MONITORING PLAN FOR THE SONGS' WETLAND MITIGATION PROJECT

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EXECUTIVE SUMMARY

Condition A of the coastal development permit (permit # 6-81-330) issued by the California Coastal Commission (CCC) requires Southern California Edison (SCE) and its partners to create or substantially restore 150 acres of tidal wetlands at an approved location within the Southern California Bight. The purpose of this condition is to serve as out-of-kind mitigation that compensates for past, present and future impacts to fish caused by the operation of San Onofre Nuclear Generating Station (SONGS) Units 2 & 3. A revised plan for wetland restoration at the San Dieguito River Valley, submitted to the CCC by SCE on November 3, 1997, called for the excavation of approximately 115 acres of upland to create tidal wetland and the enhancement of 35 acres of existing tidal wetland through the continuous maintenance of the tidal inlet in perpetuity. Created and restored habitats in this plan included a subtidal basin, channels, intertidal mudflats, and vegetated salt marsh. On October 12, 2005, the Commission approved the Final Restoration Plan and CDP #6-04-88, as conditioned, for the San Dieguito Wetlands Restoration Project. Construction of the wetland restoration project at San Dieguito commenced in August 2006 and was completed on September 29, 2011, with the completion of the inlet opening.

Monitoring by independent UCSB contract scientists working for the CCC is being done to: (1) determine whether performance standards established for the wetland mitigation project are met, (2) determine, if necessary, the reasons why any performance standard has not been met, and (3) develop recommendations for appropriate remedial measures. The coastal development permit for SONGS requires that monitoring of the wetland restoration project be done over the full operating life of SONGS Units 2 & 3. In March 2019 the CCC determined the full operating life of SONGS to be 32 years based on the commencement of Unit 2 in 1982 through the end of 2013. In accordance with the SONGS coastal development permit, we developed a monitoring plan to guide the monitoring work and oversee the monitoring studies outlined in the plan. The SONGS coastal development permit provides a description of the performance standards and the monitoring required for the wetland mitigation project. This monitoring plan closely adheres to the monitoring requirements of the permit and includes: (1) a description of the process used to evaluate condition compliance, including a list of performance standards by which the success of the mitigation wetland is judged, (2) descriptions of the specific sampling methods and analyses that are used to evaluate each of the performance standards, (3) an explanation of how project data are managed and archived for future use, and (4) a description of how the results from the monitoring program are disseminated to the CCC, the applicant, and all other interested parties.

This monitoring plan is a living document that will be updated as needed to ensure rigorous monitoring and evaluation of Condition A is completed in the most cost-effective manner possible. A history of updates to this monitoring plan is provided in Appendix 7 of this document.

INTRODUCTION

Through its 1991 and 1997 coastal permit actions (permit # 6-81-330-A, formerly 6-83-73) the California Coastal Commission (CCC) adopted permit conditions that require Southern California Edison (SCE) and its partners to create or substantially restore 150 acres of tidal wetlands at an approved location within the Southern California Bight. The purpose of this condition is to provide out-of-kind mitigation that compensates for past, present and future impacts to fish caused by the operation of San Onofre Nuclear Generating Station (SONGS) Units 2 & 3.

On June 11, 1992, the CCC approved SCE's choice of the San Dieguito River Valley as the restoration site that meets the minimum standards identified in the SONGS permit and best meets the objectives of the wetland mitigation requirement. On April 9, 1997, the CCC reaffirmed its prior determination that the San Dieguito River Valley is the restoration site and determined that SCE can propose an additional site for restoration only if achieving all 150 acres of restoration at the San Dieguito River Valley becomes infeasible due to hydrology or other engineering concerns. The CCC also determined that up to 35 acres of enhancement credit could be obtained for inlet maintenance if wetland restoration is done at San Dieguito.

SCE submitted a preliminary plan for wetland restoration at the San Dieguito River Valley (32.969545^{0}N, 117.26047^{0}W) to the CCC by SCE on September 30, 1997. In November 1997, the Commission approved SCE's revised preliminary wetland restoration plan as largely conforming with the minimum standards and objectives stated in the permit. The revised plan called for the excavation of approximately 115 acres of upland to create tidal wetland and the enhancement of 35 acres of existing tidal wetland through the continuous maintenance of the tidal inlet in perpetuity. Initially, ~21 acres of W16 were planned as a mitigation bank (SCE 2005). However, during the construction of the berms, seasonal marsh acres were lost, requiring the acres from the W16 mitigation be used to recoup the lost acres of tidal habitat (CDP 6-04-088-A4). As a result, there are 150 acres of tidal habitat within the project footprint area that occur at or below 4.5' NGVD, excluding the additional 35 acres of credit associated with maintaining an open inlet. Created and restored habitats in this plan include a subtidal basin, channels, intertidal mudflats, and vegetated salt marsh. In addition, the plan included the construction of least tern nesting sites, flood control devices such as berms and weirs, and the creation of non-tidal (seasonal) salt marsh, coastal sage scrub and grassland habitats. On October 12, 2005, the Commission approved the Final Restoration Plan and CDP #6-04-88, as conditioned, for the San Dieguito Wetlands Restoration Project. Construction of the wetland restoration project at San Dieguito commenced in August 2006 and was finished on September 29, 2011, with the completion of the inlet opening.

Condition A (Wetland Mitigation) of the SONGS permit requires monitoring, management (including maintenance) and remediation of the wetland restoration be done for a period not less than the full operating life of SONGS plus years monitored without the project attaining compliance with performance standards in the permit. The full operating life of SONGS, as determined by the CCC, includes the commencement of SONGS Units 2 and 3 in 1982 and 1983 until 2013, which marked the beginning of the decommissioning period when discharges were substantially reduced (=32 years).

In accordance with Condition D (Administrative Structure) of the SONGS permit, the post-construction monitoring of the wetland restoration will be done independently of SCE and its partners. Scientists retained by the Executive Director of the CCC shall develop the Monitoring Plan, in consultation with SCE and appropriate lead agencies, and will oversee the monitoring studies outlined in the Plan. The present document serves as the Monitoring Plan for the SONGS' wetland mitigation requirement and provides a general framework to guide the monitoring work. Further details of the monitoring effort will be set forth in biennial work plans. This updated Monitoring Plan has been reviewed by the Science Advisory Panel (SAP) retained by the Executive Director of the CCC.

It should be noted that the SONGS permit provides a description of the monitoring required for the wetland mitigation project. Specifically, the permit describes the duration of monitoring, the performance standards to be used for judging the success of the restoration, the use of reference sites as a standard of comparison, and the parties responsible for monitoring and evaluating the restoration project. This Monitoring Plan closely adheres to the conditions of the permit and includes a description of the performance standards that will be used to evaluate the success of the restoration and the sampling methods that will be used to make this evaluation. The focus of the Monitoring Plan for the SONGS wetland restoration project is on assessing project compliance using the performance standards stated in the permit. Thus, there are a number of issues related to management of the restored wetland that are not included in this document, such as monitoring and maintenance of least tern nesting sites, removal of trash, control and enforcement of public access, mosquito control and development in the watershed. In addition, the CCC or other agencies may add monitoring requirements as part of their regulatory oversight of the wetland restoration project, and this Monitoring Plan does not consider these possible requirements.

2.0 EVALUATION OF CONDITION COMPLIANCE

Condition A identifies the physical and biological performance standards that must be met in order for the wetland restoration project to comply with the SONGS permit. The performance standards fall into two categories: (1) absolute standards, which require that the variable of interest be met each year and are only evaluated within San Dieguito Wetlands, and (2) relative standards, which require that the variable of interest be similar to that measured in natural tidal wetlands within the region. The standards pertaining to topography, tidal prism, habitat areas, plant reproductive success, and exotic species are absolute standards, whereas the standards pertaining to water quality, biological communities, vegetation, *Spartina* canopy architecture, and food chain support, are relative standards that will be evaluated in comparison to reference wetlands.

In this section of the monitoring plan we provide: (1) a list of the performance standards for the wetland mitigation project as provided in the SONGS permit, (2) an explanation of the process used to select the reference wetlands used as a measure of comparison in assessing the relative performance standards, (3) a description of the measure of similarity used to assess compliance of the relative performance standards, and (4) a schedule for the monitoring period.

2.1 Performance standards

The following performance standards are used to measure the success of the restored wetland and to determine whether remediation is necessary.

<u>Absolute Performance Standards</u>.

Tidal Prism. The designed tidal prism shall be maintained, and tidal flushing shall not be interrupted.

Habitat areas. The area of different habitats shall not vary by more than 10% from the areas indicated in the final restoration plan.

Topography. The wetland shall not undergo major topographic degradation (such as excessive erosion or sedimentation).

Reproductive Success. Certain plant species, as specified in the work program, shall have demonstrated reproduction (i.e. seed set) at least once in three years.

Exotics. The important functions of the wetland shall not be impaired by exotic species.

<u>Relative Performance Standards</u>

Water Quality. Water quality variables [to be specified] shall be similar to reference wetlands.

Fish. Within 4 years of construction, the total densities and number of species of fish shall be similar to the densities and number of species in similar habitats in the reference wetlands.

Macro-invertebrates. Within 4 years of construction, the total densities and number of species of macro-invertebrates shall be similar to the densities and number of species in similar habitats in the reference wetlands.

Birds. Within 4 years of construction, the total densities and number of species of birds shall be similar to the densities and number of species in similar habitats in the reference wetlands.

Vegetation. The proportion of total vegetation cover and open space in the marsh shall be similar to those proportions found in the reference sites.

Algae. The percent cover of algae shall be similar to the percent cover found in the reference wetlands.

***Spartina* Canopy Architecture**. The restored wetland shall have a *Spartina* canopy architecture that is similar in distribution to the reference sites, with an equivalent proportion of stems over 3 feet tall.

Food Chain Support. The food chain support provided to birds shall be similar to that provided by the reference sites, as determined by feeding activity of the birds.

2.2 Reference Wetlands

The SONGS permit specifies that successful achievement of the performance standards will in some cases be measured relative to reference wetlands. The rationale for requiring that the value of a resource in the restored wetland be similar to that in reference wetlands is based on the belief that to be successful the restored wetland must provide the types and amounts of resources that occur in natural wetlands. Resources in natural wetlands, however, vary in space and time. Differences in physical characteristics of a wetland (e.g., soil, topography, flood regime, tidal hydrology) can cause plant and animal assemblages to differ among tidal wetlands while seasonal and inter-annual differences in weather, nutrient loading, and oceanographic conditions can cause the biological assemblages within tidal wetlands to fluctuate over time.

Ideally, the biological assemblages in a successfully restored wetland should vary in a manner similar to those in the natural wetlands used for reference. Temporal variability, especially of the sort associated with weather (e.g., air temperature, rainfall) or oceanographic conditions (e.g., swell height, sea level anomalies, water temperature) can be accounted for by sampling the restored and natural reference wetlands concurrently. Concurrent monitoring of the restored and natural wetlands helps ensure that regional changes in weather and oceanographic conditions affecting the restored wetland will be reflected in the performance standards, since nearby reference wetlands are likely to be subjected to similar conditions.

The permit requires that the wetlands chosen for reference be relatively undisturbed, natural tidal wetlands within the Southern California Bight (i.e., from Point Conception to the US/Mexico border). Relatively undisturbed wetlands have minimal human disturbance to habitats (e.g., trampling of vegetation, boating, fishing). Natural wetlands are not constructed or substantially restored. Tidal wetlands are continuously open to the ocean and receive regular tidal inundation. After evaluating more than 40 wetlands within the Southern California Bight, three wetlands, Tijuana River Estuary (32.569°N, 117.126°W), Mugu Lagoon (34.102°N, 119.097°W), and Carpinteria Salt Marsh (34.401°N, 119.537°W) were initially chosen as reference wetlands that best met the criteria of undisturbed, natural tidal wetlands within the Southern California Bight. In 2024, Tijuana River Estuary was deemed an unsuitable reference site due to anthropogenic impacts from transboundary sewage flows in 2023. After considering the available options, Los Peñasquitos Lagoon (32.930°N, -117.252°W) was selected as the best wetland to replace Tijuana Estuary, meeting the criteria in the SONGS permit with the additional advantage that it is close to San Dieguito Wetlands. The inlet of Los Peñasquitos Lagoon was only intermittently open at the time of the initial selection of reference sites. However, the inlet is now maintained in an open condition, meeting an important criterion of reference site selection.

2.3 Determination of similarity

Evaluating overall similarity of San Dieguito Wetlands to the reference wetlands with respect to the relative performance standards is a two-step process. The first step entails assessing statistical similarity between San Dieguito Wetlands and the reference wetlands for each relative performance standard. The second step involves assessing whether San Dieguito

Wetlands has met enough individual relative standards to be considered similar overall to the reference wetlands. These steps are described below.

For the first step, it is necessary to evaluate whether the performance of the San Dieguito Wetlands for each individual standard is similar to that of the reference wetlands. For San Dieguito Wetlands to successfully meet an individual performance standard, the mean (or in some cases the median) value for a given performance variable at San Dieguito Wetlands must not be lower than the mean (or median) value of the lowest performing of the three reference wetlands. For performance standards pertaining to dissolved oxygen concentration and algal cover, the value in San Dieguito Wetlands can not be higher (i.e., worse) than the value of the worst performing of the three reference wetlands. The rationale for comparing the mean value of San Dieguito Wetlands with the mean value of the lowest or worst performing of the reference wetlands is that the reference wetlands are considered to be natural and relatively undisturbed and acceptable measures of comparison for the San Dieguito Wetlands. Hence, if the San Dieguito Wetlands Restoration project is performing at least as well as one of the reference wetlands, then it should be judged successful.

The comparison between San Dieguito Wetlands and the reference wetlands for a given relative performance variable is accomplished using a four-year running average (based on the value in the current year and the previous three years) to account for short-term fluctuations in wetland biota. The four-year running average for a given relative performance variable at San Dieguito Wetlands cannot be significantly lower (or worse) than that of the lowest performing reference wetland. The statistical comparison is generally made using a one-sample, one-tailed t-test and statistical significance is determined using a probability value (i.e., p- value) and an effect size. Details of this approach are discussed below. However, for the standards pertaining to the cover of vegetation and algae, just the mean values of San Dieguito Wetlands and the lowest performing reference wetland are compared without statistical analysis because the values are wetland wide estimates made using aerial imagery and thus there are no estimates of variability about the mean value. For the food chain support standard, significance is determined using a resampling procedure in which the effect size is calculated as the proportional difference in the medians of the resampled distributions of the San Dieguito Wetlands and the lowest performing reference wetland. The p-value is the percentile in the distribution of the lower performing reference wetland that is equal to the median value of the San Dieguito Wetlands.

The level of certainty in assessing similarity between San Dieguito Wetlands and the reference wetlands for the relative standards is directly related to sampling effort. Data collected during pre-restoration monitoring at the reference wetlands for invertebrates, fish, and birds together with the advice of experts were used to determine the level of sampling that would likely be needed to detect a 20% deviation in the relative performance standards (i.e., the effect size, which is calculated as the proportional difference between the mean values for the San Dieguito Lagoon restoration project and the lower 80% confidence limit of the lowest performing reference wetland) with an 80% probability (i.e., the statistical power calculated as 1- Type II error) using a Type I error (α) = 0.2. However, only two of the three parameters (effect size, statistical power and α), can be controlled in a sampling design with a fixed sampling effort. The monitoring philosophy for this project is to balance the risk associated with falsely concluding that the performance standard was not met (i.e., Type I error = critical α = 0.20) with the risk associated with falsely concluding that the standard was met (i.e., Type II error = β = 0.20). Given that statistical power is directly related to both Type I error (α) and effect size, the decision of whether the restored wetland meets a particular relative performance standard is based on a partially linked relationship between effect size and α, which is equal to the calculated p-value from a one-tailed t-test. Once data are collected and an effect size for a given relative performance standard is determined, a critical α needs to be assigned to evaluate whether San Dieguito Wetlands met the performance standard for the year.

The floating alpha approach was developed because of the importance of correctly determining that San Dieguito Wetlands failed to meet a relative performance standard, irrespective of effect size. If the effect size is small, then it is necessary to apply a correspondingly small value for critical α to be certain that the difference between San Dieguito Wetlands and the lowest performing reference wetland is real. By contrast if the effect size for a relative performance standard is large, then assigning a critical value of α that is too small runs the risk of concluding that the wetlands are similar when they differ. Thus, linking the critical value of α to the effect size reduces the probability of committing a Type I error when the effect size is small, and a Type II error when the effect size is large. There may be a situation where variance is greater than anticipated and it is not possible to assess large effect sizes (i.e., >0.20) with a power of 0.80 using a critical α = 0.20. Thus, we developed a “floating alpha” approach that links critical alpha to effect size, thereby allowing the detection of large effect sizes when the variance is large.

The following rules are used with the floating alpha approach when assessing whether San Dieguito Wetlands meets a given relative performance standard (Figure 1). “Calculated α” refers to the p-value computed from the data for a given statistical test, and “critical α” refers to the threshold value of α to which the calculated α is compared for the purpose of determining statistical significance. Using these rules, critical α is set to equal the effect size for all effect sizes ≤ 0.50.

> 1) If for a given performance standard, the calculated α ≤ effect size for any calculated α ranging from 0.000 to 0.500, then San Dieguito Wetlands will be considered to have not met that performance standard (i.e., it is different from the reference wetlands) for the period of assessment (α and effect size rounded to three significant figures).
>
> 2) If calculated α > effect size for any effect size ranging from 0.000 to 0.500, then San Dieguito Wetlands will be considered to have met that performance standard (i.e., it is similar to at least one of the reference wetlands) for the period of assessment (calculated α and effect size rounded to three significant figures).
>
> 3) If effect size is > 0.500 and calculated α is > 0.500, then assessment of that performance standard for the period (based on calculated α and effect size rounded to three significant figures) will be considered inconclusive and the following steps will be taken:

1. The sampling design may be revised to increase the statistical power to an expected value of at least 0.80. Whether this effort is necessary will be based on the history of the performance of San Dieguito Wetlands with respect to the performance standard. For example, if the analyses were conclusive in previous periods, then a single inconclusive analysis would not be sufficient to invoke a change in the sampling design.
2. If needed, the revised sampling design will be implemented the following year.
3. If in the following year the performance standard is met, then the standard will be considered to have been met the previous year as well. If in the following year the performance standard is not met, then the standard will be considered to not have been met the previous year as well.
4. This process will continue until evaluation of the performance standard is no longer inconclusive, barring any changes in Condition C of the SONGS permit.

4) Monitoring data will be evaluated annually to determine whether changes need to be made to the sampling program to bring it closer to the design objective of detecting an effect size ≥ 0.20 with statistical power ≥ 0.80 using a critical $\alpha \leq 0.2$.

The second step of evaluating overall similarity of San Dieguito Wetlands relative to the reference wetlands involves comparing the number of relative performance standards met by San Dieguito Wetlands to the number of standards met by the reference wetlands. This is accomplished by applying the above procedure in step 1 to the three reference wetlands to determine whether they would have met each of the relative performance standards. This is done by treating each of the reference wetlands, e.g., Carpinteria Salt Marsh, as the mitigation wetland and using San Dieguito Wetland and the other two natural wetlands as the three reference wetlands. The San Dieguito Wetlands are considered similar to the reference wetlands if the number of relative standards met by the San Dieguito Wetlands is equal to or greater than the number of relative standards met by any of the reference wetlands. This approach ensures that the assessment of similarity is consistent with the SONGS permit requirement that the performance standards be met without the unreasonable requirement that the San Dieguito Wetlands outperform the reference wetlands for each relative performance standard. Importantly, this approach deals realistically with the inherent variability of nature in a manner that best serves the interests of both the public and SCE.

