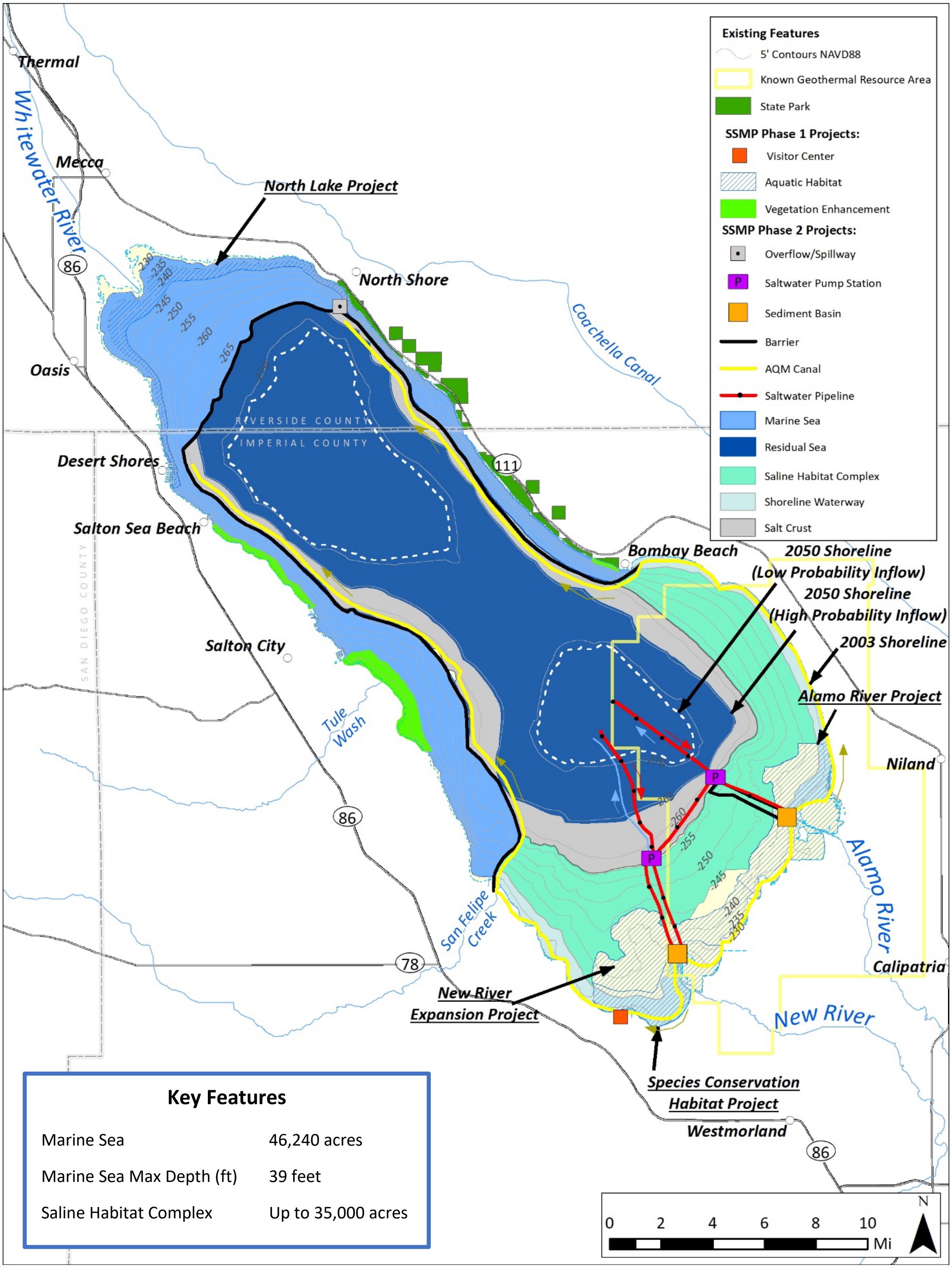

Figure 5-3. Concept 1A: North/South Marine Sea.

5.3.1 Components of the Restoration Concept

Key components of this concept are the Saline Habitat Complex (SHC), Marine Sea, and Sedimentation Basins. More detailed information about this concept is provided in Appendix A. In addition to the original North/South Marine Sea Concept, labeled as Concept 1A, two variations are under consideration.

Saline Habitat Complex – The SHC is illustrated in Figure 5-4. It would border parts of the Marine Sea and the exposed lakebed to support indigenous food webs present in the area. Excavated areas of up to 15 feet in depth would be incorporated to increase habitat diversity and provide shelter for fish and invertebrates. The salinity in the complex would range from 20 PPT to 200 PPT to reduce vegetation growth, selenium ecological risk, and vector populations. Water would be supplied from the New, Alamo, and Whitewater rivers plus water recycled from the brine sink or upgradient SHC cells to achieve a minimum salinity of 20 PPT. The first rows of the eastern and western southern SHC would serve as a mixing zone for the inflows and saline water and would be maintained at a salinity of 20 to 30 PPT. Berms would be constructed of suitable earthfill materials excavated from the seabed with 3:1 side slope. A 20-foot-wide gravel road on top of each berm would allow access for maintenance. Rock slope protection would be placed on the water side of the berm. Water depths would be less than 6 feet (2 meters). Berms could not be constructed until the residual Salton Sea recedes to an elevation below the berm location.

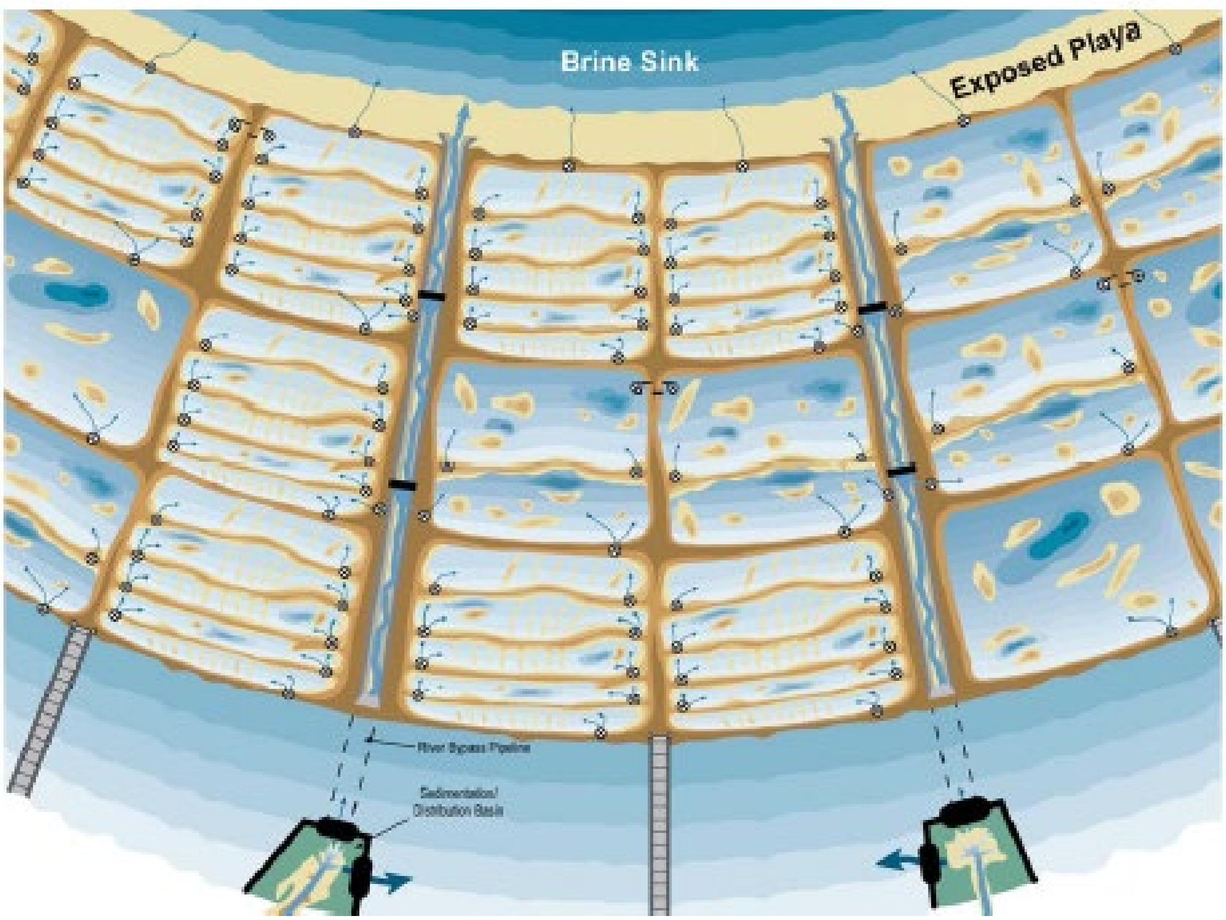

Figure 5-4. Conceptual Saline Habitat Complex Layout

The SHC concept was originally conceived prior to the SCH Project and the other habitat components of the SSMP Phase 1. The SHC could be eliminated in favor of the newer concepts or could be implemented in lower lakebed areas.

Marine Sea – A Marine Sea would be formed through the construction of a Barrier. The Marine Sea would stabilize at a surface water elevation of -230 feet msl with salinity levels between 20 PPT and 40 PPT. Air Quality Management Canals, Sedimentation/Distribution Basins, and Early Start Habitat would be constructed between the -228 and -230 foot msl contours and would avoid conflict with existing land use along the shoreline. Sources of inflows would include the Whitewater River, Coachella Valley drains, Salt Creek, San Felipe Creek, and local drainages. Flows from the New and Alamo rivers would be blended in a large Air Quality Management Canal and diverted into the SHC and the southeastern and southwestern portions of Marine Sea. The portion of the Air Quality Management Canal located between the Sedimentation/Distribution Basins and Marine Sea would be located along the shoreline of the SHC and would be siphoned under major drainages and agricultural drains. Air Quality Management Canals would continue on the interior side of the Barrier where the Marine Sea is located. Flows from the Marine Sea would spill to the brine sink to maintain salinity and elevation control.

The water depth would be less than 39 feet, but additional data should be collected, and the maximum water depth should be re-evaluated prior to the final design in the project-level analysis. The barrier would be constructed of rock with a seepage barrier on the upstream base. The barrier would be up to 47 feet above the existing seabed and up to a half-mile wide at the base. The final slope of the barrier would be 10:1 on the marine side and 15:1 on the down gradient side, and it would need to comply with DWR Division of Safety of Dams regulations. The barrier would be constructed using barges and would need to be constructed before the brine sink recedes. Efficient methods of construction are still in need of evaluation.

Sedimentation/Distribution Basins – Inflows from the New and Alamo rivers would be captured in two Sedimentation/Distribution Basins to divert desilted river water into one of Several Air Quality Management Canals or bypass flows into the brine sink. The unlined Sedimentation/Distribution Basins would be excavated along the shoreline and would be located from -228 to -230 feet msl. Water depths would be about 6 feet. Sediment collected in the basins would be periodically dredged and flushed into the brine sink. A sedimentation basin for the New River, which is currently under construction as part of the SCH Project, would be incorporated as one of the sedimentation basins for this concept. Likewise, a similar sedimentation basin is expected to be included as part of the Alamo River Project.

Variations – In addition to the original concept, labeled as Concept 1A and illustrated in Figure 5-3, two variations are being considered:

- **Concept 1B: North/South Marine Sea Without SHC.** As illustrated in Figure 5-5, this concept would be like Concept 1A, except that the SHC would not be included. The SHC was conceived prior to conception of the Phase 1: 10-Year Plan habitat projects. Projects that are part of the Phase 1: 10-Year Plan provide many of the shallow habitat benefits originally envisioned for SHC. Eliminating the SHC will significantly reduce the water requirement. Concept 1B provides Increased drought resiliency at a lower cost than Concept 1A.
- **Concept 1C: North/South Marine Sea Without SHC & Alamo Project, with Freshwater Reservoir.** As illustrated in Figure 5-6 for the High Probability Inflow Scenario and Figure 5-7 for the Low Probability Inflow Scenario, this concept would be like Concept 1B, except that it would not include the Alamo River Project and would include a freshwater reservoir, for which two

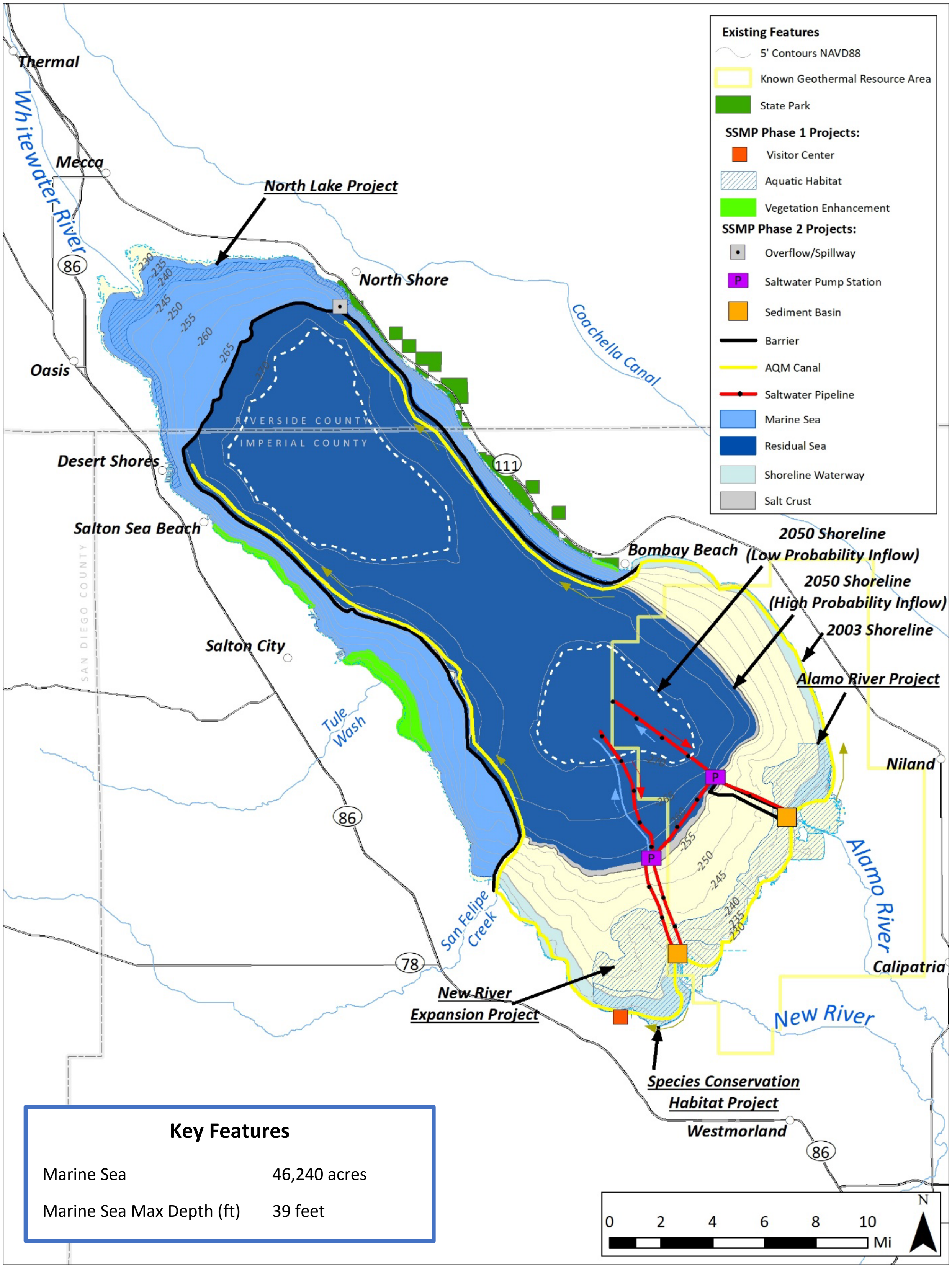

Figure 5-5. Concept 1B: North/South Marine Sea without SHC.

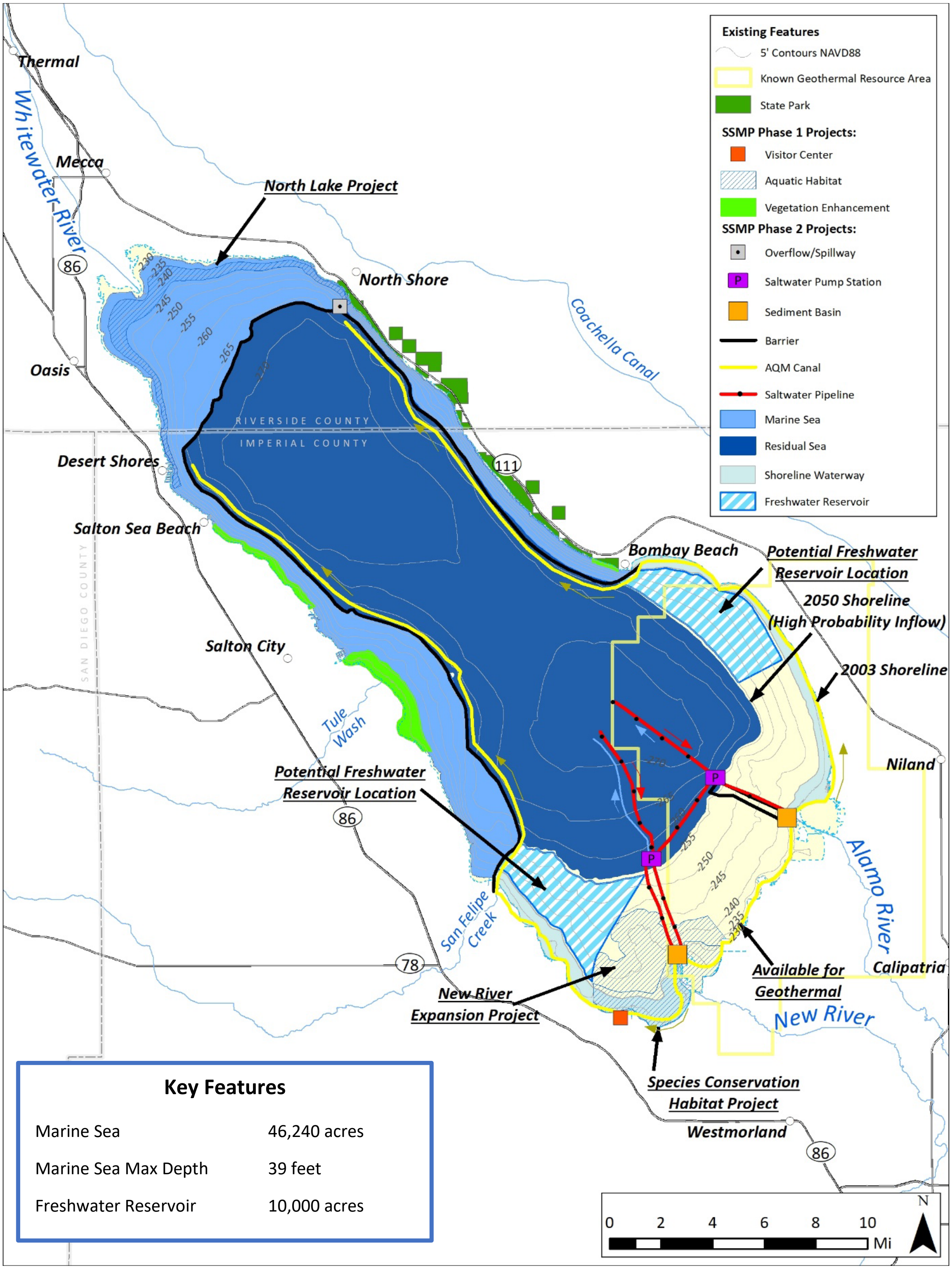

Figure 5-6. Concept 1C: North/South Marine Sea without SHC & Alamo Project, with Freshwater Reservoir, High Probability Inflow Scenario.

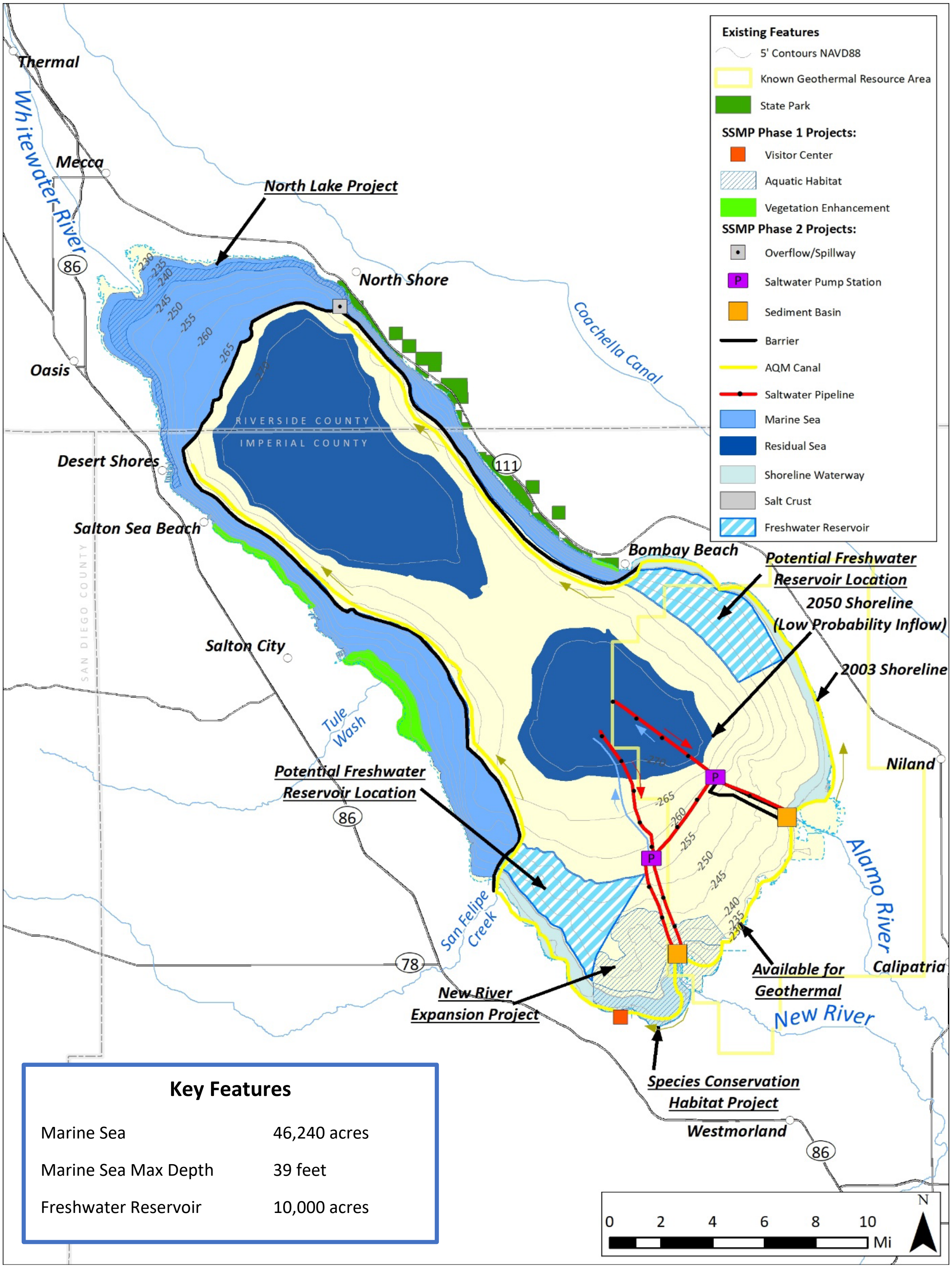

Figure 5-7. Concept 1C: North/South Marine Sea without SHC & Alamo Project, with Freshwater Reservoir, Low Probability Inflow Scenario.

possible locations are shown. This concept was developed to provide enhanced access for geothermal energy development and lithium extraction within the KGRA. Also, the freshwater reservoir would provide water storage that could be used for geothermal energy production or agricultural purposes. In addition, the reservoir would provide freshwater habitat and cover exposed lakebed to help control dust generation.

5.3.2 Performance, Expected Benefits, and Recreational Opportunities

Upon completion of the barrier, the water in the marine sea area, would return to a lower salinity in the range of 20 to 40 PPT. The elevation would be maintained close to historic levels at around -230 feet msl, but at a low enough level to avoid nuisance flooding. This would provide habitat benefits as well as a large area for recreational activities such as boating and fishing. The communities around the Sea from Salton City to Bombay Beach would have access to the lake as they did prior to the Sea's declining elevation over the past several years. Other amenities such as recreational areas, boat launches and trails could be added to take advantage of these benefits.

Estimated water requirements for the North/South Marine Sea concepts are provided in Table 5-2. As shown in Table 5-2, the water requirements for Concepts 1A, 1B, and 1C are about 800,000 AFY, 690,000 AFY, and 630,000 AFY, respectively. It has been assumed that the Phase 1 North Lake Project would ultimately be subsumed as part of the Marine Sea. The barrier used to form the North Lake could serve as a breakwater to protect the north shore area from high wave activity. For Concept 1A, seepage and flow through for the Phase 1 projects in the south have been assumed to flow into either the Marine Sea or the Saline Habitat Complex. Therefore, only evaporative losses of 6 feet per year are estimated for these projects. However, for Concepts 1B and 1C, the seepage from the New River Expansion and Alamo projects is assumed to be lost to the Residual Sea. The losses from these projects are estimated at 8 feet per year from combined evaporation and seepage.

Figure 5-8 provides a comparison of Concept 1 water requirements with the inflow scenarios that are being evaluated in this Plan. In evaluating the performance of the North/South Marine Sea concepts with respect to the inflow scenarios, it was assumed that the highest priority would be to meet all the requirements of the Phase 1 projects and maintain sufficient water for vegetation enhancement or other means of dust control on exposed lakebed. The next priority would be maintaining the Marine Sea, and the final priority would be maintaining the Saline Habitat Complex. If it were determined that sufficient water would not be available to keep the Saline Habitat Complex full, filling of ponds within the complex could be rotated on a seasonal or annual basis.

Table 5-3 shows the water requirements for North/South Marine Sea Phase 2 projects compared to water availability under each of the inflow scenarios. Note that in this table, only water available for Phase 2 Projects is shown after deducting the water required for Phase 1 projects and for dust control. For the High Probability Inflow Scenario, sufficient water would be available to support Phase 2 projects for all three scenarios. For the Low Probability Inflow Scenario, there would be enough water to support the Marine Sea at the design elevation. However, for Concept 1A, after filling the Marine Sea, only about 57,000 AFY would be available for the Saline Habitat Complex, which would keep about one-third of the ponds full at any given time. For the Very Low Probability Inflow Scenario, there would only be enough water to keep the Marine Sea at about 60-65% capacity, meaning the area would shrink to about 30,000 acres and there would be no water available for the Saline Habitat Complex.

Table 5-2. Estimated Water Requirements for the North/South Marine Sea Concepts.

Feature	Area (ac)	Losses (ft/yr)	Water (AFY)
Concept 1A			
Phase 1			
Vegetation	2,860	0.5	1,430
Wetlands	680	5.0	3,402
SCH	4,110	6.0	24,660
New River Expansion	6,850	6.0	41,102
Alamo Project	7,257	6.0	43,542
Phase 1 Total	**21,758**		**114,136**
Phase 2			
Marine Sea	46,240	11.0	508,640
Saline Habitat Complex	35,000	5.0	175,000
Dust Control	4,000	1.0	4,000
Phase 2 Total	**85,240**		**687,640**
Total	**106,998**		**801,776**
Concept 1B			
Phase 1			
Vegetation	2,860	0.5	1,430
Wetlands	680	5.0	3,402
SCH	4,110	6.0	24,660
New River Expansion	6,850	8.0	54,803
Alamo Project	7,257	8.0	58,056
Phase 1 Total	**21,758**		**142,351**
Phase 2			
Marine Sea	46,240	11.0	508,640
Dust Control	39,000	1.0	39,000
Phase 2 Total	**85,240**		**547,640**
Total	**106,998**		**689,991**
Concept 1C			
Phase 1			
Vegetation	2,860	0.5	1,430
Wetlands	680	5.0	3,402
SCH	4,110	6.0	24,660
New River Expansion	6,850	8.0	54,803
Phase 1 Total	**14,501**		**84,295**
Phase 2			
Marine Sea	46,240	11.0	508,640
Dust Control	36,257	1.0	36,257
Phase 2 Total	**82,497**		**544,897**
Total	**96,998**		**629,192**

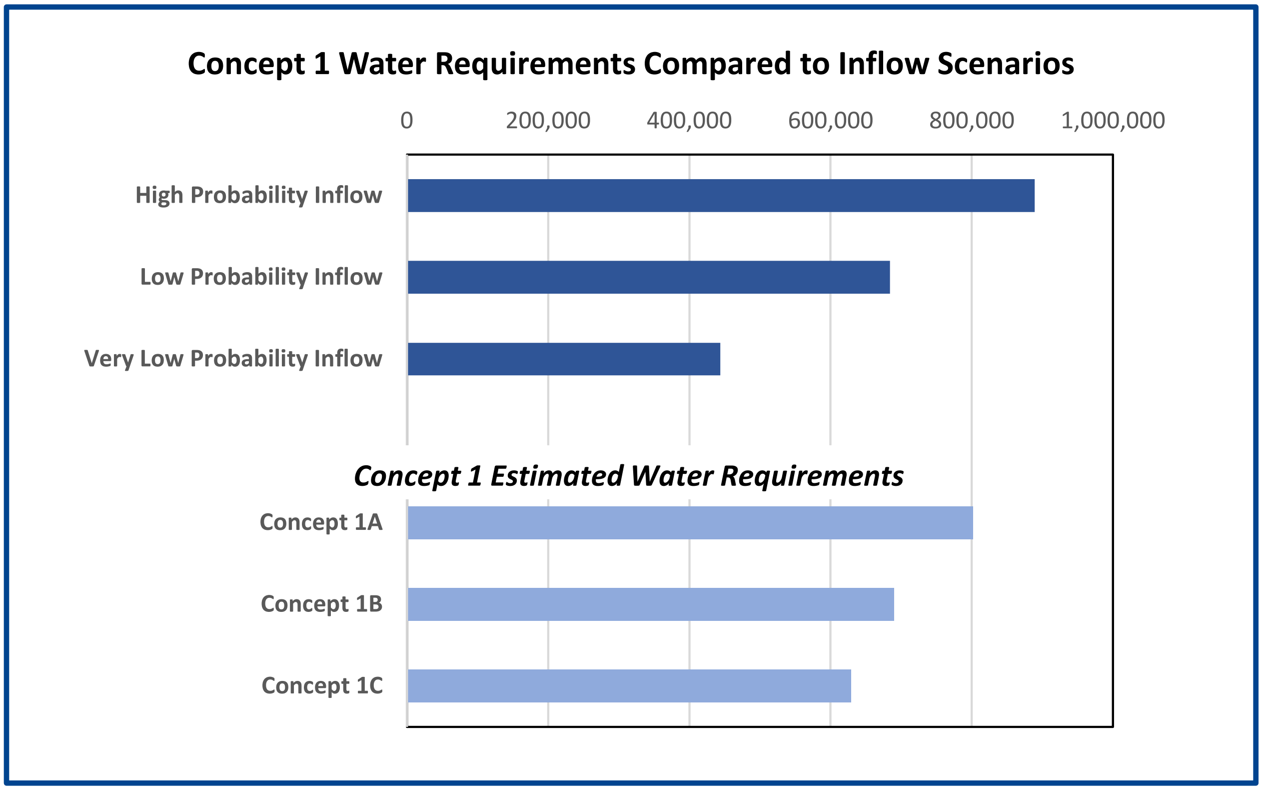

Figure 5-8. Comparison of Concept 1: Water Requirements with Inflow Scenarios.

Table 5-3. Estimated Water Requirements for North/South Marine Sea Phase 2 Projects Compared to Water Availability.

	Phase 2 Water Requirements			**Water Available for Phase 2 Projects by Inflow Scenario**		
Concept	**Marine Sea**	**Saline Habitat Complex**	**Total**	**High Probability**	**Low Probability**	**Very Low Probability**
Concept 1A	508,640	175,000	683,640	770,864	565,864	325,864
Concept 1B	508,640	NA	508,640	707,649	502,649	262,649
Concept 1C	508,640	NA	508,640	768,448	563,448	323,448

5.3.3 Status and Cost Estimate

Status – The North/South Marine Sea Concept and its variations have been retained for analysis and comparison to other alternatives considered feasible in this document.

Cost Estimate – The estimated cost for Concept 1A is based on the Salton Sea Ecosystem Restoration Program, Preferred Alternative Report and Funding Plan published by the State of California, The Resources Agency in May 2007. The estimated costs have been changed to mid-2022 dollars using indices provided by the DGS California Construction Cost Index (CCI).[8] The time-phased capital and OMER updated costs, not including Phase 1 project costs, are provided in Table 5-4.

[8] https://www.dgs.ca.gov/RESD/Resources/Page-Content/Real-Estate-Services-Division-Resources-List-Folder/DGS-California-Construction-Cost-Index-CCCI

Table 5-4. Estimated Costs in Million Dollars for Concept 1A: North/South Marine Sea, Not Including Phase 1.

	Pre-Construction Period	**Major Construction Period**		**Construction Completion Period**		**O&M Period**	**Capital Cost Totals**
Items	2026-2028	2029-2035	2035-2040	2040-2045	2045-2050	2050-2078	
Demonstration Project, Investigations, and Administration	49	-	-	-	-	-	49
Design & Environmental for "Major Construction Period"	752	-	-	-	-	-	752
Barriers	-	10,870	-	-	-	-	10,870
Saline Habitat Complex	-	68	497	410	183	-	1,159
Water Conveyance[a]	-	279	19	111	61	-	471
Unlisted Items	21	-	-	-	-	-	21
Total Study and Capital Costs[b]	**967**	**11,217**	**931**	**887**	**2,050**	**-**	**16,053**
Annual OMER Cost	7	7	80	119	263	225	

Note: Does not include cost of permits, land or easement acquisition, air quality management, or borrowing funds.

[a] Water Conveyance costs includes Sedimentation/Distribution Basins, Air Quality Management Canals, Saltwater Conveyance, Marine Sea Outlet, and roads associated with conveyance facilities.

[b] Capital costs include 5% for unlisted items, 30% for contingences, and 12% for engineering, administration, and legal.

A cost comparison for the three variations for North/South Marine Sea Concept is provided in Table 5-5, which includes both Phase 1: 10-Year Plan and Phase 2 costs. For Concept 1B, the Phase 2 costs have been decreased to account for the elimination of Saline Habitat Complex. Likewise, there has been a commensurate reduction in OMER costs. For Concept 1C, Phase 1 costs have been reduced to account for the elimination of the Alamo River Project. However, the total capital costs remain the same as for Concept 1B. That is because it is assumed that the cost of the freshwater reservoir would be about the same as those for the Alamo River Project. The freshwater reservoir would be a similar size containment facility to the Alamo River Project but would hold freshwater instead of saltwater.

Table 5-5. Estimated Costs in Million Dollars for North/South Marine Sea Concepts 1A, 1B, and 1C.

	Capital Costs ($M)			OMER Costs ($M)		
Restoration Concept	Phase 1	Phase 2	Total	Phase 1	Phase 2	Total
1. North/South Marine Sea						
1A With Saline Habitat Complex (SHC)	1,293	16,053	17,347	65	225	290
1B Without SHC	1,293	6,735	8,028	65	33	98
1C Without SHC, with Freshwater Reservoir	928	7,100	8,028	46	51	98

5.4 Restoration Concept 2: Divided Sea/Marine Sea South

Restoration Concept No. 2 would involve construction of a Mid-Sea causeway that would divide the Sea into two basins. It would provide salinity control in the south basin, but no elevation control. Initially, the marine lake in the south would be greater than 100 sq mi (64,000 ac), but the total area would be reduced over time if future inflows decline. The divided Sea concept is illustrated in Figure 5-9.

The water entering the Sea from the south into the south marine lake would support a large marine habitat. The most significant inflows to the Sea occur from the south end; therefore, the area north of the causeway is expected to serve as an outlet for water and salt from the south side. The north side would rise in salinity until it achieves a level of around 280 PPT, like that of the Great Salt Lake in Utah. As additional salts enter the north basin over time they would crystalize on the bottom or form crusts around the perimeter, and thus the salinity would be expected to stabilize at a concentration of about 280 PPT.

5.4.1 Components of the Restoration Concept

Key components of this concept are the south marine sea that would be created by constructing a causeway and sedimentation basins. Some engineering details about how the Bureau of Reclamation conceived the causeway are provided in Appendix A. In addition to the original Divided Sea/Marine Sea South Concept, labelled as Concept 2A, three variations are under consideration.

Mid-Sea Causeway – The Sea would be divided through the construction of a causeway across the central area of the Sea which is shallower than either of the deepest parts of the north and south basins. The causeway would serve as a Mid-Sea barrier designed to be operated with almost no head differential between the basins. However, it would be designed to accommodate a head differential of up to 5 feet. For most conditions, the water surface elevation in the south basin would be only about 1 foot or less higher than in the north basin. In addition to the marine lake, all the habitat and dust control features associated with the SSMP Phase 1: 10-Year Plan would be included. Figure 5-10, showing the 7-mile Davis County Causeway on the Great Salt Lake in Utah, illustrates how a typical causeway would appear in the Salton Sea.

The Mid-Sea causeway would be constructed with a crest elevation of about -240 feet msl and would accommodate the forecasted reductions in inflows. The divided-Sea concept could be designed to accommodate a wide range of future inflows so that the water surface of the two basins could shrink or grow if future inflows are lesser or greater than expected.

Flow from the south to the north could be controlled through several methods. One simple method would be a simple stop log weir that could be adjusted to control the flow of water to the north. If inflows to the Sea from the south were reduced, the weir would be lowered to increase the flows to the north. If the salinity in the south basin becomes lower than the design target level, the weir could be opened to allow mixing of saltier water from the north to increase the salinity in the south.

The USBR's design for the Mid-Sea causeway, as discussed in Appendix A, envisioned a sand dam with stone columns; however, lessons learned from SCH could be applied to develop alternative designs. The outer berm of SCH would be designed to retain about 7 feet of water, and the inner berms would be designed as barriers with little head differential. The Mid-Sea causeway would be like the interior berms, but in water depths of 20 or more feet and would need to be constructed in the wet. Lessons learned from the construction of the one-mile causeway constructed for access to the SCH saline water intake would also be valuable.

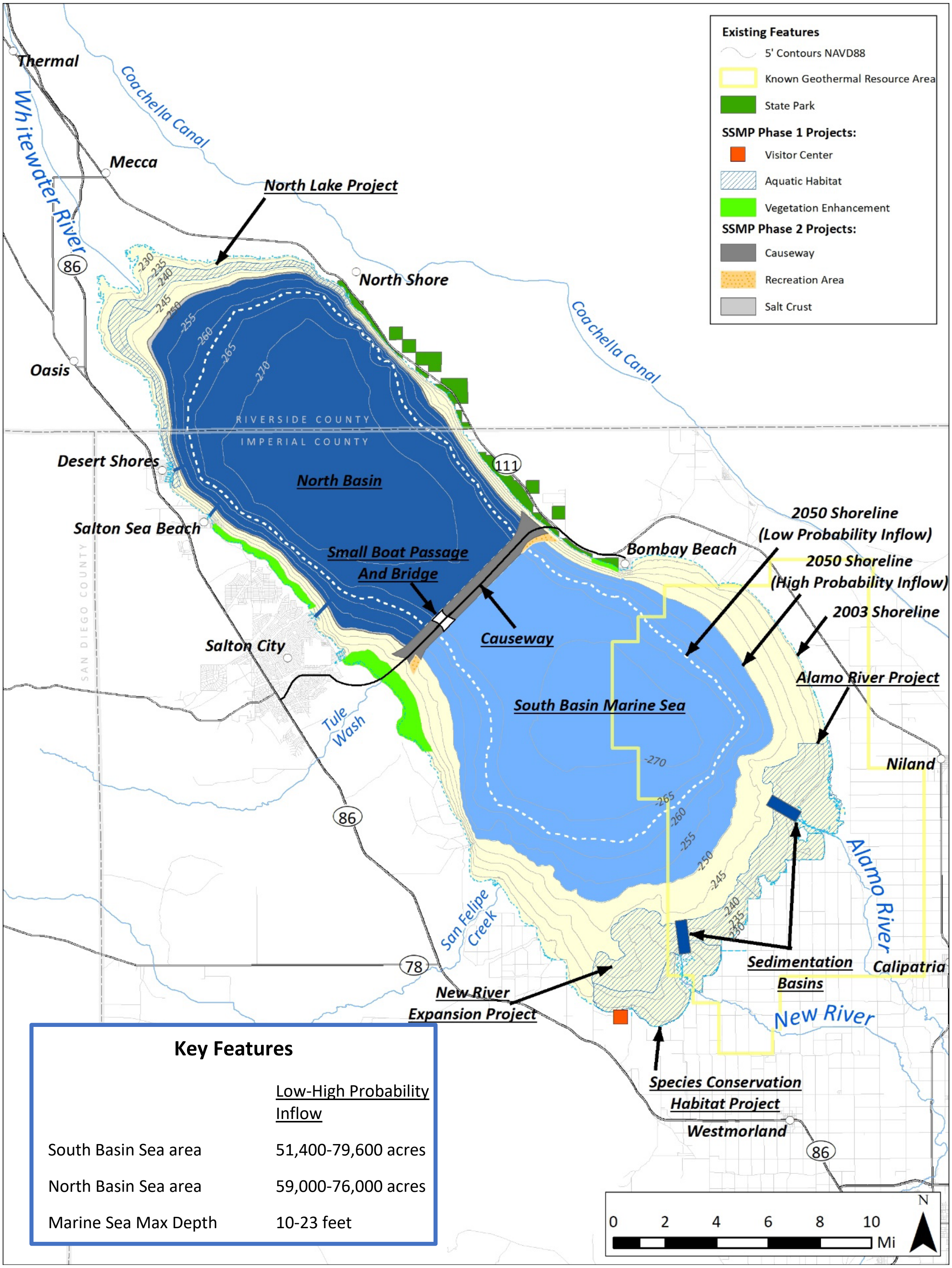

Figure 5-9. Concept 2A: Divided Sea/Marine Sea South.

Figure 5-10. Davis County Causeway on the Great Salt Lake in Utah, Illustrates a Typical Causeway that Would be the Key Feature of the Divided Sea/Marine Sea South.

SEDIMENTATION BASINS – Inflows from the New and Alamo rivers would be captured in two sedimentation basins to flow into the south marine lake. Contaminants attached to fine sediment particles would be removed in these basins. The sedimentation basins would be excavated at the mouths of the New and Alamo rivers. Water depths would be about 6 feet. Sediment collected in the basins would be periodically dredged and disposed. A sedimentation basin for the New River, which is currently under construction as part of the SCH Project, would be incorporated as one of the sedimentation basins for this concept. Likewise, a similar sedimentation basin is expected to be included as part of the Alamo River Project.

VARIATIONS – In addition to the original concept, labeled as Concept 2A and illustrated in Figure 5-9, three variations are being considered:

- **Concept 2B: Divided Sea/Marine Sea South Without Alamo River Project.** As illustrated in Figure 5-11, this concept would be like Concept 2A??, except that it would not include the Alamo River Project. This concept was developed to provide enhanced access for geothermal energy development and lithium extraction within the KGRA. In addition, by eliminating the Alamo River Project, the concept would have greater drought resiliency in that more water would be available to sustain habitat in the south basin.
- **Concept 2C: Divided Sea/Marine Sea South Without Alamo River Project, With Perimeter Lake Cells.** As illustrated in Figure 5-12, this concept would be like Concept 2B, except that it would include two perimeter lake cells. The perimeter lake cells would connect the North Lake Project from Phase 1 with the south marine sea. This would greatly enhance public access and

recreational opportunities from the west shore seaside communities. A small boat lock is included to allow boats to pass from the lower elevation perimeter lake cells to the North Lake Project.

- **Concept 2D: Divided Sea/Marine Sea South Without Alamo River Project, With Perimeter Lake Cells and a Freshwater Reservoir.** As illustrated in Figure 5-13, this concept would be like Concept 2C, except that it would include a freshwater reservoir. Two possible locations of the freshwater reservoir are shown in Figure 5-13. The freshwater reservoir would provide water storage that could be used for geothermal energy production or agricultural purposes. In addition, the reservoir would provide freshwater habitat and cover exposed lakebed to help control dust generation.

5.4.2 Performance, Expected Benefits, and Recreational Opportunities

Upon completion of the causeway, the water in the south marine sea area, would return to a lower salinity in the range of 20 to 40 PPT. The elevation would fluctuate with inflow volumes. This would provide habitat benefits as well as a large area for recreational activities, such as boating and fishing. The communities all around Salton City to Bombay Beach would have access to the lake as they did prior to the Sea's declining elevation over the past several years. Other amenities could be added to take advantage of these benefits.

As with other concepts, the Divided Sea/Marine Sea South concept could accommodate multiple recreational features. These could include:

- Short, dredged channels from the communities around the Sea to either the north or south basin for boating access.
- A small boat passageway, as shown on the map, with weirs on either end could replace the stop log weir that connects the basins. This feature would allow boats launched in the north basin to travel to the south basin for fishing.
- The central causeway could be designed as a highway that would connect the southwest shore with the northeast shore, addressing access issues.
- Regional recreation areas in the south basin where the Mid-Sea causeway connects with the shoreline as shown on the maps, which could include a beach, fishing pier, and boat launch, together with community infrastructure, such as community/cooling centers, shade structures, BBQs and picnic areas, water fountains and bathrooms.
- Multiple active and passive recreational opportunities including interpretive signs and trails, visitor and community centers, bird watching platforms, and boat launches.
- Concepts 2C and 2D provide further recreational opportunities by including a waterway that would connect the South Marine Sea with the Phase 1 North Lake Project. This would allow boating and fishing adjacent to the west shore seaside communities, and around the Sea from the North Lake all the way to Bombay Beach.

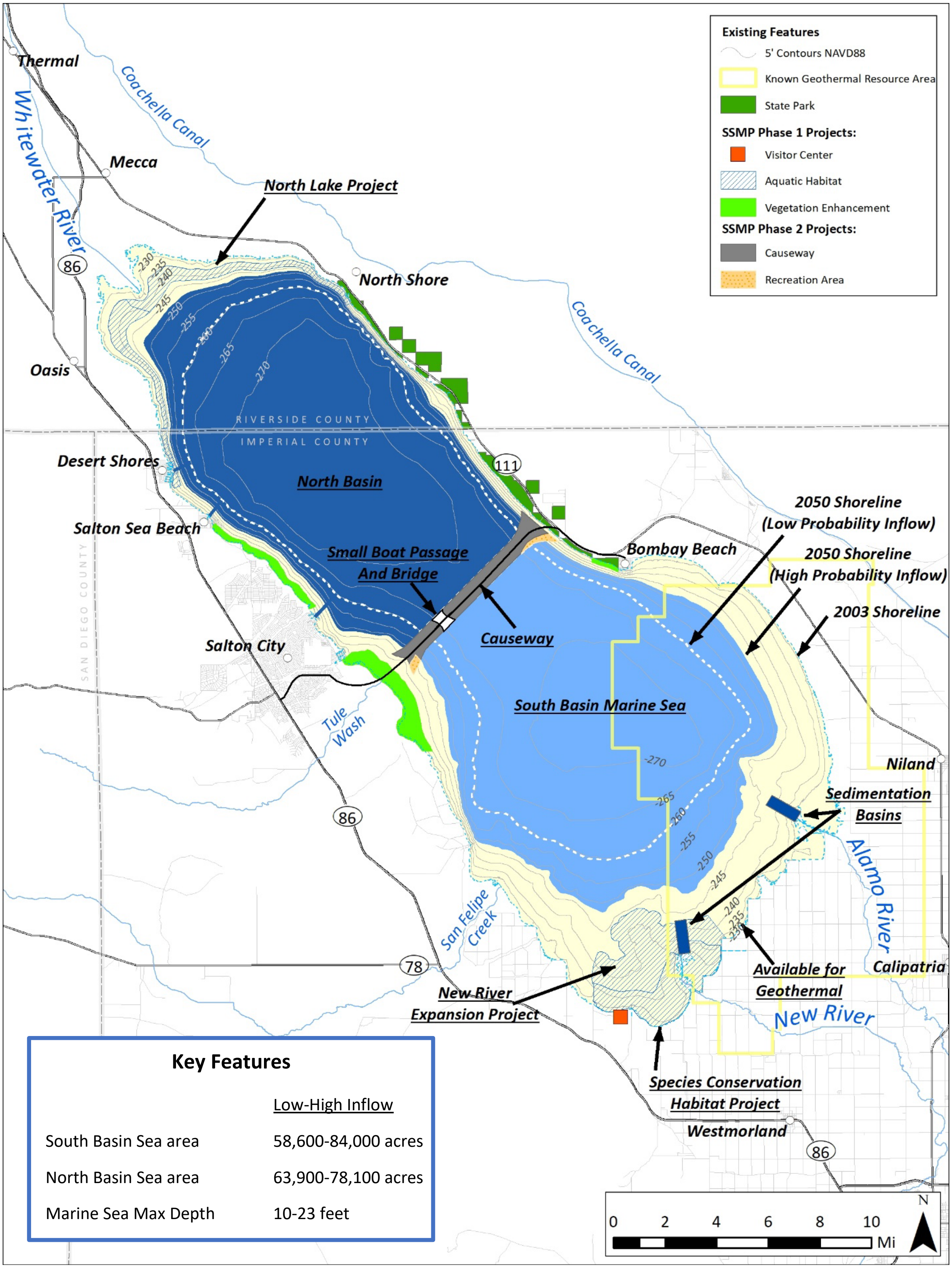

Figure 5-11. Concept 2B: Divided Sea/Marine Sea South Without Alamo River Project

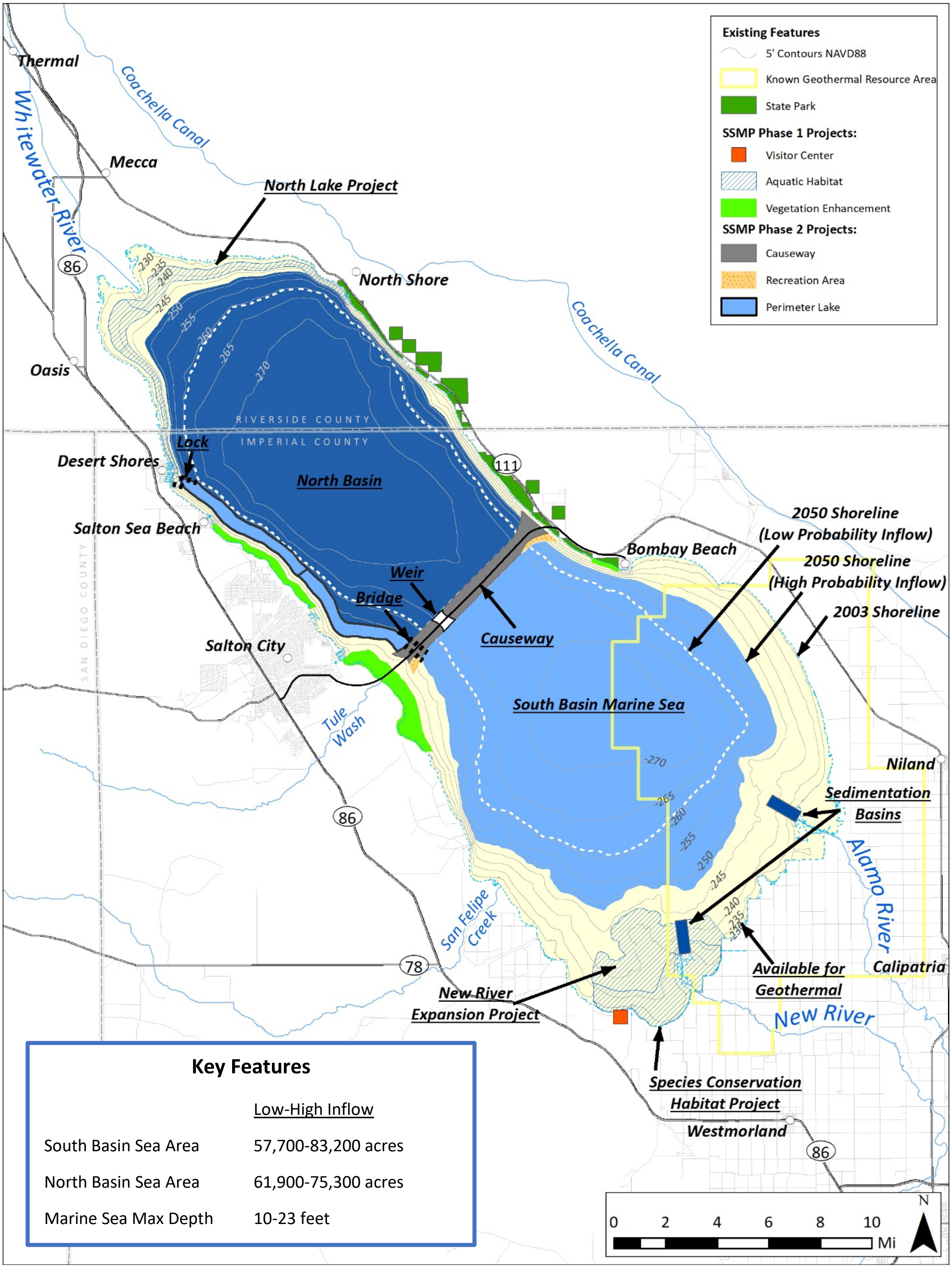

Figure 5-12. Concept 2C: Divided Sea/Marine Sea South Without Alamo River Project, With Perimeter Lake Cells.

