Evaluating Wetland Beneficial Uses At Project and Watershed Scales

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State Water Board Project 8414
Task 1

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A. Introduction

The California State Water Resources Control Board (State Water Board) is proposing *Draft Procedures for Discharges of Dredged or Fill Material to Waters of the State (proposed Procedures)* for inclusion in the Water Quality Control Plan for Inland Surface Waters and Enclosed Bays and Estuaries and Ocean Waters of California. The proposed Procedures consist of three major elements: 1) A statewide wetland area definition; 2) Wetland delineation procedures; and 3) Procedures for the regulation of dredged or fill discharges to waters of the state. The State Water Board's *Supplemental Dredged or Fill Guidelines* (Appendix A of the proposed Procedures) are consistent with the Clean Water Act Section 404(b)(1) Guidelines of the US Army Corps of Engineers (Corps). It is the State Water Board's intent to be consistent with the Corps' guidelines where feasible - bringing uniformity to the regulation of discharges of dredged or fill material to all waters of the state – including wetlands.

In addition to the *Supplemental Dredged or Fill Guidelines*, the Regional Water Boards are examining the feasibility of preparing a Water Quality Control Plan for Wetlands ("Wetlands Plan"). The Wetlands Plan describes a set of beneficial uses (BUs) attributed to all wetlands including four narrative wetland water quality objectives (WWQOs) intended to protect the BUs. The Wetlands Plan will also include guidance for evaluating whether the wetlands of a proposed restoration project, or populations of existing wetlands within the watershed, are fully attaining, partially attaining or not attaining their wetland beneficial uses.

In this memo we bring together many years of statewide coordination to develop standardized, science-based monitoring and assessment tools designed to support the state's wetland protection policies, including the *Supplemental Dredged or Fill Guidelines* and the wetland BUs and WWQOs.

- We describe the proposed wetland BUs and WWQOs and present the science-based linkages for how the California Rapid Assessment Method for wetlands (CRAM) is a *numeric translation* of the WWQOs.
- We briefly describe key EcoAtlas tools designed to support wetland restoration planning and compliance monitoring at the local, regional and statewide scales...
- We provide guidance for how to utilize CRAM and EcoAtlas tools to evaluate proposed wetland restoration projects using the 401 Certification Program's proposed Site Suitability Evaluation Checklist.
- We demonstrate how probability based wetland condition surveys that use CRAM assess wetland beneficial use attainment at a watershed scale.

B. Background

The California Wetland Monitoring Workgroup (CWMW), a workgroup of the State Water Board's California Water Quality Monitoring Council (CWQMC), developed the *Tenants of a State Wetland and Riparian Area Monitoring Plan* (WRAMP, April 2010), which calls for statewide standardized methods for mapping, condition assessment, quality assurance, data management, and reporting on wetlands. WRAMP outlines the adopted framework for standardized monitoring and assessment tools to support wetland regulation; including permitting decisions and monitoring and tracking of wetland projects to ensure that wetland BUs are protected. To support WRAMP implementation, the CWMW and its science partners developed and implemented the California Rapid Assessment Method for wetlands (CRAM), the California Aquatic Resources Inventory (CARI) and other EcoAtlas tool (www.ecoatlas.org). EcoAtlas operationalizes the CWQMC's goal to *improve the delivery of water quality and related ecosystem health information to decision makers and the public*. EcoAtlas is organized around the USEPA's 3-level framework for monitoring and assessing wetland resources: CARI is a science-based, standardized Level- 1 GIS-based map and mapping protocol for wetlands and other aquatic resources, and CRAM is a science-based, standardized Level-2 rapid assessment methodology to assess the condition of all types of wetlands across the state.

EcoAtlas tools include science-based field methods, robust data management resources, and compiled geospatial and monitoring data for assessing, tracking, and reporting on the amount, distribution, and condition of wetlands at different landscape scales (project, local, regional and statewide). The purpose of the tools is to support regulatory and management programs as well as provide scientists (and the public) access to data and information for improved monitoring and assessment of wetlands in California.

As part of the permitting process, State Water Board staff must determine if proposed wetland restoration or compensatory mitigation projects adequately ensures *'no overall net loss and long-term net gain in the quantity, quality, and permanence of wetland acreage and values…'* in the region. Section 404(b)(1) project permit applications submitted to the Corps also must be considered for 'no net loss.' The LA District of the Corps has developed a Site Suitability Evaluation Checklist to evaluate the suitability of a project in terms of ecological benefit (i.e., functional lift) and no net loss. Given the State Water Board's intent to be consistent with the Corps' guidelines (where feasible) we adopted the existing version of the Corps' checklist for the State Water Boards' project proposal evaluation of beneficial use attainment and no net loss of wetlands within a defined project evaluation area (PEA) or local watershed extent.

C. Wetland Beneficial Uses, Narrative Water Quality Objectives & CRAM

Under the Wetlands Plan, all wetlands have three designated beneficial uses (BUs): Wetland habitat, water quality enhancement, and hydrology support. There are four narrative Wetland water Quality Objectives (WWQOs) that apply to each designated BU.

> Biological Objective**:** The **biological integrity** of wetlands shall be protected, and the occurrence of flora and fauna shall be comparable to that naturally present in wetlands of similar type.
>
> Wetlands shall be protected to **prevent conditions that cause the establishment or proliferation nuisance organisms**.
>
> Physical Objective: The **physical structure** shall be protected, and be comparable to that naturally present in wetlands of similar type.
>
> Chemical Objective: Wetlands shall be **free from substances attributed to waste discharges that would substantially degrade biological communities** associated with those wetlands. The chemical constituents in water and the substrate within wetlands shall be comparable to that naturally present in wetlands of similar type.
>
> Hydrological Objective: The **hydrology** of wetlands, including the extent, duration and frequency of saturated or ponded conditions, and water flow, shall be comparable to that naturally present in wetlands of similar type.

The regulatory approach recognizes that individual wetlands are integral components of ecological and hydrological systems, and that individual wetlands must be assessed in the context of these systems, to protect their beneficial uses. The Procedures offer that the PEA demarcates the boundaries of the systems, and that the PEA is therefore the spatial template for the assessments of whether or not the WWQO are being met.

The best, currently available, field method for assessing wetland condition, relative to the standard WWQOs, is CRAM. CRAM metrics were designed to directly measure the biological, physical, and hydrological aspects of wetland condition. Individual CRAM metrics and attributes pertain directly to each to the narrative criteria of the WWQOs. The numeric CRAM scores can be used to assess how well a wetland is functioning compared to reference conditions, and relative to other wetlands in the PEA, and therefore can be used to determine whether or not a wetland is meeting the WWQOs.

C.1. Level 2 (CRAM) Numeric Translation of WWQOs

CRAM is a field-based rapid method that can be used by trained practitioners to assess wetland condition based on visible indicators of physical and biological structure. CRAM scores represent the ability or capacity of a wetland area to provide high levels of its expected ecosystem services (CWMW, 2013). CRAM was created in response to a recognized lack of systematic, standardized, and scientifically defensible statewide data on wetland condition, readily available to agencies, managers, scientists, and the public, to inform and evaluate wetland policies, programs, and projects. CRAM is well suited for providing condition data for individual wetlands and populations of wetlands, in the PEA context.

CRAM is part of the California State Wetland and Riparian Area Monitoring Plan (WRAMP) is based on the USEPA 3-level framework for comprehensive, consistent monitoring and assessment of wetlands. Level 1 tools use remote sensing data for landscape-level analyses of aquatic resources. Level 2 tools provide rapid, semi-quantitative assessments of field condition or stress based on visible indicators. Level 3 tools provide quantitative, empirical, field-based measures of particular aspects of wetland condition or stress.

CRAM development and applications are guided by the statewide Level 2 Committee (L2 Committee) of the CWMW. The L2 Committee has validated CRAM by assessing the strength of correlations between CRAM scores and independent Level 3 data that quantify variations in key wetland functions or services along natural climatic gradients, as well as gradients of anthropogenic stress. The L2 Committee has determined that CRAM can be used to assess wetland condition as affected by stage of wetland development, amount or degree of stress, as well as management actions (CWMW, 2013). It can be assumed that wetlands with higher scores have greater capacity to provide higher levels of their intrinsic services than wetlands with lower scores.

Each CRAM assessment involves evaluation of four universal attributes of wetland condition for an Assessment Area (AA) of standard size and shape. The Attributes are named Buffer and Landscape Context, Hydrology, Physical Structure, and Biotic Structure. For each Attribute, there are 2-3 Metrics, sometimes with sub-metrics, that are used to assess specific aspects of the Attribute. For each Metric, practitioners select the most suitable of four mutually exclusive descriptions of condition, based on the field indicators of the Metrics. The four descriptions together represent the statewide range in observed condition of the Metric. Each description has a numerical value 1, 3, 9, or 12. The assessment of each AA consists of the overall CRAM Index score, which is the average of the four Attributes scores, each of which is the sum of its Metric scores.

The CRAM Metric, Attribute, and Index scores are standardized, scientifically defensible, field-based evaluations of wetland condition. Because wetland condition reflects the capacity of a wetland to support its intrinsic processes, functions, and services, the CRAM scores can be used to assess the ability of the area to meet the narrative WWQOs. Understanding the scientific meaning of each score helps in the interpretation of CRAM results, relative to beneficial use attainment. **CRAM is a *numeric translation* of the narrative Wetland water Quality Objectives.** Table 3.1 lists the direct and indirect linkages between CRAM Metrics and the WWQOs.

Table 3.1. List of CRAM Attribute, metrics and sub-metrics indicating direct (D) or indirect (I) linkages between the four narrative WWQO criteria.

CRAM measure	Biology		Physical Structure	Chemistry	Hydrology
	Biological Integrity	Nuisance Organisms	Similar to Natural	Free from Degrading Substances	Similar to Natural
Buffer and Landscape Context					
Aquatic Area Abundance	D	D	I	I	D
% of AA with Buffer	D	D	I	D	I
Average Buffer Width	D	D	I	D	I
Buffer Condition	D	D	I	D	I
Hydrology					
Water Source	D	D	D	D	D
Hydroperiod or Channel Stability	D	D	D	D	D
Hydrologic Connectivity	D	I	D	NA	D
Physical Structure					
Structural Patch Richness	D	D	D	NA	I
Topographic Complexity	D	I	D	NA	D
Biotic Structure					
No. of plant layers	D	I	no	I	I
No. of co-dominants	D	I	no	I	I
Percent Invasion	D	D	no	I	I
Horizontal Interspersion	D	D	I	NA	D
Vertical Biotic Structure	D	D	NA	NA	I

A variety of ecological information is integrated into CRAM scores. Each Index Score is a single number between 25 and 100 that quickly informs project managers or regulators about the overall condition of a wetland area. The Attribute scores pertain to major aspects of condition, and help explain the Index scores. The Metric scores pertain to key aspects of the Attributes, and help explain the Attribute scores. Wetland managers and scientists can "drill down" through the Index and Attribute scores to the Metric scores of a wetland to understand what might be done to improve its condition.

C.1.1 Ecological Health Classes Based on CRAM

CRAM Index scores can also be used to classify the condition of wetland or population of wetlands as poor, fair, or good. For the purposes of demonstration, the full range of possible CRAM Index scores is partitioned into three equal-interval condition classes as follows: 25-50 (poor condition), 51-75 (fair condition), and 76-100 (good condition). These health classes can be used to evaluate wetland BU attainment (described further below): wetlands in good condition can be assumed to be meeting all of the beneficial uses, wetlands in fair ecological condition can be assumed to be meeting some of the beneficial uses, and wetlands in poor ecological condition are likely not meeting the beneficial uses.

