Guidance Document for Compensatory Mitigation Projects Permitted Under Clean Water Act Section 401 by the Los Angeles Regional Quality Control Board

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Prepared for:
Los Angeles Regional Water Quality Control Board

December 2004

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December 2004

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1 Introduction

In 2002, the Los Angeles Regional Water Quality Control Board (LARWQCB) obtained a grant from the Environmental Protection Agency, with matching state funds, to evaluate the success of compensatory mitigation projects associated with water quality certifications issued under Clean Water Act Section 401. Through this grant, the LARWQCB sought to determine if the goal of "no net loss" of wetland area, functions and values was being met, and if not, to identify the contributing factors. Due to staffing limitations, the LARWQCB was not able to carry out this study internally. Instead, they contracted with Dr. Richard F. Ambrose at the UCLA Department of Environmental Health Sciences to perform the study.

The main focus of this study was to evaluate a subset of the Section 401 permits issued by the LARWQCB; the results of this evaluation are reported separately (Ambrose and Lee 2004) and summarized below (Section 1.2). However, the Regional Board also requested a document to provide guidance to LARWQCB staff, developers, and the general public for use in proposing and/or reviewing wetland mitigation plans for southern California.

In this guidance document, we draw upon the results of the evaluation study and our general experience with the wetland mitigation process to identify deficiencies in the implementation and outcome of the Section 401 permit process and to offer recommendations to help resolve those deficiencies. This document is structured around key issues in the Section 401 process; for each of these issues, we offer recommendations on how the regulatory practices could be improved, both to increase the likelihood that the "no net loss" goal will be met and to make future investigations into compliance and function of mitigation projects more tractable. We also present a series of case studies chosen to illustrate particular lessons about the 401 Program.

This project was funded by the Los Angeles Regional Quality Control Board, so our comments are directed primarily to its Section 401 program. However, Section 401 is fundamentally connected to the entire Section 404 permit process, which is administered by the United States Army Corps of Engineers. Most of the issues and recommendations that are raised by this guidance document apply to the Section 404 permitting process as well as Section 401. In fact, the Los Angeles District of the Corps has produced a document, *Final Mitigation Guidelines and Monitoring Requirements* (issued April 19, 2004), that provides a complementary view of these issues. Our recommendations may also apply to other Regional Boards in California, but the importance of different recommendations is likely to differ among different Boards because of unique circumstances and procedures.

1.1 Organization of Guidance Document

The remainder of this section summarizes the findings of the evaluation of compensatory mitigation projects. The evaluation was a complex project that cannot be easily summarized without losing important subtleties and caveats, hence the reader is encouraged to examine the actual evaluation report (Ambrose and Lee 2004).

Section 2 presents the body of the Guidance Document. It is organized around the main issues we identified in our evaluation along with recommendations for how to resolve them. Because this document is intended for a diverse audience, we have divided Section 2 into three general subsections. Section 2.1 discusses issues related to mitigation planning. Section 2.2 discusses ways in which permit conditions could be improved. Section 2.3 discusses ways to improve the administration of Section 401 permits. This last section is relevant mainly to Regional Board staff, although a number of these issues may affect permittees and their consultants because they involve information to be included in a permit or permitting processes.

Following the main body of the Guidance Document, Section 3 synthesizes the recommendations and presents some general conclusions.

Appendix 1 presents a series of case studies illustrating important lessons. These case studies are presented to provide concrete examples of the types of issues we encountered during our field evaluations.

1.2 Summary of Mitigation Evaluation study findings

The evaluation study examined permit compliance and wetland functions in wetland compensatory mitigation projects in Ventura and Los Angeles Counties. The projects studied were issued permits requiring mitigation from the Los Angeles Regional Water Quality Control Board (LARWQCB). The assessment of mitigation projects included an extensive review of permit files followed by field monitoring to assess the condition of the habitat and map the area of the mitigation sites.

The central goal of this project was to assess compliance and function of a set of mitigation projects required by the LARWQCB under Section 401 of the Clean Water Act. We selected permits for assessment based on a physical review of permit files archived at the LARWQCB office. To ensure a broad representation of mitigation project ages, we sought to complete a permit review with files stratified by year, with at least 20 permit files requiring compensatory mitigation per year from 1991 to 2002. Since key documents were frequently absent from the LARWQCB files, we supplemented our file survey by reviewing the file archives at the United States Army Corps of Engineers office in Ventura. As we went through each storage box in the search for files, the basic information from nearly 900 permit files was recorded. For 250 of the 319 files that contained mitigation requirements, photocopies of all pertinent information were made to facilitate our office and field assessments. A new Access database was designed specifically for use on this project. Information from all 250 photocopied files was entered into this database, including basic project data, permittee, agent, location, impacts and mitigation, and permit conditions. All data collected through our office and field assessment of compliance, as well as all primary and supplemental data collected through the functional evaluation, were entered into this Access database. Site perimeter data (using GPS) were collected, and managed separately.

Fifty permit files to be included in our compliance and functional evaluations were selected randomly from the total population of 250 files with mitigation requirements. We conducted site visits at all mitigation sites associated with these 50

permits. At many sites, the site visit uncovered information indicating that the site was not suitable for assessment (e.g., the mitigation construction was still in progress); in all of these cases the file was removed from our list of 50 assessed files and replaced by an additional randomly chosen permit. In addition to these excluded permit files, there were five files for which compliance evaluations could be made, but where functional evaluations were not possible because of ambiguities in their in-lieu fee programs. Because we wanted a set of 50 fully assessed (Phase I and Phase II) files, an additional five files were added, resulting in a total of 55 files evaluated for compliance.

We determined the acreage of mitigation sites using a mapping-grade GPS. To fulfill the acreage requirements mandated by the regulatory agencies, and given the resource limitations of the typical permittee, an individual permit file may have from one to four discrete mitigation project sites that may blend together several different habitat types (e.g., wetlands, alluvial scrub, riparian areas, etc.), and multiple mitigation actions (e.g., restoration, enhancement, preservation). Where possible, we distinguished between discrete mitigation sites, and these were surveyed and evaluated separately. Of the fifty permit files we assessed, 20 files had multiple discrete mitigation project types that yielded 79 individual mitigation site evaluations. Frequently, we were unable to determine the boundaries of a mitigation site although we could determine the general area; in these cases, we recorded a single GPS reading at the approximate location of the mitigation site.

Each permit file has a series of standard and special conditions associated with it specifying management actions or performance standards that must be accomplished in order to meet the compliance requirements of the permit. We define compliance as the percent of conditions met, as determined through our field and/or office assessment. We assessed three different types of compliance: (1) compliance with the actual permit conditions; (2) compliance with "modern" permit conditions, the more inclusive and specific conditions that would have been imposed on older permits had they been processed recently; and (3) compliance with the mitigation plan, which is designed to accommodate the requirements of all agencies (e.g., U.S. Army Corps of Engineers and California Dept. of Fish and Game). For files with multiple mitigation sites, we evaluated compliance at each mitigation site separately, resulting in 79 field compliance evaluations. These were combined with the five permit files containing in-lieu fee payments for a total of 84 individual compliance evaluations. A subset of permit conditions often could not be assessed because of the age of the site or the nature of the condition; for example, it is not possible to determine if a site was mulched ten years ago based on our site visit.

The functional evaluations of the mitigation sites were conducted using the newly developed California Rapid Assessment Method (CRAM), modified specifically for this project (called UCLA-CRAM), along with supplemental information collected at each site. Supplemental assessments evaluated the success and appropriateness of the mitigation work, plant/habitat community characteristics, wetland conditions and jurisdictional habitat, and beneficial wetland/riparian services gained compared to what was likely lost at the impact site. Full functional assessments including CRAM, UCLA-CRAM and all other supplemental evaluations were performed for all 79 discrete mitigation projects. Digital photographs were also taken at all of the mitigation sites.

Ninety of the >200 LARWQCB storage boxes were inventoried. Within these 90 boxes, 887 permit applications were found from 1991 to the present, for which 601 permit certifications were issued, with 319 requiring some form of mitigation. Residential/urban development projects were the dominant project type permitted (35%), followed by flood control, bridge crossing, and bank/channel work projects (18%, 16%, and 16%, respectively). Pipeline/utility project were about half again as common (7%), and the remainder of the project types were represented by just a few files each. Permanent impacts were twice as common as temporary impacts (66% compared to 33%). Restoration projects were the most common (46%) type of mitigation project, followed by creation (27%), enhancement (20%), and preservation (8%).

Sixty-nine percent of the sites (48 of 79 sites) complied with 100% of the (assessable) conditions; 31% did not comply with all of the permit requirements (Figure 1). Only one site did not comply with any of the requirements. A summary of the compliance for individual conditions that were commonly specified in 401 permits is presented in Table 1. The surveyed mitigation projects generally did well on revegetation conditions, with 100% of mitigation sites meeting the "presence of species specified for revegetation" condition and 94% meeting the "native vegetation present?" condition. These high rates of success can be attributed in part to the simple yes versus no (presence/absence) nature of the compliance evaluation for these conditions. Only two conditions were never found to be out of compliance: grading to pre-project contours, and the presence of specified plant species. Both of these conditions relate to the initial establishment of the mitigation sites, suggesting that the contractors constructing the mitigation were reasonably diligent. However, conditions relating to longer term maintenance and performance of the mitigation sites, such as maintenance in perpetuity and lack of exotic species, had much lower rates of compliance.

The total area lost permitted through these 50 permits was 170 acres. This represents the acreage of "waters of the United States," including wetlands and non-wetland waters that were within the limits of federal jurisdiction as identified in Section 404 and Section 401 permits. The total acreage required to offset these losses was 233 acres, which would have represented a net gain of about 63 acres of wetland and other waters habitat (a gain/loss mitigation ratio of 1.38:1). The total area "gained" that we measured through out GPS survey was approximately 226 acres, assuming that the 15 mitigation sites with undeterminable boundaries resulted in zero acres of gain each. Excluding the 15 sites with undetermined boundaries from our set of acreage calculations, the total acreage lost was 139.36, the total acreage required was 197.57, and the acreage "gained" was 226.12 acres, which exceeds the required acreage by 28.55 acres and yields a gain/loss ratio of 1.62:1.

These results suggest that, overall, mitigation projects in the Los Angeles region are meeting or slightly exceeding their acreage requirements. Therefore, it might be assumed that losses to wetlands and non-wetland waters permitted under Sections 401 and 404 of the Clean Water Act are being offset by adequate gains in acreage through compensatory mitigation requirements. However, a substantial proportion of these mitigation projects are enhancements and preservation areas (which may increase or preserve function, but do not constitute gains in habitat area). In addition, these results do not indicate whether the habitat type and ecological function lost at impact sites are

being adequately replaced by comparable habitat and function at mitigation sites. These issues are discussed next.

The UCLA-CRAM functional evaluation method assessed 15 different metrics in four main categories of wetland functions or conditions. By assigning numerical values to the conditions for each metric, we were able to combine values to generate summary scores. The conditions at the 79 mitigation sites varied from 17% to 84% of the total possible UCLA-CRAM points (Figure 2). Twenty-three of the 79 sites (29%) had scores less than 54% of the total possible points, considered to be "marginal to poor" condition. Fifty-three of the 79 sites (67%) were sub-optimal, with only three sites (4%) exceeding 79%, the criterion we determined to be optimal. Figure 3 presents the distribution of scores for each of the four components of the UCLA-CRAM assessment. For the landscape context component, 34 sites (43%) were marginal to poor and 7 sites (9%) were optimal. For the hydrology component, 18 sites (23%) were marginal to poor and 7 sites were optimal (9%). For the abiotic structure component, 29 sites (37%) were marginal to poor and 14 sites were optimal (18%). For the biotic structure component, 31 sites (39%) were marginal to poor and 7 sites were optimal (9%). These scores are summarized in Table 2.

The UCLA-CRAM functional evaluation indicates that few mitigation projects support optimal wetland conditions overall, with only 4% judged optimal and nearly 30% judged to be in marginal to poor condition. Similar results were found for each of the four components of the assessment, with the mitigation projects most successful in the abiotic structure category, but even here achieving only 18% optimal. Of course, not all compensatory mitigation projects include wetland hydrology, biogeochemistry, and hydrophytic vegetation as target endpoints. In addition, the impacted wetlands may not have had optimal condition before project impacts occurred. In these cases, a CRAM score of 100% may not be an appropriate expectation, since it is based on the premise that a high-functioning natural wetland will have high condition scores in all categories. On the other hand, since the principle behind the Clean Water Act regulation is protection of wetland functions and values, and the regulatory framework is limited to the acreage of those habitats that are classified as wetlands and waters, we feel that the target endpoint of a 100% CRAM score is largely appropriate for evaluating compensatory mitigation sites permitted under CWA sections 401 and 404.

We extended the scope of our assessment through supplemental qualitative assessments. Included in this collection are estimates of plant density and diversity, total native cover and total cover of invasive species, and the percent cover of *Arundo donax*, a particularly troublesome invasive plant in the Los Angeles region. We also focus on one relevant stressor, the influence of impervious substrate on the sites. Additional assessments were made that focus on how successful the mitigation project was with respect to its potential longevity, its ability to persist without artificial watering, and the overall quality of the habitat. The final three assessments consider how successful the mitigation activities were in replacing lost function, how successful the permittees were in satisfying their permit obligations, and how appropriate those permit obligations were in guaranteeing that the goal of "no net loss" of remaining wetland habitat and function would be met, as approved. The main findings for selected supplemental assessments are

presented here. A more thorough presentation and analysis of our results can be found in our main report (Ambrose and Lee 2004).

The supplemental assessments indicate that most compensatory mitigation sites are achieving high success with respect to their plant communities. This confirms our general impression that the planting element of compensatory mitigation projects is the aspect of wetland replacement that both agency personnel and permittees focus on most.

For the "overall success of functional replacement" assessment, we considered what was actually accomplished at a mitigation site (the functional difference between the pre-mitigation state and post-mitigation state of the site) compared to the functional losses that occurred at the impact site. Twenty three sites (29%) were successful, 10 sites (13%) were partially successful, while 46 sites (58%) were failures. The "overall success in achieving stated goals of mitigation plan/permit requirements" assessment considered whether or not the permittees adequately fulfilled their mitigation-related responsibilities, as outlined in the permits and mitigation plans approved by regulatory agencies. Forty two sites (53%) were considered successful, 10 sites (13%) were partially successful, and 27 sites (34%) were failures. Compared to the functional replacement assessment, the success scores for this assessment were higher by about 20 percentage points, indicating that many mitigation projects accomplished the goals set out for them but nonetheless failed to replace the lost functions from the impacted sites. From the results of these two assessments, it appears that mitigation goals have not been adequate to ensure functional replacement.

At each mitigation site, we assessed the approximate proportions of jurisdictional and non-jurisdictional habitat types that would have been recorded had formal wetland delineations been made. The results indicate that there is a substantial amount of non-jurisdictional riparian and upland habitat (about half of the total acreage) in the surveyed compensatory mitigation sites. Upland habitat and riparian habitat that is beyond the limits of federal jurisdiction (waters of the United States) are not included in the estimates of habitat losses that result from the formal permitting process. Nor are losses to these habitats considered when determining the acreage requirement of Section 404, or 401 permits (although the riparian habitats that are beyond federal jurisdiction may be considered "waters of the state," and may thus be included in the acreage requirements of the California Department of Fish and Game Streambed Alteration Agreement). As a consequence, a simple balance-sheet approach to assessing no net loss, where acres impacted are compared to acres mitigated, can be misleading, since the loss acreage does not include non-waters habitats but the mitigation habitat does. In any case, it seems that through the Section 401 permits, a shift is occurring wherein wetlands and other waters of the United States are being replaced to a certain extent by non jurisdictional riparian and upland habitats.

Wetland protection under the Clean Water Act and the goal of "no net loss" is founded on the concept that wetlands and other "waters of the United States" provide valuable functions, values, and services that are important and beneficial to humans. Examples of such services include flood water storage, flood energy dissipation, biogeochemistry (e.g., water purification, nutrient cycling), sediment accumulation, wildlife habitat including aquatic wildlife habitat, and in some cases, groundwater

recharge. To assess whether lost functions and services actually have been replaced by mitigation activities, we compared the services occurring at mitigation sites to what was lost through project impacts. For each of the services listed above (except ground water recharge, which is not relevant at most of our riverine sites), we considered what the realized gains were through mitigation activities and what the likely losses were at the impact sites. To analyze these data, we subtracted the loss score from the gain score for every service assessment, so zero represents complete replacement, negative numbers represent net losses, and positive numbers represent net gains. We refer to the scale intervals as "service units." For each of the service category results given below, we consider success as meeting or exceeding full replacement (zero or higher score), and we consider failure as falling below a score of -1 service units. Partial replacement is defined as -1 service unit, or for the "totals" calculations, between this value and zero. Sites with service unit scores below -2 were considered "extreme failures.