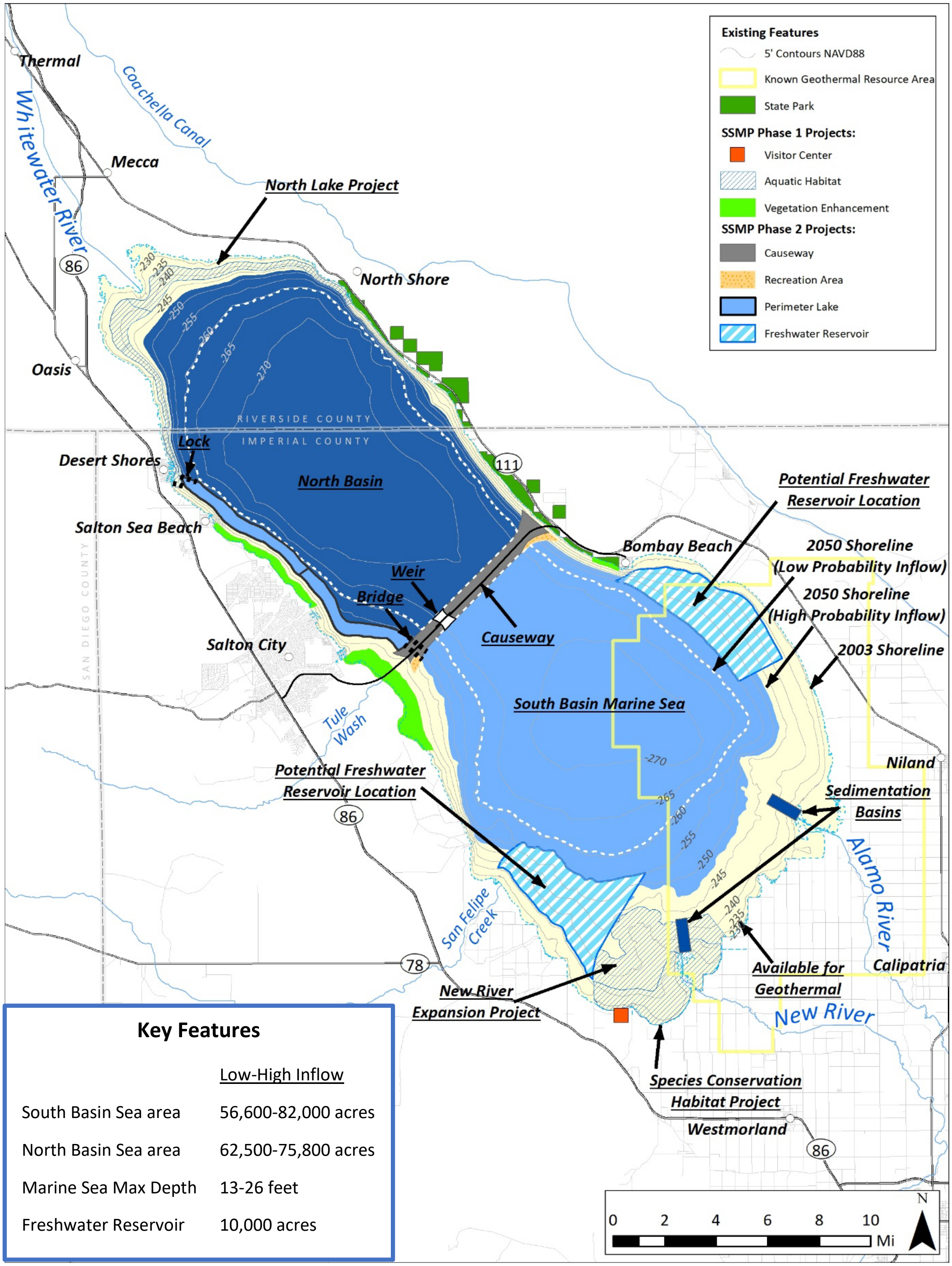

Figure 5-13. Concept 2D: Divided Sea/Marine Sea South Without Alamo River Project, With Perimeter Lake Cells and Freshwater Reservoir.

Projections of future elevation and salinity performance in the Marine Sea for Concepts 2A, 2B, 2C, and 2D for the High and Low Probability Inflow Scenarios are provided in Figure 5-14. Note that for Concepts 2C and 2D, the perimeter lake cells do not connect with the South Basin marine Sea for the Low Probability Inflow Scenario. At the next stage of design, this could be remedied by moving the lock from the North Lake to causeway bridge area and dredging a short channel to the South Basin.

Limitation of the model do not allow for accurate elevation and salinity forecasts for the Very Low Probability Inflow Scenario. Instead, for the Very Low Probability Inflow Scenario, water requirement estimates were developed to determine if there would be enough water available to support Phase 2 habitat areas. The inflow requirements for Phase 1 projects and for vegetation enhancement or other dust control measures were subtracted from the Very Low Probability Inflow Scenario to determine the amount of water remaining to irrigate the north and south basins.

Table 5-6 provides estimated water available for the Divided Sea/Marine Sea South Concepts in comparison to the Very Low Probability Inflow Scenario. Table 5-6 also shows the total area of water surface in the north and south basins that could be sustained by that amount of water. As shown, the habitat area that could be supported is estimated to be between 33,000 and 43,000 acres, depending on the concept. Some flow to the north would be needed to maintain salinity in the target range of 20 to 40 PPT. However, because of the south basin bathymetry, without dredging a channel from the south to the north basin, there would not be enough water to allow overflow to the north. If a channel were dredged, salinity in the south basin could be maintained at the target level by draining water from the south area equal to only about 10% of the inflow. That would allow for a shallow to mid-depth habitat area of 30,000 to 40,000 acres in the south.

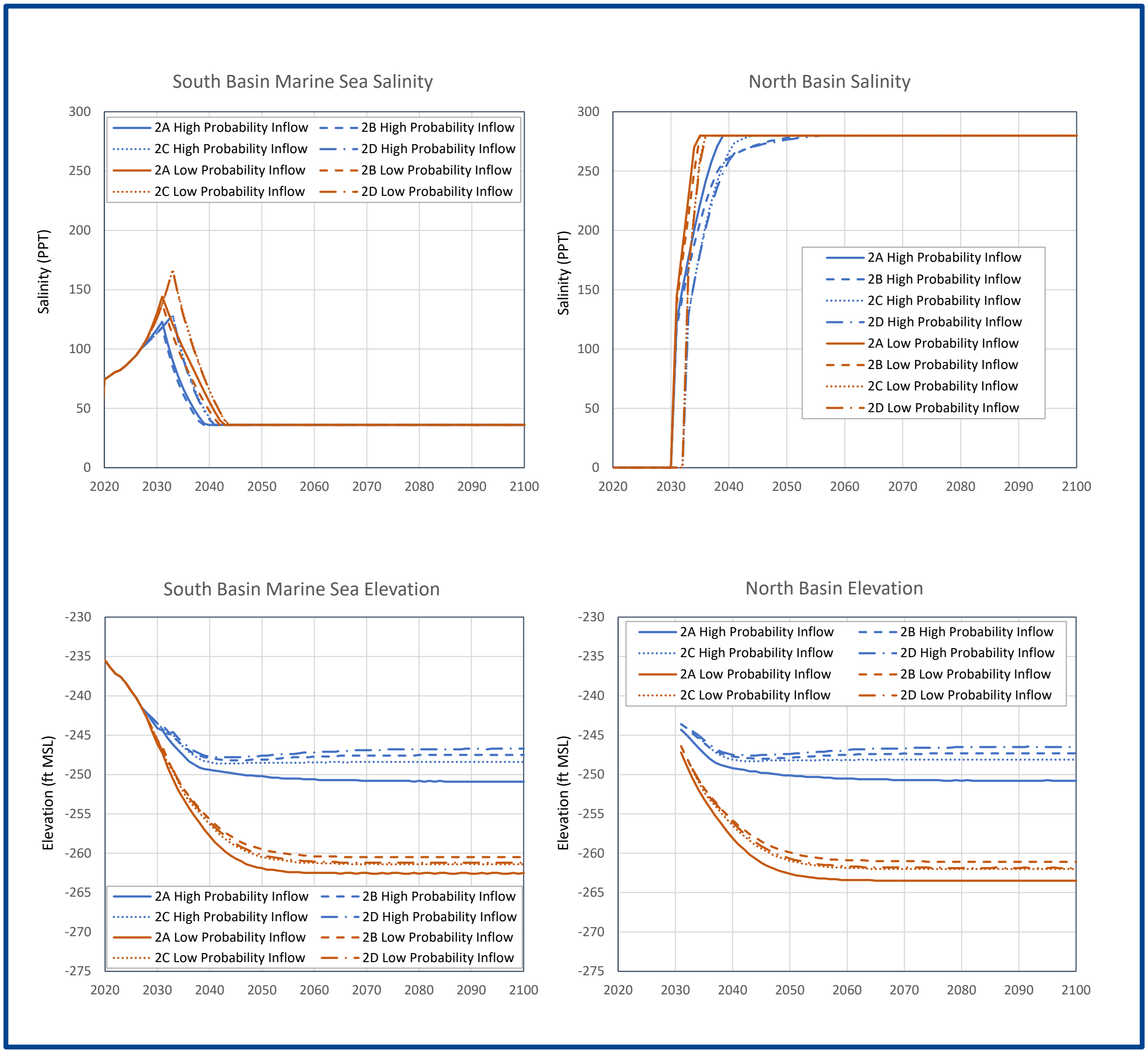

Figure 5-14. Salinity and Elevation Projections for Concept 2: Divided Sea/Marine Sea South.

Table 5-6. Estimated Water Requirements for the Divided Sea/Marine Sea South Concepts in Comparison to the Very Low Probability Inflow Scenario.

Feature	**Area (ac)**	**Losses (ft/yr)**	**Water (AFY)**	**Area (ac)**
Concept 2A				
Phase 1				
Vegetation	2,860	0.5	1,430	
Wetlands	680	5.0	3,402	
SCH	4,110	6.0	24,660	
New River Expansion	6,850	6.0	41,102	
Alamo Project	7,257	6.0	43,542	
North Lake	4,182	6.0	25,092	
Phase 1 Total	**25,940**		**139,228**	
Phase 2 Dust Control	135,000	1.0	135,000	
Total	**160,940**		**274,228**	
Very Low Probability Inflow (AFY)			**440,000**	
Water Available for Phase 2 Habitat		5.0	165,772	
Total North/South Area (acres)				**33,154**
Concepts 2B and 2C				
Phase 1				
Vegetation	2,860	0.5	1,430	
Wetlands	680	5.0	3,402	
SCH	4,110	6.0	24,660	
New River Expansion	6,850	6.0	41,102	
North Lake	4,182	6.0	25,092	
Phase 1 Total	**18,683**		**95,686**	
Phase 2 Dust Control	135,000	1.0	135,000	
Total	**153,683**		**230,686**	
Very Low Probability Inflow (AFY)			440,000	
Water Available for Phase 2 Habitat		5.0	209,314	
Total North/South Area (acres)				**41,863**
Concept 2D				
Phase 1				
Vegetation	2,860	0.5	1,430	
Wetlands	680	5.0	3,402	
SCH	4,110	6.0	24,660	
New River Expansion	6,850	6.0	41,102	
North Lake	4,182	6.0	25,092	
Phase 1 Total	**18,683**		**95,686**	
Dust Control	125,000	1.0	125,000	
Total	**143,683**		**220,686**	
Very Low Probability Inflow (AFY)			440,000	
Water Available for Phase 2 Habitat		5.0	219,314	
Total North/South Area (acres)				**43,863**

5.4.3 Status and Cost Estimate

STATUS – The North/South Marine Sea Concept and its variations have been retained for analysis and comparison to other alternatives considered feasible in this document.

COST ESTIMATE – The estimated Phase 2 costs for the four variations of the North/South Marine Sea Concept area are shown in Table 5-7. The cost for the causeway is based on estimates provided by the Bureau of Reclamation in 2006 as discussed in Appendix A to this Plan and was updated to 2022 dollars using a CCI factor. Note that the cost shown does not include costs for constructing or maintaining a highway across the Mid-Sea barrier.

The North/South Marine Sea Concept is expected to have low OMER costs as there are no large pump systems or other mechanical features to operate. The causeway would require periodic maintenance, the weir would need occasional adjustments, and the sedimentation basins would need periodic cleaning. There would be no significant energy costs associated with operations.

Table 5-8 shows the Phase 1: 10-Year Plan cost estimates combined with the Phase 2 costs to produce the total program cost estimates.

Table 5-7. Estimated Costs in Million Dollars for the Divided Sea/Marine Sea South Concept's Four Variations.

			Capital Cost ($M) by Concept Variation			
Cost Element	Cost ($M)	OMER ($M)	2A	2B	2C	2D
Causeway	1,151	9.5	1,151	1,151	1,151	1,151
Weir	50	2.5	-	-	50	50
Weir w Boat Passage	60	3.0	60	60	-	-
Bridge	10	0.5	-	-	10	10
Small Boat Lock	25	2.5	-	-	25	25
Perimeter Lake Cells	249	1.0	-	-	249	249
Freshwater Reservoir	365	18.3	-	-	-	365
Totals			1,211	1,211	1,485	1,850
OMER ($M)			$ 13	$ 13	$ 16	$ 34

Table 5-8. Estimated Costs in Million Dollars for the Divided Sea/Marine Sea South Concept's Four Variations.

	Capital Costs ($M)			OMER Costs ($M)		
Restoration Concept	Phase 1	Phase 2	Total	Phase 1	Phase 2	Total
2. Divided Sea/Marine Sea South*						
2A With Full 10-Yr Plan	1,293	1,211	2,504	65	13	77
2B Without Alamo River Project	928	1,211	2,139	46	13	59
2C Without Alamo, with 2 Perimeter Lake Cells	928	1,485	2,413	46	16	62
2D Without Alamo, with 2 Perimeter Lake Cells and Freshwater Reservoir	928	1,850	2,778	46	34	81

* Does not include costs for constructing or maintaining a highway across the mid-Sea barrier.

5.5 Restoration Concept 3: Updated Perimeter Lake

With a grant from CNRA, the SSA conducted a Funding and Feasibility Action Plan (FFAP) investigation from 2015 to 2016 (Salton Sea Authority, 2015 and 2016). The most significant outcome from the study was the perimeter lake proposal in the FFAP Benchmark 4, Volume 2 Report. The concept considered the immediate need for action, the limitations on water supply for the lake, and the possibility of constructing a project with incremental funding. The concept is updated here, as illustrated in Figure 5-15 for the High Probability Inflow Scenario and in Figure 5-16 for the Low Probability Inflow Scenario, to incorporate elements of the SSMP Phase 1 and to accommodate other work performed since 2016. Background on the Benchmark 4, Volume 2 Report is provided in Appendix A to the LRP.

The Perimeter Lake would rely on a system of low-profile levees to create a reasonably affordable and sustainable water body. This system would generally resemble an in-stream reservoir built along a slowly flowing river. It would include wider habitat and recreational areas in the north and south ends of the Sea, although boating would be accommodated along the entire 60+ miles of lakefront shoreline. Built incrementally, the water used in the Perimeter Lake system would initially flow through a series of linked but separated elongated ponds.

The annual inflow required to balance evaporative and seepage losses for the original concept was estimated at 167,000 AFY. Two variations of the original concept are discussed in this Plan. The first would have a water requirement of about 225,000 AFY and the second has two fewer cells and would have a water requirement of about 170,000 AFY, not counting water required for Phase 1 projects. Additional water through the system would provide flow through, manage salinity, and supply other habitat or dust control projects. Initially, greater quantities of water could be released through the system to reduce salinity and nutrients in the water column and clean out detritus. Once in operation, the water body could be used to convey water to other habitat areas or for dust control.

Salinity in the perimeter lake would be managed in the range of 20 to 40 PPT and the lake surface elevation would be managed at about -230 feet msl. At the south end, salt water from the SCH and Alamo River projects would be blended with river water. In this area the salinity would be closer to the lower end of the salinity range (20 PPT). Salinity in the perimeter lake water would increase toward the upper end of the range (40 PPT) as it flows northward and eastward toward Bombay Beach.

It is expected that the residual sea would eventually reach a salinity of about 280 PPT like the Great Salt Lake in Utah. If inflows continued to decline, the residual sea would become smaller, but salt deposits around the perimeter would form a hard crust that would not be expected to require dust mitigation.

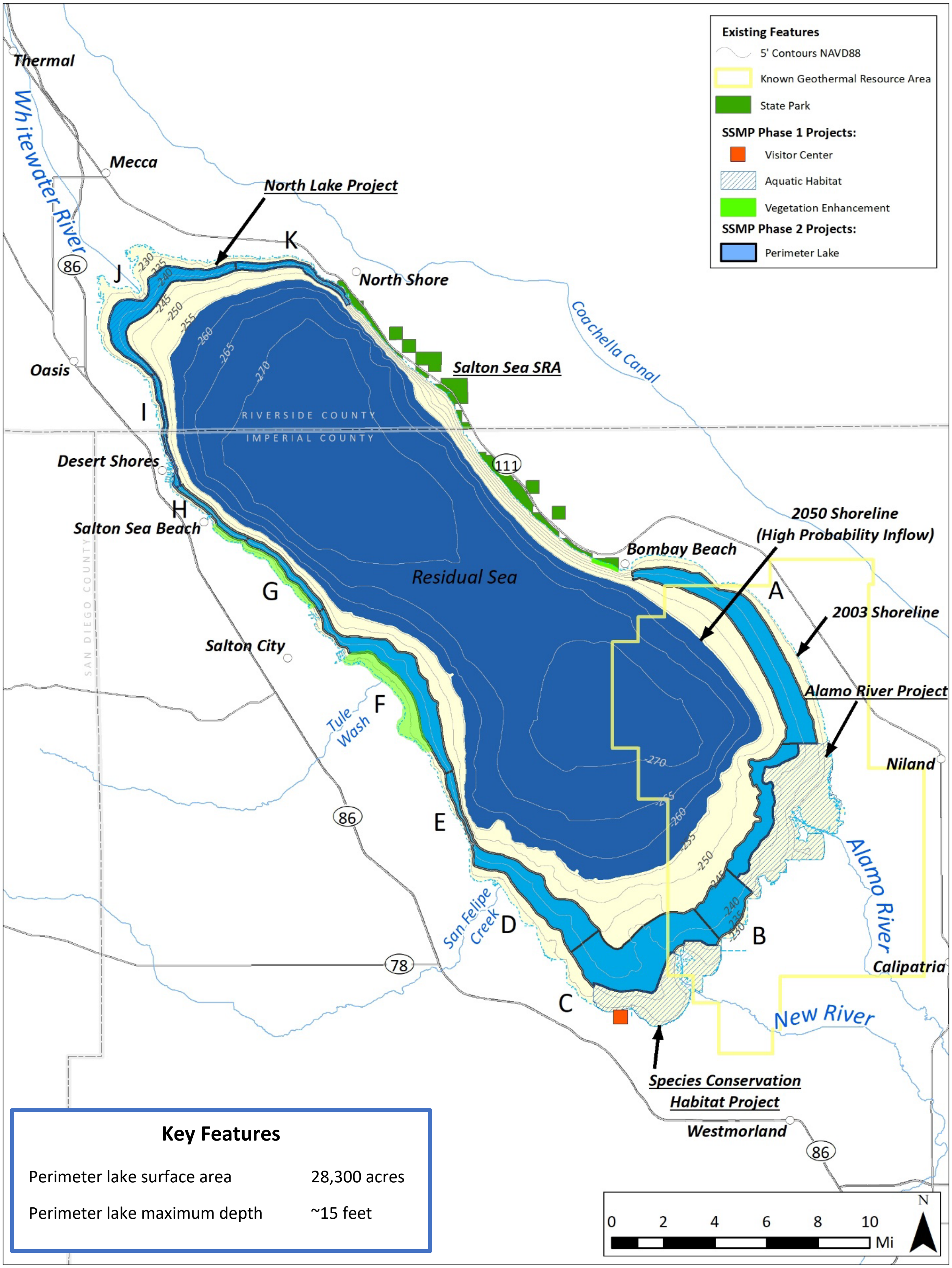

Figure 5-15. Concept 3A: Updated Perimeter Lake Under the High Probability Inflow Scenario.

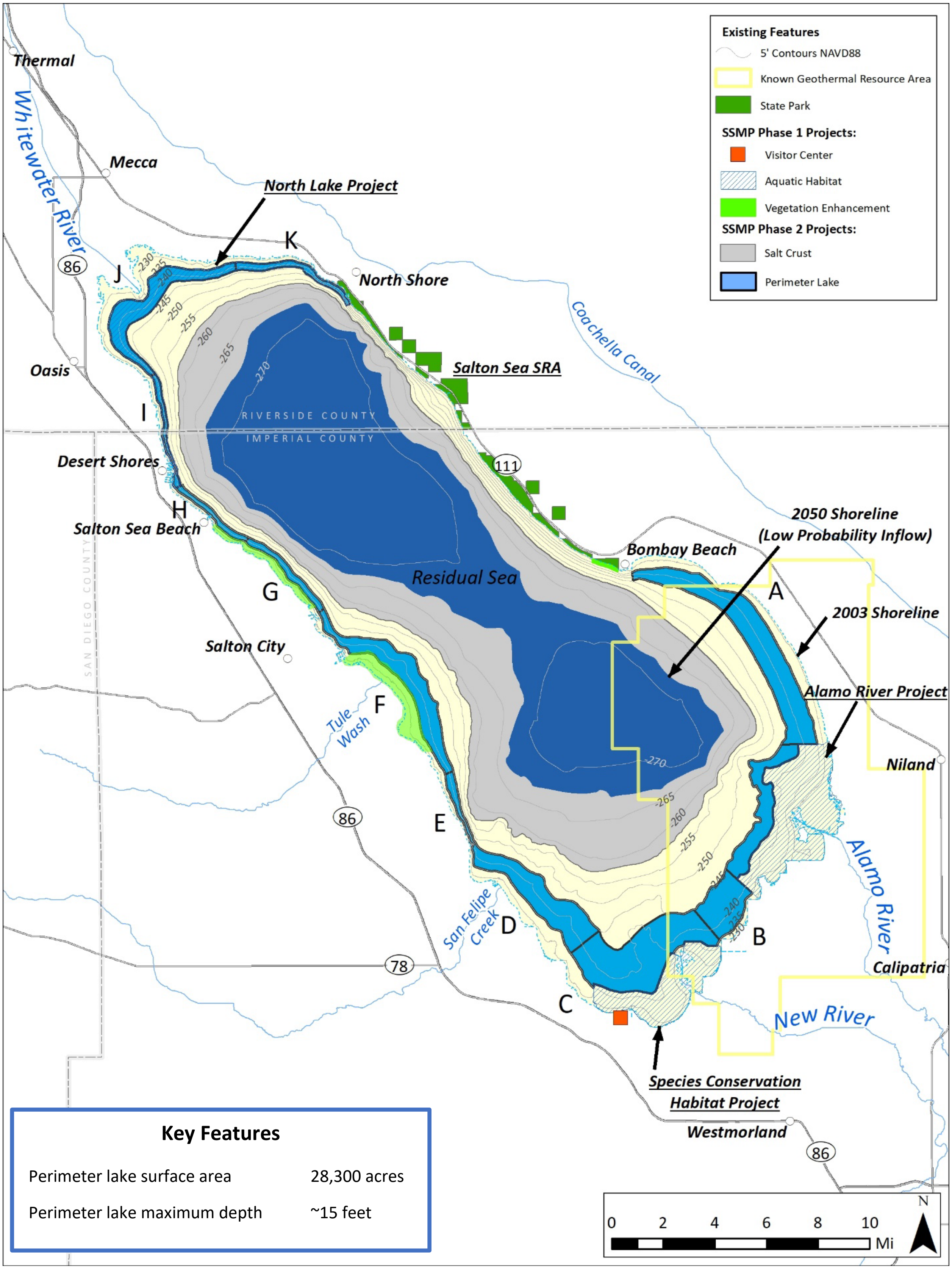

Figure 5-16. Concept 3A: Updated Perimeter Lake Under the Low Probability Inflow Scenario.

5.5.1 Components of the Restoration Concept

Key features of the concept would include the perimeter lake levees, connector levees, and spillways. In addition, two variations of the Modified Perimeter Lake Concept are under consideration.

PERIMETER LAKE LEVEES – The perimeter lake approach, as shown in Figure 5-15, would involve constructing a levee around the perimeter of the Sea which would create the perimeter lake and leave a central residual sea within the current Sea footprint. Along the west shore, the levee would be constructed along the -240-foot msl contour. In some areas in the south and north where the lakebed slope is very gradual, the levees could transition to the -245-foot msl contour. Although this would add cost, it would create more deep-water habitat and larger recreational boating areas. The levees would be constructed by dredging a channel along the Perimeter Lake side of the levee, creating a deep-water habitat area of 20 ft or more in depth for the full length of the lake. At full build out, the total levee length running parallel to the shore would be approximately 60 miles.

A feasibility-level geotechnical assessment to evaluate slope stability and seepage associated with the perimeter levees was included in the FFAP Benchmark 4, Volume 2 Report. The evaluation did not identify any geotechnical factors that would preclude the successful design and construction of the project. However, several factors would require special consideration during the design, engineering and construction of the project. These factors would include dewatering of excavated materials and mechanical placement and compaction, mitigation of settlement and seepage, and soil liquefaction and seismic deformation mitigation, all of which were considered in developing the construction scenario and detailed cost estimates and schedules.

A typical levee cross-section is illustrated in Figure 5-17. Construction would involve sheet pile installation in selected areas of higher sand content in sediments, geotextile deployment, dredging and stockpiling of sediments, construction of spillway structures, grading and armoring of the levees, construct of roadways on top of the levees, and construction of causeways. Ferry barges or floating bridges would allow access to the levees for maintenance if? causeways dividing the cells are breached.

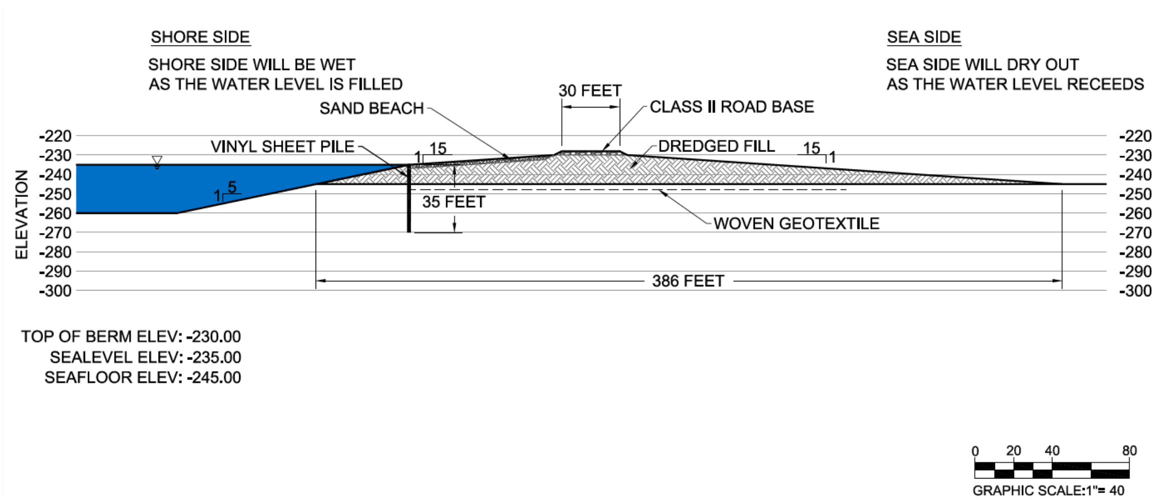

Figure 5-17. Typical Levee Cross-Section Configuration with Seepage Barrier

CONNECTOR LEVEES – The perimeter lake would be constructed in cells ranging from 500 ft to over 2 miles from the shoreline to the levee. Additionally, 12 perpendicular connector levees or dikes totaling about 6 mi would connect to existing roads so that construction could proceed as individual cells. As each new cell would be constructed, a boat passageway could be opened in the perpendicular connector levee from the previous cell. This would allow recreational boating from cell to cell around the full length of the Perimeter Lake. The total area of all 11 cells would be approximately 28,000 acres.

SPILLWAYS – Spillways at the north terminus and near Bombay Beach would discharge into the central residual Sea. Salinity in the perimeter lake could be managed by diversion of fresher river water either into the residual Sea to increase salinity in the perimeter lake or into the perimeter lake, to decrease its salinity. Likewise, higher salinity flows from SCH could be diverted toward the perimeter lake to increase salinity.

Although the Salton Sea is set in an arid region, the Perimeter Lake design must account for the occasional floods that occur. FFAP Benchmark 4, Volume 2 includes conceptual designs of overflow spillways to address both the average annual inflow as well as the occasional flooding produced from the rare storm event. The intent of the structures is to allow the average inflow of water to circulate within the Perimeter Lake while maintaining a desired water level, provide emergency flood relief to prevent overtopping of the levee, and still maintain sufficient freeboard for safety purposes. The overflow structures would include at least two, and possibly three, 20-foot bell mouth spillways: one at the north terminus, one near Bombay Beach, and possibly one somewhere along the west shore. In addition, a 1,000 ft wide broad crested weir would be constructed as an emergency spillway near where the Whitewater River discharges into the Perimeter Lake. These structures would stimulate internal circulation and exchange water inside the Perimeter Lake.

VARIATIONS – In addition to the original concept, labeled as Concept 3A and illustrated in Figure 5-16, one variation is being considered:

- **Concept 3B: Modified Perimeter Lake Without Alamo Project and Without Perimeter Lake Cells near Alamo River, Including a Freshwater Reservoir.** As illustrated in Figure 5-18 for the High Probability Inflow Scenario and in Figure 5-19 for the Low Probability Inflow Scenario, this concept would be like Concept 3A, except that it would not include the Alamo River Project nor perimeter lake cells near the Alamo River, but it would include a freshwater reservoir. This concept was developed to provide enhanced access for geothermal energy development and lithium extraction within the KGRA. Also, the freshwater reservoir would provide water storage that could be used for geothermal energy production or agricultural purposes. In addition, the reservoir would provide freshwater habitat and cover exposed lakebed to help control dust generation. In addition, by eliminating the Alamo River Project, the concept would have greater drought resiliency in that more water would be available to sustain habitat in the Modified Perimeter Lake.

5.5.2 Performance, Expected Benefits, and Recreational Opportunities

According to the SSA documents, the Perimeter Lake concept was proposed to revitalize the Salton Sea and the surrounding area. The Modified Perimeter Lake would provide the following benefits: stable shoreline with elevation control in a lake with an area of about 44 sq mi (28,000 ac); improved water quality with reduced salinity; a source of water for AQM; compatibility with other Salton Sea management projects; and a deep-water habitat that would also be suitable for recreational uses. Spillways in the north and south would provide salinity control and allow management of water in the desired salinity range (20-40 PPT). Initial flushing would help remove detritus and nutrients that are

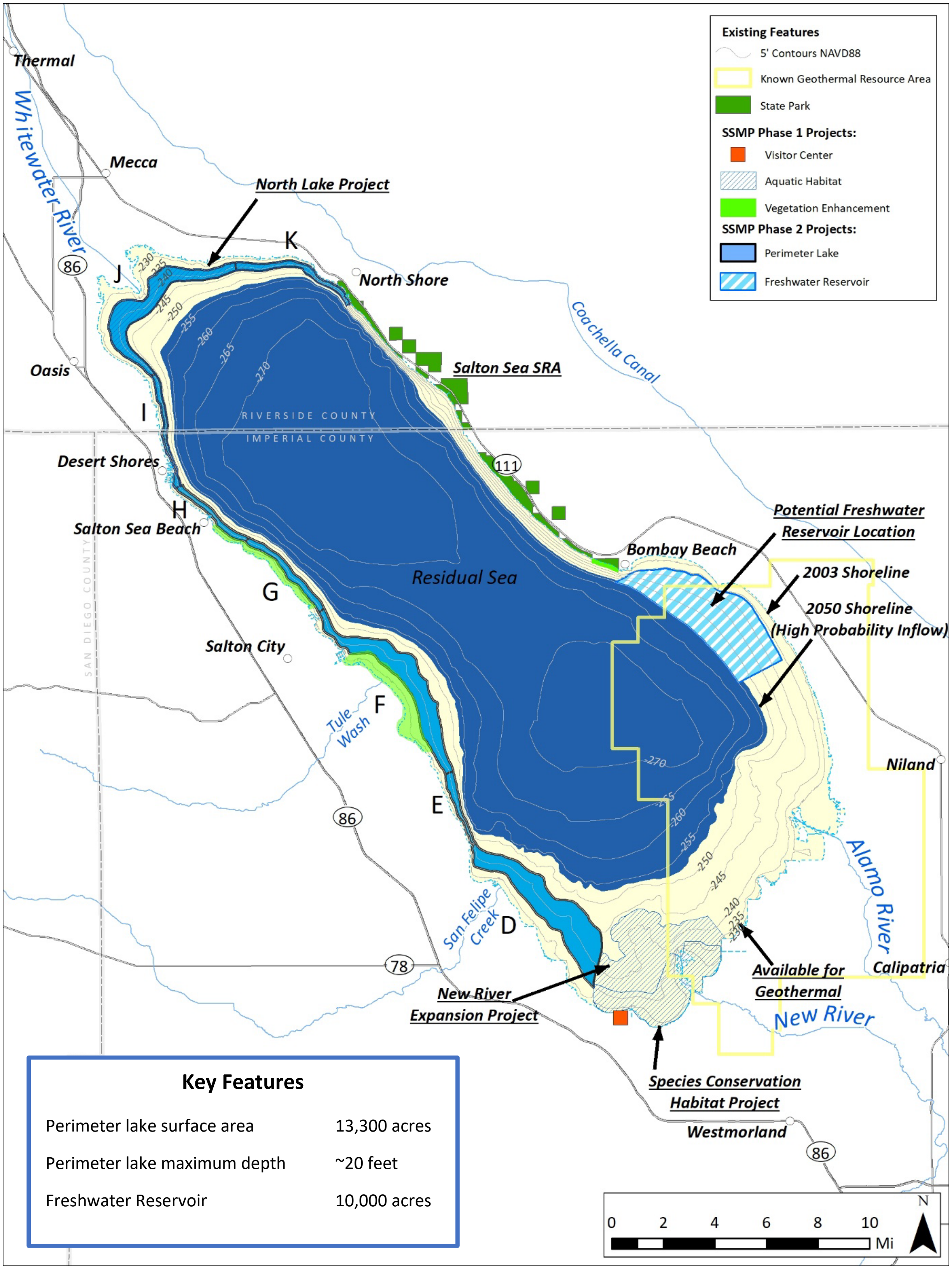

Figure 5-18. Concept 3B: Modified Perimeter Lake Without Alamo Project and Without Perimeter Lake Cells near Alamo River, Including a Freshwater Reservoir, Under High Probability Inflow Scenario.

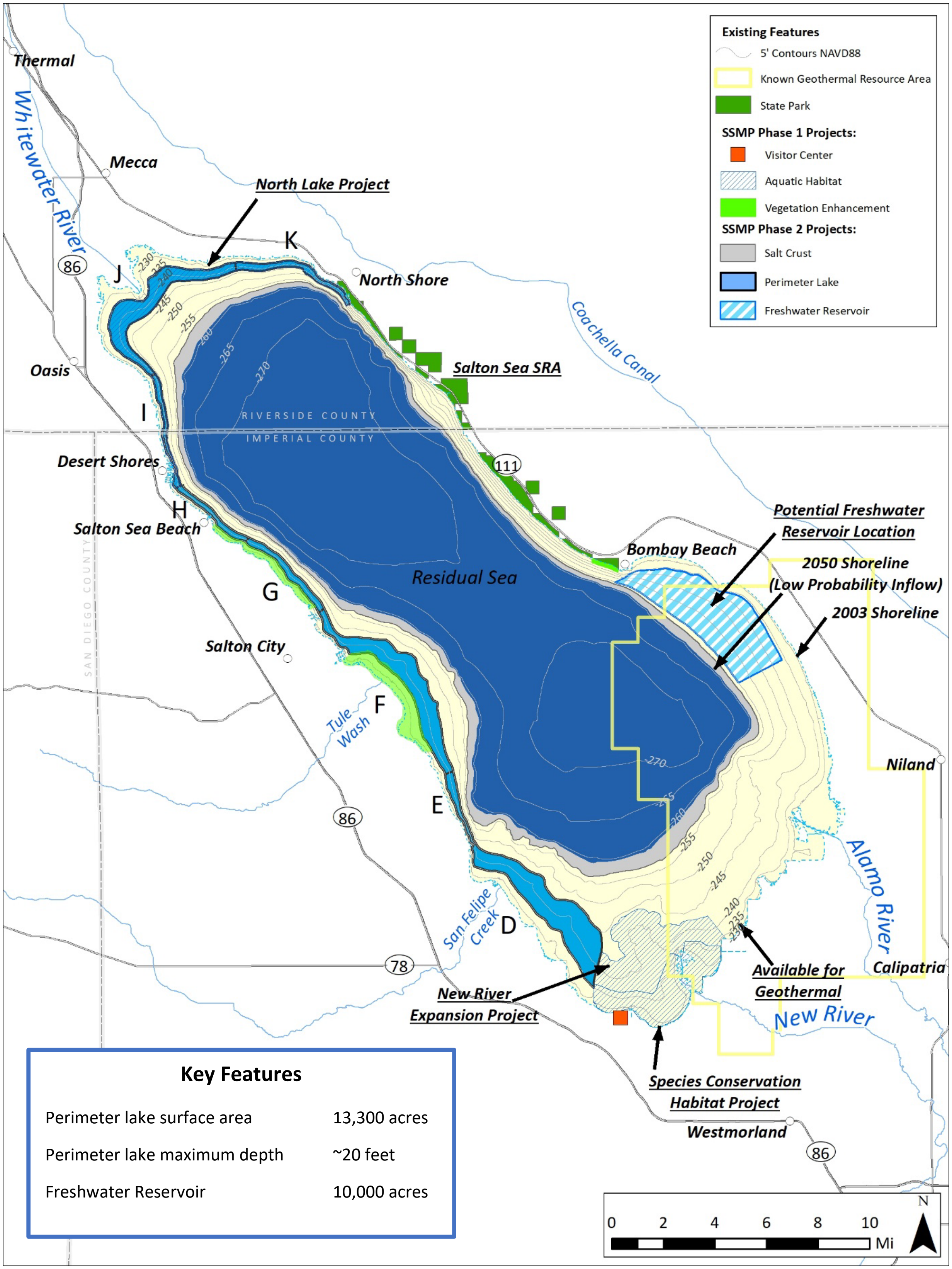

Figure 5-19. Concept 3B: Modified Perimeter Lake Without Alamo Project and Without Perimeter Lake Cells near Alamo River, Including a Freshwater Reservoir, Under Low Probability Inflow Scenario.

already present in the lake at high levels, and the sediment basin that is part of SCH would improve the quality of water flowing in from the New River. A similar basin would be included in the Alamo River Project that would be part of Concept 3A.

The deep-water areas of 20 ft or more have recreational value for boating and fishing, and they would also benefit habitat by providing a food source for resident and migratory piscivorous birds. Additionally, the Perimeter Lake plan would include 130 miles of shallow habitat along the existing shoreline and levees for wading birds. For Concept 3A, at 44 square miles, the Perimeter Lake would be significantly larger than all other lakes in southern California, and even larger than the 32-sq mi Lake Havasu.

Upon completion of the barrier, the water in the Modified Perimeter Lake would return to a lower salinity in the range of 20 to 40 PPT, which would support a fish population. The elevation would be maintained close to historic levels at around -230-foot msl, but at levels low enough to avoid nuisance flooding. This would provide habitat benefits as well as a large area for recreational activities such as boating and fishing. The communities all around the Sea, from Salton City to Bombay Beach, would have access to the lake as they did prior to the Sea's declining elevation over the past several years. Other amenities could be added to take advantage of these benefits.

Estimated water requirements for the Modified Perimeter Lake concepts are provided in Table 5-9. As shown in Table 5-9, the estimated water requirement for Concepts 3A is about 435,000 AFY and for Concept 3B is almost 270,000 AFY. For Concept 1A, it has been assumed that the Phase 1 North Lake Project would become part of the Modified Perimeter Lake. For Concept 3A, seepage and flow through for the Phase 1 projects in the south have been assumed to flow into the Modified Perimeter Lake. Therefore, only evaporative losses of 6 feet per year are estimated for these projects. However, for Concept 3B, the seepage from the New River Expansion is assumed to be lost to the Residual Sea, and the losses are estimated at 8 feet per year to include evaporation and seepage.

Figure 5-20 provides a comparison of Concept 3 water requirements with the inflow scenarios that are being evaluated in this Plan. In evaluating the performance of the Modified Perimeter Lake concepts with respect to the inflow scenarios, it was assumed that the highest priority would be to meet all the requirements of the Phase 1 projects and maintain sufficient water for vegetation enhancement or other means of dust control on exposed lakebed. The next priority would be maintaining the Modified Perimeter Lake at its design elevation. As shown in Figure 5-20, both Concept 3A and 3B could be sustained under all three inflow scenarios evaluated in this Plan.

Table 5-9. Estimated Water Requirements for the Modified Perimeter Lake Concepts.

Feature	Area (ac)	Losses (ft/yr)	Water (AFY)
Concept 3A			
Phase 1			
Vegetation	2,860	0.5	1,430
Wetlands	680	5.0	3,402
SCH	4,110	6.0	24,660
New River Expansion	6,850	6.0	
Alamo Project	7,257	6.0	43,542
North Lake	4,182	6.0	
Phase 1 Total	**25,940**		**73,034**
Phase 2			
Perimeter Lake	28,315	11.0	311,465
Dust Control	51,000	1.0	51,000
Phase 2 Total	**79,315**		**362,465**
Total	**105,255**		**435,499**
Concept 3B			
Phase 1			
Vegetation	2,860	0.5	1,430
Wetlands	680	5.0	3,402
SCH	4,110	6.0	24,660
New River Expansion	6,850	8.0	54,803
Phase 1 Total	**25,940**		**84,295**
Phase 2			
Perimeter Lake	13,218	11.0	145,398
Dust Control	52,317	1.0	52,317
Phase 2 Total	**65,535**		**197,715**
Total	**91,475**		**282,010**

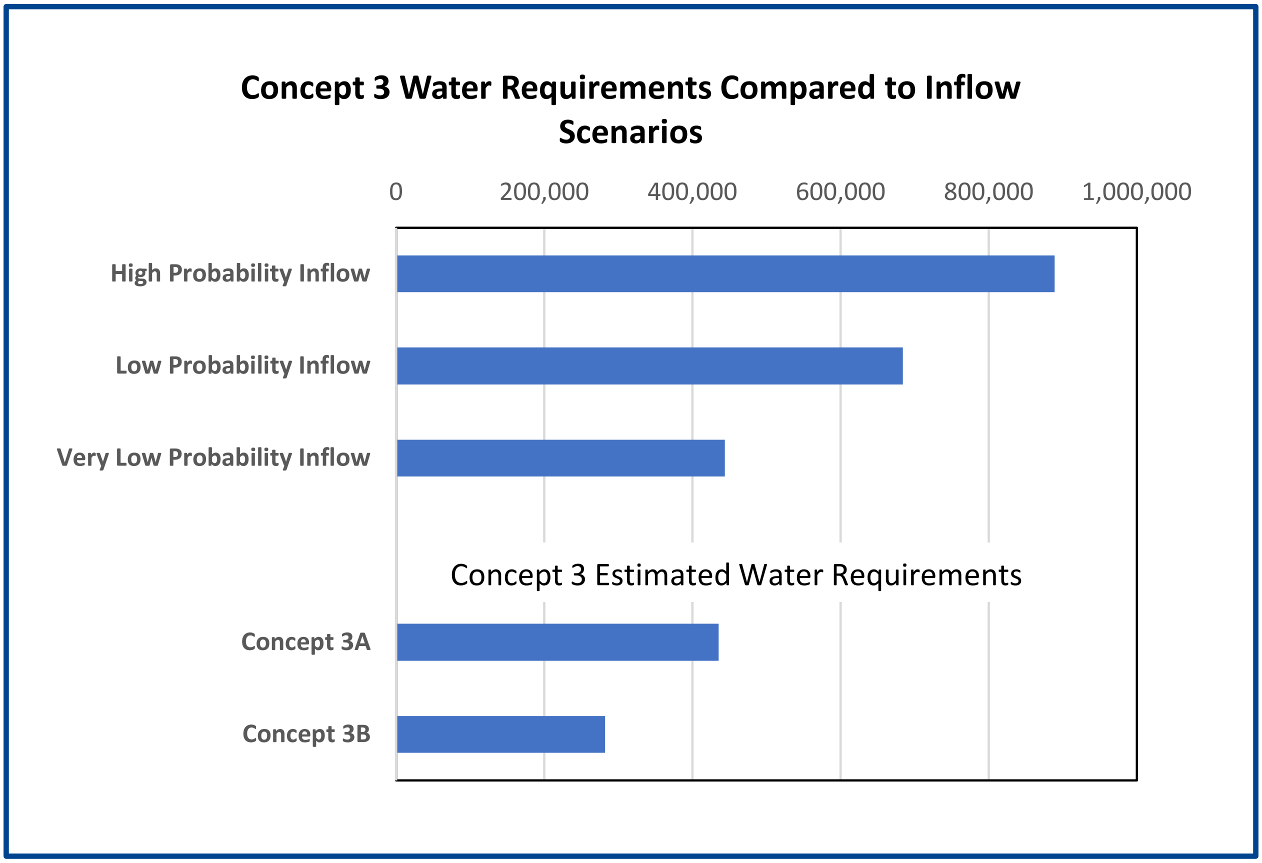

Figure 5-20. Comparison of Concept 3: Water Requirements with Inflow Scenarios.

5.5.3 Status and Cost Estimate

STATUS – The Perimeter Lake Concept and its variations have been retained for analysis and comparison to other alternatives considered feasible in this document.

COST ESTIMATE – A detailed feasibility-level cost estimate can be found as an appendix to SSA FFAP Benchmark 4, Volume 2. In 2015, construction of all perimeter lake cells in a series in the original configuration was estimated at a total cost of $1.7 billion, including contingencies, for a 10-year construction period. Sufficient cost detail was provided to allow for the costs to be adjusted for the updated configuration of cells in the Modified Perimeter Lake Concepts 3A and 3B. The estimated costs have been updated to mid-2022 dollars using indices provided by the DGS California CCI. The time-phased capital and OMER updated costs for Concept 3A, not including Phase 1 project costs, are provided in Table 5-10. A cost summary for both Concepts 3A and 3B, including Phase 1 costs is included in Table 5-11.

Table 5-10. Estimated Costs in Million Dollars for Concept 3A: Updated Perimeter Lake.

Cell Location	Reach	Length (ft)	Earthwork (cu yd)	Vinyl Sheet Pile (sf)	Earthwork ($M)	Sheetpile ($M)	Total ($M)
Bombay Beach to Alamo R Project	A	51,292	6,249,000	1,795,220	$ 261	$ 49	$ 310
Alamo R Proj to Bowles Rd	B	48,044	5,854,000	1,681,540	250	46	295
Bowles Rd. to Dirt Rd	C	24,252	2,955,000	848,820	142	23	165
Dirt Rd to Old Base	D	33,159	4,040,000	1,160,565	167	31	199
Old Base to Dirt Road	E	16,092	1,961,000	563,220	85	15	100
Dirt Rd to Marina	F	47,673	5,808,000	1,668,555	243	45	288
Marina to Dirt road	G	22,214	2,707,000	777,490	115	21	136
Dirt Road to Desert Shores	H	18,317	2,232,000	824,265	96	17	113
Desert Shores to 81st Ave	I	22,259	2,712,000	890,360	114	21	136
81st Ave. to Arthur St.*	J	33,362	6,796,000	1,334,480	232	41	273
Arthur St to North Shore YC	K	15,694	1,912,000	627,760	81	17	98
Totals			**43,226,000**	**12,172,275**	**$ 1,787**	**$ 326**	**$ 2,113**
		Initial Activities; Permitting, Engineering and Procurement; Mobilization					336
						Total	**$ 2,449**

Table 5-11. Estimated Costs in Million Dollars for the Updated Perimeter Lake Concept's Two Variations.

	Capital Costs ($M)			OMER Costs ($M)		
Restoration Concept	Phase 1	Phase 2	Total	Phase 1	Phase 2	Total
3. Updated Perimeter Lake						
3A Updated Perimeter Lake (UPL)	719	2,449	3,168	36	7	43
3B Modified Perimeter Lake Without Alamo Project and Without Perimeter Lake Cells near Alamo River, Including a Freshwater Reservoir	728	2,043	2,772	36	7	43

5.6 Restoration Concept 4: Pump Out Options

Because the Salton Sea does not have an outlet, even low levels of salt in the inflow have no other place to go but to concentrate in the Sea. One of the largest challenges facing the Salton Sea is the lack of an outlet, as the salt content conveyed into the sea concentrates over time due to evaporation. Salt has historically been conveyed into the Sea with irrigation drainage and other flows with an average salinity of about 2.5 PPT. If the salinity in the Sea could be reduced to ocean salinity of 35 PPT, the outflow would need to be only 2.5/35 or 1/14 times the inflow.

Since the Salton Basin is a closed basin below sea level, creating an outlet for the Sea would require pumping. Depending on future inflows and when the pumping begins, an initial pump-out of about 150,000 AFY could bring the salinity back to levels to support fish in 20 or more years. As the salinity approaches the target salinity concentration of 20 to 40 PPT, the pump-out rate could be gradually reduced to about 60,000 AFY to remove the same amount of salt that enters the Sea annually. The footprint of the Sea would be about 5% to 10% smaller than the footprint without any pump-out. Three possible pump-out scenarios are being considered:

- **Multiple Small Pump-Outs for Dust Control.** The use of brine with shallow flooding backup is an approved Best Available Control Technology (BACT) for dust control at Owens Lake. Salt water from the Sea could be pumped from small pump stations at multiple locations around the Sea into a network of shallow ponds where salt water would concentrate into brine and ultimately form a salt crust.
- **Large Pumping Facility to a Remote Location.** This concept would involve creating an artificial outlet to the Sea by constructing a pipeline to the Sea of Cortez.

- **Combined Small and Large Pumping Stations.** The project could begin with construction of small pump stations discussed above. This would allow time for design, permitting, and construction of the large pump station and pipeline. The large pump station could be timed to come online when the Sea's salinity has been reduced to the target salinity range of 20 to 40 PPT. Discharging at this salinity would avoid the problem of creating an elevated salinity area at the discharge location in the Sea of Cortez.

5.6.1 Components of the Restoration Concept

Key components of the concept would include the small pump system and network of brine ponds, and for the pipeline option, the large pump station and pipeline.

Brine Ponds and Small Pump Facilities – The brine ponds would be constructed like those described for the Saline Habitat Complex (SHC) discussed for Concept 1. However, whereas SHC was designed to have a blend of Salton Sea water with river water, these would be exclusively used for Salton Sea water. Small intakes would be installed at multiple locations around the Sea for pumping to a network of ponds. Berm construction following agricultural practices used for flood irrigation would be used to maximize flexibility and resilience and minimize costs. These practices would allow for thousands of acres of shallow habitat cells to be spread out across exposed lakebed. As brine deposits would build up in a pond, the brine in the pond would continue to control dust, and water would eventually be diverted to a new pond.

Pipeline and Large Pump Station – The SSA investigated ways of creating an outlet by constructing a pipeline to various locations. The analysis considered four factors: water quantity removed, the conveyance system and hydraulics necessary for removal, capital and operational cost, and institutional considerations. An applicable screening-level performance analysis using a salinity and elevation model was also conducted.

The SSA investigated several possible discharge locations:

- Laguna Salada or La Cienega de Santa Clara (Santa Clara Slough, Wetland) in Mexico
- Sea of Cortez
- Land-based discharge areas

Export to the Sea of Cortez is discussed further below. Regardless of the discharge location, the concept of creating an outlet by pumping would have the same effect of controlling salinity in the Salton Sea.

As shown in Figure 5-21, the Sea of Cortez is approximately 120 miles from the Salton Sea and 30 miles away from La Cienega de Santa Clara. There is an existing and operational canal system which covers 80 percent of the distance from the Sea of Cortez to the US-Mexico border. Additionally, 95 percent of the distance from the Gulf to the border is below sea level, with an average elevation of -25 msl. The general terrain in the area is loose, rocky to sandy soil. Over the last 50 years, the Sea of Cortez has been losing coastal land at a very high rate, and the environmental impact of discharging flows from the Salton Sea to the Sea of Cortez must be evaluated thoroughly. The flow paths to the Sea of Cortez could originate from either the southwest or southeast portions of the Salton Sea.

