Levee Vegetation Management in California:

An overview of Law, Policy and Science, and Recommendations for Addressing Vegetation Management Challenges

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Executive Summary

This paper outlines the current regulatory framework governing vegetation on levees in California; describes challenges regarding State and federal levee vegetation laws, policies, and regulations; argues that the current regulatory framework is problematic for many reasons; and offers solutions to address levee vegetation challenges moving forward. Appendixes provide further details and analyses on federal laws and policies, State laws and policies, case law, and science and research.

Applicable federal policies include the Federal Emergency Management Agency (FEMA) National Flood Insurance Program (NFIP), the United States Army Corps of Engineers (USACE) National Levee Safety Program, USACE-issued regulations on levee vegetation, the Water Resources Reform and Development Act of 2014 (WRRDA 2014), and the Endangered Species Act (ESA). USACE-issued levee vegetation regulations establish a "vegetation-free zone" on and around levees, although this has largely been met with criticism from the levee maintenance and natural resource communities. USACE-issued levee vegetation regulations also include variance guidelines, which establish a procedure for an exemption from these vegetation policies.

On the statewide management level, the Central Valley Flood Protection Board (CVFPB) and California Department of Water Resources (DWR) manage California levees. The State has embraced a levee vegetation management strategy consistent with risk prioritization, and as such prioritizes possible threats posed by levee vegetation far below other possible risks to levee integrity such as seepage, erosion, and slope failure. The State has partially incorporated vegetation-free requirements in their lifecycle management (LCM) approach, which is part of their broader Levee Vegetation Management Strategy (LVMS). The LVMS is similar to USACE requirements in many respects, except that it allows already existing mature trees ("legacy vegetation") to remain on existing levee slopes, and allows for additional recruitment of levee vegetation on the lower waterside portion of existing levee slopes. Contrastingly, USACE vegetation-free requirements require the entire levee slope to be removed of all vegetation, except for grass. In other words, while USACE requires levee maintainers to obtain a variance in order to retain existing vegetation, the State begins with a presumption that levee maintainers

may retain existing levee vegetation without going through an additional exemption process. The State views the two policies as operationally compatible, although local maintainers still report significant differences between the policies and challenges conforming to both.

Following the release of USACE vegetation management guidelines establishing vegetation-free zones on levees, two lawsuits were initiated against USACE: one by Friends of the River (FOR) and other environmental non-governmental organizations (NGOs) and another by the California Department of Fish and Wildlife (CDFW). Both lawsuits alleged that USACE violated the ESA, National Environmental Policy Act (NEPA) and the Administrative Procedure Act (APA) in promulgating their vegetation regulations. The lawsuits also argued that the USACE variance policy is unworkable and similarly violates the ESA, NEPA and APA. Both lawsuits were voluntarily dismissed without prejudice (essentially suspended) by the California District Court following the passage of WRRDA 2014, which directed USACE to revisit and reissue their levee vegetation policies. As such, in each case the Court declined to decide the case on the merits, instead directing USACE to comply with the terms of WRRDA 2014. To date, USACE has failed to do so, although the deadline passed in December 2015.

Considerable research on levee vegetation has been developed in recent years, largely in response to the contentious regulatory framework. Two Levee Vegetation Research Symposia were convened in recent years, one in 2007 and another in 2012. Each symposium brought experts and leaders in their respective fields together to discuss the state of the science and future research needs. Substantial research has been conducted by USACE's Engineer Research and Development Center (ERDC), DWR and the California Levee Vegetation Research Program (CLVRP). Most recently, CLVRP released a report that synthesized all of the most current research regarding levee vegetation. There are certain areas where more research is needed, but research to date has not shown a causal link between levee vegetation and substantial increased risk to levee integrity.

The current regulatory framework is problematic for many reasons, and greater attention is needed to address critical issues faced by levee maintainers in California. There is dire need for levee repair, but local maintainers are often unable to do so, constrained by conflicting and confusing laws and policies, or requirements which are overly time-consuming and cost-

prohibitive. For example, in many cases, USACE standards violate the ESA with respect to critical endangered fish habitat. Further, local levee maintainers are not always sure how to reconcile State and federal guidelines. Local levee maintainers also encounter problems with operations and maintenance requirements that conflict with other laws and regulations, and a time-consuming, cost-prohibitive variance policy. The confusing nature of levee vegetation guidelines can put these maintainers at risk of losing eligibility for federal rehabilitation assistance in the event of a flood.

This paper concludes by offering solutions to move forward. This includes using the most current and best available science to inform better policy. Engineering solutions are discussed, and examples presented where levees have been designed to strict safety standards while maintaining vegetation. New models are considered, which can be used to better assess when a tree might pose a threat to levee integrity. Regionally based, multi-benefit projects underway could also provide experimental project designs, which, if successful, could inform new statewide and federal policies and guidance on levee vegetation management.

In order to best address these levee vegetation issues, collaboration between stakeholders is critical. An interagency working group, similar to the one formed in the past (California Levees Roundtable) could help enormously in fostering relations and forming new policies. However, if all stakeholders are not able and/or willing to meet, other solutions could address levee vegetation issues. These include: development of one or multiple System-Wide Improvement Frameworks (SWIFs) for California's Central Valley, passage of new legislation that encourages new USACE vegetation management policies, litigation to encourage new USACE vegetation management policies, using the ESA to maintain vegetation on levees despite USACE requirements, or USACE could proactively update their levee vegetation policies.

Part I: Introduction and Background

1. *Introduction*

In 2005, Hurricane Katrina devastated New Orleans and left a lasting imprint in the consciousness of all Americans. The realization that the majority of the tragedy may have been preventable, had it not been for levee and floodwall failures, prompted swift changes to levee management policies. Regrettably, these well-intentioned policies have resulted in significant unintended consequences that continue to severely impact ecological and economic resources in flood-prone areas and may even impact public safety. This paper will focus on policies implemented by the federal government soon after Hurricane Katrina, which were intended to upgrade levees nationwide and prevent any similar breach, but have ultimately resulted in more costly flood management systems with harmful environmental side effects, especially as applied to California's Central Valley. These policies include controversial provisions mandating that all vegetation (except for grass) be removed from levees.

Vegetation on levees serves many functions, from providing aesthetic value to homeowners and recreationalists to habitat value for endangered species. Trees and other woody vegetation on levees can reduce river temperatures, preventing the water from over-heating and killing or harming endangered fish. Vegetation on riverward slopes of levees can also provide necessary habitat for spawning and rearing fish. Many also argue that vegetation on levees strengthens slope stability and reduces erosion. However, many others believe that vegetation on levees reduces levee structural integrity. Levee vegetation has been accused of causing erosion and slope instability, seepage, attracting burrowing animals, and hindering inspections and floodfighting activities. This is exactly what prompted federal vegetation-free policies, which in turn spurred strong backlash from the environmental community and a surge in levee vegetation research. The debate over levee vegetation continues to this day, reflected in differing laws and regulations.

This paper summarizes the current regulatory framework in terms of federal law, California law and case law, relative to vegetation management on levees. It also presents the state of the science, describing the most recently released and best available science regarding levee

vegetation. This paper argues that our current regulatory system is unworkable for a variety of reasons, which will be expounded on in *Part II: Problems Associated with Vegetation Removal Requirements*. This paper concludes by offering solutions for moving forward, and ways that the most critical issues articulated in *Part II: Problems Associated with Vegetation Removal Requirements* might be addressed. Rather than advocating one preferred solution to the current problematic situation, the author recognizes that many solutions may be utilized in addressing this problem, including those not expressed here. Above all else, the goal of this paper is to provide background on levee vegetation issues, argue that our current system is in dire need of change, and highlight the importance of this issue to all regulators and policymakers involved in managing levee vegetation. The ultimate goal is that, in reinforcing the problematic regulatory structure, leaders in their respective fields will be prompted to give this issue the attention it deserves and collaboratively move forward towards solutions.

Before the current state of policy is described and analyzed in detail, this paper provides a brief history of levee vegetation management in the United States and California, to provide context and a better understanding of how we arrived at our current levee vegetation management policy patchwork.

2. *History and Brief Overview of Levee Vegetation Management Policies*

In California's Central Valley, individual landowners constructed low levees to protect their properties from inundation as early as the early-mid 1800s.[2] Well into the late 1800s, landowners continued to extend levees, "encroaching on streams and confining waters."[3] Eventually, these landowners formed reclamation districts, and in turn constructed higher "and more substantial" levees around these districts for protection.[4] Federal participation in regulating levee development and maintenance began in the early 1900s.[5]

[2] U.S. Army Corps of Engineers, Standard Operation and Maintenance Manual for the Lower San Joaquin River Levees, Lower San Joaquin River and Tributaries Project, California (April 1959) at 2, paragraph 1-05; USACE, Standard Operation and Maintenance Manual Sacramento River Flood Control Project (May 1955) at 2, paragraph 1-05.
[3] U.S. Army Corps of Engineers, (April 1959) at 2, paragraph 1-05.
[4] *Id*.
[5] *Id*.

The United States Army Corps of Engineers (USACE, or "the Corps") is responsible for designing and constructing levees after design and construction plans have been submitted and authorized by the United States Congress. In 1936, the Federal Flood Control Act declared a national interest in flood damage prevention and established requirements for local cooperation. Essentially, a state or local agency could receive federal funds for constructing flood control improvement projects, but first they would be required to give assurances, satisfactory to USACE, that they would (a) provide without cost to the United States all lands, easements, and rights-of-way necessary for construction; (b) hold the United States free from damages due to the constructed works; and (c) maintain and operate all works after completion in accordance with regulations prescribed by the USACE.[6] In 1944, USACE issued regulations on operations and maintenance procedures for local flood control project maintainers.[7]

Following the promulgation of operation and maintenance regulations, USACE developed two manuals specific to the two major flood control projects in California's Central Valley involving extensive levee systems: the Sacramento River Flood Control Project and San Joaquin River and Tributaries Project. The two operations and maintenance (O&M) manuals provide requirements for all maintaining agencies that operate flood control units. The manuals, which date back to 1955 and 1959, allow "brush and small trees" on the waterside slope of levees "where desirable for the prevention of erosion and wave wash."[8] It seems that at that time USACE saw value, or at the very least did not recognize the danger of woody vegetation on levees, because when the State of California accepted responsibility from USACE for the Sacramento River Flood Control System in 1958 there was a substantial amount of mature trees and other vegetation present on the levee system.[9]

[6] Flood Control Act of 1936, Pub. L. No. 738, § 3 (June 26, 1936).
[7] 33 C.F.R. § 208.10 (1944).
[8] U.S. Army Corps of Engineers, (April 1959) at 12, paragraph 4-05(b)(1); U.S. Army Corps of Engineers, (May 1955) at 12, paragraph 4-05(b)(1).
[9] Dep't of Water Res. FloodSAFE Cal. The Corps' Vegetation Removal Policy: Jeopardizing National Public Safety (2012), <https://cwc.ca.gov/Documents/2012/03_March/March2012_Agenda_Item_13_Attachment_4_Vegetation%20White%20Paper.pdf>

Figure 1: 1955 Sacramento Levee[10]

These provisions remained in effect for decades, during which time woody vegetation was present, and at times, encouraged, by USACE and State and local maintainers. In 1996, Section 202(g) of the Water Resources Development Act directed the USACE to review their vegetation management guidelines. The law specifically mandated that USACE,

> "... examine current policies in view of the varied interests in providing flood control, preserving, protecting, and enhancing natural resources, protecting the rights of Native Americans pursuant to treaty and statute, and such other factors as the Secretary considers appropriate."[11]

In other words, USACE was ordered to consider multiple interests in updating the vegetation management guidelines, which include environmental protection as well as flood control.

[10] Photo of Sacramento River levees in 1955, prior to acceptance of the Sacramento River Flood Control System by the State of California in 1958; *Id*.
[11] Water Resources Development Act of 1996, Pub. L. No. 104-303 § 202(g)(1).

Additionally, USACE was directed to address regional variations in levee management and resource needs.[12]

In 2001, USACE issued Engineering Regulation 500-1-1 (ER 500-1-1), which allowed vegetation on levees when such vegetation would preserve, protect, and/or enhance natural resources, and/or protect the rights of Native Americans, while maintaining levee safety.[13] This vegetation was allowed where (1) the safety, structural integrity, and functionality of the levee was retained; (2) accessibility for inspection and flood fighting purposes was retained; (3) in the case of National Flood Insurance Program (NFIP) certified levees, the level of flood protection did not fall below that required for certification; and (4) the level of protection did not fall below the minimum permissible for PL 84-99 eligibility.[14]

In sum, prior to 2005, the USACE policy for vegetation on levees was generally supportive and allowed for regional considerations, so long as the structural integrity and functionality of the levee system was retained.

In 2006, following Hurricane Katrina and the New Orleans levee failures, the California governor declared a state of emergency for the California levee system. In May 2006, the governor signed into law AB 140, which granted $4 Billion in levee repair and flood control, and AB 142, which appropriated $500 million from the general fund to California Department of Water Resources (DWR) for levee evaluation and repair.[15] In November of 2006, Propositions 84 and 1E passed, to rebuild and repair California's most vulnerable flood control structures, protect homes and prevent loss of life from flood-related disasters, protect California's drinking water supply system by rebuilding delta levees vulnerable to earthquakes and storms, and generally fund flood control, natural resources, and park and conservation projects.[16] These funds have enabled FloodSAFE California (launched by California Department of Water

[12] Water Resources Development Act of 1996, Pub. L. No. 104-303 § 202(g)(3).
[13] U.S. Army Corps of Engineers, Engineering Regulation No. 500-1-1, § 5-22 (September, 2001).
[14] *Id*.
[15] Assemb. B. 140, 2006 (amending Pub. Res. Code § 5096.800 et. seq.); Assemb. B. 142, 2006, Chapter 34.
[16] Disaster Preparedness and Flood Prevention Bond Act of 2006 ("Proposition 84"), amending Pub. Res. Code § 75001 et. seq., provided $265 million to the Delta Levees Program, beginning in fiscal year 2007-08 through fiscal year 2012-13. The Safe Drinking Water Quality and Supply, Flood Control, River and Coastal Protection Bond Act of 2006 ("Proposition 1E"), amending Pub. Res. Code § 75001 et. seq. authorized over $320 million to Delta levees.

Resources [DWR]) to implement projects to improve public safety through integrated flood management.

Following the fallout from Hurricane Katrina, the realization that levee failure contributed to the national disaster, and increased national scrutiny for levee maintenance, USACE developed stringent nationwide policies. In February of 2007, USACE conducted a nationwide levee inspection, identifying maintenance deficiencies from woody vegetation. In April of 2007, the USACE released a White Paper, "Treatment of Vegetation with Local Flood-Damage-Reduction Systems," in essence stating that USACE intended to require substantial vegetation removal on levees.[17]

Prompted by the release of the USACE White Paper, levee vegetation experts from the Central Valley became alarmed at the proposal to remove substantial amounts of woody vegetation from California levees, due to potential safety and environmental consequences. These experts worried that vast woody vegetation removal would decrease levee safety and decimate critical habitat for threatened and endangered species. In order to attempt to gather the best available existing science on the subject, they convened a research Symposium, held in Sacramento in August 2007. This Symposium brought experts on woody vegetation from around the world to discuss benefits and dangers of woody vegetation on levees, dangers of removing a substantial amount of existing woody vegetation on levees, and associated environmental effects. Details on research presented in the 2007 Symposium are expounded in *Appendix 4: Science and Research*. A point of consensus that emerged from the discussion was the need for additional research to better assess the issues presented.

In August 2007, the California Levees Roundtable launched to analyze issues and interests associated with woody vegetation on levees. This was a collaborative group process formed by leadership of key federal, State, and local agencies with responsibility for federal flood control levees in the state of California. The roundtable included officials from USACE, DWR, the Central Valley Flood Protection Board (CVFPB), National Marine Fisheries Service (NMFS), U.S. Fish & Wildlife Service (USFWS), the California Department of Fish & Game (DFG), the

[17] CECW-CE, Draft Final White Paper: Treatment of Vegetation within Local Flood-Damage Reduction Systems (U.S. Army Corps of Engineers, April 20, 2007).

Federal Emergency Management Agency (FEMA), Reclamation District No. 2068, and the Sacramento Area Flood Control Agency (SAFCA). This roundtable attempted to work through competing opinions on potential dangers and benefits of woody vegetation on levees. One significant product of the Roundtable was California's Central Valley Flood System Improvement Framework of 2009 ("Roundtable Framework"), signed by all California levee roundtable participants.[18] Although initially involved, USACE withdrew from participating in the Roundtable following multiple lawsuits related to the release of their vegetation removal policies. Following their withdrawal, the remaining Roundtable participants voted to disband the group because USACE was such an integral component to discussions. Despite the group's disbandment, the Roundtable Framework persisted, representing a tentative, temporary cooperation between the participants before the group disbanded.

The Roundtable Framework provided short-term levee vegetation management guidelines for local levee sponsors and the State. If the State and local levee maintainers abided by these guidelines, they would be temporarily excused from needing to comply with the soon-to-be-released USACE vegetation removal requirements, while maintaining eligibility in important federal rehabilitation funding programs. This gave the State and local levee sponsors a brief grace period to come into compliance with USACE vegetation removal requirements, so long as they met interim vegetation management objectives.[19] The management objectives were based on DWR's Interim Levee Vegetation Inspection Criteria for Vegetation.[20] These requirements represented an approach to levee vegetation management, which avoided vast, widespread vegetation removal, but allowed for partial vegetation trimming and management for easier inspection access. Pursuant to this approach, vegetation would be trimmed and thinned on the landside slope and top twenty feet of the waterside slope, but allowed to grow on the lower waterside slope.[21] This approach eventually formed the foundation for the State's Levee Vegetation Management Strategy.

[18] California Levees Roundtable, California's Central Valley Flood System Improvement Framework (February 27, 2009).
[19] California Levees Roundtable (2009) at p 4-5.
[20] California Levees Roundtable (2009) at 5.
[21] Cal. Dept. of Water Resources, Interim Levee Vegetation Inspection Criteria (Fall 2007).

In 2008, California passed the Central Valley Flood Protection Act (CVFPA) of 2008 (commonly referred to as "SB 5"), which required DWR to prepare the 2012 Central Valley Flood Protection Plan (CVFPP). This prompted the state of California to assess and articulate its own stance on woody vegetation on levees. As such, the State invested in substantial research projects, such as helping fund and participate collaboratively in leading the California Levee Vegetation Research Program (CLVRP), discussed in greater detail below (See *Appendix 4: Science and Research*). The CVFPA of 2008 also established Urban Levee Design Criteria (ULDC), which requires urban levels of flood protection with a 0.5% chance of flood occurring in any given year ("1 in 200" or "200 year level"), using criteria consistent with or developed by DWR.

In April 2009, the USACE vegetation-free policy, first announced in the aforementioned 2007 USACE White Paper, was formally adopted. USACE issued the Engineering Technical Letter 1110-2-571 (ETL), establishing a uniform nationwide vegetation policy.[22] This policy established vegetation-free and root-free zones for levees throughout the entire country. The vegetation-free zone applied to all vegetation except for grass. The vegetation-free zone included all areas on the levee profile, plus an additional fifteen feet on both the landside and waterside of the levee toe.[23]

[22] U.S. Army Corps of Engineers, Engineering Technical Letter 1110-2-571 (April, 2009).
[23] U.S. Army Corps of Engineers, Engineering Technical Letter 1110-2-571 (April, 2009) *See* generally ch. 6.

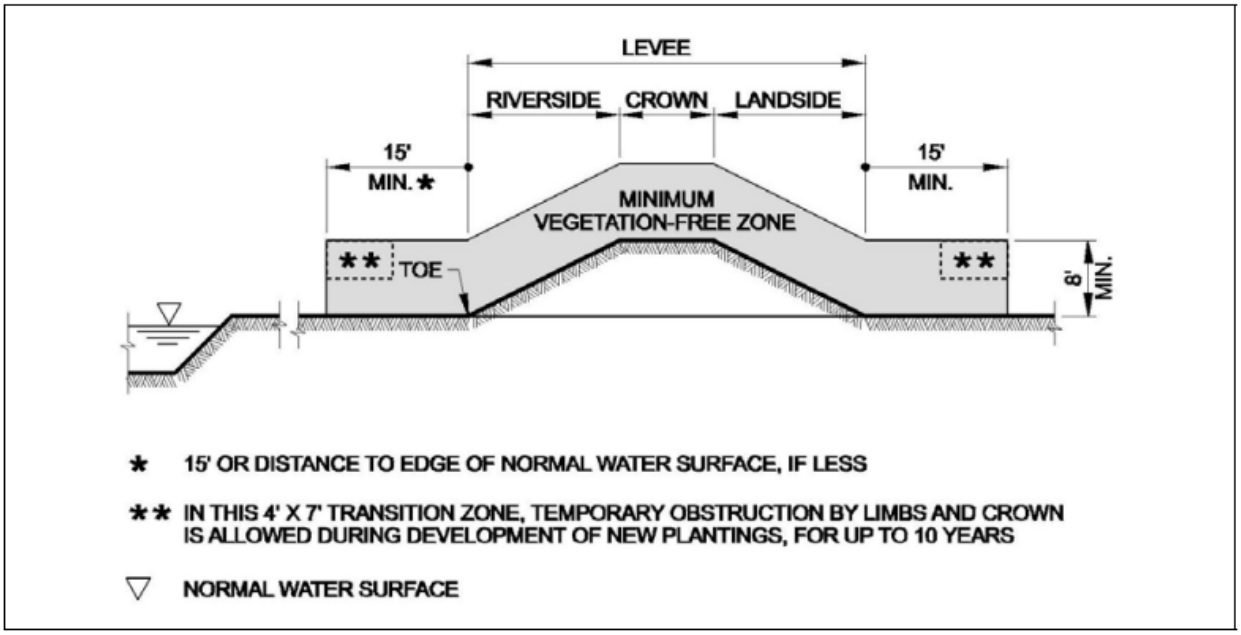

Figure 2: ETL Vegetation Free Zone[24]

The ETL applied to all levee systems under direct USACE control. Further, any levees maintained by the State or LMAs would be required to conform to the vegetation policy laid out in ETL 1110-2-571 in order to maintain eligibility under Public Law (PL) 84-99.[25] PL 84-99 provides federal funding for emergency management activities, and authorizes USACE to undertake emergency disaster preparedness, emergency operations during and after flood events, rehabilitation of flood control works threatened or destroyed by floods, emergency water provisions, and other federal emergency assistance during and after flood events.[26] Thus, if the State and LMAs wished to maintain eligibility for emergency rehabilitation relief following the promulgation of ETL 1110-2-571, they were required to comply with its vegetation-free zone requirements. The ETL may also apply in situations where other federal permits and approvals are sought through USACE, although to what extent is unclear. This will be explored in greater detail below.