The majority of the mitigation projects did not adequately compensate for services lost at the impact sites for five of the six types of services assessed; the one exception was flood energy dissipation, where 53% of the sites could be considered successful (zero or greater) at replacing the service (Table 3). Replacement failed (< -1 score) at between 29% and 39% of the sites for the six services assessed. For each of the 79 mitigation sites, the data for the six types of services were averaged across all six categories to obtain a single value for services lost versus gained, per site. These results are presented in Figure 4. As can be seen in this figure, the majority of the mitigation projects (66% or 52 sites) failed to compensate for the beneficial services lost through impact projects. Replacement could be considered successful for 27 sites (34%), with 20 sites (25%) achieving a net gain of services and seven sites (9%) having a net loss/gain of zero. Thirty-six sites (46%) failed to replace lost services, with 24 of these sites (30%) considered extreme failures.

A simple summary of mitigation success by acreage, permit conditions, and function is presented in Table 4. For this analysis, the data from the 79 individual mitigation sites were combined into their 50 respective permit files. Forty-six percent of permit files met or exceeded their acreage requirement and 60% successfully complied with their permit conditions. Among the files that had assessable permit conditions, all files met at least one assessable permit condition (and thus were judged partially successful), although 12 files (24%) failed to meet their acreage requirement. The results for acreage success are complicated by the fact that acreage determinations were not possible at a large percentage of sites, either because the approximate boundaries of the site could not be determined or because no evidence of mitigation activities could be found. Even though the success rates for acreage and compliance were not high, the success rate for function was extremely low: only one site was considered successful with respect to function. Clearly, success in meeting permit conditions does not ensure mitigation site function.

Although overall the acreage of mitigation exceeded the acreage of impacts, there are differences in the habitat types impacted and required for mitigation. Data from this study show that a net loss of wetlands and waters has been replaced by a net gain in riparian areas and terrestrial habitats as well as in-lieu fee mitigation (Figure 5). This figure shows the number of instances of the various habitat types lost compared to the

number expected to be gained from an analysis of the information in the permit files. These analyses show the mitigation habitat types proposed and subsequently approved, but may not reflect the actual habitat types present at mitigation sites. Large discrepancies between impacted and mitigation habitats occurred for vegetated and unvegetated streambeds, with more impacted than mitigated, and riparian and terrestrial, with more mitigated than impacted. (There were also more "other wetland" habitats impacted than mitigated, but this difference is likely due to mitigation plans naming specific wetland types.) Thus, it appears that streambed habitats are not being replaced as often as they are impacted, while habitat outside of the streambed (riparian and terrestrial) are included as mitigation more often than they are being impacted. This will lead to a shift in the distribution of wetland types in the landscape.

Of 250 permit files we reviewed, 16% involved in lieu fee payments. Complexities inherent in the in-lieu fee program, as currently implemented, have resulted in numerous problems with respect to both permit compliance and the assurance that the goal of "no net loss" will be met. Key weaknesses in the in-lieu fee process include problems with the timeliness of fee transfers, substantial delays in the implementation of mitigation projects by the in-lieu fee program administrator, transfer of money to an agency general fund rather than to a specific mitigation action, and use of in-lieu fee payments for projects that do not replace lost functions and services appropriately.

In conclusion, the Section 401 program has failed to achieve the goal of no net loss of habitat functions, values and services in the Los Angeles region. The root of this shortcoming lies with a lack of explicit consideration of the full suite of functions, values, and services that will be lost through proposed impacts and might be gained through proposed mitigation sites and activities. This begins with the drafting of compensatory mitigation proposals by permittees that have little or no chance of meeting the "no net loss" goal, but it is ultimately based on the conditional approval of those mitigation measures by regulatory staff. There are certainly instances where inadequacies of subsequent mitigation plans, acreage shortfalls and other compliance issues contribute to net loss on an individual permit file basis. These problems frequently go unnoticed due to a lack of regulatory oversight and enforcement. However, our results demonstrate a much higher rate of success for compliance with permit conditions and acreage requirements than for replacement of lost wetland functions and services. Improving the protection of wetland resources will require a more careful scrutiny of mitigation plans to ensure they adequately replace lost habitat types, functions and services and the imposition of permit conditions that ensure that mitigation habitats provide appropriate functions and services.

2 Issues and Recommendations

This section discusses a variety of issues related to mitigation practice and outcome in the Los Angeles region. Section 2.1 presents general issues relating to mitigation planning. Section 2.2 discusses issues relating to the special conditions placed on 401 permits. These first two sections should be useful for anyone concerned with improving the success of the 401 program. Section 2.3 discusses specific issues dealing with the administration of 401 permits; this section discusses the content and approval of

401 permits, evaluation after a permit is approved, and organization. This last section will be of interest primarily to Regional Board staff and perhaps applicants (and their consultants).

The issues discussed in this section arose during our review of 401 permits issued by the Los Angeles Regional Water Quality Control Board. Although many of these issues are universally applicable, the reader is reminded that some may be particular to the permitting process and conditions in the Los Angeles Regional Board.

2.1 Improving Mitigation Planning

The overall goal of mitigation under the Clean Water Act is to ensure that there is no net loss of wetland functions or services (with Section 401 focusing particularly on water quality services) as a result of activities impacting wetlands. Although there are many ways in which the 401 program might fail to achieve this goal, the results of our assessment indicate that many sites met their permit conditions but nonetheless failed to achieve the wetland condition necessary to replace lost services. One way to improve the 401 success rate is to optimize the planning of mitigation projects. For example, the types of mitigation projects that often fail to produce suitable wetland conditions or services can be avoided, while the types of mitigation projects that result in substantial wetland function can be emphasized. Planning for mitigation should be structured to ensure that the various functions and services lost due to the impact are fully mitigated.

One aspect of mitigation planning has seen little recognition in existing Section 401 permits: consideration of cumulative impacts. Although there have been specific studies of cumulative impacts in select watersheds in southern California (e.g., Stein 1995, Stein and Ambrose 1998, 2001, Lilien 2001), there is no simple methodology available for assessing cumulative impacts associated with 401 permits. In particular, it is not simple to determine when impacts within a region (watershed) have reached a critical threshold beyond which additional impacts must be scrutinized carefully. For this reason, there is no easy guideline for assessing cumulative impacts. Nonetheless, the 401 permit review process should move towards including an explicit step for considering cumulative impacts.

2.1.1 *Avoiding Impacts*

In the sequencing of mitigation planning, the first step is to consider ways to avoid impacts to jurisdictional habitats. Consideration of avoidance typically occurs either before an application for a project is submitted or after consultation with agency staff. Because there is no systematic paperwork documenting steps taken to avoid impacts, there generally is no way to track the amount of avoidance that has occurred. As a consequence, our evaluation did not consider avoidance in assessing the success of the 401 program, and we cannot assess how often this strategy is fully explored.

Although our evaluation could not document how many resources and services are spared impact through avoidance, we want to reinforce the importance of considering any and all possible means for avoiding impacts to wetlands and waters. A systematic attempt should be made to develop the knowledge and tools necessary to maximize

avoidance of impacts. In Section 2.1.1.1, we discuss one particular type of impact that, while extremely common, may not be required in all circumstances it is presently employed.

2.1.1.1 Channelization should be avoided to the extent possible

The stream ecosystem, including the active stream channel and associated wetland and riparian habitats, performs a wide variety of functions and services. Channelization projects often eliminate most or all of these functions and services, particularly if the channel is lined with concrete or rip-rap. Channelization is often viewed as a necessary component of a development in order to maximize developable land while protecting property. However, work in other regions (especially by A.L. Riley at the San Francisco Regional Water Quality Control Board) has shown that channelization, and in particular channelization that incorporates concrete banks, can often be avoided (Riley 2003).

Although not always successful, well designed and sited in-stream restoration projects can be very effective at replacing the functions and services lost by channelization (see Section 2.1.3.1). However, the opportunities for in-stream restoration are often limited. As a result, many impacts to the active channel are mitigated by creation or restoration outside of the active channel or through simple habitat enhancement. Such mitigation typically fails to replace many of the critical services the original site performed, including attenuation of peak flood flows, maintenance of subsurface aquifers, and water quality improvement.

To avoid the loss of critical stream functions, a special effort should be made to avoid impacts to active channels, especially impacts from channelization and bank stabilization. Wherever possible, projects should be designed to accommodate any hydrologic changes within the project boundaries. Consultants should be required to perform appropriate analyses to demonstrate that channelization could not be avoided by redesign. Dr. Riley has conducted workshops and published a simple handbook (Riley 2003) that provides examples of analyses that can be used to show whether channelization is required.

The San Francisco RWQCB has a policy of not permitting projects that channelize and add concrete to a stream. The LA Board should consider how they could also accomplish this objective.

Where channelization or bank armoring <u>is</u> necessary, an emphasis should be placed on using "soft structures" (i.e., bioengineering) instead of concrete or riprap. Most channels we evaluated contained impervious concrete or grouted riprap linings. These channels eliminated most of the functions and services of the existing stream. However, we also evaluated several sites where semipermeable structures such as interlocking blocks were used, and these had often dense vegetation growing up through the armoring that could help slow down flood waters. These sites allowed for some hydrological connection between the stream and the surrounding uplands and contributed, at least somewhat, to flood water storage, flood energy dissipation, aquifer recharge, biogeochemistry, and wildlife habitat services.

Recommendation: Avoid channelizing rivers and streams by designing projects to accommodate hydrologic changes within the project boundaries.

Recommendation: Use "soft structures" over impervious concrete and riprap whenever possible to provide for both flood control and limited wetland/riparian services.

2.1.2 *Problematic mitigation*

2.1.2.1 Habitats outside of jurisdictional "waters of the United States"

Roughly half of the acreage at compensatory mitigation sites in this study was composed of non-jurisdictional riparian and upland habitat. Upland and riparian habitat that is beyond the limits of federal jurisdiction (waters of the United States) are almost never included in the estimates of habitat losses for 401 permits. Seldom are losses to these habitats considered when determining the acreage requirement of Section 404 or 401 permits. Therefore, our evaluation study results indicate that current mitigation policies are enabling a habitat shift, with losses to wetlands and other "wetter" habitats being replaced by drier riparian and upland areas that are outside the jurisdictional boundaries of future wetland protection. It should be noted here that, while the often-confusing language of 401 permits may indicate that impacts to riparian areas are being mitigated by riparian mitigations, nearly all permitted riparian impacts were from within waters of the United States while most riparian mitigation occurred outside waters of the United States. On average, 28% of all mitigation acreage was characterized by non-jurisdictional riparian habitat. The practice of using non-jurisdictional riparian and upland habitat as compensatory mitigation for losses to jurisdictional wetland and waters habitat is generally contrary to the goal of "no net loss," since non-jurisdictional riparian and upland habitats do not provide the same functions and services as jurisdictional habitat[1]. Even if non-jurisdictional riparian areas were considered as appropriate target habitat for wetland mitigation projects, many of the riparian mitigation projects we surveyed exist along the drier (or more upland-tending) end of the wetland-to-upland transition.

This is not to say that non-jurisdictional riparian and upland habitats do not play an important role in riverine systems; clearly they are an integral part of riverine systems and are critical to many important functions and services. Nor is it the case that non-jurisdictional riparian and upland habitats should never be included as part of a mitigation requirement. However, in most cases non-jurisdictional habitats are proposed as mitigation for convenience, because these habitats are more readily available and perhaps because mitigation activities are easier to undertake in them. In most of the cases we

[1] The evaluation of mitigation jurisdictional versus non-jurisdictional acreage is complicated by the fact that the mitigation projects were designed to meet the requirements of more than one regulatory program; in particular, the California Department of Fish and Game's jurisdiction is broader than the Corps' or Regional Board's and includes what we are calling "non-jurisdictional riparian area." Thus, the non-jurisdictional riparian area in a mitigation site may have been required by CDFG rather than the Corps or the Board. In any case, too little jurisdictional habitat has been required to ensure no net loss of wetland acreage, functions and services. The habitat requirements would be clearer if the accounting in the permit was more explicit; see Section 2.2.1.1.

studied, the use of non-jurisdictional habitats as mitigation resulted in the net loss of jurisdictional habitat area, functions and values.

Recommendation: Mitigation within non-jurisdictional upland and riparian habitats should not be accepted as compensation for losses to jurisdictional wetlands and waters habitats, but could be used to supplement jurisdictional mitigation as buffer habitat. Mitigation proposals should be scrutinized to ensure that ambiguous proposal language does not allow non-jurisdictional riparian mitigations to be confused with jurisdictional riparian losses.

2.1.2.2 Preservation

While preservation areas were the least common type of mitigation in this study, our sample of 50 fully assessed permit files included several examples where preservation areas were included as compensatory mitigation. None of these permits relied solely on the preservation areas to compensate for losses, but these were required in addition to some other form of mitigation. Despite the clear benefits of preserving threatened habitat, the establishment of preservation areas does not result in gains in habitat, functions, values, or beneficial services, and therefore should not be used as compensatory mitigation. We did not include any of these permitted preservation areas in our functional and supplemental evaluations.

The problems with preservation sites can be seen clearly by considering a before-after assessment of site conditions, functions and services. Since there is no change within the site boundaries, there can be no "credit" for mitigation.

As with non-jurisdictional habitats, preservation areas may provide important functions and services. It could be appropriate to include a preservation area *as a supplement* to adequate mitigation for wetland losses. For example, it would acceptable to request preservation areas as buffers surrounding compensatory mitigation projects. However, preservation areas should not be considered in any "no net loss" evaluation.

Recommendation: Preservation areas should not be considered as direct compensation for permanent wetland losses.

2.1.2.3 Enhancement projects

The majority of enhancement projects in our study of 50 permit files consisted of plantings of native riparian and upland species within non-jurisdictional habitats. Given an adequate landscape position and an appropriate coverage of enhancement activities within the specified mitigation acreage, enhancement projects can result in valuable gains in habitat functions and services. However, these enhancements would seldom if ever result in gains in hydrological or biogeochemical functions and services. Thus, habitat enhancement can provide appropriate compensation, but care must be taken to ensure that the appropriate suite of lost functions and services are enhanced.

A critical limitation of enhancement projects is ambiguity in the required level of enhancement effort. Most 401 permits requiring enhancement specify the acreage to be enhanced, but not the effort required within that acreage. For example, for one of our

assessed permit files that required a 5.8 acre enhancement, we determined that only 28% of that area consisted of vegetative enhancements while the remaining 72% consisted of an unaltered oak/riparian area that we viewed as an unofficial preservation area. This site was unique in having a large and discrete portion of the mitigation site as unaltered "preservation." But many of the other enhancement projects included in our study consisted of isolated plants or groups of plants scattered within a larger unmodified area. The permittees are able to claim credit for a much larger mitigation acreage than was actually improved around these scattered plantings. Unless the procedures for accounting for enhancement credit are changed, enhancement projects should by avoided under most circumstances.

Many of these problems with enhancement projects could be avoided if compensation was based on a before-after assessment of site conditions, functions and services. Enhancement projects that provide some functions and services would get credit for these, but would be shown to lack other functions and services that were lost at the impact site. An enhancement site that provided a small increase in functions and services over a large area would not get credit for substantial enhancement over the entire area, but rather the credit would be proportional to the increase in functions and services.

Recommendation: Enhancement projects should only be used where it can clearly be shown that the increase in functions and services *fully* compensates for the lost functions and services.

2.1.2.4 Revegetation within active stream channels and floodplain washes

Stream channels and active floodplain washes in the Los Angeles region are subject to dramatic phase shifts wherein periodic floods wipe out the plant communities occurring in the unconsolidated channel sediments. In our study we assessed numerous mitigation projects that called for revegetation within these habitats, usually at or just downstream of the impact site.

Two scenarios were common at these sites. (1) At several sites, the entire mitigation site was almost entirely devoid of vegetation, which might suggest that no mitigation was done or that the mitigation efforts failed completely. However, at these sites the entire reach of the channel, both upstream and downstream of the mitigation site, was equally devoid of vegetation. This suggests that high flood waters had recently scoured the entire reach and that any mitigation efforts that may have occurred were rendered meaningless. (2) For the other scenario, the entire stream reach upstream and downstream of the mitigation site consisted of high vegetative cover, although photographs of the reach prior to the project indicate that the entire reach had been previously scoured. As in the previous scenario, there was no evidence that mitigation efforts had any influence on the phase shift that occurred in the entire reach.