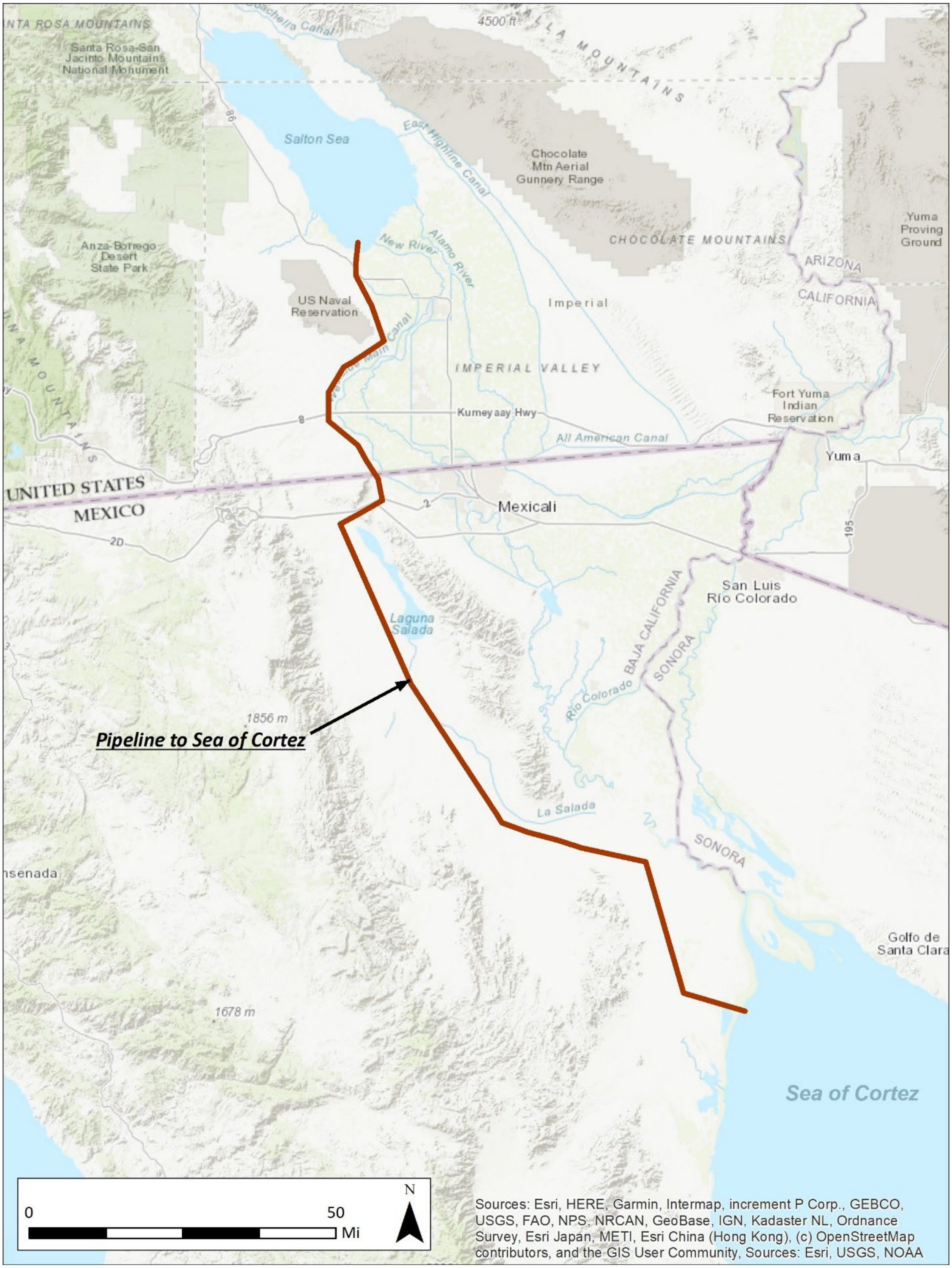

Figure 5-21. Possible Pipeline Route from the Salton Sea to the Sea of Cortez.

The quantity of water that could be exported from the Salton Sea to the Sea of Cortez would depend on several factors. These factors include levels of salinity in the Salton Sea, environmental impacts of discharging the higher salinity water from the Salton Sea into the Sea of Cortez, and the associated costs and capabilities of the pumping systems and pipelines from the Salton Sea to the Sea of Cortez. Modeling was performed with an initial pump out rate of 150,000 AFY starting in 2025, which could be reduced to 100,000 AFY or less after 20 years. For this scenario, it would take about 25 years for the Sea to return to a salinity that could support fish populations and another 10 years to return to ocean-like salinity of 35 PPT. After that, the pump-out rate could be further reduced to 60,000 to 70,000 AFT for long-term salinity control. The outlet would reduce the surface area of the Sea by about 7%.

Delivery of 150,000 AFY of water from the Salton Sea to the Sea of Cortez would require 120 miles of pipeline that is 86-inch in diameter with two pump stations as shown in Figure 5-18. There is an elevation gain of approximately 530 feet from the Salton Sea to the Sea of Cortez with the high point located south of the international border near the Mexicali-Tecate Highway 2. Delivery of water to the Sea of Cortez would also require a minimum of two pump stations. The first pump station would be located near the Salton Sea to convey water into the pipeline. A second pump station would be necessary along the pipeline alignment to deliver water to the final discharge point. Each pump station would be designed with a discharge head of 500 feet, and pipeline design would be based on internal pressure of 300 pounds per square inch (psi), accounting for surge.

The average salinity in the ocean is generally 35 PPT, whereas salinity values in the Salton Sea are currently greater than 70 PPT and projected to go substantially higher. Evaluation of discharge methods into the Sea of Cortez and significant consideration of environmental impacts to the coastal habitats would be necessary to determine whether this option is feasible. Reducing the salinity in the Salton Sea to a level close to 35 PPT, by using brine for dust control, would make it easier to design a discharge system into the Sea of Cortez. This option would require a transfer of water across the international border, and the feasibility and validity of this option would involve collaboration, permits, and approvals between the governments of the United States and Mexico.

Conceptual plans prepared for the Sea of Cortez Pipeline alternative can be found in Appendix E of the SSA's FFAP Benchmark 4-1 Report. These plans were used to form the basic concept for the pipeline route and its key components. Conceptual level cost estimates were then developed from the layouts presented in these plans. The Benchmark 4-1 Report contains the following conceptual drawings: hydraulic profile, pump station mechanical plan and section, intake structure, and discharge header.

VARIATIONS – Four variations are being considered for this concept, labeled as Concept 4A through 4D.

- **Concept 4A: Pump Out for Dust Control.** As illustrated in Figure 5-22, this concept would involve pumping water from the Salton Sea and discharging it to brine ponds which would also assist with dust control. Representative brine pond locations are illustrated in the gray shaded area in Figure 5-22. For this concept we have also included the idea of reclaiming exposed lakebed for farming purposes. For farmland that has two growing seasons, the concept would be to offer farmers incentives to use exposed lakebed for the second growing season. Representative reclaimed farmland areas are shown with a green stippled area in Figure 5-22.
- **Concept 4B: Pump Out with Pipeline.** As illustrated in Figure 5-23, this concept would involve pumping Salton Sea water to the Sea of Cortez to create an artificial outlet for the Sea. Brine ponds would not be included with this concept, but the idea of reclaiming exposed lakebed for farming purposes has been included.

- **Concept 4C: Pump Out for Dust Control Concept and Pipeline to the Sea of Cortez.** As illustrated in Figure 5-22, within the Salton Basin, this concept would look like Concept 4A, but it would include a pipeline to the Sea of Cortez. During initial phases of implementation, Salton Sea water would be exported to brine ponds. Planning and construction of the pipeline would take longer than initial development and installation of the ponds. By the time the pipeline is ready for operation, the Salton Sea salinity could be reduced closer to ocean-like salinity of 35 PPT. At that point a smaller discharge and lower salinity would reduce the technical complexity of designing an outfall facility.
- **Concept 4D: Pump Out for Dust Control with Freshwater Reservoir.** As illustrated in Figure 5-24, this concept would be like Concept 2A, except that it would include a freshwater reservoir. Possible locations of the freshwater reservoir are shown in Figure 5-24. The freshwater reservoir would provide water storage that could be used for geothermal energy production or agricultural purposes. In addition, the reservoir would provide freshwater habitat and cover exposed lakebed to help control dust generation.

5.6.2 Performance, Expected Benefits, and Recreational Opportunities

The Pump Out concepts could return the Sea to a lower salinity in the range of 20 to 40 PPT. However, depending on future inflows it could take several decades to achieve the upper salinity limit of 40 PPT. The elevation of the Sea would not be controlled, and the area would fluctuate with inflows. Once the salinity was lowered to 40 PPT, the smaller Sea would provide habitat benefits as well as a large area for recreational activities, such as boating and fishing. The communities around the Sea could build out toward the new shorelines, or channels could be dredged to provide access to the current infrastructure. Other amenities, such as beaches and parks, could be added to take advantage of the restored fish and bird habitat.

Projections of future elevation and salinity performance in the Sea for the Pump Out concepts are provided in Figure 5-25. Limitation of the model do not allow for accurate elevation and salinity forecasts for the Very Low Probability Inflow Scenario. Instead, for the Very Low Probability Inflow Scenario, water requirement estimates were developed to determine if there would be enough water available to support Phase 2 habitat areas. The inflow requirements for Phase 1 projects and for vegetation enhancement or other dust control measures were subtracted from the Very Low Probability Inflow Scenario to determine the amount of water remaining to irrigate the north and south basins.

Table 5-12 provides estimated water available for the Pump Out Concepts in comparison to the Very Low Probability Inflow Scenario. Table 5-12 also shows the total area of water surface that could be sustained by that amount of water. As shown, the habitat area that could be supported is estimated to be between 25,000 and 35,000 acres, depending on the concept. The calculations shown are for steady state conditions after the salinity in the water has reached target salinity. With a very low inflow, only a small pump out would be required to remove the amount of salt in the inflowing water.

Balance of Salt – The Pump Out concepts as well as Concepts 7, 11, 12, and 13 involve removing salt from the water. As of 2022, there is an estimated 550 million tons of salt in the Sea. For Concepts 4B and this salt would be exported as salt water to the Sea of Cortez. Concept 4C would also involve a substantial amount of salt exported to the Sea of Cortez. For Concepts 4A and 4D, at least 95% of the salt would be removed from the water and stored in the Basin and used for dust control. If it were stored in impoundments, it would need a capacity of nearly 180,000 AF. If the salt was stored in impoundments 5 feet deep, they would cover an area of over 35,000 acres or 56 square miles.

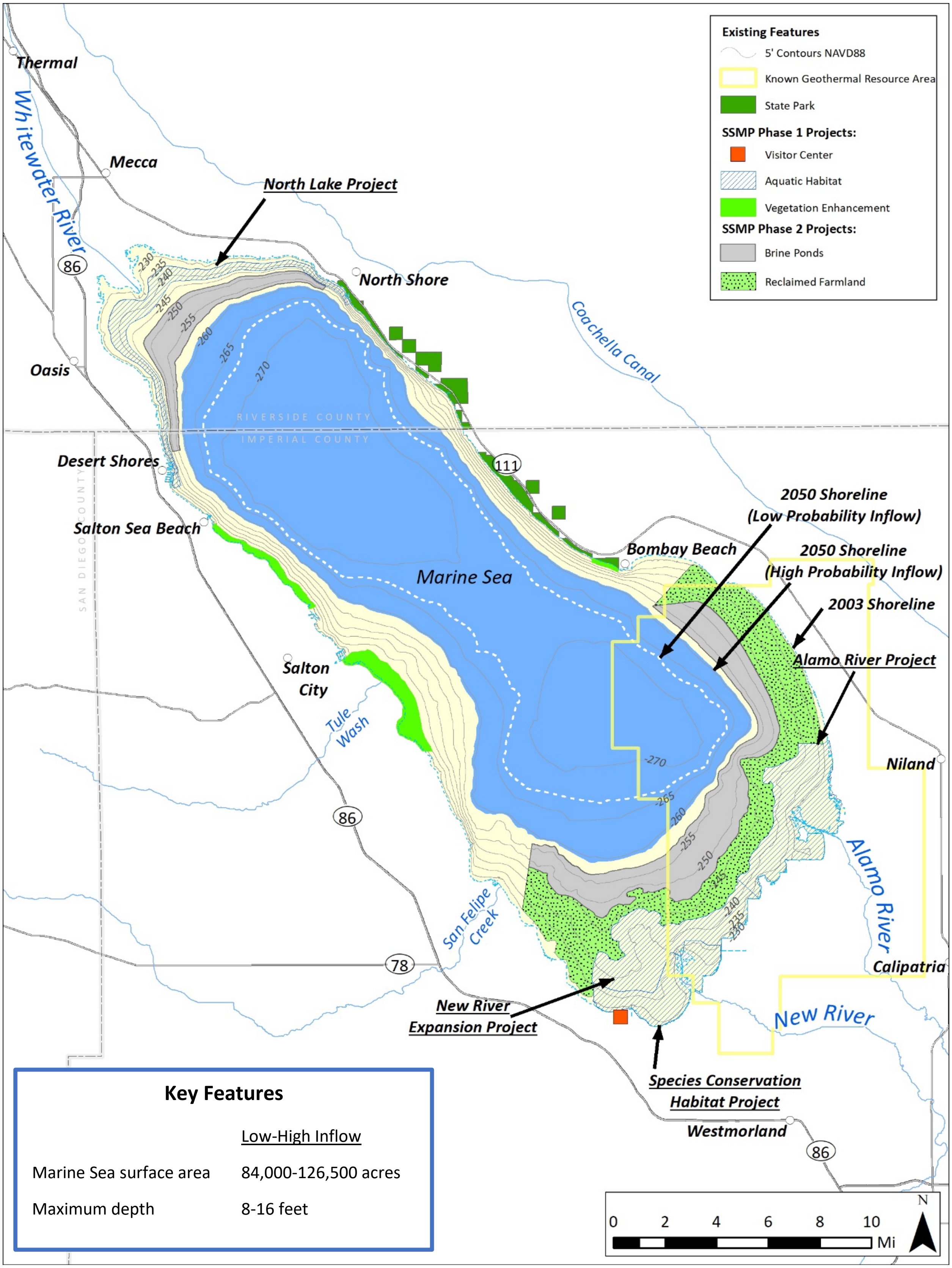

Figure 5-22. Concepts 4A and 4C: Pump Out for Dust Control Concept.

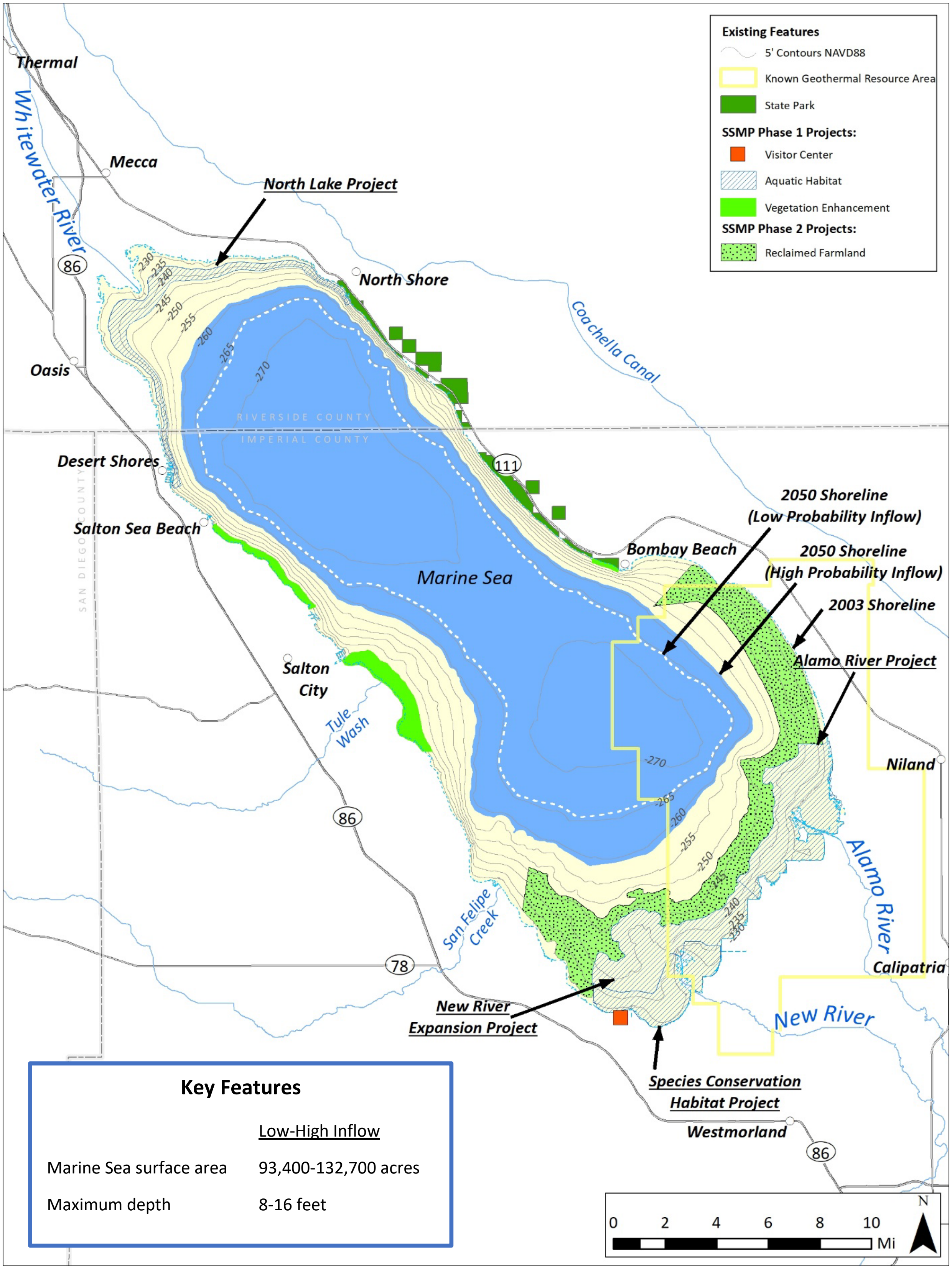

Figure 5-23. Concept 4B: Pump Out with Pipeline and No Brine Ponds.

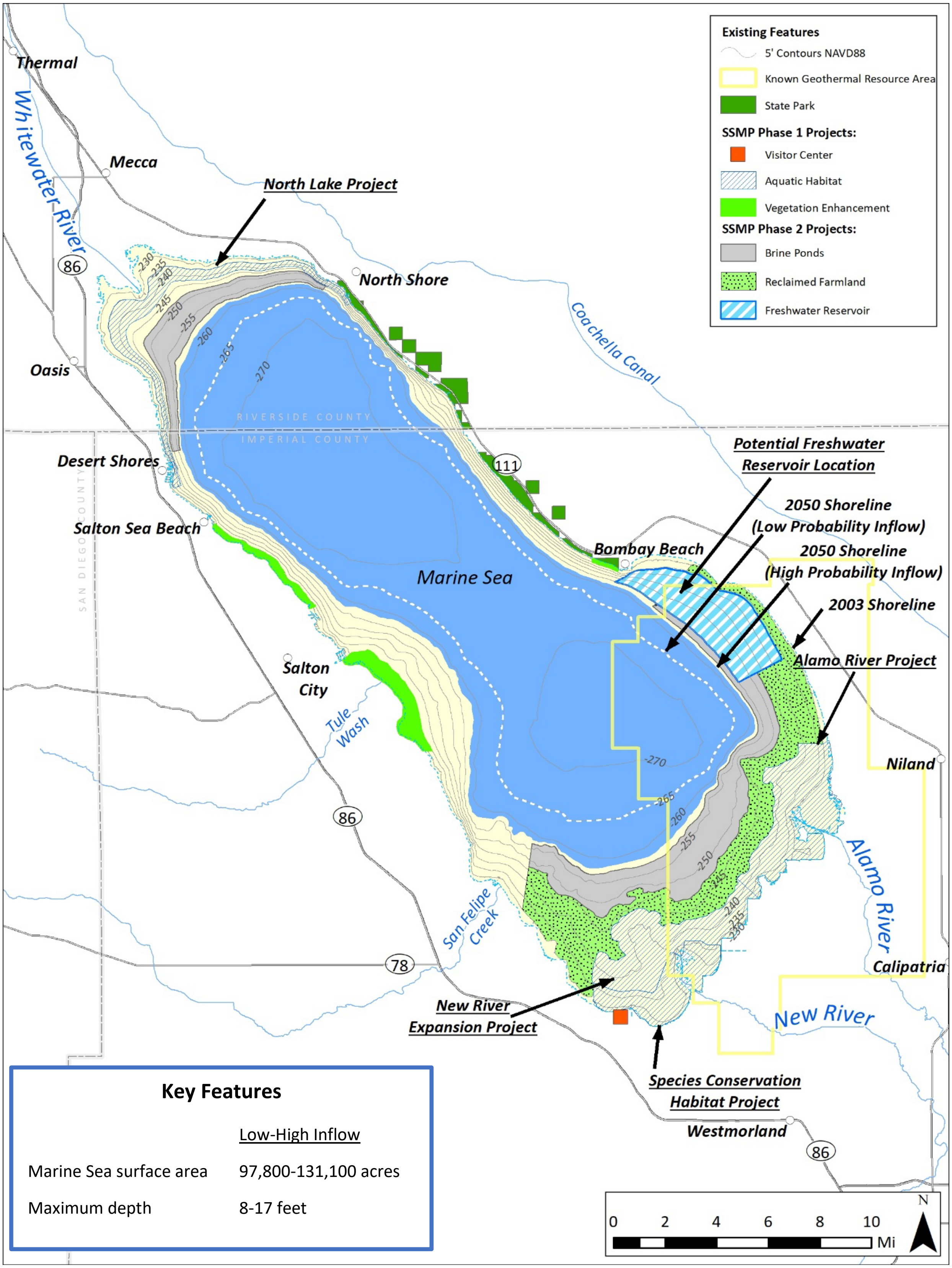

Figure 5-24. Concept 4D: Pump Out with Freshwater Reservoir.

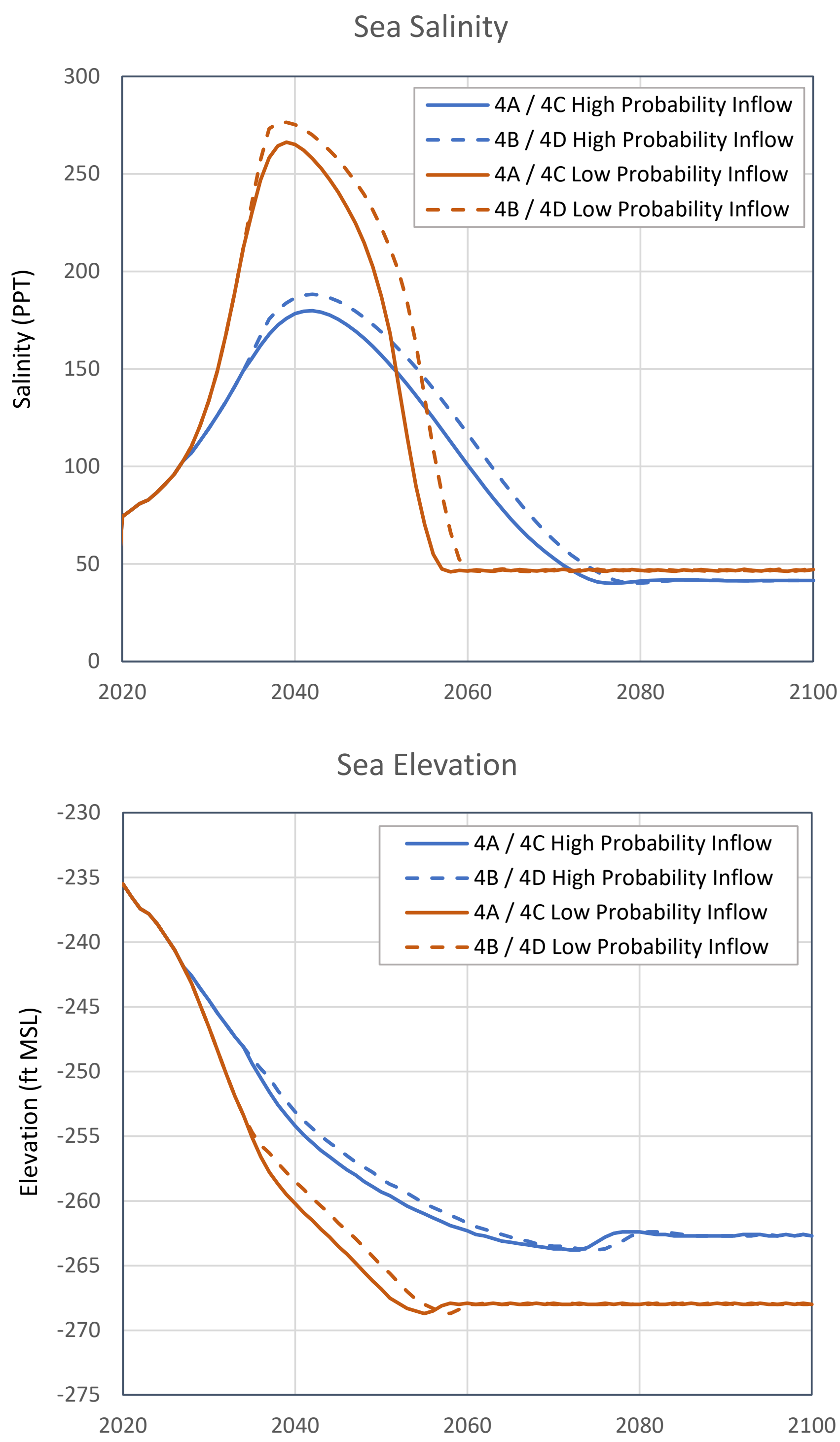

Figure 5-25. Salinity and Elevation Projections for Pump Out Concepts 4A through 4D.

Table 5-12. Estimated Water Requirements for the Pump Out Concepts in Compared to Very Low Probability Inflow.

Feature	Area (ac)	Losses (ft/yr)	Water (AFY)	Area (ac)
Concept 4A				
Phase 1				
Vegetation	2,860	0.5	1,430	
Wetlands	680	5.0	3,402	
SCH	4,110	6.0	24,660	
New River Expansion	6,850	6.0	41,102	
Alamo Project	7,257	6.0	43,542	
North Lake	4,182	6.0	25,092	
Phase 1 Total	**25,940**		**139,228**	
Phase 2 Pump Out			10,000	
Phase 2 Dust Control	80,000	1.0	80,000	
Total	**105,940**		**229,228**	
Very Low Probability Inflow (AFY)			440,000	
Water Available for Phase 2 Habitat		6.0	210,772	
Total North/South Area (acres)				**35,129**
Concepts 4B				
Phase 1				
Vegetation	2,860	0.5	1,430	
Wetlands	680	5.0	3,402	
SCH	4,110	6.0	24,660	
New River Expansion	6,850	6.0	41,102	
Alamo Project	7,257	6.0	43,542	
North Lake	4,182	6.0	25,092	
Phase 1 Total	**25,940**		**139,228**	
Phase 2 Pump Out			10,000	
Phase 2 Dust Control	142,257	1.0	142,257	
Total	**168,197**		**291,485**	
Very Low Probability Inflow (AFY)			440,000	
Water Available for Phase 2 Habitat		6.0	148,515	
Total North/South Area (acres)				**24,753**
Concept 4C				
Phase 1				
Vegetation	2,860	0.5	1,430	
Wetlands	680	5.0	3,402	
SCH	4,110	6.0	24,660	
New River Expansion	6,850	6.0	41,102	
Alamo Project	7,257	6.0	43,542	
North Lake	4,182	6.0	25,092	
Phase 1 Total	**25,940**		**139,228**	
Phase 2 Pump Out			10,000	
Phase 2 Dust Control	142,257	1.0	142,257	
Total	**168,197**		**291,485**	
Very Low Probability Inflow (AFY)			440,000	
Water Available for Phase 2 Habitat		6.0	148,515	
Total North/South Area (acres)				**24,753**
Concept 4D				
Phase 1				
Vegetation	2,860	0.5	1,430	
Wetlands	680	5.0	3,402	
SCH	4,110	6.0	24,660	
New River Expansion	6,850	6.0	41,102	
Alamo Project	7,257	6.0	43,542	
North Lake	4,182	6.0	25,092	
Phase 1 Total	**25,940**		**139,228**	
Phase 2 Pump Out			10,000	
Phase 2 Dust Control	125,000	1.0	125,000	
Total	**150,940**		**274,228**	
Very Low Probability Inflow (AFY)			440,000	
Water Available for Phase 2 Habitat		6.0	165,772	
Total North/South Area (acres)				**27,629**

5.6.3 Status and Cost Estimate

Status – The Pump Out concepts have been retained for analysis and comparison to other alternatives considered feasible in this document.

Cost Estimate – For Concept 4A, it was estimated that about 20,000 acres of brine ponds would be needed. Additional ponds would be needed in the future for the Very Low Probability Inflow Scenario. The brine ponds were assumed to be like those needed for the Saline Habitat Complex (SHC) that is part of the North/South Marine Sea Concept 1A (see Figure 5-3). In 2022 dollars, the cost for constructing SHC ponds was estimated at $33,000 per acre, which would result in a construction cost of $660 million. Annual OMER costs were estimated at 5 percent of the construction cost.

A preliminary cost estimate for the pipeline can be found in FFAP Benchmark 4, Volume 1 (SSA, 2015). In 2015, construction of the pipeline was estimated at about $1.2 billion. The estimated costs have been updated to mid-2022 dollars using indices provided by the DGS California CCI. The updated capital construction cost estimate is provided in Table 5-13. Annual OMER costs for operation of the pipeline are estimated at 5 percent of the construction costs.

Costs for each of the four Pump Out concepts were developed as different combinations of the dust control and pipeline costs discussed above. A cost summary for all four Pump Out concepts, including Phase 1 costs, is provided in Table 5-14.

Table 5-13. Estimated Costs in Million Dollars for Concept 4B: Pump Out with Pipeline.

Description	Price
1 Mobilization/Demobilization	$50,013,000
2 Intake Structure	$14,190,000
3 Intake Pump Station	$7,466,000
4 Intake Pumps	$20,345,000
5 Intake Pump Station Mechanical Piping	$422,000
6 Intake Pump Station Auxilary Items	$2,653,000
7 Conveyance Pipe	$890,298,000
8 Booster Pump Station	$7,466,000
9 Booster Pumps	$15,593,000
10 Booster Pump Station Mechanical Piping	$449,000
11 Booster Pump Station Auxilary Items	$2,653,000
12 Outlook System Facility, Offshore	$10,282,000
13 Additional Structures	$10,618,000
14 Electrical/Instrumentation	$17,809,000
Design, Project and Construction Management (25% of Items 2 to 14)	$250,060,000
Subtotal	$1,300,317,000
Contingency (30%)	$390,095,000
Total	**$1,690,412,000**

Table 5-14. Estimated Costs in Million Dollars for Pump Out Concepts 4A through 4D.

	Capital Costs ($M)			OMER Costs ($M)		
Restoration Concept	Phase 1	Phase 2	Total	Phase 1	Phase 2	Total
4. Pump Out*						
4A With Dust Control	1,293	660	1,953	65	33	98
4B With Pipeline	1,293	1,690	2,984	65	85	149
4C With Dust Control and Pipeline	1,293	2,350	3,644	65	118	182
4D With Dust Control and Freshwater Reservoi	1,293	1,025	2,318	65	51	116

* Costs for reclaiming farmland not included.

5.7 Restoration Concept 5: Water Optimization

This concept was proposed by Michael Cohen of the Pacific Institute, a member of the LRPC. It is based on an earlier NGO proposal from 2006 and builds on the IID's Salton Sea Restoration and Renewable Energy Initiative. This concept would involve a series of shallow ponds and interconnecting channels, like the Saline Habitat Complex (SHC) that is part of the North/South Marine Sea Concept 1A (see Figure 5-3). The ponds would be used for shallow (less than 6 inches of water) and lower mid-depth (6 inches to about 2 feet) habitat and provide dust control. It is likely that a pump system would be required for pumping low selenium Salton Sea waters to the upper reaches of the complex to reduce selenium levels to those acceptable for wildlife habitat. Figure 5-26 provides a map of the Sea with the Water Optimization Concept in place for the High Probability Inflow, and Figure 5-27 provides a map of the Sea with the Water Optimization Concept in place for the Low Probability Inflow Scenario.

5.7.1 Components of the Restoration Concept

Habitat Cells – For this concept a network of shallow habitat cells would be fed by one or more interceptor canals and a pump system for blending low selenium Salton Sea water with river water. Berm construction would follow agricultural practices used for flood irrigation and would maximize flexibility and resilience and minimize costs. Pond sizes would vary from 25 to 100 acres or more, based on site conditions, and information gleaned from operation of higher-gradient ponds.

These practices would allow for thousands of acres of shallow habitat cells to be spread out across exposed lakebed. Average depth in individual cells would be one to two feet depending on local topography, with relatively low berms impounding the water. Dispersed habitat cells would reduce wind fetch and dust emissions. Additional dust suppression projects would be located atop emissive lakebed.

Salinity in the cells would range from 20 PPT in the upper cells to hypersaline (saltier than the ocean) in the downslope cells. Thousands of acres of shallow habitat cells at different levels of saltiness would support a broad range of ecological diversity.

Interceptor Canals and Channels – Water would be captured in two or more interceptor channels and distributed via gravity around the historic Salton Sea shoreline, creating shallow habitat cells and dust suppression projects. Water exiting these shallow cells would flow into subsequent downgradient cells.

Pump System – It is expected that Salton Sea water with low levels of selenium would need to be blended with river water to avoid having elevated selenium levels in the habitat area. This could be accomplished by installing a pump system like that being installed for the SCH project.

5.7.2 Performance, Expected Benefits, and Recreational Opportunities

Benefits would include a broad range of ecological diversity and many eco-tourism-focused recreational opportunities. Multiple amenities could be added in coordination with local communities. These could include selected deeper areas identified for kayaking and fishing access, as well as birding and hiking paths, nature trails, picnic areas, shade areas, and educational and other features that would benefit the community and be attractive to visitors.

An estimated water budget for Concept 5 is shown in Table 5-15. For this water budget, the losses in the water optimization area have been estimated at 8 feet per year per acre. This accounts for evaporation, seepage, and some flow through, assuming there would be berms and bird islands and other areas that would not be wetted. As shown in Table 5-15, it is estimated that a 35,000-acre habitat area would require about 420,000 AFY of water. This amount could be supplied by all inflow scenarios considered in this Plan.

Table 5-15. Estimated Water Requirement for the Water Optimization Concept.

Feature	Area (ac)	Losses (ft/yr)	Water (AFY)
Phase 1			
Vegetation	2,860	0.5	1,430
Wetlands	680	5.0	3,402
SCH	4,110	6.0	24,660
New River Expansion	6,850	6.0	41,102
North Lake	4,182	6.0	25,092
Phase 1 Total	**18,683**		**95,686**
Phase 2			
Water Optimization Area	35,000	8.0	280,000
Dust Control	44,252	1.0	44,252
Phase 2 Total	**79,252**		**324,252**
Total	**97,935**		**419,938**

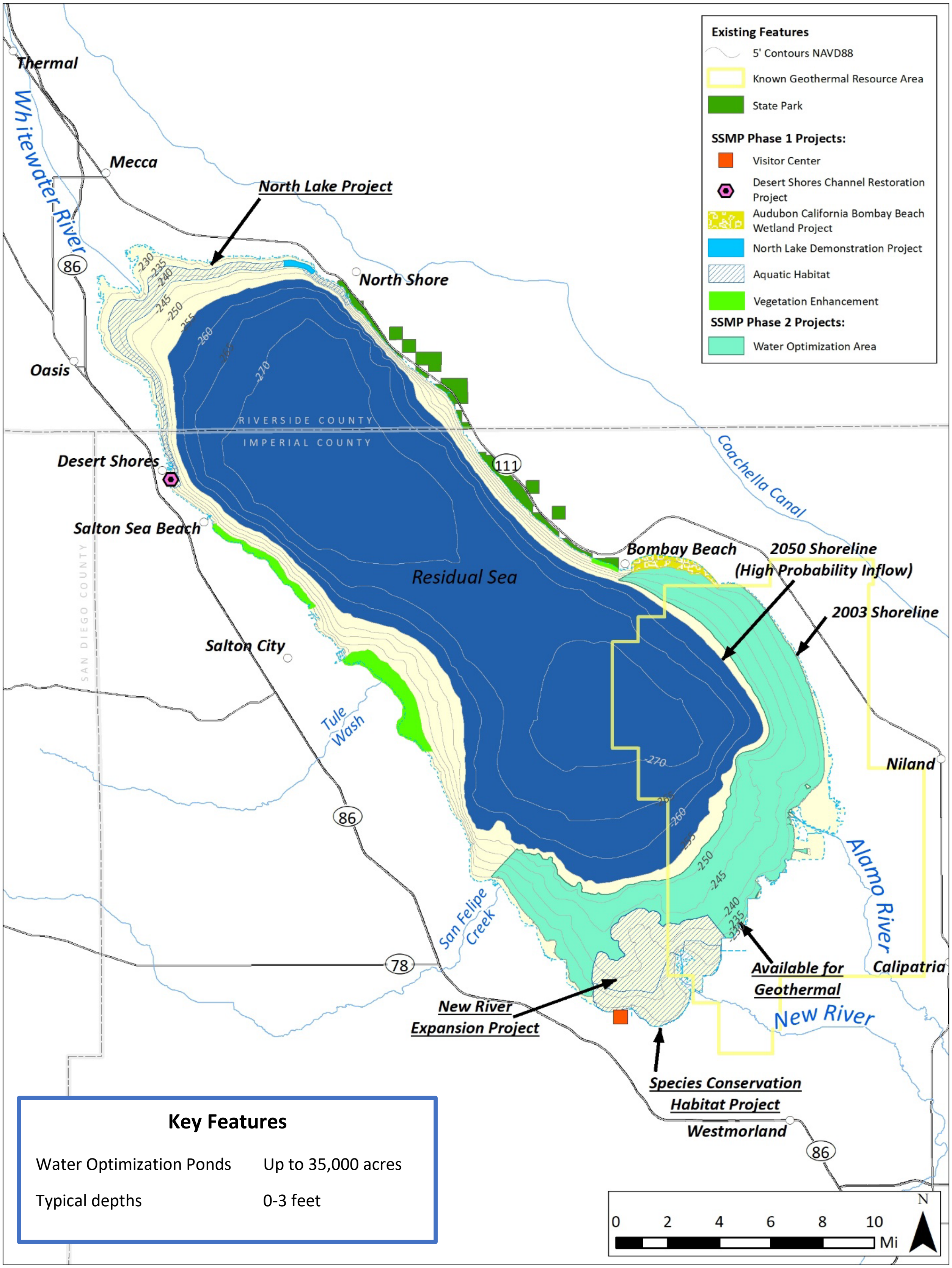

Figure 5-26. Concept 5: Water Optimization for the High Probability Inflow.

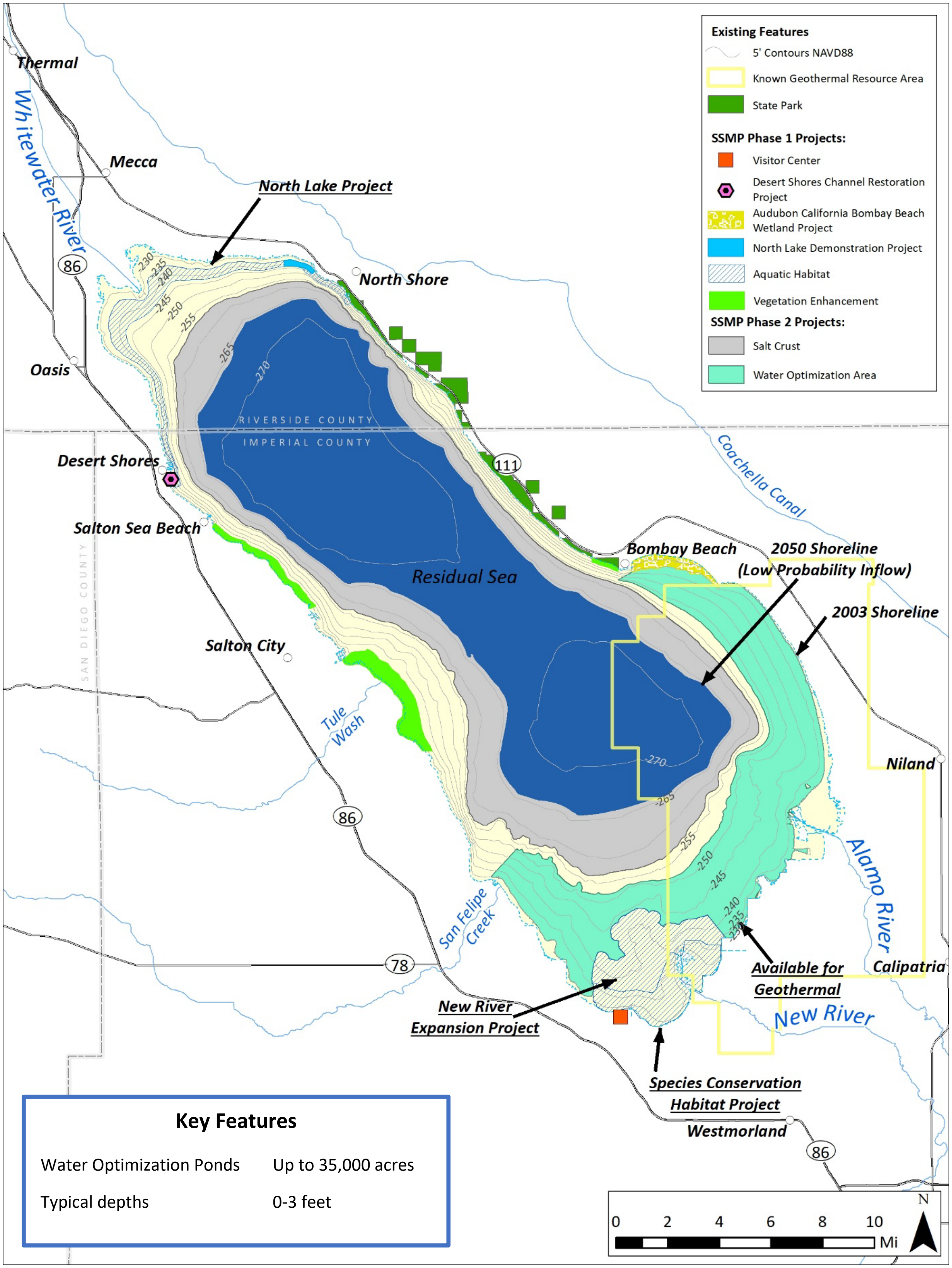

Figure 5-27. Concept 5: Water Optimization for the Low Probability Inflow Scenario.

5.7.3 Status and Cost Estimate

Status – The North/South Marine Sea Concept and its variations have been retained for analysis and comparison to other alternatives considered feasible in this document.

Cost Estimate – In developing a conceptual level cost estimate, consideration was given to the recent experience of constructing vegetation projects on the soft sediments of the exposed lakebed. Working on these soft sediments is costly and requires the use of mats for standard construction equipment or specialized equipment like Mud Cats. Based on these combined factors, the original cost estimate for SHC is expected to be a reasonable starting point for Concept 5.

The base cost per acre was taken from the original estimate for SHC presented in the CNRA Preferred Alternative Report and Funding Plan (May 2007) updated to 2022 dollars. The escalation factor was derived from the CCCI, https://www.dgs.ca.gov. The original estimate for the SHC from 2007 was approximately $17,000/acre. The escalation factor from 2007 to 2022 was 1.9, resulting in a current estimate of $33,000/acre. Assuming 35,000 acres for Concept 5, the construction cost estimate would be $1.155 billion. The annual operating cost for the SHC in 2007 was estimated at approximately 5% of the capital cost. Using this same factor, the annual OMER cost for the concept would be about $58 million/year.

Because this concept does not include the Alamo River Project, the Phase 1 costs would be lower than the full 10-Year Plan. The total program costs including Phase 1 and Phase 2 for Concept 5: Water Optimization are shown in Table 5-16.

Table 5-16. Cost Summary for Concept 5: Water Optimization.

Cost Item	Capital Costs ($M)	OMER Costs ($M)
Phase 1	$ 928	$ 46
Phase 2	1,155	58
Total ($M)	$ 2,083	$ 104

5.8 Restoration Concept 6: Southlake Restoration and Enhanced Vegetation

The concept was proposed by Long Range Plan Committee Members Nathan White and Rob Simpson of AGESS, Inc. The concept would involve low-cost construction of a south lake, and the use of plants to improve the water quality of inflowing water (Phytoremediation). A graphic representation of the south lake provided by AGESS, Inc. is provided in Figure 5-28.

5.8.1 Components of the Restoration Concept

The proponents have proposed a two-phase plan.

Phase 1 – Phase 1 would involve construction of a 17,000-acre south lake and include an alternative fuel production facility. Salinity in the south lake would be less than 8 PPT. Low and wide levees about 10 feet in height would be built to contain the lake. A mix of shallow and deeper water areas could be included. The levee would be sufficient to hold back 5-7 feet of water above the present level of the underlying sea bottom. Newly exposed sediments upslope of the lake would be converted into a terraced phytoremediation/riparian environment that would mitigate dust emission and produce substantially less evaporation than an open water reservoir. A strategic waste to energy infrastructure restoration at Mesquite Regional Landfill is proposed to produce Carbon Neutral Fuel.

Enhanced vegetation and phytoremediation could be installed in the New and Alamo rivers as well as the deltas on floating islands for immediate water quality improvements. A dredged gravity fed irrigation ditch would provide water for wetlands.

PHASE 2 – Phase 2 would involve enhanced vegetation projects on 60,000 acres. Salinities in this area would be up to 20 PPT. Phase 2 could include multi-tech waste conversion facilities to create no-sulfur diesel fuels from waste plastic repurposing.

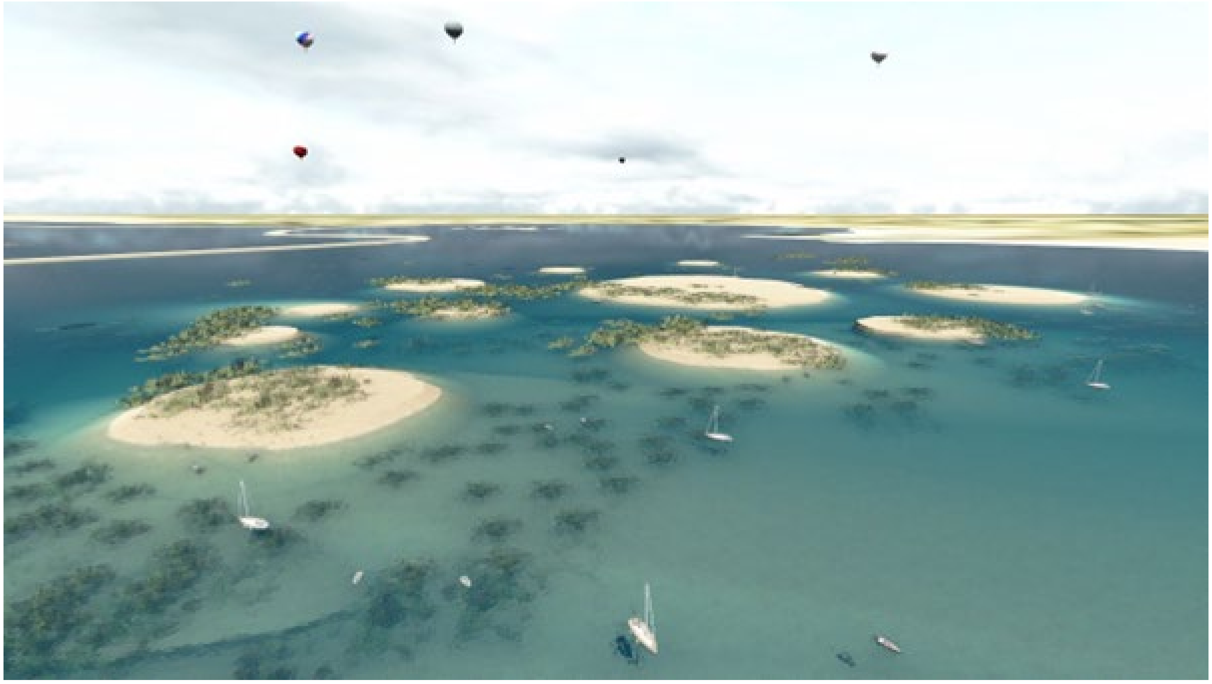

Figure 5-28. Illustration of Southlake Restoration and Enhanced Vegetation Concept, Graphic Provided by AGESS, Inc.

5.8.2 Performance, Expected Benefits, and Recreational Opportunities

The concept would include improved water quality in the inflowing waters and construction of a south lake that could have substantial habitat and recreational benefits. The south lake would have some similarities to the southern cells of Concept 3, the Perimeter Lake. The proponents have suggested that lower cost construction methods could be used compared to those proposed for the Perimeter Lake. However, the cost estimates for the Perimeter Lake were based on a geotechnical analysis of Salton Sea sediments and a feasibility level cost estimate that included seepage calculations and a seismic stability analysis. Because of the high seismicity of the area and the importance of public safety, the conceptual designs and cost estimates for the Perimeter Lake were considered appropriate for this stage of analysis. More detailed engineering and cost estimation will be included in the next phase of environmental and engineering analysis.

5.8.3 Status and Cost Estimate

Components of the concept, including phytoremediation for improving water quality of inflowing river water, are being retained for future consideration as components of larger restoration plans during the next phase of environmental and engineering analysis. Because this is not considered a full restoration concept, a cost estimate has not been developed, and it is not included in the comparison with other full restoration concepts.

5.9 Restoration Concept 7: Water Recycling (Desalination)

The concept was proposed by Long Range Plan Committee Member Tom Sephton of Sephton Water Technology, Inc. The concept would involve construction of five 20 MGD Vertical Tube Evaporation (VTE) desalination plants producing a total of 100 MGD (112,000 AFY) of fresh water which could be recycled to the Sea. In addition, pumping from local groundwater aquifers would be used to make up for water lost in the desalination process. A graphic representation of the water recycling process provided by Sephton Water Technology is provided in Figure 5-29.

5.9.1 Components of the Restoration Concept

The Salton Sea Water Recycling would involve removal of salt from the Salton Sea water and the recovery of pure water to be returned to the Sea either directly or through habitat projects near the shoreline. The treatment process outlined in the proposal (Sephton Water Technology, 2022) is illustrated in Figure 5-29. Non-purified mixed salt brine from the desalination process would be used to create salt for sale or discharged to brine ponds to control dust on the lakebed. Salt crust on the lakebed would begin to reduce PM10 dust from unpopulated areas of shoreline by 2030 and eliminate all lakebed dust by roughly 2060. Three to five million tons of pure salt would be created by a distillation/desalination process at the Salton Sea, which could be sold to fund restoration efforts. Figure 5-30 illustrates the Salton Sea in 2050 after implementation of this concept.

The objective of the treatment process is to remove divalent ions from the Salton Sea water, using nanofiltration (NF) membranes. The NF permeate is proposed to be concentrated using vertical tube evaporators – multi-effect distillation (VTE-MED) to produce pure sodium chloride (NaCl) (salt) and very low salinity water, as a distillate. The distillate would be returned to the Salton Sea.

The process consists of a combination of different commercial water treatment technologies that are expected to work individually. However, combining these technologies in one operating system may create significant challenges for process integration. Except for the VTE equipment that is described in some detail, other plant equipment and treatment processes are described in broad terms, without the engineering details and without a listing of relevant process parameters. Some plant equipment (water intake for example) was missing essential components. Other important plant subunits were omitted completely and not accounted for in the plant budget. For example, the solids management system, required for treating of the filtration system backwash water and sludge from lime precipitation unit, is not included in the system description and system cost in the document provided for review. Chemicals storage and dosing systems were also not addressed.

Based on evaluation of the proposed system, presented in Appendix G, the system could operate at 65% efficiency, which means about 153.5 MGD would need to be pumped to produce 100 MGD of fresh water returned to the Sea. To make up for some of the water lost during treatment, the proposer suggested that 50,000 AFY (44.6 MGD) water would be supplemented by pumping from local groundwater sources.