[24] *Id*. at 6-1; U.S. Army Corps of Engineers, Engineering Technical Letter 1110-2-581 (April, 2014) at A-2
[25] U.S. Army Corps of Engineers, Engineering Technical Letter 1110-2-571 (April, 2009) at 1.
[26] U.S. Army Corps of Engineers, Rehabilitation Assistance for Non-Federal Flood Control Projects, Pub. Law 84-99 (October 2009).

In February of 2010, USACE issued a draft Policy Guidance Letter (PGL), describing a variance process from USACE vegetation management guidelines.[27] The PGL established basic requirements to obtain a variance, or exemption, from the ETL's vegetation removal requirements. If any nonfederal levee sponsor wished to maintain PL 84-99 eligibility and avoid removing all woody vegetation on levees under their control, they would need to comply with the PGL requirements. These requirements are situation-specific, and will be discussed in greater detail below (See *Appendix 1: Federal Laws and Policies*). In practice, levee maintainers seeking to apply for a variance through the PGL process have found it confusing, lengthy, expensive, and impractical. As such, very few successful variances have been granted by USACE for levee maintainers in California.

On April 15, 2010, DWR and California Department of Fish and Wildlife (DFW) submitted extensive comments on the ETL and PGL. The DFW and DWR comments mainly argued that the new USACE policies would reduce public safety in California, result in extensive and unnecessary environmental damage, and eliminate USACE responsibility to assist the State and LMAs in ensuring the integrity of the California levee system. The comments also posited that there would be unintended consequences of the ETL and PGL, stemming from an attempt to address complex technical, financial, legal and institutional problems with a highly prescriptive, one-size-fits-all approach to vegetation management.[28]

In December 2010, USACE issued a Literature Review, where the Engineer Research and Development Center (ERDC) branch of USACE reviewed existing literature on topics related to vegetation on levees.[29] This review provided information on potential impacts from woody vegetation on levees, and pointed to areas where more research was still needed. Based on their review, ERDC recommended that levee vegetation policies be supported by strong science and

[27] Policy Guidance Letter (PGL) -- Process for Requesting a Variance from Vegetation Standards for Levees and Floodwalls,75 Fed. Reg. 6364-68 (February 9, 2010).
[28] Letter from Cal. Dept. of Water Resources and Cal. Dept. of Fish and Game to U.S. Army Corps of Engineers (April 15, 2010). <http://www.water.ca.gov/floodsafe/leveeveg/levee_documents/2010-0415_DWRLetter_and_attachment.pdf >
[29] *Id*.

engineering principles, and that specific guidance for levee systems be provided and managed for based on site-specific ecosystem considerations.

In 2011, USACE proposed a System-Wide Improvement Framework Policy (SWIF).[30] The intent of the SWIF was for levee sponsors to collaboratively work with natural resource agencies and USACE to transition existing levees to USACE engineering standards, while maintaining PL 84-99 eligibility and adhering to the Endangered Species Act (ESA). Under this policy, if the State or LMA successfully develops a SWIF, and the USACE accepts it, then the State/LMA may focus its resources on pressing issues and immediate dangers to levees, deferring issues like vegetation management until more immediate problems have been resolved. This is commonly referred to as the "worst first" approach. Only levee sponsors who are, or have been eligible for the PL 84-99 program in the past may use the SWIF process to regain or maintain eligibility. The SWIF does not create an exemption from vegetation-free requirements, but rather gives the levee sponsors time to come into compliance and a means to divert limited resources to more pressing threats to levee integrity. However, a SWIF may be used in conjunction with a vegetation variance obtained via PGL requirements if the levee sponsor already has a vegetation variance in place.[31] The SWIF process can also help LMAs come into compliance with ESA mandates by providing a "federal nexus" for Section 7 purposes. This policy, its implementation and Section 7 implications will be discussed in greater detail below (See *Appendix 1: Federal Laws and Policies*).

In March of 2011, DWR distributed an internal technical memorandum on entitled, "Influence of Vegetation on Levee Past Performance—a Review of Historic Data Based on Levee Evaluation Program Database."[32] The memorandum summarized the results of a study, which reviewed over 10,000 records to identify levee breaches and causes of levee failure. Of the 348 records

[30] U.S. Army Corps of Engineers, Memorandum for Commanders, Major Subordinate Commands and Districts: Policy for Development and Implementation of System-Wide Improvement Frameworks (SWIFs) (November 29, 2011).
[31] U.S. Army Corps of Engineers, Memorandum for Commanders, Major Subordinate Commands and Districts: Policy for Development and Implementation of System-Wide Improvement Frameworks (SWIFs) (November 29, 2011) at 8 § (10).
[32] *Id*.

demonstrating levee breach from floodwater flowing to the landside of the levee, none identified vegetation as the cause of the breach.[33]

Shortly after the release of the DWR memorandum, also in 2011, USACE released the report, "Initial Research into the Effects of Woody Vegetation on Levees."[34] This report was developed by ERDC and summarized a two-year effort by ERDC to gain a better understanding of potential impacts of woody vegetation on levee performance. The report concluded that woody vegetation on levees may increase or decrease levee stability, depending on site specific factors. It also identified areas for future research. Following the release of the report, USACE made the policy decision to retain their vegetation-free requirements.[35] This reflects the USACE strategy of adopting a uniform, conservative approach to levee maintenance in the face of situation-specific results and general uncertainty over whether or not woody vegetation is beneficial or detrimental to levee integrity.

In 2012, DWR released the 2012 CVFPP. This comprehensive statewide planning document was adopted by the Central Valley Flood Protection Board (CVFPB) and is intended to guide California's management of flood risk along the Sacramento River and San Joaquin River systems. The 2012 CVFPP includes the State's vegetation management guidelines on levees, most commonly referred to as the Levee Vegetation Management Strategy (LVMS). Under this strategy, newly constructed levees must meet the guidelines of the ETL (vegetation-free zones) on the entirety of the levee. Newly constructed levees are rare, however, and most management considerations relate to woody vegetation on existing levees. For existing levees, woody vegetation on the lower waterside slope is generally retained and additional woody vegetation is allowed to grow. For this portion of the levee, woody vegetation is only removed when it poses an unacceptable threat to levee integrity. This is in part because vegetation on the lower

[33] Nadira Kabir, Fran Bean, Memorandum prepared for Cal. Dept. of Water Resources, Division of Flood Management: The Influence of Vegetation on Levee Past Performance – a Review of Historic Data Based on the Levee Evaluation Program Database (URS Corporation, March 23, 2011).
[34] Donald H. Gray, Douglas Shields, Jr., for the California Levee Vegetation Research Program Science Team, Presentation to on U.S. Army Corps of Engineers, Engineer Research & Development Center as reported by Corcoran et al., Review & Summary of: Initial Research into the Effects of Woody Vegetation on Levees Volumes I-IV (December 5, 2011).
<http://www.deltacouncil.ca.gov/sites/default/files/documents/files/PB_16Dec2011_CLVRP%20-%20ERDC%20Research%20Report%20Synopsis%20Final%20Dec%20%2005%202011.pdf >
[35] *Id.*

waterside slope of levees provides the most critical habitat to listed threatened and endangered species, and the greatest benefits to levee stability. Existing vegetation on the remainder of the levee prism is managed pursuant to "lifecycle management" or "LCM." Under LCM, existing vegetation (also referred to as "legacy" vegetation) on the landside and upper waterside slope of levees is to be trimmed for visibility and access, but not removed unless it poses a threat to the levee. Additional vegetation is not allowed to grow on this portion of the levee, and so routine inspections and maintenance to remove new growth is essential for LCM.[36] The CVFPP and LVMS will also be discussed in greater detail below (See *Appendix 2: California State Laws and Policies*).

Figure 3. State Levee Vegetation Management Strategy (LVMS)[37]

In February of 2012, USACE released another Draft Policy Guidance Letter: Process for Requesting a Variance from Vegetation Standards for Levees and Floodwalls (Revised PGL).[38] This updated the procedure for obtaining a variance from the ETL requirements, with the same applicability as the 2010 PGL. The Revised PGL differs from the first in that it requires any

[36] Mark W. Cowin, Gary B. Bardini, 2012 Central Valley Flood Protection Plan (Central Valley Flood Management Planning Program December, FloodSAFE Cal., 2011). *See* generally chapt. 4.
[37] Dep't of Water Resources, CVFPP Conservation Strategy Appendix D: Vegetation Management Strategy (July 2015) at D-5
[38] Policy Guidance Letter (PGL) – Process for Requesting a Variance from Vegetation Standards for Levees and Floodwalls, 77 Fed. Reg. 9637 (February, 2012).

scientific information regarding levee vegetation to be peer-reviewed and submitted to ERDC for evaluation.[39]

In August 2012, a second Levee Vegetation Research Symposium was convened in Sacramento, California. This symposium was a follow-up to the 2007 Symposium, and included many of the same researchers and policy-makers. The 2012 Symposium revisited questions left unanswered and targeted areas for further research identified in the 2007 Symposium. As such, the 2012 Symposium presented some of the latest research and models on levee vegetation from top scientists around the world.[40] Most of the research and models presented in the 2012 Symposium were later included in the CLVRP Synthesis Report, described in greater detail below.

On April 30, 2014, USACE issued another ETL, "ETL 1110-2-583, Guidelines for Landscape Planting and Vegetation Management at Levees, Floodwalls, Embankment Dams, and Appurtenant Structures."[41] ETL 1110-2-583 maintained similar requirements as ETL 1110-2-571, requiring vegetation-free zones on levees and extending fifteen feet on either side of the levee toe. There is little difference between ETL 1110-2-583 and ETL 1110-2-571 in applicability. However, ETL 1110-2-583 updated vegetation removal requirements with respect to PL 84-99 eligibility. The new ETL still requires vegetation free zones and vegetation removal on the entirety of the levee, and uses vegetation compliance as a factor for PL 84-99 eligibility analysis. However, if the State or LMA is only deficient in terms of levee vegetation removal requirements, they will not lose eligibility in the PL 84-99 program, as they would have under the terms of the previous ETL.

In 2014, Congress enacted and signed into law the Water Resources Reform and Development Act (WRRDA) of 2014, which, among other things, addressed the USACE's levee vegetation policy. One section of WRRDA 2014, Section 3013, required that the USACE carry out a comprehensive review of their vegetation policy, including the ETL and PGL, within eighteen months.[42] At the time of this paper, USACE has not complied with the terms of WRRDA 2014

[39] 77 Fed. Reg. 9637 (February, 2012) at § (12)(a).
[40] *See*, 2012 Levee Vegetation Symposium Overview, found here http://www.safca.org/symposium2012.htm
[41] U.S. Army Corps of Engineers, Engineering Technical Letter (ETL) 1110-2-583 (April, 2014).
[42] H.R. 3080, 113th Cong. (2014), § 3013.

and no review of the ETL and PGL has been completed.[43] Section 3013 directs USACE to consider regional variation while undergoing their review. Additionally, USACE must consider potential benefits vegetation may offer to levee safety and the environment, as well as dangers of removing mass amounts of woody vegetation on levees. Section 3013 further directs USACE to revisit their variance policy, set forth in the PGL, so as to make obtaining a variance more attainable based on site-specific environmental conditions. In undergoing this review, Section 3013 directs USACE to consult with representatives from State and federal agencies, local and tribal governments, nongovernmental organizations, and the public, as well as with independent engineering and environmental experts. Section 3013 further provides interim requirements to be applied while USACE undergoes the review process. These interim requirements preclude USACE from enforcing the ETL's vegetation-free policy, or from requiring ETL compliance from any state or local levee sponsor in order to obtain or maintain PL 84-99 eligibility. Rather, USACE may only require woody vegetation removal when it poses an unacceptable threat to levee integrity.

In March 2014, USACE released a Memorandum: Interim Policy for Determining Eligibility Status of Flood Risk Management Projects for Rehabilitation Program Pursuant to Public Law 84-99. This Memorandum described interim eligibility criteria to determine PL 84-99 eligibility while USACE undergoes its larger vegetation policy review. Pursuant to this interim policy, USACE still requires a root-free zone on the levee profile, but does not use vegetation presence as the determining factor for whether the levee in question is eligible for the PL 84-99 program. For more information on this policy see *Appendix 1: Federal Laws and Policies*. Given the above interim requirements, the Section 3013 interim requirements and USACE's failure to comply with the deadline set forth in Section 3013 of WRRDA 2014, State and local levee sponsors have expressed confusion and differing opinions as to the extent that USACE currently requires vegetation removal for PL 84-99 eligibility.

In July of 2014, USACE issued Engineering Circular (EC) 1165-2-216, clarifying the use and applicability of Rivers and Harbors Appropriation Act Permits (33 USC 408, or "Section

[43] Note, at the time of this paper (January 2017), 31 months have passed since the passage of WRRDA 2014 (H.R. 3080, 113th Cong. (2014)).

408").[44] Under the terms of Section 408, USACE can grant the authority of an applicant to alter a levee (or similar public works project), only if the applicant demonstrates that the alteration is in the public interest and does not impair the usefulness of the levee. USACE authority under Section 408 dates back to 1899, but USACE did not act on issuing or enforcing Section 408 until the issuance of the EC, which essentially breathed life back into the Section 408 program. Pursuant to the EC and Section 408 permission program, an applicant proposing to modify or alter a levee must meet current USACE design and construction standards, which arguably include the ETL's vegetation-free requirements. This could exacerbate vegetation-removal issues. State and local levee maintainers have voiced concerns over selective applicability of Section 408, arguing that the program is enforced for environmental conservation projects but not for agricultural projects. Levee maintainers have also voiced concerns that the Section 408 consultation process is lengthy and time consuming. (For more on Section 408, see *Appendix 1: Federal Laws and Policies*).

In March of 2016, the CLVRP issued the report, "Synthesis of Levee Vegetation Research Results."[45] This Synthesis Report compiled the most recent scientific research on levee vegetation issues from top experts around the world, with much of the report stemming from models and research presented at the 2012 Levee Vegetation Research Symposium. Results from the report will be discussed in greater detail below (See *Appendix 4: Science and Research*). Overall, the report reviewed research demonstrating that woody vegetation likely poses low risks to levee integrity for levees in California, due in part to California wind conditions and soil types. Further, current research indicates that woody vegetation presence can actually help slope stability in almost all conditions. However, more research is needed regarding potential effects that woody vegetation can have in terms of impairing visual inspections and floodfighting activities.

Thus, national tragedy led to greater attention and funding for California levee development and maintenance. However, with this greater attention also came an overly-conservative approach to

[44] U.S. Army Corps of Engineers, Policy and Procedural Guidance for Process to Alter U.S. Army Corps of Engineers Civil Works Pursuant to 33 USC 408, Engineer Circular No. 1165-2-216 (2015).
[45] Douglas Shields, Synthesis of Levee Vegetation Research Results (2007-2014), (cbec eco engineering, January 2016). <http://www.water.ca.gov/floodsafe/leveeveg/levee_documents/2016-0127-Levee-Veg-Synthesis-Report-FINAL.pdf>

levee maintenance from the federal government, especially regarding vegetation maintenance on levees. The result in California has been a federal policy that arguably oversimplifies levee vegetation management and potentially conflicts with State policy.

For an overview of major levee vegetation milestones in California, see *Attachment 1: Timeline of Federal and State Policies Regarding Levee Vegetation Management in California*. For greater details on federal policies, State policies, science and research, and case law, see Appendixes 1 through 4, respectively.

PART II: Issues Associated with Vegetation Removal Requirements

Strict conformance with USACE vegetation removal requirements would have negative consequences for the natural environment. Total removal of woody vegetation from California levees would eliminate the last remaining critical habitat for endangered fish species, and in so doing, contradicts the ESA. Furthermore, conformance with vegetation removal requirements could have real safety consequences for those in flood risk communities. Spending time and money removing vegetation from levees could unnecessarily divert limited funds from other, more pressing levee safety projects. Further, complete compliance with USACE vegetation free guidelines and total vegetation removal would very likely directly contribute to slope instability, making levees less safe overall, increasing risk to life and property.

USACE vegetation removal requirements could also differ from California's Levee Vegetation Management Strategy, although State policymakers generally view the two as operationally compatible within the context of risk prioritization. The dichotomy between federal and State policies is nuanced and can be very confusing and difficult for local levee maintainers to understand, and unfortunately the uncertainty and confusion does not end there. Although presently vegetation removal will not in and of itself preclude levee maintainers from PL 84-99 eligibility, the full extent of vegetation removal requirements and consequences of not doing so are poorly understood. Significant confusion surrounds the issues of whether and to what extent vegetation removal is required for PL 84-99 eligibility. Further, despite WRRDA 2014 mandates that USACE not require total vegetation removal for PL 84-99 eligibility, WRRDA 2014 interim requirements have created unintended consequences of incentivizing total vegetation removal, or

else placing the burden on levee maintainers to demonstrate that any particular tree does not pose a risk to levee integrity.

Finally, complying with vegetation removal requirements is cost prohibitive for most local levee maintainers. If local maintainers wish to pursue a variance from vegetation removal requirements, they are similarly met with confusing, time consuming and expensive variance requirements, making obtaining a variance impractical in most areas.

1. *Vegetation Removal Effects on the Natural Environment*

Levee vegetation provides numerous benefits to California's natural environment, including critical habitat for ESA listed species. These benefits would be lost from strict adherence to the USACE vegetation-free policy. Further, strict adherence to this policy would violate the ESA.

California is unique in that the levee system contains almost all of the last three to five percent of riparian forest that was once present along Central Valley river corridors.[46] Due to the location and close alignment of Central Valley levees, they essentially form the riverbank and provide hundreds of miles of habitat for anadromous fish species. Thus, California's Central Valley levees serve two purposes: public safety, and designated critical habitat for listed threatened and endangered species. If vegetation were removed from Central Valley levees, this designated critical habitat would be entirely lost. Such widespread loss of designated critical habitat would strongly threaten the survival of already imperiled species.

Levees in California are unique for a variety of reasons. Most notably, they were constructed very close to flood channels to facilitate scour of hydraulic mining debris during the Gold Rush. Building levees to narrowly confine the river system also took advantage of California topography and maximized the land available for agriculture. This has ultimately disrupted natural functioning floodplains, separated rivers from their natural processes, and removed fish species from their natural riparian habitat. Salmonids historically used floodplain habitat for

[46] Cal. Dept. of Water Resources, Draft Central Valley Flood System Conservation Strategy (January 2015); National Oceanic and Atmospheric Administration Fisheries, West Coast Region, Central Valley Chinook Salmon & Steelhead Recovery Plan (Summer 2014); < http://www.westcoast.fisheries.noaa.gov/publications/recovery_planning/salmon_steelhead/domains/california_central_valley/cv_chin_stlhd_r_plan_fs_071614.pdf>

rearing; for cover in the summer months and side-channel and pond habitats in the winter months; for spawning; as shallow habitat with cover to escape from predators; as providing high abundance of food sources; as a slow-water refuge for juvenile salmon to avoid high river flows, allowing them to conserve energy for their ocean migration; as a filtration source for excess nutrients; as storage for excess sediment; and as an exchange of nutrients and organic material between land and water, increasing habitat complexity with food sources and large woody debris.[47] Because floodplains are so important to salmonid survival, the NMFS Recovery Plan points to the loss of floodplains and construction of "armored" banks[48] as a major contributor to the decline of endangered salmonids.

Riparian habitat in the Central Valley has also been adversely affected by other stressors including: human settlement, historical and current land use, nonnative species invasions, water diversions, flood management, dam construction, hydropower management, and other major modifications to natural watershed conditions.[49] This has resulted in impaired ecosystem processes; eliminated, fragmented, and degraded habitats; and declining native species populations.[50]

The elimination of natural floodplains and flood basin ecosystems and removal of extensive areas of wetland and riparian habitat has had drastic consequences. Overall there is less diversity, abundance and distribution of natural plant and animal species in the Central Valley, the remaining habitat is degraded, and this has all contributed to the extinction or extirpation of several species, and endangerment of others.[51] Approximately 95 percent of historical wetlands

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[47] National Marine Fisheries Service Fisheries West Coast Region, The Importance of Healthy Floodplains to Pacific Salmon & Steelhead (Spring 2014) < http://www.westcoast.fisheries.noaa.gov/publications/habitat/fact_sheets/floodplains_fact_sheet_031114.pdf> (last visited August 19, 2016).

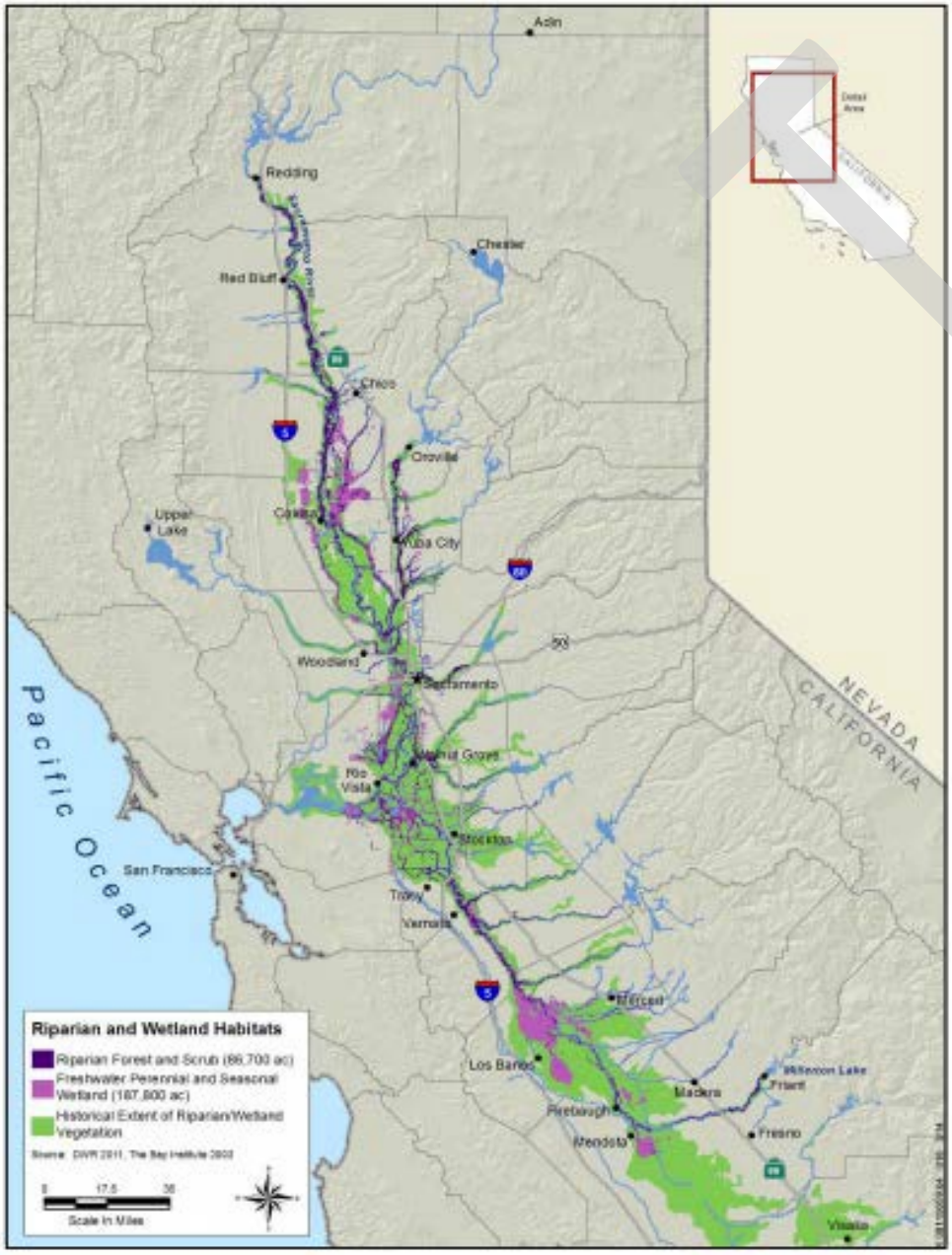
[48] "Armored" banks generally refers to the practice of removing vegetation along river banks in favor of rock-covered or "riprap" slopes.

