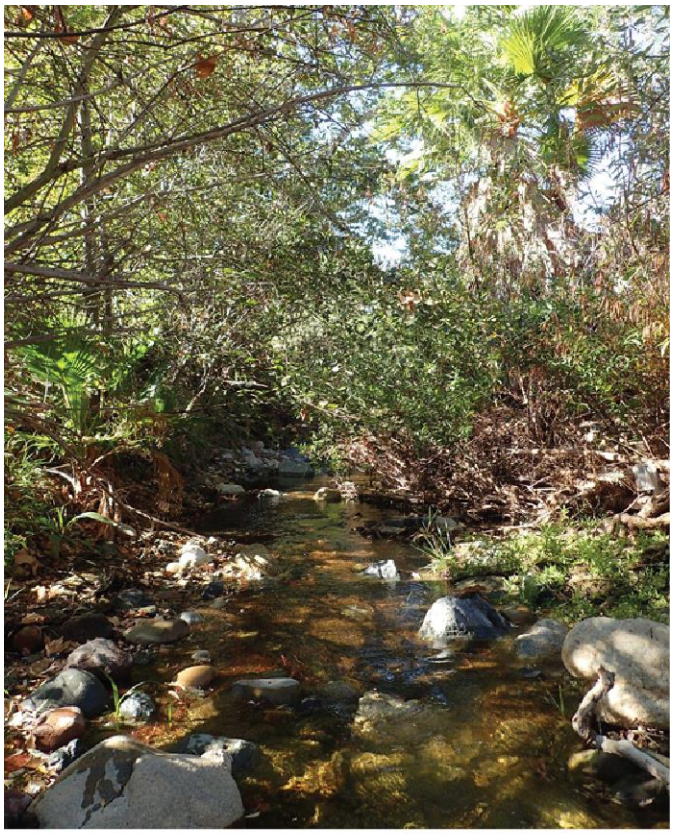
# 2024 San Diego Regional Board Mitigation and SEP Project Assessments



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# Introduction

The San Diego Regional Water Quality Control Board (San Diego Water Board) seeks to develop a Wetlands Regional Monitoring Program (WRMP) to, among other objectives, assess the collective effectiveness of permits and specific restoration and management approaches to protect and restore wetlands, as defined by the State Water Board. The San Francisco Estuary Institute-Aquatic Science Center (SFEI-ASC) is assisting the San Diego Water Board in working towards the development of the WRMP, utilizing the existing State Water Board's Wetland and Riparian Area Monitoring Plan (WRAMP) framework of the California Water Quality Monitoring Council's Wetland Monitoring Workgroup[1].

The WRAMP utilizes the United States Environmental Protection Agency's (EPA) 3-level wetland monitoring and assessment framework to establish standardized monitoring and assessment methods at the watershed or regional scale, to support state and federal wetland protection policies, resource planning, and stream and wetland restoration performance tracking. At its core, the framework recommends using standardized methods for data collection and making data readily available via online data portals. The three levels of data within the framework work together to answer the relevant monitoring and management questions. Level 1 data consists of geospatial datasets to determine the distribution, abundance, and diversity of aquatic resources or other relevant ecological information. The California Aquatic Resource Inventory and the San Diego Aquatic Resource Inventory (CARI v3.0, SFEI, 2024) are examples of Level 1 datasets. Level 2 data consist of rapid field assessments that provide cost-effective evaluations of condition based on visible ecological indicators that do not require the collection or processing of materials from the field. The California Rapid Assessment Method (CRAM) is a standardized, statewide Level 2 methodology that assesses the overall ecological condition of streams and wetlands and their adjacent riparian habitat (CWMW, 2013a). Level 3 data are intensive site assessments that provide detailed information on how well a stream or wetland is functioning, and/or how well specific regulatory monitoring requirements are being addressed. Quantitative flow measurements, water quality testing, bioassessment, and benthic macroinvertebrate or algal sampling are examples of Level 3 data. Overall, this 3-level framework provides a logical and economical structure for organizing data and information to support a large regional wetlands monitoring program.

As a part of the development of a regional monitoring program, the San Diego Water Board has identified a number of specific monitoring and management questions related to the streams and wetlands within its jurisdiction that the monitoring effort aims to address. One of the monitoring questions is:

- What is the current condition of streams and wetlands within previous mitigation or restoration projects that were permitted through the 401 Water Quality Certification Program, or were funded through Supplemental Environmental Project (SEP) funds?

[1] https://www.mywaterquality.ca.gov/wetland-monitoring/wramp.html

This question is important to the San Diego Water Board for multiple reasons. First, 401 and SEP permits typically require five years of monitoring, beyond which the San Diego Water Board has no information about continued project performance. Next, given the lack of information on long-term project performance, the San Diego Water Board cannot evaluate if their permitting process is ensuring the creation of functioning aquatic resources and thus meeting the no-net-loss requirements of acreage and condition. And finally, this information is essential to determine if permitting and monitoring requirements need to be adjusted within the Region.

To begin to address this question, SFEI-ASC and the San Diego Water Board collaborated on a demonstration project to assess the overall ecological condition of a subset of completed mitigation and SEP projects within the region. The goals of the demonstration project were to assess the overall ecological conditions of a number of completed projects to show how CRAM can be used (as one monitoring method) to evaluate project performance and track performance through time, and to help gain an understanding of (a) region-wide stream and wetland condition, and (b) how projects are contributing towards improving condition. CRAM is appropriate for this use because it can assess multiple stream and wetland types using a common scale of condition, i.e., it provides a "common measure" for quantifying condition across the completed permitted projects (CWMW, 2019).

# California Rapid Assessment Method

CRAM is a standardized, cost-effective, and scientifically defensible method for assessing the overall ecological functional capacity or condition of streams and wetlands in California (CWMW, 2019, 2013a). CRAM is designed for (1) assessing ambient conditions within watersheds, regions, and throughout the State, and (2) assessing the performance of compensatory mitigation or restoration projects to compare pre- and post-project conditions or to compare the project to broader watershed or ecoregional conditions.