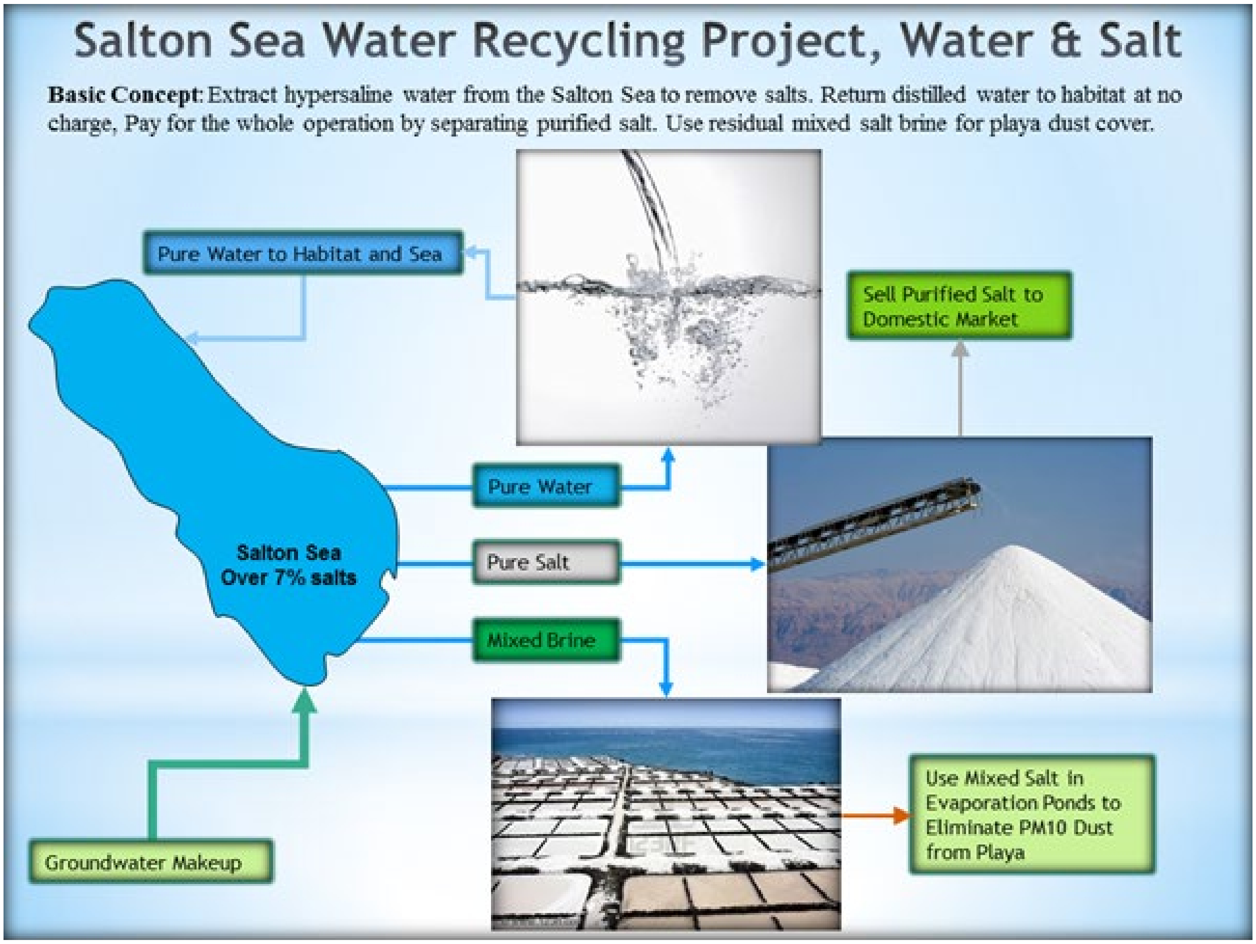

Figure 5-29. Illustration of Concept 7: Salton Sea Water Recycling, Graphic Provided by Sephton Water Technology.

5.9.2 Performance, Expected Benefits, and Recreational Opportunities

The performance of this concept would be like that of the Pump Out concepts except that the time to achieve habitat objectives would be shortened and the Sea would ultimately be about 10 to 15 percent larger. However, depending on future inflows it could still take several decades to achieve the upper salinity limit of 40 PPT. The elevation of the Sea would not be controlled, and the area would fluctuate with inflows. Once the salinity has been lowered to 40 PPT, the smaller Sea would provide habitat benefits as well as a large area for recreational activities, such as boating and fishing. The communities around the Sea could build out toward the new shorelines, or channels could be dredged to provide access to the current infrastructure. Other amenities, such as beaches and parks, could be added to take advantage of the restored fish and bird habitat.

The proponent of this concept has proposed that restoration costs could be offset by the sale of salt. While this strategy provides a promising alternative to disposal of salt by other means, whether the market could accommodate the mass of salt generated is unclear. A market study would need to be conducted to determine if the cost of processing, packaging, and transporting the salt would be offset by the value of salt sales.

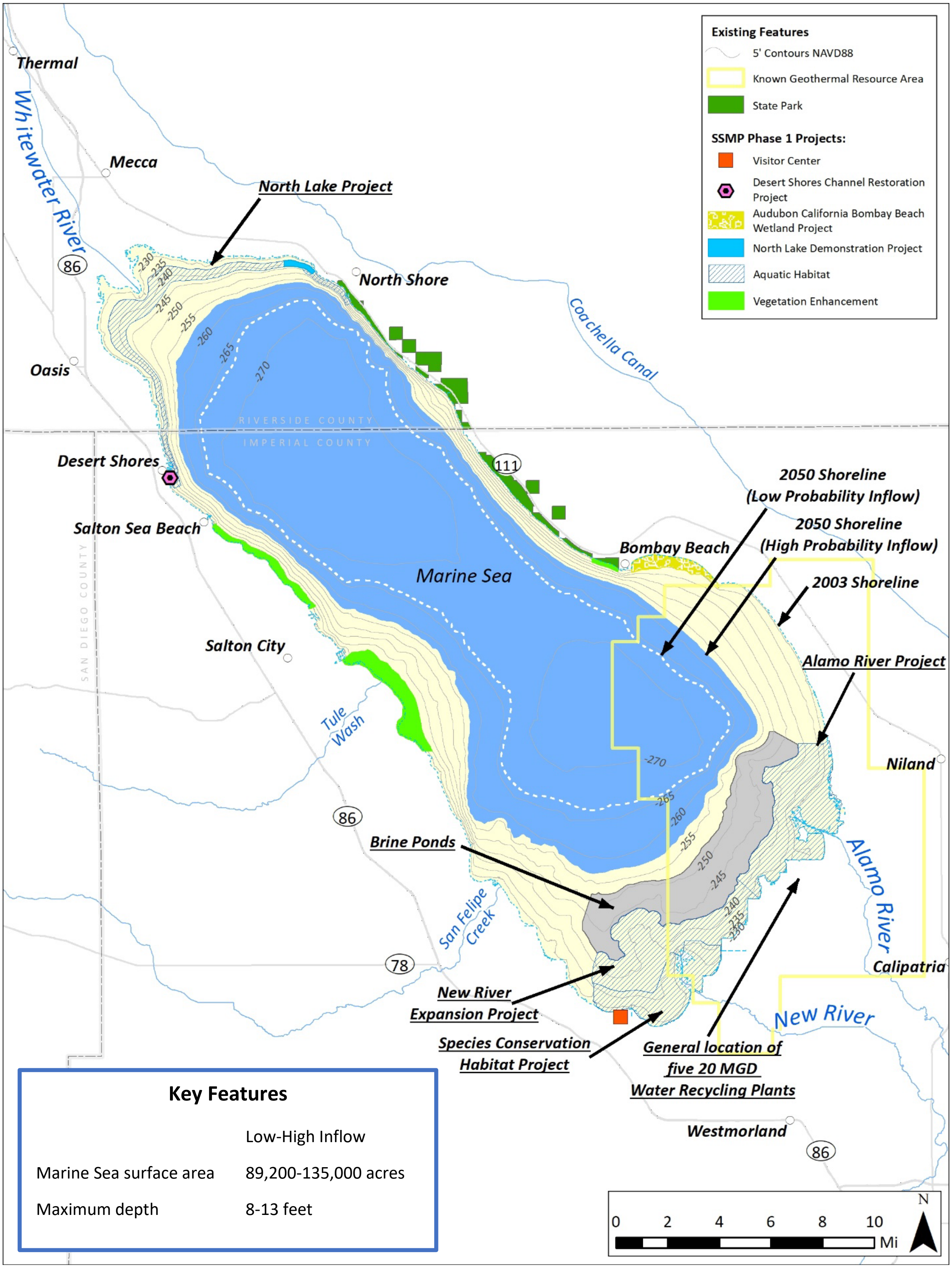

Figure 5-30. The Salton Sea in 2050 after Implementation of Concept 7: Water Recycling.

Projections of future elevation and salinity performance in the Sea for the Water Recycling Concept are provided in Figure 5-31 for the High and Low Probability Inflow Scenarios. Limitation of the model do not allow for accurate elevation and salinity forecasts for the Very Low Probability Inflow Scenario. Instead, for the Very Low Probability Inflow Scenario, water requirement estimates were developed to determine if there would be enough water available to support Phase 2 habitat areas. The inflow requirements for Phase 1 projects and for vegetation enhancement or other dust control measures were subtracted from the Very Low Probability Inflow Scenario to determine the amount of water remaining for the Marine Sea for Concept 7.

Table 5-17 provides the estimated water available for the Water Recycling Concept in comparison to the Very Low Probability Inflow Scenario. Table 5-17 also shows the total area of water surface that could be sustained by that amount of water. As shown, the habitat area that could be supported is estimated to be about 27,000 acres. The calculations shown in are for steady state conditions after the salinity in the water has reached target salinity. With a very low inflow, only a small pump out for recycling would be required to remove the amount of salt in the inflowing water. This concept also includes groundwater pumping into the Sea to supplement losses in the desalination process. For this inflow scenario, very little desalination would be required once target salinity is achieved. Therefore, excess groundwater could be used to increase the area shown in this calculation by about 7,000 acres.

Table 5-17. Estimated Water Requirements for the Water Recycling Concept Compared to Very Low Probability Inflow.

Feature	**Area (ac)**	**Losses (ft/yr)**	**Water (AFY)**	**Area**
Phase 1				
Vegetation	2,860	0.5	1,430	
Wetlands	680	5.0	3,402	
SCH	4,110	6.0	24,660	
New River Expansion	6,850	6.0	41,102	
Alamo Project	7,257	6.0	43,542	
North Lake	4,182	6.0	25,092	
Phase 1 Total	**25,940**		**139,228**	
Phase 2				
Water Recycling			0	
Dust Control	140,000	1.0	140,000	
Phase 2 Total	**140,000**		**140,000**	
Total	**165,940**		**279,228**	
Very Low Probability Inflow			**440,000**	
Water for Habitat		6.0	160,772	
Area				26,795

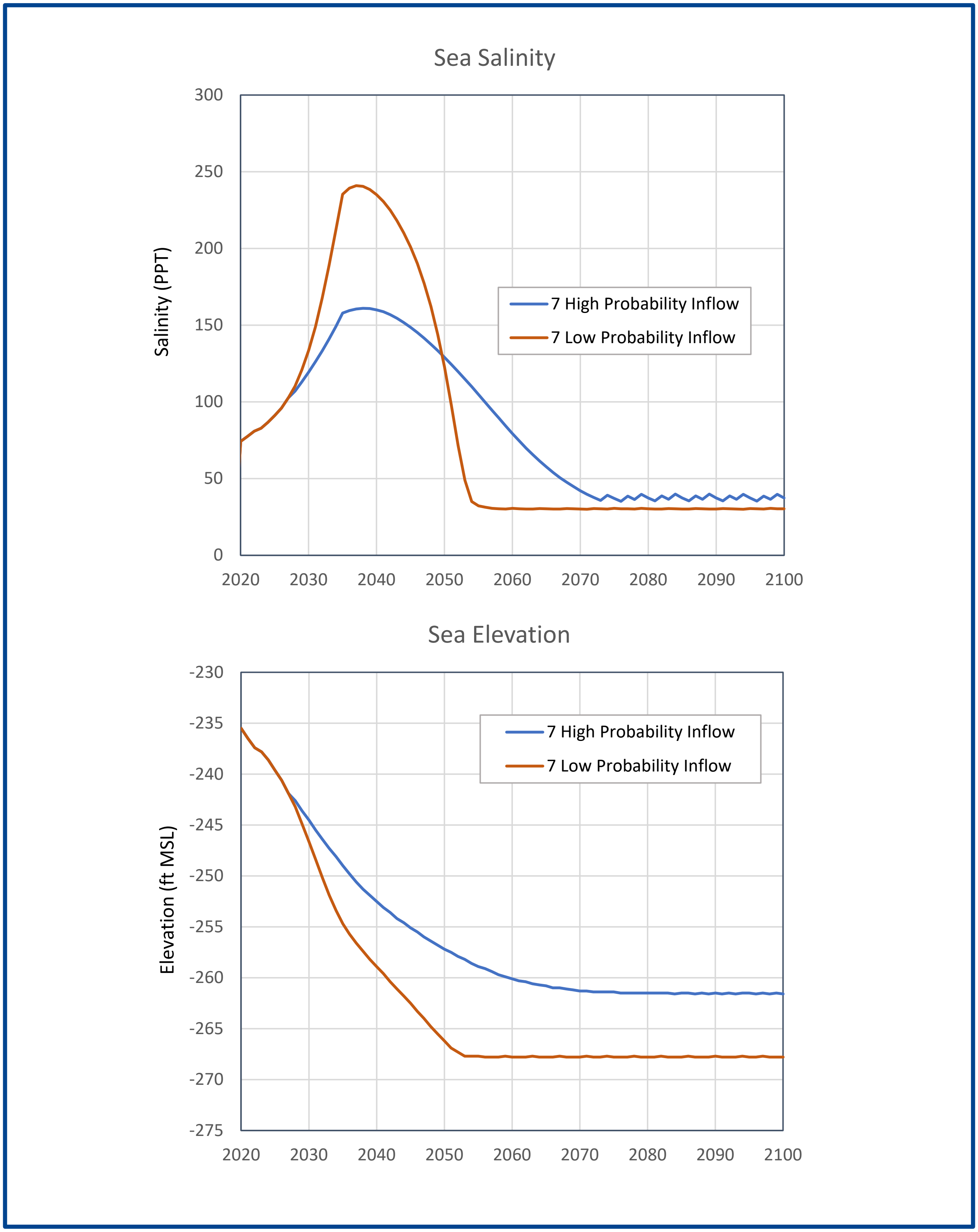

Figure 5-31. Salinity and Elevation Projections for Concept 7: Water Recycling.

5.9.3 Status and Cost Estimate

STATUS – The Water Recycling Concept and its variations have been retained for analysis and comparison to other alternatives considered feasible in this document.

COST ESTIMATE – A cost summary for the Phase 2 components of Concept 7: Water Optimization is provided in Table 5-18. A cost summary for Phase 1 and Phase 2 for Concept 7: Water Optimization is provided in Table 5-19.

Table 5-18. Cost Summary for Concept 7: Water Optimization.

Cost Element	Unit Cost	Units	Discount*	Captital Costs	Operating Costs
Desalination Plant (20 MGD)	$ 593,724,000	5	10%	$ 2,671,800,000	$ 147,460,000
Distribution Pipeline	240,000,000	1		240,000,000	
Brine Disposal Ponds	33,000	12,000	20%	316,800,000	15,840,000
Freshwater Habitat Ponds (assume 3,000 acres)	33,000	3,000		99,000,000	4,950,000
Groundwater Well and Pipeline (50,000 AFY)	44,000,000	1		44,000,000	4,400,000
Totals				**$ 3,371,600,000**	**$ 172,650,000**

*Plant discount based on economy of scale. Pond unit cost based on Saline Habitat cost estimates discounted for elements not needed.

Table 5-19. Cost Summary for Phase 1 and Phase 2 for Concept 7: Water Optimization.

Cost Item	Capital Costs ($M)	OMER Costs ($M)
Phase 1	$ 1,293	$ 65
Phase 2	3,372	173
Total ($M)	$ 4,665	$ 238

5.10 Restoration Concept 8: Reclamation of Native Desert and Agriculture

This concept was submitted by Jeff B. Geraci, a local resident, in response to a Request for Information (RFI) from the IRP. Because it does not involve water importation, it was referred to the SSMP team. The concept would involve use of up to 100 AFY of Colorado River water for construction of palm oases.

5.10.1 Components of the Restoration Concept

The concept would involve temporary utilization of New River and Alamo River and seed dispersal to provide a catalyst to start revegetation of exposed lakebed. The proposal includes creating small shallow pools of oases around the lakebed to help provide drinking water for the wildlife and help provide a catalyst for the revegetation of the lakebed. Palm oases would consist of clusters of palms surrounding small, constructed pools of water, which would provide shade for recreators, drinking water for wildlife, and habitat for pupfish.

Exposed lakebed areas around the Sea would be selected for artificial seed dispersal and temporary irrigation for up to 2-6 months. The concept asserts that dense vegetation will bind the soil even after it dies. The concept has similarities to revegetation projects being implemented on exposed lakebed to control dust.

5.10.2 Performance, Expected Benefits, and Recreational Opportunities

The plan does not involve control of salinity or lake surface. However, as mentioned, the concept is like revegetation projects being implemented on exposed lakebed to control dust. These projects are expected to continue and be incorporated with all other restoration concepts.

5.10.3 Status and Cost Estimate

The concept has been retained for future consideration as a component of larger restoration plans during the next phase of environmental engineering analysis. Because this is not a full restoration concept, a cost estimate has not been developed, and it is not included in the comparison with other full restoration concepts.

5.11 Restoration Concept 9: Floating Solar & Water Generation System

This concept was submitted by Transform Water & Power in response to an RFI from the IRP. Because it does not involve water importation, it was referred to the SSMP team. It would involve a large number of floating solar systems that would cover the water surface and slow evaporation, while generating freshwater that would return to the Sea.

5.11.1 Components of the Restoration Concept

The concept would involve solar modules on racking supported by floats with an industrial atmospheric water generation unit as illustrated in Figure 5-32. The floating solar system would cover the water surface and slow evaporation, while generating electrical energy. The electrical energy being created would supply energy to the water generation unit. The water generation unit would then generate freshwater that would be returned to the Sea. The concept would reduce salinity from decreased evaporation by covering parts of the Salton Sea and adding freshwater.

Figure 5-32. Concept 9A: Floating Solar and Water Generation System.

5.11.2 Performance, Expected Benefits, and Recreational Opportunities

The proposers have stated that the system could be used to maintain Sea elevation closer to historic levels, reduce exposed lakebed near communities, and allow for community access. However, there are many technical issues that would make this concept impractical. It was estimated that, because of the large area of the Sea, 6,000,000 or more of these units would be required to have only a 10 percent benefit in reducing evaporation. Other floating systems have been tested in the Sea and with the high salinity, large temperature extremes, and high wave activity, they are generally not practical. The operating life expectancy of individual units would be on the order of one to three years. Furthermore, having 6,000,000 of these units would be an impediment to recreational boating.

5.11.3 Status and Cost Estimate

This concept is not considered practical as a full Sea restoration concept, but it is possible the units could be tested in small local embayments. Therefore, the concept has been retained for future consideration as a component of larger restoration plans during the next phase of environmental engineering analysis. Because this is not a full restoration concept, a cost estimate has not been developed and it is not included in the comparison with other full restoration concepts.

5.12 Restoration Concept 10: Save the Coachella Valley Basin

This concept was proposed by Quantum Consultations as a community-based operation that would involve lakebed shore cleanup, waste removal, and beautification. Community outreach would include social media and public meetings and the formation of a "Save the Salton Sea Clean Up Committee" as a short-term initiative. The long-term goal would be to work directly with the community to make improvements around the Sea.

5.12.1 Components of the Restoration Concept

The "Save the Salton Sea Clean Up Committee" is proposed as a short-range plan to provide the lakebed shore with cleanup, waste removal, and beautification. Further initiatives would be developed for habitat restoration and other key goals. These initiatives would be funded through Federal or State grants. The longer-range goals would include future infrastructure and multi-purpose recreational areas that would involve more of the community surrounding the Salton Sea.

Exposed lakebeds close to the Salton Sea shore would be developed into mudflats and ponds. The habitat restoration projects would include fish rest areas, like the fish traps built by the Cahuilla Indians in premodern times. Small wetlands on the lakebed would also provide local dust suppression.

5.12.2 Performance, Expected Benefits, and Recreational Opportunities

The plan does not involve control of salinity or lake surface. However, community involvement would be beneficial to restoration efforts. The community could be directly involved in all phases of the project to design educational and habitat restoration opportunities.

5.12.3 Status and Cost Estimate

The concept has been retained for future consideration as a component of larger restoration plans during the next phase of environmental engineering analysis. Because this is not a full restoration concept, a cost estimate has not been developed, and it is not included in the comparison with other full restoration concepts.

5.13 Restoration Concept 11: IRP Water Importation

Concept 11 is the first of three proposals submitted by the Independent Review Panel (IRP). The source of imported water for this concept is desalinated water from the Sea of Cortez, Mexico. Between 860,000 and 1 million AFY of water would be extracted from the Sea of Cortez and desalinated at an Ocean Water Desalination Facility on the western shore of the Sea of Cortez near San Felipe, Baja California, Mexico. The product water from the desalination facility, approximately 430,000–540,000 AFY, would then be conveyed from the desalination facility to a location at the southwest edge of the Salton Sea. This water would be used to increase the Salton Sea elevation, decrease salinity, and decrease the amount of exposed lakebed. A second remediation desalination facility would remove salts and further decrease the salinity of the Salton Sea.

The alternative was developed by the IRP as a composite of three water importation alternatives that passed the fatal flaw screening criteria:

- R4, Salton Sea Water Importation Project, prime respondent: Cordoba Corporation
- R9, Water Import Salt Extraction Revenue, prime respondent: Sephton Water Technology, Inc.
- R10, Super Salton Trough Interconnection Project, prime respondent: New Water Group, LLC

The three alternatives had similarities and differences in various project components as summarized in Table 5-20. All three alternatives consider the Sea of Cortez as a water source and reverse osmosis (RO) for desalination. However, the other components differed by alternative. The option selected by the IRP for their composite Water Import Concept is highlighted in Table 5-20. The reasoning for this selection, as provided by the IRP, is summarized below.

Table 5-20. Components of the Water Importation Concepts that Passed the IRP Fatal Flaw Analysis.

Component	R4	R9	R10
Water Source	**Sea of Cortez**	**Sea of Cortez**	**Sea of Cortez**
Intake	**Submerged**	Tidal, sand filtered	Subsurface
Desalination at Sea of Cortez	**RO**	**RO**	**RO**
Brine Management-Sea of Cortez	Not specified	Salt recovery for sale; salinity gradient solar ponds	**Brine Outfall**
Conveyance	**Pipeline**	Pipeline and Canal	**Pipeline**
Delivery Point	**Salton Sea**	Salton Sea (R9A), Salton Sea via Mexicali (R9B), Mexicali, in Exchange for Colorado River Water (R9C)	Salton Sea; option for desalinated water delivery to Mexico
Remediation Desalination at Salton Sea	RO; pumping of hypersaline water	**RO**	TBD as part of a salinity management plan
Brine Management-Salton Sea	Evaporation Ponds; Deep well injection	**Salt recovery for sale; salinity gradient solar ponds**	TBD; brine line to ocean outfall

Note: The options selected by the IRP are highlighted in **bold**.

Intake – While tidal sand-filtered and subsurface intakes may be appropriate for the project, verifying the design criteria and suitability for the project would require additional geotechnical studies and infiltration evaluations. The IRP Water Import Concept therefore used a submerged intake as no additional studies would be required to verify suitability for the project.

Desalination at the Sea of Cortez – To reduce the amount of salt imported into the Salton Sea basin along with the imported water, desalination at the Sea of Cortez was evaluated. In the IRP Water Import Concept, the location of the desalination facility was assumed to be near the ocean intake north of San Felipe and south of the Biosphere Reserve to reduce pumping costs and reduce the required distance for a brine outfall. This location was proposed in one of the alternatives in R9, while R4 and R10 did not define a specific location for the facility.

Brine Management at the Sea of Cortez – Seawater RO facilities typically operate at a 50% recovery rate: for every gallon of desalinated water produced, a gallon of brine is produced. While options for brine management and salt recovery could be explored, an outfall would be required so that the desalination facility could operate in the event of any interruptions at the salt recovery facility. Therefore, the IRP Water Import Concept includes an outfall to dispose of RO brine.

Conveyance – Responses R4, R9, and R10 convey desalinated water from the Sea of Cortez to the Salton Sea. R4 and R10 use pipelines, while R9 uses a combination of canals and pipelines. The IRP Water Import Concept includes a pipeline to reduce potential water loss due to evaporation along the route. The IRP Water Import Concept uses an alignment to the east of the Sierra de Los Cucapah due to easier access for construction, operations, and maintenance.

Delivery to the Salton Sea – Responses R4, R9A, and R10 convey desalinated water from the Sea of Cortez directly to the Salton Sea. R9B proposes delivery in Mexicali, with water flowing via the New and Alamo Rivers and existing canals as well as providing water for beneficial use in Mexico. R10 also contains provisions for additional water delivery to Mexicali prior to crossing the US-Mexico border. While delivery of desalinated water in Mexico provides a clear project benefit, the scope and scale of the water delivery in R10 is unknown. The decision as to how much water would be delivered to Mexico is critical as it impacts the size of the desalination facility at the Sea of Cortez, pipeline length and sizing, and other considerations. The IRP Water Import Concept assumes 100% of the water delivery would be at the Salton Sea.

Salinity Reduction at the Salton Sea – Even with the desalination of imported water prior to delivery at the Salton Sea, additional salinity reduction at the Salton Sea would be required to meet the salinity goals. Response R4 proposed a RO remediation desalination facility of approximately 13.5 MGD, while R9A included a facility approximately 100 MGD in capacity. R10 proposed development of a salinity management plan with no set strategy defined. To evaluate the range of costs and benefits of the proposed desalination facilities, two sub-concepts were considered in the IRP Water Import Concept: (1) a 13.5 MGD remediation desalination facility, and (2) a 100 MGD remediation desalination facility at the Salton Sea. While operation of the facility could be adjusted based on observed conditions at the Salton Sea, for planning purposes the facility was assumed to operate at full capacity for the project duration (through 2078). The evaluation assumed the use of RO for remediation desalination for salinity and cost estimation. A constant recovery of 50% was assumed.

Brine Management at the Salton Sea – Both R4 and R9 include evaporation ponds as a part of the brine management strategy. R4 also includes the potential for brine disposal via deep well injection. The IRP Water Import Concept did not consider deep well injection due to the uncertainty of its suitability for the project. R9 includes a suite of brine management techniques to separate and dry salt for market sale. While this strategy provides a promising alternative to disposal of salt in a landfill, whether a local market could accommodate the mass of salt generated at the proposed qualities is unclear. With salt being a low value commodity, most salt is used in the geographic region in which it is produced, as transportation costs quickly reduce the cost-effectiveness of the product. Future work could evaluate the proposed salt recovery facilities at a demonstration scale to establish the quality and marketability of recovered salt. The IRP Water Import Concept therefore only investigated evaporation ponds as a brine disposal method.

5.13.1 Components of the Restoration Concept

Specific components of the Sea of Cortez water importation concept can be grouped into three types of facilities: (1) Intake and desalination; (2) Conveyance; and (3) Facilities and operations within the Salton Basin. The Salton Sea in 2050 after implementation of this concept is illustrated in Figure 5-33.

Intake and Desalination – A 960 MGD ocean water intake would be located on the west side of the Sea of Cortez near San Felipe, Baja California. The intake would be a structure at least 40 feet below sea surface. The intake would be comprised of two 144-inch diameter pipelines of steel with polyurethane lining. The intake would extend 1.9 miles offshore and include screens that would prevent entrainment and impingement of sea life. The ocean water intake would be served by a 960 MGD Sea of Cortez intake pump station with 51,100 brake horsepower (BHP).

A reverse osmosis ocean water desalination facility would be located near the intake with a product water capacity of approximately 480 MGD. This facility would be located on a 75-acre site.

The desalination brine outfall on the Sea of Cortez would be co-located with the intake. The brine outfall would consist of one 144-inch pipeline, 3.4 miles in length. The proposed pipeline material would be steel with polyurethane lining.

Conveyance Facilities – Conveyance facilities would consist of a 480 MGD conveyance pump station, 96,000 BHP, served by a 5-mile new connection to 69kV or higher transmission line between the City of San Felipe and the Sea of Cortez pump station. The presence of the necessary electrical facilities with sufficient generation and transmission capacity serving San Felipe has not been confirmed but was assumed for the purposes of this analysis. An electrical substation at the Sea of Cortez Intake Pump Station would step down the voltage 13.8kV to feed distribution switchgear within the pump station facility. Approximately 190 miles of parallel 108-inch steel pipelines with polyurethane lining would transport desalinated ocean water to the Salton Sea. The water conveyance pipeline is assumed to be installed via trenching.

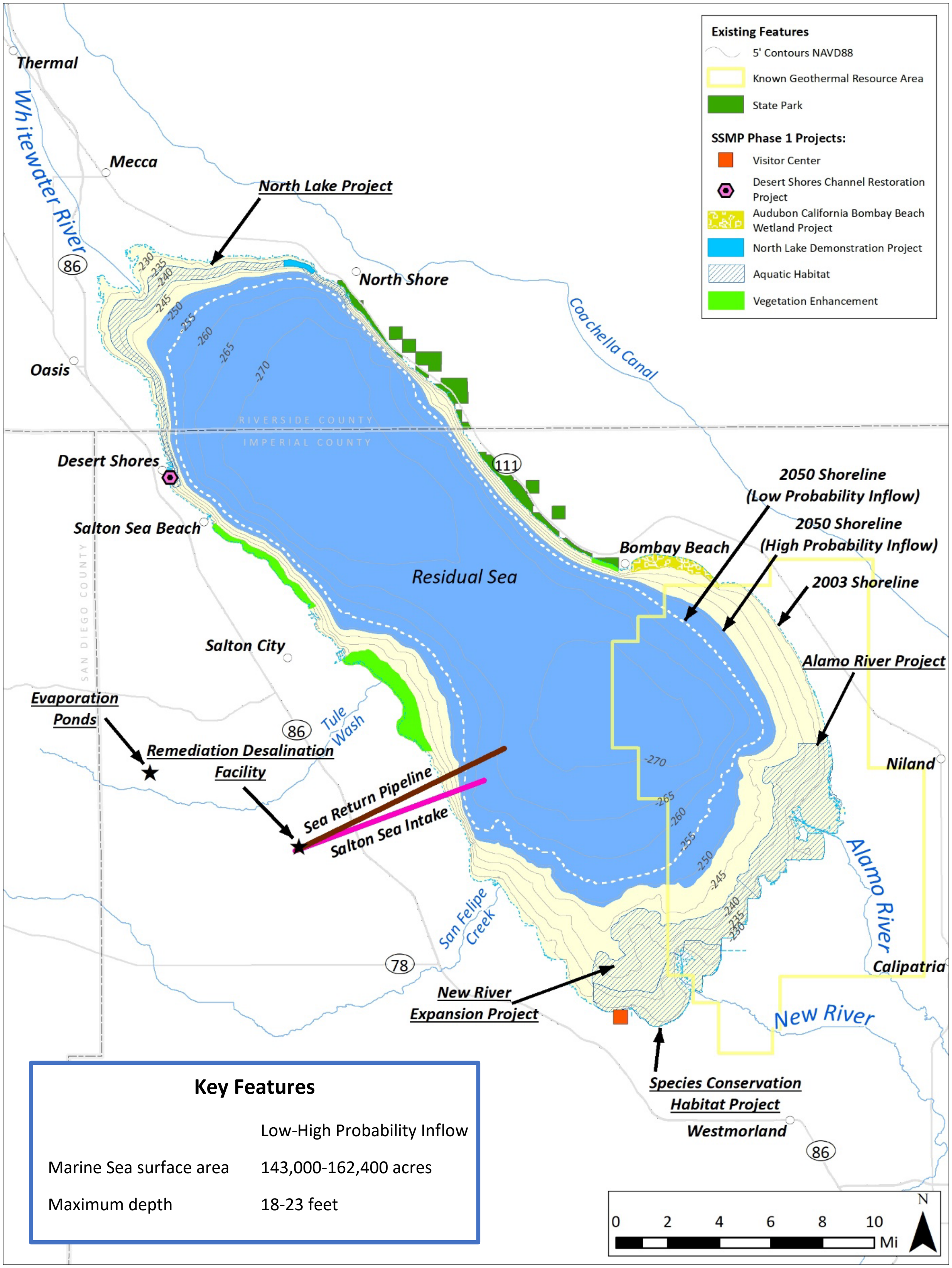

Figure 5-33. Salton Sea in 2050 after Implementation of the Independent Review Panel (IRP) Water Importation Concept.

Facilities and Operations Within the Salton Basin – Energy recovery turbines, expected to be parallel Francis turbines, would be located near the discharge at the Salton Sea. The 108-inch parallel pipelines would connect to a header that distributes flow to these turbines. The discharge piping would run under a concrete structure, and water would be discharged into the Salton Sea below the water surface. The energy recovery station could produce 29 Megawatts (MW) of power and has an expected efficiency of 87%.

The remediation desalination facility would be located near the southwest corner of the Salton Sea. The intake facilities would be 98-inch diameter steel pipe with polyurethane lining extending 1.9 miles into the Salton Sea. The 200 MGD, 25,000 BHP Salton Sea pump station would be used to move water from the Salton Sea to the remediation desalination facility. A 100 MGD reverse osmosis remediation desalination facility near the Salton Sea would further treat Salton Sea water, which would be returned to the Salton Sea via a 70-inch, 3.4-mile-long Salton Sea return pipeline.

Brine handling for remediation desalination facility would consist of 22,000 acres of evaporation ponds, located on the west side of the Salton Sea outside of sensitive ecological areas.

5.13.2 Performance, Expected Benefits, and Recreational Opportunities

The IRP Water Importation concept would return the Sea to a lower salinity in the range of 20 to 40 PPT. However, because of the long lead time on design, permitting, and construction, information provided by the IRP suggests that it would take about 37 years, or until 2059, to achieve 40 PPT. For the High Probability Inflow considered in this Plan, the time to achieve 40 PPT could be a little shorter, and for the Low Probability Inflow Scenarios, it would be longer. The elevation of the Sea would not be controlled, but the steady inflow of fresh water would provide for a stable base elevation.

If local inflows were to decline during operation of this concept, the elevation in the Sea would go down and there would be an associated increase in salinity. The local desalination plant may need to operate at full capacity to bring salinity back down.

Once the salinity has been lowered to 40 PPT, the Sea would provide habitat benefits as well as a large area for recreational activities, such as boating and fishing. The Sea would still be somewhat lower in elevation than it was around the 2000 timeframe. The communities around the Sea could build out toward the new shorelines, or channels could be dredged to provide access to the current infrastructure. Other amenities, such as beaches and parks, could be added to take advantage of the restored fish and bird habitat.

Projections of future elevation and salinity performance in the Sea for the IRP Water Import Concept are provided in Figure 5-34 for the High and Low Probability Inflow Scenarios. Limitation of the model do not allow for accurate elevation and salinity forecasts for the Very Low Probability Inflow Scenario. Instead, for the Very Low Probability Inflow Scenario, water requirement estimates were developed to determine how much water would be available to maintain the Phase 2 Marine Sea. The inflow requirements for Phase 1 projects and for vegetation enhancement or other dust control measures were subtracted from the Very Low Probability Inflow Scenario to determine the amount of water remaining for the Marine Sea for Concept 11.

Table 5-21 provides the estimated water available for the IRP Water Import Concept in comparison to the Very Low Probability Inflow Scenario. Table 5-21 also shows the total area of water surface that could be sustained by that amount of water. As shown, the habitat area that could be supported is estimated to be about 106,000 acres. The calculations shown in are for steady state conditions after the salinity in the water has reached target salinity.

Table 5-21. Estimated Water Requirements for the IRP Water Import Concept Compared to Very Low Probability Inflow.

Feature	Area (ac)	Losses (ft/yr)	Water (AFY)	Area
Phase 1				
Vegetation	2,860	0.5	1,430	
Wetlands	680	5.0	3,402	
SCH	4,110	6.0	24,660	
New River Expansion	6,850	6.0	41,102	
Alamo Project	7,257	6.0	43,542	
North Lake	4,182	6.0	25,092	
Phase 1 Total	**25,940**		**139,228**	
Phase 2				
Remediation Desalting Losses			112,000	
Dust Control	50,000	1.0	50,000	
Phase 2 Total	**50,000**		**162,000**	
Total Phase 1 and 2	**75,940**		**301,228**	
Very Low Probability Inflow			440,000	
Coastal Desalination			500,000	
Total Water Available			**940,000**	
Water for Phase 2 Habitat		6.0	638,772	
Phase 2 Habitat Area				**106,462**

5.13.3 Status and Cost Estimate

STATUS – The IRP Water Importation Concept has been retained for analysis and comparison to other alternatives considered feasible in this document.

COST ESTIMATE – The IRP estimated capital costs, planning and permitting costs, and land acquisition costs. In addition to capital cost estimates, annual OMER cost estimates were developed. Annual OMER estimates included labor costs to run the desalination plants, maintenance labor for all facilities, treatment chemicals, and power for the pump stations and desalination facilities. Operation of evaporation ponds included removal and hauling of salts from the evaporation ponds associated with the remediation desalination plant. Capital, Planning, Permitting, and Land Acquisition Costs for the concept that meets the IRP's screening criteria (Scenario 2) along with OMER costs are summarized in Table 5-12 and Table 5-14, respectively, from the IRP Feasibility Report (University of California, Santa Cruz, 2022).

Table 5-22 of this Plan provides a summary of the costs provided by the IRP for all three of their proposed concepts along with the estimated costs for the Phase 1: 10-Year Plan projects. This table provides a summary of the costs for the IRP Water Importation concept and the for the IRP Water Exchange and IRP Colorado River Water Transfer concepts, which will be discussed in the next two sections of this Plan.

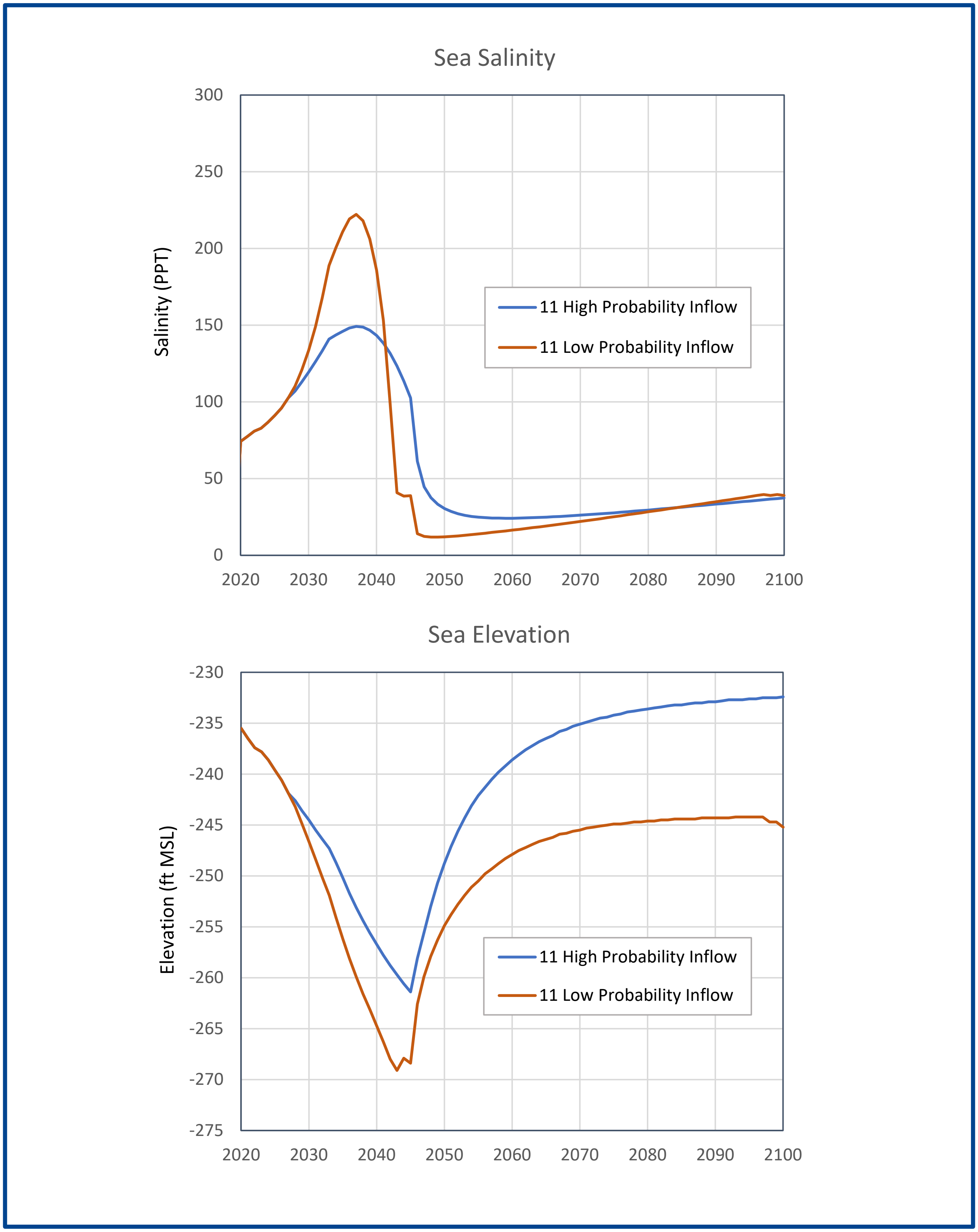

Figure 5-34. Salinity and Elevation Projections for Concept 11: IRP Water Importation Proposal.

Table 5-22. Summary of Phase 1 and Phase 2 Costs for Concepts Proposed by the IRP.

	Capital Costs ($M)			OMER Costs ($M)		
Restoration Concept	Phase 1	Phase 2	Total	Phase 1	Phase 2	Total
11. IRP Water Importation	1,293	78,376	79,669	65	3,776	3,841
12. IRP Water Exchange	1,293	45,435	46,728	65	3,030	3,095
13. IRP Colorado River Water Transfer	$ 1,293	$16,982	$18,275	$ 65	$ 2,741	$ 2,806

5.14 Restoration Concept 12: IRP Water Exchange

In the Sea of Cortez Water Exchange Concept, between 90,000 to 112,000 AFY of desalinated water would be moved from a desalination plant on the eastern shore of the Sea of Cortez in Baja California, Mexico to the Canal Alimentador Central, which delivers water to the reservoir behind Morelos Dam on the Colorado River. Through agreement with Colorado River users, an equivalent amount of water, or in-lieu water, would be delivered via the All-American Canal to the Salton Sea. These water deliveries would be used to stabilize the Salton Sea elevation and decrease the amount of exposed lakebed. Additional legal analysis would be required to determine whether such a transfer is possible and whether the transferred water could be used for Sea restoration. A remediation desalination facility is proposed in this Concept, the purpose of which is to remove salts and further decrease the salinity of the Salton Sea.

5.14.1 Components of the Restoration Concept

Specific components of the Sea of Cortez water exchange concept proposed by the IRP can be grouped into three types of facilities: (1) Intake and desalination; (2) Conveyance; and (3) Facilities and operations within the Salton Basin. The Salton Sea in 2050 after implementation of this concept is illustrated in Figure 5-35.

Intake and Desalination – The ocean water intake on the east side of the Sea of Cortez between Bahia San Jorge and Puerto Lobos, Sonora, would need to accommodate approximately 200 MGD. The pipeline would be a 98-inch diameter HDPE pipeline. The submerged ocean water intake, with velocity cap, would be 3.4 miles in length, extending 1.9 miles offshore. The intake would be served by a 200 MGD Sea of Cortez intake pump Station (9,000 BHP).

An ocean water reverse osmosis desalination 30-acre facility would be located near the intake with a product water capacity of approximately 100 MGD. The brine outfall on the Sea of Cortez would be co-located with the intake. The brine outfall would consist of one, 91-inch HDPE pipeline 4.9 miles in length, extending 3.4 miles offshore.

Conveyance Facilities – Approximately 230 miles of 70-inch steel pipe with cement mortar lining would convey up to 100 MGD product water from the desalination plant to Morelos Dam. The water conveyance pipeline is assumed to be installed via trenching. The pipeline is served by a 100 MGD conveyance pump station (26,900 BHP).

A 100 MGD booster pump station (7,000 BHP) would be located approximately 125 miles from the ocean water desalination facility, with a 368,000-gallon 50-ft diameter break tank located immediately upstream of the booster pump station. The break tank is assumed to be filled to a height of 20 ft with 100 MGD of inflow from the ocean intake pump station and 100 MGD of flow leaving the tank during normal operation. It is assumed that after two minutes of not receiving flow from the ocean intake pump station

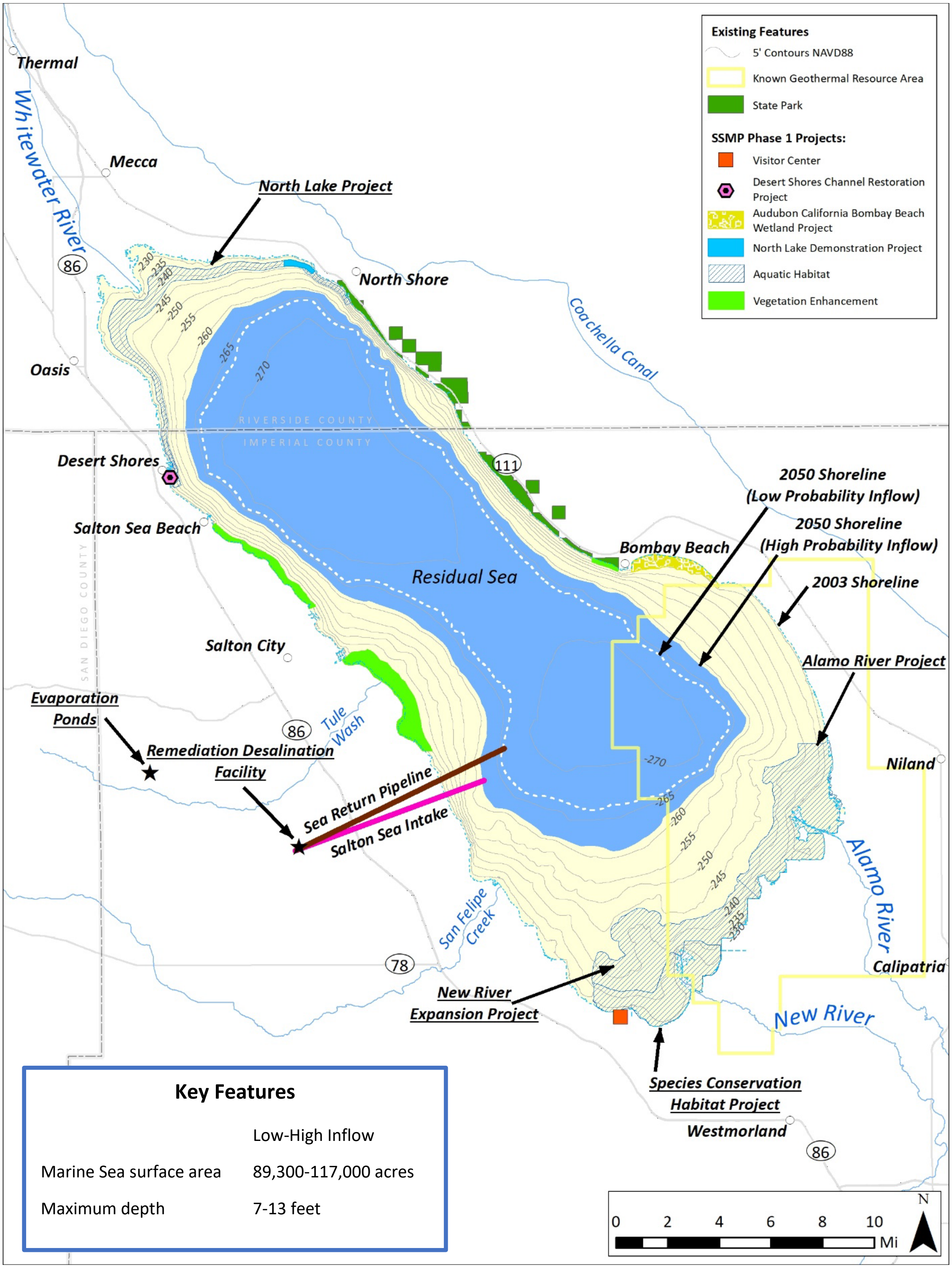

Figure 5-35. Salton Sea in 2050 after Implementation of the Independent Review Panel (IRP) Water Exchange Proposal.

while 100 MGD of flow is leaving the tank, the water elevation within the tank would reduce to a height of 10 ft, the assumed minimum submergence of the booster pumps. It is also assumed that the tank would overflow after one minute of having no flow out of the break tank while 100 MGD of flow is supplied to the tank.

Energy recovery turbines (parallel Francis turbines) would be located near Morelos Dam. The 70-inch pipeline would connect to a header that distributes flow to these turbines. The discharge piping would run under the concrete structure and water would be discharged into the Canal Alimentador Central below the water surface. This energy recovery station could produce 4030 hp and has an expected efficiency of 87%.

Five electrical substations would be constructed to serve the desalination plant and two pump stations, all to be co-located with pump stations or the ocean water desalination plant. A 78-mile new connection to the existing National Transmission Network Electrical Service 115 KV transmission line and a 27-mile new connection to the existing National Transmission Network Electrical Service 230 KV transmission line would be required.

Facilities and Operations Within the Salton Basin – The remediation desalination facility would be located near the southwest corner of the Salton Sea. The intake facilities would be 98-inch diameter steel pipe with polyurethane lining extending 1.9 miles into the Salton Sea. The 200 MGD, 25,000 BHP Salton Sea pump station would be used to move water from the Salton Sea to the remediation desalination facility. A 100 MGD reverse osmosis remediation desalination facility near the Salton Sea would further treat Salton Sea water, which would be returned to the Salton Sea via a 70-inch, 3.4-mile-long Salton Sea return pipeline.

Brine handling for remediation desalination facility would consist of 22,000 acres of evaporation ponds, located on the west side of the Salton Sea outside of sensitive ecological areas. It is assumed that evaporation ponds could be used to cover lakebed that would otherwise be exposed as the sea declines, thereby decreasing the acreage of lakebed needing restoration.

5.14.2 Performance, Expected Benefits, and Recreational Opportunities

The IRP Water Exchange Concept would return the Sea to a lower salinity in the range of 20 to 40 PPT. However, because of the long lead time on design, permitting, and construction, information provided by the IRP suggests that it would take about 36 years, or until 2058, to achieve 40 PPT. For the High Probability Inflow considered in this Plan, the time to achieve 40 PPT could be a little shorter, and for the lower inflow scenarios, it would be longer. The elevation of the Sea would not be controlled, but the steady inflow of fresh water would provide for a stable base elevation.

If local inflows were to decline during operation of this concept, the elevation in the Sea would go down and there would be an associated increase in salinity. The local desalination plant may need to operate at full capacity to bring salinity back down and it would take several years.

Once the salinity has been lowered to 40 PPT, the Sea would provide habitat benefits as well as a large area for recreational activities, such as boating and fishing. The Sea would still be at a considerably lower elevation than it was around the 2000 timeframe. The communities around the Sea could build out toward the new shorelines, or channels could be dredged to provide access to the current infrastructure. Other amenities, such as beaches and parks, could be added to take advantage of the restored fish and bird habitat.

Projections of future elevation and salinity performance in the Sea for the IRP Water Exchange Concept are provided in Figure 5-36 for the High and Low Probability Inflow Scenarios. Limitation of the model do not allow for accurate elevation and salinity forecasts for the Very Low Probability Inflow Scenario. Instead, for the Very Low Probability Inflow Scenario, water requirement estimates were developed to determine how much water would be available to maintain the Phase 2 Marine Sea. The inflow requirements for Phase 1 projects and for vegetation enhancement or other dust control measures were subtracted from the Very Low Probability Inflow Scenario to determine the amount of water remaining for the Marine Sea for Concept 12.

Table 5-23 provides the estimated water available for the IRP Water Import Concept in comparison to the Very Low Probability Inflow Scenario. Table 523 also shows the total area of water surface that could be sustained by that amount of water. As shown, the habitat area that could be supported is estimated to be about 25,000 acres. The calculations shown in are for steady state conditions after the salinity in the water has reached target salinity. This area would have shallow and some mid-depth habitat.

Table 5-23. Estimated Water Requirements for the IRP Water Exchange Concept Compared to Very Low Probability Inflow.

