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Improving Monitoring and Assessment of Wetland and Riparian Areas in California through Implementation of a Level 1, 2, 3 Framework

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**Improving Monitoring and Assessment of Wetland and Riparian
Areas in California through
Implementation of a Level 1, 2, 3 Framework**

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Executive Summary

California wetlands, streams, and watersheds have been dramatically altered by human activities over the past 150 years. The primary threats to wetlands are discharges of dredge or fill material, excavation, and habitat degradation from external stressors such as point and non-point source (NPS) pollution. Protecting and managing wetlands and streams are complicated by the fact that no single agency has authority over aquatic resources and multiple programs within an agency may have authority or regulatory control over wetlands. A comprehensive wetlands and riparian monitoring program is needed in order to improve program coordination to sustainably manage wetland resources and the stressors that affect them.

The purpose of this paper is to describe the basic components of a comprehensive wetlands and riparian assessment program, based on USEPA's recommended framework and provide recommendations on incorporation of existing wetland assessment tools into agency programs. This paper will: 1) present an overview of the existing tools; 2) discuss how these tools can be used to inform decisions regarding wetland and riparian resources, and improve coordination and efficiency of various State and Federal wetland programs; and 3) identify key technical and administrative actions necessary to achieve these goals.

The conceptual approach and collection of existing wetland and riparian assessment tools is modeled after USEPA's Level 1-2-3 framework for monitoring and assessment of wetland resources (USEPA 2006). The fundamental elements of this framework are:

- Level 1: consists of wetland and riparian inventories, landscape profiles, and assessment of stressors from upstream and surrounding land uses.
- Level 2: consists of rapid assessment, which uses cost-effective field-based diagnostic tools to assess the condition of wetland and riparian areas.
- Level 3: consists of intensive assessment to provide data to validate rapid methods, characterize reference condition, and diagnose the causes of wetland condition.

Existing tools that support the Level 1-2-3 framework include: 1) standardized wetland and riparian mapping methodologies; 2) tools to assess landscape scale stressors; 3) California Rapid Assessment Method (CRAM) for routine, cost-effective assessments of wetlands and riparian condition; and 4) Project Tracking, which is an online data management system consisting of data and maps collected and shared among agencies and the public on projects that impact wetland and riparian areas.

Implementation of a standardized wetland and riparian assessment toolkit, recently initiated through an EPA grant to the Resources Agency, can address several key needs presented by the diversity of state and federal programs in California. These needs include:

- o *Providing data to better inform management decisions, including the analysis of cumulative impacts.* Implementation of the monitoring toolkit within the Level 1-2-3 framework provides the means for a cost-effective, holistic assessment of ambient extent and condition of aquatic resources and other beneficial uses. These tools can be applied at the state, region, or watershed

scale to inform management actions and prioritize recovery efforts. CRAM can be seamlessly integrated with other bioassessment tools to more comprehensively assess the status of aquatic life use and other beneficial uses in waters of the State. CRAM can also be used as screening tool to identify when more detailed assessments are necessary. Inventories and probability-based surveys using CRAM allow a cost-effective estimate of general baseline conditions of wetlands and riparian areas in a watershed or across the state as a whole. These data can then be used to identify specific stressors that need to be managed and used as mechanism to prioritize areas for recovery or conservation. The combination of inventories, CRAM and project tracking will allow agencies and the general public to spatially display the locations of projects, including restoration projects, impact sites, and mitigation sites. This will protect against impacting past mitigation or restoration areas, and will promote watershed-scale planning and management activities. Probability-based surveys and consistent protocols also provide context to interpret data obtained from site-specific assessments. Such watershed scale perspectives are consistent with pending Federal mitigation policies, which emphasize a watershed approach. Finally, use of CRAM and Project Tracking would make it easier to track and assess cumulative impact issues.

- o *Standardizing data protocols to improve coordination between agencies and programs.* This includes common definitions of wetlands and riparian areas, approaches for classification, consistent assessment tools, and common data management platforms and standardized data transfer formats. Wetland and riparian inventories, CRAM, and project tracking provide a common set of tools and assessment language that all agencies can use to articulate wetland change on an ongoing basis due to permitted impacts, compensatory mitigation, and non-regulatory restoration and provide public access to this information.