The three equal-interval condition classes presented are simply arithmetic tertiles of the range of the possible

CRAM Index scores. They objective and neutral. They are not delimited by CRAM scores that coincide with thresholds in condition for any wetland function, service, or BU. The data to derive thresholds tend to be case-specific and have not been developed for enough cases to support any synthetic “rules of thumb.” However, the L2 Committee has determined that wetlands classified as poor, fair, or good, based on these neutral tertiles, are very likely to differ in functional capacity. Furthermore, the L2 Committee recommends that any two Index scores differing by at least ten pints probably represent different functional capacity, even if they both scores belong to the same condition class. The classes could be further adjusted based on breaks in slope or other indicators of changes in correlations between CRAM scores and Level-3 along gradients of wetland stress.

C.2 Level 1 (EcoAtlas) Numeric Translation of WWQOs

EcoAtlas is a set of interactive, map-based online tools that provide local, regional and statewide agencies with standardized wetland mapping protocols and maps including the California Aquatic Resource Inventory (CARI), rapid wetland condition assessment data (CRAM), and web-based data management and access of water quality data (CD3; the Contaminant Data Download and Display tool). It includes online forms with the capability to map a project impact and mitigation areas, and a file archive system for wetland project tracking. Data and landscaped-based summaries (based on user-defined areas) can be accessed and downloaded through EcoAtlas. More information about these tools and other available data layers are available online at https://www.ecoatlas.org/about/.

CRAM assessment sites are visible as one of the data layers in EcoAtlas (Figure 1), and it has been widely implemented across the state with almost 6,000 assessments. CRAM has been utilized to characterize the ecological condition of projects as well as ambient or baseline wetlands conditions within watersheds, regions, and statewide.

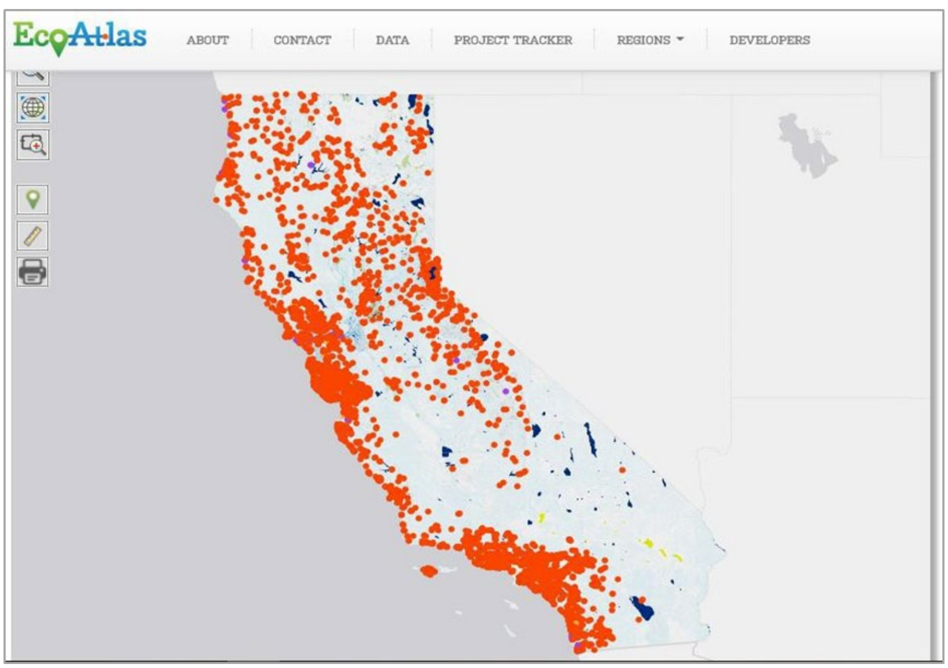

Figure 1. Screenshot from EcoAtlas showing a map of the aquatic resources (CARI) and location of almost 6,000 CRAM wetland assessment sites across the state.

D. Applications of EcoAtlas tools to support the WRAMP

The WRAMP framework for wetland monitoring and assessment was demonstrated in several watersheds representing different climatological regions of across the State. T he Santa Clara Valley Water District (SCVWD), in South San Francisco Bay Area, has been utilizing the WRAMP framework since 2010. The District's Safe Clean Water Program - Priority D5 Project implements the WRAMP framework and selected EcoAtlas tools (CARI and CRAM) to: 1) characterize the baseline amount and distribution of wetlands in five major watersheds; and 2) estimate the overall ecological conditions of the streams within these watersheds, employing CRAM in a probabilistic sample plan. SCVWD plans to reassess each watershed over time to track, evaluate, and inform wetland restoration and ecological management priorities. The SCVWD has also use CRAM to guide the design and planning for a large restoration project in the Llagas Creek watershed in Santa Clara County, CA, in a pilot project for watershed based restoration planning.

The South Pacific Division (SPD) of the U.S. Army Corps of Engineers (USACE) has adopted CRAM as an acceptable Functional or Condition Assessment Method (FCAM) for assessing wetland impacts and compensatory mitigation.[1] The Los Angeles District of the USCAE (LA USACE) has developed a procedure based on the SPD guidance. The following two sections present methods for evaluating individual wetland project proposals in a landscape context (i.e., a PEA) using a modified version of the LA USACE Site Evaluation Checklist, and how to use CRAM to assess wetland BU attainment in a PEA.

D.1 The Site Suitability Evaluation Checklist

The Checklist is intended to be completed by staff of the State Water Board 401 Program during the process of reviewing an application for 401 Certification. The checklist guides Staff to use a variety of project information provided by the applicant, plus ancillary scientific data to objectively and systematically evaluate the project, to assure that it will sustain or improve the wetland landscape profile of the encompassing PEA, and thus meet the WWQOs.

The checklist consists of a set of questions divided into nine sections (see Appendix A). Each section asks for specific details about the wetland project needed by staff to evaluate how well the project meets the WWQOs, and thus supports and protects wetland beneficial uses. Some questions can be answered yes or no, whereas other questions require descriptive answers.

The version of the Checklist used here is fundamentally the same ax the LA USACE Checklist, with a few additional questions that are relevant to the State Water Board 401 Certification Program. The added questions pertain to project administration, project type, project setting and watershed context, and project sustainability, as well as a summary evaluation.

Staff can answer each question using information provided by the applicant, from their own inquiries, and using output from one or more EcoAtlas tools. In the future, the applicant will enter most of the required information into Project Tracker or another online form accessible through EcoAtlas. Ideally, an applicant would follow these basic steps to provide staff with essential evaluation data and information.

1 The applicant enters project information into Project Tracker, including maps of the proposed project site and impact site(s), by completing the on-line project information forms. EcoAtlas has an on-line mapping tool to help applicants provide the necessary site maps, or the applicant can upload prepared KMZ or ARC GIS-shape files into Project Tracker.

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[1] http://www.spd.usace.army.mil/Portals/13/docs/regulatory/mitigation/MitMon.pdf

2 The applicant enters pre-construction CRAM assessment results for both the impact site(s) and proposed mitigation site into the online CRAM database (eCRAM).

3 The applicant develops estimates of post-project CRAM scores for the mitigation and impact sites, based on project designs, detailed knowledge of the project elements, and expected future site management plans.

4 The applicant submits a written application (or completes the application on 'On-line 401' tool prepared by the State water Board) to the State Water Board, including confirmation that the project information has been submitted to Project Tracker in EcoAtlas.

Each non-administrative section requires Staff to decide whether or not the project is "acceptable," meaning *environmentally acceptable, or appropriate for protecting beneficial uses*. The last section of the checklist is a summary evaluation that asks Staff to tally the total number of *acceptable* sections and make a final determination (with supporting narrative) for why the project site is, or is not, suitable for certification.

D.2 Santa Rosa Plain Example

The hypothetical project is located in the Santa Rosa plain, west of the town of Santa Rosa, and just east of the Laguna de Santa Rosa, in Sonoma County. The project is set on land owned by the Jones Family (see Figure 2 below). The Jones' have operated a family farm on this site for 100 years, but as times are now tough, they have decided to sell a portion of their land adjacent to Guerneville Road to a developer of convenience stores, who has necessary agreements from the County to build a new convenience store on the property. The plans for the project include filling a small portion of an existing seasonal depressional wetland, so that a truck delivery ramp can be constructed. The developer is seeking a 401 Certification for mitigation for the proposed fill.

The existing depressional wetland was created nearly 100 years ago by constructing a berm across a small, natural, intermittent channel. To mitigate for the filling that will occur in this naturalized wetland, a new seasonal depressional wetland will be created in the upland area in front of the convenience store. The depression will rely upon water from: a) an engineered feature that will route flow from the intermittent channel; and b) runoff from the convenience store parking lot. When the water in the new depression reaches a certain elevation, it will pass over a weir, returning to the intermittent channel, and then filling the remainder of the existing depression. The proposed mitigation site is currently used as farmland, and is in active production of annual low-value pasture. It is upland that does not house any special status species.

The plans for the project call for creating a 0.2-acre (800 m^2) seasonal depressional wetland that is 0.6m deep. Crews will excavate approximately 500 CY of soil from the site, placing half of it as a raised berm (with breaks) around the outside of the depression. In addition to the raised berm, a short decorative fence will be installed to protect the created wetland from store patrons. The plans call for many habitat features, drawing on concepts presented in CRAM. A small topographic bench will be created within the wetland to increase its topographic complexity, along with a number of habitat features such as logs, boulders, and snags to increase its structural patch richness and habitat complexity. It is expected that the population of burrowing rodents from the channel area will migrate to the depression margin, and that macroalgae would likely develop due to a relatively high nutrient load endemic to the agricultural setting.

With regard to vegetation, the plans for the project call for hydroseeding, using a seed mixture for three native grasses, and planting the outside edge of the depression with a native plant palette, including shrubs (mulefat, coffee berry) and trees (arroyo willow, red willow, valley oak). Plants will be arranged in rings to maximize survival due to the water requirements of each species. The applicant expects natural recruitment of herbs and forbs, such as Persicaria and willow herb, into the depression bottom. Plants will be irrigated for three years, and invasive species will be controlled by bi-annual maintenance using hand crews and spot spraying twice a year. The developer will own and manage the site in perpetuity.

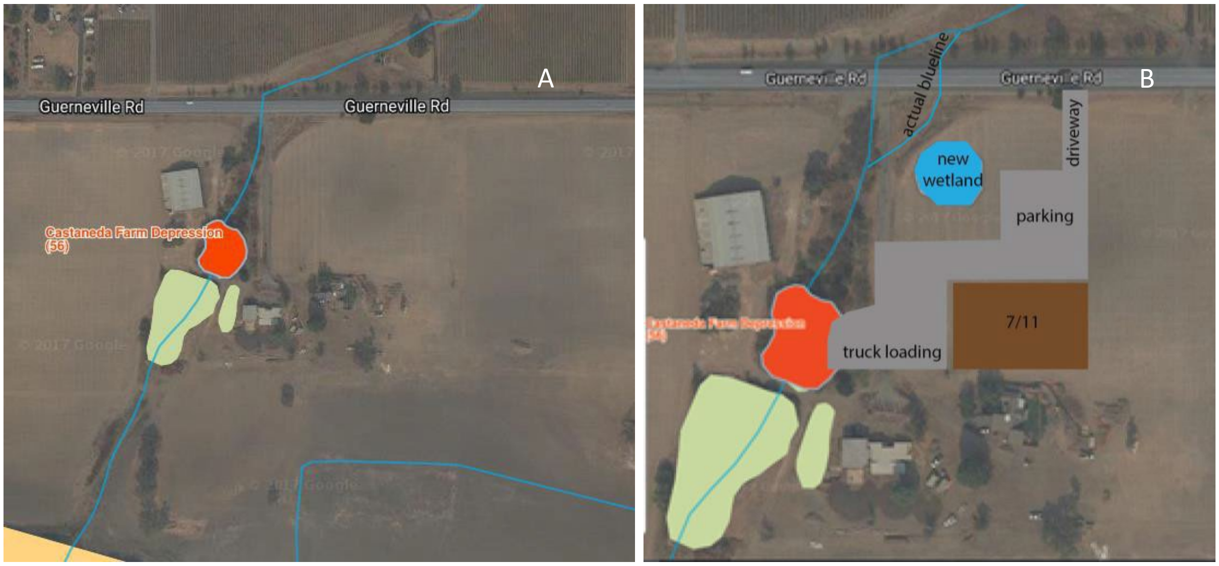


Figure 2. A: The Jones family pre-construction site showing the stream channel (blue-line) flowing top to bottom, and three depressional wetlands as mapped by CARI (two are light green, and one is red); the red polygon illustrates the Assessment Area (AA) of a single CRAM assessment. This is a real assessment completed in 2013 as part of the Santa Rosa Plain WRAMP demonstration project. B: The future site, showing the footprint o the proposed convenience store in brown, and the associated impervious surfaces in grey, and the proposed mitigation wetland in blue. The stream channel (blue-line) shows an error in the CARI map, with the updated location of the channel ("actual blue line") having been updated by the applicant using the CARI editor in EcoAtlas.