2.4 Monitoring Period and Project Compliance

Conditions A and D of the SONGS permit describe the monitoring requirements for the wetland mitigation project, which we summarize below. Additional documentation is provided in Appendix 1.

There are two monitoring stages, Stage 1 (Fully implemented monitoring) and Stage 2 (Scaled back = reduced monitoring). Stage 1 monitoring commenced upon completion of wetland construction. Within four years of construction, the total densities and number of species of fish, macro-invertebrates and birds are required to be similar to those in similar habitats in the reference wetlands. In 2016, the restored wetland met more of these biological standards than the lowest performing reference wetland, fulfilling this requirement. All performance standards must be met within 10 years, which is the same amount of time required for the mitigation reef to meet all of its performance standards. The wetland restoration project will be considered successful when all the performance standards have been met for each of three consecutive years. All years that the project is in compliance will count towards the compliance period. The duration of the monitoring period will not be less than the full operating life of SONGS plus years monitored without the project attaining compliance with permit standards. SCE will receive mitigation credit for each year that the project is in compliance. The mitigation requirements will be fulfilled when the number of years of compliance equals the total years of operation of SONGS Units 2 & 3 (32 years). Remediation may be required if the performance standards are not met within ten years and if three consecutive years of compliance has not occurred within 12 years (Appendix 1). Note that the Executive Director can prolong this stage of monitoring or reinstate it if necessary following degradation of the wetland (resulting in a period of non-compliance) or remediation (Appendix 1).

SCE and its partners are fully responsible for any failure to meet the mitigation goals and standards for the full operating life of SONGS Units 2 and 3 (32 years). If the restored wetland is not in compliance within 12 years post-construction, then (at the discretion of the Executive Director), the permittee shall fund an independent study to collect the information needed to determine what remediation is required. The permittee shall also be required to implement any remedial measures determined necessary by the Executive Director in consultation with state and federal resource agencies and to provide funds for independent monitoring that evaluates the success of the required remediation. Remediation monitoring may be different from the compliance monitoring required by the permit.

Condition D of the SONGS permit establishes that upon determination that all of the performance standard requirements have been met for three consecutive years, a scaled back level of monitoring (Stage 2) may ensue. The scaled back monitoring program will be designed and implemented by independent contract scientists working under the direction of the CCC. Reduction in monitoring effort will be based on analyses of data collected during Stage 1 of the project. Contract scientists will examine these data to determine the minimum effort that would have been necessary to assess compliance during this period. All monitoring, whether it be Stage 1 or Stage 2 must be sufficient for assessing project compliance with the performance standards.

If the restored wetland is in a period of reduced monitoring and if it falls out of compliance for a period of two consecutive years, then to determine if non-compliance is an artifact resulting from a reduction in monitoring effort, full monitoring (Stage 1) may be re-established for those standards that are not being met. If resumption of full monitoring leads to the conclusion that the reduction in monitoring was responsible for non-compliance, then monitoring will remain at the full levels for the duration of the study or until the Executive Director concludes that reduced monitoring could be reinstituted (Appendix 1).

3.0 SAMPLING METHODS AND DATA COLLECTION

3.1 Data collection

Listed below are the approaches used to evaluate the physical and biological performance standards in Condition A of the SONGS permit. Included is a discussion of the sampling methods used in collecting the information needed to evaluate each performance standard. In accordance with Condition D of the SONGS permit, final determination of the sampling design (e.g., number and distribution of sampling stations, samples per station) and specific details of the monitoring methods may be adjusted in biennial work programs.

Absolute Performance Standards

1. **Tidal prism**

   THE DESIGNED TIDAL PRISM SHALL BE MAINTAINED, AND TIDAL FLUSHING SHALL NOT BE INTERRUPTED.

   The tidal prism is generally defined as the amount of water that flows into and out of an estuary with the flood and ebb of the tide, excluding any contribution from freshwater inflows (Hume 2005). In practice, the term tidal prism is the volume of water exchanged between an estuary or lagoon and the open sea during a complete tidal cycle. Because the tidal prism varies with the tidal cycle, which varies daily, biweekly, seasonally, and over tidal epoch (19 years), there needs to be a standardized approach to the measurement of tidal prism to account for this variability over time.

   A reduction in the tidal prism of the restored wetland can have detrimental effects on water quality and alter the area of inundated habitat. Numerical modeling suggested that after restoration, the tidal prism in the restored lagoon would increase, based on the increase in tidally affected area and estimated volume of tidally exchanged water. However, predictions of tidal prism from this modeling are likely to differ from actual values for the as-built wetland since they do not include the effects of friction, which could contribute to a smaller than predicted tidal prism. Therefore, the tidal prism of the restored wetland is calculated from empirical measurements of the tidal prism on completion of construction (2011) and used as the standard of comparison to detect changes in this performance variable during subsequent monitoring. From 2012-2024, 2012 tidal prism survey data was used to characterize the as-built tidal prism (Appendix 7). In 2025, it was determined that 2015 was a more appropriate year to characterize the as-built prism of the wetland because it was one year following the re-grading of W2/3 and excavation of tidal creeks (2014) and it had a wider range of surveyed water levels (-0.1 to 4.7’ NGVD) than both 2012 (0.02 to 4.4’ NGVD) and 2014 (0.2 to 4.6’ NGVD).

   For the San Dieguito Lagoon, tidal prism is calculated by integrating sequential measurements of volume of tidal flow taken at the Jimmy Durante Bridge (0.9 km from the inlet; Figure 2) using a portable acoustic Doppler profiler/discharge measurement system (SonTek RiverSurveyor or equivalent) towed back and forth across the width of the channel every 15 minutes during an incoming tide; each pass under the bridge is referred to as a transect. The system is mounted aboard a raft (hydroboard) and features bottom tracking for displaying bathymetry, real-time display of current profiles, and discharge computation. The tidal flow volume during an incoming tide in cubic feet per second (CFS) for each transect is equal to the product of the area of the submerged channel cross sectional area (e.g. square feet) and the velocity of flow (feet per second). CFS is integrated across all transects completed during the incoming tide to produce an estimate of the volume of water entering the estuary during that tide. This summed volume is an estimate of the tidal prism and expressed as acre feet for the tidal elevational range covered (e.g., -1 to +4.5 feet NGVD) during the period of measurement.

In addition to the San Dieguito Wetlands Restoration Project, other small- and large-scale restoration projects have been built within the San Dieguito Lagoon system. For example, approximately 70-acres of tidal wetland habitat were added following the construction of W6 (December 2023) and W19 (June 2024) restoration projects, located east of the I-5 (Figure 2). These projects are of sufficient size to potentially affect the tidal prism estimates that had historically been associated solely with the San Dieguito Wetlands Restoration Project. Details on how the tidal prism standard was evaluated in 2024 relative to these restoration projects can be found in Appendix 7.

Changes in the tidal prism at San Dieguito Lagoon resulting from the W6 and W19 restoration projects could obscure changes in tidal prism that occur within the San Dieguito Wetlands Restoration Project due to changes in topography or other factors. Therefore, a more sensitive method for assessing the tidal prism standard was initiated in 2025 to (1) assess the tidal prism solely within the San Dieguito Wetlands Restoration project footprint area (150 ac), (2) attribute changes in tidal prism to the this project versus other restoration (e.g., W6 or W19 Restoration Projects) and management (e.g., USACE beach nourishment) projects, and (3) optimize and reduce the field sampling effort required to assess the tidal prism standard.

In addition to accomplishing these three goals, the new method can help pinpoint where in the tidal frame changes in prism are likely to be occurring due to topographic or bathymetric changes, which, in turn, could affect inundation frequency of planned (e.g., salt marsh, mudflat, subtidal) and unplanned (e.g., “other”) habitats and their acreages. Hence, the new approach can also be used as a diagnostic tool, as needed.

For each survey, contemporaneous measurements of water surface elevation (“WSE”, feet) data are merged with the discharge values for each transect (“Volume”, acre feet). The water surface elevation data currently used are from a monitoring station (TS12) managed and maintained by Coastal Environments (Figure 2). Beginning in 2026, these data will instead be collected at the Jimmy Durante Bridge.

The approach has two components. First (Eqn 1), is the calculation of the area of wetland that is submerged as a function of tidal elevation. This calculation is based on decomposing the volume of water flow in a transect into area and elevational change. Given that volume, area and elevation change are all measured in the same units (i.e., ft^3, ft^2, ft, respectively), dividing the volume (ft^3) by the elevational change (ft) yields an estimate of the area of submerged wetland (for that particular tidal elevation).

Eqn 1:

$$\frac{Volume_i\ (acre\ feet) - Volume_{i+1}(acre\ feet)}{WSE_i\ (feet) - WSE_{i+1}(feet)} = best\ estimate\ of\ tidal\ wetland\ acres\ submerged, y$$

The best estimate of tidal wetland acres submerged, or y, is calculated with Eqn. 1. The two consecutive transects represent the top and bottom surface of a “slice” of the wetland basin (Figure 3). Because the numerator of Eqn. 1 represents the volume of the “slice”, and the denominator represents the depth of the “slice”, the quotient produces the dimensions in acres per “slice” that are integrated across the tidal frame using Eqn. 2.

Eqn 2:

$$GAM(y) \sim s(a) + s(b) + s(c) + s(a, by = year) + s(b, by = year) + s(c, by = year)$$

A Generalized Additive Model (GAM; Eqn. 2), is run on the new transect-level variable, y, as derived from Eqn 1. The GAM includes terms for the factor of year and smooth functions (s) for the average water level between the two consecutive transects (a), the difference in WSE between the two consecutive transects (b), the tidal range for the survey (c) and each smooth function by factor, year. To estimate a set of mean values, the prediction formula from the GAM is run on 1000 bootstrapped (with replacement) values of input (by survey and year). This output is used to calculate the mean value for the year (i.e., the average area submerged for the year). The bootstrap mean is calculated for each year and compared to the 2015 as-built bootstrap mean. The San Dieguito Wetlands Restoration project meets the tidal prism standard if the bootstrap mean for a given year is greater than -10% of the as-built bootstrap mean (2015).

In 2025, tidal prism surveys were conducted at the inlets of W6 and W19 to correct the tidal prism values for the San Dieguito Wetlands Restoration project that are measured at Jimmy Durante Bridge, as the San Dieguito River channel at this bridge drains and fills all three projects (San Dieguito Wetlands Restoration, W6, and W19 projects). The same analytical approach described above was used for the W6 and W19 surveys to determine a correction factor that can be applied to the values collected at Jimmy Durante Bridge to determine the tidal prism associated solely with the San Dieguito Wetland Restoaration Project footprint.

To adaptively manage for deleterious changes in tidal prism (e.g., muting), the measurements at Jimmy Durante Bridge may be supplemented with surveys of flow further within the wetland at channels leading to the large basin (W1) and the large intertidal area of W4 and W16. These surveys will be used to proactively identify impeded tidal flow into or out of these areas and inform maintenance action.

SCE’s restoration plan calls for the one-time restorative dredging of the inlet channel and lagoon channels followed by routine maintenance dredging approximately every eight months, or as needed, to maintain the inlet channel depth and width necessary to maintain tidal flushing and the as-built tidal prism. Tidal flushing will be uninterrupted if designed channel depths and widths are maintained (SCE 2005).

2. **Habitat areas**

THE AREAS OF DIFFERENT HABITATS SHALL NOT VARY BY MORE THAN 10% FROM THE AREAS INDICATED IN THE FINAL RESTORATION PLAN.

Approach: The intent of the habitat areas standard is to preserve the mix of habitats provided in the Final Restoration Plan (SCE 2005) and to guard against large-scale conversions of one habitat type to another (e.g., vegetated marsh to mudflat and vice versa). The Final Restoration Plan set the elevations of different wetland habitats for the San Dieguito Wetland Restoration project and specified their acreages (Appendix 2; Tables 1-4). Subtidal habitat is defined at elevations of < -0.9 ft NGVD, intertidal mudflat is defined from -0.9 to 1.3 ft NGVD, and intertidal salt marsh is defined from 1.3 to 4.5 ft NGVD. Because subtidal, mudflat and salt marsh habitats are not consistently constrained by planned elevation boundaries, the area of these habitats used to evaluate this performance standard is assessed using criteria based on inundation, elevation, and cover of vegetation.

Areas are classified as subtidal habitat if they remain continuously submerged (Appendix 2; Table 5). Areas are classified as mudflat habitat if they are (1) intertidal, (2) located below an elevation of 3.5 ft NGVD and thus subject to regular tidal flooding, and (3) sparsely vegetated, possessing < 5% cover of vegetation as mudflats are by definition intertidal and unvegetated (Appendix 2; Table 5). The upper elevation limit for mudflat for the habitat areas assessment is based on the observation of surface salt deposits above 3.5 ft NGVD in some areas of the restoration project indicating infrequent tidal inundation. Areas are classified as salt marsh habitat if they are: (1) intertidal, (2) at or below 4.5 ft NGVD, which is the upper limit of tidally influenced habitat for this project, and (3) have a cover of native salt marsh vegetation of ≥ 30% to provide perches and foraging habitat for Belding's Sparrow and other species (Appendix 2; Table 5). Elevation contours are determined using a Real Time Kinematic (RTK) global positioning system (GPS) with a vertical and horizontal accuracy of a few centimeters (typically 3 cm). All elevation contours were initially measured in 2012. The 4.5 ft contour is measured annually to define the bounds of the restoration project and ensure that 150 acres of restored wetland are maintained at the site. All other contours have been measured as needed over time; see Appendix 2, Table 6 for a history of contour data collection over time.

Cover of vegetation, water, and bare space are determined using multispectral aerial imagery collected annually in the red green blue (RGB) and near-infrared (NIR) spectrum within 10 x 10 m squares on a grid superimposed over the entire restored tidal wetland. Aerial images are taken in the spring-early summer, which is the period of maximum growth of marsh plants. Because the ability to classify ground cover type based on spectral data varies with weather conditions, the images are calibrated for each aerial survey. The full classification of the aerial image is also inspected at a subset of georeferenced locations to confirm the classification. Nominal pixel size evaluated as vegetated, bare, or water using aerial imagery within each 10 x 10 m plot is 20 x 20 cm. Each 10 x 10 m grid square is assessed as subtidal, mudflat, or salt marsh habitat using the criteria above. The grid square areas are summed by habitat with the aid of GIS software and compared to the planned acreages in the Final Restoration Plan (SCE 2005) to determine whether they are within 10% of planned values. Grid squares that are not assessed as one of the planned habitats are assigned to an "other" category.

3**. Topography**
THE WETLAND SHALL NOT UNDERGO MAJOR TOPOGRAPHIC DEGRADATION (SUCH AS EXCESSIVE EROSION OR SEDIMENTATION).

Approach: Topographic changes resulting from excessive erosion or sedimentation could impede tidal flow within the wetland altering tidal prism and the areas of planned wetland habitat. Erosion or sedimentation within the restored wetland may result from high volumes of storm run-off, littoral movement of sand that block the inlet channel, or other causes.

This standard is evaluated using visual surveys throughout the restored wetland to identify signs of substantial erosion or sediment deposition that could impede tidal flow. Surveys are done opportunistically alongside ongoing wetland fieldwork. Additional surveys are done following storm events when bank erosion and channel scour and sediment deposition is more likely to occur. Constructed berms and associated structures (e.g., culverts and weirs) are a special topographical feature of the restored wetland. These features are also visually inspected during the surveys. Since the success of the restoration depends critically on tidal exchange and the proper functioning of the berms and associated structures, excessive erosion or sediment deposition that impedes tidal flow or a structural weakening of berms will trigger maintenance operations.

The CCC has defined 4.5 ft NGVD as the upper limit of tidally influenced habitat for the calculation of acreage credit for this restoration project. Sediment from the erosion of berms, disposal sites, or other sources may become deposited below this limit, raising marsh elevation. Therefore, the location of the 4.5 ft contour is of special interest and is surveyed annually (Appendix 2, Table 6). The area bounded by the 4.5 ft NGVD contour is calculated annually to evaluate compliance with the acreage requirement.

4. **Reproductive success**
CERTAIN PLANT SPECIES, AS SPECIFIED IN THE WORK PROGRAM, SHALL HAVE DEMONSTRATED REPRODUCTION (I.E. SEED SET) AT LEAST ONCE IN THREE YEARS.

Approach: The reproductive success of salt marsh plants is evaluated by measuring whether mature seed is produced for seven species that occur in the intertidal habitat of the restored wetland. Species for evaluating plant reproductive success include Parish's Glasswort (*Arthrocnemum subterminale*), Salt Grass (*Distichlis spicata*), Pickleweed (*Salicornia pacifica*, formerly *Salicornia virginica*), Alkali Heath (*Frankenia salina*), Spiny Rush (*Juncus acutus*), Marsh Jaumea (*Jaumea carnosa*), and California Sea Lavender (*Limonium californicum*). These plants are the most common species found within the restoration site.

Sampling for the setting of mature seed is done in the summer-fall when seed set is expected to be greatest. Ten flower stalks, flower heads, or fruits are collected haphazardly across the wetland from each species for a total of 100 flower stalks, flower heads, or fruits for each species. Seeds are examined under microscopes in the laboratory and seed maturity is determined using reference guides. Only one stalk per species with mature seeds is needed for a species to be considered to have demonstrated reproduction. This standard is successfully met if all of the targeted species set any mature seed in at least one out of every three years.

5. **Exotics**

THE IMPORTANT FUNCTIONS OF THE WETLAND SHALL NOT BE IMPAIRED BY EXOTIC SPECIES.

Approach: Exotic species can cause compositional and functional changes in estuarine ecosystems. Such changes can occur, for example, through the alteration of food webs or the physical structure of habitats (e.g., burrowing activities that affect the stability of tidal channel banks). Monitoring data collected for fish (Section 3.1.7), invertebrates (Section 3.1.8), birds (Sections 3.1.9 and 3.1.13), and vegetation (Sections 3.1.10) are used to assess the prevalence of exotic species.

In addition, a survey targeting exotic species that covers as much of the wetland as possible is conducted once a year to adaptively manage for exotic species. This targeted survey focuses on plants and visible invertebrates and incorporates a diving survey of the subtidal portion of the main basin (W1). Should areas of infestation be found, appropriate resource agencies will be consulted and directed studies will be done to assess how the invader is affecting the functioning of the restored wetland. For example, the Australasian isopod *Sphaeroma quoyanum* is known to modify channel bank and marsh edge through its burrowing activities. Should this isopod be found, measurements of erosion rates in infested areas will be compared with those in uninfested areas to ascertain whether the isopod is unduly influencing channel geometry, which could affect tidal flow and feeding habitat for some shorebirds and waders. *Musculista senhousia* is an invasive mussel from Asia that can occur in extremely high densities (e.g., several thousand per square meter). Should high densities of this mussel be found, studies may be done to determine if this mussel is negatively affecting the densities and species richness of native suspension-feeding species. *Caulerpa taxifolia* is a highly invasive alga that forms a dense mat on any surface, reducing plant and animal density and richness. This alga is of particular concern to State and Federal resource agencies. Should *Caulerpa* be found, appropriate resource agencies will be notified and management actions implemented. If exotic plant species (e.g., *Tamarix ramosissima, Limonium ramosissimum*) are identified in the salt marsh, these plants will be removed to prevent widespread invasion.

Relative Performance Standards

6. **Water Quality**

WATER QUALITY VARIABLES [TO BE SPECIFIED] SHALL BE SIMILAR TO REFERENCE WETLANDS.