These scenarios suggest that active or passive revegetation projects will only be appropriate under certain circumstances. Within active streambeds, mitigation consisting solely of revegetative plantings using cuttings or small container plants may only benefit the site until the next phase-shift event. Therefore, such efforts may be used to mitigate temporary impacts associated with in-channel work (i.e. disturbance associated with

bridge widening or utility line replacement), but not the permanent impacts. Revegetation may prevent a temporal loss of resources; however, since newly planted vegetation usually provides limited function until approaching maturity, such efforts may contribute little compensation, even for temporary impacts. On the other hand, we found that bridge expansions and utility crossings typically resulted in minimal permanent impacts, and losses of function and beneficial services as a result of these impacts and their associated temporary impacts were generally low. Following in-channel work, soil disruption from equipment and vegetation removal can lead to erosion and destabilization of nearby plant communities. These impacts should not go unmitigated. If they are required as mitigation, revegetation projects in active channels and floodplains should be designed to withstand annual and ten-year flood events. Larger scale efforts, such as the installation of mature riverine trees combined with the creation of islands or other stabilized planting areas, may improve the success of these revegetation projects.

Recommendation: Simple revegetation projects in active channels or floodplains are not appropriate as compensatory mitigation for permanent habitat losses, but may be appropriate for temporary impacts.

Recommendation: If revegetation projects in active channels are to be used as compensatory mitigation or as mitigation for temporary impacts to active channels, then larger scale projects should be designed to withstand annual and ten-year flood events.

2.1.2.5 Riparian creation projects isolated from hydrological processes

Creation projects should theoretically be the best option available to compensate for habitat losses permitted through the Section 401 process. Unlike preservation or even enhancement projects, wetland creation projects provide a clear gain in resources. In estuarine, lacustrine and palustrine habitats, it is *relatively* easy to create conditions that are conducive to the development of appropriate wetland hydrology, hydric soils, and hydrophytic vegetation. In contrast, riverine creation projects, which represent the vast majority of mitigation projects in the Los Angeles region, must overcome substantial obstacles because natural stream channels only form in the presence of an adequate source of overland flow and where subsurface flow systems emerge.

The "riverine" creation projects we assessed though our survey of 401 permit files fell into two general categories. At least one mitigation project consisted of two small channel creations that occurred on either side of a large concrete box channel. The water flowing through these side-channels came from diversions that were constructed at a preexisting impoundment located just upstream of a spillway within the main channel. After flowing through these side-channels, the water re-entered the main box channel through a pipe. These side-channels were densely covered with riparian and wetland vegetation and provided abundant functions, values, and beneficial services. However, the side-channels were disconnected from the natural hydrology of the area and were not beneficial with respect to flood control and flood energy dissipation services. This, combined with the rapid rate of water movement through these systems, meant that the biogeochemistry potential of these habitats was moderate, compared to similar channels with natural hydrology. In addition, these side channels did not improve the quality of the water running over the spillway

The other riverine creation scenario occurred at many sites and consisted of semi-depressional basins with artificial flow-through hydrology. One class of these semi-depressional creation projects, detention basins, will be treated separately below (Section 2.1.2.7). But for the other class, dedicated mitigation sites were located within constructed berms, usually with a small outlet on the downstream side and with a small sub-channel meandering through the middle. The source of water for these sites was urban runoff, treated wastewater, or natural intermittent flow from the watershed. Presumably, those semi-depressional areas receiving natural flow would flood during storms or other periods of higher flow, allowing saturated conditions to develop and last for periods of at least several weeks. However, sites with artificial water sources may not experience flooded conditions due to their controlled input. Most of these mitigation sites had moderate to high cover of vegetation with at least some obligate or facultative wetland species, and provided adequate functions, values, and beneficial services. However, these creation projects are largely artificial and are semi-depressional rather than riverine.

Recommendation: Mitigation proposals calling for creation projects in riverine systems should be scrutinized carefully because true riverine creation projects are rarely successful. Artificial side channels fed by diverted water and semi-depressional basins fed by urban runoff can result in moderate to high function wetland, aquatic, and riparian habitat, but these habitats are usually disconnected from the natural hydrology and some of the beneficial services and functions lost at impact sites may not be adequately replaced.

2.1.2.6 Hydrological and biogeochemical functions in restoration projects

In our study, restoration projects were more common than any other type of mitigation. For most of these restoration projects, mitigation efforts consisted primarily of revegetation efforts along the banks of stream channels, or beyond the banks in nearby riparian or upland areas. Few of these restoration projects involved substantial grading, channel restructuring, or other improvements to site hydrology, and thus few resulted in significant gains in hydrological or biogeochemical functions or services compared to the pre-mitigation conditions of the site.

The riparian restoration projects illustrate a common theme with respect to the goal of "no net loss:" most compensatory mitigation projects are focused on the habitat component of wetland function rather than ensuring that the hydrological conditions that lead to the development of wetland soils and subsequently to the development of floral and faunal wetland communities are appropriate. Even where site hydrology is appropriate, most restoration efforts simply consist of vegetative plantings rather than improvements to the hydrology, thus the gains are only in the habitat values and not in hydrological or biogeochemical function. To satisfy the goal of "no net loss" more successfully, restoration projects should aim to include gains in hydrological and biogeochemical function when these are impacted, not just habitat quality.

Recommendation: Restoration projects should be designed to include gains in hydrological and biogeochemical functions as well as habitat function.

2.1.2.7 Detention basins

A large number of mitigation sites evaluated in our study were located within flood control detention basins. The majority of these projects fell far short of meeting the "no net loss" goal.

Detention basin mitigation sites fall into two general categories: those that include the basin bottom, and those that are limited to the slopes of the basin. For both of these categories, construction of the basin itself is usually not part of the compensatory mitigation requirements; their construction is mandated by other project requirements. Only the revegetation efforts that took place after basin construction can be considered as compensatory mitigation.

The majority of detention basin mitigation projects in our study did not include the basin bottom. These projects consisted of vegetative plantings using native riparian and upland species along the sloping basin walls. Since these basins are designed to drain quickly following storm events, persistent saturated conditions do not occur within the soil of the basin slopes, and thus they do not support the more water-dependent hydrophytic plant species and can not be considered wetlands. In addition, planting vegetation on the slopes of detention basins does not contribute significantly to the replacement of desirable wetland functions and services except in creating a small amount of habitat.

On the other hand, detention basins do provide wetland services. Flood storage, flood energy dissipation, and sediment accumulation are explicitly goals of the detention basins, even though these objectives derive from other purposes than the 401 permit. Properly constructed and managed, the bottoms of detention basins can support saturated conditions, leading to the development of wetland communities and associated biogeochemistry, wildlife habitat, and perhaps aquatic habitat services. However, because detention basin bottoms are routinely cleared of vegetation, debris, and accumulated sediments, they are generally not considered appropriate for compensatory mitigation. In fact, Regional Boards have recently been moving away from using these basins for compensatory mitigation altogether.

Although current detention basin construction and management are not consistent with mitigation goals, the fact that detention basins *can* provide important functions and services means it may be worthwhile exploring alternative construction or management techniques to enhance their value. It might be possible to modify construction and management to the point that detention basins would be appropriate for some types of compensatory mitigation, or at least to be included in the balance of services and functions lost versus gained. For example, it might be possible to extend the time between disruptions to 10-20 years or greater, and if sediment and vegetation removal was managed appropriately these basins could continue to provide valuable functions and services despite periodic cleanings. We encourage the Regional Board staff to explore the possibilities for improving the ecological functions and sustainability of detention basins, both on a project-by-project basis and as a regional strategy.

Recommendation: Vegetation plantings within debris basins, especially when limited to the banks, should generally not be allowed as compensatory mitigation. However, if detention basins are oversized and designed to allow wetland conditions to develop and persist for 10-20 years or more without vegetation or sediment removal, they may be appropriate sites for compensatory mitigation. In this case, only partial vegetation and/or sediment removal should be allowed to avoid temporal losses of wetland function.

2.1.2.8 In-lieu fee programs

Complexities inherent in the in-lieu fee program, as currently implemented, have resulted in numerous problems with respect to both permit compliance and the assurance that the goal of "no net loss" will be met. Through a combination of office assessments, site reconnaissance visits, and following much correspondence with permittees and agency personnel involved with several in-lieu fee programs, we identified several key weaknesses in the in-lieu fee process.

First, we found several examples where projects were permitted and initiated prior to the transfer of fee payments and/or where documentation of fee transfer was not received by the appropriate agencies in a timely manner. Most files requiring in-lieu fee payments that we reviewed contained no documentation that transfers of in-lieu fee payments had occurred, and very few stipulated any deadline for the transfer. The transfer of in-lieu fees, including the receipt of the appropriate documentation, should occur before the 401 certification is finalized. This oversight would reduce the likelihood of a compliance problem, and would enable agencies receiving the fees to begin mitigation efforts earlier, thus minimizing temporal losses.

Second, we encountered at least two files where we confirmed that in-lieu fees payments were received by an agency, but the agency had yet to use those funds because initiation of the designated mitigation project had experienced extended delays. Situations such as these result in substantial temporal losses of wetland function, which is effectively an unmitigated impact. Time limits could be stipulated as part of the approval process, but there would be no mechanism to enforce such a limit. Because the in-lieu fee program is not a party to the 401 permit, the Regional Board presumably has limited ability to pursue an enforcement action if the in-lieu fees were not applied in a timely manner. A better solution would be to limit in-lieu fee payments to programs that are already established and are able to apply the fees immediately to the appropriate mitigation action.

Third, we found that money from in-lieu fee payments often went into an agency's "general fund" that was distributed to some indeterminate number of mitigation projects. In such cases, we were unable to track those fees to specific field mitigation sites and, thus, no functional assessment was possible with respect to those permit files. For five such permit files, we were only able to verify that the fees were paid, so the files could only be assessed for compliance (fee payment) but not function.

The final and most significant weakness in the in-lieu fee process is that in-lieu fee payments may go towards project types that are inconsistent with the goal of "no net

loss." Two examples of this were bank stabilization projects on agricultural land and *Arundo donax* eradication efforts. Both of these project types are important and result in partial gains in wetland functions, values, and services, but fall short of compensating for the hydrological, biogeochemical, and ecological function lost though permanent losses to wetlands and waters. To avoid this mismatch, in-lieu fee requirements should be developed on the basis of the lost functions and services. Impacts that affect only habitat functions, including temporary impacts, could be appropriately mitigated by in-lieu fee programs focusing on improving habitat functions. In contrast, impacts that permanently affect hydrological, biogeochemical and habitat functions will not be fully mitigated by in-lieu fee programs improving only habitat.

The concept of the in-lieu fee program is valid. In-lieu fee programs can take advantage of economies of scale and the consolidation of small mitigation requirements into a larger effort that is more likely to succeed. However, compliance cannot be assured without adequate oversight and accounting, and "no net loss" will not be achieved unless appropriate mitigation projects are undertaken. The most difficult problems with in-lieu fee programs stem from a disconnect between the resources lost versus those gained from mitigation. Simple payment of fees facilitates the loss of this explicit link, exemplified by payments to a general program without any clear accounting for what the fees produced. In these situations, how can any particular fee be justified rather than a smaller one? An explicit link between losses and gains is fundamental to the proper application of mitigation policy; in-lieu fee programs must be implemented in a way that maintains this link. Most current in-lieu fee arrangements do not.

Recommendation: The transfer of in-lieu fees, including the receipt of the appropriate documentation, should occur immediately upon the finalization of the 401 certification. Transfer should be monitored by the Regional Board to confirm compliance.

Recommendation: Procedures should be established to prevent the delay of mitigation funded by in-lieu fees. Except under extraordinary circumstances, in-lieu fees should be restricted to established programs that can implement mitigation actions immediately. If there will be necessary delays in the implementation of the mitigation funded by in-lieu fees, the amount of mitigation required must be adjusted upwards to compensate for greater temporal delays. In all cases, time limits for the initiation and/or completion of in-lieu fee funded projects should be stipulated as part of the approval process.

Recommendation: In-lieu fee payments should not be made into a natural resource agency's "general fund," but should be directly traceable to specific projects through accurate accounting and record keeping.

Recommendation: In-lieu fee requirements should be developed on the basis of lost functions and services so that the mitigation projects funded under the in-lieu fee program match the impacts.

2.1.3 *Successful mitigation*

The previous section discusses mitigation approaches that were found to be problematic during our review of Section 401 mitigation projects. Mitigation success could be improved by avoiding these problems either by using a different mitigation approach or planning mitigation projects differently. We also identified one type of mitigation project that demonstrated potential for an excellent outcome (see below).

In addition to identifying problems with particular types of mitigation (e.g., particular habitats or in-lieu fees), it might be possible to improve the success of mitigation projects by improving the management of mitigation sites. For example, certain irrigation schedules might be more effective than others, or particular species might yield better results in terms of survival and wildlife value. However, our assessment study results do not allow us to make recommendations about these aspects of mitigation. We assessed wetland compliance and condition at one point in time, often many years after construction, and typically had no information about the management of the site after it was constructed (in fact, we could not assess many permit conditions because they involved management actions that could not be evaluated after the fact). Understanding the optimum management approach for a mitigation project would require a study focused on this question; at a minimum, detailed information about the management actions and when and where they were performed would have to be available. This information might be extracted from detailed annual monitoring reports if they were available for a large number of mitigation projects.

2.1.3.1 Stream channel restoration projects

Two of the sites we evaluated were stream restoration projects that consisted of major restructuring and revegetation of active stream channels. At one of these sites, an unauthorized concrete lining was removed, the channel widened, and appropriate plantings of riparian vegetation were installed. Wetland conditions had developed within the channel and most of the hydrological, biogeochemical, and habitat functions had been restored. At the other site, a stream course was reestablished in its original location after having been moved to the base of a highly eroding cliff, where it had been impacted by excess sediments for many years. The project was only recently completed and conditions had not yet fully developed, but the geomorphology of the channel was appropriate, and the revegetation plantings were adequate. We have every expectation that the hydrological, biogeochemical, and habitat functions at this site will become fully developed and successful in the future.

These two projects illustrate that complete stream channel restoration projects can result in abundant gains in all three classes of wetland function, and that such projects can result in great contributions to the national goal of "no net loss of remaining wetland habitat." In urban areas around the country, but in the Los Angeles region in particular, much riverine function was lost in the earlier years of urbanization as stream courses were converted to flood water conveyance channels. Even today, such conversions continue despite our improved understanding of the beneficial functions and services that natural stream channels provide. In the Los Angeles region there has already been discussion of restoring the much neglected Los Angeles River to its original state. This

would be a daunting task to consider. However, there are countless tributary channels in the Los Angeles River watershed and in other regional watersheds (such as Ballona Creek) where more manageable restorations could be undertaken. Restoration of these channels could be linked to the 401 permit process, through which functional gains achieved through these efforts could be used to offset some of the permitted functional losses.

Recommendation: Full stream channel restoration projects provide the greatest potential for restoring the full suite of riverine functions and should be emphasized as the best way to ensure there is no net loss from impacts to riverine habitats.

2.2 Improving permit conditions

Although careful planning and site locating are essential for mitigation success, the actual requirement for mitigation is determined by the conditions placed in the 401 permit. For most of the projects reviewed in our evaluation study, it appeared that the permittee/consultant made a reasonable effort to comply with the permit conditions. Thus, it appears that strengthening 401 permit conditions would substantially improve the success of compensatory mitigation implemented under the 401 program.

Permit requirements are always evolving with additional experience and changing scientific understanding. The Regional Board has already modified its typical permit conditions over the past 13 years[2]. In this section, we discuss areas where new approaches to permitting could result in substantial improvement in mitigation projects.

2.2.1 *Balancing losses and gains*

2.2.1.1 Explicit connections between impact and mitigation

The typical 401 permit contains several individual types of impacts. Impacts may be temporary or permanent, and combinations of these may occur in several different habitat types within the broad categories of wetlands and non wetland waters. To fulfill the acreage requirements mandated by the regulatory agencies, and given the resource limitations of the typical permittee, an individual permit file may have from one to four discrete mitigation project sites that may combine several different habitat types (e.g., wetlands, alluvial scrub, riparian areas, etc.) and multiple mitigation actions (e.g., restorations, enhancements, and preservations).

Typically, permits do not specify explicitly the correspondence between the losses at individual impact sites and the gains at individual mitigation sites is given in the permit. This lack of correspondence has been an obstacle to determining whether the required mitigation was actually sufficient given the impacts. Furthermore, it makes it

[2] To reflect this evolution in permit conditions, the evaluation study assessed compliance with "modern" conditions (i.e., the conditions likely to have been required had the permit been processed today) as well as the actual conditions in the permit. The modern conditions were more rigorous than many of the actual conditions, and compliance was lower, indicating that the permit conditions do establish a target that the permittee or consultant attempts to meet.

difficult for an analyst to balance losses and gains systematically, to ensure that some losses (in acreage, habitat types, or services) are not being overlooked.