D.3. Completed Site Suitability Evaluation Checklist

The Site Suitability Evaluation Checklist has been completed for this hypothetical example. The completed checklist is presented below. The Checklist questions are shown in black, and the answers are shown in blue. The Questions are coded for the Checklist section to which they belong (1-9) and for their order within the section (a, a1, b, c, etc.). We chose not to use the actual worksheet format, as presented in Appendix A, in order to provide more complete descriptive answers and more guidance than the form allows. The explanations and guidance are italicized.

1.a Date
11/30/1

1.b Corps file no., Water Board file no., or Project Tracker ID
SPL-2017-xxx

1.c Project name
Guerneville Road Store

1.d Project manager

Jane Doe

2.a Wetland project site name and location

Guerneville Road Store, located in the Lower Santa Rosa Creek Watershed PEA, South side of Guerneville Road, Santa Rosa, Sonoma County, CA

2.a.1 Proposed size of wetland to be restored: acres by type

0.2 acres of seasonal depressional wetland.

This question was added to the Water Board checklist, as the LA USACE Checklist does not include a question about size of the project.

2.b Restoration objectives to improve: (habitat conservation/biodiversity; water storage/flow attenuation; water quality; etc)

Habitat creation, Flow attenuation.

This question should capture the main objectives of the project. This project will create new seasonal depressional wetland habitat suitable for some common amphibians, passerine birds, small mammals, and native wetland vegetation. It will increase locally the amount of wetland area. It will also fill with water that is sourced from the small upstream watershed (mainly vineyards), as well as runoff from Guerneville Road and the new impervious surfaces of the proposed commercial development.

2.c Proposed mitigation method (re-establishment; rehabilitation; enhancement). If enhancement, list functioning to be increased.

Establishment (Creation).

This project is creating a wetland in previous upland; no previously existing aquatic are is present.

2.d Primary types of site treatment: (Introduction of native vegetation; invasive species control; etc.)

Topographic manipulation, native vegetation plantings.

This project will move soil to create the depression, create a discontinuous berm, hydroseed and add native plantings.

2. e Aquatic resource type - Proposed type of wetland to be restored (Slope; Riverine; Estuarine, etc.)

Depressional

Wetland type is based on the CARI typology which is also the CRAM typology. Using this typology assures that L1 and L2 assessments for this project can be compared to other projects and to regional or statewide wetland landscape profiles.

2.f Hydrology

Depressional wetland, seasonally flooded.

This question asks the user to describe the hydrology that will support the system. Water will be sourced from adjacent intermittent channel (through an engineered inlet), in addition to runoff from the parking lot being routed into the depression. Water will infiltrate, evaporate, or exit over an engineered weir, returning water back into the intermittent channel. The project will be irrigated with portable water until planted vegetation is established.

2.g FCAM classification used: FCAM subclass

CRAM Depressional Module

CRAM is a functional-conditional assessment method accepted as such by the SPD USACE.

2.h Vegetation classification system used: Vegetation classes/subclasses:

Manual of California Vegetation 2015. Class/subclass: annual grassland (perennial ryegrass).

This information can be provided by the project applicant, or Staff can conduct some investigation. There are multiple vegetation classification systems in use across the state.

2.i Vernacular/common name of proposed type of aquatic resource, if appropriate:

Seasonal depression

This is a common term for seasonal depessional wetlands as defined by the CARI typology.

3.a Are mitigation proposal objectives aligned with the objectives of one or more appropriate watershed plans?

Yes.

City of Santa Rosa Master Creek Plan (https://srcity.org/DocumentCenter/Home/View/13792) Pages 89-95, additional creek-specific details after page 95, and the closest reach is listed on page 105. Project is also consistent with the pollution off-set trading program being developed by the North Coast Regional Water Quality Control Board to implement the nutrient TMDL for the Laguna de Santa Rosa.

In addition to simply listing the watershed plan, the staff should provide a short summary as to what objectives are aligned, and how are they aligned. For instance, in the Santa Rosa Citywide Creek Master Plan, a number of specific creek reaches are described and specific recommendations made. Although the plan is specific to creeks, and the small intermittent channel adjacent to the project is too small to be listed in the plan, the site is only about 400m away from a listed reach of Santa Rosa Creek. Therefore, the priorities for this reach likely apply to the project area as well. The recommendations call for overall riparian enhancement due to existing significant riparian corridors, removal of invasive plants, and planting of native species.

3.b Are step 3.a objectives acceptable overall?

Yes.

The site is in alignment with local watershed plans.

4.a Would the type of aquatic resource proposed for mitigation help sustain and improve the overall watershed profile of the watershed?

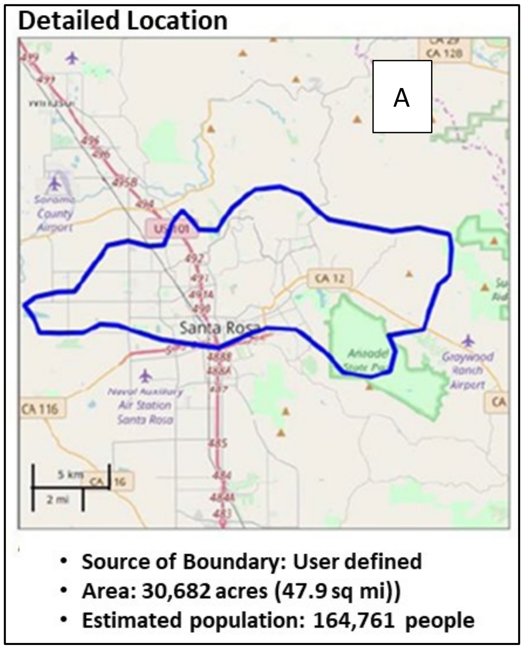
Yes.

The first part of question 4.a pertains to "no net loss". Using the Landscape Profile tool of EcoAtlas (see Appendix B), Staff develops a profile of the existing acreage of wetlands (by type) for the PEA (see Figure *3 below). Staff can then compare the project to the overall total amount of wetlands within the PEA, or to the total of that wetland type, and the effect of the project on wetland diversity is also evident. By this method, Staff determines that the Project will increase the overall acres of depressional wetland in the PEA by 0.1% (see* Figure *3), and will not diminish wetland diversity.*

The second part of the question 4.a relates to wetland condition, and places the project in the watershed context. To address this part of the question, the project proponent and 401 Staff complete the following steps

4.a.1 Conduct CRAM to assess conditions of the existing mitigation and impacts sites.

4.a.2 Estimate post-project CRAM assessments for the project site and impact site, based on either a 5-year or 10-year timeframe, using the site-specific project designs, development plans, and management and maintenance plans. These scores allow the



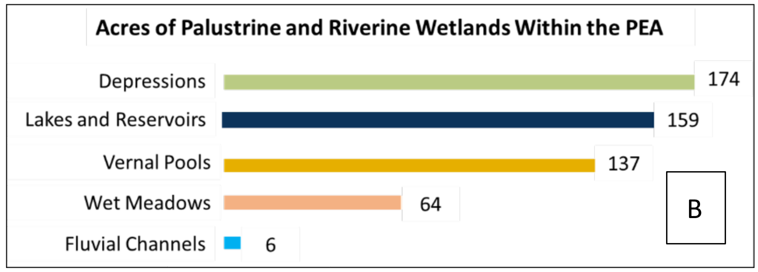


Figure 3. A: map of the PEA developed in the Landscape Profile too using the online, heads-up mapping too. B: output of the Landscape Profile Tool showing the relative and absolute amount of wetland within the PEA by type.

staff to know the pre-project and the post-project wetland condition.

4.a.3 *The post-project scores (in this instance, projected 10 years from the project completion date) allow Staff to place the project on the Habitat Development Curve (available on EcoAtlas) to see if the project is maturing at a rate that will eventually reach "reference condition" (see* Figure *4A below). If the site plots below the curve, adaptive management should be considered to raise the site condition.*

4.a.4 *Staff can utilize a Cumulative Distribution Function (CDF) of CRAM scores for the site to assess the condition of the site relative to other wetlands of the same kind. A CDF describes the distribution of wetlands across the range of possible condition for the PEA or other comparable landscape or region. In this case, a CDF for the Santa Rosa Plain was completed in 2014 (se* Figure*4B below). However, in the absence of a local CDF, EcoAtlas provides a CDF based upon the eCRAM database for that ecoregion.*

4.a.4.1 *Staff can use the CDF of Index scores to classify the existing and expected future conditions of the mitigation and impact sites are poor, fair, or good (*Figure *4B). This is important for assessing functional lift and setting mitigation ratios.*

4.a.3.2 *Staff can also use the CDF of Index scores to determine the percentiles of the existing and expected future conditions of the impact and mitigation sites (*Figure *4B). This will help inform the determination of mitigation ratios, and will help assess the overall effect of the project on the wetland landscape profile. For example, projects that score above the* 50^{th} *percentile of the CDF will increases the average condition of wetlands within the PEA. By plotting the existing project Attribute and Metric scores on the Attribute and Metrics CDFs, Staff can gain insights into what aspects of project condition might be improved through project design or management.*

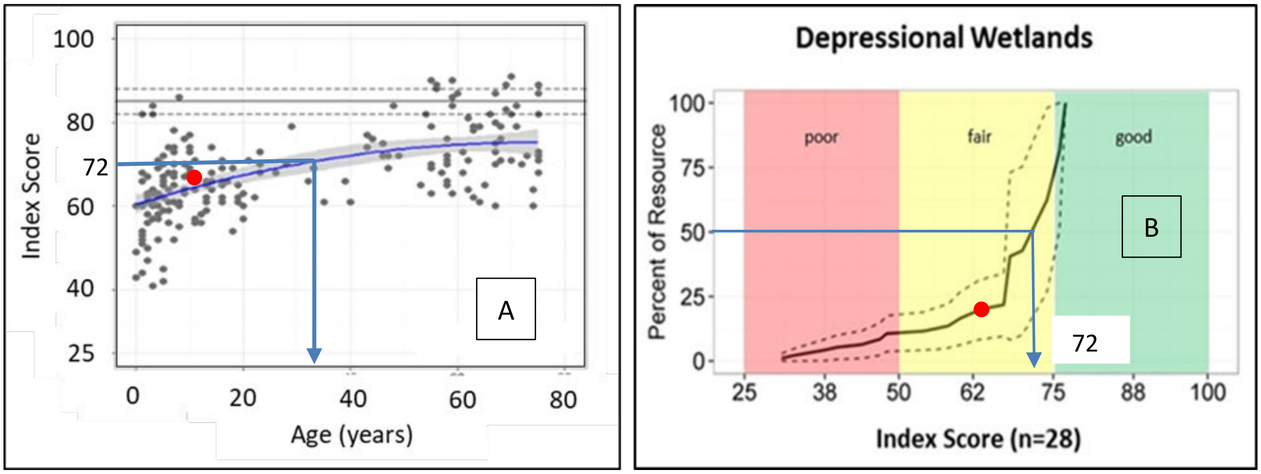


Figure 4. (A) Habitat Development Curve (HDC) for depressional wetlands in California; and (B) plot of the Cumulative Distribution Function (CDF) for depressional wetlands on the Santa Rosa Plain. The hypothetical project is expected to have a CRAM Index score of 65, ten years after project completion. The score of 65 plots just above the HDC (see red dot in 5A). The expected future Project score of 65 is less than the 50th percentile score of 72, based on the suitable CDF (see red dot in Figure 5B). The project will not sustain or improve the overall profile of wetland condition for the PEA, unless it achieves a score of 72 or greater. According to the HDC, the project will not achieve a score of 72 for about 35 years. If conditions are required to improve faster, the Attribute and Metric scores of the project should be examined for indications of how the designs or management plans of the project might be adjusted to improve its initial CRAM scores.