Approach: Because of its documented importance to wetland health, the concentration of dissolved oxygen is used to evaluate water quality within the restored wetland. Dissolved oxygen concentration can change rapidly with inlet closure resulting in adverse effects on estuarine biota. However, dissolved oxygen also varies with location, the tidal cycle and time of day (it is generally higher during the day due to oxygen provided by photosynthesis, and lower during the night and early morning due to respiration). Measurements of dissolved oxygen, water temperature, and salinity are made in San Dieguito Wetlands and the three reference wetlands (Tijuana Estuary (2012-2023), Los Peñasquitos Lagoon (2024-present), Mugu Lagoon, and Carpinteria Salt Marsh) using continuously recording environmental data loggers (e.g., YSI EXO3 sonde, HOBO Dissolved Oxygen Datalogger U26-001, HOBO U24-002-C Conductivity Logger). Instruments are calibrated in accordance with the manufacturer's specified protocol prior to deployment in the field. Data from these instruments are processed every two weeks for HOBO systems and every four weeks for the YSI EXO systems. There is either one (primary) or two (primary and backup) sampling stations at each wetland location (Table 1).

An oxygen concentration below 3 mg/l is considered hypoxic and sustained concentrations below this value may be detrimental to estuarine biota (ESA, https://www.esa.org/esa/wp-content/uploads/2012/12/hypoxia.pdf). The water quality standard is evaluated annually by comparing the mean length in hours of continuous hypoxia between San Dieguito Wetlands and the reference wetlands. If the mean number of consecutive hours of DO concentration < 3.0 mg/l is significantly higher in the San Dieguito Wetlands than in the reference wetland with the highest value, then San Dieguito Wetlands fails to meet the standard.

To adaptively manage for decreases in dissolved oxygen concentrations during the year that may reflect poor tidal flushing within San Dieguito Lagoon, measurements of sustained dissolved concentrations of < 3.0 mg/l will trigger action to identify factors contributing to the anoxic conditions and inform maintenance actions that may be necessary to raise these oxygenconcentrations.

7. Fish

WITHIN 4 YEARS OF CONSTRUCTION, THE TOTAL DENSITIES AND NUMBER OF SPECIES OF FISH SHALL BE SIMILAR TO THE DENSITIES AND NUMBER OF SPECIES IN SIMILAR HABITATS IN THE REFERENCE WETLANDS.

Approach: Data on the density and numbers of species of fish are collected using 0.4 m^2 x 0.9 m circular enclosure traps, and beach seines (generally enclosing an area of approximately of 100 m^2). Enclosure traps are used in shallow water (≤ 0.7 m deep) to sample gobies (family Gobiidae), which are small, numerically abundant fishes that are poorly sampled by other methods (Steele et al. 2006a). Beach seines in combination with blocking nets are used to sample larger more mobile fishes (Steele et al. 2006b). Gobies collected with beach seines are not included in density and species richness metrics. Fish captured by both methods are identified and counted in the field and returned to the water alive. In cases where species identification is uncertain, voucher specimens are retained for later identification in the laboratory.

Habitats sampled during fish monitoring are main channels and tidal creeks. Because tidal creek and main channel habitats differ in their locations, dimensions, and hydrology, and thus potentially in fish density and species richness, they are evaluated separately. Here, tidal creeks are defined as ≤ 4th order streams that typically fully drain, whereas main channels are defined as ≥ 4th order streams that typically do not fully drain. Main channel habitats are generally wider than tidal creek habitats. Over time, salt marsh vegetation has encroached into many of the tidal creeks at San Dieguito Wetlands, and sampling locations have shifted over time to accommodate these changes. See Appendix 3, Figure 1 for an overview of historic changes in tidal creek sampling locations. A potential concern for the monitoring design was that basins of the type constructed in the San Dieguito Wetlands Restoration do not occur naturally in southern California wetlands, and thus cannot be compared to natural reference sites. However, data collected by Marine Ecological Consultants (MEC 1993) on fish abundance from different habitats at San Dieguito Lagoon prior to restoration found that fish assemblages were similar in basin and main channel habitats and thus it is biologically reasonable to treat the constructed basin in W1 as main channel habitat in post-construction monitoring. Basin habitat in the San Dieguito Wetland Restoration is sampled using the same methods employed in tidal creek and channel habitats (i.e., a combination of enclosures and beach seines).

Because estuarine fish are patchily distributed, samples are spaced as widely as practical across these habitats to obtain representative estimates of fish density and species richness. For both fish sampling methods, the number of locations sampled within a wetland is maximized within logistical constraints. Based on available habitat in the reference wetlands, 6 tidal creek and 6 main channel locations within each wetland are sampled by each method (Figures 4, 6, 7, 8). For enclosure traps, 5 stations spaced 10-20 m apart are sampled within each tidal creek or section of main channel. Sampling an enclosure trap consists of multiple hauls using a Benthic Ichthyofauna Net for Coral/Kelp Environments (BINCKE) through the volume of water trapped by the enclosure until three hauls, which can be non-consecutive, have no fish.

For beach seine sampling, main channel sampling locations are blocked off with two blocking nets rolled out 7.6 m apart on shore. The two nets are deployed perpendicular to the shore reaching a depth of ~1.5 m or a distance of 12.2 m from shore, whichever comes first. A dowel is placed marking the corner of the sampling area and the remaining length of the nets are pulled toward each other to close the blocked area. A beach seine (2 m high x 7.6 m wide) is hauled through the blocked area five times and non-goby fishes are identified to species, counted and released. Gobies are poorly sampled by seines and are thus excluded from this method (Steel et al. 2006a). The two blocking nets are then pulled in and sampled for fish. Tidal creek sampling locations are blocked off with two blocking nets deployed perpendicular to the shore 7.6 m apart and extending across the creek. The beach seine is hauled through the blocked area five times and non-goby fishes are identified to species in the field, counted and released. The blocking net closest to the inlet of the creek is pulled in, sampled for fish, and then redeployed 7.6 m from the upland side of the still deployed blocking net. This second section of the tidal creek is sampled with five hauls of the beach seine and then the two blocking nets are pulled in and sampled for fish. An annual survey using beach seines consists of repeating this method at each main channel and tidal creek location on three different dates during early fall. The location of the seine sampling areas on the three dates is offset to minimize effects of physical alteration of habitat and to avoid sampling areas that might have been affected by previous sampling.

To avoid nesting activity of the Ridgeway's Rail in the study wetlands, fish are sampled during early fall (August-October). Sampling is also restricted to periods of similar tides and as congruent as possible in timing across all wetlands. Given the logistical difficulties of sampling at night and the tight correlation between daytime and nighttime samples (Merkel & Associates, Inc. 2002), fish are sampled only during daytime.

The total number of fish collected are standardized to 1 m^2 for each enclosure or beach seine haul. The number of hauls per method (seine, enclosure) is averaged for each tidal creek or main channel location. The methods are then summed get the fish density per location (n = 6 replicate estimates of fish density per 1 m^2 in each habitat per wetland). Species richness is determined as the number of unique species for each tidal creek or main channel replicate. These replicate values for density and species richness are used to calculate the means and standard errors used to evaluate similarity in total density and species richness of fish in tidal creeks and main channel-basin habitats between the restored and reference wetlands in a given year.

8**. Macroinvertebrates**

WITHIN 4 YEARS OF CONSTRUCTION, THE TOTAL DENSITIES AND NUMBER OF SPECIES OF MACROINVERTEBRATES SHALL BE SIMILAR TO THE DENSITIES AND NUMBER OF SPECIES IN SIMILAR HABITATS IN THE REFERENCE WETLANDS.

Approach: Macro-invertebrate sampling is conducted in tidal creek and main channel habitats in conjunction with enclosure sampling for fish in early fall. As for fish, these two habitats are evaluated separately. Five stations within each tidal creek or section of main channel sampled by enclosure traps for fish are also sampled for macro-invertebrates (Figures 4, 6, 7, 8). As for fish, sampling locations for macro-invertebrates also shifted over time in response to salt marsh encroachment. See Appendix 3, Figure 1 for an overview of historic changes in tidal creek sampling locations

Three methods are used to sample macro-invertebrates (defined as those specimens retained on a 0.5-mm mesh screen). First, epifauna (e.g., California Horn Snail, *Cerithidea californica*) are sampled by counting individuals within two sets of three-25 x 25 cm quadrats spaced uniformly (low, mid, high elevation) at each enclosure station on the unvegetated banks of tidal creeks and sections of main channel-basin between the lower limit of vegetation (or, if unvegetated, an elevation of ~1.3' NGVG) and the thalweg (i.e., the lowest point of the tidal creek), or the deepest accessible part of the main channel that falls within our sampling area. Second, larger infauna living deeper in the sediments (e.g., Jackknife Clam, *Tagelus californianus*, Ghost Shrimp, *Neotrypaea californiensis*) are sampled adjacent to the quadrats using a 10 cm diameter (large) core pushed into the sediment to a maximum depth of 50 cm. The contents of the 10 cm core are sieved through a 3-mm mesh screen in the field. Animals retained by the 3-mm mesh are identified and counted in the field and returned to the habitat. The contents of the three large cores are combined to form one sample for that station.

Third, smaller invertebrate specimens (e.g., most annelids, *Corophium* amphipods) are sampled using a 3.5-cm diameter (small) core pushed into the sediment to a depth of 6 cm adjacent to the large core samples. The small core samples are returned to the laboratory for processing through a 0.5-mm mesh and preserved in 10% buffered formalin. The small core samples from each station are combined. Specimens are identified and counted under a dissecting microscope and archived in ethanol. Invertebrates are identified to the lowest practical taxon for smaller specimens (e.g., polychaetes, oligochaetes, amphipods) and to species for larger specimens (e.g., bivalves, decapod crustaceans). Density of macroinvertebrates sampled using each method are standardized to number per 100 cm^2 and then combined to obtain a density value for each station.

Estimates of macroinvertebrate density at each station are then averaged for each tidal creek or main channel location (n = 6 replicate estimates of macro-invertebrate density in each habitat per wetland). Species richness of macroinvertebrates is evaluated by recording the number of unique species per tidal creek or section of main channel obtained using all sampling methods, including the seines and enclosures used to sample fish. Species richness is assessed as the mean number of species in the 6 replicate tidal creeks and sections of main channel-basin for each wetland in a year. These replicate values are used to calculate the means and standard errors used to evaluate similarity in total density and species richness of macroinvertebrates in tidal creeks and main channel-basin habitat between the restored and reference wetlands in a given year.

9. **Birds**
WITHIN 4 YEARS OF CONSTRUCTION, THE TOTAL DENSITIES AND NUMBER OF SPECIES OF BIRDS SHALL BE SIMILAR TO THE DENSITIES AND NUMBER OF SPECIES IN SIMILAR HABITATS IN THE REFERENCE WETLANDS.

<u>Approach</u>: Birds are sampled by visually identifying and counting (using binoculars or spotting scope) all individuals sighted within 20 replicate 100 m x 150 m (1.5 ha) plots spread across each wetland. The observer walks along the landward edge of the plot or to an access point that is in close proximity to the plot in order to obtain the best field of view and light conditions.

The time spent identifying and counting birds within each plot is 5 minutes to standardize sampling effort. Birds overflying the plots are counted if they are within 30 m above the plot area. Weather conditions are evaluated at the beginning of each sampling period and sampling is not conducted when weather conditions affect either bird behavior or the visual acuity of the observer. In general, sampling is not conducted under the following conditions: (1) precipitation or heavy fog, (2) winds exceeding 15 mph, or (3) temperatures below 40° F. Nor is sampling conducted when disturbances affect the movement or behavior of birds. Bird sampling is conducted during the same period of the tide cycle (falling and low tide) at all wetlands to reduce the potential effects of this variable on bird abundance. All wetlands are sampled within a few days of one another to reduce the potential effects of factors that might vary among wetlands over time, such as weather, on bird density and species richness.

Bird assemblages in coastal wetlands of southern California exhibit strong seasonal patterns in species richness and density that are driven by the movement of migratory birds. Sampling observations are made during three periods: winter (January, February), spring (April, May), and fall (October, November) that have high bird densities and distinctive species composition. Based on analyses of existing wetland bird data and discussion with bird experts, six sampling surveys are made in each wetland during each seasonal period with 3 surveys taken within each month of each period. Surveys within southern (Tijuana Estuary or Los Peñasquitos Lagoon, San Dieguito Wetlands) and northern (Mugu Lagoon, Carpinteria Salt Marsh) sites are conducted on alternating days (e.g., day 1 = San Dieguito Wetlands, day 2 = Tijuana Estuary, day 3 = San Dieguito Wetlands, day 4 = Tijuana Estuary, etc.).

The number of birds counted within each 1.5 ha plot is averaged across the 18 survey dates (3 periods x 6 surveys per period for each wetland) in a given year to produce an annual mean value for the density of birds in that plot (i.e., number of individuals 1.5 ha^{-1}). The total number of unique bird species observed in a plot is accumulated over all 18 survey dates in a given year to produce an annual mean value for bird species richness of that plot for that year. Yearly mean total densities and mean species richness of birds within each wetland are computed using the 20 plots as replicates for each wetland and these values are used for evaluating similarity between the restored and reference wetlands.

10. **Vegetation**

THE PROPORTION OF TOTAL VEGETATION COVER AND OPEN SPACE IN THE MARSH SHALL BE SIMILAR TO THOSE PROPORTIONS FOUND IN THE REFERENCES SITES.

Approach: The percent cover of salt marsh vegetation is evaluated in the restored and reference wetlands in 10 m x 10 m grid squares classified as salt marsh habitat as defined above (Section 3.2.2, Habitat Areas). Estimates of the percent cover of salt marsh vegetation in San Dieguito Wetlands and the reference wetlands are made using aerial imagery taken annually in the red green blue (RGB) and near-infrared (NIR) spectrum at a target resolution of 20 cm x 20 cm pixel size in the late spring or summer to capture the period of peak marsh vegetation biomass. Because the ability to classify ground cover type based on spectral data varies with weather conditions, data obtained from the aerial images are calibrated for each survey. Surveyed benchmarks visible from the air are established throughout each wetland to facilitate geo-referencing of the aerial photographs. The full classification of the aerial images is also inspected at a subset of georeferenced locations to confirm the classification. Mean percent cover of vegetation in the restored and reference wetlands is computed within the 10 m x 10 m grid squares. Since all of the salt marsh habitat is censused in each wetland, comparisons of vegetation cover among wetlands are made using mean values. The San Dieguito Wetlands Restoration project meets this performance standard if the average percent cover of salt marsh vegetation within the restored wetland is not lower than that in the reference wetlands.

11. **Algae**

THE PERCENT COVER OF ALGAE SHALL BE SIMILAR TO THE PERCENT COVER FOUND IN THE REFERENCE SITES.

Approach: The algal performance standard ensures that the development of dense mats of filamentous green macroalgae in the restoration site does not exceed that of reference wetlands. Thick mats of algae have the potential to interfere with wetland structure and function by smothering benthic invertebrates and inhibiting bird feeding on mudflats (Everett 1991, Green et al. 2013). Decomposing mats of algae in open water and on salt marsh vegetation can also adversely affect water quality and the survival of marsh and submerged aquatic vegetation. Estimates of the areas of algal mats are calculated from the classified pixel data of aerial images that cover the entire area of interest at each wetland (Section 3.2.10). Since excessive algal growth can be detrimental, the percent cover of macroalgae in the restored wetland must be lower than that of the reference wetland with the highest cover of macroalgae. All grid areas are censused in each wetland and comparisons of the percent cover of algae among wetlands are based on the mean percent cover averaged over all grid areas of wetland area of interest.

To adaptively manage for the excessive growth of macroalgae, qualitative observations for the presence of algal mats are made during routine water quality monitoring (see Section 3.2.6). Should excessive algal growth be observed at the restoration site relative to the reference sites, measurements of potential factors (e.g., nutrients, tidal flow) that may contribute to mat formation will be made at the restored site to inform a course of action to reduce algal growth.

12. **Spartina canopy architecture**

THE RESTORED WETLAND SHALL HAVE A CANOPY ARCHITECTURE THAT IS SIMILAR IN DISTRIBUTION TO THE REFERENCE SITES, WITH AN EQUIVALENT PROPORTION OF STEMS OVER 3 FEET TALL.

Approach: The canopy of the marsh cordgrass *Spartina foliosa* provides habitat for the state and federally-listed endangered Ridgeway's Rail and other bird species, and canopy heights > 3 feet provide nesting habitat for Ridgeway's Rail (Zedler 1993). The number and height of stems of *S. foliosa* in the restored wetland and in reference wetlands are assessed in 0.1 m^2 circular quadrats placed over the cordgrass every 2 m along a 20 m long transect line extending parallel to the water line and through at least three stands of cordgrass based on the methods developed by Zedler (1993). Maximum heights (excluding flowering stalks) of all stems present in the quadrat are recorded and the mean proportion of stems >3 feet tall is determined for each cordgrass stand. These mean values serve as replicates to compare the similarity in the mean proportion of stems >3 feet tall in the restored wetland to the reference wetlands where sufficient stands of *S. foliosa* exists. Suitable stands of *S. foliosa* for comparison to San Dieguito Wetlands currently occur only in Mugu Lagoon. From 2012-2023, *S. foliosa* stands at San Dieguito Wetlands and Tijuana Estuary were used to assess this performance standard. *S. foliosa* has also been measured at Mugu Lagoon since 2018. Beginning in 2024, when Tijuana Estuary was no longer considered to be an appropriate reference, Mugu Lagoon was included as a reference site for assessing this standard. See Figure 9 for maps of sampling locations at San Dieguito Wetlands and Mugu Lagoon; transect locations at Mugu Lagoon were updated in 2024. *S. foliosa* does not occur in Carpinteria Salt Marsh and is sparse in Los Peñasquitos Lagoon.

13. **Food chain support**

THE FOOD CHAIN SUPPORT PROVIDED TO BIRDS SHALL BE SIMILAR TO THAT PROVIDED BY THE REFERENCE SITES, AS DETERMINED BY FEEDING ACTIVITY OF THE BIRDS.

Approach: The invertebrates and fish inhabiting tidal wetlands provide food for resident and migratory birds. Measurements of food chain support (FCS) provided by the restored wetland to birds is conducted at the same time that birds are sampled to determine bird density and species richness (see Section 3.2.9). This performance standard is evaluated using the density of shorebirds feeding within fixed plots located in mudflat or unvegetated tidal channels. A bird is recorded as feeding if one feeding attempt is made during a 5-minute time interval. Feeding observations are made on shorebirds typically found in all of the study wetlands (e.g., willet, marbled godwit, dowitcher; Table 2). Observations are conducted during similar tide conditions across wetlands to account for the influence of tide height on bird feeding activity.

To ensure that each wetland is weighted equally, the densities of feeding birds are averaged across sample dates for each plot in a given year, and the average is resampled with replacement 20 times (20 being the targeted sample size). This process is iterated 1000 times, and the mean for each iteration is calculated to produce a dataset of 1000 FCS values for each wetland for a given year.

The four-year running median of the FCS values for each wetland is calculated using a four-year mean of each iteration based on the current year and the previous three years producing 1000 values of the four-year average of the FCS values for each wetland. The four-year median and standard deviation of the FCS values for each wetland is calculated from the resampled distribution of these 1000 values. The four-year running median of the FCS value at San Dieguito Wetland must be similar to that at the reference wetlands (as per the methods described in Section 2.3) for the San Dieguito Wetland to meet this performance standard for any given year.