[49] Cal. Dept. of Water Resources, Draft Central Valley Flood System Conservation Strategy (January 2015); National Oceanic and Atmospheric Administration Fisheries, West Coast Region, Central Valley Chinook Salmon & Steelhead Recovery Plan (Summer 2014); < http://www.westcoast.fisheries.noaa.gov/publications/recovery_planning/salmon_steelhead/domains/california_central_valley/cv_chin_stlhd_r_plan_fs_071614.pdf>

[50] *Id*.

[51] Cal. Dept. of Water Resources, Draft Central Valley Flood System Conservation Strategy (January 2015).

and riparian habitats no longer exist in the Sacramento and San Joaquin Valleys.[52] Figure 4 shows the current extent of riparian forest and scrub (dark purple), freshwater perennial and seasonal wetland (pink) and the historical extent of riparian/wetland vegetation (green).



[52] *Id*.

Figure 4: Historical and Existing Distribution of Riparian and Wetland Vegetation[53]

Much of the remaining wetlands in the Central Valley are managed habitat, located in federal and State wildlife areas, or on private duck clubs, and most of these are not directly connected to rivers. The remaining riparian habitat in the Central Valley (56,000 acres) is highly fragmented or occurs as narrow strips along the waterway.[54]

Figure 5: Representative Photograph of Remnant Riparian Habitat along the Sacramento River[55]

This fragmentation and reduction in wetlands and riparian forest has caused a reduction in the abundance and number of fish and wildlife species. More than 16 animal species associated with floodplain and flood basin habitats of the Sacramento and San Joaquin Valleys are now listed

[53] Cal. Dept. of Water Resources, Draft Central Valley Flood System Conservation Strategy, Figure 2-3 at 2-5 (November, 2016).
[54] Cal. Dept. of Water Resources, Draft Central Valley Flood System Conservation Strategy (January 2015).
[55] Cal. Dept. of Water Resources, Draft Central Valley Flood System Conservation Strategy, Figure 2-4a at 2-6 (November, 2016).

under California Endangered Species Act (CESA) or ESA, and 22 other animal species dependent on floodplain habitats are considered sensitive species.[56]

Anadromous and other native fish species have especially suffered, as their habitat connectivity, quantity and quality has been greatly reduced or degraded.[57] At one point, millions of wild salmon returned from the sea every year to spawn in the foothills and mountains of California's Central Valley.[58] Natural streams provided habitat for a diversity and abundance of Chinook salmon and steelhead. By the 1990s, three of the Central Valley's native anadromous fish populations were close to extinction and thus listed under the federal ESA: Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, and Central Valley steelhead. Today, only a few historic populations of these iconic fish remain.[59]

Dams block Chinook salmon and steelhead from over 90 percent of their historical spawning habitat in the Central Valley.[60] Additionally, 98 percent of historical riparian and floodplain habitat is no longer available to support healthy fish runs.[61] The little remaining habitat overlaps almost entirely with rivers surrounded by levees.

[56] Cal. Dept. of Water Resources, Draft Central Valley Flood System Conservation Strategy (January 2015); Cal. Dept. of Fish and Game (2011) Appendix G, Identification of Target Species and Focused Conservation Plans.
[57] Cal. Dept. of Water Resources, Draft Central Valley Flood System Conservation Strategy (January 2015);
[58] National Oceanic and Atmospheric Administration Fisheries, West Coast Region, Central Valley Chinook Salmon & Steelhead Recovery Plan (Summer 2014); < http://www.westcoast.fisheries.noaa.gov/publications/recovery_planning/salmon_steelhead/domains/california_central_valley/cv_chin_stlhd_r_plan_fs_071614.pdf>
[59] *Id*.
[60] *Id*.
[61] *Id*.

Figure 6. Historical and Existing Chinook Salmon Rearing Habitat[62]

Salmonids require instream large woody material (LWM) in river channels and shaded riverine aquatic (SRA) cover along channels. However, LWM and SRA have dramatically diminished in the past century, mainly due to the loss of natural riverbanks and riparian vegetation along riverbanks of the Sacramento and San Joaquin Rivers and their tributaries. LWM generally refers to logs or other woody material over four inches in diameter and more than six feet long, lying in the river or stream channel.[63] LWM provides valuable cover and resting habitat for fish, but as riparian forests have declined around river corridors, so has LWM. SRA is found at the interface between river corridors and adjacent woody riparian areas where, "natural banks support overhanging vegetation and provide inputs of woody debris, falling insects, and other foods for aquatic species, and create variable velocities, depths, and flows."[64] Revetment projects, including levees, have eliminated much of the high-value SRA cover along the banks of the Sacramento and San Joaquin River systems. Current data show that the amount of high-quality

[62] Cal. Dept. of Water Resources, Draft Central Valley Flood System Conservation Strategy, Figure 2-2 at 2-3 (November, 2016).
[63] Cal. Dept. of Water Resources, Draft Central Valley Flood System Conservation Strategy (January 2015).
[64] *Id*.

SRA cover along Central Valley riverbanks represents only a small fraction of what was present historically.[65]

Spawning salmon are also affected by the flood system in terms of spawning habitat and pebble size. Spawning salmon need gravel with small to moderate pebble sizes. In a natural flood system, river flows regularly replenish sources of sediment, but in the current system, gravel beds quickly degrade. This is due to altered water flows as well as dams, which hold back gravel from flowing downstream and replacing gravel that has been lost over time. Large pebbles remain while small ones wash away, and new gravel does not recruit in the streambed. The current flood control system has ultimately resulted in serious degradation of salmon spawning habitat in Central Valley rivers.[66]

Overall, endangered fish habitat in the Central Valley is now reduced to its very last remnants, and these few remaining remnants are a poor substitute for natural riparian forests and floodplains. The little residual riparian habitat falls almost completely within our flood management system. Almost all of the only remaining SRA and LWM, vital to the survival of these fish species, is contained on levees. Thus, levees do not merely act to protect people and property from flood events, but they contain the little remaining habitat necessary for the survival of ESA-listed species. If Central Valley levees conformed to USACE guidelines and contained no vegetation on the entirety of the levee plus fifteen feet on each side, we would degrade designated critical fish habitat and remove important ecosystem functions vegetation provides for ESA-listed species.

2. *Vegetation Removal and the Endangered Species Act*

The USACE policy requiring vegetation-free zones on levees could potentially violate the federal ESA. Per Section 7 of the ESA, all federal agencies are required to undergo consultation with FWS and/or NMFS prior to taking an action that may affect an ESA listed species. (For more details on the ESA, see *Appendix 1: Federal Laws and Policies)*. So long as the "Action Agency" (the federal agency undertaking the action) successfully undergoes this consultation

[65] *Id*.
[66] *Id*.

process, the permit applicant will be legally protected from any incidental take that may arise as part of the project. However, the permitted action cannot jeopardize the continued existence of the listed species or destroy or adversely modify designated critical habitat.

As discussed in the above section, complete compliance with the USACE policy by all levee maintainers would cause the extensive destruction of designated critical habitat and would jeopardize the continued existence of several ESA-listed fish species. In the case of such projects, the permit applicant and action agency typically come up with "reasonable and prudent alternatives" (RPAs), which are economically and technologically feasible for the action agency, but which do not jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat. However, for endangered Chinook salmon and steelhead, there is little to offer in terms of RPAs, because there is no way to simply move the project to an area where listed species and their habitat will not be affected. This is because of the extremely limited remaining critical habitat available to support healthy fish runs (see discussion above). ESA Section 7 applicants currently try to resolve this conflict between the ESA and USACE policy on a case-by-case, literal "tree-by-tree basis" but a higher level solution is desperately needed so as to avoid further fragmentation of remaining critical fish habitat.

Absent an action by a federal agency (generally referred to as a "federal nexus," triggering ESA Section 7) there is an even higher likelihood of a local levee sponsor violating the terms of the ESA. Section 9 of the ESA prohibits all actors, including private citizens, from engaging in "take" of a listed species. "Take" can mean many things per the ESA definition, including harming or killing the species, or destroying critical habitat. If a State or local maintainer attempts to remove vegetation from levees in order to comply with USACE vegetation-free policies, then they would essentially be removing critical endangered fish habitat, and in direct violation of the ESA. Absent a federal nexus, local agencies are barred from engaging in consultation under ESA Section 7 and developing RPAs. This leaves local maintainers vulnerable to ESA Section 9 violations with no opportunities to exempt their actions. This is extremely problematic for local maintainers. More information on the ESA is included in *Appendix 1: Federal Laws and Policies.*

3. *Safety Issues Associated with Vegetation Removal*

a. *Conformance with Vegetation Removal Requirements could Hinder LMAs from Completing Other Levee Safety Projects*

California levees are in large need of repair. Of the levees contained in the SPFC area, there are about 300 miles of "urban" levees, or levees protecting urban areas with high human population levels.[67] Of those urban levees, about half do not meet current engineering design criteria set by both USACE and DWR.[68]

Of the 1,230 miles of nonurban SPFC levees, about sixty percent have a "high potential for failure" at the assessment water surface elevation.[69] Of the approximately 1,016 miles of SPFC channels evaluated, about half have potentially inadequate capacity to convey design flows, and require additional evaluation to assess conditions.[70]

Given the large need for systemwide levee repair in California, as well as limited funding and resources, many advocate that prioritizing vegetation is a misuse of government resources. The theory is that, given the dispute over whether woody vegetation poses any threat to the structural integrity of levees, and given the numerous hazards that clearly pose threats to levee integrity, resources should be allocated to the worst threats first. The State of California has repeatedly voiced this opinion.

Following the initial release of USACE's vegetation-free policies, DWR publically criticized the policy, primarily based on the above concern. DWR argued that there was an increasing sense of urgency as climate patterns continue to change, the California water-supply system is stressed, and the Delta is threatened with intensified flood risk from extreme weather events due to climate change.[71] Because of these threats, they argued that there was an immediate and

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[67] Where "urban area" means "any contiguous area in which more than 10,000 residents are protected by project levees." (Cal. Pub. Resources Code § 5096.805(k)).
[68] 2012 Central Valley Flood Protection Plan at 1-12. Engineering and design criteria are based off the USACE Engineering Manual, *Design and Construction of Levees Engineering Manual 1110-2-1913*, (2010); and DWR manual, *Interim Levee Design Criteria for Urban and Urbanizing Areas in the Sacramento Valley, Version 4*, (2010).
[69] *Id*. at 1-12
[70] *Id*. at 1-14. (Note, these figures are based off of the 2012 CVFPP, released in December, 2011).
[71] Dep't of Water Res. FloodSAFE Cal. The Corps' Vegetation Removal Policy: Jeopardizing National Public Safety (2012),

imperative need to update California levees, but focusing on vegetation was distracting from real threats that can be fixed. A letter set forth by DWR in response to USACE vegetation removal policies states,

> "The Corps' new approach to managing vegetation impairs our collective ability to improve public safety by diverting significant funds from more important repairs and improvements, increases the likelihood of erosion in some areas, and already is delaying important and much needed repairs and improvements."[72]

This view is shared by many policymakers in California, including Congresswoman Doris O. Matsui, who spoke at the 2012 Levee Research Symposium. The Congresswoman stated her concerns with the USACE vegetation removal policy as follows:

> "[USACE's vegetation removal policy] could force thousands of trees to be pulled out and the levees to be rebuilt. This would result in the loss of shaded habitat for both aquatic and terrestrial species. But most importantly to me, in a time of shrinking federal, state, and local budgets, it could lead us down a path that makes levee improvements too costly to implement. It very likely could divert our attention away from necessary levee fixes to secondary issues that, while important, are not nearly as pressing."[73]

Thus, State maintainers and policymakers voiced strong concerns that uniform enforcement of vegetation removal requirements unnecessarily diverts funds and prevents other necessary levee repair projects from moving forward.

Local maintainers have also voiced concerns that complying with vegetation removal requirements is infeasible because it conflicts with State and other federal laws. As part of

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<https://cwc.ca.gov/Documents/2012/03_March/March2012_Agenda_Item_13_Attachment_4_Vegetation%20White%20Paper.pdf>

[72] Dep't of Water Res. FloodSAFE Cal. The Corps' Vegetation Removal Policy: Jeopardizing National Public Safety (2012), <https://cwc.ca.gov/Documents/2012/03_March/March2012_Agenda_Item_13_Attachment_4_Vegetation%20White%20Paper.pdf>

[73] Congresswoman Doris O. Matsui, Fifth Congressional District of CA, US House of Representatives, Welcome Address (August 28, 2012); Transcript found here: <http://www.safca.org/symposium_2012_documents/2012_Symposium_Matsui_Transcript.pdf> (last visited August 2016).

Roundtable discussions, participants "on all sides of the issues" mentioned that some significant projects were suspended because they "have not been able to find an acceptable project design that will simultaneously meet the [USACE] vegetation standards and the resources agencies' environmental permitting requirements."[74] This exemplifies one enormous problem with the current regulatory landscape: levees are in dire need of maintenance and repairs, but maintainers are unable to act for fear of violating one policy or another.

b. Complying with Vegetation Removal Policies could Decrease Less Safety

Recent studies suggest that removing woody vegetation from levees may not improve levee stability at all, and in some cases actually decreases levee safety. This indicates that USACE's vegetation policy should be reversed, because removing vegetation may make levee systems more vulnerable to flood events, risking life and property.

The most recent and most pertinent research on levee vegetation has been conducted in the past few years, and has been summarized into a comprehensive report released by CLVRP in January of 2016 (the Synthesis Report, referenced and described in greater detail in *Appendix 4: Science and Research*). As a result of this research we now have a better understanding than ever before as to the real threats posed by woody vegetation on levees.

As compared to known major threats like seismic activity and burrowing animals, risks posed by woody vegetation are generally less significant. The research has shown that the threat of tree overturn due to windthrow is less likely to occur in the Central Valley, as California winds do not frequently meet the level required to overturn large enough trees to compromise levee integrity. The research has also shown that, given the sandy soil types found in many Central Valley levees, there is little risk of decaying roots causing piping and erosion in levees. Woody vegetation appears to discourage most burrowing mammal activity, which could result in safer levees. Further, woody vegetation has been shown in some cases to provide benefits to levee integrity in terms of mitigating the effects of water erosion and promoting slope stability.

[74] Laura Kaplan, Final Roundtable Assessment Report (August 30, 2011), at 13.

However, there are few studies of the risks that vegetation can pose to maintenance and floodfighting activities, and this is an area where greater research is needed.

The Synthesis Report included research demonstrating that mass clearing or cutting of woody vegetation could have deleterious effects on levee slopes and must be done very carefully, if at all. This is because generally, if one tree dies or is cut, decaying roots are quickly replaced by nearby live tree roots, given the opportunistic nature of tree root growth. However, tree cutting on a massive scale leaves the rotting roots in the ground with no live roots to replace them, and can create the potential for seepage. Thus, mass clear cutting of trees and other woody vegetation, as prescribed in the vegetation-free policy can threaten levee integrity. Research and models regarding levee vegetation, including the Synthesis Report, are discussed in greater detail in *Appendix 4: Science and Research.*

NMFS, as well as State and local agencies, have advocated for reversal in the USACE anti-vegetation policy because requiring the vast removal of woody vegetation on levees could decrease levee safety, putting lives and property at risk.

4. *USACE Vegetation Removal Policy and State Policy*

Another significant reason for bringing greater attention to this issue is the fact that, as they currently stand, the USACE and State policies regarding levee vegetation are arguably in contradiction, although the full extent of contradiction between the policies remains a contested issue. Following the release of USACE vegetation-free policies, the State argued strongly against them, citing above issues of risk prioritization, limited funding, safety issues and environmental consequences. The State has since reduced the degree of their critique, noting that their own vegetation management policies can be compatible with USACE vegetation-free requirements. While the State views federal policies and their own policies as potentially compatible, an objective review and analysis of the policies can indicate otherwise. The guiding State document for levee management in California is the 2012 CVFPP (described in greater detail in *Appendix 2: California State Laws and Policies*, including its applicability to State and local levee sponsors). The 2012 CVFPP includes the State's Levee Vegetation Management Strategy (LVMS), described in greater detail above, as well as in *Appendix 2: California State Laws and*

Policies. The LVMS generally allows additional vegetation recruitment on the lower waterside slope of existing levees, and for existing vegetation to remain on all other portions of the levee prism, subject to maintenance requirements.

Pursuant to LVMS, newly constructed levees shall meet USACE vegetation-free requirements. For existing levees, however, it is difficult to reconcile State and federal vegetation policies. LVMS presumes woody vegetation retention on most parts of the levee prism with additional recruitment on the lower waterside slope, while USACE policy does not. The 2012 CVFPP attempted to reconcile the policies by stating,

> "Compatibility between the State levee vegetation management strategy and USACE vegetation policy is *potentially achievable* when framed in the following context:
>
> - Through long-term implementation of [LCM] on the landside slope, crown, and upper waterside slope of SPFC levees, the CVFPP levee vegetation management strategy will gradually (over a period of decades) result in levees clear of woody vegetation, consistent with USACE vegetation policy, except for lower waterside vegetation--which is mostly the same part of the levee where USACE has indicated that variances can be appropriate."[75]

(Emphasis added). Thus, through the LVMS, which includes LCM, State and federal policies could potentially be reconciled. The State assumes reconciliation through variance approval and the passage of time. However, this assumes the passage of many decades, allowing most of the vegetation on existing levees (except for the lower waterside slope) to die off. Given the fact that only a few years have passed since DWR's implementation of LCM, this potentially achievable situation may theoretically come to pass years down the road, but likely not in the near future. This also assumes a successful variance from USACE for retention and additional recruitment of vegetation on the lower waterside levee slope. However, realistically obtaining a successful vegetation variance from USACE is unlikely due to the time-consuming and cost-prohibitive nature of the variance approval process, which will be discussed in more detail below.

[75] *Id*. at 4-16.

The State has also voiced compatibility between federal and State policies based on a shared view of risk prioritization. The State's LVMS allocates resources first to pressing issues such as seepage, erosion, and slope failure, and then focuses resources on vegetation removal compliance. Similarly, USACE's SWIF (mentioned above, and described in detail *in Appendix 1: Federal Laws and Policies*) would prioritize limited resources by allocating funds to the most pressing threats to levee integrity first, addressing issues such as vegetation once more pressing threats have been addressed. However, there remain inconsistencies in key aspects of State and federal policies. While the SWIF would allocate limited resources to problems other than levee vegetation first, it would still require eventual vegetation removal. Contrastingly, the LVMS allows retention of existing vegetation on existing levee slopes, and allows additional recruitment of new vegetation on the lower waterside slope of the levee prism. Even assuming eventual die off of legacy vegetation, the LVMS still retains and allows additional recruitment of woody vegetation on the lower waterside levee slope. USACE allows retention of this vegetation only if a variance has been approved, and this rarely happens for a variety of reasons which will be discussed in greater detail below. Although there have been efforts by the State to argue compatibility between State and federal vegetation management policies, there remain clear distinctions and conflicting mandates between the two.

The conflicting federal and State policies should be alarming for many reasons. First, this creates uncertainty for LMAs, especially those that are part of the SPFC and subject to State regulations, but that also seek eligibility in federal programs like PL 83-99. Many of these LMAs are essentially stuck, and have no option but to violate one regulation or another, or else seek expensive and time-consuming variances.

5. *USACE Vegetation Policy Implications for PL 84-99 Eligibility*

The USACE PL 84-99 program is a federal rehabilitation assistance program designed to provide federal aid in the event of flooding. Greater details on the PL 84-99 program can be found in *Appendix 1: Federal Laws and Policies*. WRRDA 2014 (also discussed in detail in *Appendix 1: Federal Laws Policies*), and two California District court orders (discussed in greater detail in *Appendix 3: Case Law*) directed USACE to revisit and reissue vegetation management guidelines on levees. To date, USACE has failed to do so within the timeframe provided by

WRRDA 2014, and the result has been confusion as to what the current USACE standards are. Section 3013 of WRRDA 2014 explicitly states that in the "interim," or while USACE undergoes the activity of revisiting and reissuing their vegetation guidelines, they cannot require State or local entities to remove vegetation per ETL requirements in order to gain or maintain PL 84-99 eligibility. Hence, currently USACE may not eliminate State or local maintaining agencies from the PL 84-99 program due to vegetation nonconformance, nor may they deny a State or local agency eligibility into the PL 84-99 program based on vegetation issues. However, there is much confusion on what USACE is requiring in terms of vegetation management during this "interim" period, and asking local maintainers will yield different answers with regard to USACE vegetation requirements.

The USACE-issued interim guidance from March 2014 attempts to clarify USACE's stance on the issue of vegetation conformance for PL 84-99 eligibility. This interim guidance is only intended to be temporary while USACE undergoes the process of issuing new formal vegetation policies. The guidance reflects the mandate of WRRDA 2014, Section 3013, stating that vegetation management may not be the determining factor for PL 84-99 eligibility during this interim period (while USACE undergoes its larger vegetation policy update). ETL 1110-2-583, issued in April 2014, provides additional details on this interim policy. ETL 1110-2-583 mirrors the previously released policy of ETL 1110-2-571 and requires vegetation free zones on the entirety of the levee, plus fifteen feet on either side of the levee toe. ETL 1110-2-583 includes vegetation compliance as a factor for PL 84-99 eligibility analysis, but if the State or LMA is only deficient in terms of levee vegetation removal requirements, the State or LMA will not lose eligibility in the PL 84-99 program. This differs from the previously released policy of ETL 1110-2-571, which stated that the State and LMAs must conform to vegetation-free requirements, or obtain a variance, in order to maintain PL 84-99 eligibility.