CRAM provides numerical scores that estimate the overall potential of a stream or wetland and its adjacent riparian area to provide levels of the ecological services expected of the area given its type, condition, and environmental setting. CRAM scores are based on visible indicators of physical and biological form and structure relative to statewide reference conditions. Two to three trained CRAM practitioners are needed to complete an assessment, which typically takes two to three hours, depending on the complexity of the aquatic resource. The practitioners define an assessment area, and then make observations and measurements, guided by a CRAM Field Book developed for each unique stream or wetland type.

CRAM assessments consist of a number of individual metrics, which are specific questions that the practitioners answer, that are organized into four Attributes of condition: 1) Buffer and Landscape Context, 2) Hydrology, 3) Physical Structure, and 4) Biotic Structure. Each Attribute captures unique components of a stream's health or condition. Metrics are scored as letter grades (A, B, C or D), which are translated to a specific numerical value (12, 9, 6 or 3) so that

condition can be quantified. Metric Scores are then combined to calculate each Attribute Score, and the four Attribute Scores are averaged to calculate the overall CRAM Index Score. Attribute and Index Scores range from 25 - 100, where a score of 25 indicates the lowest possible condition and a score of 100 indicates the best possible condition. One can drill down from an Index Score to the underlying Attribute, Metric or Submetric scores to better understand the specific characteristics of the stream or wetland's form and function.

Each of the four Attributes evaluates different aspects of condition. The Buffer and Landscape Context Attribute considers the connection of the stream/wetland to continuous riparian corridor or to other aquatic resources, as well as the amount, width and condition of buffer that serves to protect the stream/wetland from anthropogenic stress. The Hydrology Attribute considers the sources, quantities and movements of water, plus the quantities, transport, and fates of water-borne materials, particularly sediment because the physical structure of a stream/wetland is largely determined by the magnitude, duration, and intensity of water movement. The Physical Structure Attribute considers the spatial organization of living and non-living surfaces that provide habitat for biota (Maddock, 1999). And finally, the Biotic Structure Attribute considers the composition and structure of the plant community, including vegetation height classes, co-dominant plant species, invasive plant species, and the 2-D and 3-D organization of the community.

CRAM scores can be grouped into three standard ecological health classes (also called condition classes) to characterize stream condition as 1) Poor, 2) Fair, or 3) Good (CWMW, 2019). These condition classes are defined as tertiles of the maximum range of possible CRAM Index or Attribute scores, with Poor condition scores ranging from 25 to 50, Fair condition scores from 51 to 75, and Good condition scores from 76 to 100. Results can be reported using these condition classes to bin the CRAM scores to facilitate comparison and evaluation.

In addition to providing a quantitative measure of condition, CRAM also includes a Stressor Checklist, where the presence or absence of many different stressors are recorded, in addition to a determination about whether the stressor is causing a significant negative effect upon the assessment area (AA). A stressor is defined as an anthropogenic perturbation within the AA or its immediate environmental setting that is likely to negatively influence condition and function of the wetland or stream (CWMW, 2013a).

CRAM Field Books (various versions) for each stream or wetland type are available on the statewide CRAM website (The California Rapid Assessment Method for wetlands homepage www.cramwetland.org), which also has a number of other useful resources including a CRAM User's manual, QAPP, and a Technical Bulletin that provides information on how mitigation projects and large monitoring programs might employ CRAM.

# Methods

The first step of the demonstration project was to collate a list of previous 401 Water Quality Certification Projects and Supplemental Environmental Projects (SEP). Chad Loflen, a Senior Environmental Scientist within the Monitoring Assessment & Research Unit at the San Diego Water Board, led the development of the list, consulting with other staff members, in particular current and previous 401 Unit staff, to identify appropriate projects. Projects were selected for inclusion based upon the project's age, restoration type, and accessibility. Approximately 30 projects were identified, from which a subset of 20 projects were targeted for assessment.

Sarah Pearce (SFEI-ASC), a geomorphologist and the statewide lead CRAM trainer, was the lead CRAM practitioner for this effort. Sarah prepared all field materials for the assessments, including datasheets, aerial photographs, and topographic maps based upon the provided project locations. Debbie Woodward and Carey Kowalski, both trained CRAM practitioners from the San Diego Water Board, completed the CRAM assessments alongside Sarah Pearce (Figure 1). Debbie and Carey coordinated the field schedule and gained any necessary access permissions to each site. In addition, Lauren Kim and Kate Buckley, also San Diego Water Board staff, were each able to join the assessment team for a day, to learn more about the methodology and see assessments in action.

All the CRAM assessments were conducted over a period of nine days during the Fall of 2024 (September 16-19 and October 7-11). Two to three assessments were completed each field day, depending on the project's location and ecological complexity. CRAM assessments were completed using the CRAM Riverine Field Book version 6.1 (CWMW, 2013b), the CRAM Tidal Riverine Field Book version 6.1 (CWMW, 2013c), or the CRAM Slope Wetland Field Book version 6.2 (CWMW, 2017) depending on the aquatic resource that was being assessed. Data were collected on paper data sheets while in the field, and were quality checked each evening by Sarah Pearce. In addition, each evening digital field photographs from each site were downloaded and any unknown co-dominant plant species were identified. After returning to the office, the paper datasheets were scanned and electronically filed. Assessment data were entered into eCRAM, the on-line electronic CRAM database (The California Rapid Assessment Method for wetlands homepage www.cramwetlands.org), by Emma Sevier (SFEI-ASC) and later quality checked by Sarah Pearce.

After the data were entered and quality checked, the full dataset was accessed from the statewide CRAM data management database within EcoAtlas (The EcoAtlas homepage www.EcoAtlas.org). EcoAtlas is an online wetlands decision support website that includes interactive map viewer, and data summary and data download tools. CRAM data can be explored through an interactive map, can be downloaded in a number of formats, or can be included within a condition summary report for a user-defined area using the Landscape Profile Tool. The completed assessments (19 of the 20 total) are currently publicly viewable and downloadable from EcoAtlas under the Project Name "2024 San Diego Regional Board Mitigation and SEP Assessments". The one assessment that is not viewable is the Aliso Creek

Mouth Tidal Riverine site; the Tidal Riverine Module has not yet been fully validated, and therefore data is not shown on EcoAtlas.