3.2 Strategy for dealing with unusual events.

An unusual or unforeseen anthropogenic event may result in the loss of wetland habitat and/or biota at sampling locations within the reference wetlands. Such events would render all or portions of the reference sites inappropriate as comparisons for judging the performance of the restored wetland. An example of such an event might be the loss of sampled habitat due to large-scale dredging operations.

If such an unusual event occurred at one of the reference sites during the monitoring period of the San Dieguito Wetlands Restoration project, then the following strategy will be employed:

1. To the extent possible, sampling stations lost or damaged due to human activities will be replaced with stations suitable for use as a reference using the same criteria used for placement as described above (see Section *2.2*).
2. If the amount of suitable wetland habitat in a reference wetland declines to a point where there are an insufficient number of stations to evaluate a performance standard, then this wetland will be replaced, if possible, with a different reference wetland that contains a similar mix of suitable wetland habitat as the remaining reference wetlands.

This strategy for dealing with unusual events was implemented in 2024 following the severe degradation of water quality and public health concerns in Tijuana Estuary when large inputs of raw sewage during the rains of 2023 rendered this wetland unsuitable as a reference site and necessitated its replacement. After a consideration of available options, Los Peñasquitos Lagoon was selected in 2024 as the wetland that best met the criteria for reference site selection provided in the SONGS permit. Los Peñasquitos Lagoon was not selected as a reference site initially because the inlet was intermittently closed. However, more recently the inlet has been maintained in an open condition, meeting an important criterion for reference site selection.

4.0 DATA MANAGEMENT

Data management protocols for the wetland mitigation project will follow those developed for the reef mitigation project and are outlined below.

4.1 Daily Field and Data Transfer Procedures

Data management and quality assurance procedures for the wetland mitigation project begin in the field. Upon completion of each field activity, data sheets are checked for completeness and legibility. After these field checks are completed, the data sheets are filed into a field binder for transport back to the laboratory. Upon arrival at the laboratory, data sheets are checked into a survey log that contains entries for the observer, date, and survey location. The log is used to verify that all data assignments for a day have been completed, and all field data have been accounted for.

Data consistency is also verified during the check-in procedure, and any anomalies are brought to the attention of the field supervisor. Senior staff members examine the data sheets for possible misidentification of species, missing data values, and invalid counts. The field supervisor decides how to rectify any errors and implements corrective action to avoid repeating mistakes in the field. Such actions have included retaking data, and providing additional field training for investigators.

4.2 Data Entry and Quality Assurance

All SONGS Mitigation Monitoring data are entered and stored in electronic databases based on Structured Query Language (SQL). The monitoring project's data entry procedures have been designed to facilitate rapid data entry while continuing to ensure the quality and integrity of the data as they are transformed from physical to electronic form.

The vast majority of monitoring data are entered using custom designed web forms. These web forms provide an intuitive, graphical user interface to the project's databases. Each form mimics the exact layout of the data sheets taken into the field, which allows the individual entering the data to electronically transcribe a sheet without replicating key variable entries, or manipulating columns, rows, or formats. Such tasks are processed on the project's internal web server, which translates the form data into the appropriate format for storage on the project's data servers. In some cases, these forms can reduce the amount of data a user is required to enter by over 100 fields for a single data sheet, which translates to significant time savings.

This entry system also allows the implementation of a multi-tiered checking system. Data entered using the web forms are verified in three distinct phases before any information is considered suitable for the final phase databases on which all analyses are done.

1. First, database structure (i.e., foreign key constraints) restricts the values that can be entered into a data table (e.g., the observer entry cell contains only valid entries for observer's names).
2. Second, each data entry web form executes a number of value (e.g., recognizing invalid data lengths, out of range values, and incorrect formats) and logical (e.g., sampling dates for a given location are checked against the dates recorded into the sampling log) checks before attempting to insert the data into the database tables. Failure of any of these checks prevents the form from being submitted and alerts the user of the error. The system requires errors to be corrected for a form to be successfully submitted.
3. Finally, a third filter occurs on the project's internal web server. After a form is successfully submitted, the web server will normalize the data and check that each data row does not violate any constraint built into the database. If any line of the form fails these tests, the entire form will be rejected until the invalid entry is corrected.

This three-phase checking system has greatly reduced the time required for post-entry data checking procedures by eliminating the most common data entry errors. This system has also substantially reduced the number of data checking programs previously required to find these problems, in some cases by as much as 75%.

Two final steps convert the electronically checked databases into the final databases. First, pairs of investigators manually check each data line of the database tables against the field data sheets for correct values. Once these checks are complete, the data are transferred to a production database that contains all fully checked and verified data. Data from the production database are merged onto a template that populates the data for zero value observations. The templates also contain all pertinent metadata (variable descriptions and sampling methods), which are checked thoroughly prior to posting. At this stage, databases are considered to be in their final form and suitable for analysis.

4.3 Data Storage and Preservation

After the physical data are entered and checked, each data sheet is scanned and converted into a PDF file for electronic storage. The material sheets are then filed in binders by survey type and year, and then added to the monitoring data library located at UCSB's SONGS mitigation office and laboratory in Carlsbad, CA. The PDF data sheets are similarly filed in an electronic library located on the project's data servers.

The project uses a mixture of local and cloud-based servers to manage its data assets. These assets generally fall under a few distinct categories, which are used to determine both the method of management location as well as backup and preservation.

For example, project databases are managed locally, and employ a highly redundant, multi-server system to ensure maximum data integrity, preservation, and uptime. The system consists of a central data server with multiple mirror servers located at UCSB's Carlsbad office, and data backups (in comma delimited format) geographically distributed in cloud storage.

Regular documents (e.g., documents, PDFs, spreadsheets) are managed though cloud-based storage, where they are differentially backed up in native format. Statistical and database program files are managed by a mixture of local and cloud-based servers, and are backed up every hour in native format, and daily to cloud storage in native format.

Local daily backups are written to a redundant disk array. All valid users for the system can access daily backups of regular documents and statistical or database program files, however, the restoration of SQL database files must be done by a system administrator.

5.0 DISSEMINATION OF RESULTS

The following procedures are followed to ensure efficient and effective communication with SCE, state and federal resource agencies and the general public: (1) CCC contract scientists communicate with SCE and state and federal agencies as needed via phone, email, and in-person meetings to discuss results and any potential changes in monitoring design, (2) status reports are prepared and submitted to the CCC for public viewing on an annual basis, (3) project related documents are downloadable from the project's public website https://marinemitigation.msi.ucsb.edu/ which also provides information on the history, current status, contact information, and other relevant material pertaining to the monitoring of the SONGS wetland mitigation project, (4) all monitoring data are deposited annually into the Environmental Data Initiative (EDI) repository (https://portal.edirepository.org) after they have been verified and are freely accessible to the public via the project's website or EDI's data portal (using the keywords: UCSB SONGS), and (5) as per Condition D of the SONGS permit, duly noticed annual public workshops are convened to review the overall status of the project, identify problems and make recommendations for solving them, and review activities planned for the following year.

6.0 MANAGEMENT OF THE MITIGATION SITE

The SONGS wetland restoration project (San Dieguito Wetlands Restoration Project) at San Dieguito Lagoon is only part (albeit an important part) of a larger master plan to restore and enhance the San Dieguito River Valley (JPA, 2000). Restoration of non-tidal wetlands and upland habitat, and provisions for public access and viewing are included in the San Dieguito River Park Master Plan. Many tasks and programs typically listed in such management plans (e.g., public outreach, watershed management, future land acquisition) are beyond the scope of the SONGS mitigation project, while other tasks (e.g., response to catastrophic events, routine removal of trash and debris, mosquito control) require managed coordinated efforts throughout the entire river park, which is in itself a task that is typically included in the management plans of most ecological reserves. Discussed below are management issues relevant to the SONGS mitigation requirement of creating or substantially restoring 150 acres of tidal wetland that is similar in structure and function to natural undisturbed wetlands in the Southern California Bight.

6.1. Inlet Management

As required by the SONGS permit, SCE has a plan for managing the inlet in perpetuity (SCE 2005). The plan calls for regular monitoring and dredging of the San Dieguito River inlet channel, if necessary, to ensure uninterrupted tidal flushing of the restored wetland and provides conditions that would trigger the need for additional maintenance dredging. Data on the depth and width of the inlet channel collected by SCE are used to determine whether the inlet channel is maintained in an “as designed” condition. If the data indicate substantial sedimentation has occurred in the inlet channel, then maintenance dredging will be implemented to reconfigure the channel to its as designed condition SCE’s current permit allows for the excavation of 16,000 cubic yards of sediment per inlet dredging effort. To date, the inlet has been proactively dredged approximately every 2-3 years following construction in 2011 (2015, 2017, 2019, 2022, 2024).

7.0 CONSTRUCTION IMPACT MONITORING

Conduct surveys to determine if transition habitat may be used to mitigate for impacts to seasonal salt marsh caused by construction.

Areas between elevations of 4.5 ft and 5.0 ft NGVD are defined in the Final Restoration Plan (SCE 2005) as a transitional zone between tidal wetlands and non-tidal or seasonal wetland habitats. In accordance with CDP 6-04-088, Coastal Commission Staff determined that transition zone acreage can be used to offset impacts to seasonal salt marsh that occurred during wetland construction provided that the cover of native salt marsh and non-native plants within this zone meets the performance criteria outlined below.

To determine if SCE is in compliance with the tidal wetland acreage requirement (acres below 4.5’ NGVD), it is necessary to estimate the error associated with the topographic surveys of the 4.5’ NGVD contour made using a RTK (Real-Time Kinematic)-GPS (Global Positioning System) instrument (ESA 2025). CCC contractors estimated measurement error of the 4.5’ NGVD contour surveys over the entire site using the acreages calculated from annual surveys repeated over time, excluding areas of obvious berm erosion/sloughing in a portion of W16 in 2012. The variation between survey years suggests an error of 0.75 acres over the entire site.

If the area of tidal habitat determined by the location of the 4.5’ NGVD contour is 0.75 acres or more below the 150-acre requirement, then data on vegetation type and cover will be collected in the summer-fall in the constructed transition zone and compared to reference site data to determine if transition zone acreage can be used to offset impacts to seasonal salt marsh.

Vegetation type and cover will be determined using point contact sampling at one-meter intervals along approximately 100 -10 m long belt transects situated uniformly around the periphery of the restored wetland in the transition zone. The width of these transects varies with the distance between the 4.5’ and 5.0’ contours, which may differ slightly depending on the slope. Five measurements will be taken at each meter interval perpendicular to the centerline of each transect to achieve 50 sampled points per transect.

Acreage credit will be assigned using the entire transition (approximately 0.9 acres) contingent on the results of a t-test. To receive this acreage credit, the mean cover of native salt marsh vegetation in the transition must be similar to that in the reference seasonal salt marsh as determined using a one-tailed t-test with $\alpha = 0.2$ and $\beta = 0.2$, thus balancing Type I and Type II errors. If the t-test shows significantly less cover of native vegetation in the transitional habitat of the restored site compared with the reference site then no acreage credit will be given.

8.0 REFERENCES

CCC (California Coastal Commission). 1997. San Onofre Nuclear Generating Station (SONGS) Coastal Development Permit 6-81-330-A.

Ecological Society of America (ESA). Hypoxia. https://www.esa.org/esa/wp-content/uploads/2012/12/hypoxia.pdf. Most recent access: January 21, 2021.

Everett, R. A. 1991. Intertidal distribution of infauna in a central California lagoon: the role of seasonal blooms of macroalgae. Journal of Experimental Marine Biology and Ecology 150: 223-247.

Green, L., M. Sutula, and P. Fong. 2013. How much is too much? Identifying benchmarks of adverse effects of macroalgae on the macrofauna in intertidal flats. Ecological Applications.

Hume, T. M. 2005. Tidal prism. In M. L. Schwartz (Ed.) Encyclopedia of coastal science. Springer, Dordrecht, The Netherlands.

JPA. 2000. Park Master Plan for the Coastal Area of the San Dieguito River Valley Regional Open Space Park.

Merkel & Associates, Inc. 2002. Long-term Monitoring and Pilot Revegetation Program for the Batiquitos Lagoon Enhancement Project Annual Report, January-December 2001. M&A Doc.

No. 96-057-01-A01. Prepared for City of Carlsbad Planning Department and Port of Los Angeles, Environmental Management Division. San Diego, California, Annual Report September 2002.

SCE (Southern California Edison Company). 2005. San Dieguito Wetlands Restoration Project: Final Restoration Plan. Submitted to the California Coastal Commission, November 2005.

Steele, M. A., S. C. Schroeter, and H. M. Page. 2006a. Sampling characteristics and biases of enclosure traps for sampling fishes in estuaries. Estuaries and Coasts 29:630–638.

Steele, M. A., S. C. Schroeter, and H. M. Page. 2006b. Sampling characteristics and biases associated with sampling of estuarine fishes with seines. Estuaries and Coasts 29 (6B):1172-1184.

Zedler, J.B. 1993. Canopy architecture of natural and planted cordgrass marshes: selecting habitat evaluation criteria. Ecol. App. 3: 123-138.

Wetland	Stations	Latitude	Longitude	Instrument
San Dieguito Wetland	2	32.971	-117.263	YSI EXO3
Carpinteria Salt Marsh	2	34.401	-119.540	HOBO U26-001 & HOBO U24-002-C
Mugu Lagoon	2	34.110	-119.093	HOBO U26-001 & HOBO U24-002-C
Tijuana Estuary*	1	32.568	-117.131	HOBO U26-001 & HOBO U24-002-C
Los Peñasquitos Lagoon**	1	32.934°	-117.260°	YSI EXO2

Table 1. Water quality station information by wetland. An * indicates a reference wetland used in performance monitoring from 2012-2023 and ** indicates a reference wetland monitored from 2024 to the present. San Dieguito Wetland, Carpinteria Salt Marsh, and Mugu Lagoon have been continuously monitored since 2012.

Common name	**Genus**	**Species**
American Avocet	*Recurvirostra*	*americana*
Black-bellied Plover	*Pluvialis*	*squatarola*
Black-necked Stilt, Hawaiian Stilt	*Himantopus*	*mexicanus*
Dowitcher species	*Limnodromus*	
Dunlin	*Calidris*	*alpina*
Greater Yellowlegs	*Tringa*	*melanoleuca*
Killdeer	*Charadrius*	*vociferus*
Lesser Yellowlegs	*Tringa*	*flavipes*
Long-billed Curlew	*Numenius*	*americanus*
Marbled Godwit	*Limosa*	*fedoa*
Pacific Golden-Plover	*Pluvialis*	*fulva*
Red Knot	*Calidris*	*canutus*
Sanderling	*Calidris*	*alba*
Semipalmated Plover	*Charadrius*	*semipalmatus*
Spotted Sandpiper	*Actitis*	*macularius*
Whimbrel	*Numenius*	*phaeopus*
Willet	*Tringa*	*semipalmata*

Table 2. List of shorebird species used to determine food chain support to birds.

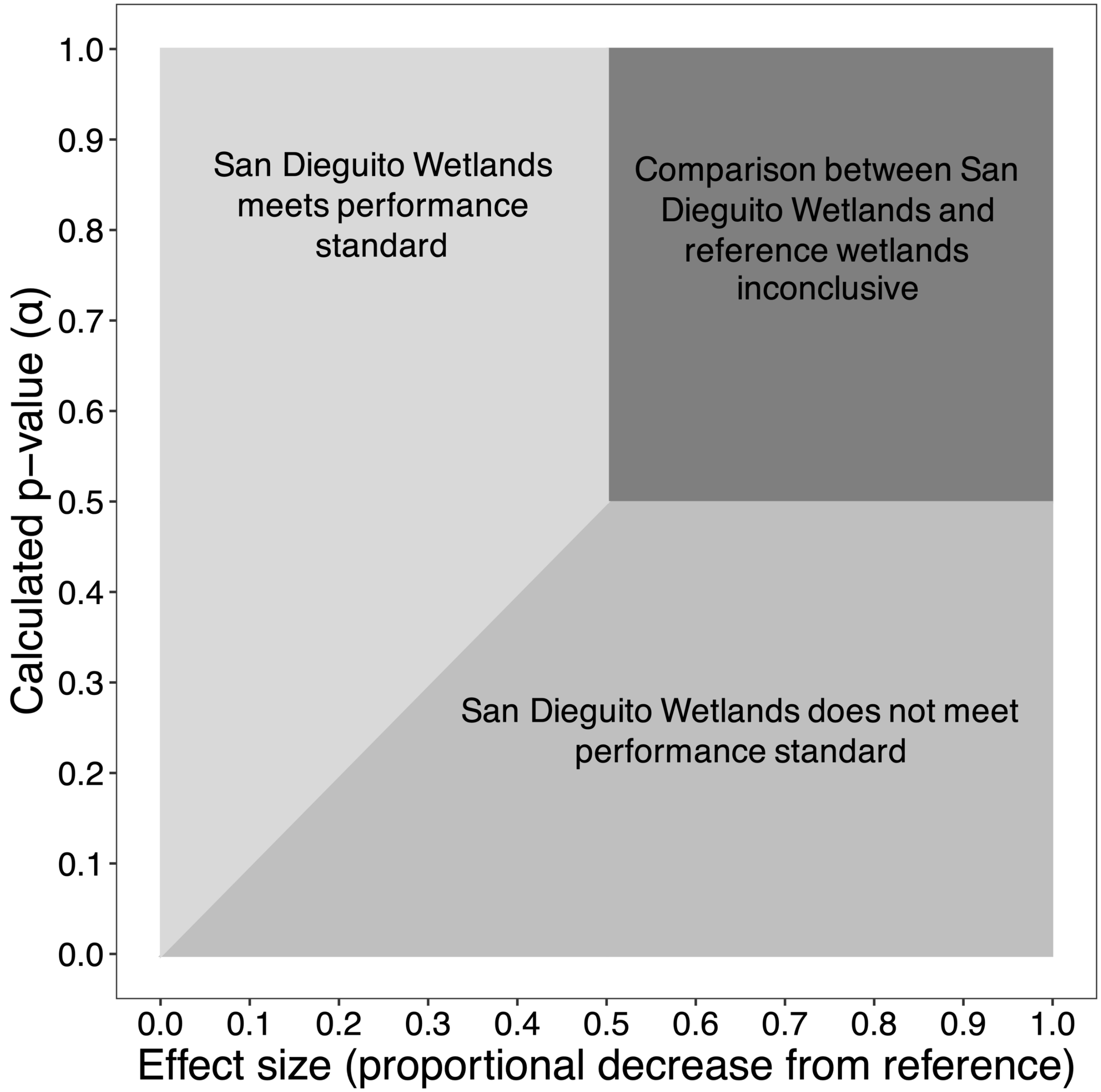

Figure 1. The relationship between effect size and α, and how it is used to determine whether San Dieguito Wetlands meets a given relative performance standard.