Tractability would be greatly improved by clearly indicating within the text of the permit the nexus between impact habitat types/acreages and the corresponding mitigation habitat types/acreages that are supposed to compensate for those losses. An explicit statement about the connection could also include the rationale for the mitigation and why it is sufficient to compensate for losses. This accounting should consider impacts by jurisdictional type, such as wetland and non-wetland waters, and the associated mitigation (see Section 2.3.1.5). The need for explicit connection between impact and mitigation is especially relevant for separating mitigation for temporary impacts from mitigation for permanent impacts, which have fundamentally different loss/gain relationships.

Recommendation: A one-to-one correspondence should be established in 401 permits between impact habitat types and acreages and mitigation habitat types and acreages.

Recommendation: Mitigation plans should clearly identify all agency requirements in the permit paperwork and delineate those portions of the mitigation site that are intended to satisfy each of those agency requirements.

2.2.1.2 Focus on functions and services

Through two aspects of our supplemental assessments, we tried to directly evaluate whether the goal of "no net loss" of wetlands was being met. Both the evaluation for "overall success of functional replacement" and the section on beneficial services lost versus gained required us to use all available information to determine the pre-project states of both the impact site and the mitigation site. Although we were able to provide judgments about the before and after conditions of impact and mitigation sites, this full set of information was almost never available explicitly in the permit files. Formalizing the process of providing a **before-after evaluation of functions and services** would accomplish two goals:

First, it would provide a framework for determining the appropriate mitigation for a particular project impact. Appropriate mitigation creates resources (and services) that balance the losses from an impact. Unfortunately, without a before-after assessment of functions and services at a site, neither the losses from an impact nor the gains from mitigation can be determined rigorously. Changes in functions and services *cannot* be measured by acreage values. Focusing on the end condition of mitigation sites while ignoring the *change* in functions likewise does not provide a full accounting of gains. For example, mitigation sites that involve diffuse enhancement may result in a large area of high-functioning wetland habitat (see Section 2.1.2.3), but when these enhancement projects take place in habitats that already function well (as they often do), the *change* in functions and services may be very small; by current accounting procedures that focus on only the end condition, the mitigation project gets "credit" for the entire habitat. Focusing on the *change* in functions and services would ensure that appropriate mitigation is required.

In addition, our evaluation of 401 permits has demonstrated a shift in habitat types, including non-jurisdictional habitats, through mitigation (see Section 2.1.2.1). The justification for this is that while net losses in certain habitat types may occur, mitigation practices will result in a net gain in functions, values, and services. However, our qualitative assessments indicate that losses to hydrological and biogeochemical services of wetlands and waters are being compensated through net gains in (mostly) riparian habitat. Focusing on all functions and services when mitigation plans are being evaluated would help ensure that all functions are being replaced.

Second, a before-after evaluation of functions and services would facilitate the evaluation of mitigation projects. For the reasons described above, it is not possible to use acreage alone to assess whether the goal of no net loss is being achieved. The functions at a mitigation site can be assessed without prior information about that site, but the critical information for assessing the net loss or gain in wetland functions is the **change** in site functions and services.

If the goal of "no net loss of functions, values, and beneficial services" is to be taken seriously, evaluations of functions and services must be performed at the impact sites both before and after construction, and at the mitigation sites both before and after creation, restoration, or enhancement actions are taken. There are many different assessment methods that could be used. The Hydrogeomorphic (HGM) Assessment Method has been structured specifically to allow these types of calculations, but even simple rapid qualitative assessments such as CRAM and the supplemental evaluations used in this study would be adequate to make these evaluations.

We recognize that staff limitations at the Regional Board make it highly unlikely that Regional Board staff could conduct any functional assessments at project sites. However, consultant's reports on impact sites and proposed mitigation could be required to include an assessment of functions and services before and after the impact and mitigation. Besides providing essential information for judging the adequacy of mitigation plans, such a requirement would help permittees plan mitigation projects because it would indicate a critical factor for judging the adequacy of the mitigation plan.

Recommendation: Evaluations of functions and services should be made at both the impact site and the mitigation site, before and after construction, using simple but standardized rapid qualitative assessments.

2.2.2 *Performance standards*

Performance standards identify the criteria by which the success of a mitigation project will be judged. Our evaluation study suggests that permittees often design mitigation projects to achieve the standards established in their permits, but no more. Therefore, the performance standards must be carefully considered to ensure that the mitigation project provides proper functions and services. The Los Angeles District of the Corps states (2004): "Development of appropriate success criteria is the single most important element in the development of a successful compensatory mitigation and monitoring program." We agree, provided that adequate mitigation planning (see Section

2.1) has occurred. This section discusses ways to improve the performance standards in 401 permits.

2.2.2.1 Performance standards rather than management actions

Each permit file has a series of standard and special conditions associated with it that specify management actions or performance standards that must be accomplished in order to meet the compliance requirements of the permit. Over the years, the standard and special conditions included in the LARWQCB 401 permits have improved, becoming more inclusive and more specific. However, the vast majority of permit conditions remain focused on management actions such as mulching or control of invasive plants rather than performance standards based on structure and ecological functions. The principle exception here is that the more recent permits have begun specifying native plant cover requirements such as "greater than 75% cover of native plants by year five." Unfortunately, it was usually impossible to determine compliance with these performance standards given the lack of mitigation reports.

Current performance standards, if they are used at all, emphasize structure of the site, especially vegetation structure. An emphasis on wetland function is important because the ultimate goal of mitigation is to create well functioning habitats or resources to replace impacted natural habitats. Our results have demonstrated that permittees can comply with their permit requirements and still produce mitigation projects of poor condition. The permit conditions currently being required are not sufficient to ensure successful mitigation.

Future permits should place more emphasis on performance standards for hydrological characteristics, soil characteristics and wetland vegetation characteristics. Compliance with these performance standards should be determined through more careful review of the mitigation reports. Because there are a few common elements to many of the mitigation projects we reviewed, it should be possible to devise a list of standard conditions that would be required routinely.

Recommendation: Permit requirements should emphasize performance standards for hydrological, soil, and wetland vegetation characteristics along with the management actions currently required.

2.2.2.2 Functional or ecological endpoints

The issue raised in Section 2.2.2.1 is exacerbated by the language for most of these conditions, which is geared too heavily toward yes/no or presence/absence determinations of compliance. For example requirements for mulching do not specify how extensive the mulching needs to be, and requirements for revegetating with natives do not specify the density, diversity, or wetland affinity of the species planted.

The common "removal of exotics" requirement illustrates the problem here. This is an appropriate issue to be addressed in permits because invasive plants have been shown to impair many natural habitats. However, according to the typical permit condition, if even a single exotic plant was present, this condition would be considered

not-satisfied[3]. The removal of exotic plant species is a very difficult task and it is unrealistic to expect that absolutely no exotic plants will be present in the years following mitigation activities, especially given the landscape position of most mitigation sites (i.e. adjacent to or "downstream" of sites with exotics). Moreover, not all exotic plants have equal ecological impact; some plants, though non-indigenous, seem to have little effect on other species, while others (such as giant reed, *Arundo donax*) cause a dramatic alteration of the entire community. The important issue is whether exotics that may be present are exerting an ecologically significant impact on the site.

When moving permit conditions towards including more performance standards (Section 2.2.2.1), the standards should focus on functional or ecological aspects of the mitigation project. For most of these standards, the permit condition should be stated in terms of a quantitative endpoint so that the amount of effort or performance needed to accomplish the standard is known and can be judged.

Recommendation: Functional or ecological endpoints should be employed, whenever possible, when management actions are specified through the conditions of the permit, rather than simple yes/no or presence/absence compliance determinations.

2.2.2.3 Hydrology and soils

Given the policy of "no net loss" of remaining wetland habitat, impacts to jurisdictional wetlands and waters should be offset by creation, restoration or enhancement of jurisdictional wetlands and waters. While only those impacts to jurisdictional habitats are considered in the regulatory process, current policies of the Regional Board and other regulatory agencies are allowing half of the mitigation projects to occur in non-jurisdictional habitats, as described in Section 2.1.2.1.

One consequence of the current procedure is that few permits require the creation or improvement of wetland-promoting conditions at mitigation sites. Appropriate hydrology and hydric soil development are seldom included as conditions in 401 permits. Rather, most of the focus of permit conditions has been on characteristics of the plant community. Even then, regulatory personnel have focused on the removal of exotics and revegetation with native species, rather than any requirement that obligate or facultative wetland species be used. Mulefat and willow have become the revegetation species of choice, probably because they are hardy and thrive in a variety of habitat conditions, but these species do not require wetland conditions to flourish.

Recommendation: Permit conditions should focus more on wetland hydrology and soils and the establishment of obligate wetland plant species when appropriate, rather than simple requirements of native species and an overemphasis on willow and mulefat. In cases where wetlands are impacted and proposed as mitigation, permit conditions should be very specific in requiring that wetland hydrology is appropriate and that hydric soils develop.

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[3] For our evaluation, we developed another condition to address the requirement of exotic removal, "evidence of exotic plant removal," so that we could record whether or not an attempt had been made to remove exotics. As expected, compliance with the latter condition was higher because it does not require the absolute absence of exotics to be met.

2.2.3 *Ensuring compliance*

2.2.3.1 Monitoring requirements

Assessing the compliance of a particular mitigation project with its permit conditions requires an objective evaluation of each condition, whether management or performance oriented. In an ideal world, this assessment would be conducted by the agency imposing the requirement; this would remove the conflict of interest inherent in having a regulated party (the permittee) determining whether a regulation was violated. In reality, agency resource limitations mean that the determination of compliance will have to depend on monitoring conducted by (or funded by) the permittee. Therefore, it is critical that the Regional Board ensure that appropriate monitoring is conducted, and the information reported is adequate to judge compliance with permit conditions. (It is also important that the information be reported in a form that facilitates a quick judgment about compliance; see Section 2.3.4.4.)

Annual monitoring reports have typically been required in Section 401 permits, but the nature of the monitoring has not been standardized. The Los Angeles District of the U.S. Army Corps of Engineers has recently published guidelines for monitoring for Section 404 projects (USACE 2004), and these could provide a starting point for standardizing the Section 401 requirements. Monitoring must be linked to the performance standards laid out in the permit (Section 2.2.2), so to some extent each monitoring requirement must be customized to the mitigation requirements.

The length of monitoring required has changed over time, becoming longer as more scientific information has become available about the time it takes for a wetland restoration project to develop and the problems that can occur a few years after its construction. From the evaluation study and other published work, it is clear that at least several years are required for vegetation to develop; soils take much longer, perhaps several decades. Five years seems to be an adequate time for assessing the basic trajectory for a mitigation site, although clearly specific events (such as large flooding events) could influence site performance.

Recommendation: Standardize monitoring requirements to ensure adequate assessment of the ecological functioning of wetland mitigation sites.

2.2.3.2 Performance bonds

Performance bonds can be used as a regulatory tool to ensure that permit conditions are met properly. By posting a bond, a permittee has an incentive to implement a successful mitigation project, since unsatisfactory performance results in the forfeiture of the bond. Although unsatisfactory performance can result in an enforcement action in any case, the mere existence of the bond may make the negative consequences of failing to conduct mitigation properly more apparent to a permittee.

We know of no studies evaluating the effectiveness of performance bonds versus normal post-construction enforcement in ensuring that mitigation projects meet their permit conditions. However, it is common sense that performance bonds could improve

compliance, and the results of our assessment demonstrate that there is generally a need for improved compliance. Although a majority of the sites we assessed complied with their permit conditions, a substantial number did not, and there were also many permit conditions we could not assess. In addition, mitigation monitoring reports were not available in the permit files for the vast majority of permits we reviewed.

Performance bonds are not currently mandated by the Los Angeles Regional Water Quality Control Board, although other agencies do utilize them. Since performance bonds involve a legal instrument, legal counsel would need to be consulted before implementing them. Consideration should also be given to developing fair and consistent criteria for requiring performance bonds. For example, performance bonds might be required for impact projects larger than a particular size, or for mitigation actions that are known to have a substantial risk of failure. Finally, performance bonds make the most sense when they are part of a system that includes periodic review of project status - at the very least a review of monitoring reports.

The Los Angeles District of the U.S. Army Corps of Engineers includes the following statement in its 2004 Mitigation Guidelines:

> An applicant may be required to provide a letter of credit, performance bond, or other special funding to ensure attainment of the approved compensatory mitigation project success criteria stated or referenced in the Corps Los Angeles District's permit conditions. The monetary value of the letter of credit or performance bond will be determined by the Corps, based on an estimate of the total cost of the proposed compensatory mitigation project provided by the applicant. The amount of the bond may also depend on the use of irrigation on the proposed site in-perpetuity or any time delay between the project-related impacts and the construction of the compensatory mitigation site. The Corps typically adds 20% (as a contingency) to the estimate of the total cost of the compensatory mitigation, which is the amount actually insured by the holder or surety of the performance bond or letter of credit. The Corps can add a higher percentage contingency, if the applicant has had a history of failed or incomplete compensatory mitigation projects. The estimate of the cost of the compensatory mitigation project shall include, at a minimum, the costs associated with site preparation (including grading), vegetation acquisition and installation, irrigation installation and operation, all maintenance and monitoring efforts, contingency measures, and monitoring reports. This total cost estimate is a required part of any compensatory mitigation and monitoring plan, regardless of whether a performance bond, letter of credit, or other special funding is required.

Recommendation: Performance bonds should be considered as a tool for ensuring timely compliance with permit conditions.

2.3 Improving permit administration

Although proper planning and the use of appropriate permit conditions represent the principle determinants of mitigation success, there are also a number of administrative actions that could improve the 401 permitting process, and help reduce wetland loss. These improvements would benefit Regional Board staff, permittees and their consultants, as well as anyone wishing to review permit requirements and assess compliance.

The issues discussed below stem from our review of 401 permits for the evaluation study. This review included permits dating back to 1991, and so some of these issues have already been addressed in some way by Regional Board staff. We also recognize that Regional Board staff time is extremely limited, and some of our recommendations may not be feasible with current staffing. We have tried to be as realistic as possible, but we have also made recommendations that might not be readily implemented at the present time, but which could serve as targets for the future.

2.3.1 *Permit clarity*

2.3.1.1 Adopt a clearer and more consistent format for permit information

The general format of 401 permits has changed throughout the years covered by this study, with substantial variability in the ease with which pertinent information can be extracted from permit paperwork. The current 401 permit template is somewhat confusing and redundant. Information (e.g., mitigation requirements and other agency permit numbers) is not always found in the same place. Most critically, "Proposed Mitigation" section is often confusing to a permit reviewer. This section sometimes contains mitigation requirements in addition to what the applicant proposed as mitigation. The Regional Board's mitigation requirements are scattered between this section and the accompanying attachments.

We recommend a format similar to that used in 1998 permits, where pertinent file information was displayed in table form. This provided for easy location of impacts, mitigation acreage, other agency permits, impacted waters, and mitigation conditions. This current format can be vastly improved by concentrating all mitigation requirements in one section within the main template of the 401 permit and deleting the section of applicant "Proposed Mitigation," as was done for the permits in 1998. As discussed in Sections 2.3.1.5 and 2.3.1.4, the presentation of the relevant permit conditions should be standardized.

Recommendation: A clearer and more consistent format should be adopted for 401 permits to eliminate redundancy and present the mitigation requirements unambiguously, in a single location.

2.3.1.2 Specify the permit condition expectations more clearly

In both recent and past 401 permits, the permit requirements (conditions) are found diffusely throughout the permit paperwork. Some of them are in the standard

conditions section, others are specified as additional conditions, and still others are found within follow up correspondence paperwork. The permit requirements need to be more clearly identified in the permits, either in table or bullet form. The more clearly these conditions are specified, the more likely they will be complied with, and the easier it will be to determine if the permittee has complied with the conditions.

Recommendation: All permit conditions, whether standard conditions or additional conditions, should be clearly outlined in a single location, either as a table or as a bulleted list.

2.3.1.3 Mitigation acreage must be specified explicitly in permit

Several of the permits we assessed contained vague mitigation acreage requirements such as "3 to 4 acres of mitigation." Given such language, only the lower limit of this range would be used to determine compliance. Recent permits tend to have reduced ambiguity in acreage requirements, but this specificity should be mandated in the regulatory guidelines.

Recommendation: Mitigation acreage requirements should be specified explicitly and precisely in 401 permits. Phrases such as "3 to 4 acres of mitigation" should be avoided.