- o *Generating information that can be used to assess the effectiveness of wetland programs and funding, including common performance measures for restoration and mitigation projects.* Information on the effectiveness of extensive public investments in wetland and riparian resource conservation, recovery and management is not readily available to resource managers, regulators, elected officials, NGO's, and the public because the condition of wetlands and riparian habitat is not being monitored systematically. Incorporation of the level 1-2-3 framework into agency programs will provide an opportunity to evaluate the effectiveness of public investment in conservation and restoration of these resources. Recent reviews of both the State and Regional Water Board water quality certification programs have identified poor record keeping and data inaccessibility as barriers to program review and evaluation, and to compliance assessments. Use of Project Tracking would help remedy this situation by providing a central repository of data on impact, mitigation, and restoration sites in a format that is easy to update and query, and is accessible to all agencies.

Substantial progress has been made toward implementation of standardized wetland and riparian inventories, landscape assessment tools, CRAM, and Project Tracking into various agency programs. To achieve broader success in implementing all elements of the Level 1-2-3 framework in agencies across the State of California, funding should be secured to address outstanding technical needs and the following programmatic needs should be addressed:

1. Strengthen agency participation and leadership in Statewide Steering Committee created through EPA-funded WDP grant to provide ongoing mechanism for coordination and identification of common assessment needs and priorities. This workgroup, which could work under the auspices of the newly formed Monitoring Council, should include representation of major regulatory and management agencies and key technical partners.
2. Develop a long-term strategy for the implementation of a statewide wetlands and riparian assessment program, including identification of short- and near-term priorities and an action plan to address these priorities.
3. Develop guidance for implementation of CRAM and Project Tracking in respective agency programs.
4. Develop regional teams for areas of the State currently underserved by the implementation effort. In particular, additional staff support for the Regional Boards outside the coastal zone is needed. This would include the Central Valley, Lahontan, and Colorado River Basin Regional Boards.
5. Develop and implement a training program for both agency staff and environmental consultants on an ongoing basis.
6. Incorporate wetlands monitoring into the Surface Water Ambient Monitoring Program (SWAMP)
7. Develop a Quality Assurance (QA) process for using Project Tracking and CRAM for permit and/or project specific monitoring. This should include routine audits of data and a process for field verification of CRAM assessments at a subset of sites.
8. Many agencies already have databases they use for project tracking. Ultimately, a process should be developed to allow sharing of data between existing agency databases and harvesting of data between Project Tracking and other agency databases. This would prevent the need for duplicate data entry, while still allowing agencies to maintain their own databases.
9. Identify a single agency or agencies to manage Project Tracking and CRAM data. This may be a State Agency or via a “data center” concept, such as that being proposed by the SWAMP program.
10. Secure a sustained source of funding for data management, QA, ongoing tool refinement and development, training and technical support, and ongoing coordination.

Introduction, Issue Statement, and Purpose of Document

Introduction

California wetlands, streams, and watersheds have been dramatically altered by human activities over the past 150 years. Development pressure continues to be intense with a doubling of the 1995 population expected by 2020. The primary threats to wetlands are discharges of dredge or fill material, excavation, and habitat degradation from external stressors such as point and non-point source (NPS) pollution. An illustration of the current scale of impacts is the State Water Resources Control Board's listing in 2006 of over 100,000 acres of tidal wetlands and 23,000 miles of creeks and rivers as impaired under Section 303(d) of the Clean Water Act. A comprehensive wetlands and riparian monitoring program is needed in order to address these stressors and sustainably manage these resources.

The need for comprehensive wetlands monitoring and assessment is supported by the National Research Council's report on "Compensating for Wetland Losses under the Clean Water Act" (NRC 2001), which noted the need to: 1) conduct ambient monitoring and assessment; 2) create tools to better inform the regulatory and management processes to make them more adaptive and performance-based; 3) provide mechanisms to engage all regulatory programs via consistent approaches and tools; 4) conduct assessment to provide a regional context for decision-making, including evaluation of cumulative impacts; 5) develop a consistent approach to assessment project performance; and 6) provide a common framework and platform for data management and dissemination.