It should be noted that although vegetation is not a factor that will, in and of itself, determine PL 84-99 eligibility status, it is still a factor considered and analyzed in determining PL 84-99 eligibility. Thus, local agencies may view vegetation removal as a requirement for PL 84-99 eligibility, whether or not that is USACE intent. Further, although ETL 1110-2-583 precludes ineligibility from the PL 84-99 program based on vegetation nonconformance alone, ETL 1110-2-583 nevertheless lists detailed vegetation removal requirements. Because detailed procedures

for vegetation removal requirements are included in the guidance itself, some view vegetation removal as an informal requirement for federal programs.

The confusion over whether or not vegetation removal is actually required for PL 84-99 eligibility, and if so, to what extent, is problematic for State and local maintainers, especially in rural and agricultural areas, who may already be disillusioned with the PL 84-99 program. Many of the rural-agricultural LMA's have foregone PL 84-99 eligibility by choice in recent years, citing limitations in its usefulness. Limitations of the program expounded by rural-agricultural LMAs include the fact that rehabilitation projects must be economically justified with a benefit-to-cost ratio of 1.0 or greater to justify federal involvement. In rural-agricultural areas in the Central Valley, this requirement can be difficult to achieve.[76] LMAs may also point to the fact that funding for PL 84-99 rehabilitation assistance is generally very limited and funding for significant damage repairs usually also require special appropriation by Congress.[77] Further, there is no mechanism to obtain reimbursement or credit when a nonfederal sponsor performs repairs, or pays USACE to perform repairs.[78] Most notably for the context of woody vegetation issues, LMAs find the increasingly stringent USACE maintenance requirements, including the expensive and confusing requirements for encroachment and vegetation removal, difficult to meet and unaffordable. Therefore, many rural-agricultural LMAs have concluded that it is in their better interest to decline involvement in the PL 84-99 program, rather than work with USACE to obtain PL 84-99 eligibility.

This is problematic in that LMAs, especially rural and agricultural LMAs, generally lack funding necessary to undergo emergency floodfighting and rehabilitation projects following a major flood event. Lack of clarity or certainty concerning woody vegetation requirements, as well as the expensive cost of implementing vast woody vegetation removal projects, have all contributed to LMA withdrawal from the PL 84-99 program, demonstrating the severe need for reconciliation and clarity on the levee vegetation issue.

[76] *Id*. at 3-28.
[77] *Id*. at 3-28.
[78] *Id*. at 3-28.

6. *Unintended consequences in the WRRDA 2014 Interim*

Another problem with the current system of dealing with levee vegetation lies in unintended consequences from WRRDA 2014 requirements. Section 3013 of WRRDA 2014 requires that in the "interim" period, or until such time a USACE revisits and reissues vegetation-removal guidelines and variance guidelines (i.e., the ETL and PGL), they may not require the removal of existing vegetation on levees by any State or local maintainer, unless that vegetation poses an unacceptable threat to the integrity of the levee. In other words, as it now stands, USACE may not require vegetation removal by State maintainers or LMAs in order to gain acceptance into any federal program (i.e., PL 84-99 rehabilitation assistance), but USACE may require vegetation removal if they demonstrate that the vegetation in question poses an unacceptable threat to the levee.

Theoretically, based on the above guidelines the presumption should be to maintain vegetation on levees and removal should only be required where vegetation is proven to pose a threat. However, in practice, there are no impartial guidelines in place to determine which trees pose an actual threat to levee integrity. Instead, it often comes down to a lengthy and contentious tree-by-tree analysis where the burden is placed on maintainers to demonstrate that existing vegetation does not pose a risk to levee integrity. If maintainers wish to avoid this lengthy analysis, they can instead assume that all trees pose a threat to levee integrity by the nature of their existence on the levee prism. Thus, maintainers are incentivized to engage in circular analysis and presuppose that woody vegetation always poses a threat to levee integrity.

NMFS officials report seeing instances of such circular analysis, where the applicant demonstrates that trees must be removed from the riparian corridor because their roots exist on the levee prism, and without additional justification for their removal. The presumption of removal of critical habitat without additional justification is problematic for many reasons, including that it lacks the scientific analysis required by the ESA. The ESA confers a statutory obligation on federal agencies to use the best available science in undergoing analysis. Assumptions and assertions that trees must be removed because they exist clearly lacks any scientific analysis, let alone the best available science required per the ESA.

In addition to violating the ESA's best available science mandate, mass tree removal resulting from this perverse incentive also has dramatic consequences for the environment and levee safety. Environmental and safety consequences of mass tree removal from levees are described in more detail above.

The status quo incentivizes levee maintainers to determine that all trees pose an unacceptable threat to levee integrity with little science to back up that assertion. This is problematic because even though levee maintainers may not be legally required to conform to vegetation-free requirements, they are still highly encouraged to, essentially creating a de facto policy of vegetation removal during an interim period where such a policy has been expressly prohibited by the legislature and court orders.

7. *Cost*

Another significant issue with the status quo is the cost of complying with USACE vegetation-removal requirements. In April, 2010, DWR released the report: Fiscal Impact Report of the U.S. Army Corps of Engineers' Vegetation Management Standards and Vegetation Variance Policy for Levees and Flood Walls.[79] The report includes cost estimates of applying USACE vegetation removal requirements to 116 critical levee repairs performed from 2006 through 2008 and the cost estimate of applying USACE requirements to the entire 1,600 miles of project levee system by extrapolation. The report estimated the cost to comply with USACE policy ranged from $6.5 billion to $7.5 billion.[80] Annualizing this cost of compliance over a 50-year project life at six percent would yield an annual cost of over $400 million.[81] This is more than ten times the USACE $30 million estimated annual assistance for levee rehabilitation under PL 84-99, based on expenditures for past flood events.[82]

Further, in their Complaint as part of the FOR lawsuit (discussed in greater detail in *Appendix 3: Case Law*), plaintiffs referenced DWR figures and the high cost of bringing non-compliant

[79] Cal. Dept. of Water Resources, Fiscal Impact of U.S. Army Corps of Engineers Policy on Variance from Vegetation Standards for Levees and Floodwalls (March, 2010).
[80] *Id*.
[81] *Id*.
[82] 2012 Central Valley Flood Protection Plan at 3-28.

project levees into compliance with USACE vegetation-free standards. The FOR lawsuit also acknowledged the extreme cost of successfully applying for a variance from USACE vegetation-removal requirements by referencing SAFCA's Natomas Levee Improvement Project, discussed in greater detail below. As part of the Natomas project, SAFCA applied for a variance from USACE vegetation-removal requirements. This project ultimately cost SAFCA about $180 million more than originally projected.[83]

The financial cost of removing vegetation along levee corridors is prohibitive for most areas. The financial cost of obtaining a variance from vegetation removal requirements is similarly impractical and prohibitive. This further demonstrates the problems associated with the status quo and extreme timely need to revisit vegetation management guidelines on California levees.

8. *Variance Requirements*

The variance process should ideally provide a pathway for State and local maintaining agencies to obtain an exemption from USACE vegetation removal requirements, if the maintaining agency can demonstrate that vegetation removal in that particular area is unnecessary and will not threaten the integrity of the levee. However, in practice, the process of obtaining a variance is highly confusing and expensive, and therefore rarely happens.

First, there is a great deal of confusion as to what guidelines govern when applying for a variance, and if there are currently any guidelines in place. The most recent governing document on variance procedure is codified in the PGL, and discussed in greater detail in *Appendix 1: Federal Laws and Policies*. This is still the presumptive guiding document for obtaining a vegetation variance, but contains the provision that all levees meeting the PGL requirements, "will have one year from the date of this memorandum [2012] to submit a letter of intent to their respective USACE District expressing intent to . . . submit a vegetation variance request . . ."[84] This clearly suggests that the cut-off date for submitting a variance request to USACE occurred one year from the PGL's release date (in 2012), and has long since passed. It remains an open and unanswered question whether USACE is accepting other variance request applications or

[83] Friends of the River v. United States Army Corps of Engineers (E.D. Cal. 2011), Case 2:11-at-00887 at 13.
[84] 77 Fed. Reg. 9637 (February, 2012) § (10)(a).

not, or if they will only do so as part of a SWIF (also discussed in detail in *Appendix 1: Federal Laws and Policies*).

Furthermore, USACE was directed by WRRDA 2014 and court orders to revisit and reissue the policy guidelines for obtaining a vegetation variance, but it is similarly unclear how far along USACE is in this process. State and local maintaining agencies are not sure whether to wait for new guidelines, attempt to obtain a variance through the PGL, embark on the time consuming and expensive process of developing a SWIF, or to simply remove all woody vegetation and forego the vegetation variance process altogether.

The Natomas Levee Improvement Project exemplifies of the arduous process for obtaining a variance. Following Hurricane Katrina and the subsequent attention brought to flood protection systems, Natomas had just been remapped by FEMA into a more rigorous flood plain. This required those living behind Natomas levees to purchase mandatory flood insurance, unless the local maintaining agency for the area (Sacramento Area Flood Control Agency or "SAFCA") could demonstrate a flood protection plan at greater than 100-year level protection. SAFCA proposed a project to fix the Natomas levees "in place," or strengthen the levees as they were currently situated. They proposed a project to build a slurry wall within the levee system, creating an impervious layer throughout the entirety of the center of the levee to alleviate any potential seepage problems. However, SAFCA soon realized that in doing so, they would also be required to come into compliance with USACE vegetation-removal requirements. In exploring the legal consequences of removing vegetation along the Natomas levee system, SAFCA engaged in conversations with NMFS to ask about ESA ramifications. NMFS expressed concern about the proposal to remove vast amounts of critical habitat for endangered fish along riparian corridors of Natomas levees. Therefore, it also became clear to SAFCA that it would be impossible to comply with USACE vegetation-removal requirements without destroying ESA critical habitat, and as such it was very unlikely that SAFCA could legally comply with both USACE requirements and ESA obligations.

Consequently, SAFCA proposed a different project to build predominately adjacent levees behind the currently existing levee system. This is similar to the "setback" levee design in many ways, as a new levee was constructed outside of the existing levee. However, "setback" levees

typically refer to new levees that have been further set back from the existing levee. (For greater discussion on levee designs see *Part VII: Solutions* and *Attachment 2: Basic Levee Terminology)*.

This adjacent levee design would theoretically enable SAFCA to build strong levees and protect communities at risk without touching vegetation on existing levees, because this vegetation was now removed from the new adjacent levee prism. SAFCA also employed setback levee designs, where feasible, as well as extra-wide levee designs, in certain areas.

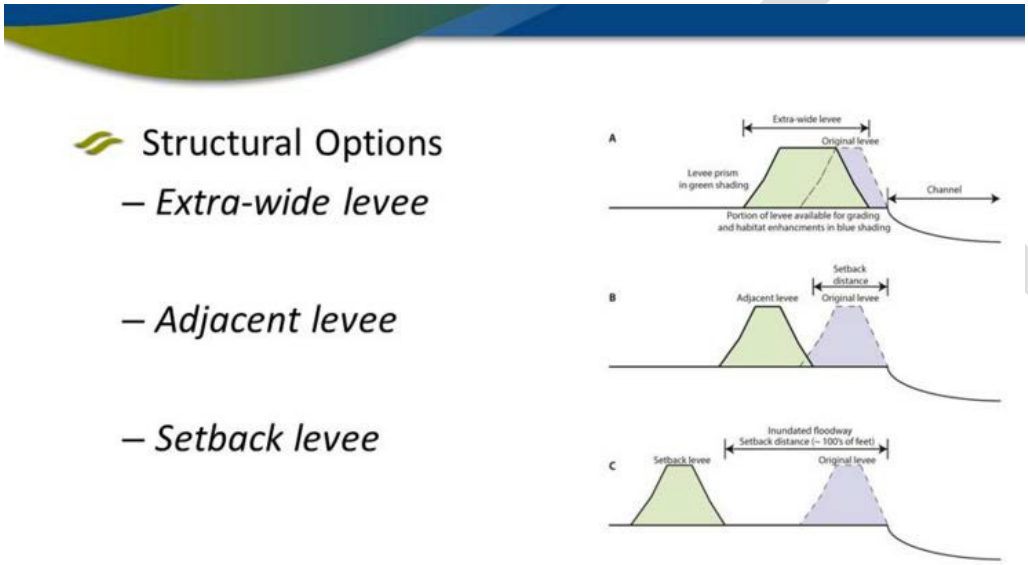


Figure 7: Basic Visual Representation of Setback Levee Designs[85]

Even with these enlarged levee designs, this plan still came with many obstacles, including a few landowners whose property would now be pushed out of the protected area to the waterside of newly constructed levees. This was extremely expensive and time consuming, but was presumably the only way that SAFCA could obtain a variance from USACE vegetation removal requirements.

SAFCA submitted a variance request to USACE for the adjacent levee design, which USACE eventually agreed to. All in all, the extra cost to SAFCA for undergoing the variance process was about $180 Million and took years longer to complete than the original proposal. The only way

[85] Jessica Davenport, Delta Stewardship Council, Improving Habitats along Delta Levees (January 28, 2016).

that SAFCA could obtain a variance was through the adjacent levee design, which is not feasible in most areas, because it often involves widening the levee system into privately held lands.

The variance process is currently confusing, expensive, and not practically feasible for most maintaining agencies. This is a huge problem, and must be addressed, especially in the Central Valley where a variance is the only option for maintaining agencies who must comply with federal law (i.e., the ESA) and USACE vegetation-removal requirements.

PART III: Problems with the Status Quo Other Than Those Associated With Vegetation Removal Requirements

As demonstrated above, many problems exist with our current regulatory framework due to federal vegetation-removal requirements, including destruction of critical habitat, violation of other federal laws like the ESA, diversion of limited funds from pressing levee safety issues, potential contribution to structurally deficient levee slopes, potential confliction with State vegetation management guidelines, confusion with regard to the extent of removal required for PL 84-99 eligibility, unintended consequences of WRRDA 2014 while USACE revisits their vegetation guidelines, high cost of compliance with vegetation requirements, and a costly and potentially unworkable variance policy.

In addition to problems caused directly from vegetation-removal requirements, other significant issues exist with our current regulatory framework relative to vegetation management on levees. This includes issues related to operations and maintenance guidelines and policies, Section 408 applicability, and the disbanding of interagency discussions, which were originally established to address levee vegetation issues in California. Operations and maintenance guidelines are outdated and can conflict with federal and State laws and policies, making conformance unattainable for many levee maintainers. This could result in structurally deficient levees and greater risk for flood-prone communities. Section 408 and its recent resurgence has been presented as time consuming, confusing, expensive, and possibly disproportionately enforced. An interagency group convened to address levee vegetation issues demonstrates competing ideologies with respect to levee vegetation. A deeper look into these competing ideologies

demonstrates the difficulty in reconciling viewpoints, as each ideology stems from positive intentions and a desire to create safe, strong flood systems.

1. *Operations and Maintenance Policy Updates*

Federal guidelines regarding operations and maintenance (O&M) duties contradict other State and federal environmental laws and policies, which can make compliance with O&M guidelines unattainable for levee maintainers. California's newly released Draft Conservation Strategy describes conflicting O&M mandates placed on LMAs, including the flood system maintenance criteria codified in 33 CFR 208.10 (described in greater detail in *Appendix 1: Federal Laws and Policies*). 33 CFR 208.10 was last updated by the Flood Control Act of 1944, and establishes national standards for operation and maintenance of levees and the greater flood system.[86] For O&M duties, the inherent conflict between State and federal environmental laws versus regulations prescribed in 33 CFR 208.10 is due to the outdated nature of 33 CFR 208.10. These federal regulations do not adequately reflect updates in federal environmental laws, including the passage of the ESA, Clean Water Act (CWA), Clean Air Act (CAA), and National Environmental Policy Act (NEPA), nor do they reflect updates in State levee maintenance decisions. This creates a myriad of problems for levee maintainers. As described in the Draft Conservation Strategy, "In some cases, it is not possible to comply with both federal project maintenance and environmental protection imperatives."[87]

Operations and maintenance programs are intended to keep flood management facilities, including levees, in good, serviceable conditions so they are able to continue to function as designed.[88] These activities usually include channel maintenance (including hydraulic assessments, sediment removal, channel clearing, and vegetation management); erosion and levee repairs; levee inspections, evaluation and maintenance; and the repair and replacement of hydraulic structures.[89] As O&M duties become deferred, levee systems suffer and require additional upkeep beyond routine maintenance. Therefore, the term "O&M" is increasingly used as shorthand terminology to refer to a host of activities included in Operation, Maintenance,

[86] 33 C.F.R. § 208.10 (1944).
[87] Cal. Dep't. of Water Resources, Draft Conservation Strategy (November 2016) at 1-3.
[88] 2012 Central Valley Flood Protection Plan at 4-3.
[89] *Id*. at 4-3.

Repair, Replacement, and Rehabilitation (OMRR&R) activities. Once flood systems are built and certified by USACE, there is an agreement in place appointing a State or local entity as the "Responsible Agency" for O&M for that flood system. The Responsible Agency takes full responsibility for all O&M activities for that portion of the flood control system, and must abide by all applicable USACE manuals and all applicable environmental laws.

Two standard O&M manuals present requirements that apply to maintaining agencies that operate and maintain levees in the Central Valley. These include: (1) Standard Operation and Maintenance Manual for the Sacramento River Flood Control Project (USACE, revised May 1955); and (2) Standard Operation and Maintenance Manual for the Lower San Joaquin River Levees, Lower San Joaquin River and Tributaries Project, California (USACE, April 1959).

These O&M manuals, provided by the USACE, both date back to the 1950's. This is problematic in many respects. First, the O&M manuals fail to include ecological, scientific and technological updates from the past sixty years. Second, these manuals predate the ESA, and therefore the USACE never underwent ESA consultation in promulgating these guidance documents. Because of this, local maintainers in the Central Valley often have no way of consulting with NMFS for O&M activities, which can result in take violations. As discussed above, absent a "federal nexus," through Section 7 of the ESA, local maintaining agencies are unable to consult for their actions, because there is no "federal action." Thus, if any part of the action harms a listed species or its habitat, the local agency is liable for an ESA take violation.

The outdated O&M manuals also have serious consequences for the environment. For example, the manuals prescribe burning of unwanted vegetation on levees, an outdated and potentially hazardous method of clearing levee vegetation. 33 CFR 208.10 also requires maintainers to clear the flood channel of debris, weeds and wild growth, and to maintain the capacity of the channel by reducing the formation of shoals.[90] This goes against most modern environmental regulations, including federal and State Endangered Species regulations.[91] Further, the environmental mandates included in 33 CFR 208.10, as well as in both regional manuals for the Central Valley,

[90] *Id.*
[91] *See*, for example, proposed rule on Western Yellow Billed Cuckoo Critical Habitat Designation, suggesting the avoidance of clearing channels and reduction in bank stabilization features.

predate almost all major environmental laws. Consequently, local maintainers are once again caught between complying with these outdated regulations, or modern environmental laws. To complicate matters further, in taking responsibility for O&M on levee systems, local maintainers are directed by their agreement with USACE to abide by all environmental laws, which is sometimes impossible to do concurrently with the directives of the manuals.

The high cost of O&M activities is also problematic for local maintainers and the safety of the flood system. The cost of routine O&M has risen dramatically in recent years, and funding has been insufficient to keep up.[92] Inspections alone can be quite costly, as each project feature is required to be inspected prior to the beginning of the flood season, immediately following each major high water period, and otherwise at intervals not exceeding 90 days, and at such intermediate times as may be necessary to insure the best possible care of the protective works.[93] Intermediate inspections may also be required for fish passage, depending on the flood control system location with respect to listed fish. Inspections occur to detect possible deviations from the original design, and if detected, to determine if they are substantial enough to require maintenance. The maintaining agency must also submit semi-annual maintenance reports on inspections. The maintaining agency is in charge of emergency operations, including general actions to prevent damage due to heavy storms, and to alert the public of the possibility of flooding if necessary. This also includes emergency floodfighting procedures, which are detailed in the maintaining agency's O&M agreement with USACE. Additionally, local maintainers are being increasingly encouraged by USACE to remove all vegetation on levees, pursuant to recent USACE guidelines such as the ETL. Removal of all woody vegetation is extremely costly, as past federal guidelines encouraged woody vegetation growth on levees in California. Therefore, to comply with these requirements, State and local maintainers have to spend vast amounts of money to remove old growth, or "legacy vegetation," over vast portions of Central Valley levees.

If O&M falls behind due to lack of funding, so does the integrity of the entire flood system. O&M activities are imperative to assess and repair levee deficiencies, which could otherwise

[92] 2012 Central Valley Flood Protection Plan at 4-3; April 22, 2015 Central Valley Flood Protection Board Meeting identified $100 million yearly deficit for O&M activities.
[93] See, for example, U.S. Army Corps of Enginners Los Angeles District, Operation, Maintenance, Repair, Replacement, and Rehabilitation Manual, Santa Paula Creek Channel Improvements (December 2011) at 5.

worsen and eventually threaten the integrity of the levee. Therefore, this issue is significant and policymakers must address the difficulties faced by levee maintainers in attempting to carry out O&M activities. This is especially timely in terms of the controversy over levee vegetation, because funding directed at vegetation removal could otherwise be used towards O&M activities. It should be noted that currently some maintainers are incentivized to spend limited funding on total vegetation removal so as to more easily and more quickly assess the levee for possible deficiencies. However, as discussed above, this can be quite problematic in terms of environmental laws, especially the ESA, and can leave the maintaining agency liable for ESA Section 9 violations. Regardless of one's view of safety issued posed by woody vegetation on levees, this exemplifies the problems with the status quo, and need for the issue to be addressed.

Local levee maintainers are also given conflicting directives in terms of O&M requirements set forth in 33 CFR 208.10, and other USACE guidelines. As discussed above, 33 CFR 208.10 and the local manuals for the Central Valley all prescribe that, where practicable, certain woody vegetation shall be encouraged and planted on the waterside slope of levees to prevent bank erosion. However, other recently-released USACE guidelines, including the ETL, directly contradict this directive, and mandate that the maintaining agency remove all woody vegetation from the entirety of the levee, as well as 15 feet from each levee toe (landside and waterside). Local maintainers are unable to comply with both requirements, as both arguably contradict each other, and so remain in a perpetual state of incompliance in one form or another. This can once again lead to confusion, fatigue at the impossible government mandates, and even anger, on the part of local agencies, who may in exasperation decide to forgo government requirements altogether.