2.3.1.4 Develop a standardized list of possible permit conditions

In the appendix of our evaluation final report, we provide a list of all the standard and additional permit conditions we found in our review of 250 permit files. In this list, there is great overlap among conditions with minor variations of permit conditions that are essentially the same. These should be consolidated and standardized, and future permit conditions should be selected from the resulting list.

Recommendation: The list of potential permit conditions should be consolidated and standardized to eliminate redundancy and confusion.

2.3.1.5 Standardize the habitat categories used in permits

There is a substantial amount of overlap among the various habitat types identified in 401 permits, both at impact sites and at mitigation sites. Examples are the relative similarity between estuary, tidal wetland, and tidal salt marsh, and between coastal scrub, coastal sage scrub, and chaparral. The use of slightly different terms for similar habitats creates unnecessary complexity and ambiguity, since it is not clear if a meaningful distinction is being made about habitat types. It would be relatively easy to develop a more standardized list of potential habitat types in the region from which a selection could be made. In our associated final report we consolidated these into a more tractable list of habitat types for our analyses. In addition, the habitat categories should be hierarchical, so that jurisdictional and non-jurisdictional areas are distinct.

A possible list of standardized habitat categories is presented in Table 5. These habitat types are organized in a hierarchical way around regulatory requirements. For example, habitats comprising waters of the United States are separated from non-waters

habitats. Similarly, within the "waters" habitats, wetlands are separated from non-wetland waters. Using standardized habitat names in this classification scheme, habitats affects by impacts and mitigation will be described consistently and unambiguously, and in addition it would simplify tracking of jurisdictional impacts and mitigation (see Sections 2.1.2.1 and 2.2.1.1).

Recommendation: The list of potential habitat types at impact and mitigation sites should be consolidated and standardized to eliminate redundancy and confusion.

2.3.2 *Permit processing*

2.3.2.1 Streamlining the permitting process

With limited staff resources for analyzing permit applications, efforts should be made to simplify the permitting process. One area in particular could benefit from streamlining to reduce extra staff effort: database data entry. It may be possible to have permit applications and mitigation plans submitted in a standardized electronic format that could flow appropriate information into the LARWQCB's database (see also Section 2.3.4.3 for recommendations about improving the database, and Section 2.3.4.4 for related recommendations about the mitigation monitoring reports). Similarly, a standardized permit summary form (see Section 2.3.1.1) could be designed to flow appropriate information in the database, thus eliminating extra data entry steps.

Permit processing might also be improved by designing the LARWQCB website to accommodate Section 401 permit inquiries and possibly to provide electronic templates for permit applications, mitigation plans, and mitigation monitoring reports. The website could also be a repository for relevant policies and guidelines. Currently, it is difficult to get any information about Section 401 requirements from the main LARWQCB website.

Recommendation: Streamline permit processing by redesigning forms and the LARWQCB 401 website and coordinating applicant submissions with the permit tracking database to eliminate unnecessary data entry.

2.3.2.2 Coordination with related permits

Section 401 permits are typically part of a set of permits that include a Section 404 permit from the U.S. Army Corps of Engineers and a streambed alteration agreement (Section 1600) from the California Department of Fish and Game. When the project is in the coastal zone, a coastal zone development permit from the California Coastal Commission is also required, and other permits may be required in other jurisdictions (as well as review by agencies such as the U.S. Fish and Wildlife Service when endangered species may be affected). Each agency has its own jurisdiction, so not all of these agencies are involved with every 401 permit, and each agency has its own mandates and regulations, so the conditions placed on permits are not the same.

Currently, a permittee processes permits for a single project independently through each agency. Although there is informal discussion amongst agency personnel,

there is no formal coordination. After all permits are acquired, the permittee must consolidate them all into one mitigation plan that satisfies all requirements.

The permitting process would be simpler, clearer and faster if all of the wetland-related permits were coordinated in a formal process. Besides streamlining the permitting process for applicants, a coordinated process would provide a fuller picture of the entire mitigation project as part of the permit; currently, the mitigation plan is the only document that reflects all permit requirements. This document is produced by the applicant, so permit requirements are not necessarily stated explicitly; moreover, the final mitigation plan often is not approved until some time after the provisional approval of the permit (see Section 2.3.3.1).

Recommendation: Establish a formal mechanism for coordinating Section 401 permits with other agencies.

2.3.3 *Final permit approval*

2.3.3.1 No approval until <u>final</u> mitigation plans reviewed

While a variety of factors lead to the submission of inadequate mitigation plans (and, hence, insufficient replacement of wetland functions and services), it is regulatory review that provides the check to ensure that the "no net loss" goal is achieved. Mitigation proposals *and subsequent planning submissions* should be subjected to greater scrutiny and oversight. Currently, the permit is effectively issued once conditional approval has been given; there is typically little scrutiny of subsequent submissions. Yet the subsequent details are essential for the ultimate effectiveness of mitigation. For example, permit applications generally contain a proposed mitigation plan. Conditional approval is given based on that plan (or possibly a revision or modifications based on subsequent correspondence). However, the details in the final mitigation plan determine the actual mitigation project - yet Regional Board staff usually put little effort into review of these final plans to ensure that the mitigation will be appropriate[4]. This means that, for all intents and purposes, the permit is approved at the conditional approval stage. When this conditional approval is given with the mitigation plan to be approved at a later date, it also means that the timing of mitigation is not linked to the timing of the impact (because project impacts frequently commence following conditional approval).

There are a variety of potential issues that can arise when the timing of mitigation is decoupled from the impact. To avoid temporal losses, mitigation should be completed (strictly speaking, successful) **before** any impacts are allowed. Although some temporal losses may be inevitable practically speaking, unrecognized but significant losses may be occurring. For example, a comparison of losses with mitigation requirements in terms of acres may indicate no net loss of acres, but if the mitigation is not implemented for years after the impacts occur, significant temporal losses have occurred[5]. In addition, delayed approval of the final mitigation plan removes the active participation of the agency at a

[4] One indication of the lack of scrutiny is the fact that the vast majority of the permit files we reviewed did not even contain the final mitigation plan.

[5] It is not clear how often this occurs. However, in our field evaluation, we could not evaluate a number of mitigation sites because they had not yet been constructed, in spite of the impacts having occurred.

critical stage. A better policy would be to require that the final mitigation plans be presented, reviewed, and approved before the permit is issued and impacts begin.

Permit analysts must have adequate training to evaluate the losses and gains from mitigation in terms of functions and services as well as acreages. With respect to the overall failure to meet the no net loss goal, the critical point of departure, and one that can be overcome, is the conditional approval of inadequate mitigation proposals.

Recommendation: The effective issuance of a permit should occur only after the final mitigation plan has been reviewed and accepted. Acceptance should be based on the presentation of sufficient details to ensure that the actual functions, values and services that will be gained through the most successful mitigation project will be sufficient to compensate for the permitted losses.

2.3.4 *Post-permit evaluation*

Mitigation planning is obviously critical to mitigation success, as is the use of appropriate conditions in the 401 permits. Post-permit evaluation is similarly important, since there is no other way to ensure that permit conditions have been complied with or that 401 program goals are being achieved. In theory, permit compliance could be evaluated by field visits by enforcement staff; in practice, there currently are no resources available for routine enforcement visits by LARWQCB staff. In practice, post-permit evaluations must be done by either special projects (such as our evaluation study) or periodic reviews of required permit documentation. This section discusses issues relevant to both approaches, but with a focus on improving the ability of 401 staff to assess compliance within the current staffing constraints.

2.3.4.1 GPS surveys of mitigation sites

In the field evaluation phase of this project, we tried to map the boundaries of mitigation sites to determine if mitigation acreage requirements were met. However, we were frequently unable to determine even approximate boundaries of the mitigation sites. We were usually able to confirm the general location of the mitigation site through evidence of mitigation activities at the expected site location and/or from information gleaned from the permit files. But when the evidence of mitigation activities was scant or absent, and when these activities blended into the surrounding landscape, it was not possible to delineate the perimeter of a project site. Even where site boundaries could be determined, they were usually not clearly delineated as they transitioned into the surrounding landscape. GPS coordinates of the purported mitigation sites were almost never available, and stakes, flags or other survey markers were seldom present.

Boundary determinations using GPS should be a mandatory part of the 401 permit process. This trend has begun to occur in recent 401 permits, but this requirement should be applied consistently. All mitigation sites should be delineated by GPS surveys that include all individual habitat types for which mitigation is specified in the permit. We recommend that area polygons be required because most sites and the habitat types that comprise them are irregular in shape. This crucial step would dramatically improve both the ease of compliance investigations and the success in meeting the "no net loss" goal.

Requiring GPS surveys of mitigation sites and habitat types would force the permittee to be specific about the precise area mitigated, which would enable a more specific evaluation of function.

Recommendation: All mitigation sites should be clearly delineated though GPS surveys of overall site perimeters as well as the perimeters of all individual habitat types for which mitigation is specified in the permit.

Recommendation: GPS information for all mitigation sites should be added to a central GIS database to enable the rapid retrieval of site data for future compliance investigations.

2.3.4.2 Digital photographic record of impact and mitigation sites

In trying to understand the context of impact and mitigation projects so that we could make determinations of whether the "no net loss" goal was being met, we found photographs of pre-construction conditions and photo-documentation throughout the compliance period to be very useful. The quality of the images was often poor as these photographs were reproduced in black and white on the permit paperwork. Digital photographs would be a valuable tool in future compliance assessments. Combined with the improved GPS information (Section 2.3.4.1), photographs would enable mitigation sites and boundaries to be determined unambiguously in the future; they would augment the mitigation reports improving permit compliance determinations, and they would provide a permanent record of site conditions lending support to function and service replacement determinations. The photographs could be stored on portable media (such as a CD) within the permit file archives and/or in a central photographic image database with cross referencing to the permit tracking database (Section 2.3.4.3).

Recommendation: A digital photographic record of impact and mitigation sites, before and after construction and throughout the compliance period, should be required in all 401 permits. These photographs should be taken at fixed and repeatable photo-reference points (identified on maps and by GPS coordinates).

2.3.4.3 Improve the permit tracking database

Early in this study, we were given copies of file tracking Microsoft Access databases from both the LARWQCB, and the State Water Resources Control Board (SWRCB) to facilitate our permit review. These databases contain much useful information. However, after working with these databases in their present form and comparing their respective file information to the information found from preliminary surveys of the LARWQCB file archives, we determined that substantial inconsistencies exist between each of these sources. In searching the LARWQCB file archives, we found numerous examples of permits that were issued but were not in either agency database. To accomplish to goals of this project, we had to develop a new database that includes information that is vital to the determination of permit compliance.

The LARWQCB database contains a great deal of basic information about issued permits, as well as a certain degree of unimplemented functionality that could significantly increase its utility. However, additional fields could increase its usefulness.

In addition, database features such as drop-down lists for standardized habitat types (Section 2.3.1.5) could increase ease of use. The database should also be expanded to include information about compliance with permit conditions, and structured to make it easy to enter compliance information (by using database features such as check boxes). This aspect of the database could be coordinated with efforts to streamline compliance reports (Section 2.3.4.4). As mitigation reports arrived at the Regional Board, they could be reviewed and the pertinent information could be extracted and recorded in the database. Then the file archive box identifier (also built into the database) would be noted and the paperwork filed appropriately.

Once the LARWQCB's database was redesigned to be more comprehensive, the new database could be partly populated by merging in information from the UCLA database. Ideally, all the required permit conditions from the archived permit files would be entered, though this is clearly not feasible under current staffing limitations. (If additional funds were available for the database, however, fully populating it should be considered.) At a minimum, however, key information such as the storage box identifiers (see Section 2.3.5.1) should be entered into the new database.

Finally, the State Board and LARWQCB databases are different, with different information entered into each. This seems like an unnecessary redundancy, and in the era of limited staff time, coordination of database entry into a single database should be considered.

Recommendation: The LARWQCB's existing Microsoft Access file tracking database should be redesigned to include the full set of standard and additional conditions required of each permit along with check boxes that would enable compliance information to be extracted from mitigation reports as they arrive. This new database would also contain a cross reference to the file archive storage box identifier.

2.3.4.4 Improve mitigation monitoring reports

In the absence of on-site visits to mitigation projects, which are rarely possible under current staffing limitations, the mitigation monitoring reports provide the best opportunity for assessing how well a mitigation project has complied with its permit conditions. However, there are currently two main impediments to the use of these reports for assessing compliance: (1) the Regional Board apparently seldom receives the required monitoring reports; and (2) Regional Board staff do not have the resources to review reports systematically to determine if the permit conditions have been met.

To address the problem of not receiving the mitigation monitoring reports required in permit conditions, the Regional Board should develop a better system for determining whether monitoring reports have been filed. This could be as simple as a centralized "tickler" file identifying the due dates for all monitoring reports, to be checked off when reports are received, or it could be part of a more comprehensive mitigation permit file tracking system (as in Section 2.3.4.3). Permittees who fail to submit a monitoring report on time should be contacted promptly and enforcement actions taken as warranted. Mitigation reports also must be filed in an organized archival system (Section 2.3.5.1).

Even when mitigation monitoring reports are received, it can be difficult for 401 staff to review them and determine compliance. The monitoring reports should be formatted in a manner that simplifies the evaluation of permit compliance. Guidance should be provided to permittees to provide a consistent format for monitoring reports (as has been done by the Los Angeles District of the U.S. Army Corps of Engineers [2004]). Summary forms should be provided that clearly and explicitly include all permit conditions; for example, specific compliance check boxes could be used that would make the job of entering compliance information into the database less formidable. (As suggested in Section 2.3.2.1, electronic submission of data in a form that flows easily into the permit tracking database would make data entry even simpler, requiring only that the analyst verify that the information entered by the permittee was accurate.)

Recommendation: Mitigation monitoring reports should be submitted using a standard format developed to facilitate review of mitigation project progress and compliance with permit conditions. A system for ensuring that monitoring reports are submitted on time and procedures for simplifying the transfer of compliance information into the permit tracking database should be developed.

2.3.5 *Organization*

2.3.5.1 Organize the file archives

The permit file archive at the LARWQCB office does not provide adequate access to be useful. The file archive consists of permit files in over 200 storage boxes. The files in a particular box were usually related by year; occasionally, a storage box had a "contents" sheet affixed to its lid (although this sheet did not always reflect the current contents of the box). There was no overall organizational scheme to these files, making it difficult for LARWQCB staff to find a file if it needed to be updated. For example, it is unlikely that correspondence, mitigation reports, or copies of permits issued by the other regulatory agencies could be added to the appropriate file once it was placed in a storage box. Since archiving usually happens prior to the end of the monitoring phase of a mitigation project, additional documents such as monitoring reports are seldom filed with the rest of the permit file. Such documents are currently placed in a separate "compliance file" at the LARWQCB, rather than relocating the original archived file. If a particular file needed to be retrieved from these archives for filing purposes or as a result of a database search, or a freedom of information act request, one would have to search box by box to find it, which could take days. The organizational scheme of these file archives should be improved to enable the rapid re-location of files for filing monitoring reports and other paperwork. In addition, improved organization would facilitate future reviews or requests for information.

Recommendation: Organize the permit file archives. Storage boxes should be placed within a series of shelving units to eliminate or minimize stacking. Each box should be clearly labeled using a standardized alpha-numeric labeling scheme that is cross referenced within the file tracking database. The previous efforts to place "contents" sheets on all the storage boxes should be abandoned in favor of this database cross referencing.

Recommendation: Once the above recommendation has been implemented, an efficient system needs to be devised wherein mitigation reports, other agency permits, and all other correspondence that arrive after a file has been archived are rapidly joined with their respective permit files.

2.3.5.2 References to other agency permits

Future permit reviews would be greatly facilitated if 401 permits clearly identified all other agency permits associated with the project, perhaps using a comparable numbering system. This includes the 404 permit, 1600 permit, and all other relevant permits. References to these permits should be located in a standard section of the 401 permit, and should also be identified in the new tracking database suggested in Section 2.3.4.3.

Recommendation: All associated agency permits (404, 1600, etc.) should be clearly identified in both the 401 permit and the permit tracking database. Such information has become more common in recent files.

3 Conclusions

The process of determining compensatory mitigation for Section 401 permits has many aspects, so our recommendations are diverse. Our recommendations can be classified into three main categories: (1) recommendations to improve the process of reviewing, issuing, and tracking permits; (2) recommendation to improve the success of mitigation projects, and particularly to ensure that mitigation projects provide sufficient gains in appropriate functions and services to balance the losses from the permitted activity; and (3) recommendations to improve the evaluation of mitigation requirements, either for compliance or for functional success. The recommendations from the previous section have been listed by these three categories in Table 6; note that one recommendation is sometimes relevant for two or more categories.