**Figure 1.** Photographs of CRAM practitioners Sarah Pearce, Debbie Woodward and Carey Kowalski collecting CRAM data in the field.

# Results

A total of 20 CRAM assessments within the San Diego Water Board jurisdiction were completed during the field effort (Table 1 and Figure 2). The assessments were distributed spatially across the San Diego Region and included three aquatic resource types: Riverine (including confined and non-confined; Figure 3), Tidal Riverine (Figure 4), and Slope Wetlands (including a Channeled Wet Meadow and a Non-channeled Wet Meadow; Figure 5).

**Table 1.** The 20 CRAM assessments completed for this effort. The Site Name and the eCRAM ID number allows for a search for the site within EcoAtlas (www.EcoAtlas.org).

| Site Name | Date Assessed | Practitioners | Type | eCRAM ID | Project Type |
|---|---|---|---|---|---|
| Adobe Springs Specific Plan | 10/10/2024 | Sarah Pearce, Debbie Woodward, Carey Kowalski | Riverine non-confined | 10162 | Mitigation |
| Aliso Creek Mouth | 10/8/2024 | Sarah Pearce, Debbie Woodward, Carey Kowalski | Tidal Riverine | 10159 | Invasives Removal |
| Alvarado Invasives Removal | 9/17/2024 | Sarah Pearce, Debbie Woodward | Riverine confined | 10147 | SEP Invasives Removal |
| Antonio Sewage Spill | 10/11/2024 | Sarah Pearce, Debbie Woodward, Carey Kowalski | Riverine non-confined | 10160 | Mitigation |
| Crystal Cove El Morro Trailer Park | 10/8/2024 | Sarah Pearce, Debbie Woodward, Carey Kowalski | Riverine non-confined | 10161 | Restoration |
| La Mesa SEP | 9/17/2024 | Sarah Pearce, Debbie Woodward | Riverine confined | 10146 | Enforcement SEP Invasives Removal |
| La Paz | 10/7/2024 | Sarah Pearce, Debbie Woodward, Carey Kowalski | Riverine non-confined | 10153 | Mitigation |
| Lake Forest Sports Park | 10/11/2024 | Sarah Pearce, Debbie Woodward, Carey Kowalski | Riverine non-confined | 10152 | Mitigation |
| Pat Road Development | 10/10/2024 | Sarah Pearce, Debbie Woodward, Carey Kowalski, Lauren Kim | Riverine non-confined | 10154 | Mitigation |
| Rancho Jamul 1 | 9/19/2024 | Sarah Pearce, Debbie Woodward | Riverine non-confined | 10150 | Mitigation Bank |

| Site Name | Date Assessed | Practitioners | Type | eCRAM ID | Project Type |
|---|---|---|---|---|---|
| Rancho Jamul Floodplain 1 | 9/19/2024 | Sarah Pearce, Debbie Woodward | Channeled wet meadow | 10151 | Mitigation Bank |
| Roripaugh Ranch OBID5 | 10/9/2024 | Sarah Pearce, Debbie Woodward, Carey Kowalski, Kate Buckley | Riverine confined | 10155 | Mitigation |
| Roripaugh Ranch OBID6 | 10/9/2024 | Sarah Pearce, Debbie Woodward, Carey Kowalski, Kate Buckley | Riverine confined | 10156 | Mitigation |
| San Elijo OBID27 | 9/18/2024 | Sarah Pearce, Debbie Woodward | Non-channeled wet meadow | 10149 | SEP Invasives Removal |
| San Vicente 401 | 9/17/2024 | Sarah Pearce, Debbie Woodward | Riverine non-confined | 10145 | Mitigation |
| Sulphur Creek A | 10/7/2024 | Sarah Pearce, Debbie Woodward, Carey Kowalski | Riverine non-confined | 10157 | Restoration |
| Sulphur Creek B | 10/7/2024 | Sarah Pearce, Debbie Woodward, Carey Kowalski | Riverine non-confined | 10158 | Restoration |
| Temescal Creek | 9/18/2024 | Sarah Pearce, Debbie Woodward | Riverine non-confined | 10148 | Enforcement SEP Restoration |
| Upper Poway Creek at Sycamore Valley Road | 9/16/2024 | Sarah Pearce, Debbie Woodward | Riverine non-confined | 10143 | Mitigation Invasives Removal |
| Upper Poway Quiet Valley Road | 9/16/2024 | Sarah Pearce, Debbie Woodward | Riverine non-confined | 10144 | Reference Site |