One challenge to developing an integrated statewide monitoring and assessment program is the fact that no single agency has authority over aquatic resources. Regulation and management of wetlands and streams falls under the authority of six state and federal agencies. To add to this complexity, multiple programs within an agency may have authority or regulatory control over wetlands. For example, wetlands and streams may be monitored or evaluated by a Regional Water Quality Control Board under the Section 401, NPDES/MS4, and SWAMP programs without any substantial intra-agency coordination. A need exists to implement standardized monitoring and assessment tools and approaches within state and federal agencies in California. The resultant data can be used to better manage wetland and riparian resources, evaluate program efficacy, and facilitate improved coordination and communication within and between agencies.

Purpose of Paper

The purpose of this paper is to describe the basic components of a comprehensive wetlands and riparian assessment program, based on USEPA's Level 1-2-3 framework and provide recommendations on incorporation of existing Level 1-2-3 tools into agency programs. This paper will: 1) present an overview of the existing Level 1-2-3 tools; 2) discuss how these tools can be used to inform decisions regarding wetland and riparian resources, and improve coordination and efficiency of various State and Federal wetland programs; and 3) identify key technical and administrative actions necessary to achieve these goals.

Wetland and Riparian Assessment Toolkit

In 2003, a consortium of scientists and managers from around the state began developing a monitoring and assessment program modeled after USEPA's Level 1-2-3 framework for monitoring and assessment of wetland resources (USEPA 2006). The fundamental elements of this framework are as follows:

- Level 1: consists of wetland and riparian inventories, landscape profiles, and assessment of stressors from upstream and surrounding land uses.
- Level 2: consists of rapid assessment, which uses cost-effective field-based diagnostic tools to assess the condition of wetland and riparian areas.
- Level 3: consists of intensive assessment to provide data to validate rapid methods, characterize reference condition, and diagnose the causes of wetland condition observed in Levels 1 and 2.

In 2006, the Resources Agency was awarded a USEPA Wetlands Demonstration Pilot (WDP) grant to begin a phased implementation of a statewide wetlands monitoring program, modeled after the USEPA Level 1-2-3 approach. This program is demonstrating the implementation of this wetland and riparian assessment toolkit in various state agency (regulatory and non-regulatory) programs in the coastal regions of California. The WDP project will help show how the Level 1-2-3 framework can be used to begin addressing statewide monitoring and assessment challenges by providing a common language and tools that can be used by all agencies and programs to evaluate wetland condition and the effects of management actions and decisions.

This framework, and the assessment tools to implement it, is applicable to wetlands and riparian habitats in their broadest sense, independent of any particular agency jurisdiction. "Wetlands," by this definition, include estuaries, lagoons, wadeable and non-wadeable streams and rivers, depressions (including ponds, wet meadows, vernal pools and other seasonal wetlands), seeps, springs, and lakes (including playas). Riparian areas include those transitional areas adjacent to rivers, streams, estuaries, lagoon, lakes, depressional wetlands and other water bodies that characteristically have a high water table and are subject to periodic flooding and influence from these adjacent water bodies. These transitional areas do not need necessarily to have riparian vegetation to be considered "riparian areas." The toolkit currently consists of the following tools:

- Standardized wetland and riparian mapping methodologies
- Tools to assess stressors on wetlands at a landscape scale
- California Rapid Assessment Method (CRAM) for wetlands
- Project tracking
- Standardized level 3 monitoring protocols

These tools are discussed in detail in the following sections.

Standardized Wetland and Riparian Mapping Methodologies (Level 1)

Inventories are the most basic component of a comprehensive wetlands and riparian assessment program, and are essential for identifying the spatial distribution and abundance of these habitats.

Inventories are the primary mechanism through which the State can evaluate its “No Net Loss” of wetlands policy. Inventories will aid habitat conservation planning by showing the locations of wetland and riparian areas relative to others. They help to identify geographic areas or habitat types in which the greatest losses have occurred. Inventories also serve as sample frames for probabilistic surveys of wetland and riparian ambient condition.

While there are various efforts to map wetlands on regional, county, and local levels, the California State Wetland Inventory, as mandated by Assembly Bill 2286, is the primary wetland inventory for the State. It is used to update the National Wetlands Inventory (NWI) of the USFWS and the National Hydrography Dataset (NHD) of the USGS, while also meeting many of the needs of the regional communities of wetland scientists, managers, and regulators. In addition to mapping all the wetlands, the State Wetland Inventory uses hydro-geomorphic modifiers to characterize the landscape context of wetlands and their water sources. Its products will include regional and statewide reports on the status and trends in the distribution and abundance of each wetland class.