The results of our assessment of 401 mitigation sites have demonstrated that success in meeting permit conditions does not ensure mitigation site function. Clearly, a major shortcoming of the 401 program lies with a lack of explicit consideration of the full suite of functions, values, and services that will be lost through proposed impacts and might be gained through proposed mitigation sites and activities, so our overarching recommendation is that the 401 program be structured in a way that allows this to happen. As the 401 permit process currently exists, the lack of explicit consideration of wetland functions, values and services begins with the drafting of compensatory mitigation proposals by permittees that have little or no chance of meeting the "no net loss" goal. But ultimately it is manifested in the conditional approval of those mitigation measures by regulatory staff. There are certainly instances where inadequacies of subsequent mitigation plans, acreage shortfalls and other compliance issues contribute to net loss on an individual permit file basis; some of these were identified in our study. These problems frequently go unnoticed due to a lack of regulatory oversight and enforcement. However, our results demonstrate a much higher rate of success for compliance with permit conditions and acreage requirements than for replacement of lost

wetland functions and services. Improving the protection of wetland resources will require a more careful scrutiny of mitigation proposals to ensure they adequately replace lost habitat types, functions and services, and the imposition of permit conditions that ensure that mitigation habitats provide appropriate functions and services.

In addition to these specific recommendations concerning permitting, there are some broader and longer-term initiatives that the Regional Board could undertake that would increase wetland habitat, functions and services in the region, and hence help the region achieve its goal of no net loss. These include:

1. The restoration of concrete-lined channels. One of the most effective mitigation projects we studied was Permit #93-06, the Medea Creek Restoration in Agoura Hills (see Section 6.8). This project demonstrated that in-channel stream restoration activities that incorporate appropriate hydrology and floodplain connection can support an appropriate riparian community and achieve a high level of wetland function and services. In the case of Medea Creek, the mitigation involved removing an unauthorized concrete lining of the channel, but the application of this idea is broader than that because the region has many, many miles of concrete-enclosed channels. The Regional Board could promote the establishment of an in-lieu fee program or a mitigation bank for the restoration of concrete lined-channels. Such a program would have a substantial impact on the wetland resources in the region, and would result in more appropriate replacement of the full suite of wetland functions and services than many of the current in-lieu fee programs.

2. Detention basins. As currently implemented, mitigation involving detention basins is problematic, providing little resource value and few services. However, detention basins are commonly included in residential developments and other types of permits, and they have the potential to provide a suite of services - **if** they were constructed and managed in a more ecologically sustainable manner. We encourage the Regional Board staff to explore the possibilities for improving the ecological functions and sustainability of detention basins, both on a project-by-project basin and as a regional strategy. Improving the ecological functioning of detention basins would have a widespread effect on wetland resources in the region.

3. Soft Structures. Where channelization or bank armoring is necessary, "soft structures" such as biomaterials, or semi-permeable interlocking block structures should be used. Such measures provide for some hydrological connection between the stream and the associated uplands, promote vegetation development, and enable the coexistence of flood control and beneficial wetland/riparian functions, values, and services.

4 Literature Cited

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5 Tables and Figures

Table 1. 401 Permit Condition Analysis including the percent of sites where these conditions were specified and met (% of sites in compliance) and the percent of sites where these conditions were specified, but there was not enough evidence to determine whether they were met (% of sites where compliance was undeterminable). This analysis includes the 70 sites among 49 files at which 401 Permit Compliance was evaluated.

401 Permit Conditions	% Met	% Not Met	% Undetermined
Mitigation has been maintained in perpetuity?	72	16	12
Grading to pre-project contours?	88	0	12
Exotic plants absent?	16	84	0
Evidence of exotic plant removal?	41	41	18
Minor impact of exotics on site?	78	22	0
Is native vegetation present?	94	6	0
Is there evidence of restorative planting?	73	18	9
Presence of species specified for revegetation?	100	0	0

Table 2. Summary of condition of wetland mitigation sites based on UCLA-CRAM scores. Data are percent of the 79 mitigation sites falling in each category. Optimal was >79.2% of possible points, sub-optimal was <79.2% but >54.2% of possible points, and poor was <54.2%.

	Optimal	Sub-optimal	Marginal to Poor
Overall	**4%**	**67%**	**29%**
Landscape context	9%	48%	43%
Hydrology	9%	68%	23%
Abiotic structure	18%	45%	37%
Biotic structure	9%	52%	39%

Table 3. Summary of condition of wetland mitigation sites based on Services Lost versus Gained Assessment scores.

	Successful	Partially Successful	Failure
Overall	**34%**	**20%**	**46%**
Flood storage	42%	19%	39%
Flood energy dissipation	53%	14%	33%
Biogeochemistry	42%	24%	34%
Sediment accumulation	49%	14%	37%
Wildlife habitat	41%	21%	38%
Aquatic habitat	49%	22%	29%

Table 4. Mitigation success by permit file. Data shown are percentages out of a total number of 50 permit files. The evaluation for 401 conditions was out of 55 files due to the inclusion of the 5 permits which had in-lieu fees paid that could not be tracked to specific mitigation projects. Numbers in parentheses are the actual number of sites within each category. See the text for a full description of the success categories.

Category	Success	Partial Success	Failure	Cannot be Determined
Acreage Requirement	46 (23)	Not a category	24 (12)	30 (15)
401 Conditions	60 (33)	29 (16)	0 (0)	11 (6)
Mitigation Plan Conditions	44 (22)	34 (17)	0 (0)	22 (11)
Functional Evaluation	2 (1)	60 (30)	38 (19)	0 (0)

Table 5. Standardized habitat categories. Habitats are organized in a hierarchy based on regulatory categories of waters/non-waters and wetlands/nonwetlands.

Waters of the United States			Habitat type
Wetland			*Estuary* *Salt Marsh* *Tidal Wetland* *Marsh Wetland* *Vernal Pool* *Non-distinguished wetland* *Seasonal wetland*
Non-Wetland Waters			*Unspecified Waters*
	Non-Streambed Open Water		*Ocean* *Lake*
	Streambed		*Active Channel*
		Open Water	*Flowing Stream*
		Unvegetated Streambed	*Unvegetated Streambed* *Flood Wash* *Gravel Bar*
		Vegetated Streambed	*Alluvial Scrub* *Vegetated Streambed*
	Other		*Riparian Waters*
Non-waters of the United States			
Riparian			*Riparian* *Riparian Scrub*
Upland			*Chaparral* *Coastal Dune* *Coastal Sage Scrub* *Oak Woodland* *Open Space*

Table 6. Summary of recommendations.

Recommendations to improve permit process	Recommendations to improve mitigation success	Recommendations to improve permit evaluation (for compliance and function)
The list of potential permit conditions should be consolidated and standardized to eliminate redundancy and confusion.	Avoid channelizing rivers and streams by designing projects to accommodate hydrologic changes within the project boundaries.	The transfer of in-lieu fees should occur immediately upon the finalization of the 401 certification.
GPS information for all mitigation sites should be added to a central GIS database to enable the rapid retrieval of site data for compliance investigations.	Use "soft structures" over impervious concrete and riprap whenever possible to provide for both flood control and limited wetland/riparian services.	A one-to-one correspondence should be established in 401 permits between impact habitat types and acreages and mitigation habitat types and acreages.
Streamline permit processing by redesigning forms and the LARWQCB 401 website and coordinating applicant submissions with the permit tracking database to eliminate unnecessary data entry.	Mitigation within non-jurisdictional upland and riparian habitats should not be accepted as compensation for losses to jurisdictional wetlands and waters habitats, but could be used to supplement jurisdictional mitigation as buffer habitat.	Mitigation plans should clearly identify all agency requirements in the permit paperwork and delineate portions of the mitigation site intended to satisfy each of those agency requirements.
Establish a formal mechanism for coordinating Section 401 permits with other agencies.	Preservation areas should not be considered compensation for wetland losses.	Evaluations of functions and services should be made at both the impact site and the mitigation site, before and after construction, using simple but standardized rapid qualitative assessments.
The RWQCB's existing Microsoft Access file tracking database should be redesigned to include the full set of conditions required of each permit along with check boxes to facilitate entry of compliance information.	Enhancement projects should only be used where the increase in functions and services *fully* compensates for the lost functions and services.	Functional or ecological endpoints should be employed when management actions are specified through the conditions of the permit, rather than simple yes/no or presence/absence compliance determinations.
Organize the permit file archives.	Simple revegetation projects in active channels or floodplains are not appropriate as compensatory mitigation for permanent habitat losses, but may be appropriate for temporary impacts.	Standardize monitoring requirements to ensure adequate assessment of the ecological functioning of wetland mitigation sites.

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Develop an efficient system for rapidly archiving mitigation reports, other agency permits, and all other correspondence.	Mitigation proposals calling for creation projects in riverine systems should be scrutinized carefully because true riverine creation projects are rarely successful.	Performance bonds should be considered as a tool for ensuring timely compliance with permit conditions.
	Restoration projects should be designed to include gains in hydrological and biogeochemical functions as well as habitat function.	A clearer and more consistent format should be adopted for 401 permits to eliminate redundancy and present the mitigation requirements unambiguously in a single location.
	Vegetation plantings within debris basins should generally not be allowed as compensatory mitigation.	All permit conditions should be clearly outlined in a single location, either as a table or as a bulleted list.
	Procedures should be established to prevent the delay of mitigation funded by in-lieu fees.	Mitigation acreage requirements should be specified explicitly and precisely in 401 permits.
	In-lieu fee payments should not be made into a natural resource agency's "general fund," but should be directly traceable to specific projects through accurate accounting and record keeping.	The list of potential permit conditions should be consolidated and standardized to eliminate redundancy and confusion.
	In-lieu fee requirements should be developed on the basis of lost functions and services so that the mitigation projects funded under the in-lieu fee program match the impacts.	The list of potential habitat types at impact and mitigation sites should be consolidated and standardized to eliminate redundancy and confusion.
	Full stream channel restoration projects provide the greatest potential for restoring the full suite of riverine functions and should be emphasized as the best way to ensure there is no net loss from impacts to riverine habitats.	All mitigation sites should be clearly delineated though GPS surveys of overall site perimeters as well as the perimeters of all individual habitat types for which mitigation is specified in the permit.

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	A one-to-one correspondence should be established in 401 permits between impact habitat types and acreages and mitigation habitat types and acreages.	GPS information for all mitigation sites should be added to a central GIS database to enable the rapid retrieval of site data for compliance investigations.
	Evaluations of functions and services should be made at both the impact site and the mitigation site, before and after construction, using simple but standardized rapid qualitative assessments.	A digital photographic record of impact and mitigation sites, before and after construction and throughout the compliance period, should be required.
	Permit requirements should emphasize performance standards for hydrological, soil, and wetland vegetation characteristics along with the management actions currently required.	The RWQCB's existing Microsoft Access file tracking database should be redesigned to include the full set of conditions required of each permit along with check boxes to facilitate entry of compliance information.
	Permit conditions should focus more on wetland hydrology and soils and the establishment of obligate wetland plant species.	Mitigation monitoring reports should be submitted using a standard format developed to facilitate review of mitigation project progress and compliance with permit conditions.
	The effective issuance of a permit should occur only after the mitigation plan has been reviewed and accepted.	All associated agency permits (404, 1600, etc.) should be clearly identified in both the 401 permit and the permit tracking database.

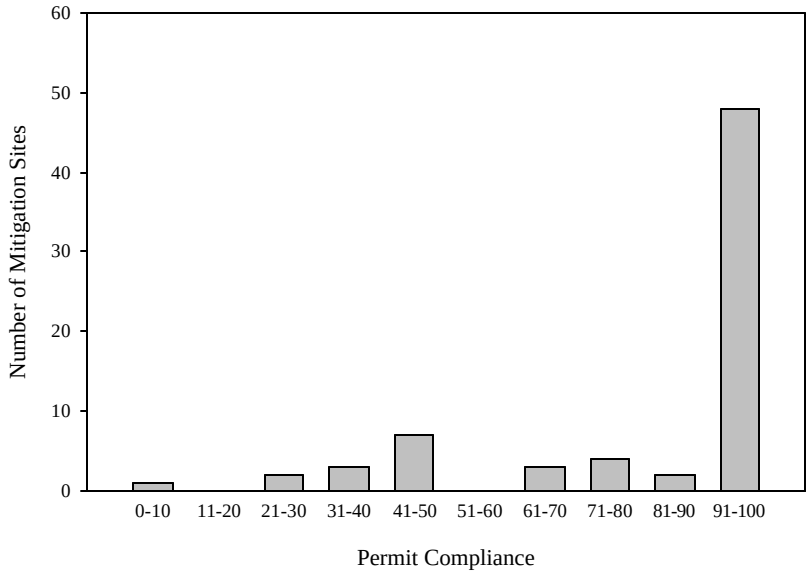

Figure 1. 401 Permit Compliance histogram showing the percent of 401 Permit Conditions met for all of the files in the subset of fifty files evaluated fully and the five in-lieu fee files for which compliance could be determined ((N= 70 mitigation sites within 49 files). Fifteen sites did not have assessable permit conditions, therefore compliance was not calculated for them.

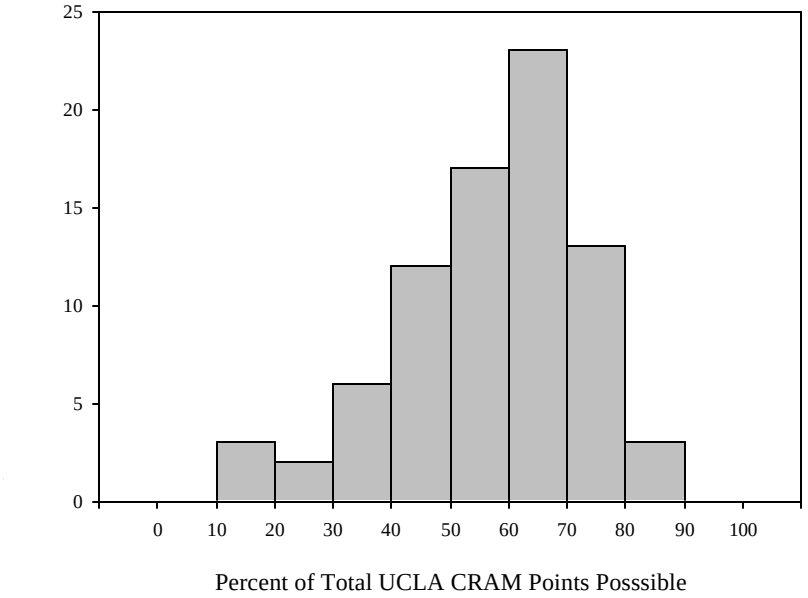

Figure 2. UCLA-CRAM Totals – All Data. All data combined into a single functional success score for each of the 79 individual mitigation sites representing 50 files.

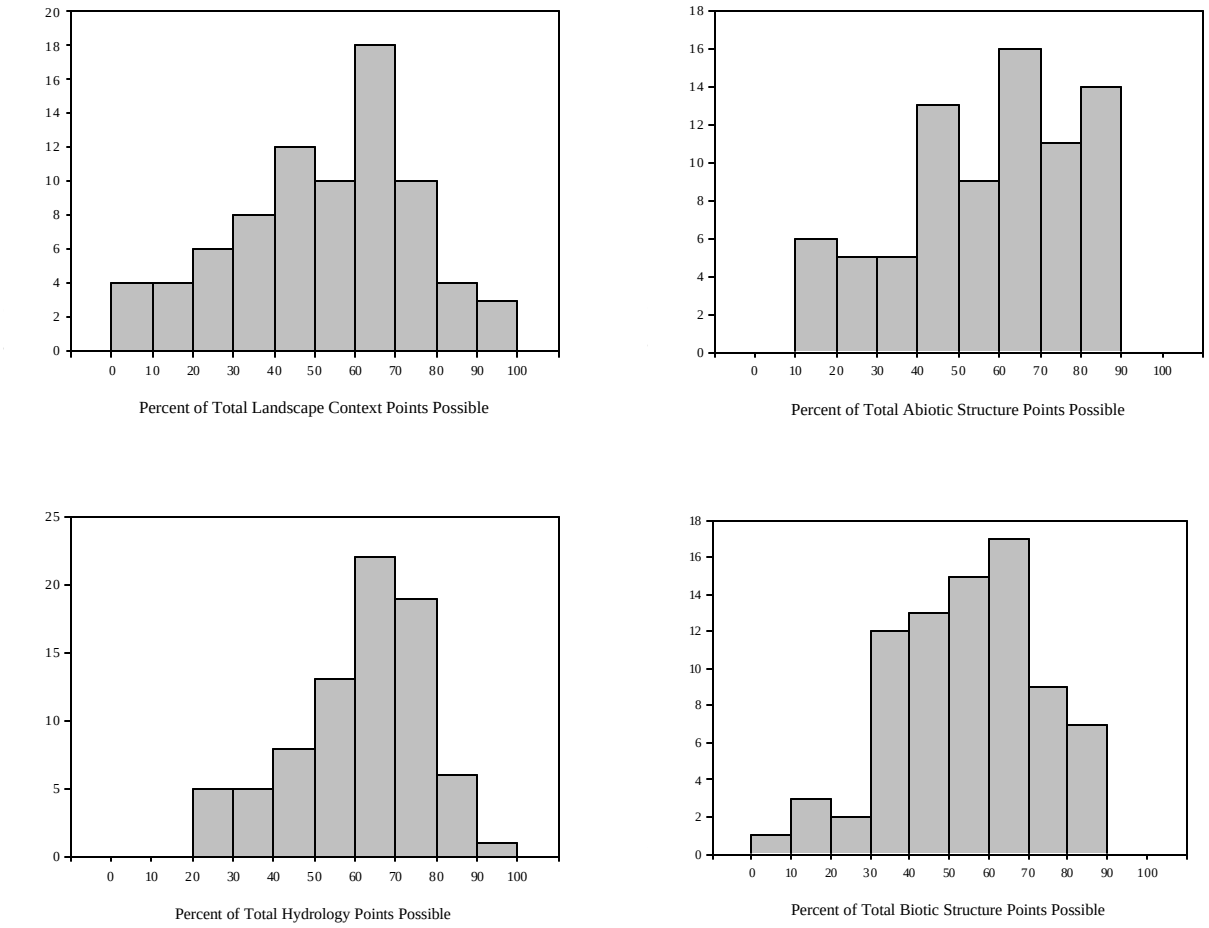

Figure 3. UCLA CRAM Totals for four main functional categories.