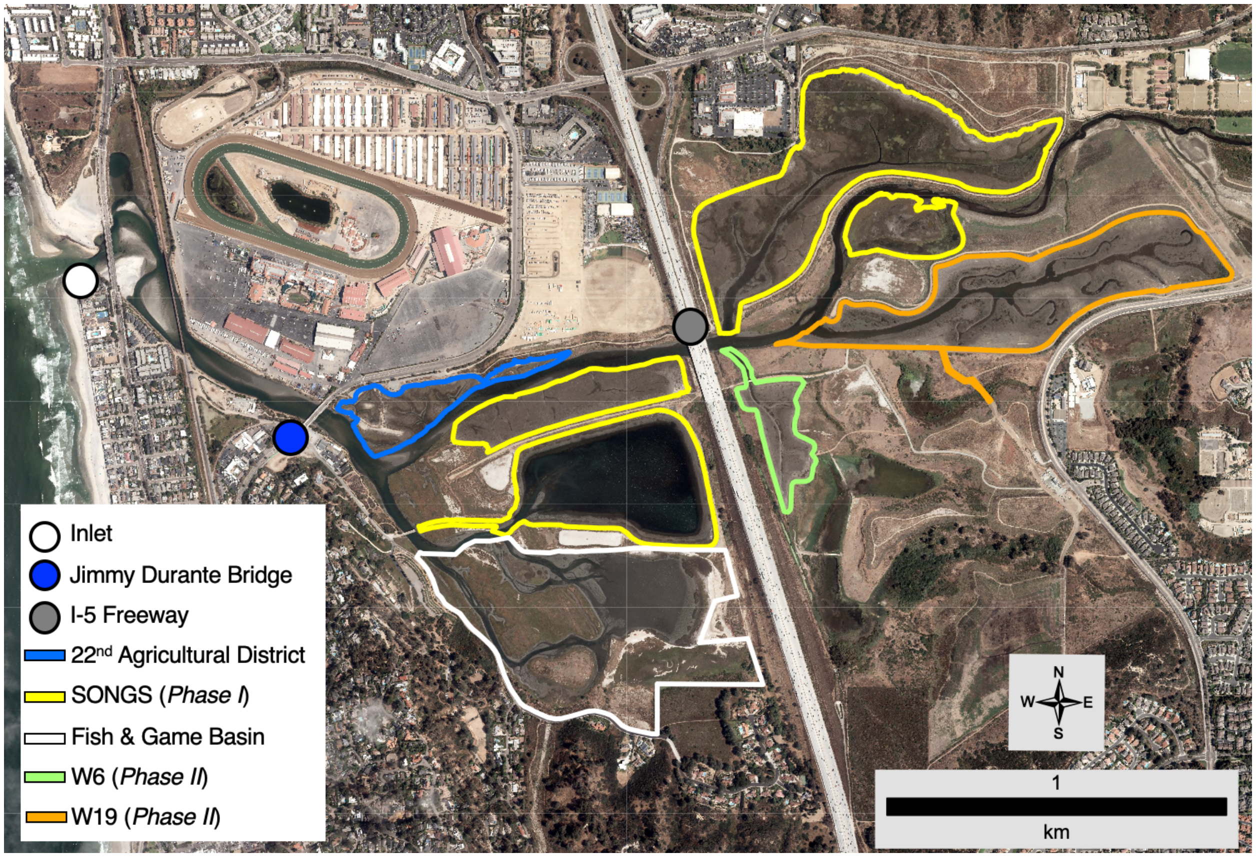

Figure 2. San Dieguito Lagoon site map. San Dieguito Lagoon encompasses multiple restoration projects of various ages and sizes. Shown in yellow is the SONGS Project, also referred to as San Dieguito Wetlands Restoration Project Phase 1 (150 acres), constructed in 2011, managed by Southern California Edison and monitored by the San Onofre Nuclear Generating Station Mitigation Monitoring Program (2012 - Present). Shown in white is the Fish and Game Basin (69 acres), constructed in 1983. Shown in blue is the 22nd Agricultural District Restoration (12 acres), constructed in 2016. Shown in green and orange are the W6 (10 acre) and W19 (49 acre) projects, constructed in 2023 and 2024, respectively. The location of the inlet (white circle), Jimmy Durante Bridge (blue circle), and the I-5 freeway (grey circle) are also marked for reference.

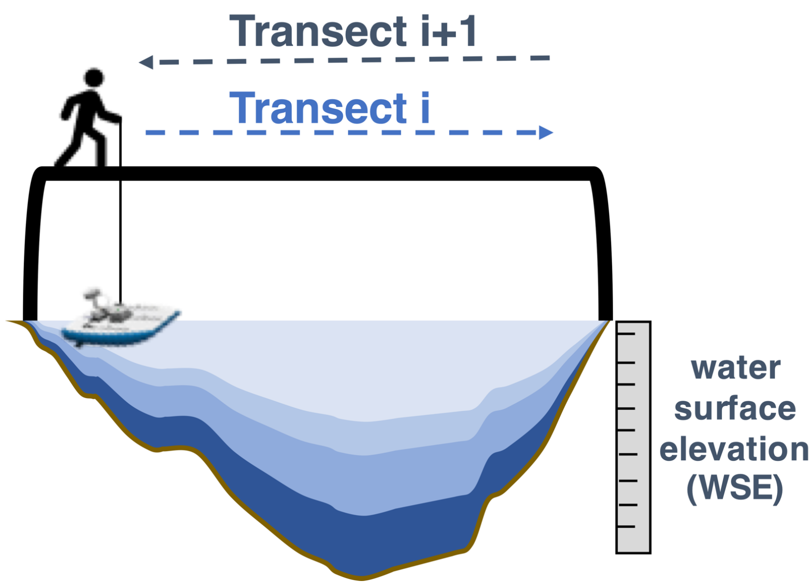

Figure 3. Schematic of tidal prism surveys. Each shade of blue in the channel represents a “slice” of the wetland or a depth, given the bathymetry and topography of the wetland, for which the wetland fills.

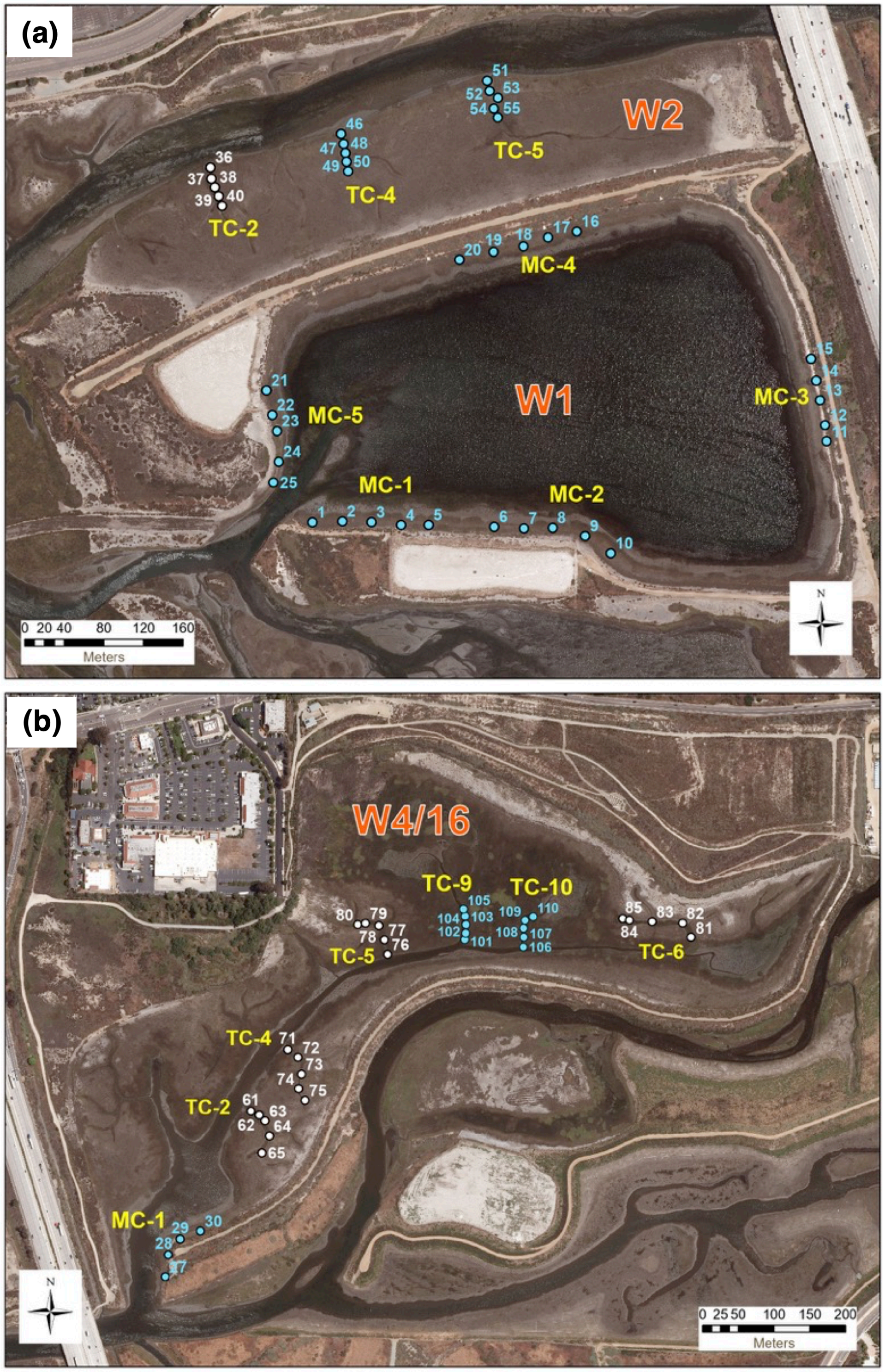

Figure 4. Tidal creeks and sections of main channel sampled for fish and macro-invertebrates in San Dieguito Wetlands a) east side of the Interstate 5 and b) west side of Interstate 5. TC-tidal creek, MC-sections of main channel. See Appendix 3 for updates to sampling locations.

Figure 5. Sampling locations at San Dieguito Wetlands for the 100 x 150 m bird plots used to assess bird density, richness, and food chain support standards.

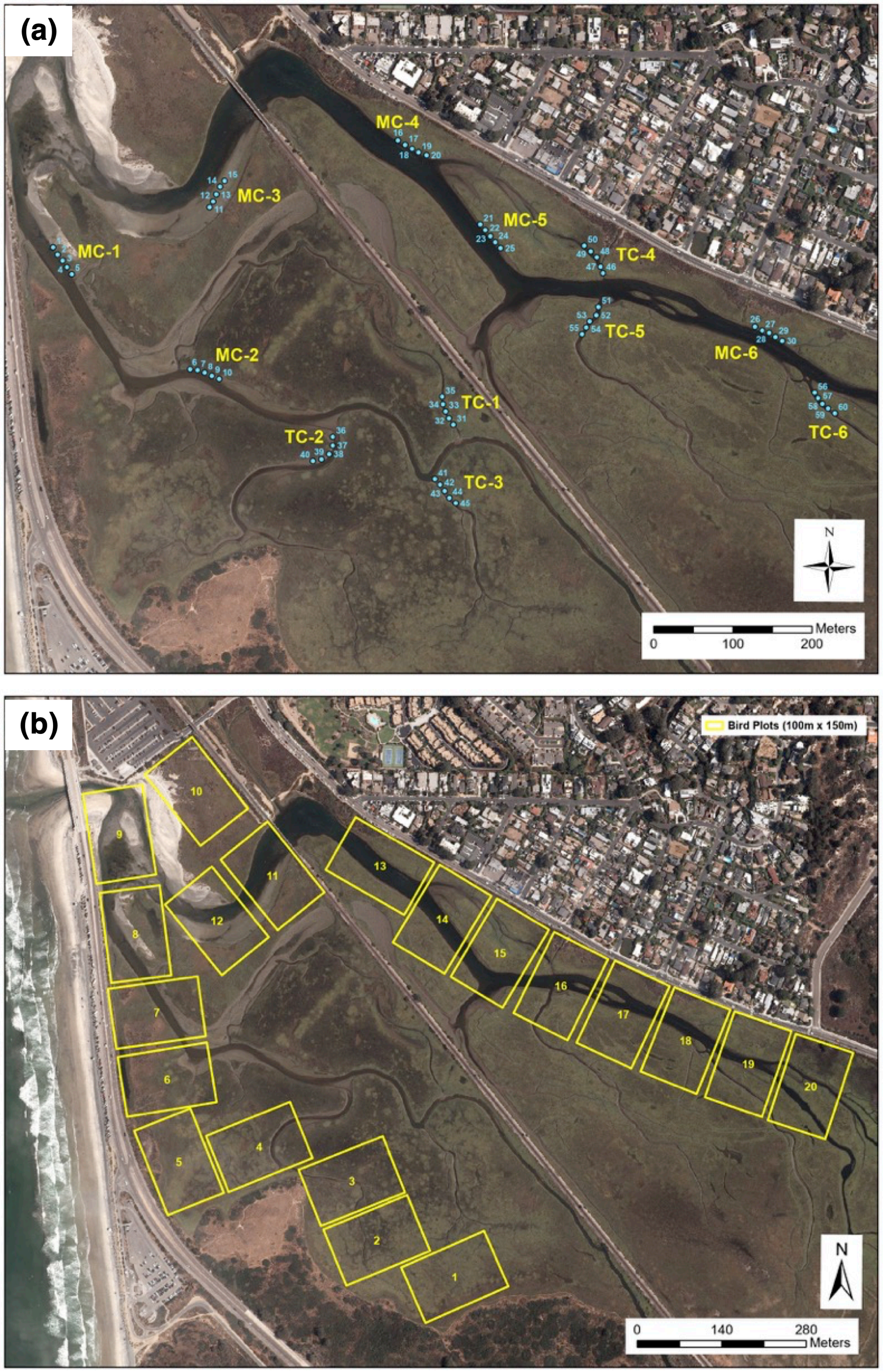

Figure 6. Sampling locations for Los Peñasquitos Lagoon, including (a) enclosure locations for fish and invertebrate standards in main channel (MC) and tidal creek (TC) habitats and (b) 100 x 150 m bird plots used to assess bird density, richness, and food chain support standards.

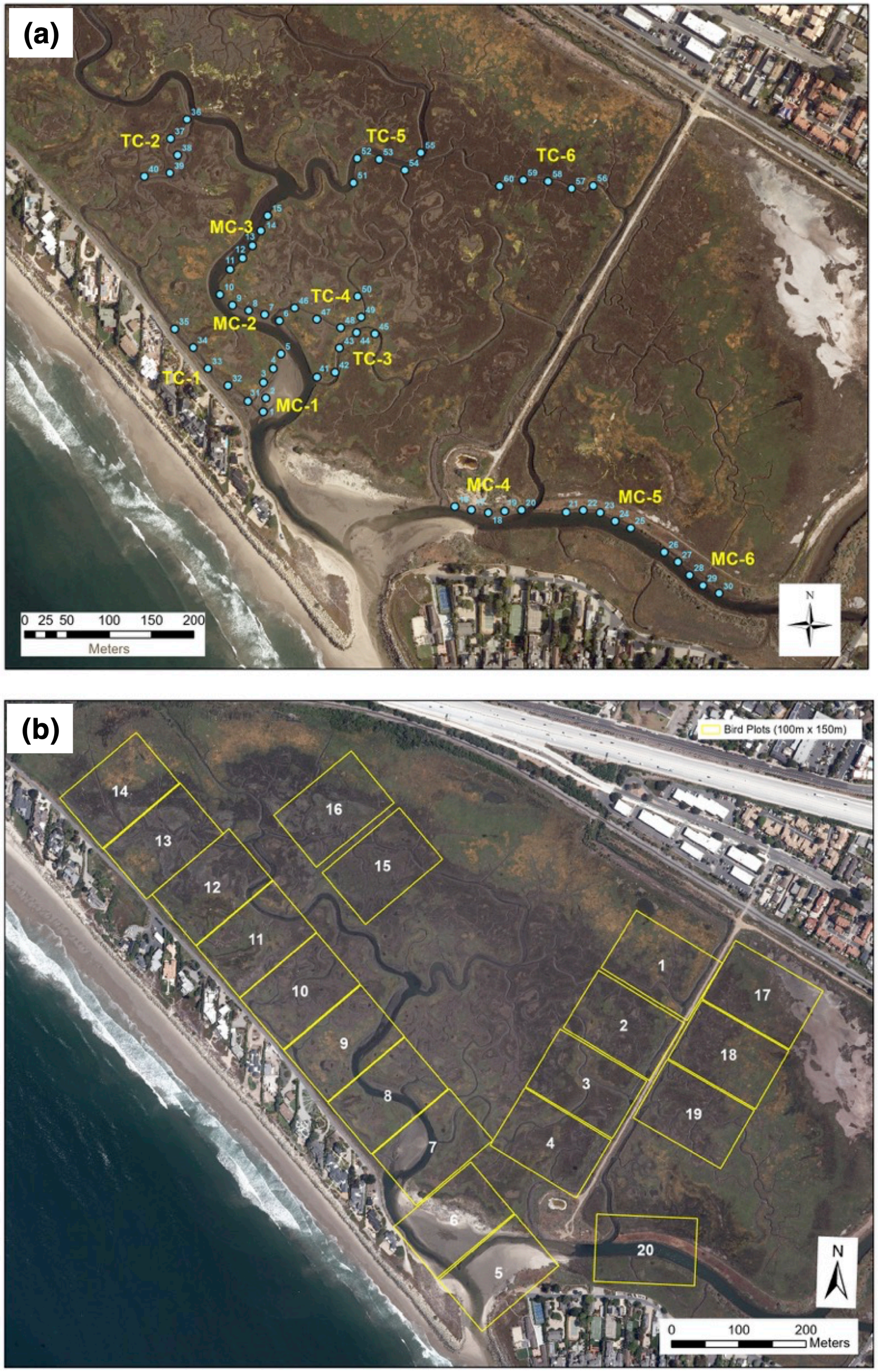

Figure 7. Sampling locations for Carpinteria Salt Marsh, including (a) enclosure locations for fish and invertebrate standards in main channel (MC) and tidal creek (TC) habitats and (b) 100 x 150 m bird plots used to assess bird density, richness, and food chain support standards.

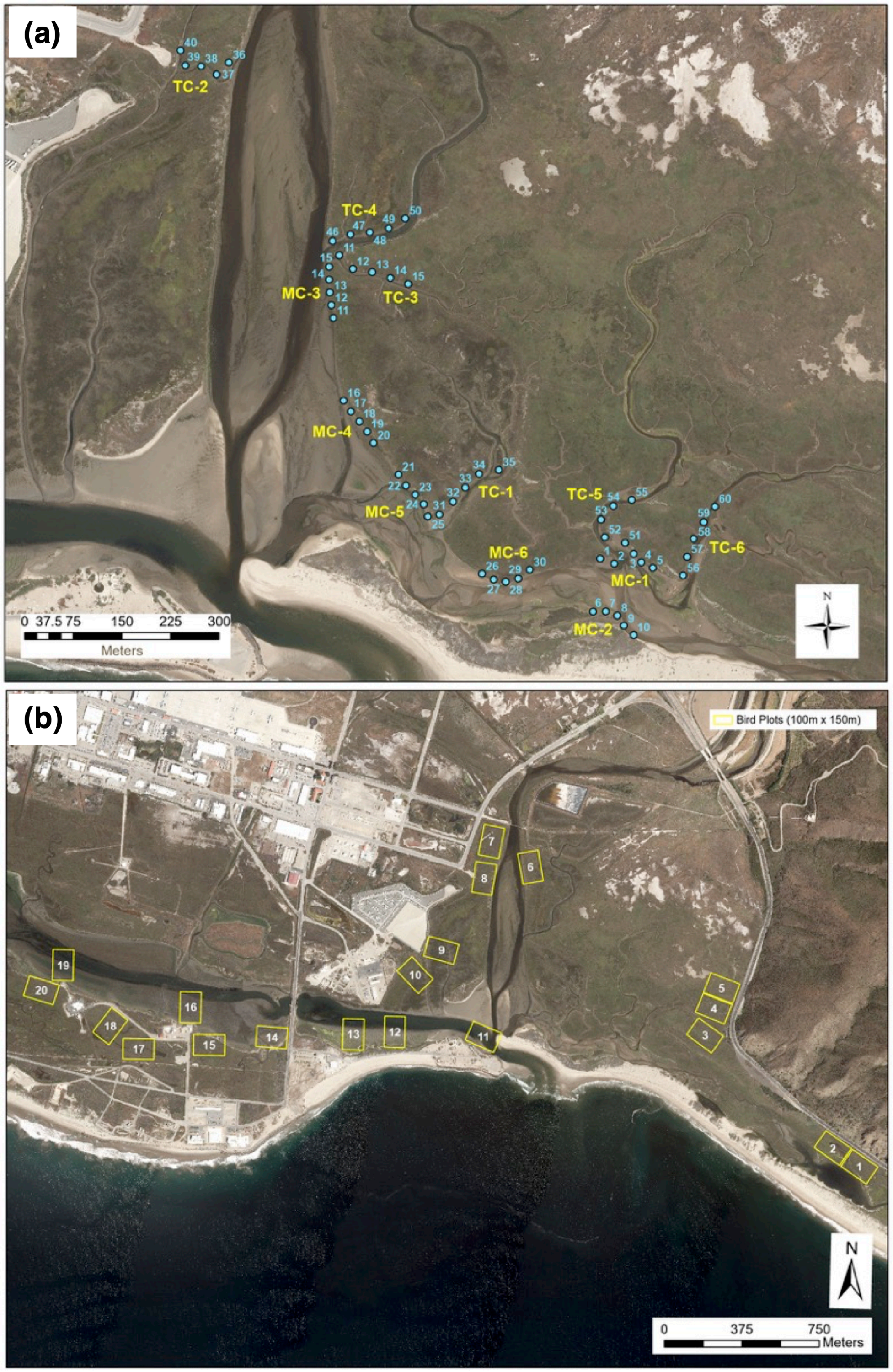

Figure 8. Sampling locations for Mugu Lagoon, including (a) enclosure locations for fish and invertebrate standards in main channel (MC) and tidal creek (TC) habitats and (b) 100 x 150 m bird plots used to assess bird density, richness, and food chain support standards.