4.b Following project completion, would the site connect to existing stream network and/or wetlands complex such that the site would not be ecologically isolated?

Yes.

The project site is 20m from an existing stream channel, and 40m from an existing seasonal depressional wetlands, as indicated by the CARI in EcoAtlas. Staff can use the measuring tool in EcoAtlas to determine distances between aquatic features. Alternatively, staff can look at the Aquatic Area Abundance Metric in the CRAM worksheets of the project assessment evidence of the abundance of aquatic features within 500m of the project.

4.c Would the site reduce gaps in stream network and or wetlands complex?

Yes.

The creation of the new seasonal depressional wetland will reduce the distance between wetlands in the immediate landscape. Staff can use the measuring tool in EcoAtlas to determine distances between aquatic features. Alternatively, staff can look at the Aquatic Area Abundance Metric in the CRAM worksheets of the project assessment for evidence of the abundance of aquatic features within 500m of the project.

4.d Is step 4 acceptable overall?

Yes.

The project will contribute to 'no net loss', will be ecologically connected, and will reduce gaps between wetlands on the landscape. However, the site will not initially achieve a high CRAM score and is unlikely to achieve scores above the 50th percentile for the PEA for at least 35 years. The applicant should consider using the CRAM assessment to guide revisions in project designs or management to achieve higher scores faster.

5.a The site is not an aquatic resource.,

Yes.

The project site is currently upland annual grassland. Apart from materials provided by the applicant, Staff can use EcoAtlas to view CARI plus, view any additional aerial imagery, as well as view the NRCS maps of hydric soils, to determine whether or not the site is wetland.

5.b The site is not high quality terrestrial habitat.

Yes.

The project site is not high quality terrestrial habitat. The 2011 National Land Cover Database (NLCD) indicates that the site is developed open space and Google Earth satellite imagery (2013) indicates that it is an agricultural field that is mowed or tilled periodically. The site is not a protected area (CPAD 2014); is not a conservation easement (CCED); is not on a Native American reservation, State Park, State or federal Wildlife Preserve or Refuge, and is not subject to an conservation easement. Staff can find this information in the BIOS of CDFW (https://map.dfg.ca.gov/bios/).

5.c The site is in close proximity to an aquatic resource in good functional condition. (For proximal site, consider FCAM scores).

No.

In this case, "close" means within the home range of amphibians, small mammals, and other resident wildlife that must traverse uplands between suitable wetlands habitat. The existing depressional wetland has a CRAM score of 56 (poor-fair condition). Using the measuring tool in EcoAtlas, we determined that the nearest stream and depressional wetland are 350m and 600m from the project site, respectively. We determined that, for the ecological functions of the setting, the site is not close to these other aquatic resources. These other aquatic resources have not been assessed except by cursory field inspection and by using recent, high-resolution aerial imagery. The available CRAM assessments for the stream are too far upstream from the reach nearest the project site to be relevant.

5.d For re-establishment, is there evidence the type of proposed aquatic resource was present historically on site?

No.

The project site was never an aquatic resource. In this case, both historical aerial imagery dating to the 1930s (e.g. NETR online), and a reproduction of the historical landscape of the late 1700s are available through EcoAtlas indicate that site has been upland or agricultural since European contact.

5.e The site is a degraded aquatic resource.

No.

The project site is currently upland, not aquatic. This question is relevant for rehabilitation or enhancement projects that intent to lift conditions of an existing wetland. This project will create new wetlands.

5.f For rehabilitation, would increase most, if not all, functions.

This question is not relevant, as this project is not rehabilitation. However, staff could think about the functions that the newly created wetland would provide. In this example, the wetland would provide habitat for amphibians, wetland plants, and small mammals, as flow flow attenuation, water quality improvements through runoff infiltration and filtration.

5.g The site has stressors/impacts that can be remedied in a practicable manner.

Yes.

Stressors are indicated by the Stressor Checklist CRAM. Some of the stressors noted for the project site can be remedied. This includes vegetation management, trash, mowing within the AA, excessive human visitation, tree cutting, and lack of treatment of invasive plants. These stressors can remedied through project management. However, many other sources of stress that were noted for the site cannot practically be remedied. These include non-point source discharges with likely elevated levels of nutrients, pesticides, or trace organics; weirs and dikes or levees, predation and habitat destruction by non-native vertebrates, commercial land use, dryland farming, intensive row-crop agriculture, and a moderately heavily used transportation corridor. For this example site, the largest stressor will likely be the adjacent commercial land use, as it will generate runoff from a parking lot and significantly reduce the amount and quality of the wetland buffer.

5.h For enhancement, mitigation work at the site will not change the type of aquatic resource or degrade its functioning and condition.

This question is not relevant, as the project is not enhancement. The site will change from upland to depressional wetland, and will provide new wetland functioning.

5.i Does preservation of the proposed aquatic resources provide important physical, chemical, or biological functions for the watershed? Attach FCAM scores, if available.

This question is not relevant, as the project is not preservation. However, the creation of the new wetland will provide new physical habitat, will allow chemical cycling and carbon storage, and will support a suite of wetland plant species and associated wildlife. As an upland, the site has a CRAM score of 0, but 10 years post-construction, the site will likely have a score of 65, and therefore, although not close to other aquatic resources, the site is likely to eventually provide moderate support for many on-site wetland functions.

5.j The aquatic resources to be preserved contribute significantly to the ecological sustainability of the watershed.

This question is not relevant, as the project is not preservation. However, the newly created wetland will contribute to the ecological sustainability of the watershed by providing new habitat that will help attenuate flood flows and improve runoff quality through infiltration and filtration.

5.k Preservation is determined by the district engineer to be appropriate and practicable.

This question is not relevant, as the project is not preservation, and has not been evaluated by an USACE district engineer.

5.l The resources are under threat of destruction or adverse modifications.

This question is not relevant, as aquatic resources do not yet exist in this location. In the absence of this project, the site would likely remain agricultural land.

5.m Proposed preservation would be done in conjunction with aquatic resource restoration, establishment, and/or enhancement activities.

This question is not relevant, as the project is not preservation. This rather small project is being completed apart from any other restoration or mitigation project, although it is consistent with local watershed management plans. The overall impact of this project on the watershed profile is incrementally positive but not substantial.

5.n The preserved site will be permanently protected through an appropriate real estate or other legal instrument (e.g., easement, title transfer to state resource agency or land trust).
This question is not relevant, as the site is not preservation. However, the land developer for this project has agreed to a long-term management plan to protect the project into perpetuity.

5.o Is step 5 acceptable overall?
Yes.
Because the project will create new wetland from agricultural upland, it will not replace high quality aquatic or upland wildlife habitat. It is not close to other aquatic resources, but will add wetland functions in a location where there currently is none. Although numerous stressors are evident, none are expected to critically constrain the expected ecological and hydrological functions of the site, names support for amphibians and wetland vegetation, and runoff filtration and infiltration.

6.a Does site have natural buffer of suitable width to attain mitigation objectives listed in step 2.b?
Yes.
Although 100% of the project site has buffer, it is only 10 to 25m wide, with moderate quality, and beyond which on three sides is a paved road, driveway, or parking lot. The buffer quality and width is only moderately good, based on the CRAM assessment, but is adequate for the project objectives stated in part 2.b.

6.b Does site have appropriate hydrology (as demonstrated by a water budget) to meet proposed mitigation site criteria listed in step 2?
Yes.
Although a water budget has not been produced for the project, the site has been sized to retain, infiltrate and filter the expected inputs of runoff. The existing depressional wetland depends entirely on water from an intermittent channel draining agricultural lands. The new, created wetland will take a portion of the peak flows from that channel, in addition to receiving runoff from the commercial development. The existing wetland stays wet approximately four to five months of most years, suggesting that there will be enough runoff to meet the objectives of the created seasonal wetland.

6.c Does site have appropriate soils to meet proposed mitigation site criteria listed in step 2?
Yes.
The soils are 2-9% Huichica Loam, which are not particularly sandy or gravelly, suggesting that excess infiltration will not occur. Staff can explore the local soils using the NRCS Web Soil Survey mapper at mhttps://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm. Staff might need to consult with a soil scientist or geologist if they need additional information about the soil type of the project site.

6.d Is site free of known contaminants?
Unknown
CEDEN does not show any contamination near this project site. Information about actual contaminants loads will likely come from the project proponent, but the staff can also use EcoAtlas, turning on the CEDEN Water and Sediment Toxicity layers, to show any samples in the region near the project site. The project hydroperiod will depend on runoff from agricultural lands and commercial impervious surfaces.

6.e Is step 6 acceptable overall?
Yes.

The project site is environmentally acceptable. The site has appropriate soils and hydrology to support a new wetland, and is probably not subject to levels of water borne contaminants that would prevent the project from achieving its stated objectives (see part 2.b). Although the buffer for the site is only moderately wide and in fair condition, it is adequate to provide functions related to runoff filtration. Due to the setting, greater buffer width is not an option.

7.a Would all existing and anticipated stressors be resolved and therefore unlikely to jeopardize the mitigation proposal?

No.

All stressors will not be resolved. Non-point source runoff from the new impervious surfaces of the development will be directed into the created wetland for treatment. In these regards, the project resembles on-site, Low Impact Development (LID), although the development is too small to require onsite treatment of runoff. Some stressors, such as trash, mowing, excessive human visitation, tree cutting, and lack of treatment of invasive plants, can be remedied to some degree by the proposed fencing and ongoing site management. However, the new commercial development, while modest in size, will increase the intensity of local traffic, and many of the land use stressors relating to the agricultural setting and transportation corridor cannot be remedied through this project.

7.b Does proposed site include necessary water rights, as necessary, to ensure hydrology?

No.

The project site does not involve any water rights. The new wetland will rely upon runoff from the intermittent channel that drains upstream vineyards and Guerneville Road, plus runoff from the proposed commercial development, that is not subject to capture or reuse under any existing water rights.

7.c Would the proposed mitigation be free of structures which would require on-going maintenance and incompatible uses (for example, on-going requirement to maintain channel capacity)?

No.

The project site will have dedicated structures. There will be an engineered water conveyance structure, involving a weir, to route a portion of the peak flows from an intermittent channel into the proposed depressional wetland. In addition, a weir will be constructed at the wetland outlet, allowing water to passively flow back into the channel. Both of these features will require annual inspection and perhaps some maintenance. And lastly, the decorative fence between the created wetland and the commercial development will require inspection and maintenance. No sediment maintenance (dredging) is expected, as the local watershed is evidently very small and flat, without significant sediment yields.

7.d Do local planning documents/policies envision the surrounding natural landscape as open space such that landscape-scale connectivity would be maintained or improved (in other words, no zoning changes or planned development are anticipated which would pose a barrier to natural drainage and the movement of wildlife)?

No.

The landscape is not dedicated to open space and is not likely to become open space. The land is primarily agricultural, and the County has zoned it for future commercial development. Any future developments nearby are unlikely to be allowed re-route the drainage channel that will serve this project. However, additional development could further increase runoff through the channel, which would increase the hydroperiod of the created wetland, and new development might also reduce ecological connectivity between the project and existing wetlands.