Progress has been made to develop a statewide method for mapping riparian areas through the Riparian Habitat Joint Venture. The definition upon which this method is based is consistent with emerging stream and wetland system protection policies in the San Francisco and North Coast Regional Boards. This method is currently being piloted and refined through two regional mapping projects in San Francisco Bay and southern California.

Assessment of Landscape Stressors on Wetlands and Riparian Areas (Level 1)

Assessment of stressors at a landscape scale provide context to understand the fundamental constraints on wetland and riparian condition due to surrounding land use. Landscape-scale measures of stress, such as percent imperviousness and landscape development intensity index (Brown and Vivas 2006) serve as indices of land use intensity and have been found to correlate to wetland condition at a field scale. These indicators can be used a coarse tool to predict the condition of wetlands and riparian habitat within a watershed or catchment and to identify reference sites.

California Rapid Assessment Method (CRAM; Level 2)

USEPA funded the development of CRAM as a Level 2 tool for wetland and riparian monitoring and assessment (Collins et al. 2007). The overall goal of CRAM is to provide a rapid, scientifically defensible, and repeatable assessment methodology that can be used routinely in wetland monitoring and assessment programs. It is intended that CRAM be applicable to wetlands and riparian areas throughout the state of California. The general framework of CRAM is consistent across wetland types and regions, yet allows for customization to address special characteristics of different regions and wetland classes. CRAM is designed for routine use in local, regional, and statewide programs to monitor wetlands and riparian areas. It is intended to provide a consistent approach without neglecting characteristic differences in wetland form or function between regions or between types of wetlands. CRAM provides an assessment of overall ecological condition in terms of four attributes: landscape context, hydrology, physical structure, and biological structure and also includes an assessment of key stressors that may be affecting wetland condition. CRAM also features a “field to PC” data management tool (eCRAM) to ensure consistency and quality of data produced with the method. CRAM has been

calibrated against independent Level 3 measures of condition for estuarine and riverine wetlands. Calibration of CRAM for other wetland classes is currently being planned.

CRAM, like other rapid methods, provides a general assessment of wetland and riparian condition. CRAM metrics and attributes can be related to wetland functions, values and beneficial uses, although they are not measured directly by CRAM. CRAM can be used as a Level 2 or 3 assessment to provide a broad evaluation of wetland condition. However, CRAM is not appropriate to address management questions that require precise, specific management questions, e.g. questions about surface water quality, hydromodification, or faunal use (Tables 1 and 2). Typically, wetland impact analysis and compensatory mitigation planning and monitoring for larger wetland areas that exhibit more complex physical and biological functions will require more information than CRAM will be able to provide. In some cases, appropriate Level 3 protocols already exist; in other cases additional Level 2 or 3 assessment tools may need to be developed to assess these areas. Further information on CRAM can be found at www.CRAMwetlands.org.

Wetland Project Tracking (Level 1 and 2)

Wetland project tracking consists of standardized sets of data and maps to collect and share data among agencies and the public on projects that impact wetland and riparian habitat quantity and quality. In the coastal regions of California, project tracking is currently being implemented through online data entry and GIS-based data management systems that will be publicly accessible. This system can serve as a shared resource on wetland projects among participating resource and regulatory agencies. It will allow information on permitted or grant-funded wetland and riparian gains and losses to be tracked and analyzed over time relative to regional trends in wetland and riparian extent and condition. Wetland project tracking is one key mechanism through which the State will be able to track the impact of permitted wetland gains and losses. It will also aid state agencies in evaluating the impact of their programs on wetland and riparian resources. Once project tracking regional databases are demonstrated within the coastal regions, the intention is to transfer this tool to the inland regions. An example of a regional project tracking system can be found at www.wetlandtracker.org.

Standardized Monitoring Protocols (Level 3)

Regional teams in southern California and San Francisco Bay continue to develop a suite of standardized Level 3 monitoring protocols (that supplement CRAM) and can be employed for both probability-based surveys and project-specific monitoring to address wetland management questions that require more precision. The state is currently implementing a benthic macroinvertebrate index of biological integrity (IBI) in streams. Also under development is a periphyton IBI for streams, as well as a host of level 3 protocols to assess the physical and biological integrity of estuarine wetlands, rivers and streams.