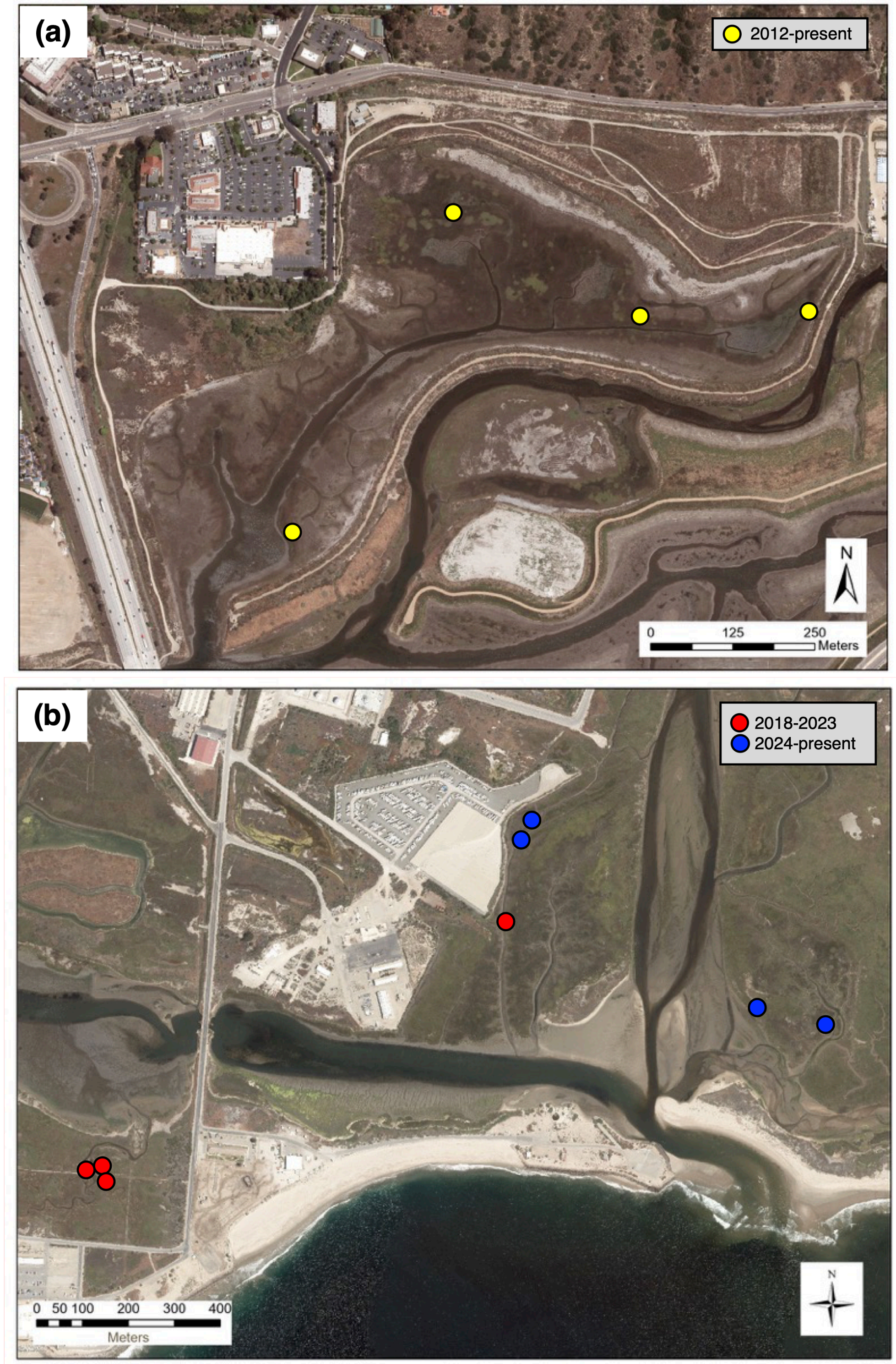

Figure 9. Sampling locations for the *Spartina foliosa* standard at (a) San Dieguito Wetlands and (b) Mugu Lagoon.

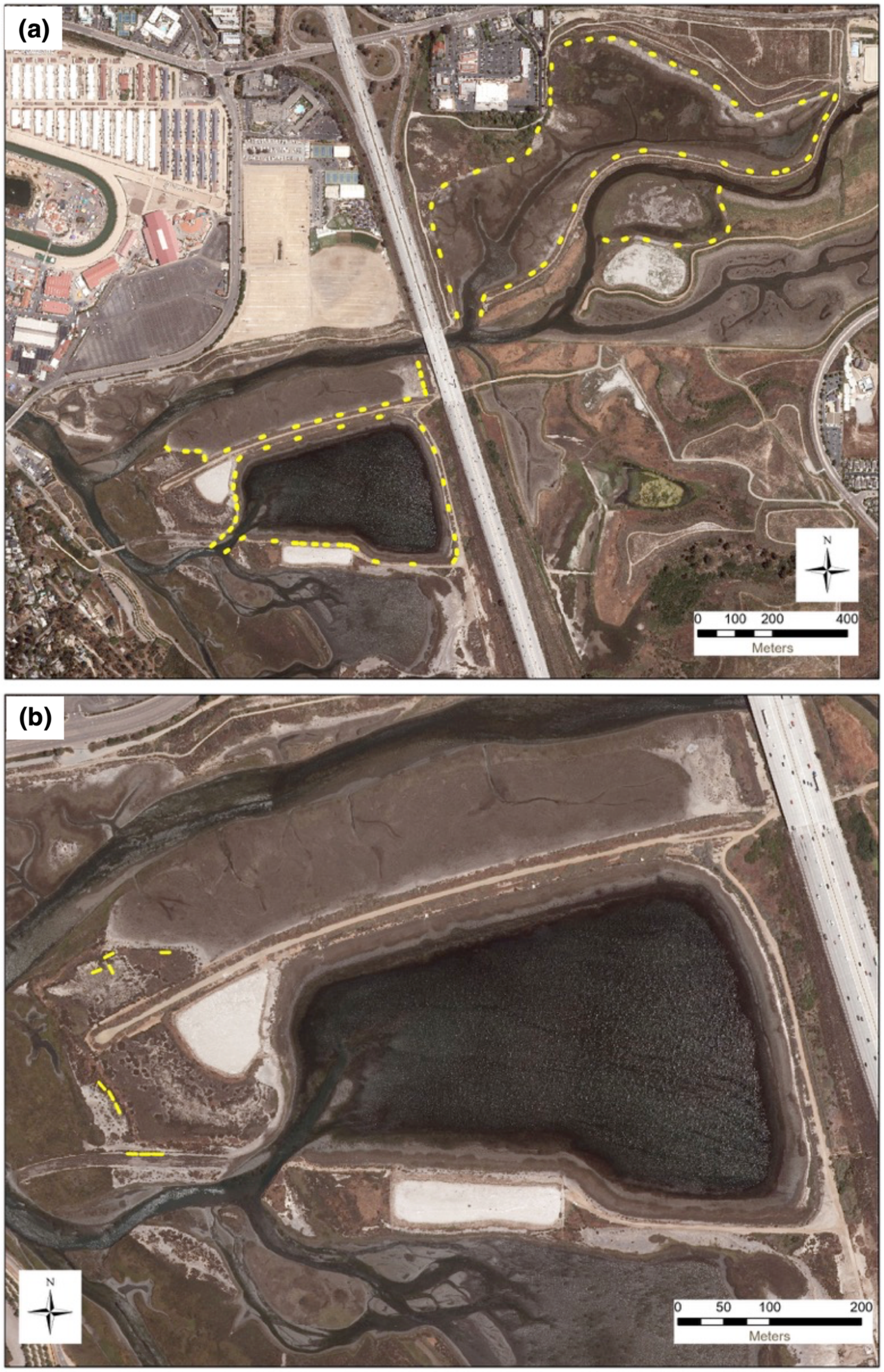

Figure 10. The location of 10 m belt transects in a) the transition zone (4.5 – 5.0 ft NGVD) of the restored San Dieguito Wetlands (n = 100) and b) seasonal marsh used as a reference site (n = 10). The width of belt transects in the transition zone vary in length, depending on the slope between the 4.5 and 5.0 ft contours, whereas the belt transects in the reference seasonal marsh are 0.5 m wide.

Appendix 1

The Definition of Compliance in the Context of the SONGS Mitigation Projects

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EXECUTIVE SUMMARY

The California Coastal Commission (CCC) has required Southern California Edison (SCE) and its partners to construct mitigation projects that provide adequate compensation for the loss of marine resources resulting from the operation of SONGS Units 2 and 3. The CCC is responsible for determining whether these projects are successful. One issue that resides at the core of this determination is the level and duration of performance by the mitigation projects that is needed to achieve compliance with specific conditions of the SONGS coastal development permit. We address this issue below.

The conditions of the SONGS coastal development permit (6-81-330-A) were amended in 1991 to mitigate the adverse impacts of the operation of SONGS Units 2 and 3 on the marine environment. The conditions that were amended to the permit require SCE and its partners to (1) create or substantially restore a minimum of 150 acres of southern California wetlands (Condition A), (2) install fish barrier devices at the power plant (Condition B), and (3) construct an artificial reef large enough to sustain 150 acres of medium to high density kelp bed community (Condition C). A fourth condition (Condition D) requires SCE to fund the Commission's oversight of the mitigation and independent monitoring functions identified in and required by Conditions A, B, and C. Physical and biological standards are identified in conditions A and C that specify how the wetland and reef mitigation projects should perform and the timing and level of monitoring that is needed to evaluate their performance. The specific requirements for attaining compliance of these conditions are discussed in various sections throughout the permit. The purpose of this document is to provide SCE with clear and consistent interpretations of key terms in the SONGS coastal development permit, which provide the basis for assessing compliance of SONGS wetland and reef mitigation projects. We identify the specific sections in the permit that provide support for our interpretations, and provide schedules for the different levels of monitoring that are required to determine whether the wetland and reef mitigation projects are in compliance with Conditions A and C.

INTRODUCTION

The SONGS coastal development permit (6-81-330-A) requires SCE to create or substantially restore a minimum of 150 acres of southern California wetlands (Condition A), and to construct an artificial reef large enough to sustain 150 acres of medium to high density kelp bed community (Condition C). Physical and biological standards are identified in these conditions that specify how the wetland and reef mitigation projects should perform and the timing and level of monitoring that is needed to evaluate their performance is discussed. The purpose of this document is to provide consistent interpretations of key terms in the SONGS coastal development permit (6-81-330-A), which provide the basis for assessing compliance of SONGS wetland and reef mitigation projects. The specific sections in the SONGS permit that provide support for our interpretations are indicated by numerical superscripts in the text and are referenced below (see p. 6 of Appendix 1 Permit language supporting CCC staff's interpretations on SONGS project compliance).

DEFINITIONS

Monitoring Period: Post-construction monitoring will ensue upon completion of the reef construction and wetland restoration[1, 2]. The duration of such monitoring will last for a period not less than the full operating life of SONGS (defined below) plus years monitored without the project attaining compliance with permit standards[2, 3].

Compliance: The condition in which all performance standards are met.

Compliance Period: The number of years that a mitigation project is in compliance. The mitigation requirements will be fulfilled when the compliance period equals the total years of operation of SONGS Units 2 & 3, including decommissioning period to the extent that there is continuing entrainment or impingement or discharge of cooling water[3,4].

MONITORING EFFORT

Mitigation Reef (see Figure 1)

1) *Stage 1: Fully implemented monitoring*: Independent monitoring designed and conducted by CCC staff scientists will be done to evaluate the performance of the mitigation reef[5]. The sampling methodology, analytical techniques, and methods for measuring performance of the mitigation reef relative to the performance standards shall be described in the monitoring plan prepared for the mitigation reef[6]. Monitoring will ensue upon completion of the reef construction[2]. All performance standards must be met within 10 years[7,8]. The project will be considered successful when all the performance standards have been met each year for three consecutive years[9]. Hence, fully implemented monitoring will last a minimum of 10 years. All years that the project is in compliance will count towards the compliance period. The level of sampling effort may be reduced during this stage of monitoring if analyses of the data indicate that compliance of the performance standards can be adequately assessed using less sampling effort. Remediation may be required if the performance standards are not met within ten years and if three consecutive years of compliance has not occurred within 12 years [10, 11]. Note that the Executive Director could prolong this stage of monitoring or reinstate it if necessary following degradation of the artificial reef (resulting in a period of non-compliance) or remediation[12].

2) *Stage 2: Annual site inspections:* Monitoring can be reduced to annual site inspections[13,14], which will serve to identify noncompliance with the performance standards, when:
   - **a.** The project has been in compliance with permit standards for at least three consecutive years, and
   - **b.** The project has been evaluated for at least ten years post-construction.

The schedule for monitoring the mitigation reef project is shown in Figure 1.

Restored Wetland (see Figure 2)

1) *Stage 1: Fully implemented monitoring:* Independent monitoring designed and conducted by CCC staff scientists will be done to evaluate the performance of the wetland restoration project[5]. A description of the monitoring can be found in the wetland monitoring plan and details of the monitoring effort will be set forth in a work plan[15]. Monitoring will ensue upon completion of wetland construction[16]. Within 4 years of construction, the total densities and number of species of fish, macro-invertebrates and birds shall be similar to the densities and number of species in similar habitats in the reference wetlands[17]. All performance standards must be met within 10 years, which is the same amount of time required for the mitigation reef to meet all of the performance standards[7,8]. The wetland restoration project will be considered successful when all the performance standards have been met for each of three consecutive years[9]. All years that the project is in compliance will count towards the compliance period. Remediation may be required if all the performance standards are not met within ten years and if three successive years of compliance has not occurred within 12 years[18]. Note that the Executive Director could prolong this stage of monitoring or reinstate it if necessary following remediation or degradation of the wetland (resulting in a period of non-compliance)[12].

2) *Stage 2: Scaled back monitoring:* Upon determination that the project has been in compliance for three consecutive years, a scaled back stage of monitoring will ensue[14]. The scaled back monitoring program will be designed and implemented by CCC staff scientists[5]. Reduction in effort will be based on analyses of data collected during the period in which the project was in compliance. Staff scientists will examine these data to determine the minimum effort that would have been necessary to assess compliance during the scaled back monitoring period. All monitoring, whether it is fully implemented or scaled back, must be sufficient for assessing compliance of the performance standards.

The schedule for monitoring the wetland restoration project is shown in Figure 2.

REMEDIATION

If the mitigation reef or restored wetland is not considered successful within 12 years post-construction or if the restored wetland has not met the biological community standard by year 4, then (at the discretion of the Executive Director):

1) The permittee shall fund an independent study to collect information needed to determine what remediation is required[19].
2) The permittee shall be required to implement any remedial measures determined necessary by the Executive Director in consultation with state and federal resource agencies and will provide funds for independent monitoring that evaluates the success of the required remediation[10,11,19]. Remediation monitoring may be different from the compliance monitoring required by the permit.

If the mitigation reef or restored wetland is in a period of reduced monitoring and if it falls out of compliance for a period of two consecutive years, then to determine if non-compliance is an artifact resulting from a reduction in monitoring effort, full monitoring (Stage 1) may be re-established for those standards that are out of compliance. If resumption of full monitoring leads to the conclusion that the reduction in monitoring was responsible for non-compliance, then monitoring will remain at the full levels for the duration of the study or until the Executive Director concludes that reduced monitoring could be reinstituted(12). CCC staff scientists will be responsible for designing and implementing the reduced monitoring program(5).

If resumption of full monitoring leads to the conclusion that non-compliance is due to poor performance of the mitigation project then:

1) The permittee shall be required to fund an independent study to collect the information necessary to determine what remediation is needed (19)
2) The permittee shall be required to implement any remedial measures determined necessary by the Executive Director in consultation with state and federal resource agencies and will provide funds for independent monitoring that evaluates the success of the required remediation(10,11,19). Remediation monitoring may be different from the compliance monitoring required by the permit.

Permit (No. 6-81-330-A) language supporting CCC staff's interpretations on SONGS project compliance

1. (III.A.3.4). Upon completion of construction of the wetland, monitoring shall be conducted to measure the success of the wetland in achieving stated restoration goals (as specified in restoration plan) and in achieving performance standards, specified below.

2. (III.B. 2.4). Following completion of construction the mitigation reef shall be monitored for a period equivalent to the operating life of SONGS.

3. (III.A.3.0). Monitoring, management (including maintenance), and remediation shall be conducted over the "full operating life" of SONGS Units 2 and 3**.** Full operating life" as defined in this permit includes past and future years of operation of SONGS units 2 and 3 including the decommissioning period to the extent there are continuing discharges. The number of past operating years at the time the wetland is ultimately constructed, shall be added to the number of future operating years and decommission period, to determine the length of the monitoring, management and remediation requirement.

4. (III.B 2.4). The permittee shall insure that the performance standards and goals set forth in this condition will be met for at least the length of time equivalent to the full operating life of SONGS Units 2 and 3…."Full operating life" as defined in this permit includes past and future years of operation of SONGS Units 2 and 3, including the decommissioning period to the extent there are continuing discharges.

5. (III.C.1.0). Personnel with appropriate scientific or technical training and skills will, under the direction of the Executive Director, oversee the mitigation and monitoring functions identified and required by conditions II-A through C. The Executive Director will retain approximately two scientists and one administrative support staff to perform this function.

This technical staff will oversee the preconstruction and post-construction site assessments, mitigation project design and implementation (conducted by permittee), and monitoring activities (including plan preparation); the field work will be done by contractors under the Executive Director's direction. The contractors will be responsible for collecting the data, analyzing and interpreting it, and reporting to the Executive Director.