Many point to the inconsistency in O&M requirements as a chief reason why so many local maintainers are out of compliance with the PL 84-99 program. The 2011 USACE periodic inspections showed that 39 of 116 LMAs have lost eligibility for PL 84-99 rehabilitation assistance, for reasons other than vegetation.[94] Rather than comply with federal regulations that mandate conflicting maintenance objectives, local maintainers around the state are choosing to take their chances outside of the PL 84-99 program. In this situation, if there is a major flood

[94] 2012 Central Valley Flood Protection Plan at 3-28 – 3-29.

event, the LMA may be ineligible to receive federal funds or federal aid in rehabilitation activities. This can have drastic consequences for those with property behind these levees, who may not be guaranteed federal rehabilitation assistance in the case of a flood event. In most cases, the LMAs do not have enough reserve funds to rebuild after a serious flood activity, so this is a serious and very risky chance to take on the part of local maintainers, reflecting the harsh regulatory framework that pushed them into this situation.

2. *Section 408 Applicability*

Many also see the current regulatory environment as problematic because of Section 408 applicability. 33 U.S.C. 408 ("Section 408," described in detail in *Appendix 1: Federal Laws and Policies*) is an old law from the late 1800s, and was not used in modern times until very recently. A few years ago, USACE issued an Engineering Circular (EC) stating that Section 408 was applicable, and provided guidelines for compliance.

Section 408 requires certain construction proponents to demonstrate to USACE that two criteria are met: (1) that the project's usefulness is not impaired; and (2) the construction is not injurious to the public interest. This applies to anything deemed an "alteration" to a USACE civil works project. "Alteration" includes any occupation, use, encroachment, improvement, movement, occupation, building, or any action that "otherwise affects the usefulness, or the structural or ecological integrity, of a USACE project."[95] The definition of "alteration" is quite broad, and includes any action that USACE in its discretion deems will affect the civil works project. The broad nature of this definition is potentially problematic, as some local maintainers have complained of uneven application of Section 408. Some have voiced concerns certain types of projects, including habitat enhancement and restoration projects, are required to undergo the 408 process while others, including agricultural and certain construction projects, are not. This has created some distrust of federal agencies and a sense of unfairness for some maintainers.

Section 408 could also be problematic because it requires compliance with all USACE design and construction standards, which presumably includes USACE vegetation-free requirements. Therefore, for any project that falls under the purview of Section 408, the project applicants must

[95] EC No. 1165-2-216 (B) (2015).

ensure compliance with USACE vegetation-free standards. It is difficult to know what the current standards are, given the confusion over ETL applicability while WRRDA 2014 is in the "interim" (for more details on WRRDA 2014, see *Appendix 1: Federal Laws and Policies*). Because the current vegetation standards are murky and confusing, this also places additional stress on project proponents who must undergo Section 408.

Maintainers have also voiced concerns over Section 408 in that the procedure for undergoing 408 consultation is lengthy and time consuming. The 408 process begins with pre-coordination between the requester, sponsor and USACE, followed by a written request. Among other things, the applicant must provide documentation demonstrating compliance with all applicable environmental laws, reasonable alternatives, public input, and a description of any impacts to the floodplain. USACE then leads an Agency Technical Review (ATR) to determine if all requirements have been met, and then issues a Summary of Findings with approval or denial of the project. They may conduct additional review, if required. The length of this process differs depending on the complexity and impacts of the project proposal.

In sum, concerns over Section 408 exist as to its uneven applicability, its reference to other vegetation-removal requirements, and the long process for gaining approval.

3. *Roundtable Dissolution*

As it currently stands, USACE policies seem to encourage substantial vegetation removal from levees, and apply uniformly throughout the country. A project applicant may apply for a variance, but the process for applying for a variance is considered overly burdensome by local levee maintainers, and it is unclear whether the variance policies set forth in the PGL are applicable at this time. Federal and State policies are considered by some local maintainers to be irreconcilable. At the center of the controversy is the debate over whether or not woody vegetation on levees poses a substantial risk.

During the initial stages of this debate, there was an attempt at compromise between stakeholders, in the formation of the California Roundtable for Central Valley Flood Management (Roundtable), in August 2007. The Roundtable was formed to analyze concerns and interests associated with the issue of woody vegetation on flood control levees, and suggest

productive ways to move towards a resolution.[96] As part of this effort, a neutral facilitator was hired to improve Roundtable functionality and move the group towards a productive resolution. The facilitator guided the group towards the production of the California Levees Roundtable Framework, released in 2009. The facilitator also released an Assessment Report, which documented points of agreement and debate amongst Roundtable participants.

In her Assessment Report, the facilitator noted that all parties to the Roundtable agreed that woody vegetation on levees could potentially cause levee safety issues, and that vegetation as a risk factor should be thoughtfully addressed.[97] All parties also agreed that levee vegetation poses smaller risks than other critical levee deficiencies, and that remediating vegetation risks should be part of improving the flood safety system as a whole. Further, all parties agreed that the greatest risks to levee integrity should be fixed first and given priority over lesser risks. All parties also agreed that levee vegetation in California, especially shaded riverine aquatic (SRA) habitat, is important habitat for many species, and all levee projects should adhere to applicable environmental laws.[98] All parties also felt "a compelling moral obligation to protect communities behind levees."[99]

The three main issues that members of the Roundtable had with the USACE vegetation-removal policy include the following: (1) the policy diverts limited resources away from more pressing safety needs to the low-priority problem of vegetation; (2) the policy promotes widespread mass removal of woody vegetation, which could substantially impair the structural integrity of levees; and (3) there is no clear way to mitigate for the impacts of vegetation removal on endangered species who depend on woody vegetation and SRA in riverine systems surrounded by levees.[100]

As part of the Roundtable discussions, it also became clear that USACE is strongly committed to its role in promoting and enforcing safe levee designs and maintenance standards and in preventing flood emergencies to the greatest extent possible. It is this concern for safety, and

[96] Laura Kaplan, Final Roundtable Assessment Report (August 30, 2011), at 6.
[97] *Id*. at 6.
[98] *Id*. at 6.
[99] *Id*. at 12.
[100] *Id*. at 12.

tendency towards a precautionary approach to protect lives and property, that has resulted in the current USACE vegetation policy.

Because of the strong conviction that minimum standards cannot be reduced, USACE representatives also expressed their "firm belief that the minimum standard represented by the ETL that disallows all woody vegetation cannot in good conscience be compromised just because solutions are politically difficult and/or expensive."[101] Some of the greatest concerns that USACE officials voiced during Roundtable discussions included that woody vegetation can interfere with levee inspections and floodfighting, and that it may interact with and accelerate other failure mechanisms (such a seepage, slope failure, and erosion). Further, there was a general sentiment that "unpredictable biological organisms that eventually die and rot have no place growing into engineered structures," and the hope that California would eventually "do the right thing" and bring levees into compliance with USACE vegetation removal policies.[102]

Other stakeholders expressed competing views that in order to maintain safety for those living in areas protected by levees, limited funds should be focused elsewhere, where there have been proven threats to levee integrity. State officials voiced the opinion that diverting funds to the "non-issue" of woody vegetation would effectively remove funding needed to address more critical levee deficiencies.[103] The resource agencies voiced concerns related to species recovery, especially for SRA habitat, which is critical for several protected species. Absent scientific clarity regarding whether woody vegetation actually poses a threat to levee integrity, resource agencies communicated that they are bound by law and cannot support policies that would remove the last remaining critical habitat for protected species.

The Roundtable discussions are best memorialized in California's Central Valley Flood System Improvement Framework (Roundtable Framework), which provided interim standards for local agencies managing vegetation to maintain PL 84-99 eligibility. As part of the framework, local agencies were given a three-year "grace period" whereby, if they abided by the trimming and thinning vegetation requirements set out in the Roundtable Framework, they would maintain PL

[101] *Id*. at 12.
[102] *Id*. at at 12.
[103] *Id*. at 13.

84-99 eligibility. This relieved local agencies from needing to remove vegetation as part of their normal operations and maintenance activities. These interim guidelines closely mirror the notion of lifecycle management (LCM, discussed in detail in *Appendix 2: California State Laws and Policies*). LCM was a policy later adopted as part of the State's Levee Vegetation Management Strategy (LVMS). Initially, State officials took the position that woody vegetation on levees was not a risk factor that required any change in policies. However, DWR ultimately adopted the LCM policy as part of their LVMS. Through LCM, existing "legacy" vegetation on the upper waterside and landside levee slopes will slowly be phased out over time.

Similarly, USACE employed principles voiced in the Roundtable, including the "worst first" approach to vegetation management. USACE included the "worst first" theory in their System-wide Improvement Framework (SWIF) guidelines, embracing the notion that flood control funding should first be apportioned to the most critical threats to levee integrity. (SWIF policies are discussed in greater detail in *Appendix 1: Federal Laws and Policies*).

Thus, both State and federal officials attempted to negotiate and come together as part of the Roundtable exercise, and officials from both sides of the debate implemented strategies from the Roundtable in their policies and regulations. However, there remained a substantial barrier to any true compromise, which was each participant's integrity and fierce desire to "do the right thing." On one side, USACE officials saw the issue as one where competing science suggested woody vegetation could be positive or negative in terms of levee safety. In the absence of scientific certainty they saw little choice but to maintain and enforce national standards of vegetation-free zones on levees to protect life and property. On the other hand, the State and resource agencies saw the issue as one where national laws were being improperly applied to California. The resource agencies, in particular, have a legislative mandate through the ESA to protect endangered and threatened species, and in the absence of scientific clarity could not support a policy that could threaten the continued survival of listed species. In their view, they had no choice but to push back on policies which could threaten the last remaining habitat of listed species. State agencies were generally concerned with limited resources, and could not in good conscience support policies that would divert funds from pressing threats to levee integrity, to issues like levee vegetation, which they saw as a very low threat based on the most recent scientific evidence.

Eventually, USACE declined to meet with the Roundtable any longer, following the initiation of the DFW lawsuit against USACE for violation of NEPA, ESA and APA in promulgating their vegetation policies (See *Appendix 3: Case Law*). After USACE officials removed themselves from Roundtable discussions, the remaining participants chose not to continue meeting, as USACE was such a key player in levee vegetation policy discussions.

Part IV: Solutions

As demonstrated above, the current regulatory framework surrounding levee vegetation is problematic in numerous respects and must be changed. There are several viable options to pursue to address issues resulting from the current regulatory framework. These solutions may be pursued individually, but greater large-scale positive change will likely occur as solutions are considered and pursued in tandem. Possible solutions include engineering and designing levees creatively to allow for woody vegetation while ensuring levee stability is maintained, implementing uniform models and methodology to better evaluate vegetation risks, implementing regionally-based policy solutions and promoting small-scale multi-benefit projects, development of a California SWIF in tandem with a programmatic variance, adopting legislation to improve our regulatory framework, using litigation as a tool to spur new policies, using ESA mandates to avoid habitat removal, voluntary change of vegetation guidelines from USACE, updating O&M regulations, and reconvening an inter-agency group similar to the Roundtable.

1. *Engineer Design Solutions*

One possible solution to address the issue of levee vegetation is to design and engineer levees in innovative ways. Creative designs may allow vegetation to safely exist on levees, providing riparian habitat without compromising levee safety or integrity. The CLVRP Synthesis Report (discussed in greater detail in *Appendix 4: Science and Research*) included research that explored the possibility of experimentally designing levees in a way that deals with uncertainty associated with vegetation.

The biggest concerns over maintaining woody vegetation on levees include: problems posed by root penetration in the levee embankment, creating preferential flow pathways and leading to

erosion; windthrow of trees that may remove enough material from the levee prism to degrade levee safety; and woody vegetation obscuring views from inspectors conducting routine inspections or otherwise hindering floodfighting activities. Engineers have been attempting to tackle these concerns through upgraded levee design features. These include overbuilt embankments and plastic or metal root barriers inserted into the levee structure.[104]

Overbuilt embankments include planting berms, for which USACE has existing guidelines on dimensions and restrictions. USACE guidelines allow planting berms to be added to levee slopes under certain limitations. These include: (i) planting berms are limited to the landside of the levee; (ii) planting berms consist of earth fill in excess of the minimum section needed to satisfy stability requirements; (iii) the planting berm must be of sufficient depth to accommodate any proposed vegetation and preclude root penetration into the root-free zone; (iv) design must include consideration of any internal drainage or seepage control system; (v) no vegetation is permitted on any "overbuild" section that has a system-reliability function except in planters (e.g., concrete vessels), and; (vi) adequate access between the levee toe and the levee crown must be maintained for inspection and floodfighting, and specifically, visual access is required for inspection of the toe area and physical access is required for floodfighting activities involving personnel and heavy equipment.[105] The root-free zone in the levee prism must be three feet thick

[104] Douglas Shields, Synthesis of Levee Vegetation Research Results (2007-2014), (cbec eco engineering, January 2016) at 14-1.
[105] ETL 1110-2-583 (April, 2014); *See* also, Douglas Shields, Synthesis of Levee Vegetation Research Results (2007-2014), (January 2016) at 14-1 – 14-2.

at a minimum.[106]

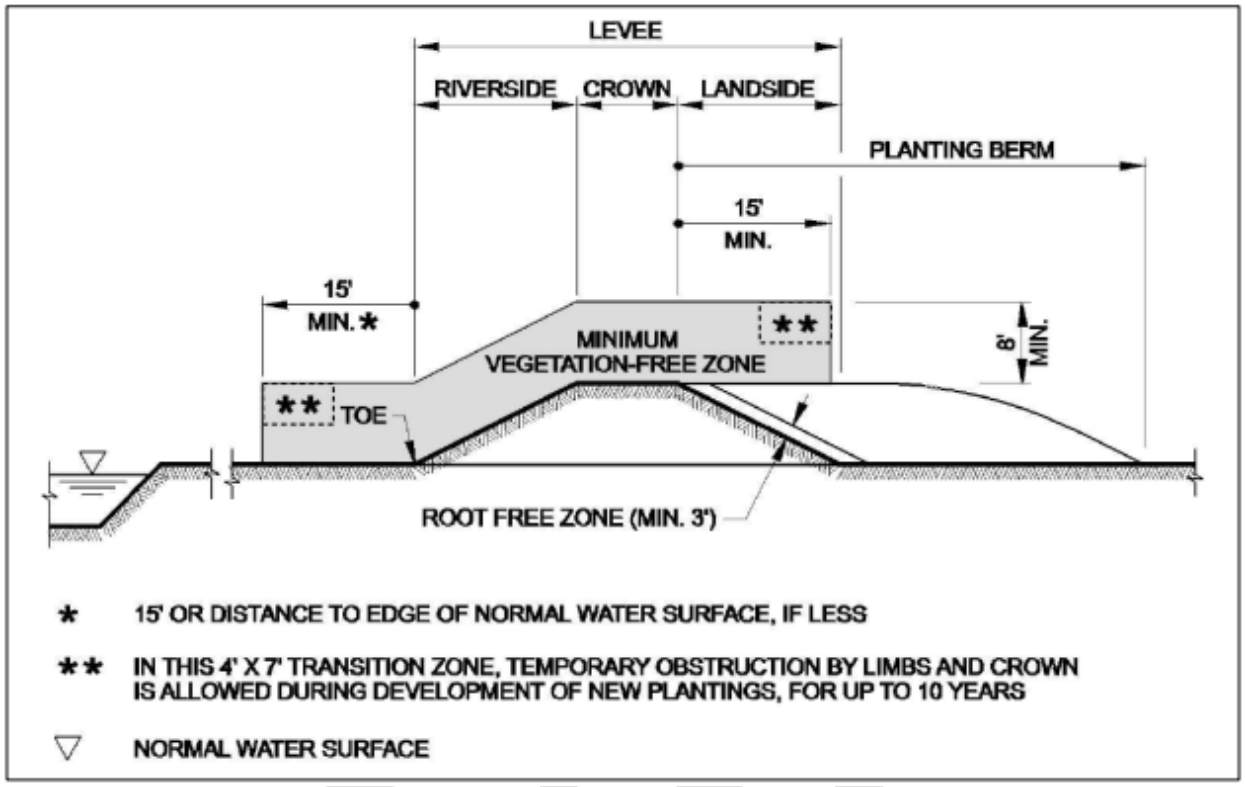


Figure 8 Overbuilt Levee with Planting Berm[107]

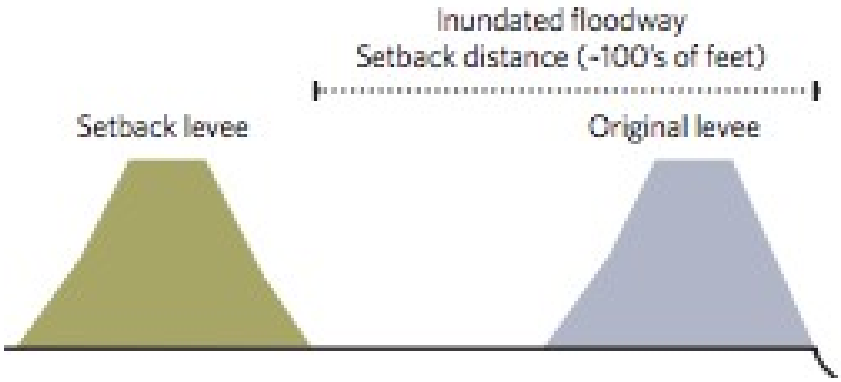
Although the above USACE procedures guide the inclusion of planting berms on levees, these guidelines do not address one of the most pressing problems encountered by vegetation-free requirements. Namely, removing vegetation from the waterside slope of the levee slope presents issues with regard to the riparian corridor and removal of limited endangered species habitat. Including a planting berm on the landside of the levee does little to address this. Thus, USACE guidelines promoting planting berms are an important start, but USACE should also accept planting berms on the waterside slopes of levees if this engineering solution will have any affect at alleviating the most pressing environmental problems associated with vegetation removal.

Researchers in Austria have recently investigated the performance of alternately designed levees with certain types of woody vegetation. The objective is to develop levees with woody

[106]ETL 1110-2-583 (April, 2014); *See* also, Douglas Shields, Synthesis of Levee Vegetation Research Results (2007-2014), (January 2016) at 14-1 – 14-2.
[107] ETL 1110-2-583 (April, 2014) at A-2.

vegetation that provide benefits in terms of slope stabilization and erosion protection, but without the perceived disadvantages of woody vegetation due to windthrow, seepage and scour. The investigation produced preliminary conclusions, including the fact that willows seemed to provide mostly positive effects on soil water balance, reducing soil water content relative to an unvegetated levee but similar to grass cover.[108] Shrubby willows seemed to be an appropriate vegetation form for well-compacted levees, had no significant impact on seepage, did not pose problems with respect to root impacts, and were small enough to allow for visual inspections.[109] Further development is the subject of ongoing research. California levee engineering designs should reference recent studies such as this and include woody vegetation types that have demonstrated to help, rather than hurt levee stability and integrity.

Setback levees refer to a design where newly constructed levees are set back further from the river than existing levees. Rather than narrowly confining a river by close levees, setback levees allow the river to flow into its natural floodplain immediately adjacent to the river. This approach is considered the most environmentally ideal by many, as it allows for natural floodplains and compliance with environmental laws, while maintaining USACE vegetation-free zones on levees situated far away from the naturally flowing river.



[108] Douglas Shields, Synthesis of Levee Vegetation Research Results (2007-2014), (January 2016) at 14-4.
[109] *Id*. at 14-4.

Figure 9: Setback Levee[110]

An Adjacent levee is similar to a setback levee in that it involves constructing a new levee behind an existing levee. This can be beneficial in terms of allowing vegetation to remain on the lower riverside slope of the existing levee, so long as the vegetated portion of the existing levee lies outside of the vegetation-free zone of the newly constructed levee prism. However, this design is less optimal than a setback levee, as it does not provide the habitat benefits of inundating the floodplain, instead maintaining narrowly confined rivers surrounded by closely aligned levees.

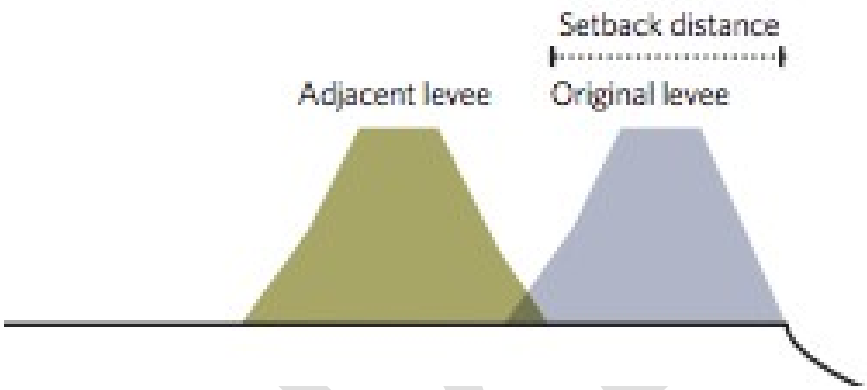


Figure 10: Adjacent Levee[111]

An overbuilt levee design generally refers to a levee that has been widened to shift the overall levee prism toward the landside slope. This can create more space for habitat improvement near the riverward slope and safer levees for greater flood protection. However, this does not create additional connective floodplain habitat, as setback levee designs can.

[110] Jessica Davenport, Darcy Austin, Jahnava Duryea, Daniel Huang and Daniel Livsey, Improving Habitats Along Delta Levees, Delta Stewardship Council (January 2016) at 5.
[111] *Id*.

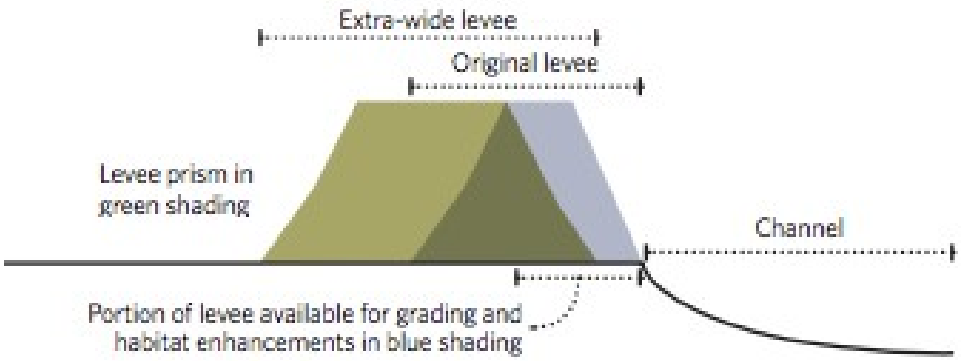


Figure 11: Overbuilt Levee[112]

This method was developed for certain areas in the Natomas Basin Levee Improvement project in an attempt to strengthen the Natomas levees while still retaining waterside vegetation, described in more detail above. As part of this design, USACE required a distance of ten feet from the waterside slope of the basic levee section to the crown of the waterside hinge point, resulting in a levee with a crown width of 44 feet and a 3:1 landside slope. This design ultimately enabled the levee maintainers to obtain a vegetation variance, since maintaining vegetation that was now outside of the newer levee slope would not threaten the stability or structural integrity of the levee system.