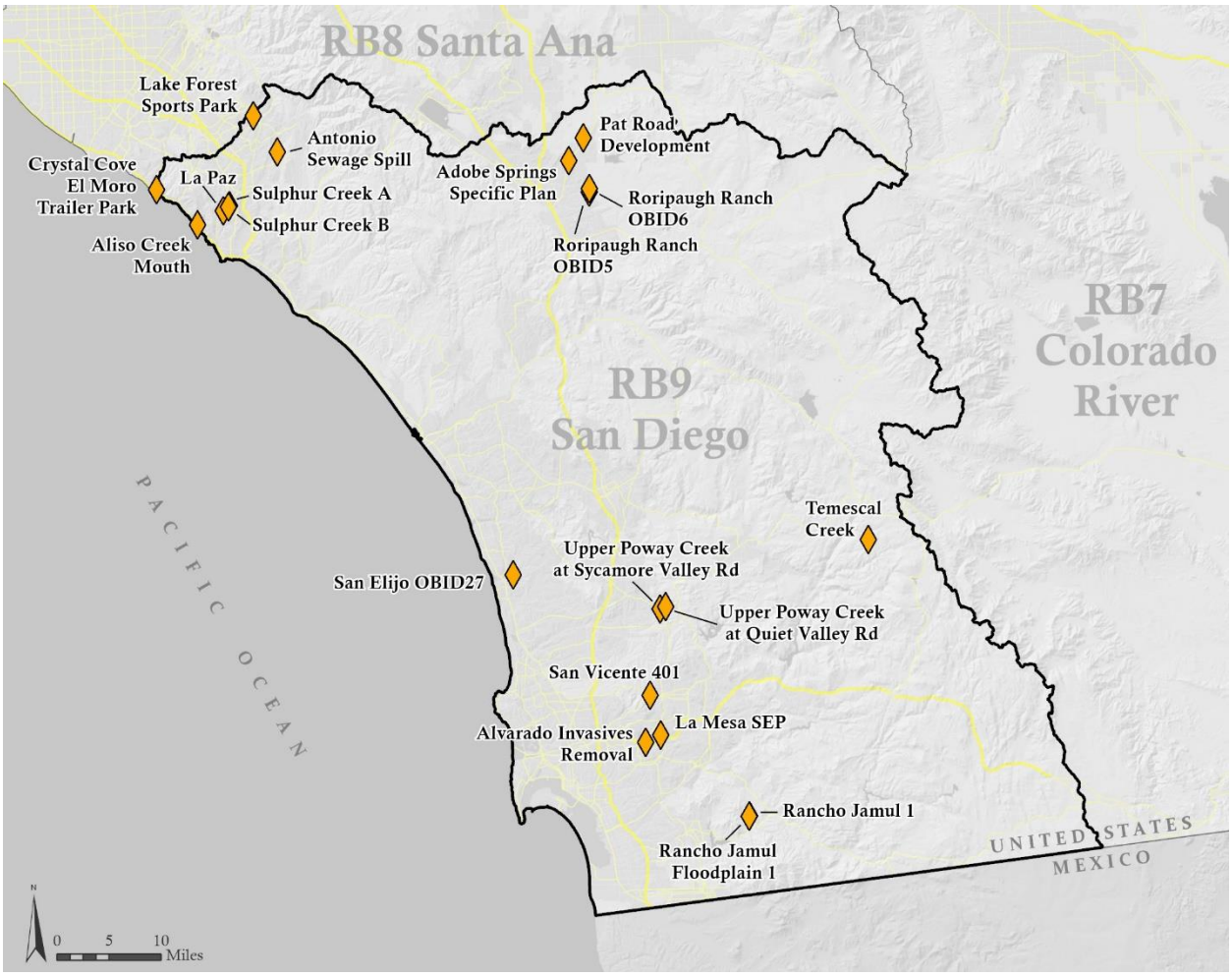



**Figure 2.** Map showing the location of the 20 CRAM assessments within the San Diego Water Board jurisdiction. The Project Name for this effort is “2024 San Diego Regional Board Mitigation and SEP Assessments”, all 20 assessments can be found on EcoAtlas (www.EcoAtlas.org) using this Project Name.



**Figure 3.** Field photographs of selected Riverine sites assessed within this effort. Top left: Stream channel at the Antonio Sewage Spill site. Top right: Dry stream bed at Roripaugh Ranch OBID 6 site. Middle left: Overview of the Alvarado Invasives Removal site. Middle right: Dry stream bed at the Upper Poway Creek at Sycamore Valley Road site. Bottom left: Looking downstream at the Temescal Creek site. Bottom right: Slow moving streamflow in the San Diego River at the San Vicente 401 site.



**Figure 4.** Field photograph looking upstream at the Aliso Creek Mouth site, a Tidal Riverine site.



**Figure 5.** Left: Field photograph of the Rancho Jamul Floodplain, a channeled wet meadow. Right: Field photograph of the San Elijo OBID27 site, a non-channeled wet meadow.

Overall Index Scores for the twenty assessments range from a low of 41 to a high of 82, however most scores are in the 40s, 50s and 60s (Table 2, Appendices A, B and C). Translating these scores into their corresponding condition class reveals that 40% of the assessments are in Poor condition (with scores of 25-50), 55% in Fair condition (with scores of 51-75), and just 5% (or a single assessment) are in Good condition (with scores of 76-100). The single assessment in Good condition is the Crystal Cove El Morro Trailer Park project that is located within California State Parks Crystal Cove State Park, in an area that is primarily open space, and is the oldest project site that was assessed (Figure 6).

**Table 2.** Index and Attribute Level Scores for the 20 CRAM assessments. The Index Score Condition Class is color-coded (red for Poor, yellow for Fair, and green for Good) for ease of interpretation.

| Site Name | Index Score | Landscape and Buffer Context Attribute Score | Hydrology Attribute Score | Physical Structure Attribute Score | Biotic Structure Attribute Score | Index Score Condition Class |
|---|---|---|---|---|---|---|
| Adobe Springs Specific Plan | 57 | 90.29 | 58.33 | 25.00 | 52.78 | Fair |
| Aliso Creek Mouth | 47 | 35.75 | 58.33 | 50.00 | 44.44 | Poor |
| Alvarado Invasives Removal | 49 | 25.00 | 66.67 | 50.00 | 55.56 | Poor |
| Antonio Sewage Spill | 63 | 80.63 | 75.00 | 37.50 | 58.33 | Fair |
| Crystal Cove El Morro Trailer Park | 82 | 90.29 | 100.00 | 75.00 | 63.89 | Good |
| La Mesa SEP | 43 | 25.00 | 66.67 | 37.50 | 44.44 | Poor |
| La Paz | 60 | 35.75 | 83.33 | 50.00 | 69.44 | Fair |
| Lake Forest Sports Park | 64 | 43.13 | 83.33 | 75.00 | 52.78 | Fair |
| Pat Road Development | 44 | 43.13 | 66.67 | 25.00 | 41.67 | Poor |
| Rancho Jamul 1 | 66 | 85.38 | 91.67 | 25.00 | 61.11 | Fair |
| Rancho Jamul Floodplain 1 | 75 | 55.79 | 91.67 | 62.50 | 88.88 | Fair |
| Roripaugh Ranch OBID5 | 41 | 43.13 | 58.33 | 25.00 | 36.11 | Poor |
| Roripaugh Ranch OBID6 | 43 | 37.50 | 75.00 | 25.00 | 36.11 | Poor |
| San Elijo OBID27 | 70 | 68.29 | 91.67 | 50.00 | 70.83 | Fair |
| San Vicente 401 | 68 | 43.13 | 83.33 | 75.00 | 69.44 | Fair |
| Sulphur Creek A | 50 | 37.50 | 66.67 | 25.00 | 69.44 | Poor |
| Sulphur Creek B | 49 | 37.50 | 66.67 | 25.00 | 66.67 | Poor |
| Temescal Creek | 67 | 93.29 | 75.00 | 37.50 | 63.89 | Fair |
| Upper Poway Creek at Sycamore Valley Road | 75 | 80.63 | 83.33 | 62.50 | 75.00 | Fair |
| Upper Poway Creek at Quiet Valley Road | 75 | 100.00 | 75.00 | 62.50 | 61.11 | Fair |



**Figure 6.** Field photographs of a stream reach within the Crystal Cove El Morro Trailer Park assessment area; this assessment has an Index Score of 82.