Landscape Context: All buffer extent, buffer width, buffer condition, and linear contiguity data combined into a single landscape context score. Hydrology: All water source, hydroperiod, and upland connection data combined into a single hydrology score. Abiotic Structure. All abiotic patch richness, topographic complexity, and sediment integrity data combined into a single abiotic structure score. Biotic Structure. All organic material accumulation, biotic patch richness, vertical structure, interspersion and zonation, and plant community integrity data combined into a single biotic structure score.

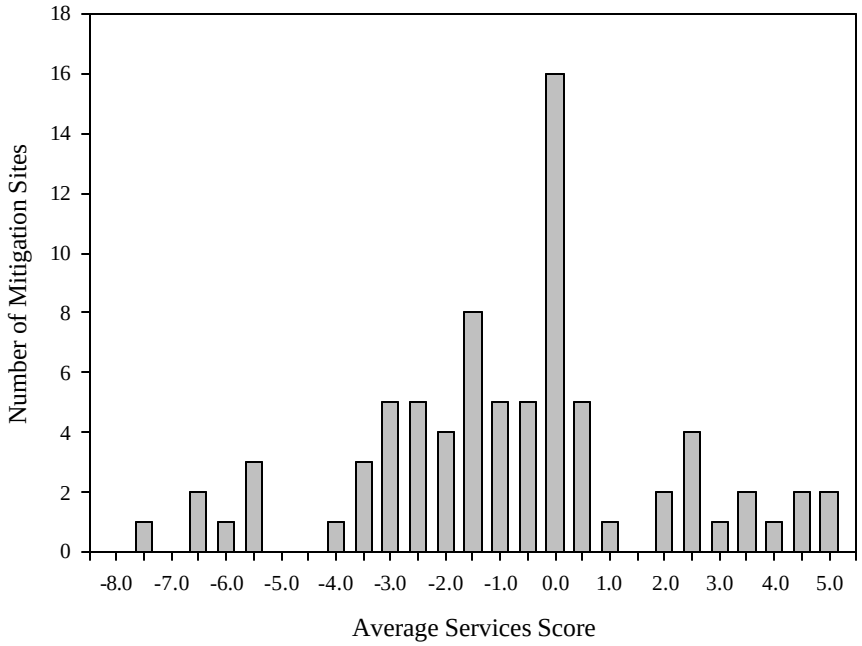

Figure 4. Average Services Gained-Lost Scores across all services categories (Flood Storage, Flood Energy Dissipation, Biogeochemical, Sediment Accumulation, Wildlife Habitat, Aquatic Habitat) for all sites evaluated fully (N=79 mitigation sites within 50 files).

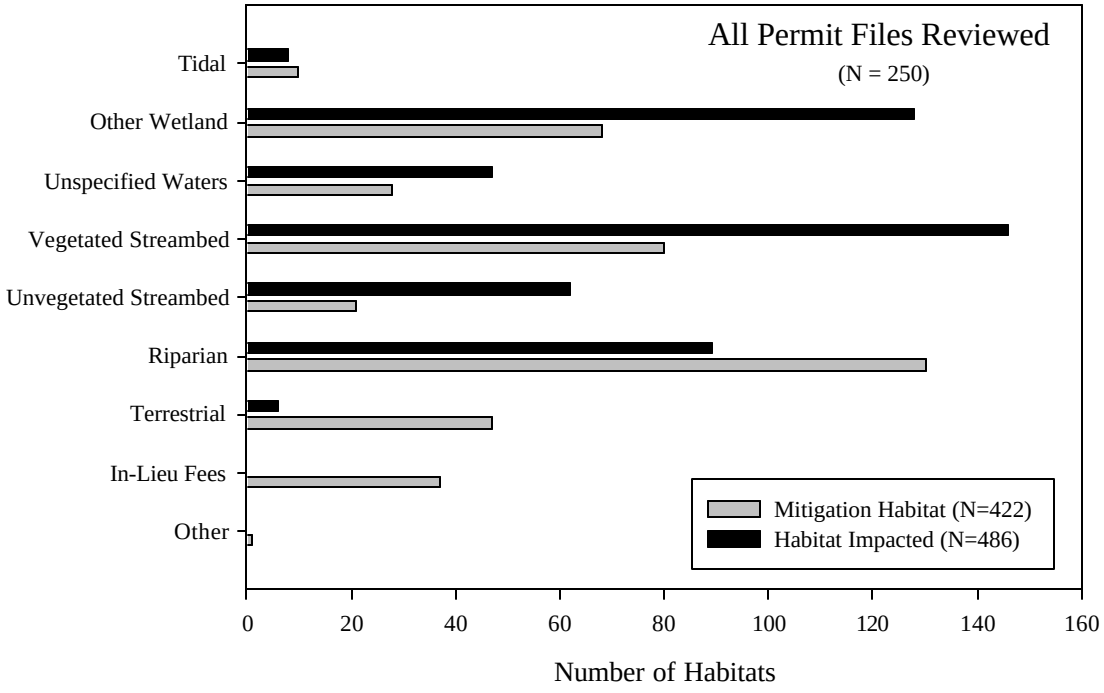

Figure 5. Comparison of the habitat types lost at impact sites vs. habitats created, restored, enhanced, or preserved at mitigation sites for all 250 Permit Files reviewed in the initial phase of this project. Most permit files involve multiple habitat types at both impact and mitigation sites.

6 Appendix 1: Case Studies

6.1 93-09 Sunshine Canyon Landfill; Arroyo Seco, Pasadena

For this project, the impact site involved the construction of the Sunshine Canyon Landfill in the Newhall Pass area (near the I5 and SR14 interchange). Through this project 3.78 acres of jurisdictional wetlands/waters habitat and 4.46 acres of non-jurisdictional riparian habitat were lost. Mitigation for this lost habitat was offsite and located within the lower Arroyo Seco natural park in Pasadena, between the Colorado St. bridge and the La Loma Ave. bridge. Required mitigation involved the creation of 4.02 acres of wetlands and 22.4 acres of riparian enhancement. This permit file was unique in that impacts to both jurisdictional and non-jurisdictional habitats were included in language of the Section 401 permit and the stated mitigation requirements apparently reflected those habitats.

Most of the mitigation area consisted of a naturally vegetated canyon with a straight concrete lined box channel and adjacent gravel access roads running down the middle. There is very little hydrologic connection between the stream and the adjacent "riparian" areas except that small drainage inlets occur periodically along the bottom of the concrete channel. It is possible that the vegetation may have some access to ground water given the geomorphology of the canyon, but the height of the canyon floor relative to the height of the channel inlets suggests that the soil conditions are toward the drier (or more upland-tending) end of the wetland to upland transitional riparian spectrum. However, for the purposes of our jurisdictional habitat evaluation, we considered most of the area as riparian rather than upland, since the subsurface hydrology was not clearly understood. It was not possible to determine the exact boundaries of this site (mitigation site #1 – enhancement) because the enhancement activities were indistinguishable from the general maintenance activities of this pre-existing park area. For this reason, our GPS evaluation overestimated the expected acreage by almost double. This mitigation site illustrates the difficulty in establishing whether the actual enhancement activities reflect the mitigation acreage they are purported to achieve. The enhancement activities, which consisted of isolated tree or shrub plantings, were performed diffusely throughout the area, such that it was not possible to identify each enhancement element, or to tally them together to determine their total effective acreage. In addition, active recreation and management are significant in this public area. Much of the west side of the river was an archery range with crisscrossing paths surrounding plantings, and the east side contained a large parking lot and a large casting pond (though these were likely not included in their reported mitigation acreage. Dog walking is very common. Houses line both sides of the area along the tops of the canyons. By our general assessments of habitat quality and function, the site does not differ significantly from the remainder of the park (downstream of the La Loma Ave. bridge), which was not included in the mitigation. This canyon was already a dedicated park before it became targeted for mitigation activities, and if our assessments had been made at the site prior to enhancement activities, they would likely have been insignificantly different from the assessments we made following these activities. This site scored very well for habitat in our functional evaluations. However, this enhancement project contributed very little to the

replacement of lost functions, values and beneficial services lost through the project impacts.

For the wetland mitigation site (mitigation site #2), water was diverted from an impoundment just upstream of the site (above a concrete spillway at the head of the box channel), and delivered by underground pipe to created channels along both sides of the main channel that meandered within created banks through the otherwise upland/riparian area before draining via culvert back into the main channel. These channels were densely covered by willow and other riparian vegetation, and had well developed wetland soils and hydrophytic vegetation including cattails. However, these side-channels were disconnected from the natural hydrology of the area and were not beneficial with respect to flood control and flood energy dissipation services. This, combined with the rapid rate of water movement through these systems, meant that the biogeochemistry potential of these habitats was low compared to similar channels with natural hydrology. Despite their artificial hydrology, these created riverine wetlands did provide favorable functions and services and could be considered successful and appropriate wetland mitigation projects. We determined that the total acreage for this site was 9.2 acres, of which about 90%, or 8.3 acres, was jurisdictional wetlands/waters habitat, including 7.2 wetland acres. This project exceeded the 4.02 acres of required wetland habitat by nearly double, and through this realized mitigation ratio, the jurisdictional functions, values, and services lost have been adequately compensated for by this component of the mitigation project.

This permit file demonstrates a significant accounting problem that we faced in determining whether no net loss was achieved between the impact projects and the mitigation projects. It was often very difficult to combine disparate types of mitigation projects together to achieve single scores of compliance, success, or functional loss/gain. In this case, the relatively high gains achieved by this wetland creation project had to be combined with the relatively low gains achieved by the much larger enhancement project into single determinations of success. In this permit file, the interconnections between multiple impact projects and multiple mitigation projects were straightforward. However, in many permit files such one-to-one correspondence was impossible to determine.

Lessons from this project include:

1. Appropriate classification of habitat types in the permit made it easy to compare lost habitat to mitigation habitat. In this case, impact s to both jurisdictional and non-jurisdictional habitats were distinguished, which is atypical of 401 permits, but these corresponded in a tractable way to the jurisdictional wetland creation, and the non-jurisdictional riparian enhancement.

2. Accounting for the "gain" in resource values or services can be problematic with enhancement mitigation. The problems in this case study were many, including the difficulty in determining the boundaries of mitigation activities (and, hence, how many acres should be credited), the diffusion of enhancement activities over a large area (again making it difficult to determine the actual incremental improvement in resources due to mitigation activities), and the lack of pre-mitigation assessments to determine the "increase" due to mitigation activities. Although the site scored well

for acreage and function, our assessment probably dramatically overestimates the true value of the enhancement.

3. Riverine creation projects are very problematic because establishing appropriate hydrology is difficult in habitats that are removed from natural stream processes. However, creative approaches can result in high levels of at least some wetland functions through riverine creation projects.

4. There are formidable accounting problems that must be resolved in order to determine whether no net loss has been achieved.

6.2 93-15 Ridgemoor Residential Development

This project consisted of a large single-family residential development in the Rowland Heights hills. Several ephemeral or intermittent streams were filled and culverted under the development. A few small sections of wetland habitat had been present within the filled stream valleys, and about 2.4 acres of jurisdictional wetland/stream habitat was lost. This was a natural area with good connection to adjacent open spaces. Many of the stream courses were surrounded by oak woodland, but some cattle grazed pastureland as well. The streams were medium gradient and near, but not at, the top of the drainage. The mitigation was to consist of three separate components: a "wetland" creation and two separate riparian enhancement areas.

The primary mitigation site (Site 1) was the wetland creation that was at the lower edge of the development and was fed by urban runoff from the development. Several portions of the development drained to the mitigation area at different locations within the site. The site was constructed as a series of stepped basins that resembled "house-pads," surrounded completely by low berms except for small outlet areas on the downstream edges that fed in sequence to the step-basin below. A small low-flow subchannel meandered through all of the basins. These basins were filled with dense mulefat, willow and other target vegetation. Wetland conditions were evident closer to the subchannel, where wetter conditions have led to hydric soil development and dense cattails. Further from the sub channel, conditions are drier, but are likely flooded during rain events. This site was clearly delineated by a fence that separated it from a dirt walking path. Through our assessments we determined that this was a reasonably successful mitigation project that compensated for many of the hydrological, biogeochemical, and habitat functions and services lost through the impact project. However, the geomorphology of this mitigation site was artificial, falling somewhere in

between a depressional and a riverine wetland, which complicates the functional evaluation of the site.

The riparian enhancement areas were more problematic. The riparian enhancement area labeled Site 2 was to occur within another untouched riparian area along the eastern border of the property. We could locate no mitigation site in this area; however, at the top of the eastern-most cul-de-sac, some mulefat and other native vegetation were planted on what appeared to be an abandoned house pad. Based on the presence of mulefat and the approximate size of the flat planted area, we determined that this was considered to be the riparian enhancement mitigation site. This area had no hydrological connection to any water source other than artificial irrigation, was not an appropriate mitigation project, and represented a departure from what was approved in the permit.

The last riparian enhancement site consisted of a large and untouched oak/riparian drainage that ran from a newly constructed concrete detention basin to the upper property line. Between this untouched area and the adjacent homes (which surrounded it on three sides), steep compacted hillsides existed that were planted with an appropriate cover of native tree and shrub vegetation. These vegetative plantings, which consisted primarily of upland species, were necessary for erosion control of the steep altered slopes and had little or no hydrological connection to the drainage. The acreage of this entire area (the planted slopes and the un-modified drainage corridor) was to be credited as enhancement. Because the natural area (Site 3) and the planted area (Site 4) were fundamentally different habitats, these were evaluated separately with the natural area treated as preservation and the planted area treated as enhancement. This highlights the ambiguities created when enhancement projects are proposed and approved as compensatory mitigation.

Lessons learned from this project include:

1. Reproducing appropriate hydrological processes in created wetlands is challenging. Creative approaches, particularly in urban settings, can result in some hydrological and biogeochemical processes being created. In this project, urban runoff was used to provide a water source. The seasonality of this water source differs from the natural pattern, and the quality of the water may not be ideal, but valuable wetland functions and services were nonetheless created. On the other hand, the geomorphology of the created wetland was artificial. This artificiality created problems for assessing its condition, but also undoubtedly resulted in different services being provided than the original destroyed wetlands.

2. Some mitigation efforts have apparently been spent on patently unsuitable projects. From our field visits, we do not understand the decisions that led to an attempt to construct a "riparian enhancement" on an unused building pad far from natural water sources, but it is clear that this effort neither complied with the approved permit conditions not replaced the lost wetland functions from the impact site.

3. Riparian "enhancement" does not occur simply by setting aside existing habitat. The inclusion of such areas in mitigation acreage results in an overestimate of gains

towards the goal of no net loss. At the extreme, if all mitigation was accomplished by habitat preservation, then a simple accounting (as indicated by permit records and followed in this report) would indicate no net loss, when in reality **all** impacted acres would have been lost. Preservation areas do not constitute gains.

4. Riparian enhancement acreage can be inappropriately inflated when it is combined with a large area of preservation. (This is similar in principle to the practice of counting a large area as enhanced even though enhancement activities are spread diffusely throughout the area.)