Feature	Area (ac)	Losses (ft/yr)	Water (AFY)	Area
Phase 1				
Vegetation	2,860	0.5	1,430	
Wetlands	680	5.0	3,402	
SCH	4,110	6.0	24,660	
New River Expansion	6,850	6.0	41,102	
Alamo Project	7,257	6.0	43,542	
North Lake	4,182	6.0	25,092	
Phase 1 Total	**25,940**		**139,228**	
Phase 2				
Remediation Desalting Losses			112,000	
Dust Control	150,000	1.0	150,000	
Phase 2 Total	**150,000**		**262,000**	
Total Phase 1 and 2	**175,940**		**401,228**	
Very Low Probability Inflow			440,000	
Coastal Desalination			112,000	
Total Water Available			**552,000**	
Water for Phase 2 Habitat		6.0	150,772	
Phase 2 Habitat Area				**25,129**

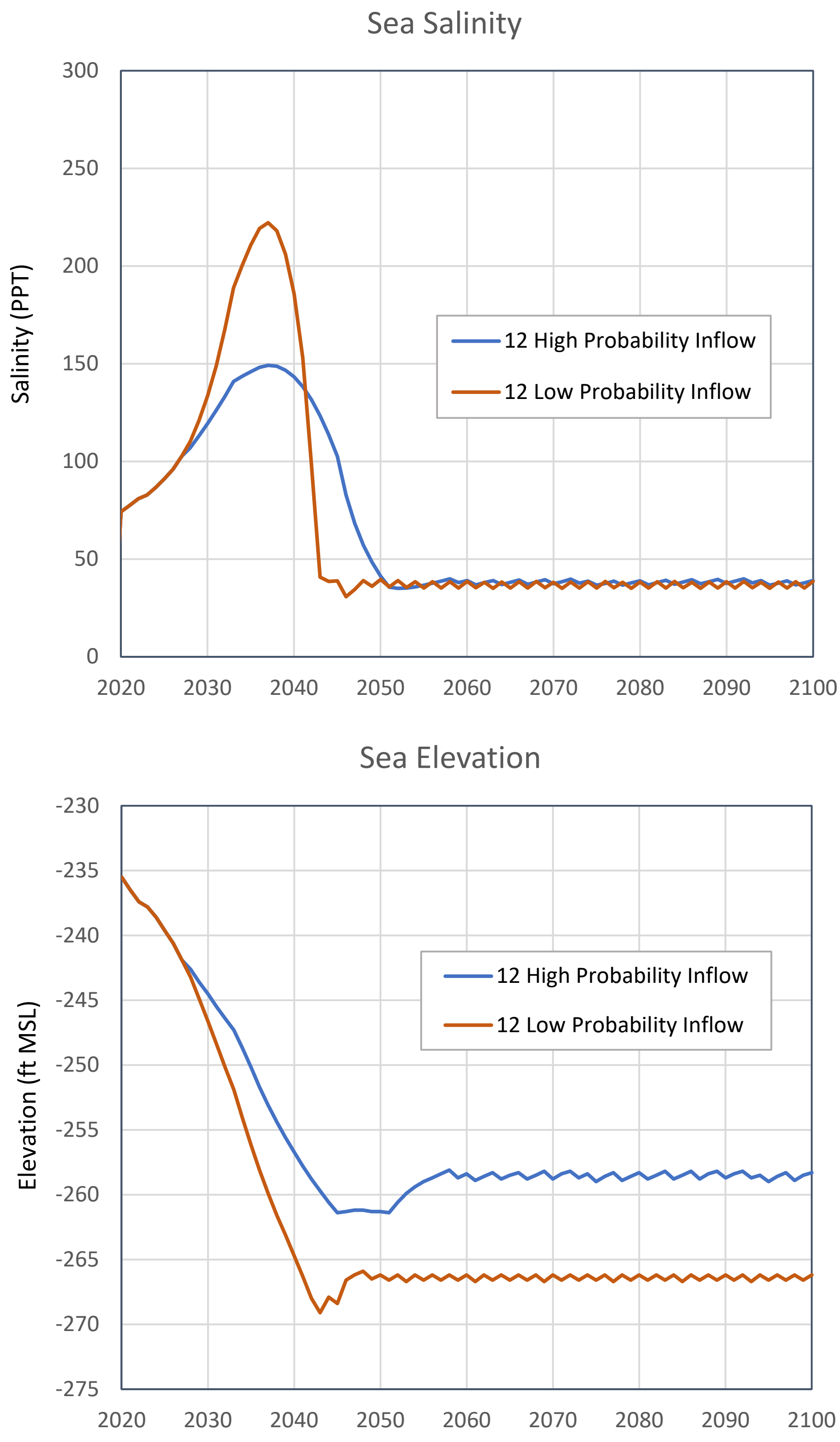

Figure 5-36. Salinity and Elevation Projections for the IRP Water Exchange Proposal.

5.14.3 Status and Cost Estimate

Status – The IRP Colorado River Water Transfer Concept has been retained for analysis and comparison to other alternatives considered feasible in this document.

Cost Estimate – The IRP estimated capital costs, planning and permitting costs, and land acquisition costs. In addition to capital cost estimates, annual OMER cost estimates were developed. Annual OMER estimates included labor costs to run the desalination plants, maintenance labor for all facilities, treatment chemicals, and power for the pump stations and desalination facilities. Operation of evaporation ponds included removal and hauling of salts from the evaporation ponds associated with the remediation desalination plant. Capital, Planning, Permitting, and Land Acquisition Costs for the concept that meets the IRP's screening criteria (Scenario 2) along with OMER costs are summarized in Table 5-5 and Table 5-6, respectively, from the IRP Feasibility Report (University of California, Santa Cruz, 2022).

Table 5-22 in Section 5.13.3 of this Plan provides a summary of the costs provided by the IRP with the estimated costs for the Phase 1: 10-Year Plan projects for all three concepts proposed by the IRP.

5.15 Restoration Concept 13: IRP Colorado River Water Transfer

In the Colorado River Voluntary Transfer Concept, enough land would be voluntarily fallowed using financial incentives provided by the State of California to result in a net additional input of 100,000 AFY to the Salton Sea. Water from voluntary transfers could stabilize the sea's elevation, and paired with remediation desalination, the Salton Sea salinity levels would be reduced.

5.15.1 Components of the Restoration Concept

In contrast to other IRP concepts, the IRP Colorado River Water Transfer concept only involves facilities within the Salton Basin.

Facilities and Operations Within the Salton Basin – The remediation desalination facility would be located near the southwest corner of the Salton Sea. The intake facilities are assumed to be 98-inch diameter steel pipe with polyurethane lining extending 1.9 miles into the Salton Sea. The 200 MGD, 25,000 BHP Salton Sea pump station would be used to move water from the Salton Sea to the remediation desalination facility. A 100 MGD reverse osmosis remediation desalination facility near the Salton Sea would further treat Salton Sea water, which would be returned to the Salton Sea via a 70-inch, 3.4-mile-long return pipeline.

Brine handling for the remediation desalination facility would consist of 22,000 acres of evaporation ponds, located on the west side of the Salton Sea outside of sensitive ecological areas. It is assumed that evaporation ponds could be used to cover lakebed that would otherwise be exposed as the sea declines, thereby decreasing the acreage of lakebed needing restoration.

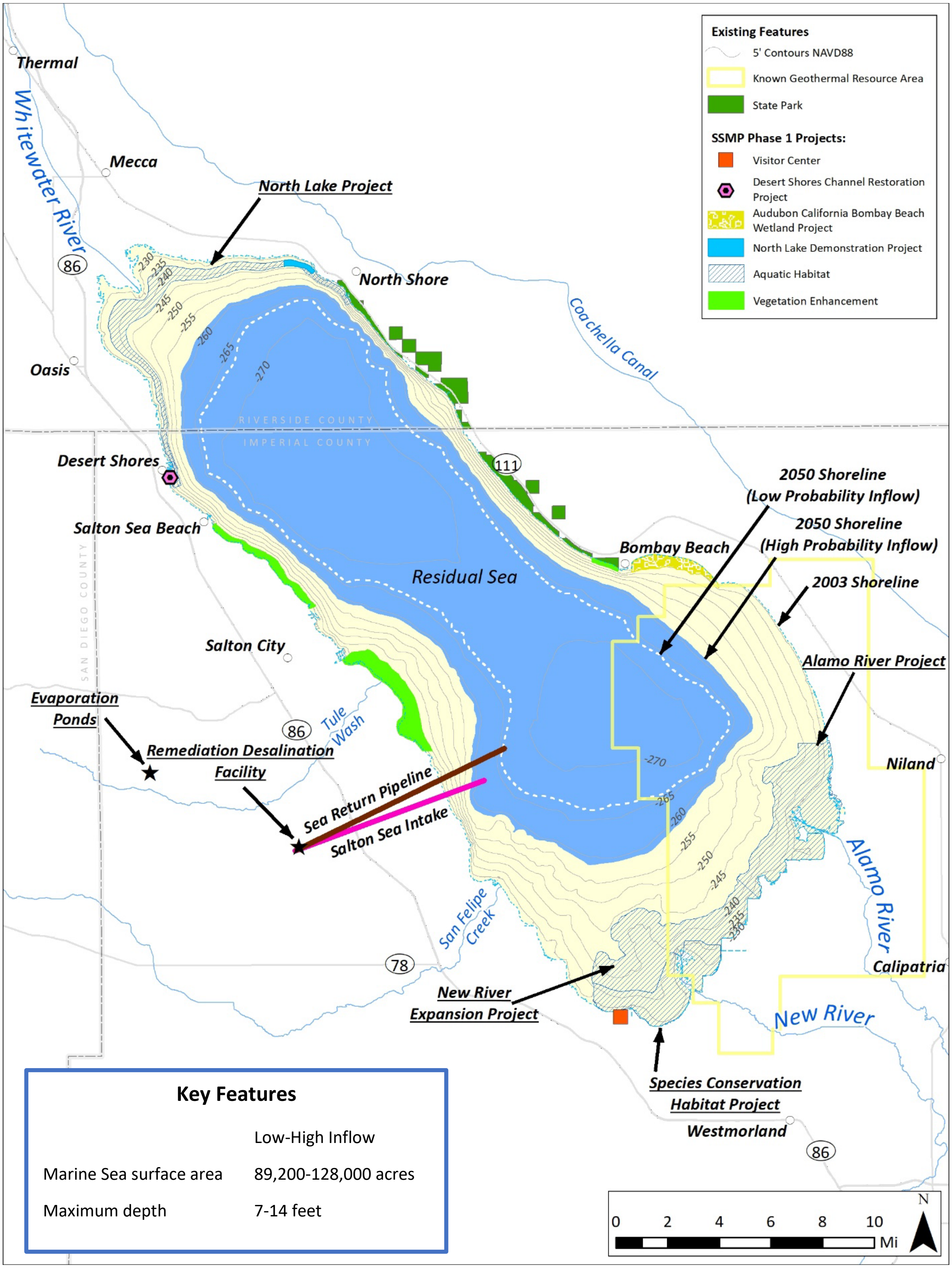

Figure 5-37. Salton Sea in 2050 after Implementation of the Independent Review Panel (IRP) Colorado River Water Transfer Proposal.

5.15.2 Performance, Expected Benefits, and Recreational Opportunities

The IRP Colorado River Water Transfer Concept would be very much like what was described for Concept 12: IRP Water Exchange Concept. Once the salinity has been lowered to 40 PPT, the Sea would provide habitat benefits as well as a large area for recreational activities, such as boating and fishing. The Sea would still be at a considerably lower elevation than it was around the 2000 timeframe. The communities around the Sea could build out toward the new shorelines, or channels could be dredged to provide access to the current infrastructure. Other amenities, such as beaches and parks, could be added to take advantage of the restored fish and bird habitat.

Projections of future elevation and salinity performance in the Sea for the IRP Water Import Concept are provided in Figure 5-38 for the High and Low Probability Inflow Scenarios. Limitation of the model do not allow for accurate elevation and salinity forecasts for the Very Low Probability Inflow Scenario. Instead, for the Very Low Probability Inflow Scenario, water requirement estimates were developed to determine how much water would be available to maintain the Phase 2 Marine Sea. The inflow requirements for Phase 1 projects and for vegetation enhancement or other dust control measures were subtracted from the Very Low Probability Inflow Scenario to determine the amount of water remaining for the Marine Sea for Concept 12.

Table 5-24 provides the estimated water available for the IRP Water Import Concept in comparison to the Very Low Probability Inflow Scenario. Table 5-24 also shows the total area of water surface that could be sustained by that amount of water. As shown, the habitat area that could be supported is estimated to be about 25,000 acres. The calculations shown in Table 5-24 are for steady state conditions after the salinity in the water has reached target salinity. This area would have shallow and some mid-depth habitat.

Table 5-24. Estimated Water Requirements for the IRP Colorado River Water Transfer Concept Compared to Very Low Probability Inflow.

Feature	Area (ac)	Losses (ft/yr)	Water (AFY)	Area
<u>**Phase 1**</u>				
Vegetation	2,860	0.5	1,430	
Wetlands	680	5.0	3,402	
SCH	4,110	6.0	24,660	
New River Expansion	6,850	6.0	41,102	
Alamo Project	7,257	6.0	43,542	
North Lake	4,182	6.0	25,092	
Phase 1 Total	**25,940**		**139,228**	
<u>Phase 2</u>				
Remediation Desalting Losses			112,000	
Dust Control	150,000	1.0	150,000	
Phase 2 Total	**150,000**		**262,000**	
Total Phase 1 and 2	**175,940**		**401,228**	
Very Low Probability Inflow			440,000	
Coastal Desalination			112,000	
Total Water Available			**552,000**	
Water for Phase 2 Habitat		6.0	150,772	
Phase 2 Habitat Area				**25,129**

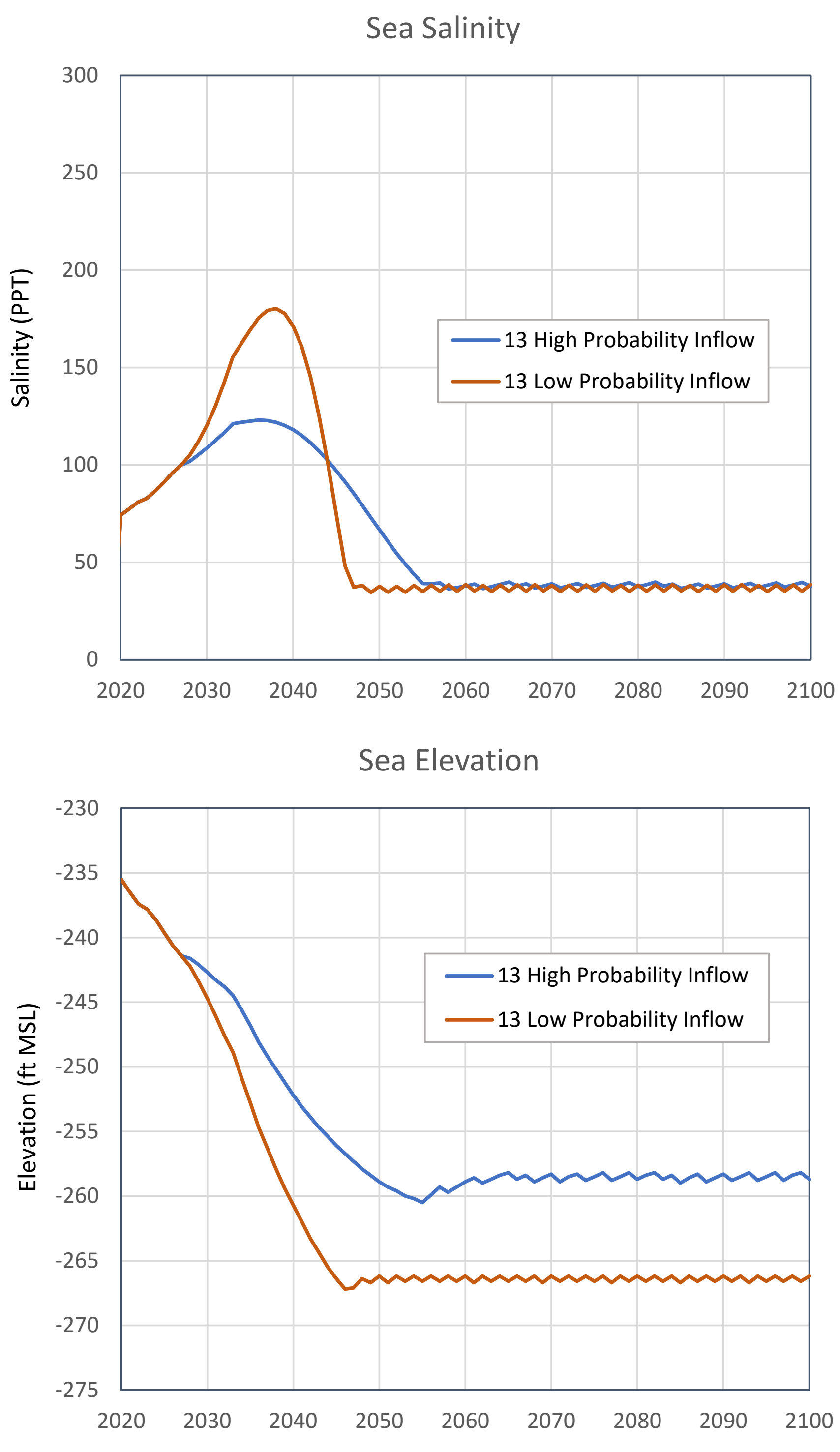

Figure 5-38. Salinity and Elevation Projections for the IRP Colorado River Water Transfer Proposal.

5.15.3 Status and Cost Estimate

STATUS – The IRP Colorado River Water Transfer Concept has been retained for analysis and comparison to other alternatives considered feasible in this document.

COST ESTIMATE – The IRP estimated capital costs, planning and permitting costs, and land acquisition costs. In addition to capital cost estimates, annual OMER cost estimates were developed. Annual OMER estimates include labor costs to run the desalination plants, maintenance labor for all facilities, treatment chemicals, and power for the pump stations and desalination facilities. Operation of evaporation ponds include removal and hauling of salts from the evaporation ponds associated with the remediation desalination plant. Table 5-22 in Section 5.13.3 of this Plan provides a summary of the costs provided by the IRP with the estimated costs for the Phase 1: 10-Year Plan projects for all three concepts proposed by the IRP. (Capital, planning, permitting, and land acquisition costs for the concept that meets the IRP's screening criteria [Scenario 2[along with OMER costs are summarized in Table 6-6 and Table 6-7, respectively, from the IRP Feasibility Report [University of California Santa Cruz, 2022]).

6 Recreation, Equitable Access and the Salton Sea LRP

6.1 Introduction to Community Amenities and the LRP Process

Over the last decade, community members and organizations have advocated for multi-benefit infrastructure projects at the Salton Sea to address a range of community health, environmental, and economic needs. Limitations on the use of bond funding, and regulatory, technological, cost, and landownership challenges have posed barriers to integrating these into the project design of SSMP projects. The development and implementation of the LRP presents a unique opportunity to incorporate some of these critical community amenities into the long-term vision for the Salton Sea.

In recognition of the need for greater investments in communities at the Sea, CNRA implemented the development of a Salton Sea Community Amenities Strategy (the Strategy). This Strategy will focus on core strategies to address needs from Salton Sea community residents related to recreation and equitable access, climate resilience, education and programming, transportation, broadband access, public health, and workforce. The Strategy will outline a series of recommended actions and funding opportunities to achieve these strategies, including specific actions the SSMP can take to support these strategies. In the context of the Strategy and this chapter, the term “community amenities” is meant to be inclusive of vital community infrastructure, community benefits, and community needs. This terminology was selected to maintain consistency and develop alignment to existing regional efforts for advancing the needs of communities at and around the Salton Sea.

This chapter focuses on background and recommendations for how the LRP process and projects can support and incorporate equitable access, recreation, and associated supporting amenities at the Sea. This chapter identifies some of the key community recommendations that surfaced to date related to access and recreation, explores how the various LRP concepts can support outdoor access and recreation as well as broadband and transportation improvements, and “least regret strategies” to achieve these benefits. This information may be used to inform the next stage of identifying, analyzing, and selecting LRP projects.

6.1.1 What are Community Amenities?

Preliminary research and review of materials to date, including public comments from Salton Sea and related meetings, interviews, and review of needs assessments materials developed by community-based organizations (CBO) have identified a range of community amenities, for fulfilling the vision of a healthy, sustainable, and vibrant future for Salton Sea communities. These Salton Sea communities have faced and continue to face a legacy of underinvestment in critical infrastructure development and services. Although many of the community needs identified may fall outside the scope of the SSMP and in the planning authority and funding of other governmental agencies and programs, CNRA is committed to supporting and advancing these efforts where possible. Needs identified include the following:

- **Partnerships opportunities with Tribes:** Community members and advocates identified needs to improve the quality of life for members of Tribes, develop tailored restoration projects on Tribal lands, host conservation and education programs led by Tribes, and advance economic development and contract opportunities to support the economic resiliency of Tribes and Tribal communities, as described in Executive Orders (EO) B10-11 and N15-19.

- **Recreational and outdoor access infrastructure at the Sea:** Communities members and advocates at and around the Sea surfaced recreational and outdoor access infrastructure opportunities that make the Sea more accessible, welcoming, and usable for communities, such as bathrooms, shaded areas, picnic tables and barbeques, lighting, drinking fountains, benches, gathering spaces like recreational or community centers, multilingual wayfinding and culturally-appropriate signage, parks, pedestrian paths and hiking trails, boardwalks along the shore, biking trails, campgrounds, wildlife viewing platforms, and boat ramps. All should comply with existing regulations for accessibility, be ergonomically suitable, and be operated and maintained in necessary working conditions such as running water, electricity, and cleanliness.
- **Climate resilience infrastructure:** Benefits identified for advancing climate resilience and environmental health include climate resiliency hubs including cooling centers, parks, green spaces, operations and maintenance funding for SSMP projects, electric bus and electric vehicle charging infrastructure, and stable energy and water infrastructure.
- **Access to environmental health protections, and improved public health:** In addition to public health objectives of the SSMP, community members and advocates prioritize access to health benefits, including new health and mobile clinics near communities at the Sea; improved medical services and specialized care; improved pollution exposure research; monitoring and mitigation measures with real-time data and notification features, such as quality monitors near communities; indoor air filters, reduced pesticide use and runoff diversion; improved air quality; ending unauthorized and hazardous waste dumping; affordable and safe drinking water; improved public and environmental health outreach to communities; improved housing; healthy food access and community gardens; and updated public health assessments and plans.
- **Expanded and enhanced transportation infrastructure:** Unmet transportation needs of the region include frequent and reliable public transportation services, electric buses, safe pedestrian paths and complete sidewalks, bike lanes and paths, safe roads, parking lots, lighting, and replacing high-polluting on and off-road vehicles. People have also requested direct connections to the Sea via public transportation.
- **Broadband access for all communities:** Community members surfaced lack of broadband to be a key constraint for engaging in SSMP or related planning processes. Benefits of broadband that cannot currently be met due to lack of infrastructure include access to virtual health, education, and commerce platforms.
- **Workforce benefits:** Community members and advocates want to see their communities employed for programs and investments at the Salton Sea. Potential opportunities identified here include: commitments to local hiring, and hiring underrepresented communities and Tribes for SSMP and other regional projects; investments in STEM and green jobs educational programs, services, certification, and training for residents, including for Lithium Valley jobs; youth education and improved higher learning; support for local entrepreneurship; and a career center for the Salton Sea.
- **Education and programming at the Sea:** Community members identified a need for improved education and programming at the Sea, such as cultural education and programming, environmental education and signage, recreational programming, youth education, reduced fee programs, STEM and community science projects, and multilingual education centers and way-finding.

The LRP prioritizes community amenities that improve public access to recreational opportunities. Communities at the Sea have called for physical infrastructure investments, such as shade structures, barbecue and picnic areas, nature viewing areas, restrooms, water fountains, lighting, parking and public transit, recreation, and cooling centers. They have also called for amenities to increase active recreation at the Sea, such as camping, boating, fishing, hunting, and trails for biking. Finally, residents and CBOs at and around the Sea have identified the need for more amenities to support additional recreational activities that meet varying user abilities, such as parks, community gardens, walking trails, wildlife viewing areas, picnic areas, and other visitor access points.

Artistic renderings of potential recreational and access amenities at the Salton Sea are provided in Figures 6-1 to 6-5. These renderings reflect select opportunities presented by implementation of the Long-Range Plan. Within these renderings, amenities such as parks, trails, bike paths, viewing platforms, fishing piers, and boat ramps are accompanied by outdoor access infrastructure to support recreation for communities at and around the Sea, such as shade, benches, restrooms, and outdoor lighting. Although recreational and access amenities is the focus of this chapter, the SSMP recognizes that additional critical infrastructure needs highlighted by communities are important to support in project planning and design where possible.

Figure 6-1. Rendering of Potential Park with Shade Structures, Restrooms, and Recreational and Cooling Center to Support Residents Experiencing Extreme Heat. Artistic Rendering by Sergio Ojeda.

Figure 6-2. Rendering of Potential Hiking Trail and Shaded Viewing Platform with Multi-lingual Trailhead Sign. Artistic Rendering by Sergio Ojeda.

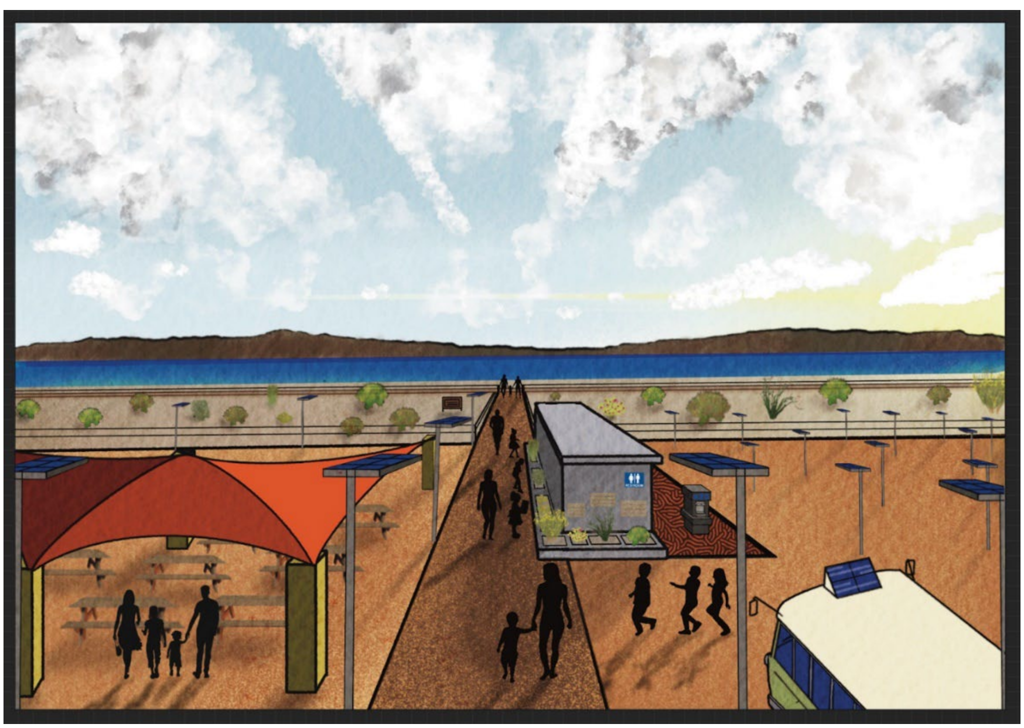

Figure 6-3. Rendering of Potential Outdoor Learning Area with Shade Structures, Bathrooms, Water Fountains, and Outdoor Lighting. Artistic Rendering by Sergio Ojeda.

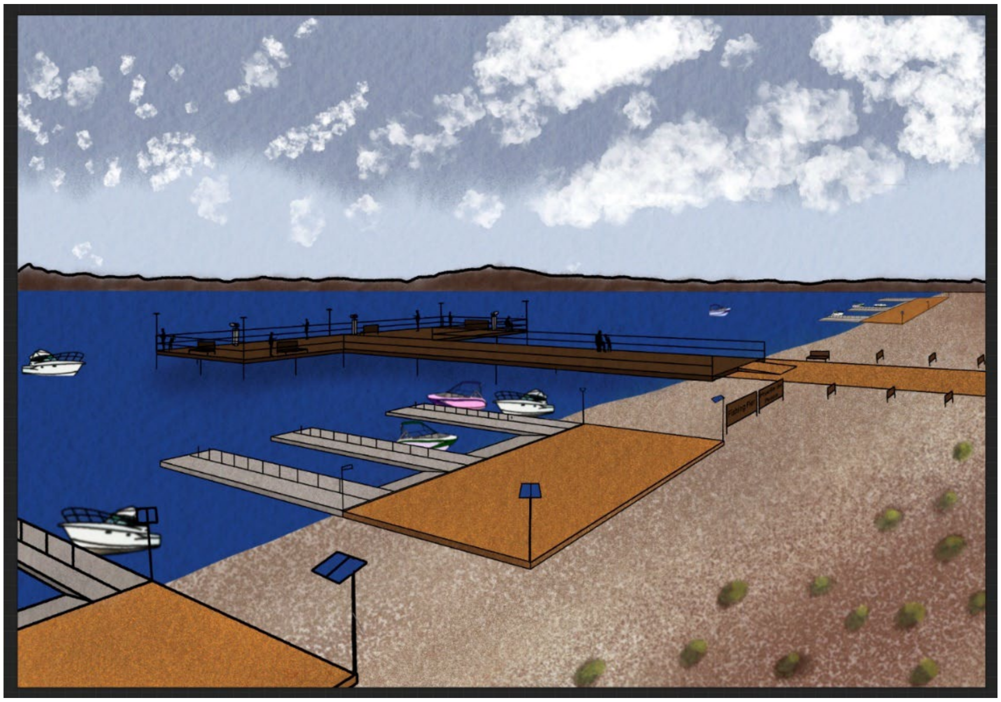

Figure 6-4. Rendering of Potential Fishing Pier and Boat Ramps. Artistic Rendering by Sergio Ojeda.

Figure 6-5. Rendering of Potential Bike Path, Pedestrian Path, and Bus Stop with Shade and Lighting. Artistic Rendering by Sergio Ojeda.

6.1.2 Intersection with the LRP

Recreational and access amenities provide critical opportunities to satisfy the “acceptability criteria” developed through the LRPC process. These criteria reflect the recognition that restoration projects at the Salton Sea must achieve multiple objectives, including fulfilling the state's commitments to Tribes, environmental justice, equitable outdoor access, and environmental justice. Although most of the concepts identified in the LRP are too early in design to be fully analyzed using these acceptability criteria, it is the hope of the SSMP that these criteria will be foundational in the next stage of environmental review and alternative development.

6.2 Methodology

This chapter and the forthcoming Strategy have been informed by available written and oral comments provided at Salton Sea-related meetings over the last decade; a literature review of relevant community-led materials, including reports and recommendations; over 100 interviews with local residents and leaders at and around the Sea; and a public community workshop on community amenities at the Salton Sea. This chapter and the Strategy also build upon longstanding efforts of many CBOs in the region to advance equitable, multi-benefit solutions.

Building off this foundational work, a Salton Sea Regional Community Benefits Working Group is conducting meetings focused on various issues that have been repeatedly raised by Salton Sea residents. To date these have included workforce development benefits, broadband access, and community amenities for recreation. Upcoming meetings will discuss public health programming and benefits, transportation, climate resilience, and education and programming.

Additional fact-finding and community engagement work will continue to inform the Strategy. In 2022, the SSMP began a Salton Sea Regional Community Benefits Working Group made up of community members and leaders across the region to support discussion of cross-cutting issues. This working group has advanced collaborative identification of present gaps and pathways for realizing community amenities, such as funding, across topics that include equitable outdoor access, public health, transportation, climate resilience, broadband, workforce development, and education and programming. Furthermore, the SSA has distributed State funding to conduct outreach in communities within the Salton Sea region to collect input on community amenities and further inform the Strategy. This outreach will be completed in January 2023.

6.3 Community Amenities at the Salton Sea

6.3.1 Recreational and Equitable Access Amenities at the Salton Sea

Community residents, members, and advocates have long advocated, in a variety of venues, for multi-benefit infrastructure projects at the Sea (SSMP, 2019; SSMP, 2020; Alianza CV et al., 2019; Better World Group Advisors, 2022; CA State Parks, 2020a). These investments are supported by recent State and Federal commitments to advance environmental justice and equitable outdoor access. Deep community engagement, which elevated the need for investments in amenities, can help ensure projects meet local needs and are sustainable in the long-term, and that the SSMP can effectively implement the LRP.

The communities immediately near the Sea and throughout the Salton Sea region have demonstrated a high need for increased, equitable access to quality outdoor recreational opportunities. CalEnviroScreen ratings in the region are high, particularly in census tracts immediately surrounding the Sea, indicating a high need and limited existing investments to support public health (CalEPA, October 2021; Alianza, Center for Social Innovation, UC Santa Cruz Institute for Social Transformation, 2021). Furthermore, residents at the Sea, including in the North Shore and Oasis communities, are more than a 10-minute walk from a park, meaning they lack easy, proximal access to parks and the mental and physical health benefits they provide (Desert Healthcare District & Foundation, 2020; South et. al., 2016; Christensen et. al., 2000; Shanahan et. al., 2016). Recreational amenities, while often considered as an additional feature that is desirable but not required, is in fact critical to supporting community well-being and should be a component of alternative development and selection. Investments in recreational infrastructure at the Salton Sea would therefore advance equitable access and public health, in alignment with the SSMP's equitable access acceptability criterion.

Recreational amenities are critical to supporting community well-being. A survey and outreach process conducted in Spanish, English, and Purépecha, on behalf of the Bureau of Reclamation in 2022 by the Audubon Society, highlighted the importance of diverse community infrastructure investments at the Sea for meeting local outdoor access and recreational needs. Over 70% of residents reported that investments in bathrooms with running water, shaded areas, picnic or barbeque areas, and combined infrastructure, such as placing bathrooms near picnic areas, are most important for advancing access. 54% percent of Latino respondents noted that the availability of public transportation options to the Sea is also important, and broad majorities emphasized additional needs to improve lighting, paved roads, drinking fountains, and access for people with disabilities. About 56% of residents wanted to see more opportunities to participate in water sports.

6.3.2 Complementary Community Amenities: Transportation and Broadband

In addition to access and recreational needs at the Sea, community members have identified additional needs, such as active transportation and broadband, as complementary to advancing public health and enhancing local SSMP engagement across the region. Implementation of the LRP presents opportunities to advance transportation and broadband needs throughout the Salton Sea region through coordination, planning, and project design.

In addition to repeated requests for increased recreational access and infrastructure at the Sea, community members have called for improved transportation and broadband. Investments in expanded infrastructure would further address critical needs, support the LRP's acceptability criteria, and complement recreational investments. The SSMP should coordinate with regional transportation and broadband efforts to increase resource efficiency and the LRP's impact.

Community residents and regional and county transportation planning processes have each identified the significant mobility and transportation needs of transit-dependent community members in Eastern Coachella and Imperial Valley communities, which are rooted in historic underinvestment in local transportation systems. Communities in the Eastern Coachella Valley additionally need safer walking and biking infrastructure. Imperial County's active transportation plan highlighted the communities of Desert Shores and Bombay Beach as priority areas for pedestrian and transit improvements, specifically paving missing sidewalks, expanding bike lanes, and installing bus shelters and high-visibility crosswalks (Imperial County Transportation Commission, February 2022). Plans also highlight needs for investments in community gathering infrastructure, such as shade structures (Riverside County Transportation and Land Management Agency, February 2020).

A significant portion of Imperial and Eastern Coachella local transit riders can be termed "transit-dependent." A community survey found 42 percent of respondents did not have access to a personal vehicle, and an additional 25 percent only had access some of the time (Imperial County Transportation Commission Coordinated Public Transit-Human Services Transportation Plan Update, 2021). Indeed, some unincorporated communities at the South end of the Sea are unserved by fixed-route service and receive on-demand bus service only twice a week, making day-to-day life for transit-dependent riders extremely difficult. The ECV Regional Mobility Plan recommends bus and public transportation improvements, and both the ECV and Imperial County plans recommend traffic calming measures (Riverside County Transportation and Land Management Agency, February 2020; Imperial County Transportation Commission, February 2022). These findings and existing efforts support the community feedback SSMP has received around transportation needs.

Communities in the unincorporated eastern parts of Riverside County have identified the need for more walking and biking infrastructure as a means of staying connected to community social networks, accessing local parks, and being physically active (Riverside County Transportation and Land Management Agency, February 2020). In Desert Recreation District's master planning survey process, "walking trails and paths" emerged as a clear recreational priority, in alignment with Audubon's findings (Riverside County Transportation and Land Management Agency, February 2020; Alianza Our Salton Sea: Where Theory Meets Practice on Inclusive Economic Development October 2021). Additionally, the need for reliable internet connection is a demonstrated, pervasive need for this region and one which is increasingly necessary for accessing basic services as well as engagement in the Salton Sea processes. Communities at the Salton Sea and throughout the Salton Sea region experience the "digital divide" -- lacking critical access to broadband. There are 5,458 residents in Imperial and 27,820 in Riverside, primarily in the Eastern Coachella Valley communities near the Sea who are unserved by broadband (California Public Utilities Commission, Decision Adopting Federal Account Rules April 21, 2022). In 2019 in Imperial County, 30% of those under 18 lacked access to a computer or internet service (Digital Divide Within the SCAG Region, January 2022). As noted by the Desert Healthcare Foundation in their 2020 Needs Assessment, the three communities with the lowest access to internet include Oasis (47.3%), Thermal (56.9%), and North Shore (64.7%), and "*(N)otably, it is the [communities] with higher rates of poverty that most commonly lack internet access, illustrating the myriad of obstacles faced by people living in poverty. These same communities experience higher environmental contamination, lower rate of medical coverage*" (Desert Healthcare Foundation, 2020).

6.4 Opportunities to Implement Multi-Benefit Solutions Within the LRP

The LRP presents opportunities to develop multi-benefit solutions that meet the needs of community members at and around the Salton Sea. To bring clarity to the suite of multi-benefit opportunities that exist through implementation of the LRP concepts, this section applies recreational and equitable access, broadband, and transportation amenities, as identified by communities at and around the Sea onto concept maps provided in Chapter 5. The following recreational and access amenities are applied onto concept maps, using the principles described below. Concepts reviewed in the LRP are at an early stage of design. The next stage of environmental review and concept selection will provide opportunity for feedback on scale, type, and location of amenities.

Benefit Type	Application of Community Vision onto LRP Concepts
Bike Paths	Bike paths are proposed to cover the perimeter of the Sea wherever possible, with access points and entryways adjacent to the shoreline and communities at and adjacent to the Sea. Bike paths are not included in the SCH Project due to implementation needs.
Boat Ramps	A suitability assessment conducted on behalf of the Bureau of Reclamation by the Audubon Society was considered for the proposed placement of boat ramps. Suitability assessment criteria included current conditions such as proximity to communities; slope; sediment; and distance to roads, rivers, campground, birding spots, and vegetation or wetlands. These were compared to potential, future infrastructural conditions established by LRP concepts.
Broadband	As identified in the California Interactive Broadband Map, broadband towers are proposed where Consumer Fixed Downstream Deployment is weakest to serve the communities of Mecca, Oasis, Niland, Calipatria, and Westmorland.
Bus Stops	Bus stops are proposed at 10-Year Plan project areas projected to receive more visitors once complete (at the SCH Visitor Center, and near the North Lake Demonstration Project). Bus stops are also mapped where Audubon survey results indicated highest visitation (Bombay Beach, Desert Shores, Salton Sea Recreation Area and Visitor Center, Sonny Bono Salton Sea National Wildlife Refuge, the Yacht Club); where Sunline Transit currently stops (Mecca, Oasis, North Shore); and where Imperial Valley Transit currently stops (Westmorland, Calipatria, Niland).
Campgrounds	Campgrounds are proposed where they currently exist on the Northwest side of the Salton Sea and by San Felipe Creek to provide opportunities to camp on the South end of the Salton Sea.
Fishing Piers	Fishing piers are proposed adjacent to all boat ramps where salinity is projected to support fish.
Hiking Paths / Trails	Hiking paths and trails are mapped to cover the perimeter of the Sea where possible, with access points adjacent to the shoreline and communities at and adjacent to the Sea. Hiking paths and trails are also placed adjacent to campgrounds, visitor centers, and boat ramps. They are not included in the SCH Project due to implementation needs.

Outdoor Access Infrastructure	Outdoor access infrastructure includes shade structures, benches, water fountains, outdoor lighting, restrooms, and vending machines. Outdoor access infrastructure is proposed wherever bus stops or recreational opportunities are proposed. Where needed, this infrastructure is additionally proposed on the concept maps for every 40 minutes of walking distance to allow pedestrians to access to shade, benches, and restrooms within 20 minutes of walking at any given point around the Sea.
Parks	Parks are proposed within communities at or adjacent to the Sea: Mecca, Oasis, Desert Shores, Salton City, Westmorland, Calipatria, Niland, Bombay Beach, and North Shore.
Parking Lots	Parking lots are proposed wherever there are trailheads, visitor centers, campgrounds, boat ramps, and/or fishing piers.
Recreational Facilities and Cooling Centers	Recreational facilities and cooling centers are proposed within communities at or adjacent to the Sea: Mecca, Oasis, Desert Shores, Salton City, Westmorland, Calipatria, Niland, Bombay Beach, and North Shore.
Viewing Platforms	A suitability assessment conducted on behalf of the Bureau of Reclamation by the Audubon Society was considered for the proposed placement of viewing platforms. Suitability assessment criteria included current conditions such as proximity to communities; slope; sediment; and distance to roads, rivers, campground, birding spots, and vegetation or wetlands. These were compared to potential, future infrastructural conditions established by LRP concepts.
Visitor Centers	Visitor centers are proposed where the current Salton Sea State Recreation Area (North Shore) Visitor Center exists and where the SCH Visitor Center has been proposed.

Recreation and access benefits are projected to apply to all concepts, as summarized in Table 6-1. Maps following the table visualize how community amenities might be proposed at and around the Salton Sea, as determined through infrastructural conditions imposed by each concept design. For concepts with multiple variations, one variation was selected to demonstrate how community amenities may be limited or enhanced by general concept design. The selected variation for the mapping exercise features the most unique concept design.

Table 6-1. Community Amenity Opportunities by Concept

	North Shore	North Lake Project	Mecca, Thermal/Oasis, Desert Shores	Salton City	San Felipe Creek	SCH Project	Westmorland, Calipatria, Niland	Bombay Beach	Salton Sea Recreation Area
Phase 1: 10-Year Plan									
Concept 1: North/South Marine Sea									
Concept 2: Divided Sea/Marine Sea South									
Concept 3: Perimeter Lake									
Concept 4: Pump Out									
Concept 5: Water Optimization									
Concept 7: Water Recycling (Desalination)									
Concept 11: IRP Water Importation									
Concept 12: IRP Water Exchange									
Concept 13: IRP Colorado River Water Transfer									

Phase I: 10-Year Plan

Full implementation of the Phase 1: 10-Year Plan includes four large habitat projects, multiple smaller habitat projects, and several revegetation projects designed to mitigate dust emissions. Outdoor access and recreational amenities may be provided as part of or adjacent to habitat projects proposed in the Phase I: 10-Year Plan (Figure 6-6).

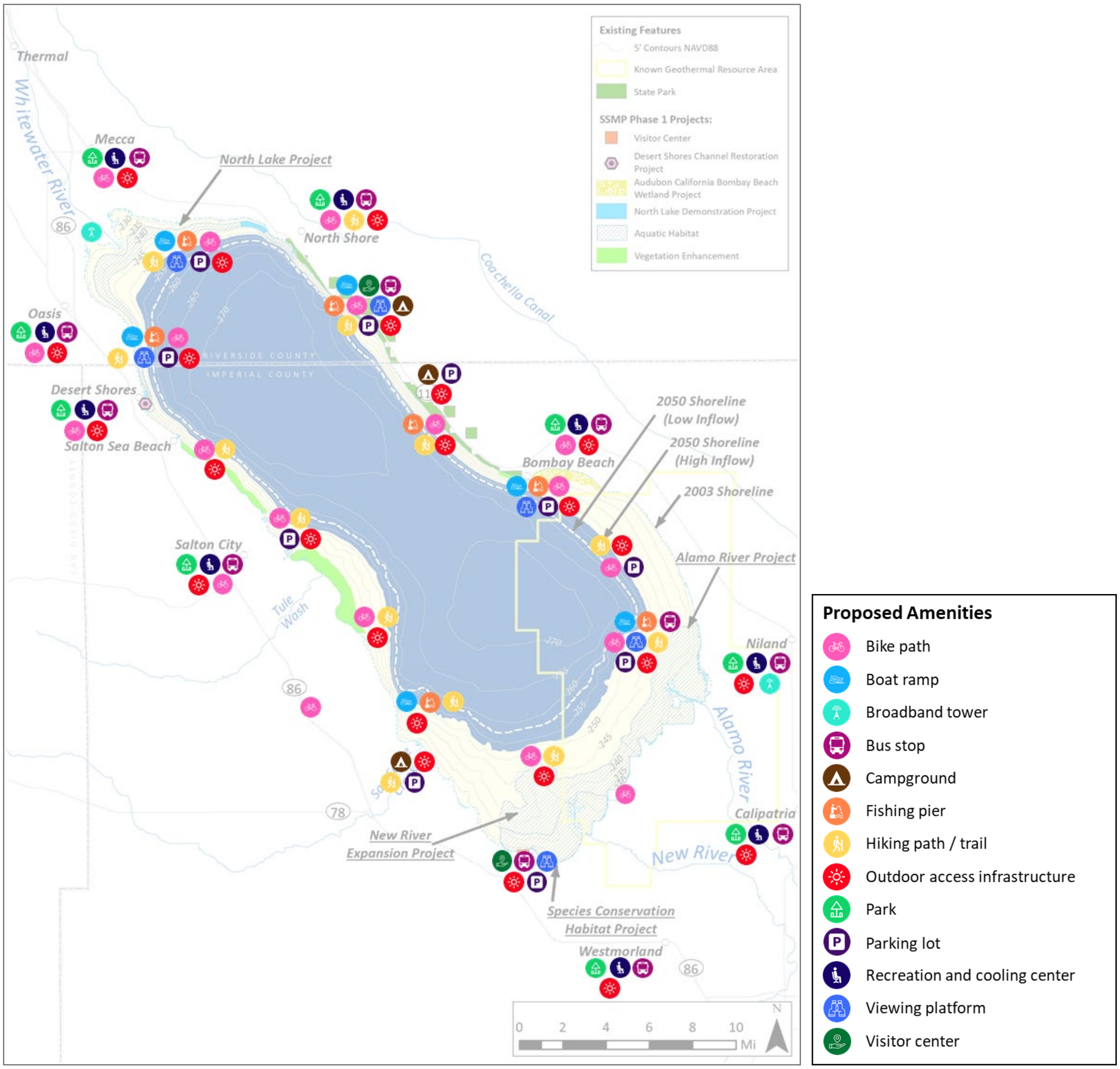

Figure 6-6. Potential Recreation and Access Benefits for the Phase I: 10-Year Plan

Concept 1: North/South Marine Sea

The North/South Marine Sea features a horseshoe-shaped Marine Sea that would establish salinity similar to ocean water. This concept provides opportunities for walking and bike paths along the shoreline and along the salt crust barrier. Fishing piers and boat ramps could be placed along the shoreline of the Marine Sea, at points adjacent to the communities of Salton City, Desert Shores, Oasis, Mecca, and North Shore. Water depth will be shallow along the shoreline, and up to 39 feet at the barrier. Water elevation will be maintained near historic 2000 levels, minimizing exposed playa adjacent to seaside communities from Salton City to Bombay Beach and creating outdoor recreational opportunities that support hiking and bike trails (Figure 6-7).

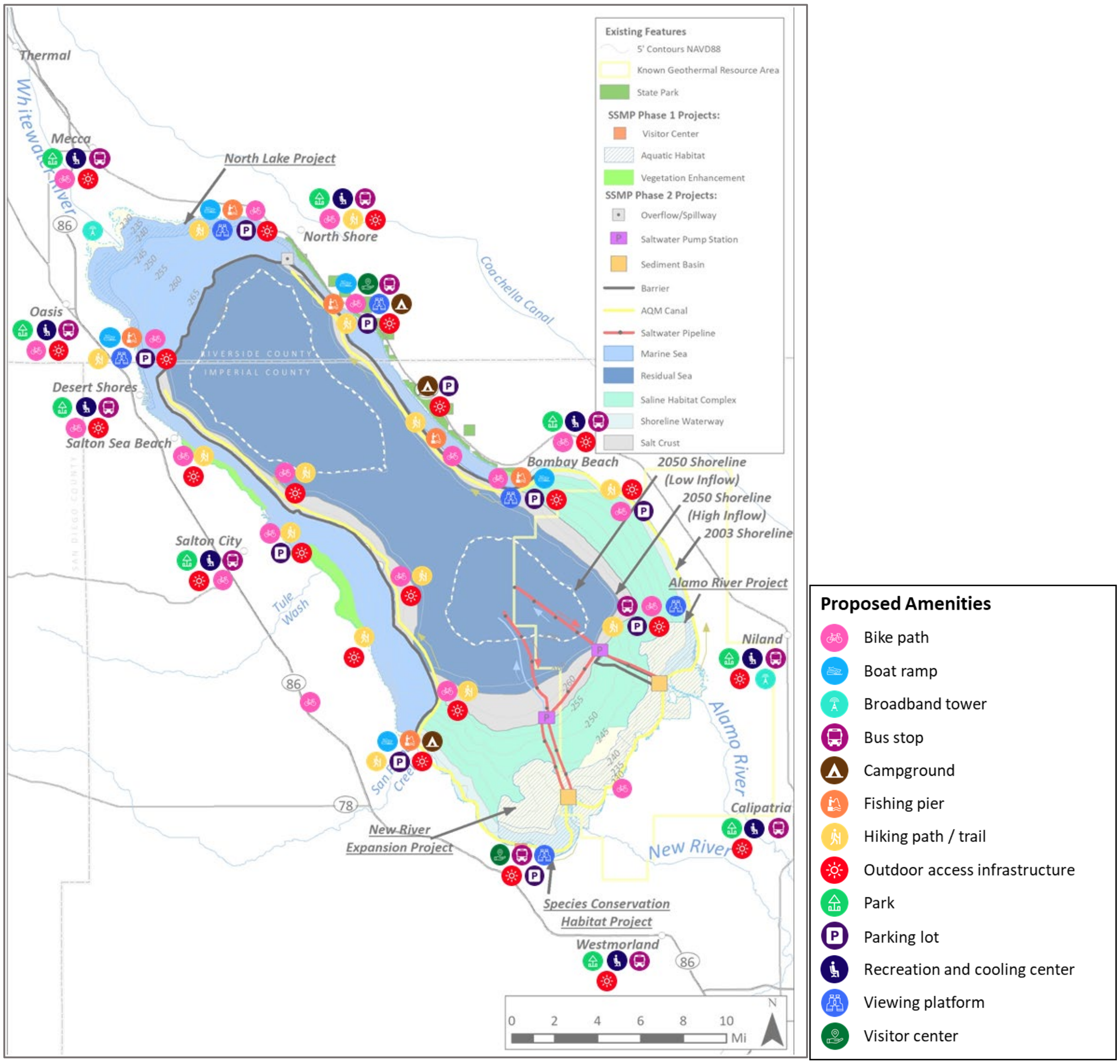

Figure 6-7. Potential Recreation and Access Benefits for Concept 1A: North/South Marine Sea

Concept 2: Divided Sea/Marine Sea South

The Divided Sea/Marine Sea South proposes a residual body of water on the Northern half of the Salton Sea with rising salinity that achieves a level of salinity similar to that of the Great Salt Lake, and a south basin with salinity similar to or less than ocean water. The concept provides recreational opportunities along the shoreline of the Salton Sea, with additional walking, biking, wildlife viewing, and fishing infrastructure along a causeway that traverses the lake from Salton City to Bombay Beach (Figure 6-8). Due to hypersaline conditions in the North Basin, fishing piers would be limited to the South Basin.