In addition to condition classes, CRAM data is also regularly viewed on a cumulative frequency distribution (CDF) curve. A CDF characterizes the percent of the aquatic resource, for example stream miles within an ecoregion, that has a specific CRAM score, with a known level of confidence. On a CDF, the x-axis shows the CRAM Index Score, while the y-axis shows the percent of the resource, or number of stream miles within the area of interest. The curve indicates the estimated percentage of stream miles in the ecoregion that have specific CRAM Index Scores. The grey shading around the curve indicates the upper and lower 95% confidence limits around the CDF estimates. CDFs can provide context for the range of condition observed across a region. For example, the median CRAM Index Score for the ecoregion can be found by selecting the 50th percentile on the y-axis, following it across horizontally until reaching the CDF curve, then tracing straight down to read the corresponding CRAM Index Score on the x-axis. In addition, a CDF shows the percentage of stream miles in the ecoregion in each of the three condition classes (poor, fair, and good).

The shape and location of a CDF curve on the graph provides information about the overall condition of the population of aquatic resources, or streams within the ecoregion. For example, a CDF curve that is shifted toward the right (towards higher CRAM Scores on the x-axis) reflects relatively better ecological conditions as compared to a curve that is shifted towards the left. A convex downward curve (one that starts on the left with a steep slope upward that then decreases towards the right) would indicate a higher proportion of stream miles with low CRAM condition scores, compared to a convex upward curve (one that starts on the left with a gradual upward slope that increases towards the right) indicates a higher proportion of stream miles with high condition scores.

Figure 7 shows the Riverine South Coast Ecoregion CRAM CDF (orange line), the 95% confidence limits (grey shading around the orange curve) and the 17 Riverine CRAM assessments conducted as part of this effort (black diamonds). The 17 CRAM assessments are within the 31st percentile to the 79th percentile of condition for all Riverine resources in the South Coast Ecoregion.

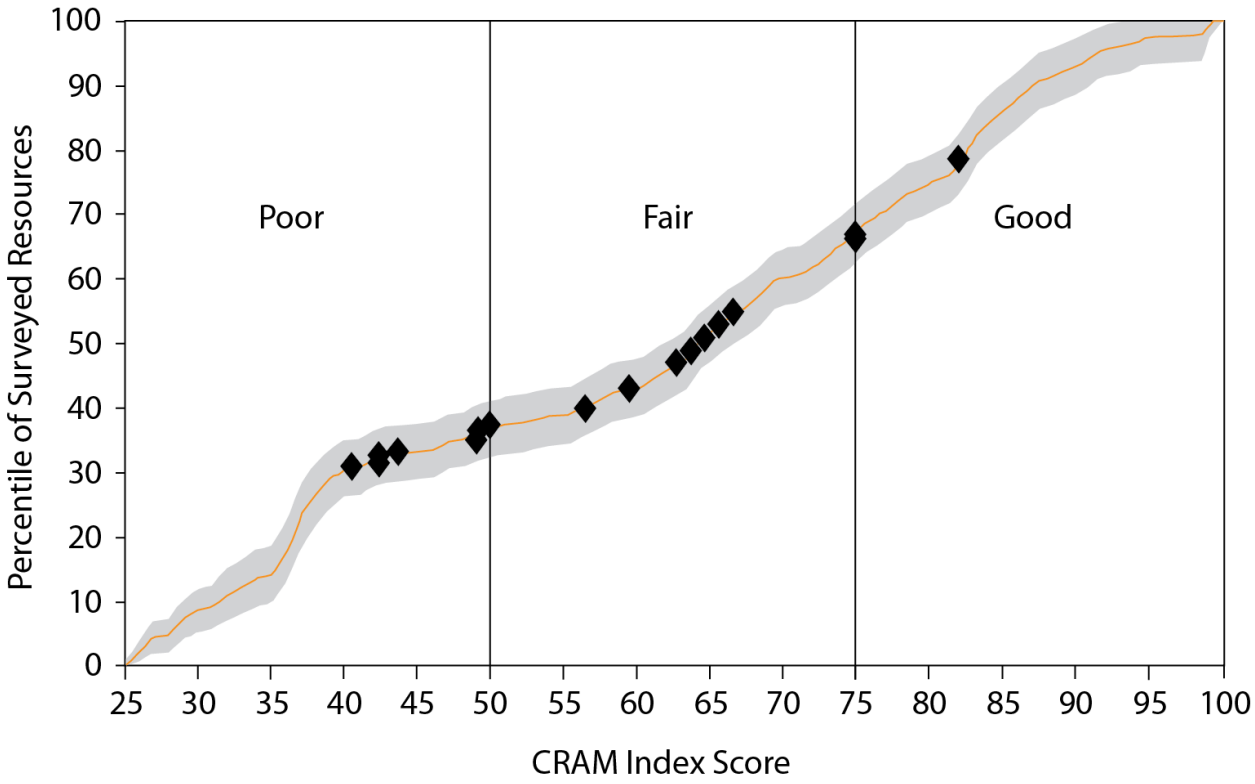



**Figure 7.** Graphic of the South Coast Ecoregional cumulative distribution function (CDF) estimate. The orange curve shows the CDF, while the grey shading around the curve indicates the 95% confidence limits. The 17 Riverine CRAM assessments completed during this effort are plotted on the curve as black diamonds.