Meeting Management Information Needs via a Statewide Wetlands Assessment Program

Wetland regulation and management in California is covered by a multitude of agencies, programs and guidance, including the following:

- Federal Regulatory Programs – Federal Clean Water Act, Sections 404, 401, 402 (NPDES), Coastal Zone Management Act.
- State Regulatory Programs – Porter-Cologne Act, Section 1600 of the Fish and Game Code, California Coastal Act, McAteer-Petris Act,
- Planning and Monitoring Programs – Surface Water Ambient Monitoring Program (SWAMP), Statewide Wetland Monitoring Program (WDP), State Water Board Watershed Management Initiative, USEPA Advanced Identification (ADID), Corps of Engineers Special Area Management Plans (SAMP), Regional Water Quality Control Board Urban Runoff Management Plans (JURMP/WURMP/SUSMP)
- Restoration Programs administered by the State Coastal Conservancy, US Fish and Wildlife Service, Department of Fish and Game, Wildlife Conservation Board and others.

There are several key needs within the diversity of programs focused on wetland regulation and management that can be addressed through implementation of a standardized wetland and riparian assessment toolkit. These needs include:

1. Providing data to better inform management decisions, including the analysis of cumulative impacts.
2. Standardizing data protocols to improve coordination between agencies and programs. This includes common definitions of wetlands and riparian areas, approaches for classification, consistent assessment tools, and common data management platforms and standardized data transfer formats.
3. Generating information that can be used to assess the effectiveness of wetland programs and funding, including common performance measures for restoration and mitigation projects

The Level 1-2-3 framework and the associated tools developed under this framework can help address some of these needs by providing a coherent conceptual approach that provides information to agencies and the general public on wetlands and riparian areas (Tables 1 and 2):

Providing Data to Better Inform Management Decisions

Implementation of the monitoring toolkit within the Level 1-2-3 framework provides the means for a cost-effective, holistic assessment of ambient extent and condition of aquatic resources and beneficial uses. These tools can be applied at the state, region, or watershed scale to inform management actions and prioritize recovery efforts.

Implementation of inventories, landscape assessment of stressors, and probability-based surveys utilizing rapid assessment tools and Level 3 protocols provide a comprehensive picture of

ambient condition. Inventories show the geographic distribution and extent of the resources. When coupled with an understanding of distribution of historic habitat, they provide an understanding of how to prioritize recovery efforts. Landscape assessment of stressors can be used to characterize the constraints that anthropogenic land use practices have on resource condition. It can also be used as a coarse tool to predict condition of wetlands at a catchment scale. Probability-based surveys using CRAM and other Level 3 monitoring protocols provide an evaluation of ambient condition and data with which to formulate management actions. Application of these tools at the project scale then provide a means by which to interpret data obtained from site-specific assessments within the context of the overall ambient condition at the watershed, region, or statewide scale. These tools can also be used to provide assessments of status and trends of wetland and riparian beneficial uses.

The State's ambient water quality monitoring program (SWAMP) has in the past been limited to evaluation of the ambient condition of the rivers and streams, emphasizing water quality over aquatic life use. This emphasis is now shifting with the implementation of a benthic macroinvertebrate IBI in rivers and streams, and the identification of the importance of assessing wetland beneficial uses in the recently revised SWAMP Program Strategy. Rapid assessment tools such as CRAM can be seamlessly integrated with other bioassessment tools to more comprehensively assess the status of aquatic life use in waters of the State. Similarly, CRAM provides a tool to help support emerging wetland ambient assessment programs, such as that being developed by the Resources Agency (WDP).

The Level 1-2-3 framework and the wetland monitoring toolkit also have tremendous potential for application at the watershed scale, where most management actions should be formulated. Inventories and probability-based surveys using CRAM allow a cost-effective estimate of general baseline conditions of wetlands and riparian areas in a watershed. These data can then be used to identify specific stressors that need to be managed such as hydromodification, excessive sedimentation, invasive species, and other human impacts. It can also be used as mechanism to prioritize degraded areas for recovery work or pristine areas for conservation. The combination of inventories, CRAM and project tracking will allow agencies and the general public to spatially display the locations of projects, including restoration projects, impact sites and mitigation sites. This will protect against impacting past mitigation or restoration areas, and will promote watershed-scale planning and management activities. Such watershed scale activities are consistent with pending Federal mitigation policies, which emphasize a watershed approach.