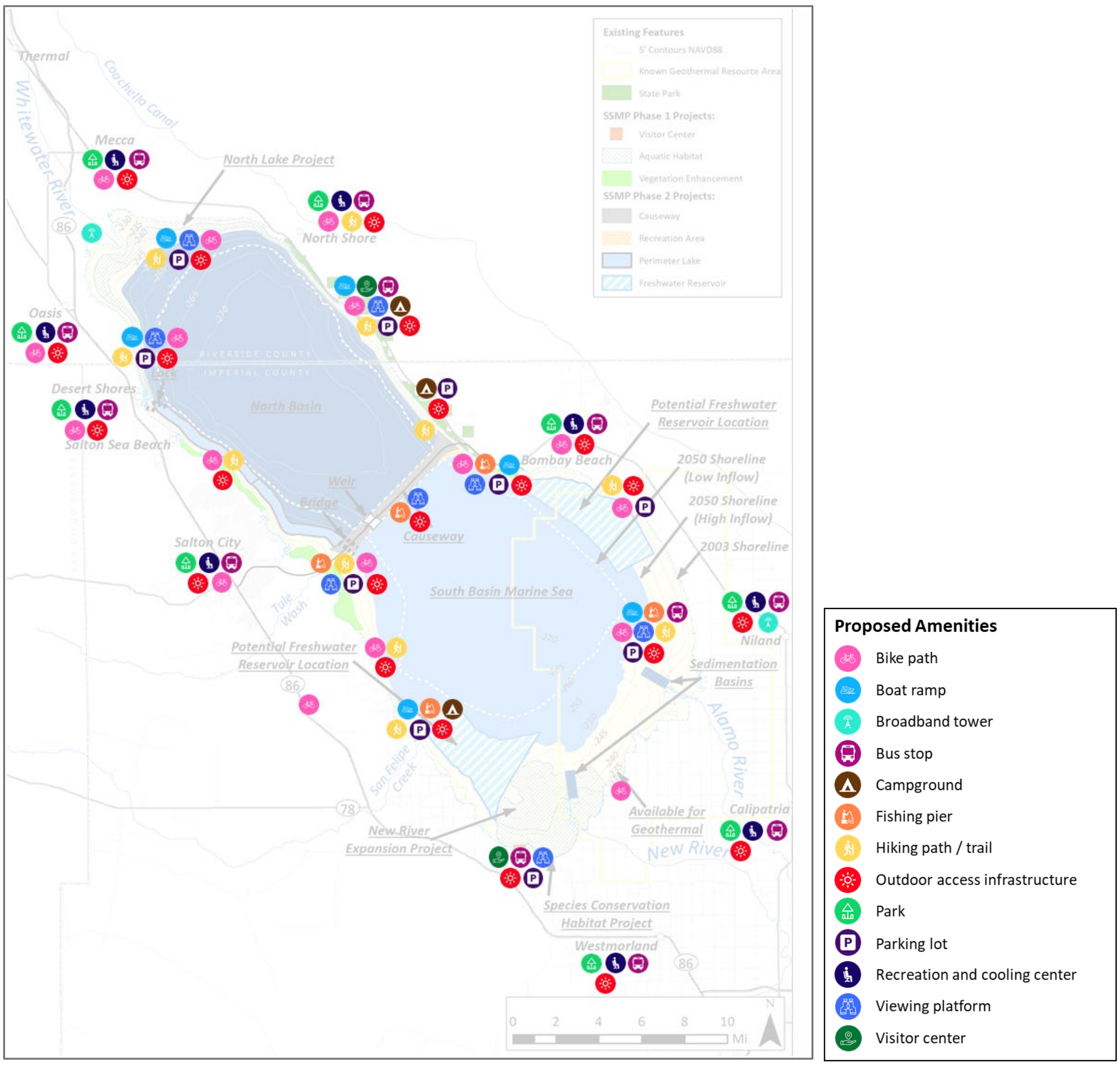

Figure 6-8. Potential Recreation and Access Benefits for Concept 2D: Divided Sea/Marine Sea South Without Alamo River Project, With Perimeter Lake Cells and Freshwater Reservoir

Concept 3: Perimeter Lake

The Perimeter Lake features a ribbon of water that borders a residual sea to provide habitat benefits and maintain water elevation along communities at the Sea. Water elevations in the perimeter lake would be maintained near historic levels, reducing exposed playa near communities and allowing for community access. Boat passageways between cells would allow recreational boating throughout the lakefront. The perimeter lake would support a fish population and promote fishing opportunities near the communities of North Shore, Desert Shores, and Salton City (Figure 6-9).

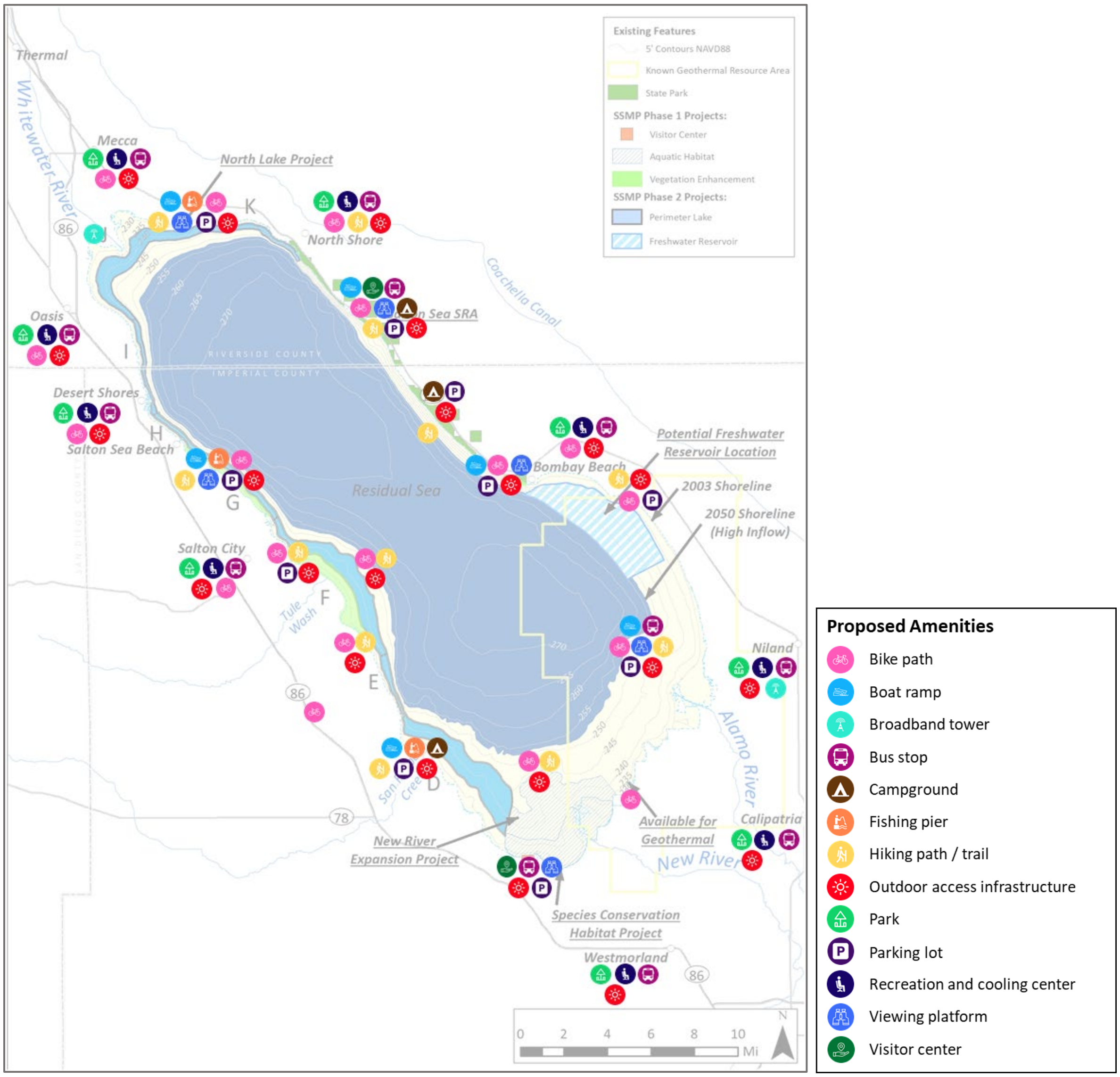

Figure 6-9. Potential Recreation and Access Benefits for Concept 3B: Modified Perimeter Lake Without Alamo Project and Without Perimeter Lake Cells near Alamo River, Including a Freshwater Reservoir

Concept 4: Pump Out

The Pump Out concepts include brine ponds along the northern and southern edges of the lakefront. Fish species would not survive in a brine pond environment due to salinity extremes and anoxia, and thus, would provide limited opportunities for recreation. The Pump Out concepts would achieve ocean-level salinity before 2060, at which point water-based recreational activities, such as boating and fishing, might be considered in addition to hiking trails and bike paths (Figure 6-10). Water elevations would fluctuate with inflows and could allow for communities of Desert Shores, Salton City, Bombay Beach, and North Shore to build out toward new shorelines.

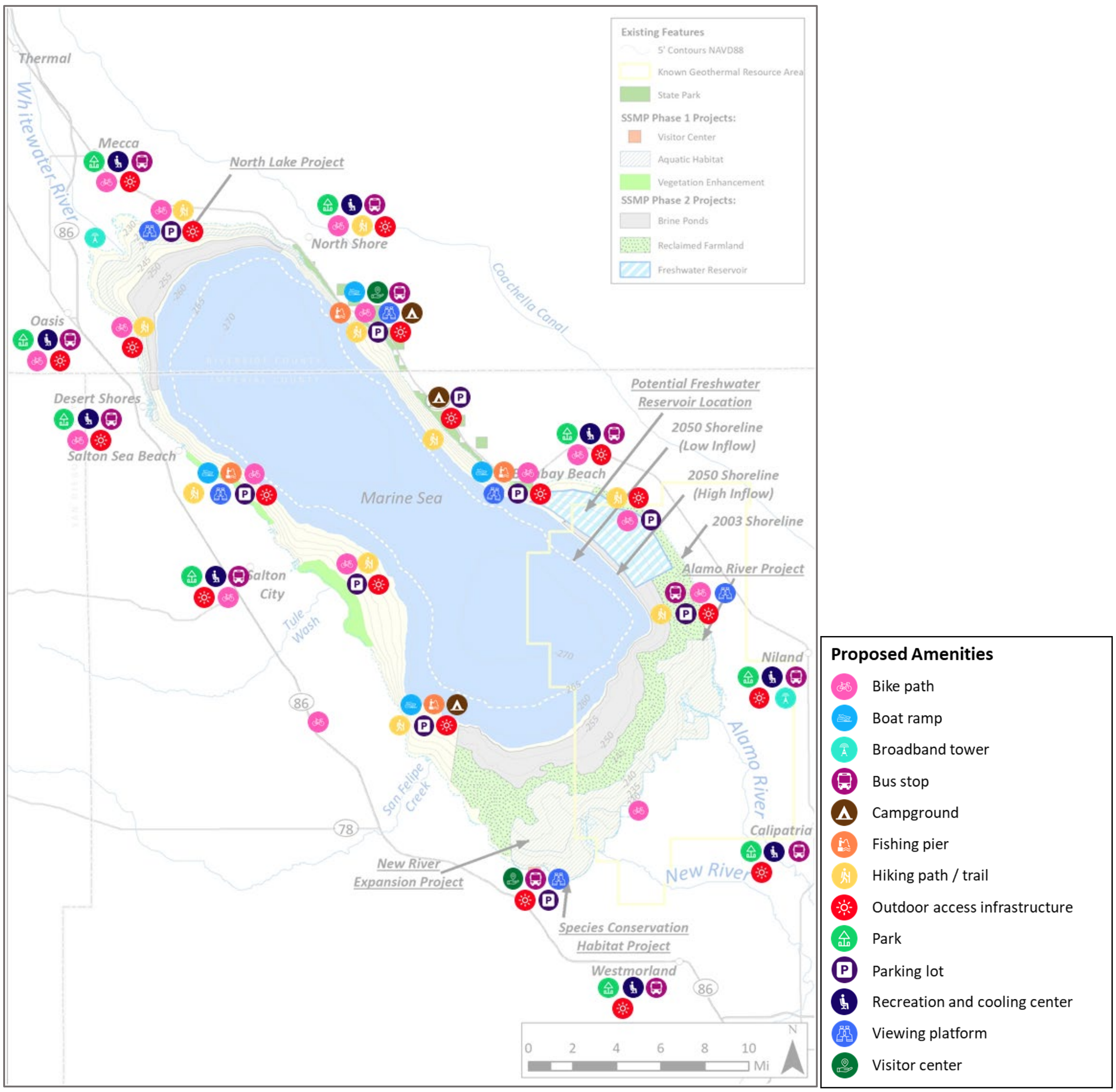

Figure 6-10. Potential Recreation and Access Benefits for Concept 4D: Pump Out for Dust Control with Freshwater Reservoir

Concept 5: Water Optimization

The Water Optimization concept features a network of shallow habitat cells along the southern edge of the lakefront, at varying levels of salinity that could be engaged for recreational and outdoor access like kayaking, and benefits such as fishing piers, hiking trails, bike paths, and picnic tables. The residual sea would remain at a hypersaline condition along the communities of North Shore, Oasis, Thermal, and Salton City, and could support boat, but not fishing access (Figure 6-11).

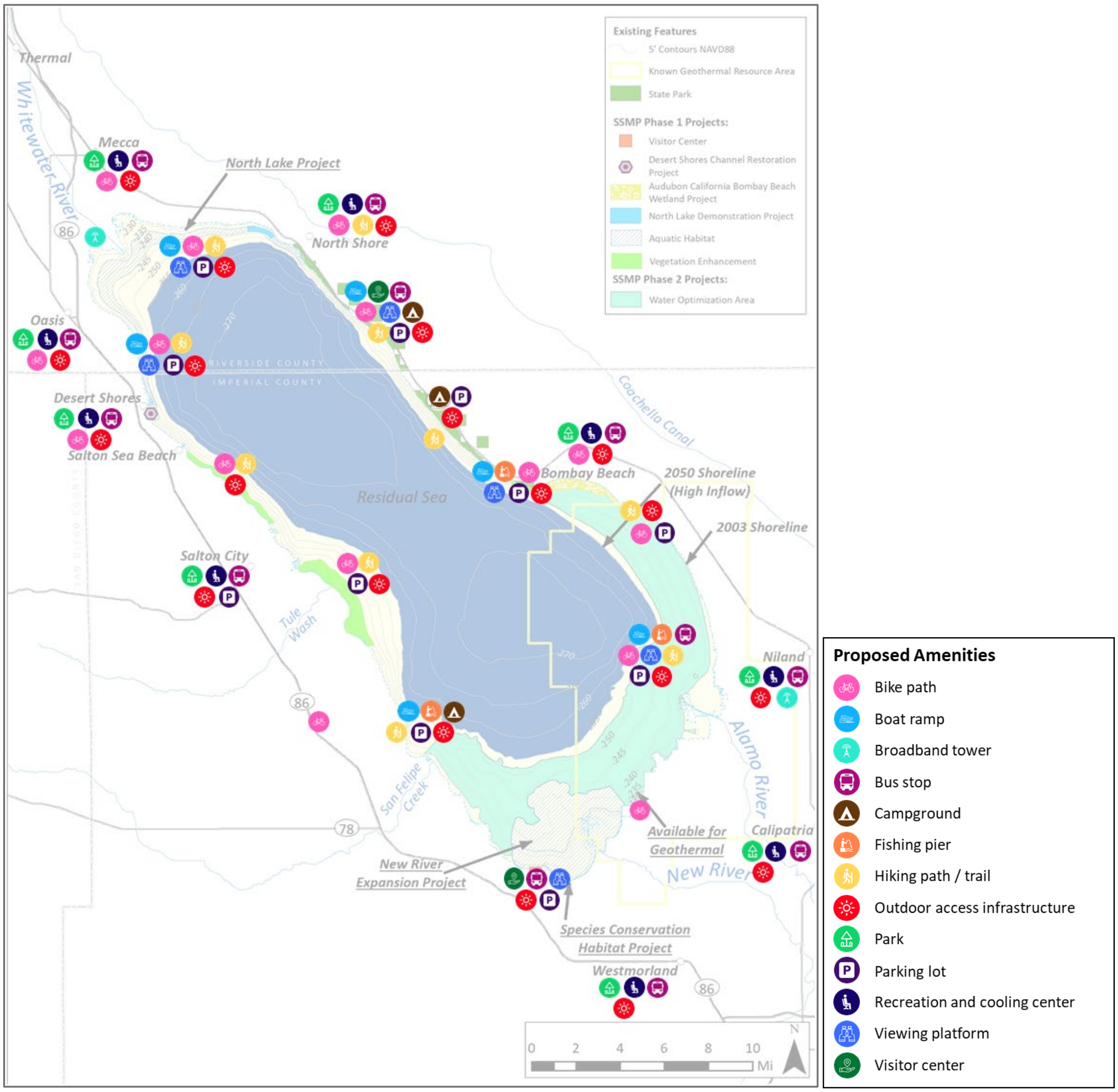

Figure 6-11. Potential Recreation and Access Benefits for Concept 5: Water Optimization

Concept 7: Salton Sea Water Recycling (Desalination)

The Water Recycling concept proposes desalinating water at the Sea which could then be recycled as fresh water to the Sea either directly or through habitat projects near the shoreline. Salt may be discharged to brine ponds to control dust at the southern edge of the lake front. This concept would bring sea salinity to ocean-level within 30 years and would allow for the development of all recreational benefits, including boat ramps, fishing piers, and hiking trails and bike paths around the shoreline, except where brine ponds exist (Figure 6-12). Water elevations would decline from the present condition and could allow for communities around the Sea to build out toward new shorelines.

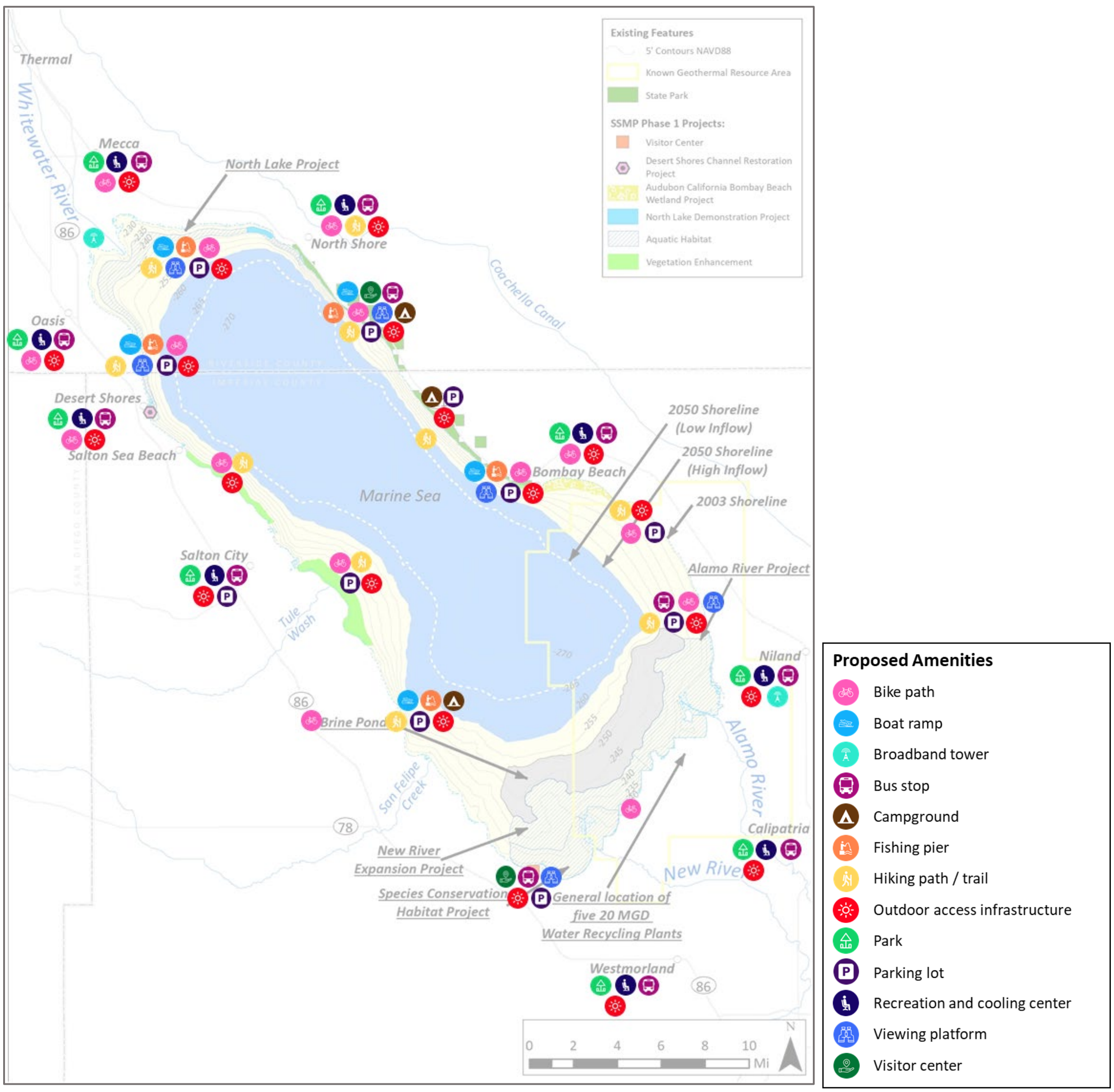

Figure 6-12. Potential Recreation and Access Benefits for Concept 7: Water Recycling (Desalination)

Concept 11: IRP Water Importation

The IRP Water Importation concept proposes water importation that would return the Sea to a less salty lake that could support restored fish and bird habitat when 40 PPT salinity is achieved at or after 2059. Water elevations would fluctuate with inflows and could allow for communities around the Sea to build out toward new shorelines (Figure 6-13).

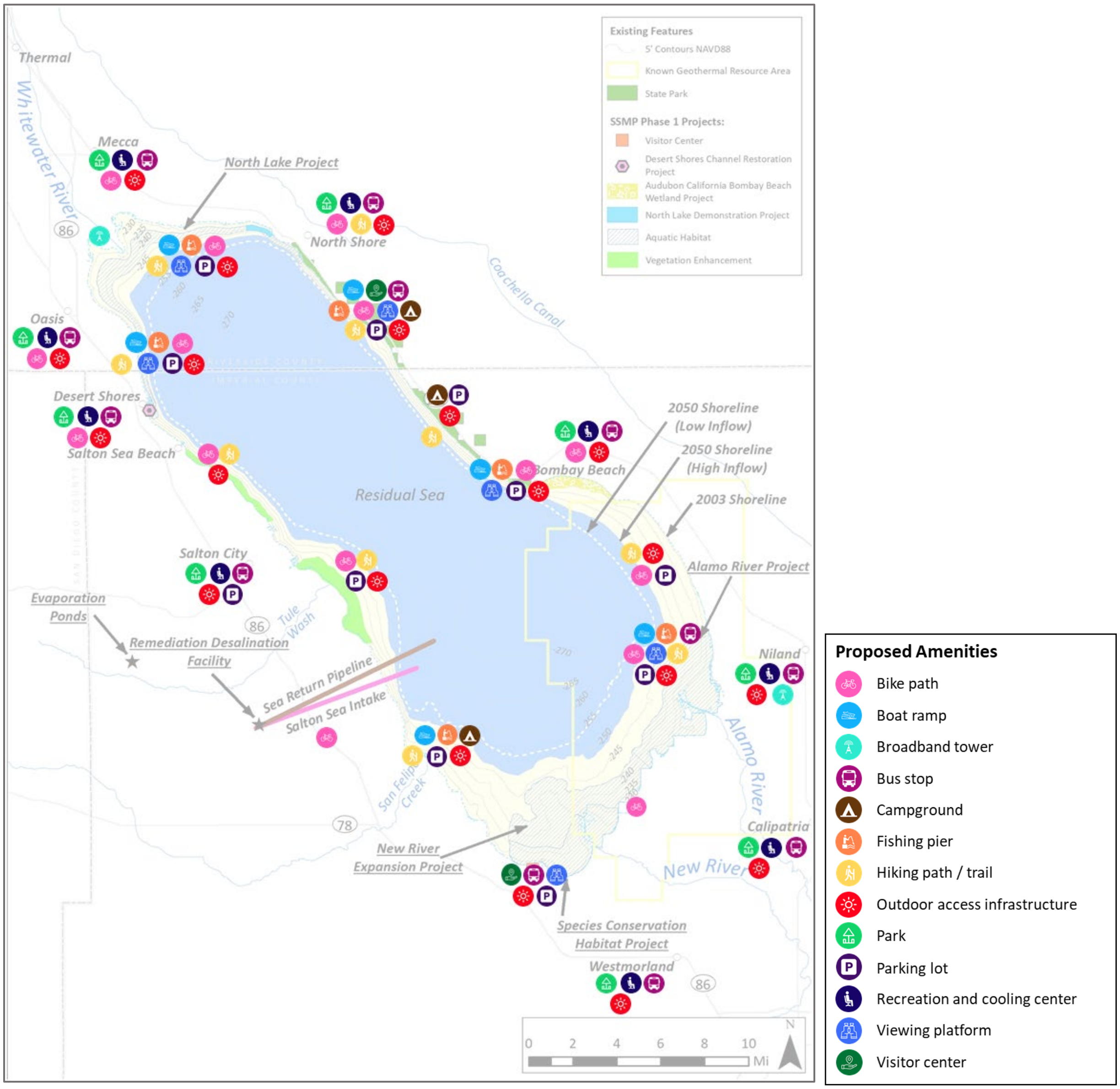

Figure 6-13. Potential Recreation and Access Benefits for Concept 11: IRP Water Importation

Concept 12: IRP Water Exchange

The IRP Water Exchange concept proposes water intake, desalination, and conveyance to support the Salton basin. This concept also includes a remediation desalination facility located near the southwest corner of the Salton Sea and evaporation ponds on the west side of the Salton Sea, outside of sensitive ecological areas. Boating, fishing, hiking, and biking amenities may still be realized; however, hiking and bike paths would not be able to encompass the full perimeter of the Sea's shoreline. This concept that would return the Sea to a less salty lake that could support restored fish and bird habitat when 40 PPT salinity is achieved at or after 2058. Water elevations would fluctuate with inflows and could allow for communities around the Sea to build out toward new shorelines (Figure 6-14).

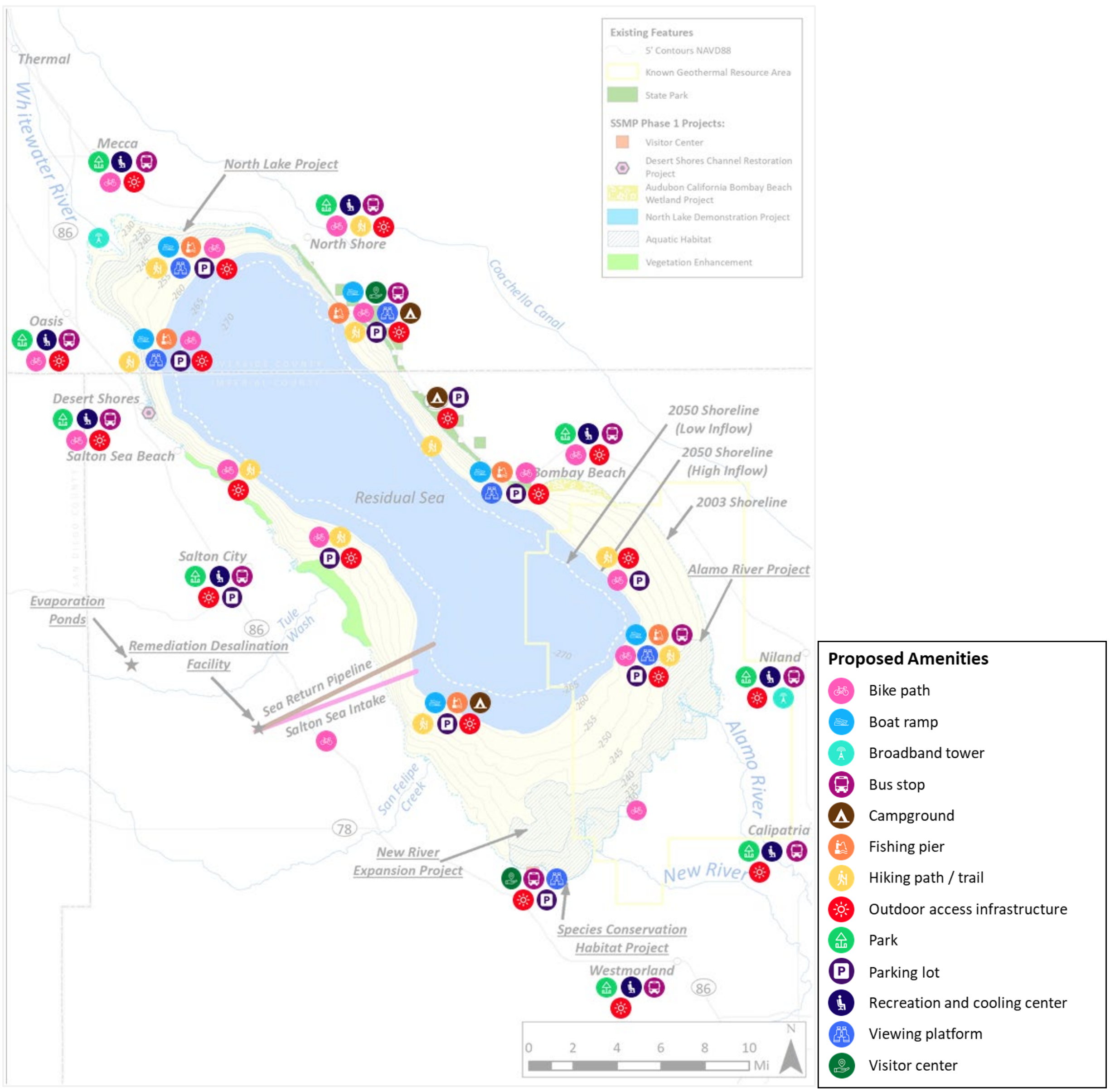

Figure 6-14. Potential Recreation and Access Benefits for Concept 12: IRP Water Exchange

Concept 13: IRP Colorado River Water Transfer

The IRP Colorado River Water Transfer concept proposes voluntarily fallowing enough land to result in a net additional input of 100,000 AFY to the Salton Sea. This concept also includes a remediation desalination facility located near the southwest corner of the Salton Sea and evaporation ponds on the west side of the Salton Sea, outside of sensitive ecological areas. Water importation that would return the Sea to a less salty lake could support restored fish and bird habitat by the year 2045-2055, depending on the inflow scenario. Water elevations would fluctuate with inflows and could allow for communities around the Sea to build out toward new shorelines (Figure 6-15).

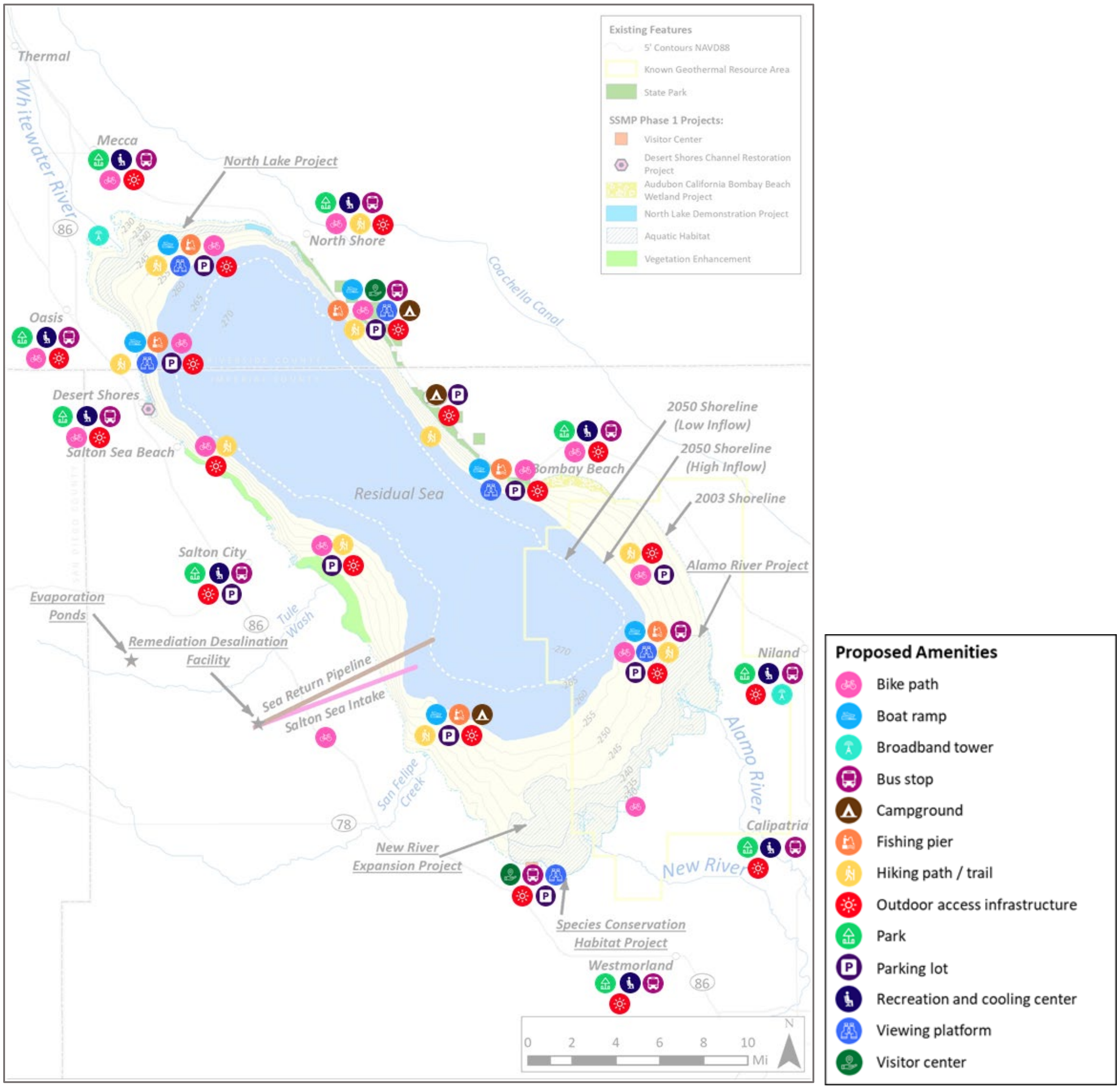

Figure 6-15. Potential Recreation and Access Benefits for Concept 13: IRP Colorado River Water Transfer

6.5 Policy Support for Community Amenities

Increased investments in community amenities at the Sea explicitly advances state and federal priorities related to equitable access (recreation, transportation, broadband), as well as equitable engagement and benefit transfer to Tribal and underserved communities. The inclusion of these investments would ensure further alignment between the SSMP's efforts and broader policy priorities, as well as that of the Army Corps or future federal planning partners and funding sources. Key policies include the following:

State

- **California Executive Order N-16-22** on equity calls on state agencies and departments to update or develop strategic plans that identify policies, programs, and other practices to advance equity and eliminate identity-based disparities. This process should involve underserved communities.[9]
- **California Executive Order B-10-11** orders that executive-level state agencies and departments communicate and consult with California Indian Tribes for input on policies that impact Tribal communities.[10]
- Governor Newsom's **Statement of Administrative Policy on Native American Ancestral Lands** builds from and affirms the above executive order to promote expanded Tribal access and co-management of lands currently controlled or owned by the state.[11]
- California Assembly Bill 30 – **Equitable Outdoor Access Act** – requires certain state agencies advance equitable and affordable access to nature in alignment with agency missions and conservation goals.[12]
- **Broadband for All** – Executive Order N-73-20 – and related Action Plan aims to achieve digital equity across the state.[13]
- Senate Bill 153 – **Middle-Mile Broadband Initiative and Last-Mile Programs** – will invest in the infrastructure needed to connect homes and key institutions to the internet, addressing affordability and technical assistance needs.[14],[15]

Federal

- **Executive Order 13985** – Advancing Racial Equity and Support for Underserved Communities Through the Federal Government – directs government agencies to advance equity and address past harms for communities that are historically marginalized and face disproportionate poverty or inequality through intentional resource investments. EO 13985 directs agencies to evaluate

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[9] Executive Department, State of CA. Executive Order N-16-22. Accessed October 2022 from https://www.gov.ca.gov/wp-content/uploads/2022/09/9.13.22-EO-N-16-22-Equity.pdf?emrc=c11513

[10] Executive Department, State of CA. Executive Order B-10-11. Accessed October 2022 from https://www.ca.gov/archive/gov39/2011/09/19/news17223/index.html

[11] Office of the Governor. Statement of Administrative Policy: Native American Lands. Accessed October 2022 from https://www.gov.ca.gov/wp-content/uploads/2020/09/9.25.20-Native-Ancestral-Lands-Policy.pdf

[12] California State Assembly Bill 30, Equitable Outdoor Access Act. Accessed October 2022 from https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=202120220AB30

[13] State of CA. Broadband for All. https://broadbandforall.cdt.ca.gov/executive-order/

[14] State of CA. Middle-Mile Initiative. https://broadbandforall.cdt.ca.gov/middle-mile-broadband-initiative/

[15] State of CA. Last-Mile and Adoption Programs. https://broadbandforall.cdt.ca.gov/last-mile-broadband/

how their programs further or alleviate systemic inequities with the aim to equitably direct program benefits to and engage with underserved communities.[16]

- **Justice40 Initiative** – established under EO 13990, Section 223 – directs the federal government to ensure 40% of federal investments benefit "disadvantaged communities," or those who are "marginalized, underserved, and overburdened by pollution".[17] The federal government has noted that training and workforce development programs must comply with this initiative.[18]
- **Executive Order 14063** – Use of Project Labor Agreements for Federal Construction Projects – requires the use of Project Labor Agreements (PLAs) for federal construction projects, valued at over $35 million, to facilitate more coordinated and timely project completion, and ensure high-quality jobs.[19]
- **Executive Order 14008** – Tackling the Climate Crisis at Home and Abroad – promotes agency actions to accelerate clean energy development in an environmentally, economically, and socially responsible manner. This includes advancing environmental justice through programs and policies that alleviate disproportionate negative human, environmental, and economic impacts on underserved communities.[20]
- **Executive Order 13175** — Consultation and Coordination with Indian Tribal Governments – directs executive departments and agencies to meaningfully engage and consult with Tribal leaders in the development of administrative policies that have impacts on Tribal communities.[21]
- **U.S. Government Interagency Memorandum of Understanding on Promoting Equitable Access to Nature in Nature-Deprived Communities**, under the America the Beautiful Initiative, strengthens and streamlines the efforts of 10 federal agencies to increase parks and conservation projects in underserved communities. Participating agencies, including DOI, DOT, and USDA, have agreed to "promote locally led conservation and park and green and blue space projects."[22]

6.6 Least Regrets Recommendations for Incorporating Community Amenities

The following recommendations include objectives and strategies that will be considered by the SSMP as an outcome of the forthcoming Strategy. These recommendations reflect outdoor access and recreational needs identified by community members at and around the Salton Sea, and are proposed as

[16] Biden, Joseph, The United States Government. (January 2021). *Executive Order on Advancing Racial Equity and Support for Underserved Communities Through the Federal Government*. The White House. Accessed July 2022 from https://www.whitehouse.gov/briefing-room/presidential-actions/2021/01/20/executive-order-advancing-racial-equity-and-support-for-underserved-communities-through-the-federal-government/

[17] The White House. (2022). *Justice40*. Accessed July 2022 from https://www.whitehouse.gov/environmentaljustice/justice40/

[18] Executive Office of the President, Office of Management and Budget. (July 2021). *Interim Implementation Guidance for the Justice40 Initiative*. Accessed July 2022 from https://www.whitehouse.gov/wp-content/uploads/2021/07/M-21-28.pdf

[19] Biden, Joseph, The White House. (February 2022). *Executive Order on Use of Project Labor Agreements for Federal Construction Projects* and *Fact Sheet: President Biden Signs EO to Boost Quality of Federal Construction Projects*. Accessed October 2022 from https://www.whitehouse.gov/briefing-room/presidential-actions/2022/02/04/executive-order-on-use-of-project-labor-agreements-for-federal-construction-projects/; https://www.whitehouse.gov/briefing-room/statements-releases/2022/02/03/fact-sheet-president-biden-signs-executive-order-to-boost-quality-of-federal-construction-projects/

[20] Biden, Joseph, The White House. (January 2021). *Executive Order on Tackling the Climate Crisis at Home and Abroad*. Accessed July 2022 from https://www.federalregister.gov/documents/2021/02/01/2021-02177/tackling-the-climate-crisis-at-home-and-abroad

[21] Biden, Joseph, The White House. (January 2021). *Memorandum on Tribal Consultation and Strengthening Nation-to-Nation Relationships*. Accessed July, 2022 from https://www.whitehouse.gov/briefing-room/presidential-actions/2021/01/26/memorandum-on-tribal-consultation-and-strengthening-nation-to-nation-relationships/

[22] U.S. Government. (2022). Interagency Memorandum of Understanding on Promoting Equitable Access to Nature in Nature-Deprived Communities. Accessed October 2022 from https://www.whitehouse.gov/wp-content/uploads/2022/09/Nature-Deprived-Communities-MOU.pdf

opportunities for the SSMP to consider upon implementation of the LRP. Due to SSMP commitments for current requirements, the SSMP team recognizes that implementation of these strategies will require added internal capacity, including new categories of employee classifications that do not currently exist within the program.

Given the high need for increased community amenities investments, especially related to recreation and outdoor access, and its close alignment with the SSMP's acceptability criterion, these investments must be integral to planning processes at the Sea. This should happen in three main ways. First, these projects should be incorporated into environmental planning processes, including the U.S. Army Corps of Engineers (USACE)'s NEPA compliance process, so that these amenities are fully integrated into planning efforts rather than added as an afterthought. In addition, there needs to be concurrent recreational planning processes that stand alone so that infrastructure that can be developed today is not unnecessarily delayed. Third, current funding opportunities outside of the SSMP should be sought to achieve these goals. A set of recommendations for how the next stage of the LRP should consider and successfully incorporate recreation and access amenities as follows. Community residents have been waiting many years for recreational and access infrastructure. Any investments made using funds available now outside of SSMP should not wait until implementation of the LRP. That said, it is important that recreation and access features and investments take into account current and future restoration and other development at the Sea to avoid investments that ultimately may conflict with restoration or other efforts.

Incorporate Recreational Access into LRP Alternative Development – The recreational community amenities, and transportation infrastructure required to access them, that communities have requested should be identified and described at the front end of developing LRP concepts so that the public has an opportunity to provide feedback on these features as part of their comments on the LRP projects. Residents have the expertise to identify which features best meet local needs, which ultimately will improve the quality of their recreational experiences.

Purpose and Need in the LRP Environmental Review Document – The SSMP's Draft Environmental Assessment for the 10 Year Plan stated that *"10-Year Plan projects will prioritize including public amenities, such as picnic areas and walking trails, provided that the amenities do not conflict with the project's overall purpose and need."* The LRP process has the opportunity go further to meet local needs by incorporating these values at the front end of planning.

Dig Once Policies – As part of Governor Newsom's "Broadband for All Initiative" and federal infrastructure spending, a transformative amount of government funding to address the digital divide exists, especially supporting "middle mile" and "last mile" build out.[23] Design and construction of LRP projects should occur in coordination efforts with other entities to ensure large investments in infrastructure construction can advance multiple needs and efficiently use resources. A "Dig Once" policy requires coordination among public works departments, public utility companies, and internet service providers around laying broadband simultaneously with planned excavation/trenching projects in the public right of way, ultimately ensuring the deployment of faster, more reliable broadband infrastructure and saving construction costs. (Caltrans is currently applying a Dig Once Policy as part of the State's Broadband for All effort). Dig Once policies should be applied for broadband at the Sea, but this approach could be expanded to require coordination with recreational and transportation planning entities to

[23] Coachella Valley Association of Governments is currently leading efforts to create a backbone of 'middle mile efforts' as part of a light synchronization effort in the Coachella Valley, exhibiting the power of Dig Once policies.

ensure that each construction planning, design, and construction efforts at the Sea maximizes efficiency and ensures multi-benefit outcomes.

Collaborative Planning – Despite sustained interest and notable need, there has never been a comprehensive infrastructure planning process for recreation, transportation, and broadband in the Salton Sea region. There are currently numerous planning grants available to support this work, such as the America the Beautiful Challenge and Caltrans Sustainable Transportation Planning Grants. The SSMP should coordinate with local and regional transportation authorities to share recreational planning efforts. A coordinated approach early in the planning process can identify opportunities to equitably distribute investments or strategically link projects, such as locating a bus stop near a recreational amenity.

Community-led Design and Planning – CBO-led efforts have highlighted that the surrounding communities can provide valuable expertise to inform design of recreational amenities at the Sea (Alianza Coachella Valley, 2018). State recreational planning and equity grants, such as the Wildlife Conservation Board's expanded planning and implementation grants, mean that CBOs and local government partners can and should play a role in designing and implementing new projects (CA Wildlife Conservation Board, 2022). There is valuable precedent with community and CBO led designs, such as Desert Shores and Audubon's Bombay Beach, which include these elements and are now part of the SSMP's 10-Year Plan projects.

Multi-Purpose Recreation – Recreation centers and related amenities offer creative opportunities for supporting broadband buildout under a broader definition of "access." For example, California State Parks is exploring opportunities to provide broadband at key parks locations, which could benefit the Salton Sea region (CA State Parks, 2020b). Additionally, construction at the Sea could offer opportunities for expanding broadband. Alianza ECV's Resilient Salton Sea has recommended innovative ideas on the North End of the Sea that can serve as a model for this work.

Active Transit and Trails – Investments to expand multi-use trails and active transportation networks is a key, community-identified need for improved recreational amenities at the Sea. Trails are both critical for connecting communities to recreation and natural spaces, as well as connecting regional open and natural areas. Currently, multiple restoration projects are moving forward at the Sea with signage and trail components, emphasizing the need for a cohesive trail planning process. Trails are also key for identifying locations and supporting other community infrastructure, such as shade structures or picnic areas. A key next step will be initiating a public trail planning process with buy-in and support from key landowners, community, and agency partners. This trail planning process could serve as the foundation for a future public recreation process and garner specific, on-the-ground information from community members on what they want to see and any potential land-use conflicts. There are currently planning grants that could support this process.

Programming and Educational Signage – Enhanced programming and signage at the Sea can increase communities' sense of connection with the region and provide for meaningful recreational experiences. Partnerships with local nonprofits and CBOs to bring residents to the Sea for guided recreational opportunities can provide high-quality experiences that inspire a commitment to environmental stewardship. Additionally, multilingual signage ensures that diverse communities in the region can easily access information about the Sea and the recreational opportunities it provides. These features, including activity selection, should be identified early in the design process with the help of local residents.

Workforce Recommendations – The presence of higher education institutions in the Salton Sea region is at a significantly smaller scale than in nearby larger cities (Alianza, Center for Social Innovation, UC Santa Cruz Institute for Social Transformation, 2021) and the region has comparatively few opportunities for economic mobility. Imperial County has the highest unemployment rate in California (19.4% in August 2021, according to the State's Employment Development Department). Likewise, staffing is a major constraint in the implementation of the SSMP. The LRP has the potential to create hundreds of jobs for contractors, sub-contractors, and state employees ranging from construction, operations, and maintenance to vegetation and wildlife management, communications, outreach, planning, and all aspects of engineering.[24] To ensure these restoration careers are available to residents in the future, local education institutions should create curriculum now in conjunction with contractors and local workforce boards. Additionally, SSMP projects should encourage the employment of a local workforce and ensure that a local workforce has the opportunity to participate.

[24] September 21, 2022 Presentation to Regional Community Benefits Working Group Focused discussion on Workforce; https://docs.google.com/presentation/d/1Tf__RnCv_Gyhc5WwC3x-Te6ry8zK3YYwRRD_kyt4BU4/edit#slide=id.g1571b2653b1_0_24

7 Evaluation of Restoration Concepts

This chapter evaluates the expected performance of 18 Phase 2 restoration concepts carried forward for analysis at this stage of the planning process. As described in Chapter 2 of this LRP, the criteria for evaluating restoration concepts were formulated for the following four categories:

- Effectiveness
- Acceptability
- Completeness
- Efficiency

These categories, the restoration concepts, and the results of the evaluation process for the restoration concepts are detailed in the following sections. The 18 Phase 2 concepts being evaluated against the criteria include 15 concepts that were proposed by the SSMP team or the LRPC, as discussed in Chapter 5 of this Plan. The remaining three concepts were selected from the process facilitated by the IRP also described in Chapter 5 (a combined water importation concept, a water exchange concept, and a Colorado River Transfer concept based on land fallowing).

The scoring for all concepts followed these general guidelines:

Criteria Category	Scoring Guidelines				
Effectiveness	Highly Effective	Very Effective	Effective	Somewhat Effective	Not Effective
Acceptability	Acceptable	Mostly Acceptable	Somewhat Acceptable	Minimally Acceptable	Not Acceptable
Completeness	Complete				Not Complete
Efficiency	Highly Efficient	Very Efficient	Efficient	Somewhat Efficient	Not Efficient
Scores >>	5	4	3	2	1

The IRP Feasibility Report, Summary Report, and other supporting documents are available for download at: https://saltonsea.ca.gov/planning/water-importation-independent-review-panel.

7.1 Effectiveness

Effectiveness measures how well a restoration concept would be expected to accomplish an individual objective from the suite of Salton Sea LRP objectives. Expected performance was measured under a range of future climatic conditions being considered for the State of California planning efforts, including extreme events such as droughts and heat waves.

Effectiveness has been divided into the following three criteria:

- Air Quality/Public Health:
  - Ability to reduce dust emissions from exposed lakebed with the intent to protect or improve air quality
  - Ability to protect or improve air quality
- Habitat:
  - Area of shallow habitat (0-6 inches)

  - Area of medium-depth habitat (6 inches to 6 feet)
  - Deep-water habitat (greater than 6 feet)
  - Salinity
  - Pupfish habitat and connectivity

- Water Quality:
  - Ability to meet selenium standards
  - Ability to improve water quality

The evaluation of the restoration concepts for each of these effectiveness criteria is discussed below.

7.1.1 Air Quality/Public Health

The Air Quality/Public Health Ability criterion focuses on the ability of a concept to reduce dust emissions from exposed lakebed with the intent to protect and improve air quality.

Ability to Reduce Dust Emissions – Exposed lakebed areas are expected to be a source of wind-blown dust. The ability of a restoration concept to minimize dust emissions from exposed lakebed and thus protect and improve air quality was evaluated and compared to the Phase 1: 10-Year Plan.

As discussed in Section 3.4, the lakebed was divided into zones of variable emissivity based on sediment characteristics. Annual emissions were then estimated for each area. The total estimated unmitigated emissions from each concept were compared with the estimate of the unmitigated emissions from the Phase 1: 10-Year Plan.

It is expected that emissions from exposed lakebed will be mitigated by implementing enhanced vegetation or other dust mitigation programs. Furthermore, it is assumed that dust mitigation for concepts that have greater estimated dust emissions than the Phase 1: 10-Year Plan alone will be mitigated. However, prior to mitigation, these concepts have been assigned a score of 2 or 1 depending the extent of mitigation required. The costs for dust mitigation above that of the Phase 1: 10-Year Plan will be considered as part of the OMER costs for those concepts. Concepts that are expected to have lower emissions than the unmitigated Phase 1: 10-Year Plan have been assigned a score of at least 4, and those with less than half the estimated emissions than the Phase 1: 10-Year Plan have been assigned a score of 5.

The accompanying chart shows the estimated annual unmitigated dust emissions associated with each concept for each of the three inflow scenarios. For those concepts that received a score of 3 (shown in yellow), additional dust mitigation would be required above and beyond that required for the Phase 1: 10-Year Plan. The results shown on the chart are for the expected exposed lakebed in 2050 for each concept and inflow scenario. Cost estimates for OMER expenses related to additional dust mitigation will be added for those concepts with scores of less than 3 based on the High Probability Inflow Scenario.

Ability to Protect or Improve Air Quality –

As introduced in Section 3.4, air quality modeling for particulate matter (PM_{10}) was performed using the CALPUFF modeling framework. A summary of this modeling, as completed for this plan, is presented in Appendix E, and key results briefly summarized here.

CALPUFF modeling was conducted for a full year of meteorological data (representing the year 2020) with emission rates based on 80% sand presence on the exposed lakebed surface. The results for the annual run for baseline exposed lakebed conditions were evaluated to identify discrete episodes when elevated 1-hour average ambient PM_{10} concentrations (i.e., greater than 200 μg/m^3) were predicted. Review of the concentration isopleths indicate that persistent durations of predicted elevated 1-hour average ambient PM_{10} concentration are associated with winds blowing from the northwest to the southeast along the axis of orientation of the Salton Sea and with winds blowing from west to east across the Salton Sea. The modeling indicates that fugitive dust emissions from exposed lakebed are being transported to communities north of the Salton Sea episodes are infrequent. Rather, transport of fugitive dust emissions from exposed lakebed toward the communities south of the Salton Sea are much more likely. This observation is not only associated with the wind vectors occurring on episode days, but also with the relatively high emissivity of the exposed lakebed in the southern and western regions of the Salton Sea. It is notable, however, that the predicted concentrations in the communities south and north of the Salton Sea are considerably lower than those predicted along the seashore itself and no exceedances of ambient air quality standards in these communities is predicted by CALPUFF for the communities.

The results of the modeling framework implemented here indicate the utility of this approach for evaluating the impacts of different exposed lakebed areas on PM_{10} concentrations in receptor communities. At this stage of the analysis, these model outputs are not used to assign numeric scores to restoration concepts. However, the modeling analysis is useful in highlighting where future air impacts are likely to occur, so that future dust suppression projects can be designed on areas of exposed lakebed which contribute to air quality impacts.