6. (III.B.2.4. A monitoring plan for the mitigation reef shall be developed by the Commission staff scientists pursuant to Condition D. The monitoring plan shall be completed within six months of approval of a coastal development permit for the mitigation reef proposed in a final plan developed pursuant to this condition. The monitoring plan shall provide an overall framework to guide the monitoring work. The monitoring plan shall describe the sampling methodology, analytical techniques, and methods for measuring performance of the mitigation reef relative to the performance standards identified below.

7. (III.B.2.4). The independent monitoring program for the mitigation reef shall be designed to assess whether the performance standards have been met. If these standards are met after ten years following the completion of construction, then monitoring can be reduced to annual site inspections.

8. (III.B.2.4). If the standards listed above are not met within ten years after reef construction, then the permittee shall undertake those remedial actions the Executive Director deems appropriate and feasible.

9. (III.C.3.0). The mitigation projects will be successful when all performance standards have been met each year for a three-year period. The Executive Director shall report to the Commission upon determining that all of the performance standards have been met for three years and that the project is deemed successful.

10. (III.B.2.4). The permittee shall undertake necessary remedial actions based on the monitoring results and annual site inspections for the full operating life of the SONGS Units 2 and 3.

11. (III.B.2.4). If the standards listed above are not met within ten years after reef construction, then the permittee shall undertake those remedial actions the Executive Director deems appropriate and feasible.

12. (III.C.3.0). If subsequent monitoring shows that a standard is no longer being met, monitoring may be increased to previous levels, as determined necessary by the Executive Director.

13. (III.B.2.4). The independent monitoring program for the mitigation reef shall be designed to assess whether the performance standards have been met. If these standards are met

after ten years following the completion of construction, then monitoring can be reduced to annual site inspections.

14. (III.C.3.0). If the Commission determines that the performance standards have been met and the project is successful, the monitoring program will be scaled down, as recommended by the Executive Director and approved by the Commission. A public review shall thereafter occur every five years, or sooner if called for by the Executive Director.

15. (III.A.3.1). A monitoring and management plan will be developed in consultation with the permittee and appropriate wildlife agencies, concurrently with the preparation of the restoration plan, to provide an overall framework to guide the monitoring work. It will include an overall description of the studies to be conducted over the course of the monitoring program and a description of management tasks that are anticipated, such as trash removal. Details of the monitoring studies and management tasks will be set forth in a work program.

16. (III.A.3.4). Upon completion of construction of the wetland, monitoring shall be conducted to measure the success of the wetland in achieving stated restoration goals (as specified in restoration plan) and in achieving performance standards.

17. (III.A.3.4.b.1). *Biological Communities.* Within 4 years of construction, the total densities and number of species of fish, macroinvertebrates and birds shall be similar to the densities and number of species in similar habitats in the reference wetlands.

18. (III.A.3.4). The permittee shall be fully responsible for any failure to meet these goals and standards during the full operational years of SONGS Units 2 and 3. Upon determining that the goals or standards are not achieved, the Executive Director shall prescribe remedial measures, after consultation with the permittee, which shall be immediately implemented by the permittee with Commission staff direction. If the permittee does not agree that remediation is necessary, the matter may be set for hearing and disposition by the Commission.

19. (III.B.2.4). Executive Director may also use any other information available to determine whether the performance standards are being met. If information from the annual site inspections or other sources suggests the performance standards are not being met, then the permittee shall be required to fund an independent study to collect the information necessary to determine what remediation is needed. The Executive Director shall determine the required remedial actions based on information from the independent study. The permittee shall be required to implement any remedial measures determined necessary by the Executive Director in consultation with state and federal resource agencies, as well as provide funds for independent monitoring that evaluates the success of the required remediation. As described under the funding option (Condition D) of this permit, the cost of remediation shall not be limited if the permittee elects to implement the mitigation reef.

Figure 1. Idealized monitoring schedule for the mitigation reef showing the minimum time periods for the two stages of monitoring: (1) Fully implemented monitoring and (2) annual site inspection. The actual time periods for each stage may be longer, depending on the performance of the project.

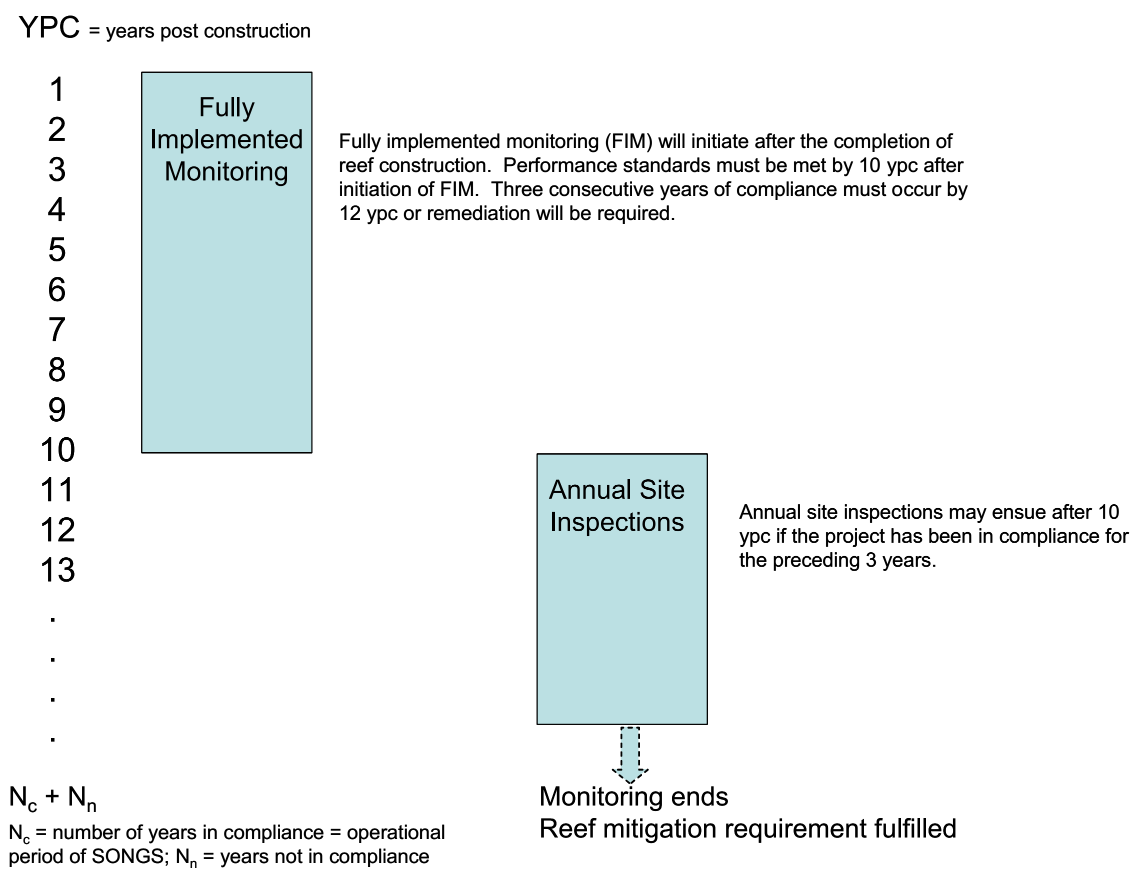
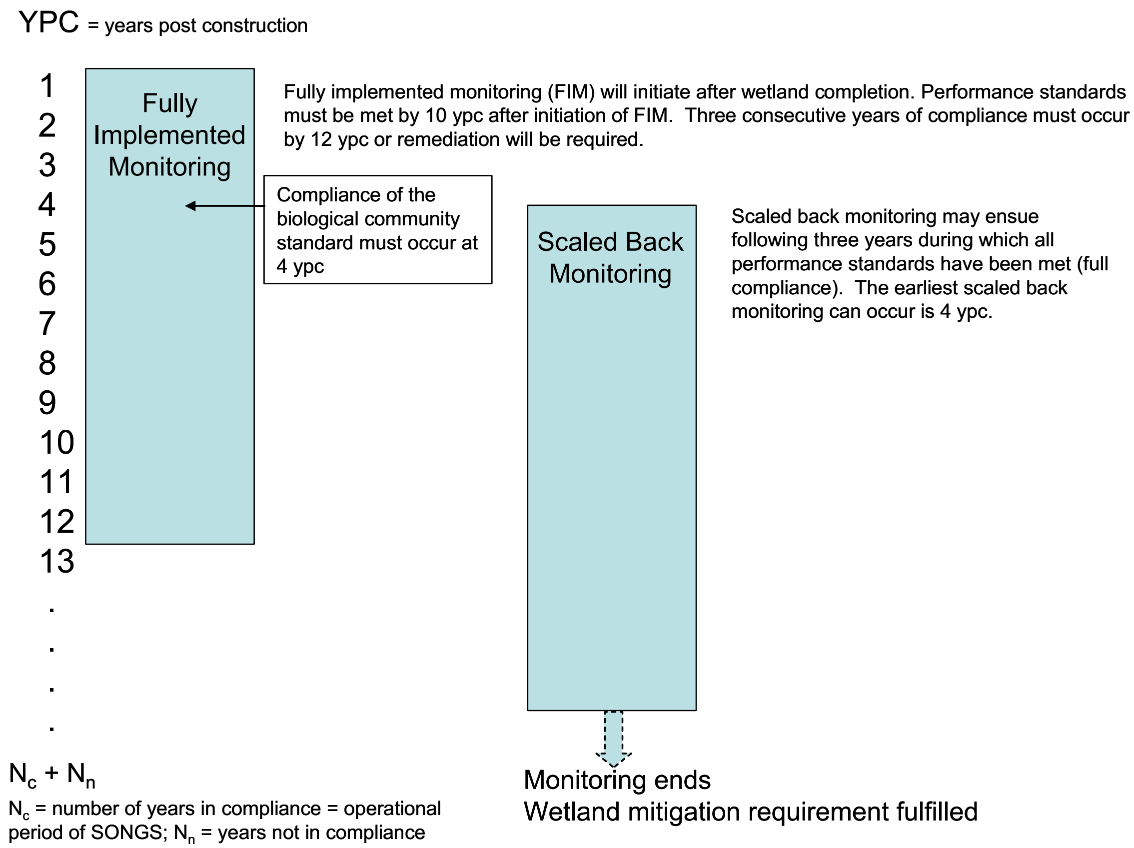


Figure 2. Idealized monitoring schedule for the wetland restoration project showing the minimum time periods for the two stages of monitoring: (1) Fully implemented monitoring and (2) scaled back monitoring. The actual time periods for each stage may be longer, depending on the performance of the project.



Appendix 2

Planned Acres of Subtidal, Mudflat, and Salt Marsh Habitat for the San Dieguito Wetlands Restoration Project as Provided in the Final Restoration Plan (SCE 2005)

Table 1. Table 5.3 from the FRP (SCE 2005) showing planned areas of Subtidal, Mudflat, and Salt Marsh Habitat for the San Dieguito Wetlands Restoration Project. Includes 3.2 acres of mudflat habitat in W16.

Table 5.3 Summary of Net Wetland Habitat Creation - SCE Project Components to Fulfill SONGS Permit Requirements

Habitats	Restored Area (acres)[1] A	Area Required to Compensate for Permanent Impacts (acres)[1,2] B	Area Required to Compensate for Temporary Impacts (acres)[2] C	Net Wetland habitat Creation (acres) A-(B +C)
Tidal Wetland (below +4.5 feet, NGVD)				
Subtidal	32.03	0.00	0.33	31.70
Frequently Flooded Mudflats	11.50	0.00	0.00	11.50
Frequently Exposed Mudflats	10.73	0.00	0.00	10.73
Low Coastal Salt Marsh	17.55	0.08	0.00	17.47
Mid Coastal Salt Marsh	38.37	0.40	2.13	35.84
High Coastal Salt Marsh	21.93	0.56	0.86	20.51
Estuarine Flats Inter Tidal	0.00	0.04	0.00	-0.04
Fresh and Brackish Marsh	0.00	0.08	0.44	-0.52
Riparian Southern Willow	0.00	0.01	0.01	-0.02
Total Tidal Wetland	**132.11**	**1.17**	**3.77**	**127.17**
Nontidal Wetland (above +4.5 feet, NGVD)				
Seasonal Salt marsh	8.65	7.43	14.00	-12.78
Transitional Wetlands	0.82	0.00	0.00	0.82
Estuarine Flats Non Tidal	0.00	0.00	0.21	-0.21
Freshwater Marsh	0.00	0.00	0.00	0.00
Total Nontidal Wetland	**9.47**	**7.43**	**14.21**	**-12.17**
Total Wetland	**141.58**	**8.60**	**17.98**	**115.00**

[1] 4:1 requirement for permanent impacts to B7, B8, NS15, DS32 and Road.
[2] No mitigation is proposed or required for nesting site impacts.

Table 2. Table 4.5 from the FRP (SCE 2005) showing planned areas of Subtidal, Mudflat, and Salt Marsh Habitat for the the Villages Property (W16).

Table 4.5. Summary of Net Wetland Habitat Creation – Villages Project Components[2]

Habitat	*Restored Area (acres)* **A**	*Permanent Wetland Loss (acres)* *B*	*Credits Assigned to Meet SONGS Requirement for SCE Restoration Project (acres)[1]* *C*	*Converted Area (acres)* *D*	*Net Wetland Habitat Creation (acres)* *(A-C)-D*
Tidal Wetland (below +4.5 feet, NGVD)					
Subtidal	0.00	0.00	0.00	0.00	0.00
Frequently Flooded Mudflats	0	0.00	0.00	0.00	0.00
Frequently Exposed Mudflats	5.90	0.00	0.00	0.00	5.90
Low Coastal Salt Marsh	3.60	0.00	0.00	0.00	3.60
Mid Coastal Salt Marsh	4.83	0.00	0.00	0.00	4.83
High Coastal Salt Marsh	6.30	0.00	0.00	0.00	6.30
Fresh and Brackish Water	0.00	0.00	0.00	0.72	-0.72
Total Tidal Wetland	20.63	0.00	0.00	0.72	19.91
Nontidal Wetland (above +4.5 feet, NGVD)					
Seasonal Salt Marsh	0.00	0.00	0.00	5.70	-5.70
Transitional Wetlands	0.14	0.00	0.00	0.00	0.14
Total Nontidal Wetland	0.14	0.00	0.00	5.70	-5.56
Credits Assigned to Meet SONGS Requirement for SCE Restoration Project[1]	0.00	0.00	3.20	0.00	-3.20
Total Wetland	**20.77**	**0.00**	**3.20**	**6.42**	**11.15**

[1] 3.2 acres of the Villages Mitigation Bank will be used to offset permanent wetland impacts from DS32 in order to achieve the 115 acres required for the SCE restoration project.

[2] Based on August 30, 2005 delineation by WRA.

Table 3. Table 5.1 from the FRP (SCE 2005) showing planned areas of Subtidal, Mudflat, and Salt Marsh Habitat including 3.2 acres from W16, but without Villages Property (Table 4.5).

Habitats	**WETLAND HABITAT AREA (ACRES)** *Module No.*									***Total***
	W1	**W2A**	**W2B**	**W3**	**W4**	**W5**	**W10**	**W16**	**W45**	
Subtidal	31.08	-	-	-	0.95	-	-	-	-	**32.03**
Frequently Flooded Mudflats	5.50	-	-	-	6.00	-	-	-	-	**11.50**
Frequently Exposed Mudflats	1.23	-	-	-	6.30	-	-	3.20	-	**10.73**
Low Marsh	2.92	0.18	-	0.10	10.53	3.82	-	-	-	**17.55**
Mid Marsh	3.13	5.50	-	3.08	25.60	1.06	-	-	-	**38.37**
High Marsh	0.54	1.40	7.50	2.34	2.60	0.45	7.10	-	-	**21.93**
Seasonal Salt Marsh	-	-	-	-	-	-	-	-	8.65	**8.65**
Freshwater Marsh (nontidal)	-	-	-	-	-	-	-	-	-	**0.00**
Transitional Wetlands	0.33	0.00	0.06	0.03	0.24	0.16	-	-	-	**0.82**
Totals	44.73	7.08	7.56	5.55	52.22	5.49	7.10	3.20	8.65	**141.58**

Table 4. Summary of total planned acres of Subtidal, Mudflat, and Salt Marsh Habitat in the San Dieguito Wetlands Final Restoration Plan (SCE 2005), which includes the Villages Property.

Habitat	**Acreage from Column A Table 5.3**	**Acreage from Column A Table 4.5**	**Total Planned Acres**
Subtidal	32.03	0	32.03
Mudflat	19.03*	5.90	24.93
Salt Marsh	77.85	14.73	92.58

Table 5. Definitions of subtidal, mudflat, and salt marsh habitats based on elevation, inundation, and vegetation cover, as well associated planned acreages (± 10%). Asterisk indicates that “other habitat” is not a planned habitat type; the category is not included in the Final Restoration Plan and was defined after Stage 1 monitoring began.

Habitat	Elevation (ft, NGVD)	Necessary characteristics	Planned acres	± 10% planned acres
Subtidal	< -0.9	Continuously submerged	32	28.8 – 35.2
Mudflat	-0.9 to 3.5	Intertidal < 5% vegetation cover	24.9	22.4 – 27.4
Salt marsh	-0.9 to 4.5	Intertidal ≥ 30% vegetation cover	92.6	83.3 –101.9
*Other**	*-0.9 to 4.5*	*Intertidal* *< 30% vegetation cover*	*0*	*NA*
		Total	149.5	

Table 6. History of elevation contours collected at San Dieguito Wetlands since wetland construction.

Elevation contour (NGVD, ft)	**Years measured**
-0.9 ft	2012; 2022; 2024-2025
1.3 ft	2012; 2022; 2024-2025
3.5 ft	2014; 2022
4.5 ft	2012-2025
5.0 ft	2016-2018

Appendix 3

Changes in the Location of Sampling Sites Due to the Encroachment of *Spartina foliosa* Into Tidal Creeks Sampled in Previous Years

Cordgrass, *Spartina foliosa*, has encroached into six tidal creeks that are sampled for invertebrate and fish densities and species richness. The cordgrass inhibits the use of beach seines and enclosure traps used to sample fish. As a result, sampling of invertebrates and fish has been repeatedly moved to creeks that lack cordgrass or sampling has been compressed or moved to lower order branches within partially encroached creeks beginning in 2019.

Figure 1 shows the location of constructed and naturally-formed tidal creeks (TC) both sampled and not sampled for fish and macro-invertebrates in San Dieguito Wetlands to show how *Spartina* has shifted sampling locations over the years.