[112] *Id*.

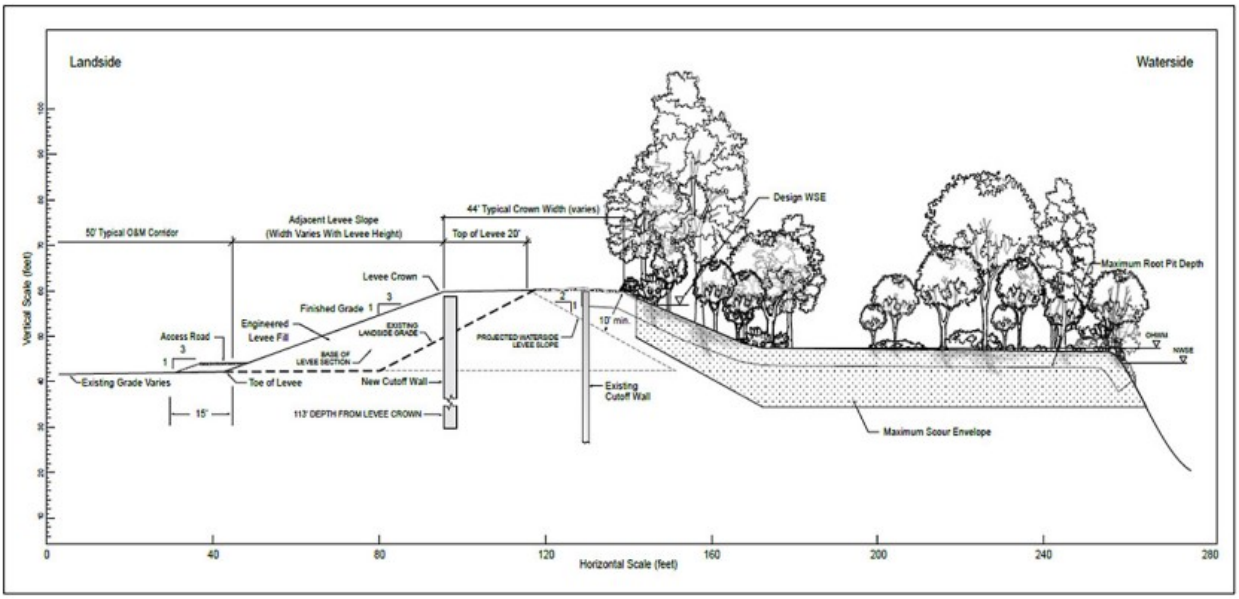


Figure 12: Adjacent Levee[113]

Overbuilt levees, adjacent levees and setback levees could theoretically be replicated in other areas, allowing more geographic regions to be protected by strong levees while retaining ecologically important and aesthetically valued vegetation. However, realistically this is unlikely to be replicated elsewhere because of the extreme cost associated with these levee designs, essentially building twice the amount of the existing levee system. As mentioned above, Natomas Basin Levee Improvement Project cost SAFCA an additional $180 million than the original proposal to fix the levees in place. Additionally, community acceptability can prohibit the construction of setback levees, because it generally requires acquiring private property or repurposing public lands for floodplains. Further, in the Central Valley many agricultural lands extend to the landside of levee toes, and these lands could also be affected by setting back levees. It could take agricultural land out of production, reducing the revenue for farmers as well as levee maintaining agencies.

Another possible engineering solution to problems posed by woody vegetation on levees is the inclusion of root barriers. Mechanical or biological barriers may be used to prevent roots from

[113]Douglas Shields, Synthesis of Levee Vegetation Research Results (2007-2014), (January 2016) at 14-6, Adapted from Washburn 2012.

penetrating embankments. USACE guidelines allow for root barriers, but also make clear that, "[root barriers] should not be a substitute for adequate distance between plantings and root-free zones."[114] Biological root barriers are commercially available and generally economically feasible.[115] Cutoff walls or "slurry walls" can also be included in levees to prevent seepage. Existing levees can be retrofitted to include cutoff walls using the slurry-trench method. Per this method, slurry walls (usually made of mixtures of soil, cement and bentonite) are built through the bottom center of the levee prism. These slurry walls eliminate seepage through the levee and control underseepage to the depth of the base of the wall. Even if the slurry wall becomes compromised by cracks, they still partially protect the levee from seepage erosion because the slurry wall material is resistant to the erosion itself.[116]

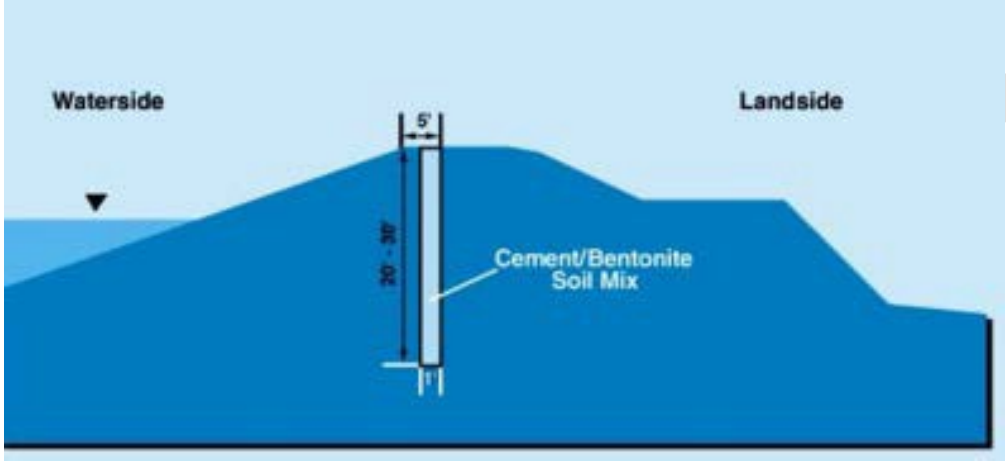


Figure 13: Slurry Cut-Off Wall[117]

One recent study conducted in the Central Valley included excavations of old slurry walls (constructed in 1991) along the Sacramento River.[118] These excavations showed that the old slurry walls were partially effective as root barriers. Observations showed that tree roots tended to grow alongside slurry walls in most instances, and sometimes grew in slurry wall cracks.

[114] ETL 1110-2-583 (April, 2014); *See* also, Douglas Shields, Synthesis of Levee Vegetation Research Results (2007-2014), (January 2016) at 14-5.
[115] *See* Shields, Synthesis Report (2016) at 14-5, referencing products such as porous geotextile that slowly releases the herbicide trifluralin, plastic mesh or panels that provide a mechanical barrier to roots, and soil moisture.
[116] Douglas Shields, Synthesis of Levee Vegetation Research Results (2007-2014), (January 2016) at 14-5 – 14-8.
[117] Flood Emergency Action Team, Final Report of the Flood Emergency Action Team (May 1997) Appendix C.
[118] Harder et al. (2010, 2011); *See* also Douglas Shields, Synthesis of Levee Vegetation Research Results (2007-2014), (January 2016) at14-8.

Given the opportunistic nature of tree roots, it is not surprising that they tend to fill cracks created in slurry cutoff walls. Another study suggested that given the composition of the slurry walls, it was not surprising that the walls were susceptible to desiccation, shrinkage, and cracking.[119] There is an ongoing debate as to whether tree roots penetrate slurry cutoff wall cracks after the walls have cracked due to other forces, or whether tree roots cause slurry walls to crack.

In order to improve the efficacy of slurry cutoff walls to tree root penetration, the slurry walls themselves should be less prone to cracking in the first place, because once they do crack, tree roots will generally fill the remaining voids. The performance of modern, thicker cutoff walls as root barriers is unknown, but some European levee designs include sheet pilings inserted into cutoff walls to act as root barriers and barriers to burrowing animals. This remains an important area for further study and analysis.

Newly constructed levees or levee rehabilitation projects could also include a soil trench or planting box to safely incorporate woody vegetation on the waterside slope. Under this design, woody vegetation on the lower waterside levee slope can help with erosion concerns and provide essential riparian habitat, while not threatening the structural integrity of the levee. This would incorporate requirements for fish, including shade and instream woody material, while also allowing for cautious safety designs, such as rock (rip-rap) on the waterside slope between trees.

[119] Gray (2009); *See* also Douglas Shields, Synthesis of Levee Vegetation Research Results (2007-2014), (January 2016) at 14-9.

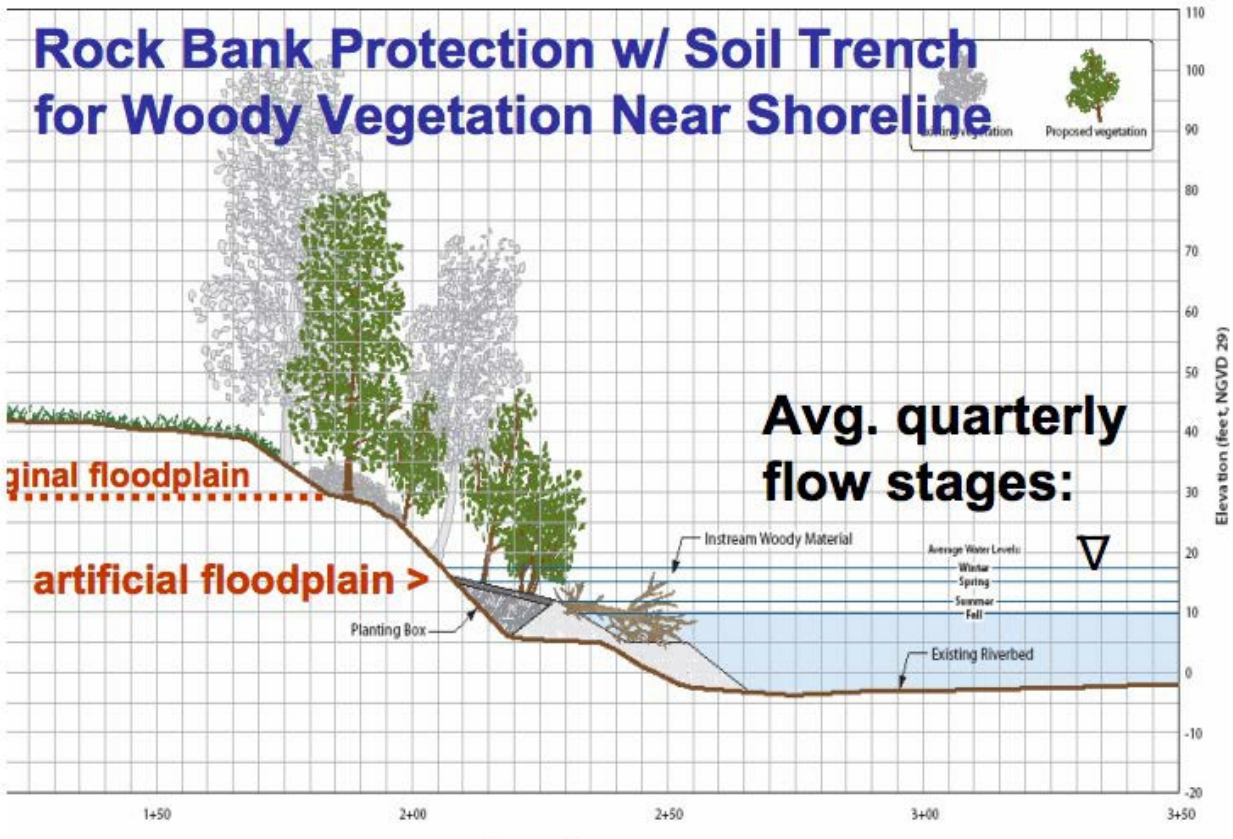


Figure 14: Levee with Soil Trench[120]

2. Using Uniform Models and Methodology to Evaluate Vegetation Risks

As described in greater detail in *Part II: Problems with Levee Vegetation Removal Requirements*, one major issue with the status quo is the lack of commonly accepted methodology for evaluating when woody vegetation actually poses a risk to levee integrity. Absent a universally accepted methodology, many levee maintainers are incentivized to determine that all vegetation present on the levee poses a threat, with little analysis supporting their conclusion. This is problematic because it leads to more vegetation removal than is necessary to comply with vegetation requirements, creating negative consequences for endangered species habitat and maintainers who become open to liability under the ESA. In order to combat this problem,

[120] 2007 Levee Symposium Presentation by Steve Chainey, found at: http://www.safca.org/protection/NR_Documents/2007_Symposium_Chainey_Presentation.pdf

USACE and levee maintainers should ideally use peer-reviewed risk models to evaluate vegetation risks.

There are currently several models in development that could help illuminate the risks posed by trees on levees, discussed in more detail in *Appendix 4: Science and Research*. One such tool, the CLVFP's Levee Tree Assessment (LTA), would provide a uniform methodology for determining when woody vegetation might pose a risk to levee integrity. This should ideally be used only for trees that are already being considered for removal because they may pose a threat to levee integrity. Rather than conducting a tree-by-tree assessment of every tree on the levee, there should be a presumption of retaining woody vegetation on levees, as per the directive of WRRDA 2014 and multiple court orders. When a certain tree throws up red flags, or when there is uncertainty as to whether a specific tree may pose a risk to levee integrity, levee maintainers may apply this neutral set of standards to determine what risk the tree actually poses, if any, and if removal is necessary.

This is preferable to the current approach, which instead presumes that all trees on the levee pose a threat to levee integrity and places the burden on levee maintainers to demonstrate otherwise. The current approach is, in part, due to confusion and uncertainty over how to determine whether trees pose a threat to the levee. The employment of clear standardized guidelines to determine possible threats posed by woody vegetation will help ensure that the spirit of WRRDA 2014 is maintained. Standardized guidelines will help ensure that woody vegetation is not removed unnecessarily while USACE undergoes the exercise of revisiting and reissuing vegetation guidelines. Therefore, the LTA (as it is released), or a similar peer-reviewed tool should be used to evaluate vegetation risk. However, the soon-to-be-released LTA cannot be expected to be a perfect fix for determining when to keep a potentially problematic tree or not, and other similar tools should be developed.

Other studies evaluating the overall risk posed by woody vegetation presence on levees are needed, and the results should be reflected in levee policies. A study currently being conducted by UC Berkeley (discussed in greater detail in *Appendix 4: Science and Research*) seeks to evaluate the incremental probability of levee failure due to the effects of woody vegetation, as compared with other risks to levee failure. Policymakers from State and federal government

agencies should pay close attention to the results of studies like this, and include results in permitting decisions.

Including the best and most recently available science will ensure that levee designs are as safe as possible, and that critical habitat for endangered species is not removed unnecessarily. There are some important studies currently underway that policymakers should particularly be aware of, including the aforementioned LTA and UC Berkeley incremental risk study. The general notion of using neutral models and methodology to evaluate levee vegetation risks should be an ongoing priority of all policymakers involved in permitting and maintaining California levees.

3. Regionally-Based Policy Solutions

Another approach to dealing with levee vegetation issues would be to support policy solutions already underway or in the development stage. One approach could be to employ successful policies from elsewhere to California's Central Valley. For example, the 2007 Levee Vegetation Research Symposium included a speaker who presented on the Dutch experience, where strict levee vegetation policies exist on paper but are not uniformly enforced. Instead, each water board has developed its own localized standards regarding vegetation on levees. A similar approach based on regional standards would be helpful in California, where localized environmental conditions could influence vegetation management decisions. However, an updated variance policy program would be necessary for this approach to be successful, so local maintainers would not be at risk of violating the law. Not following national standards, as the Dutch do, could leave LMAs vulnerable to loss of rehabilitation funding and possible legal action under other national environmental laws.

Another approach to the levee vegetation issue is to start at the local or regional scale, making change "from the bottom" of the policy spectrum. This approach would include supporting regional compromise, and multi-benefit projects done on a basin-wide scale. Different government agencies have specific guidelines as to what constitutes a "multi-benefit" project, but all generally refer to projects that benefit the environment, ecosystem, and preserve endangered species habitat, while simultaneously providing the greatest possible degree of safety and risk reduction to life and property protected by levees. Other benefits included in multi-

benefit designs include groundwater recharge and incorporating agricultural operations. The USACE Engineering Circular (EC) 1105-2-404, entitled, "Planning Civil Work Projects under the Environmental Operating Principles," describes USACE guidelines for multi-benefit projects.[121] Although the guidance expired in 2004, it still seems to be used by USACE as if it is governing policy for multi-benefit projects, and was utilized in the Hamilton City Flood Damage Reduction and Ecosystem Restoration project (authorized by Congress in 2007), discussed in greater detail below. The USACE guidance sets goals to achieve balance between economic and environmental benefits of a project. The guidance encourages plans that produce economic development benefits and national ecosystem restoration benefits, including principles of avoiding or minimizing significant adverse impacts or damage to the natural ecosystem where practical and supportable.[122]

The USACE guidance for multi-benefit projects identifies federal interest in terms of National Economic Development (NED) Plans, National Ecosystem Restoration (NER) Plans, or Combined NED/NER Plans. Plans that produce economic and ecosystem restoration benefits, such that "no alternative plan or scale has a higher excess of NED plus NER benefits over total project costs" are considered a Combined NED/NER Plan, and thus the most optimal choice in terms of greatest benefit to the economy and ecosystem.[123] NER and NED benefits must both be reasonable and not be at the cost of the other, and financial costs must be feasible in order to qualify as a Combined NED/NER plan.[124] If ecosystem restoration (ER) is a main objective of a study or project, USACE must also obtain congressional authorization.[125] Many principles underlie the USACE approval of multi-benefit projects, but the key principle for economic development benefits is "the potential increase in national outputs of goods and services," and the key principle for ecosystem restoration outputs is "the restoration of significant ecosystem resources."[126]

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[121] U.S. Army Corps of Engineers, Engineering Circular No. 1105-2-404 (May 1, 2003).
[122] *Id*. at 2.
[123] *Id*. at 2.
[124] *Id.* at 2.
[125] U.S. Army Corps of Engineers, Sacramento River GRR Synopsis, Ecosystem Restoration Authorities (April 2016) at 2; <http://www.nae.usace.army.mil/Missions/Public-Services/Ecosystem-Restoration-Authorities/> (last visited August 10, 2016).
[126] U.S. Army Corps of Engineers, Engineering Circular No. 1105-2-404 (May 1, 2003) at 2.

The United Nations Educational, Scientific and Cultural Organization (UNESCO) also proposes what they refer to as "strategic basin planning," which essentially mirrors the goals of multi-benefit planning. UNESCO defines strategic basin planning as, "a coherent multidisciplinary approach to managing basin water resources and their users in order to identify and satisfy social, economic and environmental priorities."[127] The UNESCO report on strategic basin planning describes the importance of rivers to humanity in terms of water supply, waste assimilation, fisheries, energy production, flood attenuation, spiritual, cultural and recreational benefits.[128] Rivers also support habitat for a wide range of ecosystems.

The UNESCO strategic basin planning guidance offers additional background into the general idea of regional, multi-benefit planning. In the beginning and middle of the twentieth century, the concept of water management was largely one of "water resources development planning," which is characterized by "primarily a technical activity that can be undertaken by engineers, with the objective of optimizing the benefits derived from infrastructure development and operation."[129] In other words, in the past we have globally attempted to solve water-planning problems in river basins from a technical standpoint, where engineers have attempted to optimize water allocation and infrastructure development for human use and consumption. However, in the late twentieth century, it became clear that new approaches were needed, as more information was gathered on the importance of functioning aquatic ecosystems and technical solutions to water allocation were exhausted with the fast growing human population. The UNESCO report prescribes moving forward from an era characterized by single-purpose engineering fixes to flood system conveyances, to a multi-purposed approach that takes into account all economic, social and environmental objectives within a water basin.

This regionally scaled, multi-benefit approach is beneficial for many reasons, including the ability to take localized environmental conditions into account, creating safer levees and precluding unnecessary removal of essential habitat. However, for similar reasons noted above, this approach should be accompanied by USACE-granted vegetation variances in some form or

[127] Guy Pegram, et.al., UNESCO, River Basin Planning: Principles, Procedures and Approaches for Strategic Basin Planning (2013) at 3. <http://unesdoc.unesco.org/images/0022/002208/220866e.pdf>
[128] *Id.* at 3.
[129] *Id*. at 3.

another, so as to not leave levee maintainers vulnerable to policy violations, and so levee maintainers can gain or remain eligible for rehabilitation programs. Therefore, multi-benefit regionally scaled projects should be encouraged, but as part of a greater effort to revisit larger levee vegetation issues, rather than as solutions in and of themselves.

Multi-benefit regionally scaled projects can be particularly helpful as large "experiments," or to test out levee designs or policy configurations before attempting to apply similar theories at the State or national scale. Further, these projects can promote improved flood protection by increasing permitting efficiency and certainty. Multi-benefit regionally scaled projects can improve public safety while ensuring the future of endangered and threatened species, preserve and protect agriculture, and include stakeholder involvement and collaboration throughout the permit development process.[130] For LMAs, a regionally scaled project can help reduce the overall time and cost for permitting, help achieve compliance with State and federal laws, and incorporate optional conservation measures into activities and projects. This could benefit LMAs by decreasing maintenance costs, improving flood management efficiency, and increasing public safety.[131] For environmental interests, this regional approach could improve the efficiency and effectiveness of conservation efforts and guide comprehensive conservation planning, including promoting the recovery of species and creating system-wide conservation benefits.[132]

One example of a successfully completed multi-benefit project is the Hamilton City Flood Damage Reduction and Ecosystem Restoration Project. The project aims to enhance and restore the ecosystem while providing increased flood protection for Hamilton City. It will do so through the construction of 6.8 miles of setback levees, reconnecting segments of the river to the natural floodplain, and restoration of about 1,500 acres of native habitat between the new setback levee and the Sacramento River.[133] A Feasibility Study was completed in 2004 for the Project,

[130] Cal. Dept. of Water Resources, Feather River Regional Environmental Permitting Program <http://www.water.ca.gov/conservationstrategy/docs/cs_feather_fact.pdf> (last visited August 9, 2016).
[131] *Id*.
[132] *Id*.
[133] Sacramento River Forum, Hamilton City Flood Damage Reduction & Ecosystem Restoration Project, < http://www.sacramentoriver.org/forum/index.php?id=hamilton_city> (last visited August 18, 2016).

and construction was scheduled to begin in 2016. Assuming appropriate levels of funding are made available in the future, major construction should be finished by 2018.