Another application of these tools at the watershed scale is the assessment of cumulative impacts. Cumulative impacts are an important aspect of regulatory programs that is seldom adequately addressed. Previous studies have documented that in many cases, the majority of total impacts to a watershed (or region) can occur as a result of the cumulative effect of numerous small actions over space and time (Lee and Gosselink 1988, Holland and Kentula 1992, Allen and Feddema 1996, Stein and Ambrose 1998). Use of CRAM and Project Tracking would make it easier to track and assess these small projects and hence address cumulative impact issues.

Several demonstration projects are underway to demonstrate how CRAM can be implemented in an ambient survey at spatial scales ranging from the watershed to statewide level: 1) a statewide

estuarine assessment, planned for 2007, which combines a level I assessment of wetland extent, a level 2 ambient survey of estuarine condition and assessment of the status of estuarine restoration projects with CRAM; 2) implementation of CRAM along with the benthic macroinvertebrate IBI in a statewide assessment of rivers and streams; and 3) demonstration of how CRAM and the Level 1-2-3 framework can be implemented in three demonstration watersheds throughout the state. Reports demonstrating how these data can be used will be available by September 2008.

Standardizing Data Protocols to Improve Coordination and Outreach

Wetland and riparian inventories, CRAM, and Project Tracking provide a common set of tools and assessment language that all agencies can use to articulate wetland change on an ongoing basis due to permitted impacts, compensatory mitigation, and non-regulatory restoration, and to provide public access to this information. Using this common language can facilitate improved coordination and data sharing between programs. It will help agencies implement a variety of stated objectives, such as setting beneficial use standards for wetlands, developing common performance measures, and evaluating “no net loss” policies. In particular distribution of wetland condition based on CRAM score (relative to specific wetland type or landscape/land use context) can be used to establish wetland and riparian protection policies and assess wetland beneficial uses and impairments of those beneficial uses.

In particular, Project Tracking provides an easy way to cross-reference agency actions (and file numbers) and provides an online mechanism for agency coordination on projects. Such information sharing has the potential to improve program efficiency across agencies by reducing redundancy in data processing and evaluation and providing for shared permit evaluation and compliance data. It also makes it easier and less time consuming for regulatory agency staff and others to track the status, success, and regional context of tidal and inland wetland projects by providing an online source for detailed information on individual wetland restoration, creation, and enhancement projects. It promotes easy exchange and archiving of project monitoring or descriptive information. It also provides a means to consistently update the public on the status of their wetland and riparian areas.

Generating Information to Assess the Effectiveness of Wetland Programs

Over the last 20 years, billions of public and private dollars have been invested in the protection, restoration, creation, and enhancement of wetlands and riparian areas throughout California. Unfortunately, information on the effectiveness of these investments is not readily available to resource managers, regulators, elected officials, NGO’s, and the public because the condition of wetlands and riparian habitat is not being monitored systematically. Incorporation of the Level 1-2-3 framework into agency programs will provide an opportunity to evaluate the effectiveness of public and private investment in conservation and restoration of these resources. This will help agencies be accountable to the California legislature on the impact of public investment in agency programs to conserve, restore, manage and regulate wetland and riparian resources.

Recent reviews of both the State and Regional Water Board water quality certification programs have identified poor record keeping and data inaccessibility as barriers to program review and

evaluation, and to compliance assessments (Ambrose et al. 2006). Use of Project Tracking would help remedy this situation by providing a central repository of data on impact, mitigation, and restoration sites in a format that is easy to update and query, and is accessible to all agencies.

Incorporation of common, structured tools, such as CRAM will facilitate Quality Assurance (QA) and Permit compliance processes. Use of a common assessment tool can generate consistent data formats that in turn, facilitate internal agency reviews. It can also make it easier for outside (or third party) reviewers to assist in the process, and can allow agencies with overlapping jurisdiction to more readily share QA and compliance responsibilities. Thus, use of these tools will aid agencies in striving to meet “no net wetland loss” goals.