Drilling down to the four Attribute Scores provides additional information about the condition of each site. The Buffer and Landscape Context Attribute Scores span the full range of scores between 25.00 and 100.00 for the full set of 20 assessments. However, closer inspection reveals that scores tend to be either poor or good, with very few scores in fair condition. This bi-modal distribution of scores reflects the landscape setting of these mitigation and restoration projects. The Poor condition scores are from sites that exist within the urban landscape, and are affected by upstream and downstream breaks in the riparian corridor (for instance, channels that go into underground culverts) and disruption in adjacent buffers. Many of the urban streams have a portion of their boundary without any buffer, either due to fencing at the top of the bank, or non-buffer land cover (e.g. parking lot, lawn, buildings) immediately adjacent to the stream. In other instances, buffer was present, but was either narrow, again due to adjacent non-buffer land covers, or was in poor condition due to non-native vegetation and/or disturbance. On the other hand, approximately one-third of the assessments were in Good condition, representing

sites located in rural or open space landscapes, or in the dedicated open space within larger developments.

The Hydrology Attribute scores range between 58.33 and 100.00, representing only Fair and Good condition. This Attribute is a good example of needing to drill down to the individual Metric Scores to better understand condition. Here, the Water Source Metric most often was impacted by some amount of urban development (a proxy for modified hydrology) in the watershed. This is not surprising, given the amount of urbanization within the San Diego Water Board jurisdiction. Next, the Channel Stability Metric most typically showed channels that are currently in equilibrium, as the wave of historical incision that previously impacted most stream reaches has subsided. However, the previous wave of incision *is* captured within the Hydrologic Connectivity Metric, as 12 of the 17 Riverine assessments have a reduced score.

The Physical Structure Attribute consistently has the lowest scores of the four Attributes, ranging from 25.00 to 75.00, but with only three assessments with a score of 75.00. The two Metrics within this Attribute are quantifying the relative simplicity of these 20 project sites, that is, not having many patch types and not having many benches, or unique elevations for floodwaters to spill across. Specifically, for the 17 Riverine sites, the lack of patch types, items such as pools, riffles, large wood, cobbles or boulders, channel bars, etc, is likely due to two primary reasons. First, many small, sand-dominated Southern California streams naturally lack large numbers of patches; the Physical Structure Attribute CDF shows that 56% of streams have an Attribute Score of 50 or lower, and 83% of streams have an Attribute Score of 75 or lower. The Upper Poway Creek at Sycamore Valley Road site represents a natural stream reach in a non-urban setting; this site has a Structural Patch Richness Metric score of C (6). However, many of the other low scores are due to channels that have been modified, simplified, and are managed for flow conveyance, such as the Sulphur Creek and Roripaugh Ranch sites. In addition, the other Metric, the Topographic Complexity Metric, captures the simplified channel geometry, or shape of many of these channels. Channels either completely lack a bench surface for floodwaters to spill across (typically due to historical incision) or have a single bench surface present. Sites with the single bench are those more natural channels (e.g. Upper Poway Creek, San Vicente, Crystal Cove El Morro), or project sites with larger channel corridors (La Paz, Lake Forest Sports Park). Future projects can use this information to design a more functional creek system by including a greater variety of physical patch types (ensuring that they are appropriate for the area and type of stream channel) and by ensuring that the stream channel has access to at least one inset floodplain surface. Building these features into future designs are not just “building to the Metric Score”, but instead represent features that ensure many geomorphic and ecologic processes and functions can occur within the stream.

And finally, the Biotic Structure Attribute has a wide range of scores, varying between 36.11 to 88.88. Of note, two of the three highest scores for this Attribute are from Slope Wetland assessment sites. The scores within this Attribute show that most of the 20 assessment sites have good scores for the Number of Plant Layers and the Percent Invasion Submetrics. However, the Number of Co-dominant Plant Species scores are generally low, with many sites receiving a score of C (6) or D (3). This score can partially be explained by the timing of these assessments; because CRAM does not include plants that have fully senesced as co-dominants, assessments that occur during the Fall typically have slightly lower scores for this Submetric because they may not include the annual understory species that were alive earlier in the season. However, best professional judgement and experience in Riverine systems across

the state suggests that many of these project sites generally *do* have simple vegetation communities, and that the scores are capturing an important characteristic of the site. Notably, two sites (Alvarado Invasives Removal and Aliso Creek Mouth) received a D (3) for the Percent Invasion Submetric. Both sites were included in the field assessments because they were invasive plant removal projects; current data shows that 50% (at the Alvarado Invasives Removal site) and 71% (at the Aliso Creek Mouth site) of the identified co-dominant plant species were invasive species listed on the California Invasive Plant Council (Cal-IPC) invasive list (Figure 8), indicating that removal of invasive plants at these sites has thus far been unsuccessful. In addition, the Horizontal Interspersion and the Vertical Biotic Structure Metrics also quantify the relative simplicity of the vegetation community in many of these assessment sites. Only the two slope wetland sites received an A (12) for Horizontal Interspersion; most of the Riverine sites received a C (6) or D (3). And more than half of the Riverine sites had very low amounts of overlapping plant layers (receiving C (6) or D (3)), illustrating a simple vegetation structure. Similarly to the Physical Structure Attribute above, future projects can use this information to design better projects. The vegetation community in project sites should aim to be complex, variable, and not necessarily predictable. Designs should aim to include a variety of height classes, species, two dimensional variability, and three dimensional complexity. There is ecological value in a heterogeneous plant community, because it offers unique niches and increased resilience.



**Figure 8.** Field photographs of invasive species observed at the Alvarado Invasives Removal project site (left) and the Aliso Creek Mouth project site (right).

# Stressors

Although the CRAM Stressor Checklist does not factor into the quantitative condition score, it is an important part of every assessment. The Stressor Checklist allows the practitioner to identify possible causes for low scores, to identify possible corrective actions, and to develop testable hypotheses relating scores to stressors. In other words, the Stressor Checklist can help explain the reasons behind low scores, and can help identify solutions to reduce stress on the site, and thus increase the condition score.

The Stressor Checklist reveals expected patterns across the 20 sites. Firstly, project sites located within the urban environment have a larger number of total stressors, and they have more stressors that are likely having a significant negative impact upon site condition. This is in contrast to the more rural sites, which have a much lower total number of stressors and fewer with a significant negative impact. Common stressors found at urban sites include: non-point source discharges, engineered channel, vegetation management, nutrient impaired, trash, predation and habitat destruction by non-native vertebrates, lack of treatment of invasive plants, urban residential, industrial/commercial, transportation corridor, and passive and active recreation. Stressors at rural sites were more varied, depending on where the project site was located and adjacent land uses. Observed stressors at these sites included: nutrient impaired, bacteria and pathogens impaired, mowing/grazing/excessive herbivory, lack of treatment of invasive plants, orchards/nurseries, and ranching or rangeland. Figure 9 shows photographs of some observed stressors from the 20 project assessments.