The flood damage reduction benefits of the Hamilton City project are expected to be significant, with an increase from a 1 in 10 chance of flooding in any given year to a 1 in 75 chance of flooding in any given year. This also translates to a reduction of average of $577,000 in annual flood damages. The ecosystem restoration benefits include the restoration of about 1,500 acres of native habitat, of which 1,000 acres is riparian, 100 acres is grassland, 150 acres is savannah, and 250 acres is scrub. This will also restore floodplain connectivity in the Hamilton area. This has been an example of a truly multi-benefit project, and was successfully planned due to high levels of engagement from local officials and environmental NGOs, participation by USACE staff, and overall strong partnerships and communication.

The idea of "regional permitting" has been largely embraced by DWR, and the State agency has plans to permit more of these regionally based projects in the future. Permitting each individual project separately, as has been the status quo, has associated inefficiencies, high cost and unpredictable outcome (explored in more detail in *Part II: Problems Associated with Vegetation Removal Requirements*). It has also created a system where small isolated mitigation areas exist in locations far removed from the action, which are difficult and costly to manage. As such, DWR has attempted to facilitate development of "regional permits," which would allow for compliance with environmental laws at a broad, regional scale, over longer time periods than traditional permitting approaches. Ideas for regional permits include permitting that covers routine operations and maintenance activities, and multi-benefit conservation/flood protection projects. Multi-benefit actions for the State include flood protection systems that also restore and enhance the ecosystem and critical habitat such as levee setbacks, removing fish passage barriers, and other similar ecosystem restoration and enhancement actions. The state also considers multi-benefit objectives to include improvements to water supply, water quality, navigation, recreation, open space, and commercial fisheries.

One of these regional permitting efforts is focused on the Feather River region. Here, DWR is leading an effort to obtain permits through implementing the Feather River Corridor Management Plan. The goal of the plan is to permit the Feather River region holistically, with a

focus on integrating ecosystem improvements into flood risk management projects. Eventually, DWR hopes to regionally permit flood improvement projects in the region with a focus on ecosystem and habitat restoration. In order to do so, regional permits under consideration include a Habitat Conservation Plan (HCP) to satisfy ESA; an Incidental Take Permit through Section 2081 to satisfy CESA, a Regional General Permit through USACE to satisfy Clean Water Act (CWA) Section 404 and Rivers and Harbors Act Section 10, a Central Valley Regional Water Quality Control Board CWA Section 401 Certification; CDFW and Wildlife Master Streambed Alteration Agreement to satisfy California Fish and Game Code Section 1600, a Programmatic Agreement through National Historic Preservation Act (NHPA) Section 106, and a Joint Environmental Impact Report (EIR)/Environmental Impact Statement (EIS) through CEQA and NEPA.[134] Discussions are currently underway to begin the process of creating an HCP to satisfy ESA, but to date, this proposal is in its infancy.

The Sacramento River Flood Control Project General Evaluations Report (Sacramento River GRR) is another substantial effort to assess flood risk management capabilities and ecosystem opportunities within the Sacramento River flood conveyance system. This includes all levees and other flood control mechanisms in the Sacramento River Flood Control Project (SRFCP), which contains approximately 980 miles of levee protecting 2.3 million people within 50 communities, 1 million acres of land and nearly $38 billion worth of infrastructure.[135] This effort could present a similar opportunity to employ true multi-benefit project goals of flood risk reduction, ecosystem restoration and habitat protection.

The Sacramento River GRR is "a study to reevaluate the SRFCP to determine whether modification of the authorized project should be recommended due to changes in physical, economic, or environmental conditions."[136] The project seeks to integrate multi-benefit goals, improving the flood management system while also taking proactive steps to restore the riparian ecosystem. It is intended to account for system-wide hydrologic, hydraulic, and economic effects

[134] Cal. Dept. of Water Resources, Feather River Regional Environmental Permitting Program <http://www.water.ca.gov/conservationstrategy/docs/cs_feather_fact.pdf> (last visited August 9, 2016).
[135] U.S. Army Corps of Engineers, Sacramento District: Sacramento River General Reevaluation Report; <http://www.spk.usace.army.mil/Missions/Civil-Works/Sacramento-River-GRR/> (last visited August 8, 2016).
[136] U.S. Army Corps of Engineers, Sacramento River GRR Synopsis, Ecosystem Restoration Authorities (April 2016) at 2.

throughout the SRFCP area through the use of system-wide models and analyses. In April 2016, a draft Report Synopsis for the Sacramento River GRR was released, providing a tentative timeline for the project. As of the date of the Synopsis release, a feasibility cost share agreement was in place, scoping charette completed, and scoping for NEPA/CEQA had been done to define and inform alternatives for the project. Public review of NEPA/CEQA documents is anticipated to take place in May 2017, and the final EIS is tentatively planned to be submitted to the US Environmental Protection Agency (EPA) in September 2018.[137] Plans are also underway to include ER into the "purpose" of the SRFCP, so that USACE may have Congressional authority to pursue a multi-benefit project.

Some of the largest efforts to permit projects on a basin-wide scale are State-led Basin-Wide Feasibility Studies (BWFS's) and locally led Regional Flood Management Plans (FRMPs). The BWFS's are large in spatial scale, based on the two major river basins in the Central Valley, where RFMPs are more detailed plans based on subdivisions of those larger river basins. DWR initiated two BWFS's as part of the effort to implement goals of the 2012 CVFPP, including the goal to address flood risk management in the Central Valley on a systemwide scale.[138] This was done in close coordination with development of the Conservation Strategy. The two BWFS's are for the Sacramento River Basin and San Joaquin River Basin. These studies evaluate the feasibility of different alternatives for improving the flood management system, including expanding the flood bypass system, integrating ecosystem enhancement objectives, and combining regional improvements.[139] The studies present options, which are evaluated based on their ability to meet objectives for flood risk management, ecosystem functions, agricultural stewardship, cost, and other benefits. Recommended options will be refined through the development of the 2017 CVFPP. Overall, the BWFS's recommend long-term improvements over a large physical area, where RFMPs identify more specific projects and strategies to address local and regional flood risk management needs. Locally led RFMPs develop strategies for

[137] *Id*. at 1.
[138] Cal. Dept. of Water Resources, Basin-Wide Feasibility Studies (last modified 06/13/2016) <http://www.water.ca.gov/cvfmp/bwfs/>
[139] *Id.*

regional projects. DWR will review the plans and offer input consistent with the objective of promoting multi-benefit projects.

The State of California is also embarking on an effort to obtain environmental permitting for all O&M activities occurring on levees directly under State control. This effort is in the initial stages and has not progressed into an actual plan to date, but is commonly referred to as Environmental Permitting Operations and Maintenance, or "EPOM." DWR is currently undergoing CEQA analysis as part of this effort. Following CEQA analysis, they will initiate consultation under the California Endangered Species Act (CESA) with CDFW. Following this, a second phase of the effort will involve federal consultations. It is not presently clear which path DWR will take as a "federal nexus," but it will likely either include development of an HCP for all of their maintenance areas, or the development of a SWIF. If successful, this EPOM effort would be groundbreaking, and could benefit LMAs and State maintainers enormously by relieving them of common problems and confusions around O&M permits (described in detail in *Part II: Problems Associated with Vegetation Removal Requirements*).

Although regionally-scaled multi-benefit projects hold enormous potential in terms of increasing flood system safety and improving the ecosystem, these projects also have substantial challenges. The challenges commonly associated with such projects include the lengthy process, cost, policy issues, need for new technical expertise, and lack of local support. The duration of the process and associated cost are perhaps the biggest impediments to project development. For example, the Hamilton City project started as a concept in 1998, with a feasibility study completed in 2004, and construction to begin in 2016. The entire process may take longer than two decades to complete. Further, sources of federal and local funding are difficult to obtain. It is often hard to justify the value of a multi-benefit project with abstract ecological benefits, whereas one that simply targets flood damage reduction can be easily defined in terms of dollars. Politics also plays a role in funding agreements. Deeply ingrained mistrust of environmental interests, agricultural interests, and other stakeholder interests can lead to deadlock over crucial funding decisions. Finally, smaller communities are often unable to pay for such expensive projects.

Policy is also a prohibitive factor from implementing multi-benefit projects. For example, the leading USACE policy on multi-benefit projects has expired, but still seems to be used by the

federal government. This can be confusing when communities approach government agencies about potential multi-benefit projects. Further, State policies that divert from federal policies and USACE vegetation-removal requirements can be problematic in terms of permitting a multi-benefit project. These projects also require technical expertise. Biologists and engineers must inform the design process to ensure multi-benefit objectives are truly being met, but the requisite level of expertise can often be difficult to obtain. Finally, multi-benefit projects typically include some sort of acquisition of lands, easements, and/or rights of ways, which locals may adamantly oppose. This can halt or slow a multi-benefit project at the local level.[140]

4. Re-form roundtable

Another possible solution to levee vegetation issues could be to re-form the California Levees Roundtable with the involvement of a neutral facilitator. The Final California Central Valley Flood System Improvement Framework ("Framework Agreement") released by the California Levees Roundtable included the recommendation:

> "The participating agencies should endorse this Framework and commit to collaboratively work together as partners in upcoming years during implementation of this Framework and the Central Valley Flood Protection Plan to improve public safety and environmental sustainability."[141]

The neutral facilitator for the California Levees Roundtable also recommended that the Roundtable participants move forward with a Regional Solutions Team. This was a key recommendation included as part of the recommended next steps for Roundtable participants. The vision for such a team is to reconvene Roundtable participants to "explore the feasibility of various possible technical remediation treatments or engineering designs to address woody vegetation risks."[142] The facilitator saw the benefits of continuing Roundtable discussions with a focus on technical solutions to levee designs. This would include suggestions for levee designs

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[140] *See*, Sacramento River Conservation Area Forum: Projects and Resources Committee (PARC) Meeting Notes (March 12, 2015) at 2-3. < http://www.sacramentoriver.org/forum/publications/parc/2015-03-12_PARC_Meeting_Notes.pdf >

[141] California Levees Roundtable, California's Central Valley Flood System Improvement Framework (February 2009) at 76.

[142] Laura Kaplan, Final Roundtable Assessment Report (August 30, 2011) at 7.

that would retain waterside vegetation while also maintaining strict safety standards and would help establish designs that would be generally acceptable for USACE variance requests. One such example could be setback levees, leaving the existing waterside levee slope intact and building a new active levee prism adjacent to the landside of the levee, outside of the rooted zone. Another potential solution could be to install a floodwall or slurry wall in the center of the levee to reduce the likelihood of seepage or root penetration. The recommendation also includes encouraging the team to explore new designs that could be acceptable to all stakeholders and balance ecosystem and safety needs.

The reconvening of the Roundtable to generally discuss levee vegetation issues may lead to a similar dissolution as the first Roundtable discussions. This is because every stakeholder feels as if they are doing the "right thing," and pushing strongly for policies that support their main objective, whether it is maintaining strict national safety standards for levees, or ensuring that the last remaining critical endangered fish habitat survives. However, if Roundtable participants were to convene over a specific project, more productive progress could be made. Often times it is easier to compromise over a specific project with tangible outcomes, rather than to discuss solutions or changes to policies in the abstract sense. Thus, there may be more hope in convening a Regional Solutions Team that would focus on technical solutions to specific project proposals.

Roundtable participants from the original Roundtable could convene, following a specific flood system and ecosystem restoration proposal by an applicant. This group could discuss problems associated with that particular project application, and discuss and propose technical solutions. This would ensure cooperation by government agencies and provide project proponents with clarity and guidance on what should be expected of them. This would also help project proponents with developing a vegetation variance, if needed, and would combat the incentive to forgo obtaining a variance due to perceived confusion, costliness and length of time to obtain a variance. If this group were to convene, they should also involve a neutral facilitator to ensure that conversations stay on task and productive.

Although the convening of a Regional Solutions Team could provide potential significant benefits, it may also be unlikely, due to a variety of prohibitive factors. This includes how the Roundtable initially disbanded, following the lawsuit brought by State agencies against USACE

for their vegetation management policy. Although years have passed since dissolution of the Roundtable, lingering emotions may still be at play and there may be a general hesitance from participating agencies to try to reconvene. Further, the structure of some agencies may reduce the effectiveness of the team. For example, federal agencies are often structured in such a way that regional policymakers are prohibited from making important planning decisions without first going through headquarters in Washington D.C., which can take significant time. This can make discussions frustrating, because regional representatives from these agencies cannot commit to any acceptable designs during Roundtable meetings, and have to go back and forth trying to relay intricacies discussed in Roundtable meetings with officials in headquarters.

5. Develop SWIF/s for California's Central Valley

Another possible solution would be to develop a System-Wide Improvement Framework (SWIF) or multiple SWIFs specific to California's Central Valley. The framework for developing a SWIF is discussed in greater detail in *Appendix 1: Federal Laws and Policies*. The theory behind a SWIF is for State or local maintainers to develop a plan to fix the worst levee deficiencies first, eventually getting to a point where all levees will be brought into compliance with USACE engineering criteria. However, while maintainers bring the levees into total compliance, they will maintain PL 84-99 eligibility and not be seen as violating vegetation standards for purposes of other permits and approvals.

The SWIF does not create any vegetation variance in and of itself, but it does allow vegetation flexibility based on two opportunities. First, the SWIF allows maintainers to fix the least threatening factors to levee safety last. Levee maintainers can focus primarily on issues like burrowing animals, seepage and erosion control, and then years down the road (once all major threats to levee stability have been addressed) they may focus on bringing levee vegetation into compliance with USACE engineering criteria. This addresses issues of limited funding and resources allocated to low priority threats like vegetation. It ensures that limited funds will be used for severe levee threats, and only once those severe threats have been addressed will limited funds be used to address levee vegetation, widely acknowledged as an overall low threat to levee stability.

The second way a SWIF can allow vegetation flexibility is to be used in conjunction with a variance. The SWIF guidelines state that a SWIF may be used in conjunction with a vegetation variance, obtained pursuant to the terms of the PGL. The overall intent of the SWIF policy is to provide a regional solution to bring levees into compliance with all USACE requirements. These requirements can include a vegetation variance, so long as the applicant gets a formal variance approval through USACE.

Finally, a SWIF can provide a federal nexus for ESA Section 7 purposes. As discussed above, local levee maintainers generally have no federal action associated with regular O&M activities, and therefore can be liable for Section 9 take violations under the ESA. However, if the local maintainers successfully develop a SWIF and that SWIF is approved by USACE, USACE has engaged in a federal action and provided a federal nexus, triggering Section 7 of the ESA. Section 7 requires the federal action agency to undergo consultation with the consulting agency, and the consulting agency can provide take coverage for the action, alleviating the local agency of potential liability. The ESA will be discussed in greater detail in *Appendix 1: Federal Laws and Policies.*

One example of a successful SWIF is the SWIF developed by the King County Flood Control District (King County SWIF) for the Lower Green River.[143] The King County SWIF covers about 42 miles total of the Lower Green River shoreline, including 16 miles of levees already enrolled in the PL 84-99 program, 12 miles of non-PL 84-99 levees/revetments, and 14 miles of shoreline with no facilities.[144] The King County SWIF contains information on: an overview of the King County levee system, identified levee deficiencies needing corrective action to retain PL 84-99 eligibility, a plan to resolve PL 84-99 deficiencies that cannot be corrected through routine maintenance and operations actions, vegetation recommendations, interim risk reduction measures, and a funding strategy.

The King County SWIF describes in detail each area and its associated deficiencies identified by USACE. In 2014, the District underwent extensive vegetation removal to identify and track levee

[143] King County Flood Control District, Green River Interim System-Wide Improvement Framework (February 19, 2016). < http://your.kingcounty.gov/dnrp/library/water-and-land/flooding/capital-projects/SWIF/green-river-system-wide-improvement-framework-interim-report-february-2016.pdf>
[144] *Id.,* Figure 1-1 at 1-3.

deficiencies. The largest category of deficiencies was categorized as Unwanted Vegetation Growth (154 sites out of 456 deficiency sites).[145] Other deficiencies included Animal Burrows (39 sites), Encroachments (61 sites) and Other-Culverts (56 sites).[146] Chapter Two of the SWIF contains the Deficiency Action Plan, or the plan to bring the system into PL 84-99 compliance based on a "worst-first" approach. The deficiencies that pose the greatest threat to Lower Green River levee integrity include slope stability and culvert deficiencies.[147] As such, those deficiencies are addressed first in the Deficiency Action Plan.

Corrective actions prioritized to be completed in the near-term and mid-term comprise of those to be completed or initiated during the 2016-2021 time period. Near-term actions include actions such as culvert and pipe repairs, stump removals, site assessments, and encroachments. Mid-term actions include site assessments, implementation of a Vegetation Management Plan, and mid-term capital projects. Long-term actions include capitol projects that correct current slope stability deficiencies on PL 84-99 segments.[148]

The SWIF includes a programmatic Vegetation Management Plan. This is characterized by an approach that manages vegetation to ensure it does not impede inspection, but remains to support habitat and water temperature goals. Removal of stumps located within the levee prism is also a SWIF priority. In 2008-2009, nearly 500 trees were cut to comply with ETL requirements. In 2014, stump removal was initiated for the stumps left over from the cut trees. The removal of these stumps remains a priority for the region, including removal of stumps and roots that exceed ½ inch in size. Levee slopes are replanted, and levee crests paved as appropriate following stump removal.[149] Problems associated with vast vegetation removal include possibilities of seepage and erosion. These problems are discussed in greater detail in *Appendix 4: Science and Research.*

The SWIF's Vegetation Management Plan recognizes that "vegetation is no longer one of the deficiency categories by which the USACE determines levee or floodwall eligibility for the PL

[145] *Id*. at 2-3.
[146] *Id*. at 2-3.
[147] *Id*. at 1-4.
[148] *Id*. at 2-5.
[149] *Id*. at 2-8.

84-99 Program" but that "ensuring inspection viability is still a consideration."[150] Thus, the SWIF recognizes that USACE cannot preclude levees from PL 84-99 eligibility based on vegetation non-compliance, but that in practice it becomes more complicated. The Vegetation Management Plan seeks to balance all interests involved, while also ensuring compliance with ESA and the CWA.[151]

As a hallmark of the Vegetation Management Plan, no future tree removals along PL 84-99 shorelines are anticipated, unless an individual tree is determined to pose a safety hazard to levee integrity.[152] The SWIF's Vegetation Management Plan includes references to a report made by the Washington Department of Ecology, which recommended planting additional shoreline shade trees to reduce elevated water temperatures in the Green River.[153] The Vegetation Management Plan also recognizes benefits of carefully planted and stewarded shoreline vegetation, including increased shade to the river channel; native shrubs providing micro habitat and climatic benefits; improved shoreline stability in terms of erosion and slope stability; and improved conditions overall for people, fish, farmers and the community at large.[154]

The Vegetation Management Plan is not intended to be prescriptive, but as a "starting point" for individual projects.[155] As such, the plan encourages site-specific variability.[156] The plan provides these guidelines in terms of Vegetation Management Zones, which were designed to provide guidelines for consistent maintenance, operations and stewardship of vegetation along shorelines.[157] The PL 84-99 shorelines are grouped into six zones based on specific characteristics related to PL 84-99 eligibility including, levee integrity, environmental characteristics, and public use and safety. Each zone is assigned a target vegetative structure to achieve outcomes relative to:

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[150] King County Flood Control District, Green River Interim System-Wide Improvement Framework (February 19, 2016) at 4-1; referencing, *Interim Policy for Determining Eligibility Status of Flood Risk Management Projects to Rehabilitation Program, Pursuant to PL 84-99*, (March 2014).
[151] King County Flood Control District, Green River Interim SWIF (February 19, 2016) at 4-1.
[152] *Id*. at 4-1.
[153] *Id*. at 4-2.
[154] *Id*. at 4-2.
[155] *Id*. at 4-3.
[156] *Id*. at 4-3, 4-4.
[157] *Id*. at 4-3.

> "plant/tree species selection guidance, location (specifically new trees, with respect to the internal levee core prism); vegetation densities; and long-term vegetation maintenance, operations and stewardship practices in the vicinity of current and potential future PL 84-99 shorelines."[158]

The six Vegetation Management Zones consist of: landward zone, landward slope zone, crest zone, upper riverward slope, riverward bench zone, and lower riverward slope zone.[159] The Vegetation Management Plan makes recommendations based on these zones, categories, and type of vegetation. For example, large trees would be planted most densely in vegetation management zones on the riverward slope and riverward bench, and less densely in the landward slope.[160] Shade tree planting would be informed by the location of the internal levee core prism, location of trail/access road on the levee crest, or location/depth/type of levee or floodwall.[161] Setback levees are encouraged, where feasible, to allow more space to support large shade trees.[162]

[158] *Id*. at 4-3.
[159] *Id*. at 4-4.
[160] *Id*. at 4-6.
[161] *Id*. at 4-6.
[162] *Id*. at 4-6 – 4-7.