Taking Steps Toward Implementation

Substantial progress has been made toward implementation of standardized wetland and riparian inventories, landscape assessment tools, CRAM, and Project Tracking into various agency programs. CRAM has been included in agency work plans and guidance, such as the State Water Resources Control Board's SWAMP work plan. In addition, the Corps of Engineers is considering incorporating CRAM into their revised mitigation monitoring guidelines. In October 2006 the Wetland Recovery Project (WRP) Board of Governors endorsed a wetland regional monitoring program for southern California that includes the tools discussed above. Since that time, agency workgroups have been meeting in southern California, Central Coast, the San Francisco Bay area, and North Coast to develop specific programs and policies to implement CRAM and Project Tracking into their respective programs. Since winter 2007, the San Francisco Regional Water Quality Control Board has been implementing Project Tracking on a pilot basis.

To achieve broader success in implementing CRAM, Project Tracking, and the Level 1-2-3 framework in agencies across the State of California, the following technical and programmatic needs should be addressed.

Technical Needs

- Establish a statewide network of reference sites for each CRAM wetland class that can be used as follows: 1) for continued refinement, calibration and validation of CRAM, especially to ensure applicability to inland areas of the state; 2) to provide a set of sites that form the basis for "reference" for each region of the state; 3) to establish sentinel sites that can be used for training and documentation of long-term trends; and 4) to provide sites to train practitioners in standardized assessment methods.
- Refine and calibrate CRAM methodology for targeted wetland subclasses, including wet meadows and ephemeral, headwaters streams. This would build on the established calibration already completed for the riverine and estuarine wetland classes.
- Develop guidance on the appropriate uses of CRAM for a variety of different uses, e.g. probability-based surveys, monitoring of impact and mitigation sites, etc. For regulatory applications of CRAM, this guidance should address application of CRAM to mitigation sites for performance monitoring, interpretation of CRAM scores when assessing immature sites, interpretation of stressor index relative to mitigation sites, and use of CRAM in a predictive manner to assess potential effects of permitted projects on wetlands.
- Continued refinement of information management tools to facilitate: 1) agency use of wetland and riparian inventories and assessment data for reporting on status and trends; 2) distribution of data to watershed stakeholders and the general public; and 3) quality assurance of data from field data collection to reporting.

Programmatic Needs

- Strengthen agency participation and leadership in Statewide Steering Committee created through EPA-funded WDP grant to provide ongoing mechanism for coordination and identification of common assessment needs and priorities.
- Develop a long-term strategy for the implementation of a statewide wetlands and riparian assessment program, including identification of short- and near-term priorities and an action plan to address these priorities.
- Develop guidance for implementation of CRAM and Project Tracking in respective agency programs.
- Develop regional teams for areas of the State currently underserved by the implementation effort. In particular, additional staff support for the Regional Boards outside the coastal zone is needed. This would include the Central Valley, Lahontan, and Colorado River Basin Regional Boards.
- Develop and implement a training program for both agency staff and environmental consultants on an ongoing basis.
- Incorporate wetlands monitoring into the Surface Water Ambient Monitoring Program (SWAMP)
- Develop a Quality Assurance (QA) process for using Project Tracking and CRAM for permit and/or project specific monitoring. This should include routine audits of data and a process for field verification of CRAM assessments at a subset of sites.
- Many agencies already have databases they use for project tracking. Ultimately, a process should be developed to allow sharing of data between existing agency databases and harvesting of data between Project Tracking and other agency databases. This would prevent the need for duplicate data entry, while still allowing agencies to maintain their own databases. This would also allow for information collected by Project Tracking to be uploaded to State or Federal databases for reporting purposes.
- Identify an agency(ies) to host Project Tracking and CRAM data. This may be a State Agency or via a “data center” concept, such as that being proposed by the SWAMP program.
- Secure a sustained source of funding for data management, QA, ongoing tool refinement and development, training and technical support, and ongoing coordination.

Work is already underway to address some of the challenges above. Although many are yet to be resolved, implementation of CRAM and Project Tracking should not be delayed pending resolution of these issues. CRAM and Project Tracking have been developed in close coordination with agency staff. Resolution of the issues listed above can occur along with

initial implementation of the monitoring and assessment described in this paper. Finally, as new policies emerge (e.g., the State Dredge and Fill Policy), CRAM and Project Tracking should be incorporated into their implementation.