7.e Is step 7 acceptable overall?

No.

The project is not environmentally acceptable with regard to the mediation or control of stressors. This step highlights the limitations of location of the project. For instance, the project site will have land use related stressors that cannot be addressed in this project. It does not have dedicated water rights, but instead relies upon natural runoff from a small agricultural watershed and the proposed commercial development. It will have engineered structures to control the flow of water in and out of the wetland that will require inspection and some maintenance. And, the surrounding land use could change in the future to more commercial uses that will increase the land use stressors. None of these stressors should prevent the project, but they will prevent it from achieving reference conditions common to natural wetlands with good buffer in dedicated open space. This is the situation for many "urban" wetlands. In this case, the project is likely to provide adequate levels of the beneficial uses appropriate for the setting.

8.a Final Evaluation

List number of final overall "yes" and "no" answers for each section above (i.e., questions 3b, 4d, 5o, 6e, and 7e). Total answers should be five (5) unless a watershed plan is not available (in that case, 4 there should be 4 answers). Most steps must be acceptable for a mitigation proposal to be found environmentally acceptable; however, in some cases, a single "no" may render a proposal unacceptable.

For this project, there are 5 answers, four "yes" answers and one "no" answer.

9.a Overall Conclusion

Provide a descriptive summary of why the site is, or is not, suitable for restoration.

This Project site is suitable for the proposed mitigation.

Positive answers to four of five summary questions indicate that this site is suitable for a project.

The project will mitigate for the loss of a portion of an existing seasonal depressional wetland by creating an area of new wetland of the same kind and potentially better condition. The proposed wetland is essentially for managing storm water flows and treating non-point source runoff from a small catchment that will contain both agricultural and commercial land uses. The potential habitat functions are rather minor, but consistent with the objectives of the project and appropriate for the landscape setting. This project is in-line with an existing watershed plan, and will incrementally increase the total amount of historically dominant kind of wetland in the PEA, and marginally increase connectivity between wetlands. The site has appropriate physical characteristics to support the proposed wetland.

Although the 10-year post-construction CRAM Index score is not likely to be above the 50th percentile for the PEA, it is above the habitat development curve, suggesting that the project continue to improve in condition as it matures. To accelerate the processes of habitat maturation, and thus achieve good conditions above the 50th percentile score sooner, the CRAM Attribute and Metric scores can be examined to see what aspects of project design or management might be adjusted. However, the project is subject to stressors that cannot be mediated or remedied by project design or management, due to its land use setting.

9.b Overall impression: Would the mitigation project support all three wetland beneficial uses?

Yes.

The proposed project will incrementally provide wetland habitat, enhance water quality, and enhance the hydrological support of other wetlands in the PEA.

- *Wetland habitat will be enhanced within the PEA by creating new wetland habitat that is focused upon providing complex structure to support multiple wildlife species, namely amphibians, passerine birds, and small mammals. The project involves planting native plants, and constructing topographic and biological structure suitable for the plant and animal species of interest, and for the retention, infiltration, and filtration of runoff. Some buffer, although narrow, plus fencing, will be provided to protect the wetland and its wildlife from outside stresses. Annual maintenance will focus on controlling trash and preventing colonization by invasive plant species. The wetland will be constructed with complex physical structure, and will likely be comparable to other wetlands in the PEA.*
- *Water quality will be enhanced because the wetland will retain, infiltrate, and filter runoff from agricultural areas (vineyards), the Guerneville Road, and from the proposed commercial development. The soils are appropriate for these hydrological functions. The project will also decrease peak flows of storm water runoff to downstream areas, although the amount of flow reduction is unknown. The project is challenged by the legacy high concentration of macro-nutrients in the agricultural lands draining to the project, plus the possible inputs of pesticides and other agricultural chemicals from these same lands. Monitoring of water quality will be needed to identify any potentially excessive contaminant loads that might warrant changes in upstream land use practices.*
- *The project will enhance hydrological functions by reducing peak flows of storm water and thereby helping to prevent or reduce downstream hydromodification, while also helping to trap and retaining fine sediments, although the sediment yields from the wetland catchment are evidently slight. The hydroperiod of the created wetland will be very similar to that of natural depressional wetlands in the PEA.*

6. Evaluating Beneficial Use Attainment for Wetlands within the PEA

Evaluating wetland BU attainment at a watershed scale (i.e., within the PEA) is dependent on having access to a comprehensive map of surface waters and adequate surveys of their condition within the PEA. Since 2010, the USEPA, State Water Board, and local agencies have supported several watershed-based, ambient surveys of streams and other wetland types in California, based on WRAMP. These surveys support restoration planning and performance tracking in the watershed context. Furthermore, since the surveys employed the same standardized monitoring methods, they can be compared to each other. To illustrate this capability, we can compare profiles of stream condition for different watersheds (i.e., PEAs), based on probabilistic surveys using CRAM. In each case, the surveys are summarized as CDFs that are subdivided into health classes (poor, fair, good), based on the standardized tertiles of the range of possible CRAM scores.

A WRAMP demonstration project surveyed ambient stream conditions at the Santa Rosa Plain in 2013 (Collins *et al.*, 2014). Those results are presented below to illustrate the how to interpret CDF curves based on CRAM probability based surveys, and to demonstrate a framework for evaluating wetland BUs in a watershed or landscape (i.e., PEA) context.

CRAM CDFs illustrate the estimated proportion of a wetland resource likely to score above or below any given CRAM score with a known level of confidence. For example, the CDF for the CRAM Index scores from the 2013 Santa Rosa Plain stream condition survey (see Figure 5). The CRAM Index scores ranged from 45 to 83, and half of the surveyed stream miles (y-axis, Percent of Resource) were likely to have Index scores of 61 or less. To be more precise, the dashed-line confidence intervals of Figure 5 indicate that there is a 95% chance that half the area of stream habitat had Index scores equal to or less than a value between 58 and 70. If the condition of streams in the Santa Rosa Plain were to improve over time, the CDF curve would be expected to shift to the right, such that the 50th percentile CRAM Index score would increase in numerical value. Figure 5 also shows the ranges in CRAM index score for the three, equal-interval, ecological health classes representing poor, fair, or good condition.

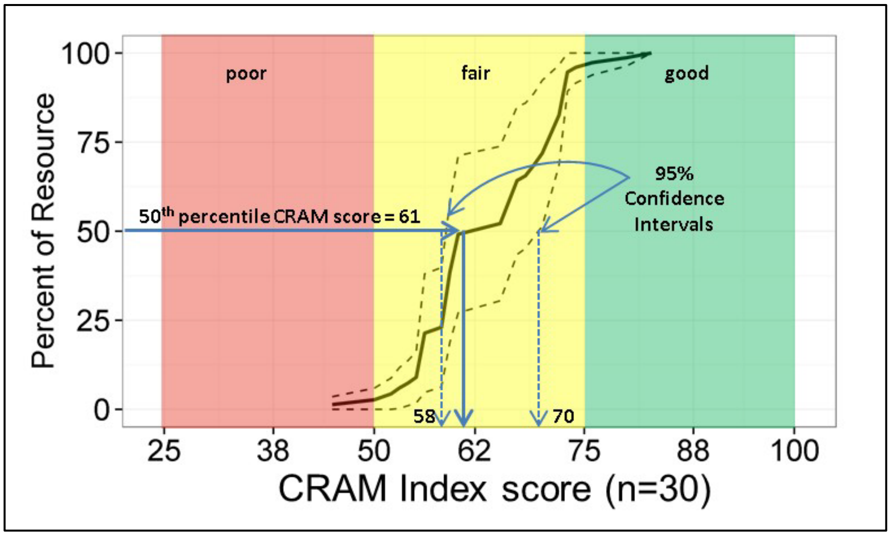


Figure 5. Anatomy of the Cumulative Distribution Function curve (CDF) of CRAM Index scores for streams at the Santa Rosa Plain (surveyed in 2013).

Based on the 2013 survey, 93% of the stream resources surveyed in the Santa Rosa Plain are in fair condition (supporting moderate levels of most or all wetland BUs across the PEA). About 4% of the streams are in good condition (supporting high levels of most or all wetland BUs). Only about 3% are in poor condition (providing low level of most or all wetland BUs).

Knowing which BUs are supported by streams to what levels within the PEA would require examining the CDFs for the Attribute and perhaps Metric scores (Figure 6). This would only be necessary if there was a plan to guide restoration efforts to improve the condition of stream resources across the Santa Rosa Plain PEA. Attribute or Metric scores that account for any assessments of poor condition should be addressed first, in order to improve the overall condition of the stream resource.

Figure 6.presents the four CRAM attribute CDFs for the Santa Rosa Plain stream condition survey (2013). The Buffer and Landscape Context attribute CDF indicates that about 75% of the stream resource has good Buffer condition, and about 10% of the streams have poor Buffer conditions. About 80% of the stream resource has only fair hydrological conditions but none are in poor condition with regard to hydrology. About 75% has poor condition for Physical Structure, and about 25% and 50% of the streams resource has poor or fair Biotic Structure, respectively. These results suggest that future stream enhancements and restoration projects within the PEA should focus on improving the physical structure of the stream habitat. Further examination of the score of the Physical Structure Metrics suggest that the streams are lacking in bed and bank complexity, due mainly to an over-abundance of fine sediment, a lack of pools, and bank erosion due to channel incision. The implication is that stream enhancement across the PEA will require reuctions in fine sediemnt and peak flows. ivation is that stream enhance will require

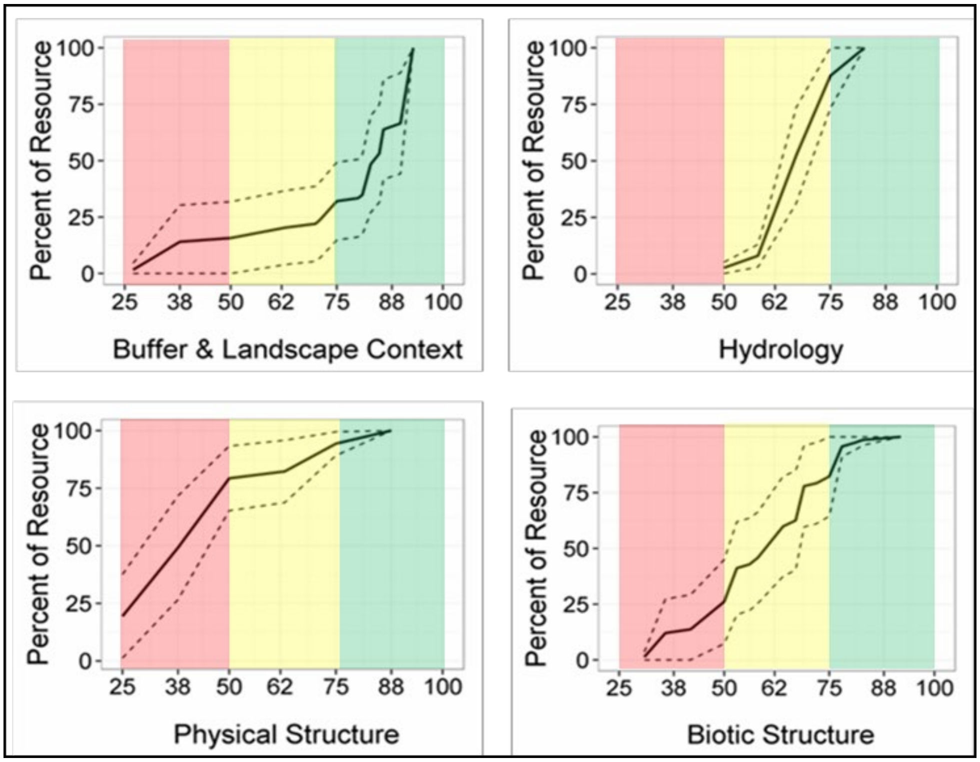


Figure 6. CRAM Attribute CDFs and equal-interval ecological health classes for the Santa Rosa Plain stream condition survey (2013).