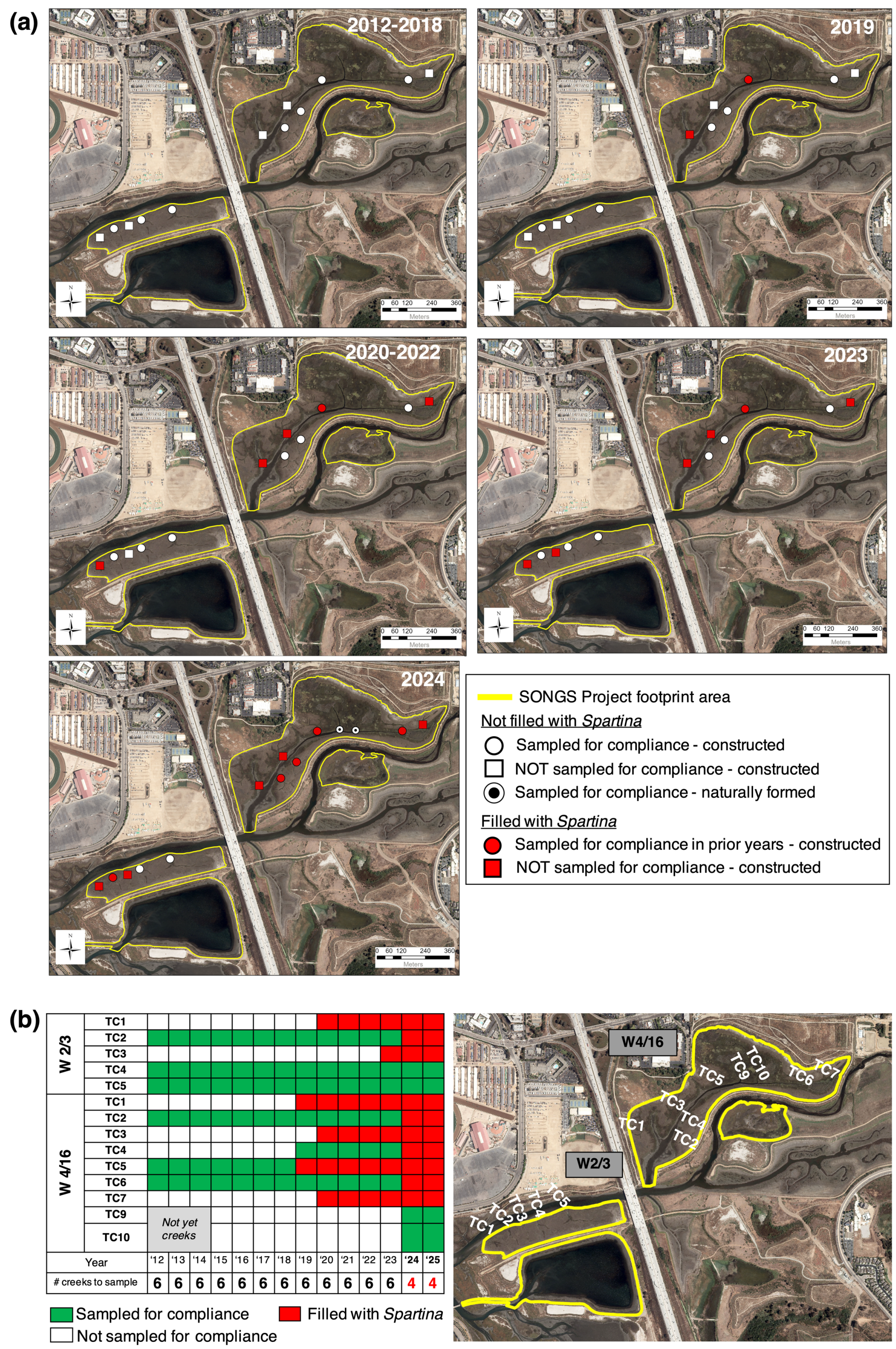


Figure 1. The top panel (a) shows the time series of tidal creek monitoring status (sampled for compliance, not sampled for compliance), condition (filled with *Spartina* vs. not filled with *Spartina*; constructed vs. naturally-formed) within the SONGS project footprint area (delineated in yellow). With increased encroachment of *Spartina*, creeks monitored for compliance shifted, beginning in 2019. The bottom panel (b) shows in tabular form how creek sampling changed and the number of creeks available to sample for compliance from 2012-2025 with a labeled map on the right as reference.

Appendix 4

Historic (2012-2023) sampling of Tijuana Estuary as a reference wetland

Tijuana Estuary served as a reference wetland from 2012-2023. The sampling locations for bird (Figure 1a) and fish and macro-invertebrate (Figure 1b) surveys are shown below for reference.

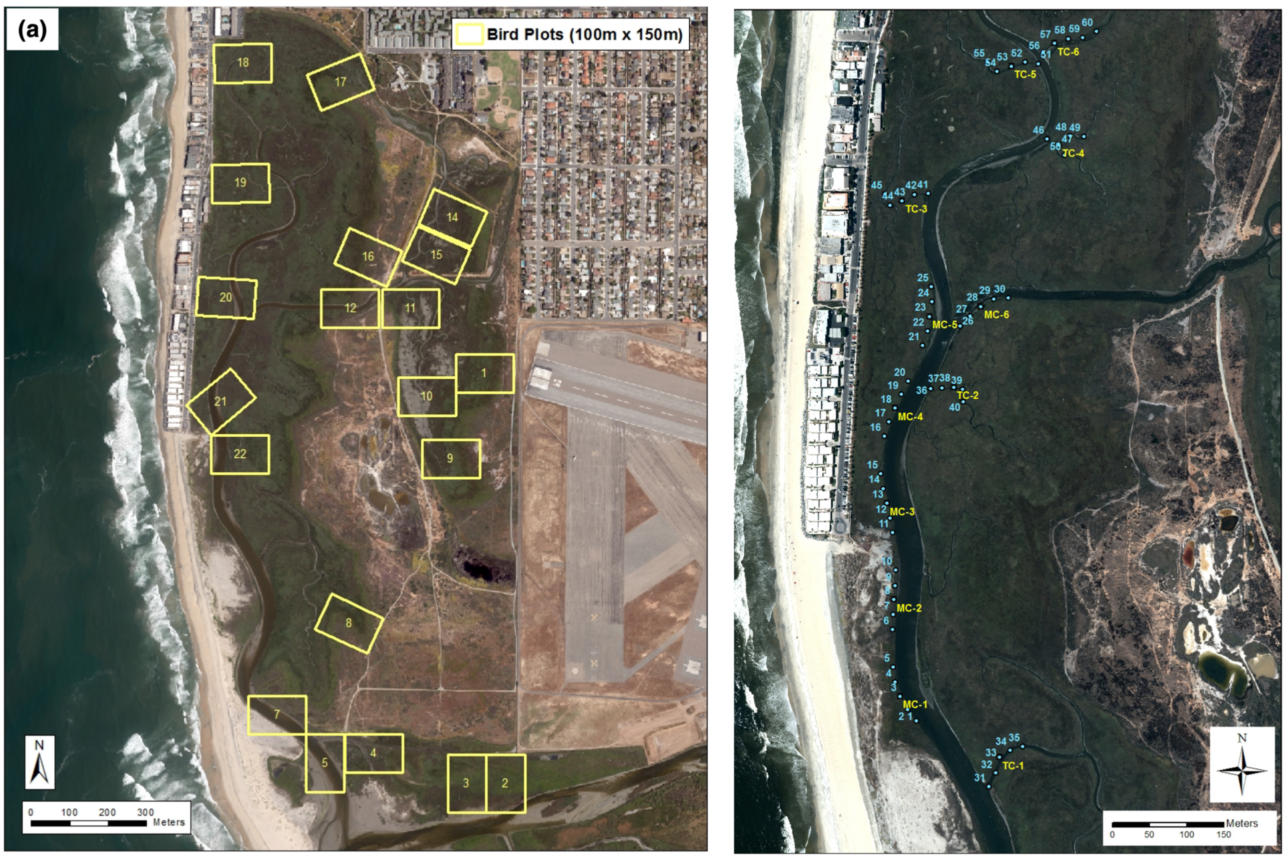


Figure 1. Historic sampling locations for Tijuana Estuary, including (a) 100 x 150 m bird plots used to assess bird density, richness, and food chain support standards and (b) enclosure locations for fish and macroinvertebrate standards in main channel (MC) and tidal creek (TC) habitats.

Appendix 5

Modifications to Performance Monitoring in 2020 due to the COVID-19 Pandemic

To comply with State, Local, and University guidelines regarding the implementation of measures to reduce the spread of COVID-19, elements of performance monitoring of the San Dieguito Wetlands in 2020 were scaled back to reduce the number and contact time of personnel in the field and laboratory. The following section outlines the modifications from the SONGS Wetland Mitigation Monitoring Plan that were made in 2020.

Most performance standards were assessed without modification.

Adjustments to performance monitoring:

Fish Beach Seine sampling
A reduction in the number of beach seines used to sample fish in tidal creek and main channel/basin habitats. Seine sampling is conducted at all wetlands at six main channel and six tidal creek sites. Normally, three seine samples are taken, one each over a three day period. The number of seines taken each site was reduced from three to one.

Bird Surveys
Birds are sampled during the fall, winter, and spring. Spring surveys were missed in 2020 due to a shutdown in research operations. Bird surveys were conducted on schedule in fall and winter as detailed in the Monitoring Plan.

The reduction in sampling effort occurred in all the wetlands and if it did have an effect it appears to be similar across wetlands without imparting bias in evaluating the standards.

Appendix 6

Metadata for the SONGS Wetland Restoration Project

Metadata and data for the SONGS Wetland Restoration Project can be found using the Data tab at the UCSB SONGS Marine Mitigation website (see also Section 5.0, Dissemination of Results):

https://marinemitigation.msi.ucsb.edu/

Appendix 7

Updates to the SONGS Wetland Mitigation Monitoring Plan

Updates in the January 2015 plan.

Addition of Section 7.0, Mitigation of Construction Impacts Monitoring.

The area between elevations of 4.5' to 5.0' NGVD is defined in the Final Restoration Plan (SCE 2005) as a transitional zone between tidal wetlands and non-tidal or seasonal wetland habitats. Coastal Commission Staff have determined, in accordance with CDP 6-04-088, that transition zone acreage can be used to offset impacts to seasonal salt marsh that occurred during wetland construction provided that the cover of native salt marsh and non-native plants within this zone meets the performance criteria outlined in this section.

Updates in the February 2016 plan.

Revision to Section 3.2.9 pertaining to the monitoring of birds.

The approach used to assess the total densities and number of species of birds in San Dieguito Wetlands and the reference wetlands from 2012 to 2015 entailed visually identifying and counting (using binoculars or spotting scope) all individuals sighted within 20 replicate rectangular plots measuring 100 x 150 m spread throughout the wetlands. However, this approach has been revised because the area of different habitat types within the plots (i.e., open water, land) was not standardized to permit a comparison of bird density and number of species in similar habitats between the restored wetland and reference wetlands as required by the permit. Since bird density and numbers of species found in open water may differ from that of land, these two habitats will be evaluated separately. The locations of the plots in San Dieguito Wetlands, Tijuana Estuary, and Mugu Lagoon have been adjusted such that two habitats, open water and land, can be sampled and compared among wetlands.

Updates in the August 2018 plan.

Revision to Section 3.2.9 pertaining to the monitoring of birds.

The approach used to assess the total densities and number of species of birds in San Dieguito Wetlands and the reference wetlands is currently under review by CCC staff. During this review, the approach employed from 2012 to 2015, which entailed visually identifying and counting (using binoculars or spotting scope) all individuals sighted within 20 replicate rectangular plots measuring 100 x 150 m spread throughout the wetlands will be used.

Updates in the June 2021 plan.

Revision to Section 3.2.9 pertaining to the monitoring of birds.

Deleted: “Note: the approach used to evaluate the bird standard provided in the Monitoring Plan updated in 2017 has has been revised in the August 2018 update and is currently under review by CCC staff.”

Following review by CCC staff, the approach used to monitor the total densities and number of species of birds in San Dieguito Wetlands will follow the original approach employed since 2012 and as provided in the August 2018 update.

Addition of Appendix 3 showing the adjusted locations of tidal creeks and stations sampled for invertebrates and fish in 2020.

Changes in the location of tidal creek sampling sites was necessary due to the encroachment by *Spartina foliosa* Into tidal creeks sampled in previous years preventing the use of beach seines and enclosure traps used to sample fish.

Addition of Appendix 4 detailing modifications to performance monitoring in 2020 due to the COVID-19 pandemic.

Performance monitoring was adjusted in 2020 to accommodate restrictions to laboratory and field work imposed by the pandemic.

Deletion of several appendices, including three concerning the sampling of fish by Steele et al., which have been published. General reordering of the appendices, including the addition of Appendix 5 containing performance monitoring metadata with the inclusion of some of this information in the section on fish sampling (Section 3.2) and elsewhere in the document.

Updates in the May 2022 plan.

Modification in the method of analysis used to evaluate data pertaining to the relative performance standard for bird species richness.

Bird assemblages in the coastal wetlands of southern California can exhibit strong seasonal patterns in species richness that are driven by the movement of migratory birds. The sampling design used to assess species richness in performance monitoring takes this temporal variability into consideration through sampling birds within three periods during the year, winter, spring, and fall that are expected to have distinctive species composition. During performance monitoring, the number and species of birds are identified and counted within each of the 20 -1.5 ha plots during each of 18 survey dates (3 seasonal periods x 6 surveys per period for each wetland, see Section 3.2.9, Birds).

From 2012 – 2019, the method used to evaluate the species richness standard for birds entailed averaging the number of unique species of birds for each plot across the 18 surveys, then averaging those values across the 20 plots to produce an annual mean value for species richness of birds in each wetland. However, because the number of bird species for each plot is averaged rather than accumulated across the 18 survey dates, this approach does not take full advantage of the temporal sampling design in capturing the number of unique bird species that frequent a particular plot during overwintering and the spring and fall migration. An alternative approach that accumulates the number of unique bird species within a plot over time better reflects the annual species richness of birds in that plot. Consequently, in 2020, the method of analysis was changed and the total number of unique bird species observed in a plot is accumulated over all 18 survey dates in a given year to produce a value for bird species richness in that plot for the year. Yearly mean species richness of birds within each wetland is then computed using the 20 plots as replicates for each wetland and these values are used for evaluating similarity between the restored and reference wetlands.

Replacement of the wetland metadata text and tables in Appendix 5 with a url to the updated UCSB SONGS Marine Mitigation website that contains links to this information, and the insertion of a reference to Section 5.0, Dissemination of Results.

Updates in February 2026 Monitoring Plan

Modification of the analytical approach applied to evaluate the tidal prism standard

In 2025, the analytical approach to assess the tidal prism standard was changed to 1) isolate the tidal prism solely of the SONGS project area, 2) identify changes in tidal prism and attribute potential cause of changes to projects within (W6 and W19 restorations) and outside (USACE beach nourishment) of San Dieguito Lagoon, and 3) determine how changes in tidal prism are connected to elevation-specific topographic or bathymetric changes that may affect other performance standards (e.g., habitat areas). The analytical approach applied from 2012-2024 is listed below.

> Analytical approach (2012-2024): The cumulative discharge (acre-feet) for each survey is calculated and plotted against the highest tide during the survey period. Since tidal prism can influence the area of planned wetland habitat hit by the tides, the tidal prism standard is evaluated, in part, using criteria set forth in the habitat areas standard, which provides that the areas of the different habitats (subtidal, intertidal mudflat, vegetated salt marsh) shall not differ by more than 10% from planned values (see Habitat Areas Standard; 3.2.2). The planned tidal volume-elevation relationship indicated that a decrease in tidal prism of greater than 12% could result in a reduction in the area of planned salt marsh habitat (1.3 to 4.5 ft NGVD) of greater than 10%. Since the area of salt marsh habitat may not differ by more than 10% from the planned area, the tidal prism can not be less than 88% of the as-built prism to ensure no more than 10% of planned salt marsh habitat remains exposed during a 4.5 ft tide. Moreover, since a larger than planned tidal prism could increase erosion within the restored wetland, the prism shall also not be larger than 112% of the as-built prism. In 2024, the upper threshold of 112% was removed and assessment of the standard was based solely on whether it was >88% of the as-built prism (Smith et al. 2025). Cumulative discharge values are plotted against the highest verified water level, as reported from the Scripps

Pier station available on the Tides & Currents website managed by NOAA, for that survey period.

To capture reductions in tidal prism that could require inlet maintenance, or increases in prism that could lead to erosion, tidal prism is measured every 1-2 months during spring and neap tides (n = 6 - 24 surveys per year). The performance standard is met if the regression line fit through the prism measurements taken during the monitoring year fall within 12% of the as-built tidal prism values, which were based on measurements of a range of high tides taken in from 18 surveys that spanned a range of high tides from 1.17’ NGVD to 4.43’ NGVD collected from February to December 2012.

Additionally, there are numerous small- and large-scale restoration projects within San Dieguito Lagoon, some of which are of sufficient size or excavate large enough volumes of fill to affect evaluation of the tidal prism associated solely with the SONGS project. Once these projects are open to tidal flow, corrections of the SONGS tidal prism data may be necessary. In 2016, a 11-acre tidal wetland restoration was conducted opposite of the San Dieguito River of W2/3. This restoration project, managed by the 22nd Agricultural district, required a correction factor of 45 acre-feet be applied to the cumulative discharge value for each survey conducted at Jimmy Durante Bridge from 2012-2024 (Appendix 7; Figure 1). In December 2023, the 9-acre W6 wetland restoration project was opened to tidal flow (Figure 1). In June 2024, the 60-acre W19 wetland restoration project was opened to tidal flow (Figure 1). Assessment of the tidal prism standard in 2024 only included the 6 surveys conducted prior to the W19 inlet opening since analyses that isolated the tidal prism of the SONGS project footprint area were still in development and the approach used at the time was not sensitive enough to detect observed changes to the tidal prism following the opening of the inlet to W19, see Section 3.1.1. Tidal Prism for the current analytical approach.

Modification in how relative performance standards assessed in tidal creeks are analyzed to minimize impacts of unequal sample size due to *Spartina* encroachment at San Dieguito Wetlands

In 2024 and 2025, only four tidal creeks were sampled at San Dieguito Wetlands and six tidal creeks were sampled at the reference wetlands (Carpinteria Salt Marsh, Mugu Lagoon, Los Peñasquitos Lagoon). To account for the unequal sample sizes between the restored and reference wetlands, we developed an analytical approach for when San Dieguito Wetlands is the second lowest performer. If San Dieguito Wetlands is the second lowest performer for a given standard, the one-sample t-test uses the 95% confidence interval for the lowest performer, which includes the full sample size of six tidal creeks. This approach maintains the desired error structure for comparison and ensures that the same sample size (n = 6 tidal creeks) is used for comparison between wetlands to assess pass/fail outcomes. If San Dieguito Wetlands is the lowest performer for a given standard, there is no change to approach--we construct a 95% confidence interval around the second lowest performer using a one-sample t-test; the analysis remains unaffected by the unequal sample sizes between the two assessed wetlands (restored, n = 4 tidal creeks; reference wetlands, n = 6 tidal creeks).

Replacing Tijuana Estuary with Los Peñasquitos Lagoon as a reference wetland

In 2024, Tijuana River Estuary was deemed an unsuitable reference site due to anthropogenic impacts from transboundary sewage flows in 2023. After considering the options available, Los Peñasquitos Lagoon (32.930405°N, -117.252608°W) was selected as the best wetland to replace Tijuana Estuary, meeting the criteria in the SONGS permit with the additional advantage that it is close to San Dieguito Wetlands. The inlet of Los Peñasquitos Lagoon was only intermittently open at the time of the initial selection of reference sites. However, the inlet is now maintained in an open condition, meeting an important criterion of reference site selection.

Replacing Tijuana Estuary with Mugu Lagoon as the reference wetland used to assess the Spartina canopy architecture standard

As a result of this change in reference sites from Tijuana Estuary to Los Peñasquitos Lagoon, the sites used to assess the standard for Spartina Canopy Architecture were changed from Tijuana Estuary to Mugu Lagoon where *Spartina* has expanded in recent years and includes areas of sufficient size to implement our sampling scheme. Currently, Los Peñasquitos Lagoon does not have *Spartina* stands large enough to sample. *Spartina* habitat at Los Peñasquitos Lagoon will be closely monitored and included in the evaluation of the standard if it continues to expand and becomes sampleable.

Modification of algal standard evaluation description from using 10 x 10 m grids to using the full classification (pixel-scale) to calculate total algal cover.