5. Vegetative plantings in upland areas with no hydrologic connection to a drainage may be appropriate management for a site, and may even provide valuable habitat, but do not replace the functions of natural wetlands.

6.3 97-203 Tujunga Housing Development

This project consisted of a moderately large housing development on a foothill slope above Sunland and below the steep headwaters of a sub-catchment, which permanently impacted 0.75 acres of vegetated streambed habitat. Two high gradient ephemeral drainages were filled by the development and two detention basins were created as mitigation, one at the top of the development and one at the bottom.

The top detention basin (Site 1) was contiguous with open space but was sandwiched between houses and streets and completely surrounded by an iron fence. The mitigation area was limited to the sloping banks of the basin, and involved planting native upland shrub species, along with some mulefat. Water entered the basin through a concrete spillway and exited through a large vertical drain pipe. The bottom of the basin consisted of compacted dirt which was devoid of vegetation, and was not included in our assessment.

The lower basin (Site 2) received runoff water from the development. A very steep terraced planting area occurred above the basin. Water flowed into the basin from an extensive series of concrete V ditches on the terraces above and through an underground pipe that ran under the development from the upstream basin and presumably received inputs from storm drains. Mitigation plantings were similar to the upper site and limited to the basin slopes. The lower site had slightly better buffer properties, however, as it transitioned into an undeveloped chaparral slope on one side.

This project demonstrates several important issues. First, as with all permits, the jurisdictional habitat affected by this project was limited to the acreage within the banks of the very narrow stretches of ephemeral streams that used to run through this area. After fill from mountain tops was excavated and placed into the drainages, and after the much of the resulting area was covered by impervious substrate, most of the functions and services of the greater project area such as wildlife habitat and flood attenuation (flood storage and ground water recharge) were lost. The detention basins were established to compensate for the loss of this natural flood attenuation, but this was not part of the compensatory mitigation requirements, which resulted only from those losses to the narrow strip of jurisdictional stream habitat. These stream sections were ephemeral and of high gradient. Therefore, the actual functions and services lost were relatively low compared to a lower gradient perennial stream. However, the insignificantly small amount of habitat value achieved through plantings on the banks of the detention basins was not sufficient to account for the lost functions, values, and services. These basins have large outlets and are designed to drain rapidly following heavy storm downpours. They are not designed to retain residual water within the basin bottoms where wetland conditions might develop. If detention basins were designed such that water and fine alluvium were retained and wetland conditions were allowed to develop (with only infrequent sediment removal), then these basins might provide some value as compensatory mitigation sites. But vegetation plantings on basin slopes provide no hydrological function, negligent biogeochemistry function, and minimal habitat value. Such projects are not adequate for achieving the "no net loss" goal of the Clean Water Act.

The lessons learned from this case study include:

1. Detention basins provide problematic mitigation. Although vegetation can include riparian plants such as mulefat, plants are more typically upland shrubs. The basins themselves replace some of the wetland functions and services, but planting vegetation on the basin slopes provides very little compensation for the remaining losses permitted under Section 401. It might be possible to manage detention basins so they create higher wetland values, but this is rarely done.


97-203
Site 1
Site 2


97-203 Site 1

6.4 94-03 Arroyo Simi Repair of Embankment and Utility Lines

This project consisted of two discrete impact projects and two corresponding mitigation projects. The first project occurred just downstream of the Madera Rd. bridge crossing on Arroyo Simi and involved the replacement of a buried sewer line running perpendicularly under the stream, along with the reconstruction of substantial sections of grouted riprap armoring along both banks (over 500 feet on the north bank and 25 feet on the south bank). Upstream of this site, Arroyo Simi runs through the heavily urbanized city of Simi Valley. For most of its length and continuing through this site, Arroyo Simi is a straightened channel with sloping armored banks and unconsolidated alluvium comprising the channel bottom. The old sewer line crossing was armored with concrete that had begun to fail. Impacts from the pipeline consisted of temporary impacts due to tractor work in the channel and permanents impacts caused by extensive pipeline armor on the channel bottom and a moderate extension of riprap along one of the banks.

Mitigation for both the temporary and permanent losses was to involve revegetation of mulefat within the channel, in the vicinity of the project activities. We were not able to establish mitigation boundaries as we found almost no vegetation, mulefat or otherwise, in the vicinity of the pipeline crossing. This observation would seem to indicate that mitigation activities did not occur and that a compliance issue has been identified. However, the entire channel, as far as one could see both upstream and downstream, was equally devoid of vegetation. The conversion of Arroyo Simi to a straightened flood conveyance channel and the associated predominance of impervious substrate has resulted in frequent peaks in stream power that re-suspend massive amounts of alluvium and uprooted plant matter and transport them downstream, scouring away plants in the channel. There is no way to tell if the required mitigation activities had occurred after the pipeline was replaced. But it is likely that even if the mitigation requirements had been met, they would likely have had a negligible impact on the present condition of the site.

The second impact project occurred about one mile downstream and involved the reconstruction and burial of a reclaimed water pipeline leaving the nearby sewage treatment facility. The physical setting at this site was fundamentally different because channelization ended just downstream of the first site and Arroyo Simi at this site was a wide and reasonably natural alluvial floodplain with a meandering and often braided low flow channel running through it. This second site was located at a bend in the river where the channel dimensions were much narrower. The entire stretch of floodplain upstream, downstream and an in the vicinity of the crossing was characterized by mature communities of floodplain vegetation with the expected degree of patchiness among community elements. Much of the vegetation was native, with canopy, understory, and low growing species, although stands of very tall and dense *Arundo donax* and other invasive species were common. This second project was very similar the first except that armoring was not installed on either the banks or the stream bottom. Remnants of an irrigation line led to the site, confirming personal communications with facility staff that at least some mitigation plantings had been performed. However, as with the upstream site, mitigation boundaries could not be determined, and we could find no direct evidence that plantings had occurred. It is possible that some of the individual plants that were present had been installed as part of mitigation, but aerial photographs around the time of the study showed that the entire floodplain upstream and downstream of the site had very low vegetative cover due to the destruction of recent floods. This suggests that the entire reach of the floodplain had undergone a major phase shift since the time of the impact project, which again suggests that even if the mitigation requirements were met, they would have likely had a negligible impact on the present condition of the site.

As far as we could tell, mitigation activities for both of these projects did not result in any substantive long-term gains in functions or services. However, the actual losses associated with these two projects were not very significant either. Most of the losses were temporary and would likely have been no greater than the damage caused by the peak floods of the year. While the concrete and riprap armoring created substantial losses in function when originally installed, simply replacing these structures did not.

Lessons learned from this case study include:

1. Passive or active revegetation projects within active channels are problematic as there is little assurance that these efforts will result in lasting gains.

2. Revegetation projects provide minimal gains in hydrological and biogeochemical functions and services compared to services already existing in the channel. If such revegetation projects persisted through major ecological phase shifts and developed into mature communities, then their hydrological and biogeochemical contributions might become significant. But we found little evidence that this was happening at the mitigation sites we visited.

3. Mitigation must be geared appropriately for temporary versus permanent losses. Revegetation in an active channel will likely persist only until the next flood; this is appropriate mitigation for temporary impacts within an active channel, but may not be appropriate for permanent impacts. In all cases, identifying mitigation for temporary and permanent impacts separately and explicitly would clarify accounting.


94-03 Site 1


94-03 Site 1

6.5 99-045 Arroyo Simi Channel Replacement, Simi Valley

The impact project site was the replacement of a shallow trapezoidal concrete channel on Arroyo Simi with a tall concrete box channel. The original channel had developed cracks through which vegetation had become established. The quality of the habitat lost was very low, consisting solely of vegetation that had become established within cracks in the failed channel. The mitigation was to consist of the removal of castor bean and *Arundo donax* from an unspecified amount of the stream reach downstream of the project site. The stream bottom in this area consists of soft alluvium

and contains dense *Typha* and other vegetation. It was wet across the entire length to the bottom of the banks. No *Arundo* and only a moderate castor bean and tree tobacco occurred at this general location, which suggests that the mitigation activities occurred, though there was no direct evidence that mitigation was done and the boundaries of the site could not be determined. Regardless, this project was unique in that the presumed mitigation site has since been structurally altered by a new impact project. The entire reach in this location has been reconstructed and armored as part of a new housing development that is being constructed along both sides of the reach (but mainly on the right bank and farther upstream on the left bank). This mitigation site has clearly not been maintained in perpetuity. As part of this new development, both banks of the mitigation site have been completely re-engineered and armored with interlocking blocks, and a two-lane bridge crosses through the middle of the site. Within this "soft structure' armor, riparian vegetation including willow and mulefat has recently been planted in the block spaces, and while it is currently young, it appears it will develop into a dense riparian stand that will provide appropriate hydrological biogeochemical, and ecological functions.

Lessons learned from this case study include:

1. Mitigation requirements should clearly state the precise location and extent of the expected mitigation activities.

2. Mitigation sites must not be subjected to future impacts that will minimize or erase the expected functional gains they were supposed to achieve. If such impacts were to be approved, then the subsequent mitigation requirements should account for both the original and secondary impacts, but with an additional factoring of cumulative temporal losses. Had these sites been incorporated into a GIS of mitigation areas, these secondary impacts may have been avoided.

3. Soft structures such as interlocking block armoring should be emphasized whenever possible because the riparian communities that they enable can provide significant improvement of function compared to solid concrete channels.

6.6 99-071 Industrial Park, Thousand Oaks

The impact project was the construction of a 47-acre industrial park that permanently impacted 0.47 acres of unspecified waters through the placement of fill material into an unnamed tributary to Arroyo Conejo. Required mitigation was payment of $225,000 in-lieu fees to the Calleguas Creek Watershed Habitat Restoration Account managed by the Coastal Conservancy. According to Coastal Conservancy personnel, the funds had been paid but mitigation activities had not yet been initiated. This file could be assessed for compliance (the in-lieu fees were paid) but there was no mitigation site to assess for function. In-lieu fees from several permit files including $71,250 from 97-152 (Royal-Madera Shopping Center, Simi Valley), one of our 55 randomly selected files, were paid to this fund. It is not clear whether this restoration will adequately replace the functions, values, and services lost through these impact projects. It is clear, however, that the 5-7 years of temporal losses that have occurred so far are substantial. Built into the in-lieu fee program is the potential for such temporal losses. This may or may not be appropriate given the application of appropriate mitigation fee ratios. However, we feel that in-lieu fee programs should be in the latter stages of planning before they begin accepting payments, and time limits for implementation should be mandated as part of the permit approval process. No photograph is available because there was no mitigation site.

Lessons learned from this case study include:

4. Payments to in-lieu fee programs can be problematic for a variety of reasons. Although the permittee may fulfill the mitigation requirement in a timely fashion, there is currently little accountability for the in-lieu fee program.

5. In-lieu fee programs must be well-established *before* they accept fees if temporal losses are to be avoided.

6.7 02-108 Forecast Homes, Mint Canyon, Santa Clarita

The impact project for this permit was the construction of a large housing development that involved the grading of 32 acres of land and filled 10 ephemeral drainages, with a reported permanent loss of 0.28 acres of unspecified jurisdictional waters.

Required mitigation was payment of an unspecified amount of in-lieu fees to the United States Forestry Service (USFS) for the removal of *Arundo donax* in San Francisquito Canyon. The USFS and the permittee's agent confirmed that the payment was received, and that *Arundo* removal was underway at several sites in the canyon. After visiting several of the removal sites, which had varying degrees of success with respect to removal and regeneration, we determined that functional evaluations of the mitigation activities were neither possible nor appropriate for several reasons. First, even though all of the removal sites were located in this one canyon, there was great variability in the characteristics of the different sites, making it difficult to combine them together into a single evaluation. Second, the application of these fees came after the project was initiated and they may have gone toward secondary removal and herbicide application rather than the total removal efforts. Third and most importantly, these fees went into a "general fund" where they were comingled with funds from other in-lieu fee payments along with other sources of non-mitigation related revenue that, collectively, went toward the *Arundo* removal efforts in the canyon.

The "general fund" aspect of the in-lieu fee program, which results in a non-traceable links between impacts and mitigation, is even more problematic for other permit files we assessed. In-lieu fee payments of an unspecified amount and $83,472 from permits 98-055 (Old Topanga Road, Department of Public Works, Los Angeles) and 02-018 (Verdugo Debris Basin), respectively, along with payments from six other non-assessed permit files, were also paid to the USFS for exotic-plant removal but with no specificity for even the approximate location of removal sites. These funds were, again, pooled with other revenue sources into a "general fund" that was applied to any number of project sites and perhaps went to administrative costs as well. Such confusion in the accounting between impacts and mitigation makes evaluations of function and determinations on net gain or loss impossible. Even if these funds were traceable, it is not clear how well the habitat functions gained through the removal of exotic species would serve to compensate for the hydrological, biogeochemical, and habitat functions, values, and services that were lost through project impacts. This is not to say that exotic species removal, erosion control (another mitigation project type that in-lieu fees were applied toward), or other partial habitat improvements are not important projects that can result in significant value additions. These are very important watershed management actions, but it is difficult to determine how well the "no net loss" goal of the Clean Water Act is achieved through the inclusion of such projects as compensatory mitigation.

The lessons learned from this case study include:

1. Accounting for the benefits of in-lieu fee programs is difficult. Such programs often lose the nexus between the amount of lost resources from the impact and the amount of gained resources from the mitigation. Thus, it is difficult to justify the amount of

contribution to in-lieu fee programs, among other problems; perhaps the contribution should have been greater, or smaller.

2. Accountability within an in-lieu fee program is problematic. Although it is generally easy to verify that a transfer of funds to the program took place, accounting for how the money was spent is generally not possible. Efficient use of in-lieu fees is dependent on the program organization, which is beyond the control of both the permittee and the regulatory agency.

3. Accounting for in-lieu fee benefits is even more problematic when the mitigation takes the form of *Arundo* removal. *Arundo* removal is by its nature an ephemeral effort, except in the rare (unknown?) case of complete eradication from a watershed. Thus, it may be most appropriate for temporary wetland losses. *Arundo* removal is also a diffuse activity, so it would not be possible to identify a particular removal effort as being supported by in-lieu fees from a particular permit.

6.8 93-06 Medea Creek Restoration, Agoura Hills

This project involved the restoration of a 0.5 mile long section of Medea Creek back to its pre-channelized condition. This section of stream had been altered by an unauthorized cement lining that extended half way up both sloping banks. There was no project associated with this permit file per se, but for the purposes of our evaluation, we considered the original installation of the cement lining to be the project and the permitted restoration to be the mitigation.

The mitigation involved removing the concrete lining, widening the channel, decreasing the slope of the banks, and planting native riparian tree and shrub species

along the banks. The majority of this mitigation project was either jurisdictional habitat or had appropriate riparian hydrology. In the years since the mitigation, a mid-successional riparian community had developed consisting of a dense canopy of willow and cottonwood trees and other riparian shrubs of appropriate diversity and abundance, and extensive wetland conditions had developed within the channel. Through natural recruitment, cattails and other wetland emergent plants had become common along with abundant leaf litter and woody debris in various stages of decomposition. A wide variety of wildlife was seen at the site, including rabbits, ducks, hawks, lizards and insects. The aquatic habitat was of lower quality and while this was not specifically investigated here, our other research has shown that tolerant benthic macroinvertebrates and mostly non-native fish are common near this section of Medea Creek. A wide green belt on one side of the stream separated the channel from nearby houses, while much the other side of the stream had significantly less developed buffer habitat. Some riprap armoring was present on the banks along a small section of the reach, which appeared to be new and likely installed after the mitigation project was completed. These armored sections were removed from our acreage estimates. Otherwise there was little impervious substrate within the mitigation area aside from the culverts associated with two road crossings.

Most of the perennial flow running through this channel is urban runoff from this medium density suburban community. As runoff water flows through this relatively low gradient system, the biogeochemical functions provided by its well-developed soils and plant communities likely contribute to significant water quality improvements to the runoff water. During storms the dense riparian vegetation within the channel and the moderate connectivity with adjacent uplands would be expected to provide substantial hydrological services such as flood attenuation through energy dissipation and the temporary storage of flood waters within bank and upland soils.

Through our assessments we determined that the mitigation activities were sufficient to compensate for the functions, values, and services lost through the original modifications to the stream.

Lessons learned from this case study include:

1. Highly modified flood conveyance channels can be restored to serve as appropriate mitigation sites for future permit projects. Such mitigation projects would substantially increase the likelihood that the “no net loss” goal of the Clean Water Act will be met.

2. In-channel stream restoration activities that incorporate appropriate hydrology and floodplain connection can support an appropriate riparian community and achieve a high level of wetland function and services.


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