Estimated Dust Emissions (tons/yr)

Restoration Concept	Hi Prob Inflow	vs Phase 1	Score	Lo Prob Inflow	vs Phase 1	Score	V Lo Prob Inflow	vs Phase 1	Score
Phase 1: 10-Year Plan	2,204		3	2,696		3	2,958		3
1. North/South Marine Sea									
1A With Saline Habitat Complex (SHC)	113	5%	5	76	3%	5	265	9%	5
1B Without SHC	1,584	72%	4	1,562	58%	4	1,823	62%	4
1C Without SHC, with Freshwater Reservoir (FWR)	1,325	60%	4	1,405	52%	4	1,480	50%	4
2. Divided Sea/Marine Sea South									
2A With Full 10-Yr Plan	1,910	87%	4	3,235	120%	2	5,892	199%	1
2B Without Alamo River Project (ARP)	1,997	91%	4	3,192	118%	2	6,164	208%	1
2C Without ARP, with 2 Perimeter Lake Cells	1,992	90%	4	3,230	120%	2	6,073	205%	1
2D Without ARP, with 2 Perimeter Lake Cells & FWR	1,641	74%	4	2,735	101%	3	5,615	190%	1
3. Updated Perimeter Lake									
3A Updated Perimeter Lake	1,753	80%	4	2,022	75%	4	2,153	73%	4
3B Updated Perimeter Lake wo ARP & 3 Cells/w FWR	1,839	83%	4	2,244	83%	4	2,362	80%	4
4. Pump Out									
4A With Dust Control	1,498	68%	4	3,066	114%	2	1,389	47%	5
4B With Pipeline	2,104	95%	4	1,970	73%	4	2,058	70%	4
4C With Dust Control + Pipeline	1,498	68%	4	3,066	114%	2	1,389	47%	5
4D With Dust Control/wo ARP/w FWR	1,255	57%	4	2,449	91%	4	1,315	44%	5
5 Water Optimization (35,000 ac)	1,217	55%	4	1,429	53%	4	1,480	50%	4
7 Water Recycling	2,356	107%	2	4,011	149%	1	2,554	86%	4
11 IRP Water Importation	1,766	80%	4	2,472	92%	4	2,721	92%	4
12 IRP Water Exchange	3,396	154%	1	4,415	164%	1	3,067	104%	2
13 IRP Colorado River Water Transfer	3,004	136%	1	4,415	164%	1	6,464	219%	1

7.1.2 Habitat

The objective of restoring aquatic habitat is to re-establish the historical levels and diversity of fish and wildlife that depend on the Salton Sea. SSMP is targeting habitat conditions like those that existed before the year 2000. After the year 2000, abundance and diversity of fish and wildlife at the Sea experienced a sharp decline, coinciding with average salinity approaching 45 PPT. Most of the concepts evaluated in this Plan have a primary aquatic habitat restoration area, which is generally the largest contiguous water body, with salinities in the target range of 20 to 40 PPT at a variety of water depths. These areas are expected to be the most able to support the abundance and diversity of fish and wildlife that have depended on the Salton Sea in the past. Several concepts also have supplemental areas with salinities over a much wider range (20 to 200 PPT), which could provide additional diversity.

As discussed in Chapter 2, five criteria were used to assess a concept's ability to restore habitat. The first three assess a concept's ability to restore its primary habitat in different water depth ranges: shallow (0 to 6 inches), medium (6 inches to 6 feet), and deep (greater than 6 feet). The fourth criterion is salinity, and the final criterion is pupfish connectivity. Habitat evaluations were completed for each of the inflow scenarios being considered in this Plan. The results of the evaluation are shown on the charts on the following pages and discussed below.

Depth Criteria – For each of the depth criteria, the area of habitat in a particular depth class was compared to historical water surface elevations when the greatest abundance and diversity of wildlife existed at the Sea. The area in each depth category was calculated for a historical Sea elevation of -230 ft msl, which existed in 1999 and earlier. For each depth range, concepts that could restore 50 percent or more of the habitat area were assigned a score of 5. Areas between 25 and 50 percent of historical areas were assigned a score of 4. Similar reductions were made for lower scores. This scale is only a means to compare the habitat areas provided by different concepts. At the next stage of analysis habitat modeling

Habitat Scores for the High Probability Inflow Scenario

Restoration Concept	Shallow	Medium	Deep	Salinity	Pupfish
Phase 1: 10-Year Plan	5	5	1	5	5
1. North/South Marine Sea					
1A With Saline Habitat Complex (SHC)	5	5	3	5	5
1B Without SHC	5	5	3	5	5
1C Without SHC, w Freshwater Reservoir	5	5	3	5	5
2. Divided Sea					
2A With Full 10-Yr Plan	5	5	4	5	5
2B Without Alamo River Project	5	5	4	5	5
2C Without Alamo/w 2 Perimeter Lake Cells	5	5	4	5	5
2D Without Alamo/w 2 Perimeter Lake Cells & Freshwater Reservoir	5	5	4	5	5
3. Updated Perimeter Lake					
3A Updated Perimeter Lake (UPL)	5	5	2	5	5
3B UPL Without Alamo Project & 3 Cells/w Freshwater Reservoir	5	5	1	5	5
4. Pump Out					
4A With Dust Control	5	5	4	5	5
4B With Pipeline	5	5	4	5	5
4C With Dust Control + Pipeline	5	5	4	5	5
4D With Dust Control/Without Alamo/w Freshwater Reservoir	5	5	4	5	5
5 Water Optimization (35,000 ac)	5	5	1	5	5
7 Water Recycling	5	5	5	5	5
11 IRP Water Importation	5	5	5	5	5
12 IRP Water Exchange	5	5	4	5	5
13 IRP Colorado River Water Transfer	5	5	4	5	5

Habitat Scores for the Low Probability Inflow Scenario

Restoration Concept	Shallow	Medium	Deep	Salinity	Pupfish
Phase 1: 10-Year Plan	5	5	1	5	5
1. North/South Marine Sea					
1A With Saline Habitat Complex (SHC)	5	5	3	5	5
1B Without SHC	5	5	3	5	5
1C Without SHC, w Freshwater Reservoir	5	5	3	5	5
2. Divided Sea					
2A With Full 10-Yr Plan	5	5	2	5	4
2B Without Alamo River Project	5	5	3	5	4
2C Without Alamo/w 2 Perimeter Lake Cells	5	5	3	5	4
2D Without Alamo/w 2 Perimeter Lake Cells & Freshwater Reservoir	5	5	3	5	4
3. Updated Perimeter Lake					
3A Updated Perimeter Lake (UPL)	5	5	2	5	5
3B UPL Without Alamo Project & 3 Cells/w Freshwater Reservoir	5	5	1	5	5
4. Pump Out					
4A With Dust Control	5	5	2	5	4
4B With Pipeline	5	5	3	5	4
4C With Dust Control + Pipeline	5	5	2	5	4
4D With Dust Control/Without Alamo/w Freshwater Reservoir	5	5	3	5	4
5 Water Optimization (35,000 ac)	5	5	1	5	3
7 Water Recycling	5	5	2	5	4
11 IRP Water Importation	5	5	5	5	5
12 IRP Water Exchange	5	5	2	5	4
13 IRP Colorado River Water Transfer	5	5	2	5	4

Habitat Scores for the Very Low Probability Inflow Scenario

Restoration Concept	Shallow	Medium	Deep	Salinity	Pupfish
Phase 1: 10-Year Plan	5	5	1	5	5
1. North/South Marine Sea					
1A With Saline Habitat Complex (SHC)	5	5	2	5	4
1B Without SHC	5	5	2	5	4
1C Without SHC, w Freshwater Reservoir	5	5	2	5	4
2. Divided Sea					
2A With Full 10-Yr Plan	5	5	1	5	3
2B Without Alamo River Project	5	5	1	5	3
2C Without Alamo/w 2 Perimeter Lake Cells	5	5	1	5	3
2D Without Alamo/w 2 Perimeter Lake Cells & Freshwater Reservoir	5	5	1	5	3
3. Updated Perimeter Lake					
3A Updated Perimeter Lake (UPL)	5	5	2	5	5
3B UPL Without Alamo Project & 3 Cells/w Freshwater Reservoir	5	5	1	5	5
4. Pump Out					
4A With Dust Control	5	5	1	5	3
4B With Pipeline	5	5	1	5	3
4C With Dust Control + Pipeline	5	5	1	5	3
4D With Dust Control/Without Alamo/w Freshwater Reservoir	5	5	1	5	3
5 Water Optimization (35,000 ac)	5	5	1	5	3
7 Water Recycling	5	5	1	5	3
11 IRP Water Importation	5	5	5	5	4
12 IRP Water Exchange	5	5	1	5	3
13 IRP Colorado River Water Transfer	5	5	1	5	3

will be needed to better estimate how increases in habitat area would result in improved ecological outcomes. Evaluations for each of the depth criteria are discussed below:

- **Shallow.** At a water surface elevation of -230 feet msl, the bathymetry of the Sea suggests that prior to 2000, about 1,200 acres of shallow habitat (less than 6 inches) existed. Because Phase 1 projects like SCH have extensive shallow habitat, at full build-out, all concepts would have more shallow habitat than the historical Sea did, and thus score 5. This scoring applies for all inflow scenarios.
- **Medium Depth.** At a water surface elevation of -230 feet msl, the bathymetry of the Sea suggests that prior to 2000, about 14,000 acres of medium-depth habitat (6 inches to 6 feet) existed. Phase 1 projects have medium-depth habitat and when combined with Phase 2 projects, at full build-out, all concepts would have more medium-depth habitat than the historical Sea did, and thus score 5, even at the Very Low Probability Inflow Scenario.
- **Deep Water.** At a water surface elevation of -230 feet msl, the bathymetry of the Sea suggests that prior to 2000, about 220,000 acres of deep-water habitat (greater than 6 feet) existed. As indicated in the charts, the extent of deep-water habitat that would be associated with each concept would vary substantially with inflows. Deep-water habitat under the inflow extremes would be as follows:
  - **For the High Probability Inflow Scenario**, all Concepts except 3A, 3B, and 5 score 3 or above for this criterion. Concept 5 does not include any deep-water habitat other than the small amount included in Phase 1 projects. Concepts 3A and 3B have 15,000 and 7,600 acres, respectively, of deep-water habitat.
  - **Conversely, for the Very Low Probability Inflow Scenario**, only Concept 11 scores better than 3. As discussed in Chapter 5, the Perimeter Lake Concepts 3A and 3B could both perform as planned at a design elevation of -230 feet msl even under the Very Low Probability Inflow Scenario with the same area of deep-water habitat as described for the High Probability Inflow. The Marine Sea in in Concepts 1A, 1B, and 1C would perform at a lower than design elevation and the Saline Habitat Complex in Concept 1A could not be sustained. Other than Concept 11, all other concepts would have primary habitat areas typically around 25,000 acres with no deep-water habitat.

Any concept that receives less than a score of 3 in an effectiveness category would be deemed incomplete. For the High Probability Inflow Scenario, Concepts 3A, 3B, and 5 are all less than effective at providing deep water habitat. These concepts cannot easily be modified to meet effectiveness in these areas due to the fundamental basis of their design; therefore, these concepts will be deemed incomplete. For the Very Low Probability Inflow Scenario, all concepts except 11 would be considered incomplete.

SALINITY CRITERIA – Salinities in the target range of 20 to 40 PPT at a variety of water depths are the most able to support the abundance and diversity of fish and wildlife that have depended on the Salton Sea in the past (pre-2000). This metric evaluates salinity in the primary habitat area of a concept. All concepts would have primary habitat areas in this target range; therefore, all were assigned a score of 5 for this habitat criterion. This scoring applies for all inflow scenarios.

PUPFISH CONNECTIVITY – The pupfish habitat and connectivity criterion measures the extent of pupfish connectivity between drains and inlets with water quality that can support pupfish. Restoration concepts that maintain the highest amount of suitable connectivity would score highest. All concepts would be designed to provide pupfish connectivity, and connectivity will be provided in all Phase 1 habitat projects.

Therefore, all concepts were assigned a score of at least 3 for this habitat criterion. At a more detailed stage of design, some concepts may be determined to have better connectivity than others. However, connectivity may be reduced with reduced inflows. The inflow extremes are discussed below:

- **High Probability Inflow Scenario.** For this inflow scenario, all concepts would be designed to provide pupfish connectivity, and all were given a score of 5.
- **Very Low Probability Inflow Scenario.** For this inflow scenario, concepts would have a reduced habitat pool, well away from drains were given a score 3 because the connectivity would be reduced but will still be provided by the Phase 1 projects. Concepts that would have lesser retreat were given a score of 4, and those that would maintain design connectivity were given a score of 5.

7.1.3 Water Quality

Water quality associated with each concept has been assessed using two criteria: (1) the ability to meet selenium standards, and (2) the ability to improve water quality parameters other than salinity, which was assessed as part of the habitat criteria.

Ability to Meet Selenium Standards – This criterion measures the ability of a restoration concept to create or maintain habitats where selenium concentrations are below levels that cause wildlife risk. Habitat areas that mirror the Sea's historical salinity are believed to have a high probability to sequester selenium and were assigned a value of 5. Habitat areas that have a managed risk for selenium were assigned a value of 3. The Phase 1 projects and the Water Optimization concept are believed to have a managed risk for selenium and were assigned a value of 3. The North/South Marine Sea with Saline Habitat Complex was given a score of 4. (This score is because the Saline Habitat Complex would have a managed risk for selenium ([a value of 3]) and the North/South Marine Sea would mirror the Sea's historical ability to sequester selenium (a value of 5)). Scores assigned to all concepts for the selenium criterion are shown on the side chart.

Ability to Meet Selenium Standards

Restoration Concept	Score
Phase 1: 10-Year Plan	3
1. North/South Marine Sea	
1A With Saline Habitat Complex (SHC)	4
1B Without SHC	5
1C Without SHC, w Freshwater Reservoir	5
2. Divided Sea	
2A With Full 10-Yr Plan	5
2B Without Alamo River Project	5
2C Without Alamo/w 2 Perimeter Lake Cells	5
2D Without Alamo/w 2 Perimeter Lake Cells & Freshwater Reservoir	5
3. Updated Perimeter Lake	
3A Updated Perimeter Lake	5
3B Updated Perimeter Lake wo Alamo & 3 Cells/w Freshwater Reservoir	5
4. Pump Out	
4A With Dust Control	5
4B With Pipeline	5
4C With Dust Control + Pipeline	5
4D With Dust Control/Without Alamo/w FW Reservoir	5
5. Water Optimization (35,000 ac)	3
7. Water Recycling	5
11. IRP Water Importation	5
12. IRP Water Exchange	5
13. IRP Colorado River Water Transfer	5

Ability to Improve Water Quality – This criterion measures the extent to which a restoration concept improves water quality parameters other than salinity. This criterion applies to inflowing waters and water bodies and habitat areas within the Salton Sea footprint that provide opportunities for beneficial uses (designated in the Regional Water Board Basin Plan) and that reduce environmental consequences. Indicators include the ability to reduce loads of potentially contaminated sediments and control total phosphorus, total nitrogen, and other contaminants in inflows. All concepts have components for improvement of water quality in primary habitat areas including features such as sedimentation basins, flow through systems, and export of Salton Sea water which is high in nutrients. Other features could be added such as phytoremediation of inflows to further improve water quality. At this stage of analysis, as shown on the side chart, all concepts have been given a score of 3.

Ability to Improve Water Quality

Restoration Concept	Score
Phase 1: 10-Year Plan	3
1. North/South Marine Sea	
1A With Saline Habitat Complex (SHC)	3
1B Without SHC	3
1C Without SHC, w Freshwater Reservoir	3
2. Divided Sea	
2A With Full 10-Yr Plan	3
2B Without Alamo River Project	3
2C Without Alamo/w 2 Perimeter Lake Cells	3
2D Without Alamo/w 2 Perimeter Lake Cells & Freshwater Reservoir	3
3. Updated Perimeter Lake	
3A Updated Perimeter Lake	3
3B Updated Perimeter Lake wo Alamo & 3 Cells/w Freshwater Reservoir	3
4. Pump Out	
4A With Dust Control	3
4B With Pipeline	3
4C With Dust Control + Pipeline	3
4D With Dust Control/Without Alamo/w FW Reservoir	3
5. Water Optimization (35,000 ac)	3
7. Water Recycling	3
11. IRP Water Importation	3
12. IRP Water Exchange	3
13. IRP Colorado River Water Transfer	3

7.2 Acceptability

The acceptability of a restoration concept will be measured by its compatibility with State law and policies applicable to the Salton Sea, such as the potential to protect Natural Resources, Cultural Resources and Tribal Cultural Resources; provide equitable outdoor access to recreational opportunities; sustainably enhance local economies; address environmental justice; and minimize GHG emissions. Acceptability shall also include how well a proposed restoration concept considers and incorporates locally led values and goals, including those of underserved populations experiencing environmental injustice in the region.

Acceptability was measured across the following ten criteria:

- Tribal Access to Natural Resources, Cultural Resources, and Tribal Cultural Resources
- Protection of Natural Resources, Cultural Resources, and Tribal Cultural Resources (Based on overall area)
- Protection of Natural Resources, Cultural Resources, and Tribal Cultural Resources (Based on location)
- Incorporation of Tribal Expertise
- Environmental Justice and Equity
- Do No Harm
- Equitable Outdoor Access
- Minimize GHG Emissions
- Workforce Development

- Sustainable Economic Development

The evaluation of the restoration concepts for each of these acceptability criteria is discussed below.

The first four acceptability criteria evaluate Tribal access and protection of Natural Resources, Cultural Resources, and Tribal Cultural Resources and are scored through government-to-government consultation: (1) Tribal Access to Natural Resources, Cultural Resources, and Tribal Cultural Resources; (2) Protection of Natural Resources, Cultural Resources, and Tribal Cultural Resources Based on Overall Size; (3) Protection of Natural Resources, Cultural Resources, and Tribal Cultural Resources Based on Location and (4) Incorporation of Tribal Expertise. As of this writing, the consultation process has not been concluded. Each of these criteria are discussed briefly below.

7.2.1 Tribal Access to Natural Resources, Cultural Resources, and Tribal Cultural Resources

This criterion addresses the ability for a concept or strategy to identify opportunities for Tribal access and management of ancestral lands, the lake, and other Natural Resources, Cultural Resources, and Tribal Cultural Resources. Evaluation of this criterion is informed through ongoing government-to-government consultation between the Tribes and the State.

7.2.2 Protection of Natural Resources, Cultural Resources, and Tribal Cultural Resources (Based on overall area)

The ability for a potential concept to avoid adverse effects to Natural Resources, Cultural Resources, and Tribal Cultural Resources and landscapes, including but not limited to sacred places, archeological sites, ceremonial and burial grounds, village sites, and cultural sites will be assessed in detail at the next phase of technical and environmental analysis. For this stage of analysis, the overall size of footprints of the different concepts have been evaluated as an early indicator of the possibility that resources could be affected. The chart below shows the approximate land area that each concept could occupy. The analysis includes areas on land and those within the historic Salton Sea footprint. No specific project areas have been identified at this time, and it is expected that sensitive areas would be avoided during detailed analysis and design. Therefore, this is only a preliminary indicative analysis to rank potential risk.

Protection of Natural and Cultural Resources Based on Overall Project Size

Restoration Concept	Ponds & Plants*	Linear Features**		Total Est. Area	Score
	Acres	Miles	Est. Acres	Acres	
1. North/South Marine Sea					
1A With Saline Habitat Complex (SHC)	43,100	100	3,000	46,100	1
1B Without SHC	13,100	100	3,000	16,100	3
1C Without SHC, w Freshwater Reservoir	14,600	100	3,000	17,600	3
2. Divided Sea					
2A With Full 10-Yr Plan	1,500	10	300	1,800	5
2B Without Alamo River Project	1,500	10	300	1,800	5
2C Without Alamo/w 2 Perimeter Lake Cells	1,500	20	2,100	3,600	5
2D Without Alamo/w 2 Perimeter Lake Cells & Freshwater Reservoir	3,000	20	2,100	5,100	5
3. Updated Perimeter Lake					
3A Updated Perimeter Lake (UPL)	1,000	50	9,100	10,100	4
3B UPL Without Alamo Project & 3 Cells/w Freshwater Reservoir	2,500	40	7,300	9,800	4
4. Pump Out					
4A With Dust Control	35,000	0	0	35,000	1
4B With Pipeline	11,000	150	4,500	15,500	4
4C With Dust Control + Pipeline	46,000	150	4,500	50,500	1
4D With Dust Control/Without Alamo/w Freshwater Reservoir	36,500	20	600	37,100	1
5 Water Optimization (35,000 ac)	35,000	10	300	35,300	1
7 Water Recycling	16,000	80	2,400	18,400	3
11 IRP Water Importation	30,000	150	4,500	34,500	1
12 IRP Water Exchange	26,000	150	4,500	30,500	2
13 IRP Colorado River Water Transfer	25,000	150	4,500	29,500	2

*Ponds and plants includes areas of habitat and brine ponds and facilities such as pumping plants and recycling plants.
**Linear Features include pipelines, channels, and roads. Corridor widths of 250 feet have been assumed for potential disturbance during construction.

The areas of ponds and plants shown on the chart include areas of habitat and brine ponds, as well as areas that would be occupied by facilities such as pumping plants and recycling plants. The area estimates include approximate locations that would be permanently occupied by facilities and layout areas that could be temporarily disturbed during construction. Linear Features include pipelines, channels, and roads. Corridors of potential disturbance for construction of pipelines, channels, and roads have been assumed to be 250 feet wide. Note that the Phase 1: 10-Year Plan projects are going through a separate environmental and cultural evaluation documented in the 10-Year Plan EA. Therefore, the Phase 1 projects are not included in the present analysis.

There is substantial variability in the area that could be affected by the different concepts. For the North/South Marine Sea, Concept 1B has a barrier that is almost 50 miles long and at its base in the deepest areas of the Sea would be about 2,500 feet wide. The total area of the barrier is estimated at 11,100 acres. In addition, another 1,000 acres is included to account for pump stations and other ancillary facilities. In addition to these features, Concept 1A would include the Saline Habitat Complex (SHC) which would occupy about 30,000 acres. Concept 1C combines the areas shown for Concept 1B with an additional 1,500 acres for a freshwater reservoir, which was assumed to be created with an 8-mile-long embankment with a 1,500-foot-wide corridor of disturbance. Finally, all the North/South Marine Sea concepts include about 100 miles of channels and pipelines.

The key feature of the Divided Sea Concepts is the causeway which would have a footprint of about 500 acres plus another 1,000 acres of temporary disturbance within the Sea and about 10 miles of roads leading to the causeway. Divided Sea Concept 2C would also have about 10 miles of levees that would contain the two perimeter lake cells. For Concept 2D, a freshwater reservoir is included that would add about 1,500 acres.

The Updated Perimeter Lake Concept 3A would have about 50 miles of levees and 500 acres is included for miscellaneous onshore facilities. The footprint of the levee would be about 250 feet wide, and an additional temporary disturbance would expand the total width of disturbance to about 1,500 ft, resulting in 9,100 acres of permanent and temporary disturbance along the levee corridor. Concept 3B would have a shorter levee system but would include the added area of a freshwater reservoir.

The Pump Out Concepts 4A and 4C include 25,000 acres of brine ponds. Concepts 4B and 4C also include about 1,000 acres for pump stations and support facilities and about 150 miles of pipelines, some of which would be in Mexico. Concept 4D would be like Concept 4A, except that it would include a freshwater reservoir. In addition, all Pump Out concepts would include about 10,000 acres of reclaimed farmland.

Concepts 5, 7, 11, 12, and 13 all include areas for different types of ponds. Water Optimization Concept 5 involves 35,000 acres of ponds and channels within that area, plus an estimated 10 miles of channels to convey water to these areas. Concept 7 was estimated to include about 12,000 acres of brine ponds, another 3,000 acres of wetland areas along the shoreline, and areas for five water recycling plants. In addition, Concept 7 would have five intake pipelines and distribution pipelines along the shoreline. The total length of pipelines for Concept 7 is estimated at 80 miles. Concepts 11, 12, and 13 all would have onshore brine disposal ponds located southwest of the Sea and estimated by the IRP at 24,000 acres plus an allowance for 1,000 acres for a desalination facility. Concepts 11 and 12 have added allowances for desalination facilities in Mexico. In addition, Concepts 11 and 12 would have about 150 miles of pipelines.

Scores shown on the chart were developed to illustrate the total potential extent of land disturbance associated with each concept as shown below. Concepts with potential disturbance:

- Less than 8,000 acres would receive a score of 5
- Greater than 8,000 acres, but less than 16,000 acres would receive a score of 4
- Greater than 16,000 acres, but less than 24,000 acres would receive a score of 3
- Greater than 24,000 acres, but less than 32,000 acres would receive a score of 2
- Greater than 32,000 acres would receive a score of 1.

At full build-out, the Phase 1: 10-Year Plan is estimated to have a potential extent of ground disturbance up to 24,000 acres. In order to meet acceptability, a concept needs to be below this threshold. Therefore, concepts that fall below 24,000 acres will receive a score of at least 3. Scores increase or decrease linearly based on increments of 8,000 acres.

7.2.3 Protection of Natural Resources, Cultural Resources, and Tribal Cultural Resources (Based on location)

In order to evaluate whether a potential concept can avoid adverse effects to Natural Resources, Cultural Resources, and Tribal Cultural Resources and landscapes, including but not limited to sacred places, archeological sites, ceremonial and burial grounds, village sites, and cultural sites, we require specific information that would be obtained through Tribal engagement based on location of concept features. At this phase, we have not identified site-specific locations. Therefore, this metric will be assessed in detail during the feasibility study and environmental review through the government-to-government consultation process. For this stage of analysis, no score will be assigned.

As concepts proceed to the next phase of development, this site-specific analysis will supersede the "7.2.1.2 Resource Protection (Based on overall area)" analysis.

7.2.4 Incorporation of Tribal Expertise

This criterion addresses the ability for a concept to integrate or incorporate Tribal subject matter expertise, including Traditional Ecological Knowledge (TEK) and indigenous science.

SSMP is committed to integrating Tribal subject matter expertise, including TEK and indigenous science as concepts are developed to higher level detailed designs. At this time, concepts lack sufficient detail for this participatory process. However, this commitment will be met through ensuring that Tribal subject matter experts are part of a design technical team during future, more detailed feasibility studies and environmental review. Because of this commitment, every concept will achieve acceptability and be assigned a score of 3 for its ability to incorporate Tribal expertise.

7.2.5 Environmental Justice and Equity

This criterion incorporates the extent to which a restoration concept directly or indirectly includes locally led initiatives; reflects local values; has already undertaken significant local outreach; or furthers the needs, input, and values of underrepresented regional populations in and around the Salton Sea. It could similarly demonstrate this by establishing the extent to which a proposed restoration concept provides equitable access to state or federal funding for regionally identified and supported restoration or remediation projects, or the extent to which a concept promotes regionally led management and shared decision-making opportunity for underrepresented populations.

Environmental Justice & Equity

Restoration Concept	Score
Phase 1: 10-Year Plan	3
1. North/South Marine Sea	
1A With Saline Habitat Complex (SHC)	3
1B Without SHC	3
1C Without SHC, w Freshwater Reservoir	3
2. Divided Sea	
2A With Full 10-Yr Plan	3
2B Without Alamo River Project	3
2C Without Alamo/w 2 Perimeter Lake Cells	3
2D Without Alamo/w 2 Perimeter Lake Cells & Freshwater Reservoir	3
3. Updated Perimeter Lake	
3A Updated Perimeter Lake	3
3B Updated Perimeter Lake wo Alamo & 3 Cells/w Freshwater Reservoir	3
4. Pump Out	
4A With Dust Control	3
4B With Pipeline	3
4C With Dust Control + Pipeline	3
4D With Dust Control/Without Alamo/w FW Reservoir	3
5. Water Optimization (35,000 ac)	3
7. Water Recycling	3
11. IRP Water Importation	3
12. IRP Water Exchange	3
13. IRP Colorado River Water Transfer	3

Projects designed using tools such as participatory budgeting would receive a higher score in this criterion, which prioritizes community-led design and decision-making and is consistent with previous State efforts to collaborate and support community-led projects that are consistent with local values and goals. SSMP does not anticipate that any of the LRP concepts would preclude participatory budging or other community-led design processes. Such processes could identify new or additional recreational or other components of a concept to increase or enhance its value or use to communities.

At this stage of the conceptual design, all LRP concepts lack the detail to fully incorporate locally led values, design, and initiatives. Further stages of design can more fully integrate community input and tools including participatory budgeting. Therefore, all concepts were given a score of 3 to reflect that community-led design and decision making will be further incorporated as the long-range planning process continues.

7.2.6 Do No Harm

This criterion identifies the extent that a restoration concept prevents, reduces, and controls the risk of environmental harm to environmental justice communities in the Salton Sea region. A concept would score highly if it avoided disproportionate pollution, contamination, air and water quality burdens, or existing hazards to environmental justice communities. In addition, projects that include the deterrence, reduction, and elimination of pollution burdens, including air and water quality burdens or existing hazards, could also meet this standard. A concept could demonstrate this by expanding healthy environments for regional populations, particularly for environmental justice communities. Scores could range from 1 to 5, with 5 being assigned to concepts that avoid harm.

Do No Harm

Restoration Concept	Score
Phase 1: 10-Year Plan	5
1. North/South Marine Sea	
1A With Saline Habitat Complex (SHC)	3
1B Without SHC	3
1C Without SHC, w Freshwater Reservoir	3
2. Divided Sea	
2A With Full 10-Yr Plan	5
2B Without Alamo River Project	5
2C Without Alamo/w 2 Perimeter Lake Cells	5
2D Without Alamo/w 2 Perimeter Lake Cells & Freshwater Reservoir	5
3. Updated Perimeter Lake	
3A Updated Perimeter Lake	4
3B Updated Perimeter Lake wo Alamo & 3 Cells/w Freshwater Reservoir	4
4. Pump Out	
4A With Dust Control	5
4B With Pipeline	4
4C With Dust Control + Pipeline	4
4D With Dust Control/Without Alamo/w FW Reservoir	5
5. Water Optimization (35,000 ac)	5
7. Water Recycling	4
11. IRP Water Importation	3
12. IRP Water Exchange	3
13. IRP Colorado River Water Transfer	5

In general, SSMP believes that all concepts would avoid the above-stated harms. However, at this level of the conceptual design it is difficult to measure risks of environmental harm to environmental justice communities. Importantly, environmental harms can also occur from construction activities. Therefore, at this stage of the evaluation, a score will focus on the timeframe over which construction activities take place, since the length of construction time cannot be mitigated.

For any concept, the temporary nuisance of construction is likely an acceptable long-term tradeoff, so long as all other environmental harms identified at later stages of design are avoided. Therefore, we are assigning a lowest possible score of 3 to the concepts that would take the longest to construct.

Scores are presented in the accompanying chart. A score of 3 (longest time frame) was assigned to concepts with significant construction activities. These include the Marine Sea Concepts 1A, 1B, and 1C and Concepts 11 and 12 that involve water importation or exchange. A score of 4 (intermediate timeframe) was assigned to Perimeter Lake Concepts 3A and 3B and Pump Out Concepts 4B and 4C that have pipelines. A score of 5 was assigned to all other concepts, which can be constructed within 5 years.

7.2.7 Equitable Outdoor Access

This criterion addresses the extent to which a restoration concept expands or advances outdoor access to regional environmental justice communities. Restoration concepts that would score high under this criterion include those that could expand equitable access by creating or enhancing open space infrastructure in proximity to these communities. Examples of open space infrastructure include parks and trails, beaches, fishing piers, new community gathering spaces, recreational or educational facilities, as well as those that would expand ADA and public access and safety, through features such as lighting, multi-modal transportation access, bathrooms and water fountains, safety elements, shade structures and community centers. Scores will range from 1 to 5, with 5 being assigned to concepts that have the greatest potential to expand equitable outdoor access.

Equitable Outdoor Access

Restoration Concept	Score
Phase 1: 10-Year Plan	1
1. North/South Marine Sea	
1A With Saline Habitat Complex (SHC)	4
1B Without SHC	4
1C Without SHC, w Freshwater Reservoir	4
2. Divided Sea	
2A With Full 10-Yr Plan	4
2B Without Alamo River Project	4
2C Without Alamo/w 2 Perimeter Lake Cells	5
2D Without Alamo/w 2 Perimeter Lake Cells & Freshwater Reservoir	5
3. Updated Perimeter Lake	
3A Updated Perimeter Lake	4
3B Updated Perimeter Lake wo Alamo & 3 Cells/w Freshwater Reservoir	4
4. Pump Out	
4A With Dust Control	3
4B With Pipeline	3
4C With Dust Control + Pipeline	3
4D With Dust Control/Without Alamo/w FW Reservoir	3
5. Water Optimization (35,000 ac)	2
7. Water Recycling	3
11. IRP Water Importation	4
12. IRP Water Exchange	3
13. IRP Colorado River Water Transfer	3

The specific factors considered under this criterion are listed below. These factors are considered together to provide the scores in the accompanying table.

- Water suitable for recreation located close to the local community.
- Contiguous water bodies.
- Restoration of the shoreline for thriving recreational opportunities.
- Ability for a concept to include new facilities for equitable access and recreation.
- Ability of a concept to provide for more transportation opportunities from communities to the Sea or between communities at the Sea.
- Equitable access opportunities (including, for example, trails, wildlife access, or infrastructure to expand the quality of experience for the communities at the Sea where none existed previously).

As shown on the side chart, a score of 5 was assigned to Divided Sea Concepts 2C and 2D with perimeter lake cells, due to the proximity of water to communities. The North/South Marine Sea Concepts 1A, 1B, and 1C were also awarded a score of 5, because they provide local access to a wide range of recreational opportunities on a large water body close to the seaside communities.

A score of 4 was assigned to Perimeter Lake Concepts 3A and 3B, which bring water close to the communities but does not have a large water body for a wider range of recreational activities. Water importation Concept 11 received a score of 4 since they restore the Sea to current Sea levels, although not to historical levels.

A score of 3 was assigned to Pump Out Concepts 4A, 4B, 4C, and 4D, the Water Recycling Concept 7, and IRP Concepts 12 and 13 due to a smaller residual Sea, more homogeneous landscape, and the Sea being located further from communities. A score of 2 was assigned to the Water Optimization Concept 5, due to lack of a large recreational water body.

7.2.8 Minimize GHG Emissions

Concepts were modeled to assess their contributions to GHG emissions. The modeling focused on the following three factors:

- Emissions from construction equipment,
- Landscape emissions, and
- Energy use during operations.

This evaluation compared direct differences from baseline conditions which were taken at the lake surface and shoreline as it existed in 1999. To the extent feasible, concepts would incorporate measures to minimize GHG emissions. Beyond this, the carbon offsetting would be identified where possible through nature-based solutions, carbon sequestration, and renewable energies. For this evaluation, "landscape emissions" refers to emission changes that could occur from the shift from an inundated area to a non-inundated area, or vice-versa.

The following charts provide the results of the GHG calculations, and the scores assigned to each concept for the High Probability, Low Probability, and Very Low Probability inflow scenarios, respectively. The methods of analysis for each of the three factors are discussed in Appendix F. Concepts that are expected to have combined GHG emissions from the three factors less than the 1999 baseline GHG emissions were assigned a score of 5.

For the High Probability Inflow Scenario, all concepts except 1A and 11 are expected to have GHG emissions below 1999 levels and were given a score of 5. GHG emissions associated with Concept 1A are expected to be only slightly above 1999 baseline emissions, and therefore Concept 1A was given a score of 4. GHG emissions associated with Concept 11 would be substantially higher than 1999 conditions, and therefore this concept was assigned a score of 2.

For the Low Probability Inflow Scenario, all concepts except 1C and 11 are expected to have GHG emissions below 1999 levels and were given a score of 5. GHG emissions associated with Concept 1C are expected to be only slightly above 1999 baseline emissions and were given a score of 4. As for the High Probability Inflow Scenario, GHG emissions associated with Concept 11 would be substantially higher than 1999 conditions, and therefore this concept was assigned a score of 2.

For the Very Low Probability Inflow Scenario, all concepts are expected to have GHG emissions below 1999 levels and were given a score of 5.

Minimize Greenhouse Gas (GHG) Emissions: High Probability Inflow Scenario

Restoration Concept	Construction*	Energy	Landscape	Total	vs. 1999**	Score
1999 Shoreline			1,760,000	1,760,000		
Phase 1: 10-Year Plan	3,189	111	1,290,000	1,293,300	73%	5
1. North/South Marine Sea						
1A With Saline Habitat Complex (SHC)	42,781	111	1,750,000	1,792,892	102%	4
1B Without SHC	19,799	111	1,498,000	1,517,910	86%	5
1C Without SHC, with Freshwater Reservoir (FWR)	19,799	111	1,475,000	1,494,910	85%	5
2. Divided Sea/Marine Sea South						
2A With Full 10-Yr Plan	6,176	111	1,341,000	1,347,287	77%	5
2B Without Alamo River Project (ARP)	5,276	111	1,300,000	1,305,387	74%	5
2C Without ARP, with 2 Perimeter Lake Cells	5,952	111	1,313,000	1,319,063	75%	5
2D Without ARP, with 2 Perimeter Lake Cells & FWR	6,852	111	1,343,000	1,349,963	77%	5
3. Updated Perimeter Lake						
3A Updated Perimeter Lake	7,814	111	1,429,000	1,436,925	82%	5
3B Updated Perimeter Lake wo ARP & 3 Cells/w FWR	6,836	111	1,381,000	1,387,947	79%	5
4. Pump Out						
4A With Dust Control	4,817	274	1,484,000	1,489,091	85%	5
4B With Pipeline	7,358	274	1,347,000	1,354,632	77%	5
4C With Dust Control + Pipeline	8,986	274	1,507,000	1,516,260	86%	5
4D With Dust Control/wo ARP/w FWR	4,817	274	1,544,000	1,549,091	88%	5
5 Water Optimization (35,000 ac)	5,138	111	1,437,000	1,442,249	82%	5
7 Water Recycling	11,506	111	1,358,000	1,369,617	78%	5
11 IRP Water Importation	196,484	1,263,000	1,380,000	2,839,484	161%	2
12 IRP Water Exchange	115,243	452,000	1,053,000	1,620,243	92%	5
13 IRP Colorado River Water Transfer	45,071	131,000	1,391,000	1,567,071	89%	5

*GHG Emission Factor Based on Construction of SCH.

**Estimated change in GHG Emissions Compared to the Salton Sea water surface and shoreline in 1999.

Minimize Greenhouse Gas (GHG) Emissions: Low Probability Inflow Scenario

Restoration Concept	Construction*	Energy	Landscape	Total	vs. 1999**	Score
1999 Shoreline			1,760,000	1,760,000		
Phase 1: 10-Year Plan	3,189	111	1,196,000	1,199,300	68%	5
1. North/South Marine Sea						
1A With Saline Habitat Complex (SHC)	42,781	111	763,000	805,892	46%	5
1B Without SHC	19,799	111	1,369,000	1,388,910	79%	5
1C Without SHC, with Freshwater Reservoir (FWR)	19,799	111	1,805,000	1,824,910	104%	4
2. Divided Sea/Marine Sea South						
2A With Full 10-Yr Plan	6,176	111	1,101,000	1,107,287	63%	5
2B Without Alamo River Project (ARP)	5,276	111	1,120,000	1,125,387	64%	5
2C Without ARP, with 2 Perimeter Lake Cells	5,952	111	1,131,000	1,137,063	65%	5
2D Without ARP, with 2 Perimeter Lake Cells & FWR	6,852	111	1,203,000	1,209,963	69%	5
3. Updated Perimeter Lake						
3A Updated Perimeter Lake	7,814	111	1,472,000	1,479,925	84%	5
3B Updated Perimeter Lake wo ARP & 3 Cells/w FWR	6,836	111	1,294,000	1,300,947	74%	5
4. Pump Out						
4A With Dust Control	4,817	274	1,485,000	1,490,091	85%	5
4B With Pipeline	7,358	274	1,354,000	1,361,632	77%	5
4C With Dust Control + Pipeline	8,986	274	1,486,000	1,495,260	85%	5
4D With Dust Control/wo ARP/w FWR	4,817	274	1,525,000	1,530,091	87%	5
5 Water Optimization (35,000 ac)	5,138	111	1,357,000	1,362,249	77%	5
7 Water Recycling	11,506	111	1,377,000	1,388,617	79%	5
11 IRP Water Importation	196,484	1,263,000	1,235,000	2,694,484	153%	2
12 IRP Water Exchange	115,243	452,000	891,000	1,458,243	83%	5
13 IRP Colorado River Water Transfer	45,071	131,000	831,000	1,007,071	57%	5

*GHG Emission Factor Based on Construction of SCH.

**Estimated change in GHG Emissions Compared to 1999.

Minimize Greenhouse Gas (GHG) Emissions: Extremely Low Probability Inflow Scenario

Restoration Concept	Construction*	Energy	Landscape	Total	vs. 1999**	Score
1999 Shoreline			1,760,000	1,760,000		
Phase 1: 10-Year Plan	3,189	111	438,000	441,300	25%	5
1. North/South Marine Sea						
1A With Saline Habitat Complex (SHC)	42,781	111	763,000	805,892	46%	5
1B Without SHC	19,799	111	512,000	531,910	30%	5
1C Without SHC, with Freshwater Reservoir (FWR)	19,799	111	503,000	522,910	30%	5
2. Divided Sea/Marine Sea South						
2A With Full 10-Yr Plan	6,176	111	167,000	173,287	10%	5
2B Without Alamo River Project (ARP)	5,276	111	104,000	109,387	6%	5
2C Without ARP, with 2 Perimeter Lake Cells	5,952	111	129,000	135,063	8%	5
2D Without ARP, with 2 Perimeter Lake Cells & FWR	6,852	111	184,000	190,963	11%	5
3. Updated Perimeter Lake						
3A Updated Perimeter Lake	7,814	111	379,000	386,925	22%	5
3B Updated Perimeter Lake wo ARP & 3 Cells/w FWR	6,836	111	485,000	491,947	28%	5
4. Pump Out						
4A With Dust Control	4,817	274	317,000	322,091	18%	5
4B With Pipeline	7,358	274	167,000	174,632	10%	5
4C With Dust Control + Pipeline	8,986	274	317,000	326,260	19%	5
4D With Dust Control/wo ARP/w FWR	4,817	274	353,000	358,091	20%	5
5 Water Optimization (35,000 ac)	5,138	111	372,000	377,249	21%	5
7 Water Recycling	11,506	111	167,000	178,617	10%	5
11 IRP Water Importation	196,484	1,263,000	167,000	1,626,484	92%	5
12 IRP Water Exchange	115,243	452,000	167,000	734,243	42%	5
13 IRP Colorado River Water Transfer	45,071	131,000	462,000	638,071	36%	5

*GHG Emission Factor Based on Construction of SCH.

**Estimated change in GHG Emissions Compared to 1999.

7.2.9 Workforce Development

There is potential for the ongoing maintenance of most concepts to create the backbone of a restoration economy, with jobs ranging from vegetation management to electricians, equipment operators, scientific monitoring technicians, and engineering and planning staff. The workforce development criterion refers to the extent to which a restoration concept increases the likelihood that a local workforce will be used on the project, encourages the employment of a local workforce, and ensures that a local workforce can participate. A restoration concept that increases the likelihood a local workforce will be used for construction and ongoing maintenance or will provide for local production of materials and technology to create and maintain restoration

Workforce Development

Restoration Concept	Score
Phase 1: 10-Year Plan	5
1. North/South Marine Sea	
1A With Saline Habitat Complex (SHC)	5
1B Without SHC	5
1C Without SHC, w Freshwater Reservoir	5
2. Divided Sea	
2A With Full 10-Yr Plan	5
2B Without Alamo River Project	5
2C Without Alamo/w 2 Perimeter Lake Cells	5
2D Without Alamo/w 2 Perimeter Lake Cells & Freshwater Reservoir	5
3. Updated Perimeter Lake	
3A Updated Perimeter Lake	5
3B Updated Perimeter Lake wo Alamo & 3 Cells/w Freshwater Reservoir	5
4. Pump Out	
4A With Dust Control	5
4B With Pipeline	3
4C With Dust Control + Pipeline	4
4D With Dust Control/Without Alamo/w FW Reservoir	5
5. Water Optimization (35,000 ac)	5
7. Water Recycling	5
11. IRP Water Importation	3
12. IRP Water Exchange	3
13. IRP Colorado River Water Transfer	2

infrastructure or will provide training or educational opportunities for local residents would score well under this criterion.

To examine how each concept might provide opportunities for workforce development, we examined a breakdown of craft labor and employee locations for the SCH. SCH is used as an example of the type of construction that would occur for concepts. This data for SCH was obtained from Kiewit, the company constructing the project.

Figure 7-1 presents the count of workers plotted on the overlay of 90-minute travel distance (shown in red) from either Salton City, Mecca, or the south Sea (points in yellow). Figure 7-2 presents the breakdown of SCH labor between employees living within the local area (blue area in Figure 7-1) and in areas outside of this area. The figures shows that most labor categories are well-represented by employees living within 90 minutes of the Sea. Except for Teamsters, local employees are nearly 50% or greater of the total employees. Scores for this criterion range from 2 to 5, as shown on the side chart, with 5 being assigned to concepts that have the greatest potential to support local workforce development. Based on the data from SCH, it is likely that in-basin projects that have components like that of SCH will support workforce development and have been assigned a value of 5.

Pipeline projects where much of the work would be out of the area have been given a score of 3. Concept 13, the IRP Colorado River Water Transfer concept, would create some local jobs, but could also have a negative impact on some farm workers, and was therefore, assigned a score of 2.

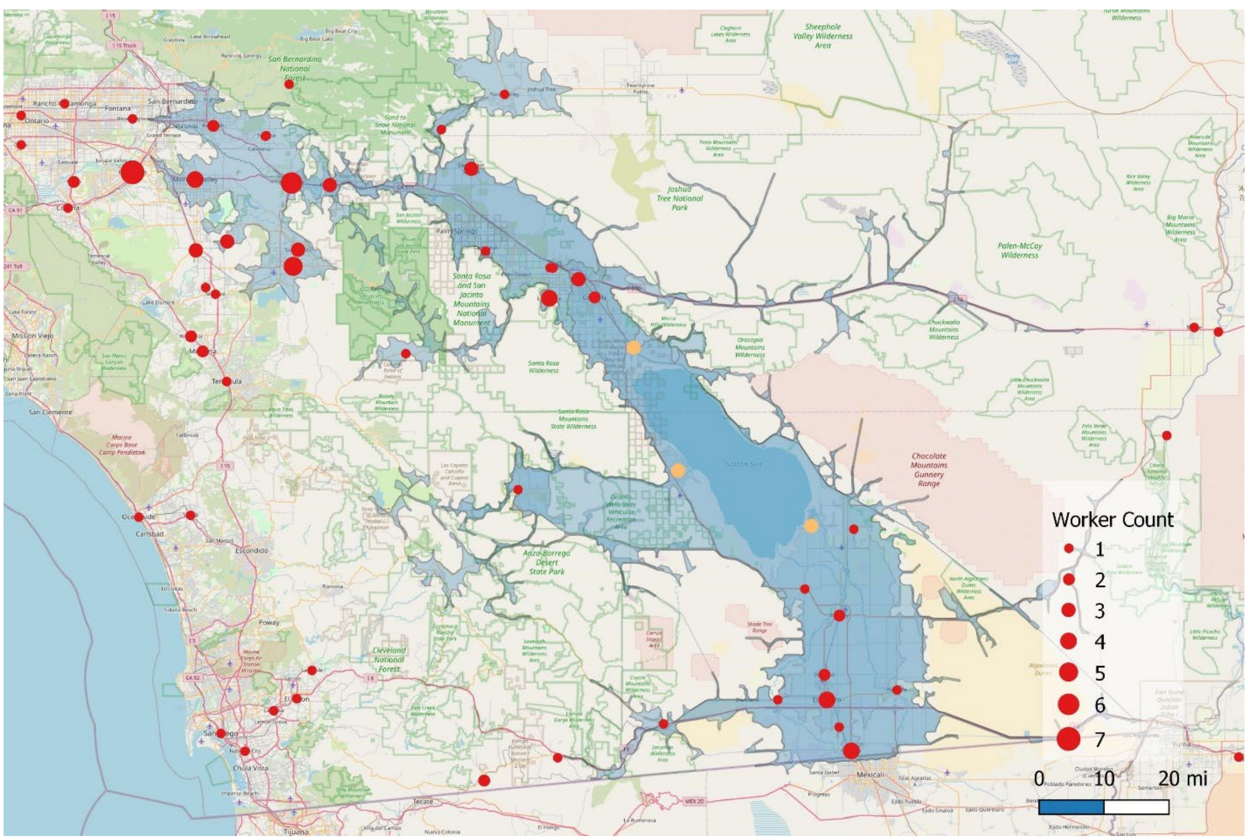

Figure 7-1. Overlay of 90-min travel distance from three locations near the Salton Sea (Salton City, Mecca, south Sea, in yellow) by Species Conservation Habitat (SCH) workers. Red points present the location and count of workers.

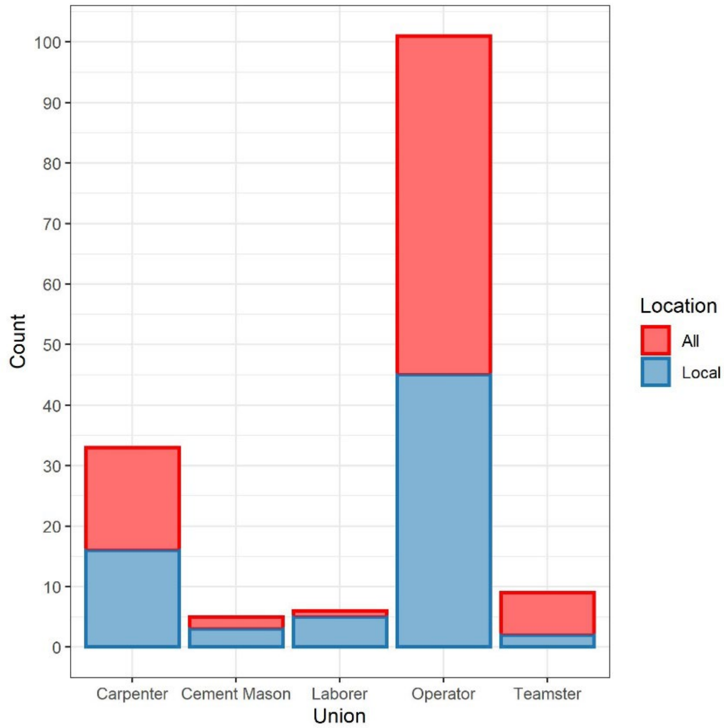

Figure 7-2. Species Conservation Habitat (SCH) workers by union type. The local designation applies to workers within a 90-minute driving radius of Salton City, Mecca, or the south Sea.

7.2.10 Sustainable Economic Development

This criterion refers to the extent to which a restoration concept directly or indirectly provides or allows for sustainable economic development benefits. Restoration concepts that utilize local materials and technologies to create and maintain restoration infrastructure score well under this criterion. Scores will range from 1 to 5, with 5 being assigned to concepts that have the greatest potential to support sustainable economic development and the local economy.

In scoring the concepts, it was assumed that benefits from the Phase I Plan have already accrued. Therefore, this criterion refers to benefits beyond the Phase I Plan, and the Phase 1: 10 Year Plan receives a 1 for this criterion.

Sustainable Economic Development

Restoration Concept	Score
Phase 1: 10-Year Plan	1
1. North/South Marine Sea	
1A With Saline Habitat Complex (SHC)	3
1B Without SHC	4
1C Without SHC, w Freshwater Reservoir	5
2. Divided Sea	
2A With Full 10-Yr Plan	4
2B Without Alamo River Project	5
2C Without Alamo/w 2 Perimeter Lake Cells	5
2D Without Alamo/w 2 Perimeter Lake Cells & Freshwater Reservoir	5
3. Updated Perimeter Lake	
3A Updated Perimeter Lake	3
3B Updated Perimeter Lake wo Alamo & 3 Cells/w Freshwater Reservoir	5
4. Pump Out	
4A With Dust Control	4
4B With Pipeline	3
4C With Dust Control + Pipeline	4
4D With Dust Control/Without Alamo/w FW Reservoir	5
5. Water Optimization (35,000 ac)	4
7. Water Recycling	5
11. IRP Water Importation	5
12. IRP Water Exchange	3
13. IRP Colorado River Water Transfer	2

The specific factors considered under this criterion are listed below. These factors are considered together to provide the scores in the accompanying chart.

- Access to lithium and geothermal development. Ensuring access to lithium and geothermal development provides continuing economic benefits to communities around the Sea. Therefore, a concept that does not preclude lithium development and access to geothermal energy will score higher.
- Impacts to the local agricultural economy. Concepts that do not support the local agricultural economy will score lower. This factor applies to Concept 13, which involves fallowing of local agricultural fields in exchange for Colorado River water for the Sea.
- Pipelines in or out of the region. Long distance pipelines do not use local materials or technologies; therefore, concepts with these pipelines will score lower than concepts that do not utilize them.
- In-Basin expenditure of resources. Projects that involve mostly construction and operation within the Salton Basin are expected to best support sustainable economic development and will score higher than those that do not.

As shown on the side chart, a score of 5 was assigned to concepts that have almost exclusive expenditure of resources in the Salton Basin and that do not have major construction within the KGRA. A score of 4 was assigned to concepts that have almost exclusive expenditure of resources in the Salton Basin with some construction within the KGRA that can be planned to avoid specific areas of geothermal energy development. A score of 3 was assigned to pipeline projects and 2 was assigned Concept 13, which includes fallowing.

7.3 Completeness

Completeness was assessed on whether a restoration concept satisfies the Salton Sea LRP objectives. A concept that achieves the following objectives would receive a “complete” score:

- Protection or improvement of air quality to reduce public health consequences;
- Restoration of long-term stable aquatic and shoreline habitat for the historic levels and diversity of fish and wildlife that depend on the Salton Sea (F&GC 2931); and
- Protection or improvement of water quality to provide opportunities for beneficial uses and reduce environmental consequences.