Recommended Next Steps

To continue making progress on implementation of inventory tools, CRAM, and Project Tracking, a Statewide Steering Committee should be strengthened to develop activities to address the needs listed above. This workgroup, which could work under the auspices of the newly formed Monitoring Council, should include representation of major regulatory and management agencies and key technical partners (e.g. SCCWRP, SFEI, MLML) to address the following:

1. Develop policy recommendations for their respective agencies to incorporate these tools into agency programs.
2. Prioritize challenges, develop strategy to address the priority challenges, and identify opportunities where they exist for interim implementation. Construct summary “implementation profiles” (see example in Appendix A) for each program where implementation could occur.
3. Develop a mechanism for ongoing funding, coordination, and communication.
4. Develop means to sustain an integrated and coordinated assessment program that addresses the needs of state and federal agencies involved in aquatic resource management.

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Table 1: Status and Uses of Monitoring and Assessment Tools

	<i>Primary Use</i>	<i>Status</i>	<i>What it can do</i>	<i>What it can NOT do</i>
<i>Inventory</i>	provide consistent maps of extent and distribution of wetland and riparian areas by wetland type	coastal quads are completed, mapping of all coastal watersheds will be complete by late 2009	provide a regionally consistent digital map of wetlands and riparian areas using the NW1/HGM classification system	represent jurisdiction of all agencies, provide detailed site information on habitat
<i>CRAM</i>	evaluate wetland condition for use in ambient monitoring, project assessment, impact evaluation, and performance monitoring	ready for use, calibrated for estuarine and riverine wetlands, uncalibrated for other wetland classes	provide a "score" for overall wetland condition, and condition based on elements of wetland condition, provide a common tool for assessment between agencies	identify "jurisdictional areas", provide data on water quality, provide detailed wetland data (e.g. use by wildlife, etc.)
<i>Project Tracker</i>	provide a shared on-line data submittal and data management system for tracking change in wetland extent and condition	in-use in SF Bay area (for wetland extent), in development in S. Ca. and central coast (expect completion in July 2008)	allow participating regulatory and resource agencies to share data on project related impacts and mitigation, provide a "one-stop" data submittal portal for permittees/project proponents	serve as joint permit application process, replace existing agency databases, consolidate all monitoring into a single system
<i>Monitoring Protocols</i>	provide a consistent set of monitoring protocols for collection of intensive (Level 3) data	estuarine protocols exist in SF Bay and are under development in S. Ca (expect first set in Summer 2008); riverine protocol development will be initiated in 2008	facilitate sharing of data between projects and between agencies, improve ability to relate ambient and compliance data	replace need for all project-specific monitoring

Table 2: Potential Uses of Existing Monitoring and Assessment Tools

	<i>Inventory</i>	<i>CRAM</i>	<i>Project Tracker</i>	<i>Monitoring Protocols</i>
Document wetland extent and distribution	YES	NO	YES	NO
Ambient assessments	YES	YES	YES	YES
Assess impact sites	NO	YES	YES	YES
Site design issues	NO	NO	NO	NO
Impact site avoidance and minimization	MAYBE	MAYBE	YES	NO
Siting of mitigation sites	YES	MAYBE	NO	NO
Mitigation/restoration monitoring	NO	YES	YES	YES
Jurisdictional determinations	NO	NO	YES	NO
meeting water quality objectives	NO	NO	MAYBE	MAYBE

Appendix A – Implementation Profiles for Targeted Agency Programs

NOTE: Below is a template for these profiles. Ultimately, such a template could be completed for each program of interest.

Table A1. (Example) Application of WDP Monitoring and Assessment Tools within California wetland protection policies – California Coastal Act

Program responsibilities: *The biological productivity and the quality of coastal waters, streams, wetlands, estuaries, and lakes appropriate to maintain optimum populations of marine organisms and for the protection of human health shall be maintained and, where feasible, restored through, among other means, minimizing adverse effects of waste water discharges and entrainment, controlling runoff, preventing depletion of ground water supplies and substantial interference with surface water flow, encouraging waste water reclamation, maintaining natural vegetation buffer areas that protect riparian habitats, and minimizing alteration of natural streams.*

Current program needs relating to wetland tracking and assessment: Limited ability to compare data among permitted projects, limited ability to evaluate cumulative impacts on wetlands resources, limited ability to quantify wetland condition of mitigation projects, limited ability to track permitted projects.

Tool	Regulatory Linkage	Primary Use	Needed Action	Value	Limitation
<i>Inventory</i>					
CRAM					
Project Tracker					
Level III Monitoring Protocols					