CRAM ecological health classes can be used to compare wetland BU attainment across different watersheds. Figure 7 shows the percent of streams in poor, fair, or good condition based on CRAM Index scores provided by probabilistic surveys for four watersheds in Santa Clara County, the Bay-Delta ecoregion, the Santa Rosa Plain, and statewide

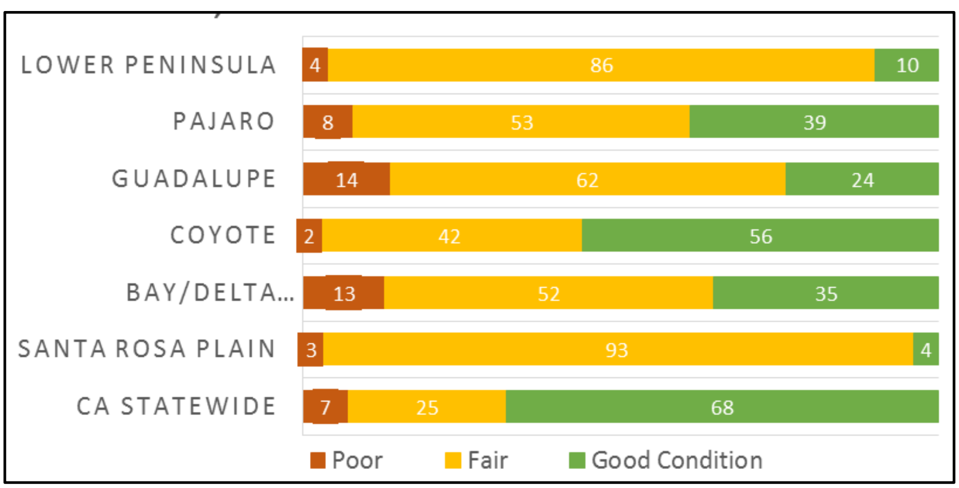


Figure 7. Percent of streams in poor, fair, or good condition in four watersheds, the Bay-Delta ecoregion, the Santa Rosa Plain, and statewide, based on probabilistic surveys using CRAM. The ecological health classes (poor, fair, and good) correspond to three equal intervals of the full range of possible CRAM Index scores: 25-50, 51-75, and 76-100, respectively.

The profiles of different PEAs may not completely comparable. For example, in the land use settings of these example surveys, the headward reaches of stream systems, which are relatively undeveloped, tend to be in better condition than their downstream reaches, which are usually intensively developed. As a result, surveys that exclude the headward streams tend to have smaller proportions of stream resources in good condition. This explains why the proportion of good stream resources is less for the Lower Peninsula and Santa Rosa Plain PEAs, from which the headward streams were excluded, than for the other PEAs.

A probabilistic survey of a PEA can be subdivided into different sampling strata, in order to diagnose the effects of various factors on wetland condition. For example, the Upper Truckee River PEA was separated into urban and rural strata, based on the density of development. The resulting survey using CRAM revealed a greater proportion of stream resources in good condition for the rural stratum. This is evident in the up-scale shift in the CDF for rural verses urban strata (Figure 8). An analysis of the Attri8bure and Metric scores supports the inference that the riparian set back ordinance, which has been in effect in the Tahoe Basin for more than forty years, is not adequately mediating urban land use stressors, perhaps because of inconsistent enforcement and variations in management among protected riparian areas.

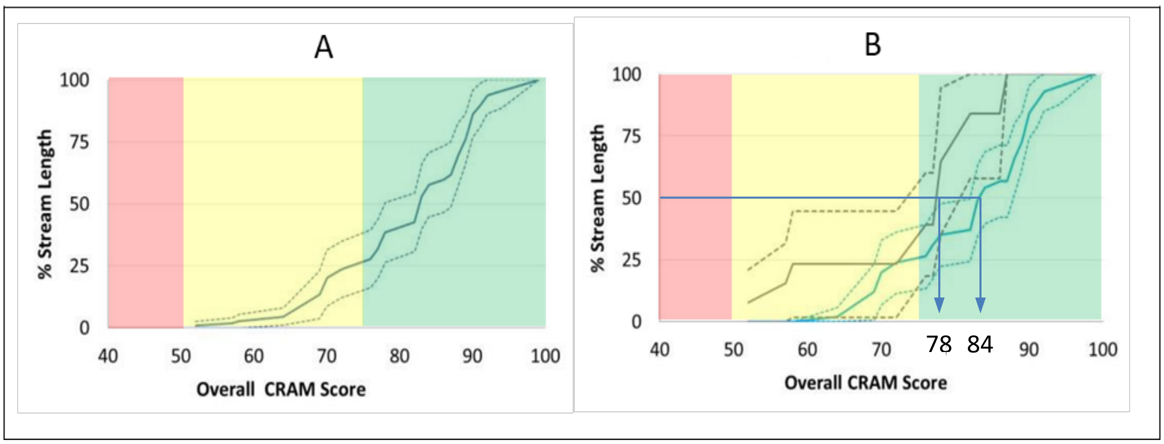


Figure 8. Results of the Upper Truckee River WRAMP demonstration stream survey of 2011, showing (A) CDF for the rural sampling stratum, and (B) the CDFs for both the rural and urban strata. Note that the CDF for the urban stratum is shifted down-scale, and therefore has a lower value for the 50th percentile score (78 for the rural strum vs 84 for the urban stratum).

7. Additional Considerations

7.1 Defining a PEA

The Project Evaluation Area (PEA) is a term invented for the California Dredge and Fill Procedures to represent the area encompassing a mitigation project that has a direct and measurable effect on the project's success, and for which the project has a measurable, incremental, or more holistic effect on the distribution, abundance, diversity, and condition of wetlands and other aquatic resources (i.e., the landscape profile). There is no standard or fixed dimensions for PEAs. They can vary in size and shape depending on the size of the mitigation project and the spatial extent of ecological, physio-chemical, or hydrological processes that measurably affect the project, or that the project measurably affects. The following guidelines are suggested for defining a PEA.

A. The extent of the functional relationships between a mitigation project and its PEA will depend on its position within the drainage system and catchment basin of the PEA. To determine their drainage positions, the boundaries of mitigation projects should be mapped using the Project Tracker of EcoAtlas. This will enable Staff to visualize the locations of the projects in relation to all other aquatic features evident in CARI, including rivers, streams, canals, ditches, lakes, reservoirs, ponds, and wetlands. If necessary, the online mapping tool of CARI can be used to update or enhance the local base map of surface waters.

B. Most of the landscape effects on a project will be due to conditions, events, processes and land use operations occurring upstream of the mitigation project. This suggests that the PEA should extend some distance upstream of the project within its encompassing drainage system and catchment.

C. Most of the environmental effects on a project will occur downstream of the project within encompassing drainage system. This suggests that the PEA should extend some distance downstream of the project.

D. When deciding how far upstream and downstream of a project its PEA should extend, Staff should consider how the project might affect the migration, dispersal, or foraging patterns of any wildlife species of special interest. The effects of a project on the ecological connectivity among patches of the same or different habitat types can extend varying distances in any direction from a project boundary. Understanding this connectivity will depend on seeing the project in the context of vegetation and land use, as well as surface drainage. Uploading the project into Project Tracker will facilitate this visualization.

E. Existing spatial templates for land use planning should be considered. This might include Areas of Special Biological Significance (ASBS), Natural Community Conservation Plans (NCCPs), Habitat Conservation Plans (HCPs), and management units of public parks, wildlife refuges, nature preserves, and other open spaces. In the Bay Area, the Operational Landscape Units (OLUs) developed by the San Francisco Estuary Partnership (SFEP) should be considered as possible PEAs.

F. In the absence of other guiding information, the 12-digit Hydrological Unit (HUC 12) of the Watershed Boundary Dataset (WBD) of the U.S. Geological Survey (https://water.usgs.gov/GIS/huc.html) should be considered as the default PEA. The HUC 12 is the smallest of the standard watersheds of the WBD and is frequently used for local environmental and land use analysis and planning. All HUC 12 watersheds of California have been delineated by the USGS and are publicly available as digital maps with supporting data.

7.2 What to Do in the Absence of an Ambient Survey of Condition

A profile of the distribution, abundance, and diversity of aquatic resources can be produce for any PEA using the Landscape Profile Tool in EcoAtlas. However, not all projects can afford to conduct an ambient survey of aquatic resource condition, even using CRAM in HUC 12 or smaller PEAs. In these cases, where an ambient survey of condition within the PEA is not available, and if a CDF of the condition of the resource is needed, Staff can elect to use the eco-regional CDF for the eco-region of the project, or a CDF for another, comparable PEA.

7.3 Additional Level 1 Metrics

The Procedures will evolve and be improved as they get used. It is likely, for example, that the PEA profile of the distribution, abundance, diversity, and condition of aquatic resources will be expanded to include Level 3 data and additional L1 data. The Level 2 assessment methodology, namely CRAM, is likely to evolve but not be replaced. At this time, site=specific Level 3 data are not routinely included in the Dredge and Fill Site Evaluation Procedures, except to address questions about habitat uniqueness and special status. However, Level 3 assessments can be built into individual profiles as needed. For example, the home ranges of wildlife species of interests that are known to inhabit the PEA can be integrated into measures of ecological conductivity. Estimates of population abundance or density for key species can be used to assess project impacts, both positive and negative. Likewise, project the quantified effects of projects on water quality can be visualized in EcoAtlas and integrated into PEA profiles. Eventually, given the current progress in GIS-based numerical environmental modeling, projects will be designed and managed based on comparisons of alterative future landscapes. The proposed Dredge and Fill Procedures provide a purpose for that advanced technology.

7.4 Custom Dashboards

At this time, EcoAtlas can synthesize some of the basic metrics of the needed PEA profile into a readily useable dashboard for any area delineated online using the EcoAtlas mapping tool. The State water Board should consider working with its CWMW partners to design a custom dashboard that that reduce the time the time needed for Staff to compete the mitigation site evaluation checklist, while increasing its voracity and repeatability.

Appendix A. Proposed Site Suitability Evaluation Checklist

Question Number	Question Type	Question	Descriptive Answer	Yes	No
1.a	Administrative	Date			
1.b	Administrative	Corps file no., Water Board file no., or Project Tracker ID			
1.c	Administrative	Project name			
1.d	Administrative	Project manager			
2.a	Project Characterization	Wetland restoration site name and location			
2.a.1	Project Characterization	Proposed size of wetland to be restored: acres by type			
2.b	Project Characterization	Restoration objectives to improve: (habitat conservation/biodiversity; water storage/flow attenuation; water quality; etc.)			
2.c	Project Characterization	Proposed mitigation method (re-establishment; rehabilitation; enhancement). If enhancement, list functioning to be increased.			
2.d	Project Characterization	Primary types of site treatment: (Introduction of native plant materials; invasive species control; etc.)			
2.e	Project Characterization	Aquatic resource type - [Proposed type of wetland to be restored (CARI system): (Slope; Riverine; etc.)]			
2.f	Project Characterization	Hydrology			
2.g	Project Characterization	FCAM classification used: FCAM subclasses:			
2.h	Project Characterization	Vegetation classification system used: Vegetation classes/subclasses:			
2.i	Project Characterization	Vernacular/common name of proposed type of aquatic resource, if appropriate:			
3.a	Watershed Context	Are mitigation proposal objectives aligned with the objectives of one or more appropriate watershed plans?			
3	Watershed Context	Is step 3 acceptable overall?			
4.a	Watershed Context	Would the type of aquatic resource proposed for mitigation help sustain and improve the overall watershed profile of the watershed?			