A minimum score of 3 (effective) must be achieved in each of the effectiveness criteria to satisfy each of the completeness objectives.

For the High Probability Inflow Scenario, an initial evaluation of all concepts revealed low scores for the “Ability To Reduce Dust Emissions” criterion for concepts 7, 12, and 13. To make these concepts meet “completeness criteria,” they were altered to include vegetation enhancement as lakebed was exposed overtime. The cost of these programs is currently estimated at about $30,000 per acre. These funds would typically need to be spread out over many years as the rate of exposure would happen over many years with declining inflows. Time-phased estimates of revegetation costs are currently under preparation and will be included with annual operating costs for each concept.

After altering concepts to include a revegetation program, as shown on the chart on the following page, concepts 3A, 3B, and 5 still did not meet “completeness” because they were less than effective at providing sufficient deep-water habitat. These concepts cannot be easily modified to provide sufficient area of deep-water aquatic habitat due to the fundamentals of their design. Concepts 3A and 3B

Completeness: Meets All Individual Objectives

Restoration Concept	Before*	After*	Before*	After*	Before*	After*
Baseline	1	1	1	1	1	1
1. North/South Marine Sea						
1A With Saline Habitat Complex (SHC)	5	5	5	5	1	1
1B Without SHC	5	5	5	5	1	1
1C Without SHC, w Freshwater Reservoir	5	5	5	5	1	1
2. Divided Sea						
2A With Full 10-Yr Plan	5	5	1	1	1	1
2B Without Alamo River Project	5	5	1	5	1	1
2C Without Alamo/w 2 Perimeter Lake Cells	5	5	1	5	1	1
2D Without Alamo/w 2 Perimeter Lake Cells & Freshwater Reservoir	5	5	5	5	1	1
3. Updated Perimeter Lake						
3A Updated Perimeter Lake (UPL)	1	1	1	1	1	1
3B UPL Without Alamo Project & 3 Cells/w Freshwater Reservoir	1	1	1	1	1	1
4. Pump Out						
4A With Dust Control	5	5	1	1	1	1
4B With Pipeline	5	5	5	5	1	1
4C With Dust Control + Pipeline	5	5	1	1	1	1
4D With Dust Control/Without Alamo/w Freshwater Reservoir	5	5	5	5	1	1
5 Water Optimization (35,000 ac)	1	1	1	1	1	1
7 Water Recycling	1	5	1	1	1	1
11 IRP Water Importation	5	5	5	5	5	5
12 IRP Water Exchange	1	5	1	1	1	1
13 IRP Colorado River Water Transfer	1	5	1	1	1	1

*Completeness scores before and after implementation of vegetation enhancements projects to control dust, beyond those that would be needed if only Phase 1 projects are implemented.

have levee systems designed to work with low inflows and moving them would reduce that ability. Concept 5 was created based on providing low-cost, highly water-efficient, shallow- and medium-depth aquatic habitat. Modifying this concept to incorporate sufficient deep-water habitat would change its original cost.

For the High Probability Inflow Scenario, concepts that meet completeness include all variations of the Divided Sea, all variations of the Pump-out option, Water Recycling, IRP Water Importation, IRP Water Exchange, and IRP Colorado River Water Transfer.

The columns in the chart marked “After,” identify the concepts that were modified with additional dust control measures to meet the Completeness Criterion. The scores are shown to be changed from 1 to 5.

For the Low Probability Inflow Scenario, concepts 2A, 4A, and 5A are added to the group that would not have sufficient deep-water habitat to meet Completeness. Concepts 2B and 2C would be made complete with additional dust control measures. For the Very Low Probability Inflow Scenario, all concepts except Concept 11 would not meet the Deep-Water Habitat Criterion and are therefore considered incomplete at that inflow.

7.4 Efficiency

Efficiency measures the estimated costs of the restoration concept, the timeline for its implementation, the benefits achieved, and direct and indirect risks. Efficiency has been divided into the following 10 criteria:

- Timeframe for Complete Solution

- Capital Cost
- Operation, Maintenance, Energy, and Replacement (OMER) Cost
- Incremental Benefits with Incremental Funding
- Proven Technology/Reduced Risk
- Water Supply Risk
- Earthquake Risk
- Climate Change Related to Extreme Weather
- Regulatory Compliance
- Local, State, and Federal Water Rights and Agreements

The evaluation of the restoration concepts for each of these efficiency criteria is discussed below.

7.4.1 Timeframe for Complete Solution

This criterion evaluates the timeframe for a restoration concept to be completed and commissioned. The timeframe has been broken down into four components:

- Feasibility Study and preparation of NEPA/CEQA environmental documents: The timeframe for these activities has been assumed to be three years for all concepts.
- Detailed design and permitting: The timeframe for completing final designs and all permitting documents will vary with the complexity of the restoration concepts and has been assumed to range from 3 to 10 years. For concepts proposed by the IRP, timeframes for design and construction were taken from the IRP final report. For concepts based on other sources material where design and construction timeframes were presented, they have been adopted. Engineering judgement based on project complexity compared to similar scale projects has been applied where information from source documents was not available.
- Construction: The construction timeframe will vary with the complexity of the restoration concepts and has been assumed to range from 3 to 20 years following the guidelines discussed above for design and permitting.
- Timeframe to reach habitat goal: The timeframe to reach the habitat goal is the time from when construction is complete to when target salinity can be achieved in the primary habitat area. In most cases, the target salinity is 20-40 PPT for the primary habitat area. The timeframe to reach habitat goals will vary with future inflows. The initial analysis is based on the inflow condition that assumes that: (1) IID will receive its legal allotment of water; (2) that climate change will gradually cause a rise in evapotranspiration (ET), which will require an increase in crop watering efficiency and thus reduce flows to the Sea; and (3) that there will be periodic droughts that will result in implementation of the drought curtailment plan.

The concept with the shortest timeframe to achieve full project objectives, as indicated by attaining the target salinity goal in the primary habitat area, has been assigned a score of 5. One point was deducted for each additional five years to achieve full project objectives, down to a minimum of 1. The chart on the following page shows how the timeline for each of the concepts scored based on the High Probability Inflow Scenario.

Timeline in Years to Achieve Habitat Objectives

Restoration Concept	Feasibility & NEPA/CEQA	Design & Permits	Construct	Habitat Goal*	Total	Score
Phase 1: 10-Year Plan					**10**	5
1. North/South Marine Sea						
1A With Saline Habitat Complex (SHC)	3	4	20	2	**29**	2
1B Without SHC	3	4	8	2	**17**	4
1C Without SHC, with Freshwater Reservoir	3	4	8	2	**17**	4
2. Divided Sea/Marine Sea South						
2A With Full 10-Yr Plan	3	2	3	5	**13**	5
2B Without Alamo River Project	3	2	3	5	**13**	5
2C Without Alamo, with 2 Perimeter Lake Cells	3	2	5	5	**15**	5
2D Without Alamo, with 2 Perimeter Lake Cells and Freshwater Reservoir	3	2	5	5	**15**	5
3. Updated Perimeter Lake						
3A Updated Perimeter Lake	3	3	8	2	**16**	4
3B Modified Perimeter Lake Without Alamo Project and Without Perimeter Lake Cells near Alamo River, Including a Freshwater Reservoir	3	3	8	2	**16**	4
4. Pump Out						
4A With Dust Control	3	3	5	37	**48**	1
4B With Pipeline	3	6	5	36	**50**	1
4C With Dust Control and Pipeline	3	6	5	34	**48**	1
4D With Dust Control and Freshwater Reservoir	3	5	6	36	**50**	1
5. Water Optimization (35,000 ac)	3	3	10	2	**18**	4
7. Water Recycling	3	3	6	36	**48**	1
11. IRP Water Importation	3	10	9	15	**37**	1
12. IRP Water Exchange	3	10	8	15	**36**	1
13. IRP Colorado River Water Transfer	3	5	3	14	**25**	3

* Timeframe from when construction is complete to achieve target salinity in the primary habitat area.

7.4.2 Capital Cost

Capital costs for each concept were estimated mostly from other source documents updated to 2022 dollars as described in Chapter 5. The estimated total capital construction costs in 2022 dollars for a restoration concept includes the costs for constructing the Phase 1 Baseline program plus the Phase 2 projects. The score for each concept was then based on the combined estimated capital cost for Phase 1 and Phase 2.

The scale used is based primarily on the historical efficiency of remediating exposed lakebed into vegetated or aquatic habitat on a per-acre basis under Phase 1 actions. At the time of this Plan, the Phase 1 actions are anticipated to cost $1.3 Billion. SSMP has secured approximately half of the necessary funds to carry out Phase 1 actions and anticipates a combination of additional State and Federal funds will cover the remaining financial needs.

For the purposes of this Plan, any concepts that achieve “Completeness” and cost less than the Phase 1 actions, would be deemed highly efficient and receive a score of 5. This efficiency scale is applied in a non-linear fashion, such that each time the cost basis is doubled, the efficiency score drops by 1 (see table below). The rationale for a non-linear scale for Capital Cost is that historically capital investment decisions are made based on current and near-term budget forecasts, which involve relatively greater certainty. Conversely, committing long-term funding for OMER relies on long-term budget forecasts, which are highly uncertain. This non-linear scale captures the value of having near-term budget forecast certainty.

The following table shows how the capital construction cost for each of the concepts scored.

Criteria	Scale				
	5 **Highly Efficient**	**4** **Very Efficient**	**3** **Efficient**	**2** **Not Very Efficient**	**1** **Not Efficient**
Capital Cost of Phase 1 & Phase 2 Actions	$2.6B or less	$2.6B - $3.9B	$3.9B - $6.5B	$6.5B - $11.7B	$11.7B or greater

7.4.3 Operation, Maintenance, Energy, and Replacement Cost

This cost is the estimated total annual operation, maintenance, energy, and replacement (OMER) costs in 2022 dollars for a restoration concept (i.e., the annual amount needed to pay for OMER over a 75-year planning horizon), accounting for possible revenues generated from a concept. This scale used to evaluate OMER costs is based primarily on the historical ability to secure funding for OMER activities for vegetated or aquatic habitat. At the time of this Plan, the anticipated OMER costs for Phase 1 actions is anticipated to cost $64 Million. SSMP has not yet secured annual funds to operate, maintain, and repair Phase 1 actions and anticipates a combination of additional State and federal funds to cover this financial need.

Long-term funding for OMER relies on long-term budget forecasts, which are highly uncertain. Therefore, there is greater value placed on the efficiency of OMER costs. Therefore, a linear scale is used for this metric such that a score of 5 requires OMER costs for the LRP to remain within 50% of costs of the Phase 1 Actions. The level of efficiency drops in a linear fashion each time the cost basis increases by half of the Phase 1 OMER costs using the scale shown below.

Criteria	Scale				
	5 **Highly Efficient**	**4** **Very Efficient**	**3** **Efficient**	**2** **Not Very Efficient**	**1** **Not Efficient**
Annual OMER Cost of Phase 1 & Phase 2 Actions	$96M or less	$96M - $128M	$128M - $160M	$160M - $192M	$192M or greater

The chart on the following page shows the estimated capital and OMER costs for each concept and how the costs for each of the concepts was scored.

Conceptual Level Cost Comparison

	Capital Costs ($M)				OMER Costs ($M)			
Restoration Concept	**Phase 1**	**Phase 2**	**Total**	**Score**	**Phase 1**	**Phase 2**	**Total**	**Score**
Phase 1: 10-Year Plan	$ 1,293		$ 1,293	5	$ 65		$ 65	5
1. North/South Marine Sea								
1A With Saline Habitat Complex (SHC)	1,293	16,053	17,347	1	65	225	290	1
1B Without SHC	1,293	6,735	8,028	2	65	33	98	4
1C Without SHC, with Freshwater Reservoir	928	7,100	8,028	2	46	51	98	4
2. Divided Sea/Marine Sea South*								
2A With Full 10-Yr Plan	1,293	1,211	2,504	5	65	13	77	5
2B Without Alamo River Project	928	1,211	2,139	5	46	13	59	5
2C Without Alamo, with 2 Perimeter Lake Cells	928	1,485	2,413	5	46	16	62	5
2D Without Alamo, with 2 Perimeter Lake Cells and Freshwater Reservoir	928	1,850	2,778	4	46	34	81	5
3. Updated Perimeter Lake								
3A Updated Perimeter Lake	719	2,449	3,168	4	36	7	43	5
3B Modified Perimeter Lake Without Alamo Project and Without Perimeter Lake Cells near Alamo	728	2,043	2,772	4	36	7	43	5
4. Pump Out**								
4A With Dust Control	1,293	660	1,953	5	65	33	98	4
4B With Pipeline	1,293	1,690	2,984	4	65	85	149	3
4C With Dust Control and Pipeline	1,293	2,350	3,644	4	65	118	182	2
4D With Dust Control and Freshwater Reservoir	1,293	1,025	2,318	5	65	51	116	4
5. Water Optimization (35,000 ac)	928	1,155	2,083	5	46	58	104	4
7. Water Recycling	1,293	3,372	4,665	3	65	173	238	1
11. IRP Water Importation	1,293	78,376	79,669	1	65	3,776	3,841	1
12. IRP Water Exchange	1,293	45,435	46,728	1	65	3,030	3,095	1
13. IRP Colorado River Water Transfer	$ 1,293	$ 16,982	$ 18,275	1	$ 65	$ 2,741	$ 2,806	1

* Does not include costs for constructing or maintaining a highway across the mid-Sea barrier.
** Costs for reclaiming farmland not included.

7.4.4 Incremental Benefits with Incremental Funding

This criterion evaluates the extent to which incremental funding for a restoration concept can result in incremental benefits. A concept that delivers significant benefits the earliest would score the highest, whereas a concept that delivers significant benefits the latest would score the lowest.

Scores have been assigned from 1 to 5 considering funding requirements for each component, and the habitat area achieved with construction of each component. This scale is based on recent maximum funding allocated to the SSMP, totaling $220 million. Assuming a federal match in funds, that amount could double to $440 million. Scores were assigned based on how many benefits could be achieved with a funding allocation of $440 million.

Incremental Benefits with Incremental Funding

Restoration Concept	**Score**
Phase 1: 10-Year Plan	5
1. North/South Marine Sea	
1A With Saline Habitat Complex (SHC)	2
1B Without SHC	1
1C Without SHC, w Freshwater Reservoir	3
2. Divided Sea	
2A With Full 10-Yr Plan	1
2B Without Alamo River Project	1
2C Without Alamo/w 2 Perimeter Lake Cells	2
2D Without Alamo/w 2 Perimeter Lake Cells & Freshwater Reservoir	4
3. Updated Perimeter Lake	
3A Updated Perimeter Lake	4
3B Updated Perimeter Lake wo Alamo & 3 Cells/w Freshwater Reservoir	4
4. Pump Out	
4A With Dust Control	1
4B With Pipeline	1
4C With Dust Control + Pipeline	1
4D With Dust Control/Without Alamo/w FW Reservoir	1
5. Water Optimization (35,000 ac)	5
7. Water Recycling	3
11. IRP Water Importation	1
12. IRP Water Exchange	1
13. IRP Colorado River Water Transfer	2

The results of the incremental benefits scoring are shown on the side chart. The Baseline and Water Optimization concepts could be funded in increments and incremental habitat benefits would be in proportion to each funding increment. Both concepts were given a score of 5. The Updated Perimeter Lake and Concept 2D also have components that could be incrementally funded with incremental habitat benefits and were assigned scores of 4. Several other concepts would have some incremental benefits and were assigned scores of 2 or 3 based on habitat benefits that could be achieved with incremental funding. Those concepts with large blocks of funding greater than $440 million and with no incremental benefits were assigned a score of 1.

7.4.5 Proven Technology/Reduced Risk

This criterion evaluates whether a restoration concept uses untested technologies or technologies that have a high measure of construction and operational risk. Proven, widely used technologies are assumed to have lower risk and score higher.

Proven Technology/Reduced Risk

Restoration Concept	Score
Phase 1: 10-Year Plan	5
1. North/South Marine Sea	
1A With Saline Habitat Complex (SHC)	1
1B Without SHC	1
1C Without SHC, w Freshwater Reservoir	1
2. Divided Sea	
2A With Full 10-Yr Plan	5
2B Without Alamo River Project	5
2C Without Alamo/w 2 Perimeter Lake Cells	5
2D Without Alamo/w 2 Perimeter Lake Cells & Freshwater Reservoir	5
3. Updated Perimeter Lake	
3A Updated Perimeter Lake	4
3B Updated Perimeter Lake wo Alamo & 3 Cells/w Freshwater Reservoir	4
4. Pump Out	
4A With Dust Control	3
4B With Pipeline	2
4C With Dust Control + Pipeline	2
4D With Dust Control/Without Alamo/w FW Reservoir	3
5. Water Optimization (35,000 ac)	5
7. Water Recycling	1
11. IRP Water Importation	2
12. IRP Water Exchange	2
13. IRP Colorado River Water Transfer	2

Concepts that employ standard technologies, with proven low-risk performance, will be given the highest score of 5. Concepts that have technologies that have been used elsewhere but not necessarily in highly seismic areas such as that of the Salton Basin or on such a large scale as at the Salton Sea will be given an intermediate score of 3. Concepts that have technologies that have not been widely used elsewhere and not used on any large scale like that needed at the Salton Sea will be given the lowest score of 1. Concepts that employ a mix of technologies with varying maturity may be assigned intermediate scores.

The following concepts were assigned a score of 5 for this criterion: the Baseline, the Divide Sea concepts, and Concept 5, Water Optimization. The Baseline involves low berms and pumps and includes an SCH as a key element, which is already under construction. The key element of the Divided Sea concepts is a central causeway that is based on a conceptual design developed by the Bureau of Reclamation (USBOR, 2007) which is presented as meeting the Bureau's design standard. A 1-mile causeway has recently been constructed in the Salton Sea as part of the SCH project. Concept 5, the final concept assigned a score of 5, would involve low berms and channels, generally following agricultural practices common in the Imperial Valley.

The updated Perimeter Lake concepts were assigned a score of 4. The cells in the Perimeter Lake would be constructed using berms like the 7-mile outer berm of the SCH that is now under construction. Lessons learned on SCH could be applied to the berm designs of the perimeter lake cells. However, because of the total length of berms and need to manage the water through the system, the proven technology for the Perimeter Lake has been assigned a 4.

Several other concepts have been assigned lower scores. The Pump Out concepts where brine is used for dust control have been assigned a score of 3. While these concepts use common technologies, the specific applications are unique and the ability to work on exposed lakebed provides some challenges. The Pump Out with Pipeline and IRP recommended concepts involve complex technologies that would be unique to the Salton Sea.

The North/South Marine Sea and Water Recycling concepts have been assigned a score of 1. The North/South Marie Sea would involve constructing a water-retention structure of up to 47 feet in height and approximately 50 miles in length in the wet, on soft lake bottom sediments, in a highly seismic area. A similar project of such scope has never been constructed to our knowledge. The Water Recycling concept involves construction of five 20 MGD water distillation plants using technologies that have not been used together in any large-scale production plants before. Furthermore, each distillation plant requires low pressure steam from geothermal activities. There is risk associated with this quantity of steam not being available.

7.4.6 Water Supply Risk

Restoration concepts that can perform as planned under a wider range of future inflow conditions would score higher than those that have a narrower range.

The score for water supply risk is based on how performance is reduced when the hydrologic regime changes from the High Probability Inflow to the Low Probability Inflow. This metric doesn't account for overall habitat value since that metric has already been considered. The value of this metric is in providing certainty in environmental conditions, not overall amount of habitat.

For example, a concept could have relatively low scores for habitat metrics, but if the performance didn't change as the hydrologic scenario changed, the concept was given a score of 5. Concepts with the largest drop in performance were given a score of 1. A linear interpolation was then used to assign intermediate scores.

Water Supply Risk

Restoration Concept	**Score**
Phase 1: 10-Year Plan	5
1. North/South Marine Sea	
1A With Saline Habitat Complex (SHC)	5
1B Without SHC	5
1C Without SHC, w Freshwater Reservoir	5
2. Divided Sea	
2A With Full 10-Yr Plan	1
2B Without Alamo River Project	2
2C Without Alamo/w 2 Perimeter Lake Cells	2
2D Without Alamo/w 2 Perimeter Lake Cells & Freshwater Reservoir	2
3. Updated Perimeter Lake	
3A Updated Perimeter Lake	5
3B Updated Perimeter Lake wo Alamo & 3 Cells/w Freshwater Reservoir	5
4. Pump Out	
4A With Dust Control	1
4B With Pipeline	3
4C With Dust Control + Pipeline	1
4D With Dust Control/Without Alamo/w FW Reservoir	3
5. Water Optimization (35,000 ac)	3
7. Water Recycling	1
11. IRP Water Importation	5
12. IRP Water Exchange	2
13. IRP Colorado River Water Transfer	2

7.4.7 Earthquake Risk

The Earthquake Risk criterion evaluates how susceptible individual concept elements, such as berms, gates, and pipelines, are to potential seismic activity. Time and cost to restore functionality after a potential failure is also considered for this criterion, as is limited functionality if parts of a concept can still perform as planned. All concepts would be developed to withstand a design earthquake event based on seismic conditions in the area. This could involve lateral accelerations of close to one g-force. However, despite robust design, some seismic risk will remain.

Concept scoring for earthquake risk is shown on the side chart and discussed below:

Earthquake Risk

Restoration Concept	Score
Phase 1: 10-Year Plan	4
1. North/South Marine Sea	
1A With Saline Habitat Complex (SHC)	1
1B Without SHC	1
1C Without SHC, w Freshwater Reservoir	1
2. Divided Sea	
2A With Full 10-Yr Plan	5
2B Without Alamo River Project	5
2C Without Alamo/w 2 Perimeter Lake Cells	5
2D Without Alamo/w 2 Perimeter Lake Cells & Freshwater Reservoir	5
3. Updated Perimeter Lake	
3A Updated Perimeter Lake	4
3B Updated Perimeter Lake wo Alamo & 3 Cells/w Freshwater Reservoir	4
4. Pump Out	
4A With Dust Control	5
4B With Pipeline	4
4C With Dust Control + Pipeline	4
4D With Dust Control/Without Alamo/w FW Reservoir	4
5. Water Optimization (35,000 ac)	5
7. Water Recycling	5
11. IRP Water Importation	4
12. IRP Water Exchange	4
13. IRP Colorado River Water Transfer	5

- For concepts with earth embankments, the concepts with the lowest combination of embankment structure height/head differential and water retention volume received a score of 5. Two of the Divided Sea concepts were assigned a score of 5. The waterbodies on either side of the central causeway would have only a few inches of difference in water surface elevation; therefore, there would be no chance for a catastrophic release of flood water.
- Shallow pond systems would also have little chance for major flood releases and were assigned a score of 5.
- Perimeter Lake concepts would be designed to retain water with an elevation of up to 10 feet higher than the downstream face. If a breach occurred, because the system is design in cells, the passage between cells could be temporarily plugged, and the cell drained while the repair is accomplished. While there could be some release of water, it would be to the central basin of the Salton Sea footprint in areas that would not be accessible to the public. The perimeter lake cells were assigned a value of 4 for this criterion. The exception is Concepts 2C and 2D. While these concepts included perimeter lake cells, they were planned to have the same water level elevation as the north basin. Therefore, these concepts were also assigned a score of 5.
- The water importation concepts have long, large pipelines that are subject to possible damage from earthquakes. This would primarily involve damage to facilities with costly repairs and temporary loos of function. However, flooding risk is not expected and, therefore, these concepts have been assigned a score of 4.
- The highest combination of embankment structure height/head differential and water retention would be associated with the North/South Marine Sea concepts. The barrier in these concepts would be about 50 miles long and constructed in the wet on soft long-bottom sediments. A significant portion of the barrier would be designed to retain water with an elevation of from 35 to 40 feet higher than the downstream face. The barrier would be conceived to be a broad

earthen structure, up to half a mile wide at the base, and thus designed to withstand earthquakes. However, a breach could result in a significant release of water and a danger to any boats on the upstream side of the lake. The downstream area was not designed to be accessible to the public, but there would be facilities there and the possibility of workers present. For these reasons, the North/South Marine Sea concepts received a score of 1 for Earthquake Risk.

7.4.8 Climate Change Related to Extreme Weather

All concepts will be required to remain effective during conditions of extreme weather resulting from climate change, such as extreme heat, wind pattern changes, and monsoonal changes. Note that climate change is part of the inflow hydrology scenarios, and the effects of changing inflows will be evaluated as part of the efficiency criteria under Water Supply Risk.

Climate Change Related to Extreme Weather

Restoration Concept	Score
Phase 1: 10-Year Plan	5
1. North/South Marine Sea	
1A With Saline Habitat Complex (SHC)	4
1B Without SHC	5
1C Without SHC, w Freshwater Reservoir	5
2. Divided Sea	
2A With Full 10-Yr Plan	5
2B Without Alamo River Project	5
2C Without Alamo/w 2 Perimeter Lake Cells	5
2D Without Alamo/w 2 Perimeter Lake Cells & Freshwater Reservoir	5
3. Updated Perimeter Lake	
3A Updated Perimeter Lake	5
3B Updated Perimeter Lake wo Alamo & 3 Cells/w Freshwater Reservoir	5
4. Pump Out	
4A With Dust Control	5
4B With Pipeline	5
4C With Dust Control + Pipeline	5
4D With Dust Control/Without Alamo/w FW Reservoir	5
5. Water Optimization (35,000 ac)	4
7. Water Recycling	5
11. IRP Water Importation	5
12. IRP Water Exchange	5
13. IRP Colorado River Water Transfer	5

Because of the long north-south fetch of the Sea, high wave activity can be expected at the Sea without climate change. With climate change, high wind, waves, monsoonal conditions, and temperature extremes may be more frequent. Because the features of most concepts will be designed to withstand such conditions, most concepts can be given a score of 5 for this criterion. Exceptions would be those concepts that involve lower technology berms and channels for shallow habitat and dust control. These may be more subject to erosion and may need higher levels of maintenance and repair under climate change conditions. Two concepts with these features are 1A with Saline Habitat Complex and 5 Water Optimization. As shown in the side chart, these concepts have been assigned a score of 4 and all others have been assigned a score of 5.

7.4.9 Regulatory Compliance - Permits and Environmental Documentation

The evaluation of regulatory compliance has been based on factors such as the number of jurisdictions affected, including all local, state, federal, tribal, and international permits, certifications, and other approval necessary for the construction and operation of the project. The scoring considered the complexity of the environmental documents required and the likelihood of the acquisition of the required permits.

Permits & Environmental Documentation

Restoration Concept	Score
Phase 1: 10-Year Plan	3
1. North/South Marine Sea	
1A With Saline Habitat Complex (SHC)	3
1B Without SHC	3
1C Without SHC, w Freshwater Reservoir	3
2. Divided Sea	
2A With Full 10-Yr Plan	3
2B Without Alamo River Project	3
2C Without Alamo/w 2 Perimeter Lake Cells	3
2D Without Alamo/w 2 Perimeter Lake Cells & Freshwater Reservoir	3
3. Updated Perimeter Lake	
3A Updated Perimeter Lake	3
3B Updated Perimeter Lake wo Alamo & 3 Cells/w Freshwater Reservoir	3
4. Pump Out	
4A With Dust Control	3
4B With Pipeline	1
4C With Dust Control + Pipeline	1
4D With Dust Control/Without Alamo/w FW Reservoir	3
5. Water Optimization (35,000 ac)	3
7. Water Recycling	3
11. IRP Water Importation	2
12. IRP Water Exchange	2
13. IRP Colorado River Water Transfer	2

As shown in the side chart, concepts where almost all project activities would take place within the Salton Basin are expected to have similar environmental documentation and permitting requirements and have been assigned an average efficiency rating of 3. Concepts 11 and 12 submitted by the IRP, which would include substantial construction activity in Mexico, have been scored as 2 for the added complexity of attaining international permits and approvals. Concept 13 has also been assigned a score of 2 because of the complexities associated with the water transfer issues. Finally, Concepts 4B and 4C, which would involving discharging Salton Sea water into the Sea of Cortez, have been assigned a score of 1. This score is based on the international complexities plus the environmental issues associated with the discharge of Salton Sea water near the international biosphere at the northern end of the Sea of Cortez.

7.4.10 Local, State, and Federal Water Rights and Agreements

Scores for local, State, and Federal water rights and agreements also include any agreements for transferring water across the international border.

Water Rights & Agreements

Restoration Concept	Score
Phase 1: 10-Year Plan	3
1. North/South Marine Sea	
1A With Saline Habitat Complex (SHC)	2
1B Without SHC	2
1C Without SHC, w Freshwater Reservoir	2
2. Divided Sea	
2A With Full 10-Yr Plan	5
2B Without Alamo River Project	5
2C Without Alamo/w 2 Perimeter Lake Cells	5
2D Without Alamo/w 2 Perimeter Lake Cells & Freshwater Reservoir	5
3. Updated Perimeter Lake	
3A Updated Perimeter Lake	3
3B Updated Perimeter Lake wo Alamo & 3 Cells/w Freshwater Reservoir	3
4. Pump Out	
4A With Dust Control	5
4B With Pipeline	5
4C With Dust Control + Pipeline	5
4D With Dust Control/Without Alamo/w FW Reservoir	5
5. Water Optimization (35,000 ac)	5
7. Water Recycling	5
11. IRP Water Importation	2
12. IRP Water Exchange	2
13. IRP Colorado River Water Transfer	2

A score of 5 is being assigned to concepts that do not require amendment to existing water rights or agreements or changes to existing water policy or law. Concepts that work with whatever water is available flowing into the Sea such as the Divided Sea, Pump Out, Optimization, and Recycling Concepts have all been assigned a score of 5.

The Updated Perimeter Lake concept would require construction of retention structures that would create an elevated water body that would essentially be a series of saltwater reservoirs restoring shoreline water surface elevation to near historical levels. This concept is expected to require an agreement with IID like that developed for SCH, only involving more water. Therefore, the Perimeter Lake concepts have been assigned a score of 3 for this criterion. The North/South Marine Sea concepts would involve a similar agreement, only for even more water, and therefore have been assigned a score of 2.

The Water Importation and Exchange Concepts 11 and 12, respectively, both involve international water agreements and have been assigned a score of 2. Concept 13, the Colorado River Water Transfer proposal from the IRP, would involve the development of water agreements that could be complex and therefore has also been assigned a score of 2. The side chart illustrates the water rights scoring for all concepts.

7.5 Evaluation Summary

The charts on the following three pages provide summaries of the scoring results for the concepts included in the evaluation for all criteria. Figure 7-3 provides a summary of evaluation results for the High Probability Inflow Scenario. Figure 7-4 provides a summary of evaluation results for the Low Probability Inflow Scenario. Figure 7-5 provides a summary of evaluation results for the Very Low Probability Inflow Scenario.

CRITERIA / RESTORATION CONCEPTS >>	Phase 1	1A	1B	1C	2A	2B	2C	2D	3A	3B	4A	4B	4C	4D	5A	7A	11A	12A	13A
EFFECTIVENESS																			
Air Quality/Public Health																			
Ability to Reduce Dust Emissions	3	5	4	5	5	4	4	5	5	4	4	5	5	4	4	2	5	1	1
Ability to Protect or Improve AQ	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i
Habitat																			
Area of Shallow Habitat (0-6 in)	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Area of Medium Depth Habitat (6 in-6 ft)	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Area of Deep Water Habitat (>6 ft)	1	3	3	3	4	4	4	4	2	1	4	4	4	4	1	5	5	4	4
Salinity of Primary Habitat Area	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Pupfish Habitat & Connectivity	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Water Quality																			
Ability to Meet Selenium Standards	3	4	5	5	5	5	5	5	5	5	5	5	5	5	3	5	5	5	5
Ability to Improve Water Quality	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
ACCEPTABILITY																			
Tribal Access to Natural & Cultural Resources*	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i
Protection of Resources (Based on overall area)**	N/A	1	3	3	5	5	5	5	4	4	1	4	1	1	1	3	1	2	2
Protection of Resources (Based on location)***	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i
Incorporation of Tribal Expertise	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Environmental Justice & Equity	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Do No Harm	5	3	3	3	5	5	5	5	4	4	5	4	4	5	5	4	3	3	5
Equitable Outdoor Access	1	4	4	4	4	4	5	5	4	4	3	3	3	3	2	3	4	3	3
Minimize Greenhouse Gas (GHG) Emissions	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i
Workforce Development	5	5	5	5	5	5	5	5	5	5	5	3	4	5	5	5	3	3	2
Sustainable Economic Development	1	3	4	5	4	5	5	5	3	5	4	3	4	5	4	5	5	3	2
COMPLETENESS																			
Meets all Individual Objectives (wo dust mitigation)	**1**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**1**	**1**	**5**	**5**	**5**	**5**	**1**	**1**	**5**	**1**	**1**
Meets all Individual Objectives (with dust mitigation)	**1**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**1**	**1**	**5**	**5**	**5**	**5**	**1**	**5**	**5**	**5**	**5**
EFFICIENCY																			
Timeframe for Complete Solution	5	2	2	4	5	5	4	4	4	4	1	1	1	1	4	1	1	1	2
Capital Cost ($M)	5	1	2	2	5	5	5	4	4	4	5	4	4	5	5	3	1	1	1
OMER Cost ($M/yr)	5	1	5	5	5	5	5	5	5	5	5	5	4	5	5	2	1	1	1
Incremental Benefits with Incremental Funding	5	2	1	3	1	1	2	4	4	4	1	1	1	1	5	3	1	1	2
Proven Technology/Reduced Risk	5	1	1	1	5	5	5	5	4	4	3	2	2	3	5	1	2	2	2
Water Supply Risk	5	5	5	5	1	2	2	2	5	5	1	3	1	3	3	1	5	2	2
Earthquake Risk	4	1	1	1	5	5	5	5	4	4	5	4	4	4	5	5	4	4	5
Climate Change Related to Extreme Weather	5	4	5	5	5	5	5	5	5	5	5	5	5	5	4	5	5	5	5
Permits & Environmental Documentation	3	3	3	3	3	3	3	3	3	3	3	1	1	3	3	3	2	2	2
Water Rights & Agreements	3	2	2	2	5	5	5	5	3	3	5	5	5	5	5	5	2	2	2

Full criteria titles: *Tribal Access to Natural Resources, Cultural Resources, and Tribal Cultural Resources; **Protection of Natural Resources, Cultural Resources, and Tribal Cultural Resources (Based on overall area); ***Protection of Natural Resources, Cultural Resources, and Tribal Cultural Resources (Based on location)

Note: i = Incomplete, N/A = Not Applicable.

Figure 7-3. Summary of Evaluation Results for the High Probability Inflow Scenario

CRITERIA RESTORATION CONCEPTS >>	Phase 1	1A	1B	1C	2A	2B	2C	2D	3A	3B	4A	4B	4C	4D	5A	7A	11A	12A	13A
EFFECTIVENESS																			
Air Quality/Public Health																			
Ability to Reduce Dust Emissions	3	5	4	5	1	1	1	4	5	4	1	5	1	4	4	1	5	1	1
Ability to Protect or Improve AQ	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i
Habitat																			
Area of Shallow Habitat (0-6 in)	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Area of Medium Depth Habitat (6 in-6 ft)	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Area of Deep Water Habitat (>6 ft)	1	3	3	3	2	3	3	3	2	1	2	3	2	3	1	2	5	2	2
Salinity of Primary Habitat Area	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Pupfish Habitat & Connectivity	5	5	5	5	4	4	4	4	5	5	4	4	4	4	3	4	5	4	4
Water Quality																			
Ability to Meet Selenium Standards	3	4	5	5	5	5	5	5	5	5	5	5	5	5	3	5	5	5	5
Ability to Improve Water Quality	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
ACCEPTABILITY																			
Tribal Access to Natural & Cultural Resources*	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i
Protection of Resources (Based on overall area)**	N/A	1	3	3	5	5	5	5	4	4	1	4	1	1	1	3	1	2	2
Protection of Resources (Based on location)***	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i
Incorporation of Tribal Expertise	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Environmental Justice & Equity	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Do No Harm	5	3	3	3	5	5	5	5	4	4	5	4	4	5	5	4	3	3	5
Equitable Outdoor Access	1	4	4	4	4	4	5	5	4	4	3	3	3	3	2	3	4	3	3
Minimize Greenhouse Gas (GHG) Emissions	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i
Workforce Development	5	5	5	5	5	5	5	5	5	5	5	3	4	5	5	5	3	3	2
Sustainable Economic Development	1	3	4	5	4	5	5	5	3	5	4	3	4	5	4	5	5	3	2
COMPLETENESS																			
Meets all Individual Objectives (wo dust mitigation)	**1**	**5**	**5**	**5**	**1**	**1**	**1**	**5**	**1**	**1**	**1**	**5**	**1**	**5**	**1**	**1**	**5**	**1**	**1**
Meets all Individual Objectives (with dust mitigation)	**1**	**5**	**5**	**5**	**1**	**5**	**5**	**5**	**1**	**1**	**1**	**5**	**1**	**5**	**1**	**1**	**5**	**1**	**1**
EFFICIENCY																			
Timeframe for Complete Solution	5	2	2	4	5	5	4	4	4	4	1	1	1	1	4	1	1	1	2
Capital Cost ($M)	5	1	2	2	5	5	5	4	4	4	5	4	4	5	5	3	1	1	1
OMER Cost ($M/yr)	5	1	5	5	5	5	5	5	5	5	5	5	4	5	5	2	1	1	1
Incremental Benefits with Incremental Funding	5	2	1	3	1	1	2	4	4	4	1	1	1	1	5	3	1	1	2
Proven Technology/Reduced Risk	5	1	1	1	5	5	5	5	4	4	3	2	2	3	5	1	2	2	2
Water Supply Risk	5	5	5	5	1	2	2	2	5	5	1	3	1	3	3	1	5	2	2
Earthquake Risk	4	1	1	1	5	5	5	5	4	4	5	4	4	4	5	5	4	4	5
Climate Change Related to Extreme Weather	5	4	5	5	5	5	5	5	5	5	5	5	5	5	4	5	5	5	5
Permits & Environmental Documentation	3	3	3	3	3	3	3	3	3	3	3	1	1	3	3	3	2	2	2
Water Rights & Agreements	3	2	2	2	5	5	5	5	3	3	5	5	5	5	5	5	2	2	2

Full criteria titles: *Tribal Access to Natural Resources, Cultural Resources, and Tribal Cultural Resources; **Protection of Natural Resources, Cultural Resources, and Tribal Cultural Resources (Based on overall area); ***Protection of Natural Resources, Cultural Resources, and Tribal Cultural Resources (Based on location)

Note: i = Incomplete, N/A = Not Applicable.

Figure 7-4. Summary of Evaluation Results for the Low Probability Inflow Scenario

CRITERIA RESTORATION CONCEPTS >>	Phase 1	1A	1B	1C	2A	2B	2C	2D	3A	3B	4A	4B	4C	4D	5A	7A	11A	12A	13A
EFFECTIVENESS																			
Air Quality/Public Health																			
Ability to Reduce Dust Emissions	3	5	4	5	1	1	1	1	5	4	5	5	5	5	4	5	5	3	1
Ability to Protect or Improve AQ	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i
Habitat																			
Area of Shallow Habitat (0-6 in)	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Area of Medium Depth Habitat (6 in-6 ft)	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Area of Deep Water Habitat (>6 ft)	1	2	2	2	1	1	1	1	2	1	1	1	1	1	1	1	5	1	1
Salinity of Primary Habitat Area	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Pupfish Habitat & Connectivity	5	4	4	4	3	3	3	3	5	5	3	3	3	3	3	3	4	3	3
Water Quality																			
Ability to Meet Selenium Standards	3	4	5	5	5	5	5	5	5	5	5	5	5	5	3	5	5	5	5
Ability to Improve Water Quality	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
ACCEPTABILITY																			
Tribal Access to Natural & Cultural Resources*	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i
Protection of Resources (Based on overall area)**	N/A	1	3	3	5	5	5	5	4	4	1	4	1	1	1	3	1	2	2
Protection of Resources (Based on location)***	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i
Incorporation of Tribal Expertise	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Environmental Justice & Equity	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Do No Harm	5	3	3	3	5	5	5	5	4	4	5	4	4	5	5	4	3	3	5
Equitable Outdoor Access	1	4	4	4	4	4	5	5	4	4	3	3	3	3	2	3	4	3	3
Minimize Greenhouse Gas (GHG) Emissions	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i
Workforce Development	5	5	5	5	5	5	5	5	5	5	5	3	4	5	5	5	3	3	2
Sustainable Economic Development	1	3	4	5	4	5	5	5	3	5	4	3	4	5	4	5	5	3	2
COMPLETENESS																			
Meets all Individual Objectives (wo dust mitigation)	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**5**	**1**	**1**
Meets all Individual Objectives (with dust mitigation)	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**5**	**1**	**1**
EFFICIENCY																			
Timeframe for Complete Solution	5	2	2	4	5	5	4	4	4	4	1	1	1	1	4	1	1	1	2
Capital Cost ($M)	5	1	2	2	5	5	5	4	4	4	5	4	4	5	5	3	1	1	1
OMER Cost ($M/yr)	5	1	5	5	5	5	5	5	5	5	5	5	4	5	5	2	1	1	1
Incremental Benefits with Incremental Funding	5	2	1	3	1	1	2	4	4	4	1	1	1	1	5	3	1	1	2
Proven Technology/Reduced Risk	5	1	1	1	5	5	5	5	4	4	3	2	2	3	5	1	2	2	2
Water Supply Risk	5	5	5	5	1	2	2	2	5	5	1	3	1	3	3	1	5	2	2
Earthquake Risk	4	1	1	1	5	5	5	5	4	4	5	4	4	4	5	5	4	4	5
Climate Change Related to Extreme Weather	5	4	5	5	5	5	5	5	5	5	5	5	5	5	4	5	5	5	5
Permits & Environmental Documentation	3	3	3	3	3	3	3	3	3	3	3	1	1	3	3	3	2	2	2
Water Rights & Agreements	3	2	2	2	5	5	5	5	3	3	5	5	5	5	5	5	2	2	2

Full criteria titles: *Tribal Access to Natural Resources, Cultural Resources, and Tribal Cultural Resources; **Protection of Natural Resources, Cultural Resources, and Tribal Cultural Resources (Based on overall area); ***Protection of Natural Resources, Cultural Resources, and Tribal Cultural Resources (Based on location)
Note: i = Incomplete, N/A = Not Applicable.

Figure 7-5. Summary of Evaluation Results for the Very Low Probability Inflow Scenario

8 Findings and Recommendations

8.1 Findings

The findings in Chapter 8 summarize more detailed material presented in Chapter 7, Evaluation of Restoration Concepts, with additional analysis of how key uncertainties influenced the evaluation. The findings are organized by hydrologic scenario.

8.1.1 High Probability Inflow Findings

As described in Section 3.1, the most reasonably foreseeable average annual inflow, barring any significant future policy changes, is estimated at 889,000 AFY. This estimate is approximately 201,000 AFY less than the current 7-year average (1,090,000).

Fifteen of the 18 Phase 2 concepts that were evaluated in detail have been deemed “Complete,” which means they met a minimum standard of “Effective” for Air Quality, Habitat, and Water Quality metrics. Concepts 3A, 3B, and 5 have been deemed “Incomplete” because of their inability to provide sufficient deep-water habitat. However, our scoring rubric for deep-water habitat is based on a linear relationship as compared to historical conditions. It is very likely that density dependent factors would exist for future fish and wildlife populations such that this linear scoring system would overvalue deep-water habitat. Furthermore, more work is needed to identify target species for desired future ecological outcomes.

As noted in Chapter 4, Key Areas of Uncertainty, the SSMP recommends establishing a technical team led by U.S. Fish and Wildlife Service and CDFW to identify desired fish and wildlife assemblages. Until this step is completed, the full value of deep-water habitat cannot be accurately quantified. At this time, concepts should not be disregarded simply for their inability to score “Effective” for the deep-water metric. Still, despite this uncertainty, all other concepts score well for this criterion, and likely possess greater potential to achieve historical levels and diversity of fish and wildlife.

Concept 11 scored the best for “Effectiveness” primarily because it offers more deep-water area habitat and covers the most amount of exposed lakebed when compared to other concepts. Other concepts that scored high for Effectiveness include concepts 2A, 2B, 2C, 2D, 4A, 4B, 4C, 4D, and 7. These concepts were “Very Effective” in providing deep-water habitat, which set them apart from the remaining concepts.

Concepts that scored the highest for “Acceptability” include concepts 2A, 2B, 2C, 2D, and 3B. These concepts all scored well for their potential to develop local workforce and deliver sustainable economic development. Additionally, they offer the highest potential for equitable outdoor access. Finally, these concepts all scored well for minimizing GHG emissions.

Concepts that scored the highest for “Efficiency” include Concepts 2A, 2B, 2C, 2D, 3A, 3B and 5. These concepts established themselves as more efficient than other concepts for scoring well under the criteria for capital costs, operational costs, and proven technology.

The concepts that performed best across all four categories for the High Probability Inflow are Concepts 2A, 2B, 2C, and 2D, all variations of the Divided Sea Concept. Specific metrics where 2A, 2B, 2C, and 2D, did not score well include water supply risk. A low score in this category indicates that air quality, habitat, or water quality scores drop when the hydrologic regime changes from High Probability Inflow to Low Probability Inflow. Despite this drop in habitat scores, Concepts 2B, 2C, and 2D still register as "Very Effective" for their overall scores for the Low Probability Inflow Scenario.

Concepts 3A, 3B, and 5 scored well across nearly all categories except for deep-water habitat. This result underscores the importance of a more detailed scoring metric for aquatic habitat based on population dynamics and ecological outcomes rather than the linear relationship where habitat is scored proportionally based on area.

8.1.2 Low Probability Inflow Findings

The Low Probability Inflow is estimated at 684,000 AFY (406,000 AFY less than the current 7-year average). By relative comparison, barring unforeseen policy changes, this hydrologic scenario has a relatively low probability of establishing itself as the average annual inflow. However, as described in Chapter 4, Key Areas of Uncertainty, SSMP acknowledges the uncertainty that exists with potential policy changes given the large number of Colorado River water users and the growing demand. Therefore, this estimate in flow is used to evaluate concept performance, should extreme environmental conditions occur, or should policy changes drastically affect inflow.

Nine of the 18 Phase 2 concepts were deemed "Complete" for the Low Probability Inflow. Like the High Probability Inflow, lack of sufficient deep-water habitat was the metric that precluded concepts from being deemed "Complete." Concepts 2A, 3A, 3B, 4A, 4C, 5, 7, 12, and 13 all failed to provide sufficient deep-water habitat. However, all of the concepts met a minimum score of 3 for all other "Effectiveness" criteria.

Concept 11 again scored the highest for overall "Effectiveness." Concept 5 was the least effective, primarily because it scored moderately for pupfish connectivity and the ability to meet selenium standards. All other concepts were overall "Very Effective" for the "Effectiveness" category.

"Acceptability" and "Efficiency" were not rescored for the Low Probability Inflow.

Concepts that performed the best across all criteria for the Low Probability Inflow scenario were Concepts 2B, 2C, and 2D. Concepts 2A, 3A, and 3B would have scored well overall, except for their limitation in providing sufficient deep-water habitat.

8.1.3 Very Low Probability Inflow Findings

The Very Low Probability Inflow is estimated at 444,000 AFY (646,000 AFY less than the current 7-year average). By relative comparison, barring extreme policy changes, this hydrologic scenario has a relatively very low probability of establishing itself as the average annual inflow. However, an extremely stressful scenario was requested in response to concerns that the current 23-year drought in the Colorado River Basin will persist and eventually lead to permanent major policy changes.

Only Concept 11 was deemed "Complete" for the Low Probability Inflow. Like the High Probability Inflow, lack of sufficient deep-water habitat was the metric that precluded concepts from being deemed "Complete." Every concept except 11 failed to provide sufficient deep-water habitat. Additionally, while difficult to quantify due to limitations in available models, we anticipate that most concepts would not provide ideal habitat conditions at this inflow. Because of the comparatively low water demand, we anticipate that Concepts 3A, 3B, and 5 would provide the most marginal habitat.

Acceptability criteria and Efficiency criteria were not rescored for the Very Low Probability Inflow Scenario.

8.2 Recommendations

In addition to the recommendations presented in this chapter, the recommendations identified in Chapter 4, Areas of Key Uncertainty, should also receive strong consideration. The following recommendations are for consideration for a subsequent feasibility study and environmental review process.

8.2.1 Concepts Recommended for Further Evaluation

Concepts 2B, 2C, and 2D performed best across all categories for both the High Probability Inflow and Low Probability Inflow scenarios. These and other variations of Divided Sea concepts should receive further consideration with a focus on improving resilience in the event hydrology performs worse than anticipated.

Concepts 3A and 3B score well but are limited in their ability to provide deep-water habitat. Because they utilize less water than other concepts, they provide low risk in terms of future water supply concerns. Variations of Concepts 3A and 3B should receive further consideration with a focus on maximizing deep-water habitat.

Concepts 4A and 4D score well for “Effectiveness” and only reasonably well for “Acceptability.” While they are deemed incomplete by this analysis due to insufficient deep-water habitat, this metric will be replaced with a more appropriate biologically based measure in a subsequent review phase. Variations of these concepts should move forward for further consideration with a focus on improving acceptability measures.

Concept 5 generally performs well except for lacking sufficient deep-water habitat, and for lesser recreational opportunities. A variation of Concept 5 should receive further consideration with a focus on adding recreational opportunities.

Concept 6 was not fully analyzed in this document, however components of the concept, including phytoremediation for improving water quality of inflowing river water, are recommend for future consideration as components of other concepts during the next phase of environmental review.

Concept 7 generally scores well for “Effectiveness” criteria, reasonably well for “Acceptability” criteria, but relatively poorly for “Efficiency” criteria. A variation of Concept 7 should receive further consideration either 1) as a stand-alone concept with a focus on reducing cost and accelerating the timeframe to a complete solution, or 2) combined with other concepts with a focus on delivering greater overall value.

Concept 10 was not fully analyzed because it primarily focuses on new processes. It involves lakebed shore cleanup, waste removal, and beautification. Community outreach would include social media and public meetings and the formation of a “Save the Salton Sea Clean Up Committee” as a short-term initiative. The long-term goal would be to work directly with the community to make improvements around the Sea. The plan does not involve control of salinity or lake surface. However, community involvement would be beneficial to restoration efforts. The community could be directly involved in all phases of the project to design educational and habitat restoration opportunities. Variations of concept 10 that allow for greater community involvement is recommended for further consideration.

Concept 11 was the most effective concept for all hydrologic scenarios and was the only concept to meet completeness for the Very Low Probability Inflow. This concept is also the most expensive and requires the longest time to implement. This concept should move forward for future consideration with a focus on identifying cost saving measures and delivering greater value. While this concept has already received significant review and conceptual iteration from the IRP, it is possible that variations of this concept can be combined with other concepts to deliver greater value.

Concepts 12 and 13 are too expensive for the benefits provided as currently configured, when compared to in-basin concepts. However, smaller variations of these concepts should be considered for their potential to be combined with other concepts in the event hydrology is worse than expected.

8.2.2 Concepts Not Recommended for Further Evaluation

Concepts 1A, 1B, and 1C carry significant costs and risk without adding significant benefits. Constructability and potential catastrophic damage from earthquakes are risks that preclude us from recommending these concepts for further consideration.

Concepts 4B and 4C provide similar benefits to Concepts 4A and 4D, but with added unnecessary costs and risks. We recommend that 4B and 4C be removed from further consideration as standalone concepts.

Concept 8 uses 100 AFY of Colorado River water to develop vegetated habitat. It was not fully evaluated because it does not involve control of salinity or creation of habitat. Similar strategies already exist like revegetation projects being implemented on exposed lakebed to control dust. These projects are expected to continue and be incorporated with all other restoration concepts. Due to its similarity, there is no need for Concept 8 to receive further consideration.

Concept 9 would involve solar modules on racking supported by floats with an industrial atmospheric water generation unit as illustrated in Figure 5-32. The floating solar system would cover the water surface and slow evaporation, while generating electrical energy. The concept would reduce salinity from decreased evaporation by covering parts of the Salton Sea and adding freshwater. Several technical issues existed that made this concept impractical. It was estimated that 6,000,000 or more of these units would be required to have only a 10 percent benefit in reducing evaporation. Other floating systems have been tested in the Sea and with the high salinity, large temperature extremes, and high wave activity, they are generally not practical. The operating life expectancy of individual units would be on the order of one to three years. Furthermore, having 6,000,000 of these units would be an impediment to recreational boating. This concept is not recommended for further consideration due to the technical challenges.

8.2.3. Consideration of Air Quality in Scoring Restoration Concepts

The consideration of air quality impacts from the exposed lakebed should include not only fugitive dust, but also the quality of the dust, including the potential for the dust particles to contain constituents that cause adverse human health impacts. This type of analysis requires transport modeling, but also characterization and chemical analysis of the transported particulates. Such analysis was beyond the scope of this plan, but we acknowledge that it is a part of ongoing regional research studies and may need to be considered by other State agencies charged with protecting public health in the region.

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