Although many project sites are unable to affect many of the landscape stressors outside of the project footprint, sometimes the Stressor Checklist can serve to highlight the reasons why a project site has a low score, and how additional projects in the adjacent area could improve both the new project location and the assessed project location. For example, the La Mesa SEP site is a short reach of daylighted stream that exists between underground segments upstream and downstream. The Stressor Checklist highlighted the existence of flow obstructions (underground culverted reaches), as well as grouted riprap grade control structures and engineered channel reaches as significant effects upon the condition of the daylighted reach. Daylighting adjacent upstream and/or downstream reaches would improve the condition of the entire channel length.



**Figure 9.** Field photographs of example stressors observed in the 20 project assessments. Upper left and right: trash and fan palm seedlings observed at the San Antonio Sewage Spill site. Middle left and right: adjacent urban residential and transportation corridors at the Roripaugh Ranch project site. Lower left: Adjacent urban park at the La Paz site. Lower right: riprap grade control structure at the Roripaugh Ranch project site.

# Summary

This demonstration project, completed through a collaboration between SFEI-ASC and the San Diego Water Board, assessed the overall ecological condition of completed mitigation, restoration, and SEP Projects within the region. The project aimed to illustrate how CRAM can evaluate project performance, track performance through time, and gain a regional understanding of stream and wetland condition and how projects are contributing towards improved condition. The project focused on answering the monitoring question:

- What is the current condition of streams and wetlands within previous mitigation or restoration projects that were permitted through the 401 Water Quality Certification Program, or were funded through Supplemental Environmental Project (SEP) funds?

The results of this project will help the San Diego Water Board evaluate if their permitting process is ensuring the creation of functioning aquatic resources and meeting the no-net-loss requirements of acreage and condition.

The project conducted CRAM assessments at 20 mitigation, restoration, or SEP project sites during the Fall of 2024. CRAM Index Scores ranged from a low of 41 to a high of 82; most sites were in Fair or Poor condition, with just a single site in Good condition. The single Good condition site (Crystal Cove El Morro Trailer Park restoration) is notable because it is the oldest project that was assessed, and is the only project within California State Park lands, relatively removed from adjacent development and on protected lands. With the exception of the Crystal Cove assessment and the Upper Poway Creek assessments, the other project sites are in the 31$^{st}$ percentile to the 54$^{th}$ percentile of condition for all Riverine resources in the South Coast Ecoregion. Ideally completed projects will be above the 50$^{th}$ percentile of condition in order to help shift the entire CDF curve to the right, representing an increase in condition across the full population of Riverine streams. Projects lower than the 50$^{th}$ percentile are not contributing towards improving the region's stream resources.

Drilling down into the CRAM Metric and Attribute Scores reveal the reasons for the distribution of Index Scores. Many of these sites exist within heavily urbanized landscapes, have experienced historical incision (for the Riverine sites), are physically very simple, and also have simple vegetation communities. Interestingly, two projects with the worst scores for the Percent Invasive Submetric (Aliso Creek Mouth and Alvarado Invasives Removal) were projects specifically funded for invasives removal; perhaps initial results were favorable, but lack of continued maintenance has allowed the sites to be overrun with invasives again. However, other sites that involved invasives removal (La Mesa SEP, San Elijo, and Upper Poway Creek at Sycamore Valley Road) all received the highest scores for this Submetric, indicating that the invasive plant removal at these sites has been successful. And finally, the Stressor Checklist within CRAM can be used as a tool to help project proponents and regulators identify stresses that are likely impacting the overall condition of each project site, and plan for modifications or adaptive management to reduce the impact of those stressors.

This demonstration project serves as a key step towards the development of a Wetlands Regional Monitoring Program (WRMP) to, among other objectives, assess the collective effectiveness of permits to protect and restore wetlands, as defined by the State Water Board. It also provides informative and valuable data to help the San Diego Water Board assess the effectiveness of projects within the region, and to potentially update permit and monitoring requirements for these types of projects.

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# APPENDIX A

# 2024 CRAM Assessment Scores

**Appendix A Table 1.** CRAM Metric, Attribute, and Index Scores for the 20 assessments completed in Fall 2024 in the San Diego Water Board region.