Question Number	Question Type	Question	Descriptive Answer	Yes	No
4.b	Watershed Context	Following project completion, would the site connect to existing stream network and/or wetlands complex such that the site would not be ecologically isolated?			
4.c	Watershed Context	Would the site reduce gaps in stream network and or wetlands complex?			
4	Watershed Context	Is step 4 acceptable overall?			
5.a.a	Setting and function	The site is not an aquatic resource.			
5.a.b	Setting and function	The site is not high quality terrestrial habitat.			
5.a.c	Setting and function	The site is in close proximity to an aquatic resource in good functional condition. (For proximal site, consider FCAM scores)			
5.a.d	Setting and function	For re-establishment, is there evidence the type of proposed aquatic resource was present historically on site?			
5.b.a	Setting and function	The site is a degraded aquatic resource.			
5.b.b	Setting and function	For rehabilitation, would increase most, if not all, functions.			
5.b.c	Setting and function	The site has stressors/impacts that can be remedied in a practicable manner.			
5.b.d	Setting and function	For enhancement, mitigation work at the site will not change the type of aquatic resource or degrade its functioning and condition.			
5.c.a	Setting and function	Does preservation of the proposed aquatic resources provide important physical, chemical, or biological functions for the watershed? Attach FCAM scores, if available.			
5.c.b	Setting and function	The aquatic resources to be preserved contribute significantly to the ecological sustainability of the watershed			
5.c.c	Setting and function	Preservation is determined by the district engineer to be appropriate and practicable.			
5.c.d	Setting and function	The resources are under threat of destruction or adverse modifications.			
5.c.e	Setting and function	Proposed preservation would be done in conjunction with aquatic resource restoration, establishment, and/or enhancement activities.			
5.c.f	Setting and function	The preserved site will be permanently protected through an appropriate real estate or other legal instrument (e.g., easement, title transfer to state resource agency or land trust).			

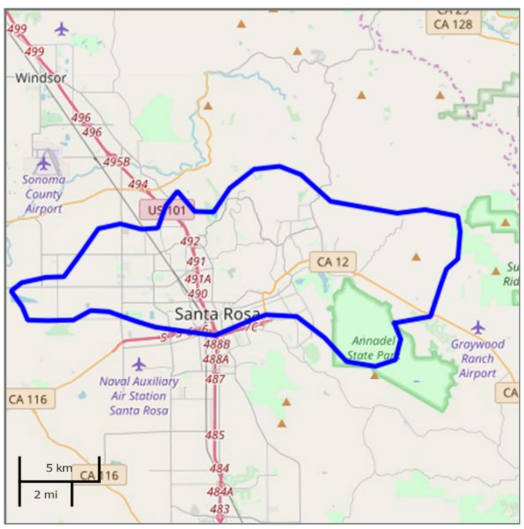
Question Number	Question Type	Question	Descriptive Answer	Yes	No
5	Setting and function	Is step 5 acceptable overall?			
6.a	Setting and function	Does site have natural buffer of suitable width to attain mitigation objectives listed in step 2.b?			
6.b	Setting and function	Does site have appropriate hydrology (as demonstrated by a water budget) to meet proposed mitigation site criteria listed in step 2?			
6.c	Setting and function	Does site have appropriate soils to meet proposed mitigation site criteria listed in step 2?			
6.d	Setting and function	Is site free of known contaminants?			
6	Setting and function	Is step 6 acceptable overall?			
7.a	Sustainability	Would all existing and anticipated stressors be resolved and therefore unlikely to jeopardize the mitigation proposal?			
7.b	Sustainability	Does proposed site include necessary water rights, as necessary, to ensure hydrology?			
7.c	Sustainability	Would the proposed mitigation be free of structures which would require on-going maintenance and incompatible uses (for example, on-going requirement to maintain channel capacity)?			
7.d	Sustainability	Do local planning documents/policies envision the surrounding natural landscape as open space such that landscape-scale connectivity would be maintained or improved (in other words, no zoning changes or planned development are anticipated which would pose a barrier to natural drainage and the movement of wildlife)?			
7	Sustainability	Is step 7 acceptable overall?			
8.a	Checklist Tally	**Final Evaluation** a. List number of final overall “yes” and “no” answers above (acceptable or not) for each section. Total answers should be five (5) unless a watershed plan is not available (in that case 4). Most steps must be acceptable for a proposal to be found environmentally acceptable; h o w e v e r , in some cases, a single “no” may render a proposal unacceptable.			
9.a	Final Evaluation Summary	**Overall Conclusion** Provide a descriptive summary of why the site is or is not suitable for restoration/mitigation.			
9.b	Final Evaluation Summary	**Overall impression: Would the mitigation project meet the Wetland Water Quality Objectives and all 3 wetland beneficial uses?**			

Appendix B: Landscape Profile of the PEA from EcoAtlas

This Landscape Profile is a compilation of information from EcoAtlas about the abundance, diversity, and conditions of aquatic resources for a selected area of California. This report summarizes information about factors affecting the profile, such as the relative abundance of wetland conditions by ecoregion and distribution of stream condition index scores. Sources of this information are documented on the EcoAtlas data page. The purpose of the Profile is to support public policies and programs that protect aquatic resources. Additional information will be incorporated into future versions of the Landscape Profile Tool, based on advice from its user community. The computational time required to generate a Landscape Profile Report increases with the size of the profile area and the complexity of its aquatic resources.

Area of Interest

User Defined Region generated by user-defined delineation Area: 30,682.1 acres / 47.9 miles^2
Estimated Population: 164,761 persons



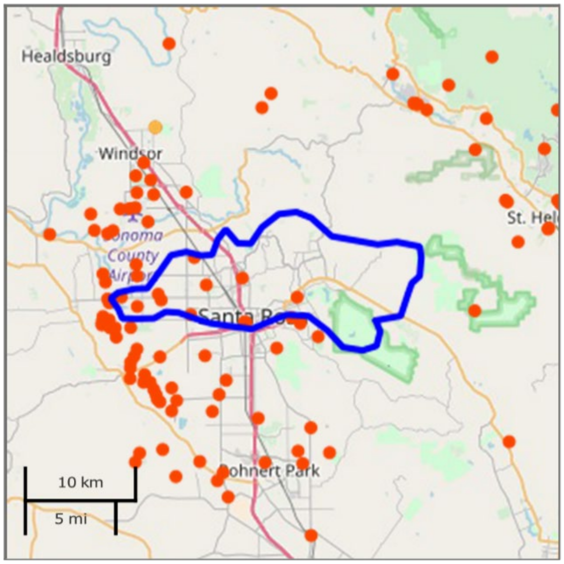
- Ecoregions: Bay/Delta
- Water Board Regions: North Coast
- Counties: Sonoma
- Congressional Districts: 02, 05
- Hydrologic Regions (HUC8): Russian

Aquatic Resource Condition based on CRAM

Number of CRAM assessments in the profiled region: **12**

eCRAM ID	AA Name	Visit Date	Wetland Type	Assessment Category	Index Score	BLC*	HYD*	BIO*	PHY*
5860	Santa Rosa Creek	2017-06-15	riverine non-confined		72	80.63	66.67	66.67	75.00
5825	Woodbridge	2016-04-25	vernal pool system		81	62.50	91.67	87.50	83.33
3387	Castaneda Farm	2013-09-27	Depressional	study - ambient	56	40.17	83.33	50.00	50.00
2907	Place to Play Reservoir	2013-09-10	Depressional	study - ambient	58	37.50	58.33	75.00	62.50
3374	Guerneville Road	2013-08-30	riverine confined	study - ambient	67	71.04	66.67	80.56	50.00

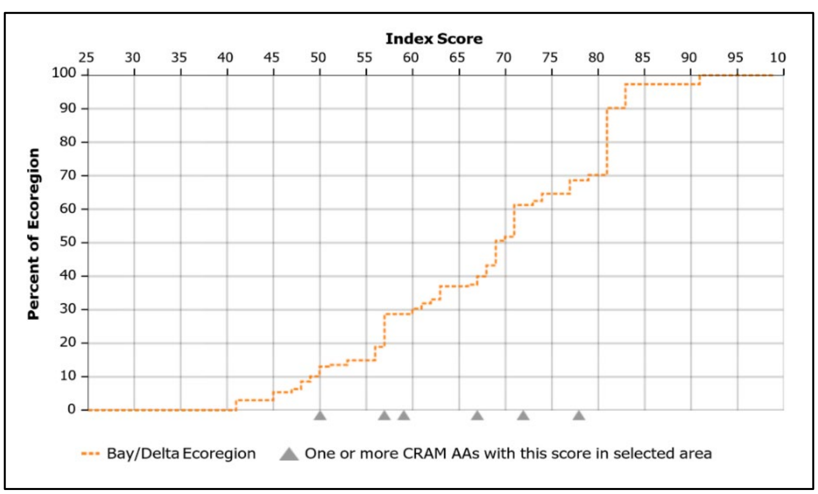
Summary of CRAM Scores by Wetland Type



		Min	Max	Ave
depressional (4)	Index	45	60	81
Buffer & Landscape Context		37	44	62
Hydrology		58	73	91
Biotic Structure		36	62	87
Physical Structure		50	61	83
riverine (8)	Index	36	60	78
Buffer & Landscape Context		27	55	80
Hydrology		36	61	75
Biotic Structure		42	67	80
Physical Structure		37	61	87

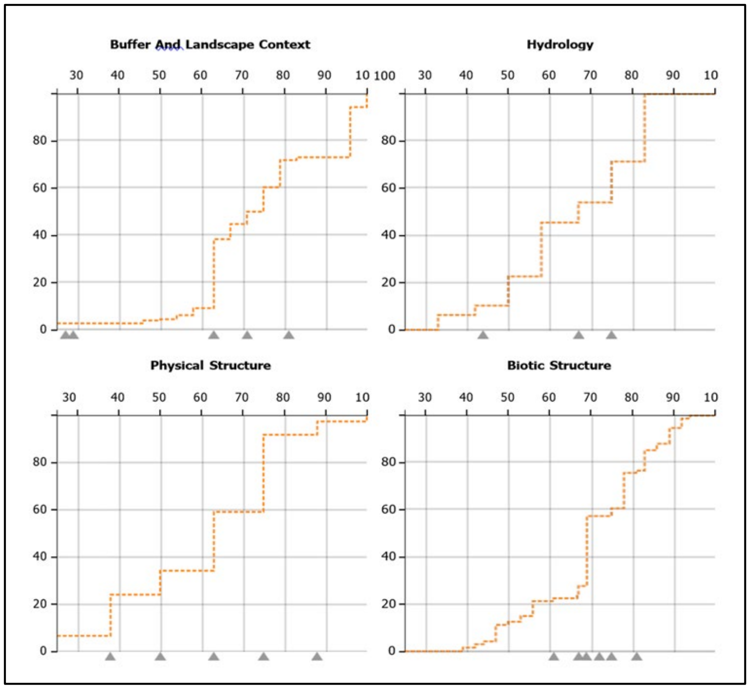
CRAM Cumulative Distribution Functions for Riverine Wetland Class

An eco-regional CRAM CDF can be used to compare different areas of one wetland type to each other and the whole ecoregion. The comparison is made by plotting the CRAM scores for selected Assessment Areas (AAs) on the x-axis of the eco-regional CDF and determining the corresponding y-axis values representing the percent of the ecoregion with the same or lower score. For example, a y-axis value of 40% for a selected AA means that 40% of that wetland type in the ecoregion is likely to have the same or lesser condition than the selected AA. Conversely, 60% of the wetland type is likely to have an equal or higher condition. To-date, ecoregional CDFs have been developed for riverine wetlands. Ecoregional CDFs will be developed for other ecoregions and wetland types as the necessary data become available.



There are 8 riverine CRAM AAs in your selected area.

CDF of streams for the Bay-Delta eco-region showing locations of CRAM scores from the PEA (grey triangles along x-axis).



CDFs of the CRAM Attribute scores of the Bay-Delta eco-region showing locations of CRAM scores from the PEA (grey triangles along x-axis).

California Stream Condition Index (CSCI)

The California Stream Condition Index (CSCI) is a statewide tool that translates complex data about individual benthic macroinvertebrates (BMIs) into an overall measure of stream health. For more information view The California Stream Condition Index (CSCI): A New Statewide Biological Scoring Tool for Assessing the Health of Freshwater Streams SWAMP Technical Memo. To download data, visit the Surface Water Ambient Monitoring Program (SWAMP) website.

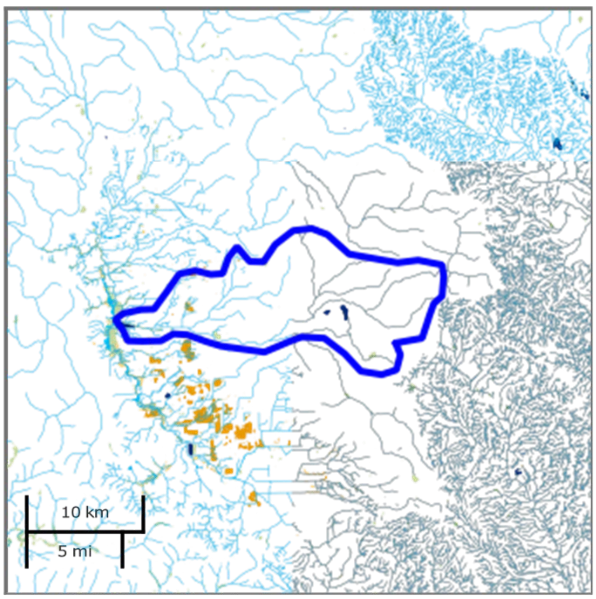
Number of CSCI stations within in the profiled PEA: **1**

Summary of CSCI	No. Stations
Very Likely Altered Condition (≤ 0.62)	1
Likely Altered Condition (0.63 - 0.79)	0
Possibly Altered Condition (0.80 - 0.91)	0
Likely Intact Condition (> 0.91)	0

Abundance and Diversity of Existing Aquatic Resources

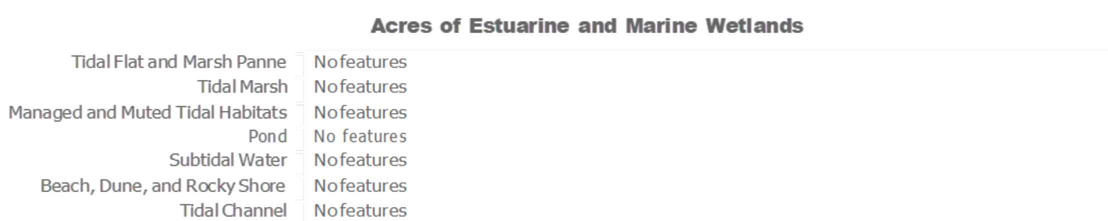
The Landscape Profile Report includes information about the historical and existing abundance and diversity of California state surface waters, including marine waters, estuaries, river and streams, lakes, and wetlands. The historical information is derived from local and regional historical ecology studies and is not available statewide. The information for existing surface waters is derived from the California Aquatic Resource Inventory (CARI), which serves as the default layer for EcoAtlas. To learn how to become a local or regional steward of CARI, email CARImapping@sfei.org.

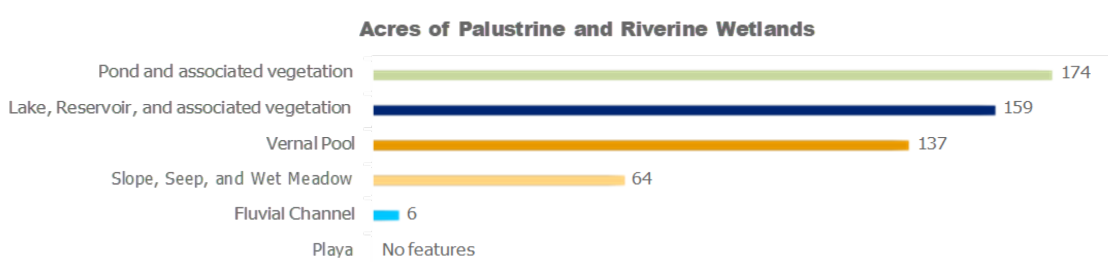
Riparian extent has been estimated for some state waters based on the Riparian Zone Estimator Tool (RipZET). The Landscape Profile Tool of EcoAtlas does not incorporate riparian extent unless it has been estimated for all state surface waters within the area of the profile



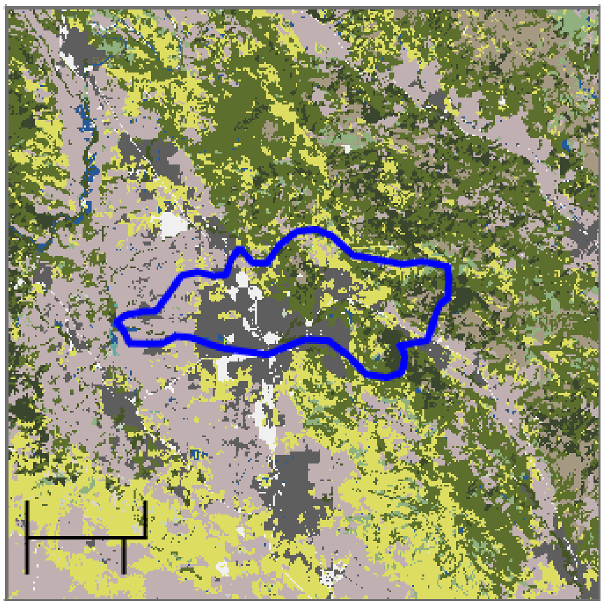
CARI Summary Statistics

- Area of all wetlands: 540 acres
- Area of palustrine and riverine: 540 acres2
- Total Length of Drainage Features: 74 miles
- Length of Fluvial Features: 74 miles





CALVEG Habitat Types



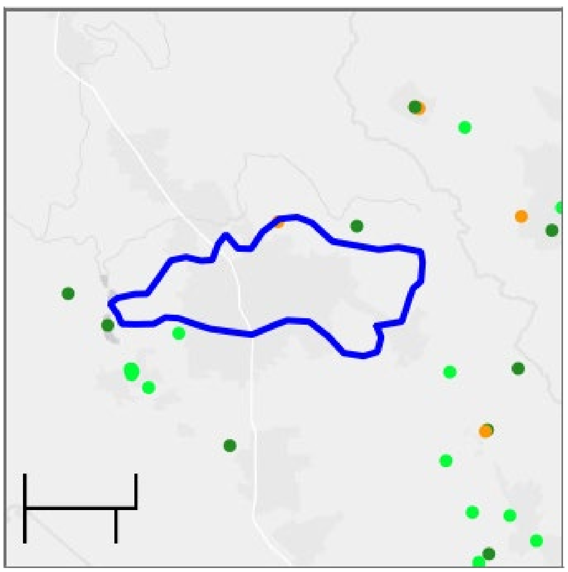
CALVEG is a USDA Forest Service product providing a comprehensive spatial dataset of existing vegetation cover over California. The habitat profile is based on a crosswalk of the CALVEG classifications to the California Wildlife Habitat Relationships (CWHR). CWHR is a state-of-the art information system for California's wildlife developed on the life history, geographic range, habitat relationships, and management information on California Wildlife Species. https://www.wildlife.ca.gov/Data/CWHR

Table of Top 12 CALVEG Habitats in the Profiled Region

Habitat Type	Area (ha)	Area (acres)	Area (%*)
Urban	3,687	9,110	29.7%
Montane	2,141	5,290	17.2%
Annual Grass	1,936	4,785	15.6%
Douglas Fir	949	2,345	7.6%
Cropland	920	2,273	7.4%
Pasture	663	1,638	5.3%
Barren	508	1,255	4.1%
Montane	481	1,189	3.9%
Mixed Chaparral	366	904	2.9%
Montane Riparian	277	686	2.2%
Coastal Oak	224	553	1.8%
Lacustrine	137	339	1.1%

Ecological Restoration Based on Habitat Projects

The Landscape Profile includes information about the number and status of on-the-ground restoration and mitigation projects having a Waste Discharge Requirements (WDR) and/or a Section 401 Water Quality Certification from the State Water Resources Control Board or one of its Regional Water Quality Control Boards. Projects for which a WDR or Section 401 Certification is pending are not currently included in the Landscape Profile. The amount of information that is available about a project depends in part on how much information the project sponsors have submitted. It is anticipated that this information will be derived from the Online 401 Application Tool in the future. For more information about Online 401, visit http://app.californiawetlands.net/. Acres displayed are from reported values and not calculated from project geometries. Lake Tahoe Environmental Improvement Program (EIP) projects are not included in the Summary Statistics.



Summary Statistics

Project Status	Count	Acres
Unknown	1	n/a
Completed	1	n/a
Project Type	**Count**	**Acres**
Repair/Maintenance	1	n/a
Non-mitigation	1	n/a
Totals	2	0.0

Habitat Projects in the PEA

Name	Status	Type	Acres	Associated eCRAM IDs
RiebliBT1340: Unnamed Trib to Riebli Creek	Unknown	Repair Maintenance	n/a	none
Saddle Mountain Open Space Preserve	Completed	Non-mitigation	n/a	none

Species of Special Status based on CNDDB Species Information

The Landscape Profile includes publicly available data provided by the California Natural Diversity Database (CNDDB) relating to the status and approximate locations of special status species of plants and animals in California. CNDDB is a collection of certified sightings of special status species that represents the most complete set of information available on the state's declining and/or vulnerable plant and animal species. These species are rare, threatened, or endangered. All special status species from quadrangles that overlap any part of the area demarcated in the Landscape Profile are reported in this report, although the species reported may not necessarily inhabit all or any part of the demarcated area. The PEA ***may*** contain the following state and federally protected species. This data summary is based on coarse scale data (7.5 quad scale). For more information visit the CNDDB website.

Table of First 4 Federally Listed Species of Special Status

Common Name	Scientific Name	Listing
California red-legged frog	*Rana draytonii*	Threatened
northern spotted owl	*Strix occidentalis caurina*	Threatened
California freshwater shrimp	*Syncaris pacifica*	Endangered
steelhead - central California coast DPS	*Oncorhynchus mykiss irideus*	Threatened

Table of First 4 California Listed Species of Special Status

Common Name	Scientific Name	Listing
foothill yellow-legged frog	*Rana boylii*	Candidate Threatened
northern spotted owl	*Strix occidentalis caurina*	Threatened
California freshwater shrimp	*Syncaris pacifica*	Endangered
Kenwood Marsh checkerbloom	*Sidalcea oregana ssp. valida*	Endangered

Human Population Based on 2010 Census

The Landscape Profile includes information about the population of people residing in the Profile area based on the latest census by the U.S. Census Bureau. The census aggregates data for census blocks that do not exactly match the boundaries of a Profile area. The Landscape Profile therefore adjusts the census data based on the proportions of census blocks within the Profile area. Information about languages spoken within the Profile area is included to support environmental outreach and education.

Population:	164,761 persons
Population Density:	3,453 persons per sq mile
Housing Units:	67,959 units
Housing Units Density:	1,424 units per sq mile

Language Spoken at Home

English:	74%
Spanish or Spanish Creole:	20%

**Note languages under 1% not reported.*

Developed Landcover Based on NLCD 2011 Category

The Landscape Profile includes information about selected types of natural and unnatural land covers excluding surface waters. The information is derived from the National Land Cover Database 2011 (NLCD 2011). NLCD 2011 is the most recent product created by the Multi-Resolution Land Characteristics (MRLC) Consortium. NLCD 2011 uses a 16-class land cover classification scheme that has been applied consistently across the United States at a spatial resolution of 30 meters. At this time, the Profile summarizes information for six land cover classes. For more information about NLCD, go to: http://www.mrlc.gov/nlcd2011.php

Land Cover Class	Percent of Profile Data
Developed Open Space	30%
Medium Intensity Development	28%
Low Intensity Development	27%
Crops and Pasture	12%
High Intensity Development	3%