| | | 2024_RB9_SanDiego_Adobe Springs Specific Plan | 2024_RB9_SanDiego_Aliso Creek Mouth | 2024_RB9_SanDiego_Alvarado Invasives Removal | 2024_RB9_SanDiego_Antonio Sewage Spill | 2024_RB9_SanDiego_Crystal Cove El Morro Trailer Park | 2024_RB9_SanDiego_La Mesa SEP | 2024_RB9_SanDiego_La Paz | 2024_RB9_SanDiego_Lake Forest Sports Park | 2024_RB9_SanDiego_Pat Road Development | 2024_RB9_SanDiego_Rancho Jamul 1 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | eCRAM ID | 10162 | 10159 | 10147 | 10160 | 10161 | 10146 | 10153 | 10152 | 10154 | 10150 |
| **Attribute** | **Metric** | | | | | | | | | | |
| **Buffer and Landscape Context** | | **90.29** | **35.75** | **25.00** | **80.63** | **90.29** | **25.00** | **35.75** | **43.13** | **43.13** | **85.38** |
| | **Aquatic Area Abundance** | 12 | 3 | 3 | 12 | 12 | 3 | 3 | 3 | 3 | 12 |
| | **B: % of AA with Buffer** | 12 | 9 | 3 | 12 | 12 | 3 | 9 | 12 | 12 | 12 |
| | **B: Average Buffer Width** | 9 | 3 | 3 | 3 | 9 | 3 | 3 | 3 | 3 | 12 |
| | **B: Buffer Condition** | 9 | 6 | 3 | 9 | 9 | 3 | 6 | 9 | 9 | 6 |
| | | | | | | | | | | | |
| **Hydrology** | | **58.33** | **58.33** | **66.67** | **75.00** | **100.00** | **66.67** | **83.33** | **83.33** | **66.67** | **91.67** |
| | **Water Source** | 6 | 6 | 6 | 6 | 12 | 6 | 6 | 6 | 6 | 9 |
| | **Hydroperiod/Stability** | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 9 | 12 |
| | **Hydrologic Connectivity** | 3 | 3 | 6 | 9 | 12 | 6 | 12 | 12 | 9 | 12 |
| | | | | | | | | | | | |
| **Physical Structure** | | **25.00** | **50.00** | **50.00** | **37.50** | **75.00** | **37.50** | **50.00** | **75.00** | **25.00** | **25.00** |
| | **Structural Patch Richness** | 3 | 3 | 9 | 6 | 9 | 6 | 3 | 9 | 3 | 3 |
| | **Topographic Complexity** | 3 | 9 | 3 | 3 | 9 | 3 | 9 | 9 | 3 | 3 |
| | | | | | | | | | | | |
| **Biotic Structure** | | **52.78** | **44.44** | **55.56** | **58.33** | **63.89** | **44.44** | **69.44** | **52.78** | **41.67** | **61.11** |
| | **PC: No. of plant layers** | 12 | 12 | 12 | 9 | 9 | 6 | 12 | 9 | 9 | 12 |
| | **PC: No. of codominants** | 6 | 6 | 9 | 6 | 3 | 3 | 9 | 3 | 6 | 6 |
| | **PC: Percent Invasion** | 12 | 3 | 3 | 12 | 12 | 12 | 9 | 9 | 12 | 12 |
| | **Horizontal Interspersion** | 6 | 6 | 6 | 6 | 6 | 3 | 9 | 3 | 3 | 6 |
| | **Vertical Biotic Structure** | 3 | 3 | 6 | 6 | 9 | 6 | 6 | 9 | 3 | 6 |
| **CRAM Index Score** | | **57** | **47** | **49** | **63** | **82** | **43** | **60** | **64** | **44** | **66** |

| | | 2024_RB9_SanDiego_Rancho Jamul Floodplain 1 | 2024_RB9_SanDiego_Roripaugh Ranch OBID5 | 2024_RB9_SanDiego_Roripaugh Ranch OBID6 | 2024_RB9_SanDiego_San Elijo OBID27 | 2024_RB9_SanDiego_San Vicente 401 | 2024_RB9_SanDiego_Sulphur Creek A | 2024_RB9_SanDiego_Sulphur Creek B | 2024_RB9_SanDiego_Temescal Creek | 2024_RB9_SanDiego_Upper Poway Creek at Sycamore Valley Road | 2024_RB9_SanDiego_Upper Poway Quiet Valley Road |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | eCRAM ID | 10151 | 10155 | 10156 | 10149 | 10145 | 10157 | 10158 | 10148 | 10143 | 10144 |
| **Attribute** | **Metric** | | | | | | | | | | |
| **Buffer and Landscape Context** | | **55.79** | **43.13** | **37.50** | **68.29** | **43.13** | **37.50** | **37.50** | **93.29** | **80.63** | **100.00** |
| | **Aquatic Area Abundance** | 3 | 3 | 3 | 6 | 3 | 3 | 3 | 12 | 12 | 12 |
| | **B: % of AA with Buffer** | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| | **B: Average Buffer Width** | 12 | 3 | 3 | 12 | 3 | 3 | 3 | 12 | 3 | 12 |
| | **B: Buffer Condition** | 9 | 9 | 6 | 9 | 9 | 6 | 6 | 9 | 9 | 12 |
| | | | | | | | | | | | |
| **Hydrology** | | **91.67** | **58.33** | **75.00** | **91.67** | **83.33** | **66.67** | **66.67** | **75.00** | **83.33** | **75.00** |
| | **Water Source** | 9 | 6 | 9 | 9 | 6 | 6 | 6 | 9 | 9 | 9 |
| | **Hydroperiod/Stability** | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 |
| | **Hydrologic Connectivity** | 12 | 3 | 6 | 12 | 12 | 6 | 6 | 6 | 9 | 6 |
| | | | | | | | | | | | |
| **Physical Structure** | | **62.50** | **25.00** | **25.00** | **50.00** | **75.00** | **25.00** | **25.00** | **37.50** | **62.50** | **62.50** |
| | **Structural Patch Richness** | 6 | 3 | 3 | 3 | 9 | 3 | 3 | 6 | 6 | 6 |
| | **Topographic Complexity** | 9 | 3 | 3 | 9 | 9 | 3 | 3 | 3 | 9 | 9 |
| | | | | | | | | | | | |
| **Biotic Structure** | | **88.88** | **36.11** | **36.11** | **70.83** | **69.44** | **69.44** | **66.67** | **63.89** | **75.00** | **61.11** |
| | **PC: No. of plant layers** | 12 | 6 | 9 | - | 12 | 12 | 12 | 12 | 12 | 9 |
| | **PC: No. of codominants** | 9 | 3 | 3 | 6 | 6 | 6 | 6 | 3 | 3 | 3 |
| | **PC: Percent Invasion** | 12 | 12 | 9 | 12 | 12 | 12 | 9 | 9 | 12 | 9 |
| | **Horizontal Interspersion** | 12 | 3 | 3 | 12 | 6 | 6 | 6 | 6 | 9 | 6 |
| | **Vertical Biotic Structure** | 9 | 3 | 3 | 3 | 9 | 9 | 9 | 9 | 9 | 9 |
| | | | | | | | | | | | |
| **CRAM Index Score** | | **75** | **41** | **43** | **70** | **68** | **50** | **49** | **67** | **75** | **75** |

# APPENDIX B & C

Appendix B and C are available to download online in SFEI's *Publications and Report* Library[2]. They include:

- Appendix B: copies of downloaded CRAM Assessment Reports (~ 38 MB pdf)
- Appendix C: copies of 2024 CRAM field photos (~ 8 MB pdf)

[2] https://www.sfei.org/documents/2024-san-diego-regional-board-mitigation-and-sep-project-assessments