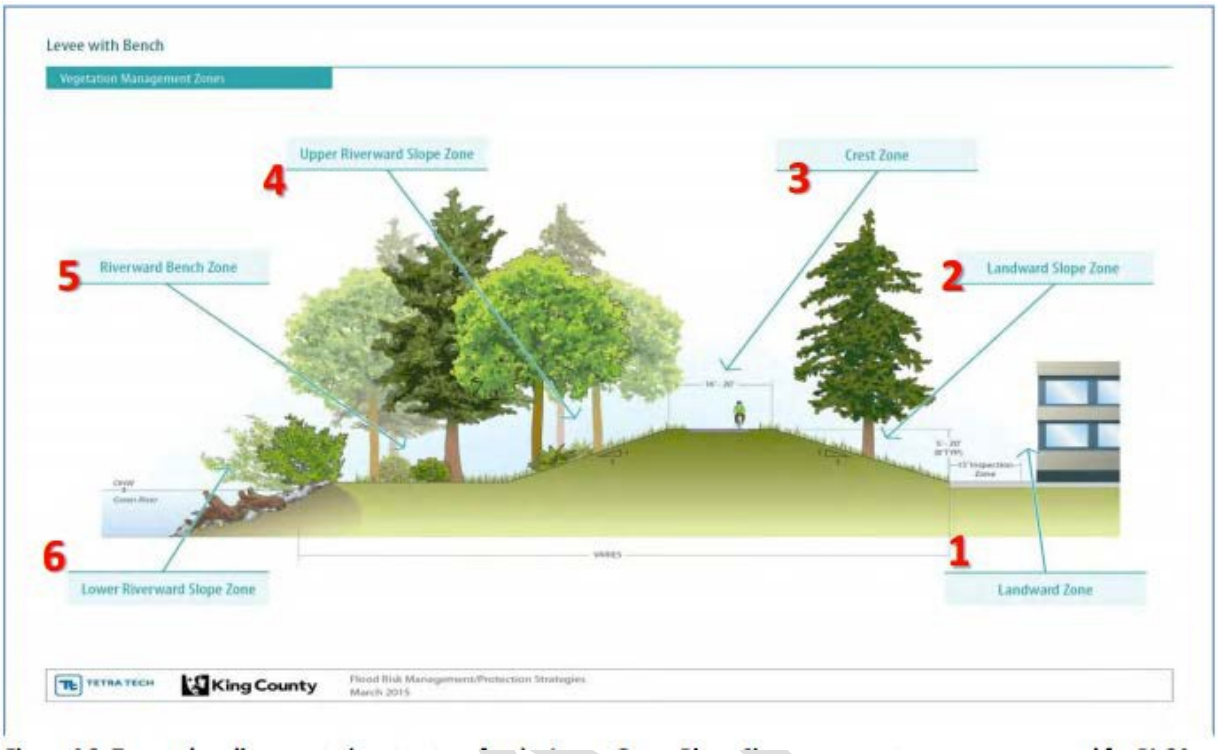

Figure 15: King County SWIF, Showing Target Shoreline Vegetation for Green River with Riverward "Bench" Planted With Trees[163]

Levees are further categorized based on shoreline type, when the levee was constructed, how it was constructed, and any recent repairs. Areas characterized as "Shoreline Type A" include levees that were engineered prior to attempts to establish vegetation, often characterized by rock armor filled with invasive plant species. Vegetation management for Type A shorelines includes slope mowing, noxious weed control, tree management for stumps left over from mass tree removal in 2008-2009, and removal of hazardous trees if necessary.[164]

Areas characterized as "Shoreline Type B" include levees that received early bioengineering repairs and "bench back projects," or levee projects that include native vegetation plantings, usually on the waterside slope.[165] Vegetation management recommendations for type B shorelines include: thinning vegetation as needed for inspections, and maintaining inspection

[163] *Id*. at 4-2.
[164] *Id*. at 4-8.
[165] *Id*. at 4-8 – 4-9.

zones; conducting inspections during the early spring when shrubs do not have leaves; minimal thinning of willows along the shoreline, but not over the water, to allow light for slower growing trees planted on benches; protection of existing trees and planting new trees in a coordinated manner; removing vegetation except for grass on the levee crest and 8-10 feet down from the levee crest on the riverward slope; and ongoing invasive species and noxious weed management.[166]

Areas characterized as "Shoreline C" include recently planted levee setbacks and floodwall projects. This is the smallest category, and maintenance and stewardship recommendations for type C shorelines include: invasive species control in the bench and riverward slopes; thinning of willows planted at the toe if necessary for inspections; evaluation to incorporate larger shade trees into riverward slopes; watering for plant establishment and noxious weed control; and mowing of the upper riverward slope for trail safety and for inspections.[167]

The plan also encourages balancing vegetation risks and benefits. For example, the plan states that in areas where woody vegetation could pose large benefits in terms of river shading, those benefits might outweigh potential risks, while this might not be the case for areas where woody vegetation does not provide shading functions to the river.[168] Certain trees may require site-specific assessments to determine whether and to what extent they may pose a threat to levee integrity.

The plan includes detailed guidelines for vegetation management based off of vegetation zone and category, which are beyond the scope of this review. However, this could provide a helpful example for a similar SWIF specific to California.

Part of what made development of the King County SWIF successful was the high level of interagency collaboration. As part of the SWIF's development, the King County Flood Control District convened two advisory groups. The first was the "Advisory Council," comprised of members from the "leadership level in their respective organizations."[169] The Advisory Council

[166] *Id*. at 4-9.
[167] *Id*. at 4-9 – 4-10.
[168] *Id*. at 4-4.
[169] *Id*. at 1-2.

was convened five times to provide policy input at project briefings. The second advisory group was the "Technical Advisory Committee," which was convened eleven times to provide a technical review of work products, and to provide policy and technical input.[170] Advisors represented the following organizations: King County Flood Control District; King County; the cities of Tukwila, Renton, Kent, and Auburn; Muckleshoot Indian Tribe; State agencies, including Puget Sound Partnership, the Department of Fish and Wildlife, and the Department of Ecology; federal agencies including USACE, NOAA, and FEMA; Water Resource Inventory Area (WRIA) 9; business community members including Boeing, Washington REALTORS, Master Builders Association, and NAIOP Commercial Real Estate Development Association; and environmental groups including The Nature Conservancy and American Rivers.[171]

Development of the King County SWIF also exemplifies challenges associated with planning and implementing a SWIF. One challenge is the length of time it took to plan and implement the King County SWIF. The process started with the submittal of a letter of intent to USACE in 2012. Then King County worked with stakeholder Advisory Council & Technical Advisory Committee to develop final submission material to USACE in February 19, 2016. According to USACE SWIF guidelines, after a letter of intent is approved by USACE, a SWIF must be developed within 2 years.[172] However, development of the King County SWIF took twice that, resulting in the SWIF technically violating the USACE guidelines by exceeding the appointed timeframe. This is indicative of the lengthy time necessary to develop a successful SWIF, perhaps more than USACE intended when they originally designed the process with a two-year development mandate.

The King County SWIF begins with a letter from the King County Flood Control District Board of Supervisors to the Regional USACE Commander, which recognizes the SWIF's limitations. The letter acknowledges that it is intended as a short-term solution to regain eligibility under the PL 84-99 program, but does not meet all of the goals and objectives of Green River stakeholders.

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[170] *Id*. at at 1-2.
[171] *Id*. at 1-2.
[172] U.S. Army Corps of Engineers, Memorandum for Commanders, Major Subordinate Commands and Districts: Policy for Development and Implementation of System-Wide Improvement Frameworks (SWIFs) at 5. <http://www.sas.usace.army.mil/Portals/61/docs/Engineering/LeveeSafety/SWIF_Policy.pdf>

Rather, King County will try to integrate stakeholder objectives in a larger River Corridor Plan in the future.

In California, it could be feasible to pursue a similar SWIF as King County's. However, California would need a similar commitment of all key stakeholders in order for the effort to be successful. This is possible but would take time and energy and would be more doable if the project had a champion to push the SWIF forward and a neutral facilitator to keep stakeholders focused and on track. California may further be limited because here, we may not be able to conduct a similar extensive vegetation removal to identify deficiencies, like they did in King County, given the little remaining critical habitat that California woody vegetation provides. Instead it is likely that we would need a different assessment tool or assessment system to identify existing deficiencies.

Further, in order to protect critical habitat the SWIF in California would likely need to be associated with a vegetation variance, although this is unclear given the current state of the regulatory framework. In King County, the district cited interim guidelines that preclude using vegetation removal as the factor that prohibits levees from PL 84-99 eligibility. However, levee vegetation can still factor into PL 84-99 analysis overall. It is unclear whether a similar SWIF policy that retained vegetation would be possible in California without a variance. This is where input from regional USACE leadership would be paramount. If a variance is also required, it is less likely that this would be a feasible option, given the confusion around variance guidelines and procedures. However, with appropriate USACE leadership and guidance, this obstacle could be overcome.

Finally, the California SWIF would need to be developed in an appropriate geographic location to be successful as a test case. Ideally, the SWIF would cover a very large geographic area, but realistically that could be unduly onerous as a pilot project. Instead, a SWIF should be developed in a specific watershed with the opportunity to rebuild or modify levees as well as opportunity for habitat enhancement. This could be an area where landowners are open to setback levee development, likely in non-urbanized areas to avoid resident relocations. This should also be attempted in an area where key leadership is engaged. In order to be successful, the SWIF would need strong leadership from the levee maintainers and all agencies involved. If successful, the

pilot SWIF could provide an example for larger SWIFs to cover the entire Sacramento and San Joaquin River Basins.

6. Support Legislation to Improve Regulatory Framework

Another approach to resolving issues described in *Part II: Problems Associated with Vegetation Removal Requirements* could be to support new legislation that would improve the regulatory framework for permitting flood conveyance systems. Recently, legislation was proposed in the Senate's version of Water Resources Development Act (WRDA) 2016 to address some pertinent levee vegetation issues. (The House of Representatives also passed a version of WRDA 2016, which did not address anything related to levee vegetation). The language included in the Senate's version of WRDA 2016 was not included in the final bill (renamed the Water Infrastructure Improvements for the Nation or "WIIN"), but the ideas included in the Senate version can still be used as a foundation for future legislation.

The Senate version of WRDA 2016 proposed language that would update WRRDA 2014, Section 3013(g)(1). WRRDA 2014, Section 3013(g)(1) provides "interim actions" that the USACE shall adhere to, pending the submission of review of the ETL and PGL. The Senate version of WRDA 2016 would have updated the WRRDA 2014, Section 3013(g)(1) language by: (1) Inserting "remove existing vegetation or" after "the Secretary shall not," and (2) Removing "as a condition or requirement for any approval or funding of a project, or any other action."

These proposed changes would have provided greater clarity than the previous language in WRRDA 2014. Without these updates, no legislative authority prevents USACE from removing existing vegetation on levees during the "interim," (or while the USACE carries out a comprehensive review of their vegetation removal guidelines). Rather, WRRDA 2014 only directly prevents USACE from requiring that others remove existing vegetation in order to maintain eligibility for emergency relief programs like PL 84-99. The Senate's proposed language in WRDA 2016 would have clarified and strengthened the spirit of WRRDA 2014, which sought to prevent the removal of existing vegetation on levees until such time as USACE thoughtfully revisits their vegetation removal policies.

Additionally, the language removing confusing qualifiers from the directive that USACE shall not require removal of existing vegetation would have clarified the directive of the law. This proposed language would have made it clear that, until such time that the USACE conducts a thorough review and reexamination of their vegetation removal policies, they may not require removal of existing vegetation from any other person or entity under any circumstances, unless that vegetation poses an unacceptable safety risk.

Finally, the proposed language in the Senate version of WRDA 2016 § 1027 (b) would have provided much needed consequences for failing to meet deadlines of WRRDA 2014. WRRDA 2014 provided that USACE shall carry out the terms of the legislation and provide revised guidelines within 18 months of the law's enactment. That deadline passed in December of 2015. The Senate version of WRDA 2016 would have required that USACE submit a report, within 30 days, detailing the reasons for failing to meet the WRRDA 2014 requirements, along with a plan for how they will come into compliance. This addition would have been a key means to enforce the terms of WRRDA 2014.

Unfortunately, the above language in WRDA 2016 was not included in the final bill. However, legislative history of the Senate's original version could provide a guide for similar legislation that may be proposed and passed in the near future.

Another bill (AB 2087) was approved by the Governor on September 22, 2016. AB 2087 amends the California Endangered Species Act (CESA) to include regional conservation investment strategies, which encourages planning on a regional basis that includes conservation goals. Under CESA, the California Department of Fish and Wildlife (CDFW) may authorize the take of listed species if it is incidental to an otherwise lawful activity and the impacts are fully mitigated. Existing law further prohibits any entity from substantially diverting or obstructing the natural flow of, or substantially changing or using any material from the bed, channel, or bank of any river, stream, or lake, or from depositing certain material where it may pass into any river,

stream, or lake, without first notifying CDFW of that activity, and entering into a lake or streambed alteration agreement if required by CDFW to protect fish and wildlife species.[173]

AB 2087 would instead authorize CDFW to approve a regional conservation investment strategy after one or more public agencies request and submit a proposed strategy to CDFW. The proposed strategy would be developed in consultation with applicable local agencies with land use authority. AB 2087 authorizes conservation and habitat enhancement actions that would measurably advance conservation objectives of a CDFW approved strategy to be used as mitigation credits. If so, the conservation strategy must contain additional requirements under the law. Mitigation credits could be used to fulfill State or federal compensatory mitigation requirements for laws like the ESA and CESA, among others. Prior to using the mitigation credits, the submitting person or entity must also enter into an agreement with CDFW to ensure certain additional requirements are met. Although this legislation is not perfect (it includes tough requirements that may be difficult to realistically meet), it does allow public agencies to create mitigation credits with CDFW instead of traditional mitigation banking, adding flexibility to the mitigation process, and creating an opportunity for holistic environmental panning. This bill is also significant in that it allows for flexibility with regard to mechanisms for funding long term O&M of areas used for mitigation, and mechanisms to preserve land in perpetuity. In that sense, AB 2087 is a useful starting point. Overall, legislation such as this would facilitate holistic flood system management and regional conservation. This would help planning at the State level, and useful aspects of AB 2087 could potentially be adapted to similar national legislation.

Other legislation adopted at the State or federal level could advance similar goals as the Senate version of WRDA 2016 and California's AB 2087 by encouraging USACE to follow through with directives of WRRDA 2014, strengthening and clarifying directives of WRRDA 2014, and encouraging regional conservation as a primary goal of flood system management projects.

[173] Levine, AB 2087: An act to add Chapter 9 to Division 2 of the Fish and Came Code, relating to fish and wildlife (February 17, 2016).

7. Litigation

Another option to improve problems faced by the current state of woody vegetation policy could be to initiate or reinitiate litigation. *Appendix 3: Case Law* details two major lawsuits brought by the State and environmental NGOs over the promulgation of the USACE vegetation policy, which may violate ESA, NEPA and APA. These cases were both dismissed without prejudice by the Court, following the release of WRRDA 2014, which directed USACE to revisit and rewrite their vegetation policies (specifically the ETL and PGL), taking new science into account and with the advisement of experts in the field.

The deadline that WRRDA 2014 established for USACE to comply with its terms has long passed. If they chose to, the State or environmental NGOs who originally brought the suits against USACE could reinitiate their lawsuits, or bring a suit compelling USACE to comply with WRDDA 2014's legislative requirements. It is unclear whether the Court would hear the suit on its merits before USACE had promulgated new vegetation management policies, but it does seem as if the Court could at least compel USACE to release new guidelines, per the law's directives. Further, once these guidelines have been released, it is more likely that a Court would rehear the State or NGO claims on the merits.

If, in the re-release of the new vegetation guidelines, USACE similarly does not undergo consultation per Section 7 of the ESA and does not undergo the process of developing an EIS per NEPA, it is possible for the plaintiffs from the previous lawsuits to reinitiate their suit, or bring a new lawsuit with similar allegations. If the previous plaintiffs choose not to do so, a different plaintiff with proper standing could also sue based on the refusal of USACE to undergo ESA and NEPA procedures.

Litigation could be successful in that the Court could order USACE to undergo the required environmental consultations and environmental assessments. However, typically in these actions deference is given to the government agency acting as defendant, unless they have blatantly violated the procedure of an environmental law. The outcome in the present situation would be far from clear. Thus, any initiation of a lawsuit would be a risk undertaken by potential plaintiffs, as litigation can take years and would likely be very costly.

Perhaps the biggest reason that litigation may be a poor route to pursue is the large potential for relationship fallout. During the time when the State initiated its lawsuit against USACE, USACE decidedly ended its involvement in the Roundtable discussions. The Roundtable was involved in creating compromise agreements in a productive way, but initiation of the lawsuit brought those discussions to a screeching halt. Litigation often spends large amounts of time and money to create a more polarized debate. Therefore litigation should only be used as a last resort where alternative resolution cannot be reached.

8. Use Endangered Species Act

The ESA has been described as one of the strongest environmental laws in the United States, in part because it prohibits any act that would result in the "take" of a species or the degradation of its habitat. As such, the ESA has a large potential to provide solutions to the current regulatory framework regarding woody vegetation on levees. This includes using usage of strong, consistent reasonable and prudent alternatives (RPAs) during formal consultations for large levee projects; usage of the "no RPA" alternative for consultation on large levee projects when there is no equivalent habitat present and a vegetation variance is demonstrably infeasible; and referencing State planning tools to use as Best Available Science in RPAs. For additional background and information on the ESA, see *Appendix 1: Federal Laws and Policies*.

As the "consulting agency" (FWS and/or NMFS, depending on the species) undergoes a formal consultation with the "action agency" (the agency undertaking the federal action) per Section 7 of the ESA, the consulting agency and action agency must agree on a determination as to whether or not the action results in jeopardy to the listed species in question. If the action is likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of critical habitat, then the formal consultation is characterized as a "jeopardy biological opinion."[174] In the case of a "jeopardy" biological opinion, the biological opinion (BiOp) must include reasonable and prudent alternatives (RPAs).[175] If the consulting

[174] 50 C.F.R. §402.14(h)(3).
[175] 50 C.F.R. §402.14(h)(3).

agency is unable to develop RPAs, "it will indicate that to the best of its knowledge there are no [RPAs]."[176]

RPAs are identified during a formal consultation, and offer alternative actions consistent with the action's original purpose that will avoid the likelihood of jeopardizing the continued existence of listed species or the destruction or adverse modification of designated critical habitat.[177] RPAs must also be economically and technologically feasible.[178] In formulating RPAs, the consulting agency must use the "best scientific and commercial data available" and "give appropriate consideration to any beneficial actions taken by the federal agency or applicant, including any actions taken prior to the initiation of consultation."[179]

One possible solution to the levee vegetation issue could be for a consulting agency to recommend strong RPAs for levee improvement projects. Large, programmatic levee improvement projects that propose large-scale tree removal would likely result in a jeopardy opinion, and would present such an opportunity. For example, a consultation submission by USACE for a levee improvement project would likely include tree removal as part of the action. If the proposed tree removal is on a large scale, this would likely result in a jeopardy opinion, as it would involve the destruction of critical habitat, particularly critical fish habitat. As such, the consulting agency could include strong RPAs in the project's BiOp. As described above, these RPAs are constrained in that they must be economically and technologically feasible, they must avoid the likelihood of causing jeopardy to the species and/or its habitat, and they must be consistent with the project's original purpose. If NMFS and/or FWS were able to recommend strong RPAs within those constraints in the Central Valley, then by definition jeopardy to the species would be avoided and the project's intended purpose could still commence.

Developing an RPA that meets the above requirements would likely necessitate maintaining most of the riparian vegetation and SRA habitat along the waterside of the levee prism, especially along the lower waterside slope, as this provides the most beneficial habitat to listed fish. It should be noted that many applicants are able to mitigate for their actions through

[176] 50 C.F.R. § 402.14(h)(3).
[177] 50 C.F.R. §402.02.
[178] 50 C.F.R. §402.02.
[179] 50 C.F.R. § 402.14(g)(8).

purchasing mitigation credits at a "mitigation bank" when a bank exists in the affected species critical habitat and the bank has similar habitat to that being destroyed or affected by the action. However, given the limited available habitat currently in California riparian corridors for Central Valley ESA-listed fish species, it is unlikely that an applicant would be able to fully mitigate for extensive vegetation removal for a large scale project.

The RPA/s would also need to maintain the original purpose of the project, which would likely be to update the levee prism and increase the factor of safety of the levee. In the case of a USACE levee project submission, the consulting agency could suggest an RPA requiring USACE to retain all or most woody vegetation on the levee, while still increasing levee safety and following through with all other goals of the project. In doing so, the consulting agency would be required to use the best available science. The consulting agency could utilize research compiled in the Synthesis Report (for more details on the CLVRP Synthesis Report, see *Appendix 4: Science and Research*), as this report presents the most current science on levee vegetation. The consulting agency could also utilize policies implemented by the State of California as best available science. The State has been managing levees with vegetation to ensure levee safety and stability while not sacrificing critical riparian habitat for the past five years. (For more information on State vegetation management policies, see *Appendix 2: California State Laws and Policies*). State policies are characterized by DWR's Levee Vegetation Management Strategy (LVMS), which includes LCM and allows for thinning of vegetation on upper waterside and landside slopes to maintain inspection accessibility, long-term compatibility with USACE standards, and retention of woody vegetation on the lower waterside levee slope. The consulting agency could borrow from these policies, which arguably represent best available science in terms of woody vegetation management, and utilize ideas of the LVMS in an RPA.

If the consulting agency were to refer to research presented in the Synthesis Report and implement innovative ideas for vegetation management, then RPA/s for a large project could meet the RPA regulation requirements. A successful RPA would maintain critical habitat, not jeopardize listed species, be economically and technologically feasible, and maintain the original purpose of the project: levee safety. Implementing such an RPA on a large levee segment could have an enormous habitat preservation benefits for a particular area.

However, this also comes with challenges, including the fact that USACE would likely require a large variance in order to maintain woody vegetation on levees, even if part of an RPA. As discussed above, applying for a vegetation variance is time consuming expensive, and confusing. If USACE officials were heavily engaged in the process, confusion could be alleviated a successful variance could be issued, but absent clear guidance from officials it is unlikely that another applicant would be able to navigate the variance process.

The consulting agency could also come to a conclusion that no RPAs exist, and so the only option for the applicant would be to cancel the project or refrain from removing vegetation as part of the project description. However, to do so, the consulting agency would need to clearly demonstrate that no RPAs exist. This is unlikely given the demonstrated ability for some previous projects to manage safe levees with woody vegetation (see above examples, such as the Hamilton City Flood Damage Reduction and Ecosystem Restoration project), proving that balancing environmental and safety objectives for levee projects is possible. However, if the consulting agency demonstrates that the action agency is unable to practically obtain a waiver required by USACE, and that a waiver is required in order to maintain woody vegetation on the levee, a "no RPA" conclusion could be an option. In this case, the consulting agency could essentially reject a project proposal from an applicant seeking to remove vast amounts of woody vegetation on Central Valley Levees.

This option would also come with substantial challenges, the foremost of which is that it would result in project deadlock and prevent necessary projects from going forth to fix and update levees. This would result in risk to communities behind the levees to be updated, and as such is a poor choice of policy. However, the consulting agencies are bound by the stringent terms of ESA, so if a variance is necessary but proves impracticable, this could occur.

In addition to utilizing RPAs to effect change, an applicant could also pursue a Habitat Conservation Plan (HCP) as part of a project. A successful HCP must satisfy the following requirements: (i) it must describe the impact resulting in a take; (ii) include steps the applicant is taking to minimize and mitigate impacts that result in a take, and associated funding sources; (iii) describe alternative actions considered by the applicant, and why those alternatives are not being

pursued; (iv) and include any other measures the consulting agency deems appropriate.[180] When reviewing the HCP, if the consulting agency finds the following factors have been met, they may approve of the HCP: (i) the taking will be incidental; (ii) the applicant will minimize and mitigate the impacts of the taking to the maximum extent practicable; (iii) the applicant will demonstrate adequate available funding; (iv) the taking will "not appreciably reduce the likelihood of the survival and recovery of the species in the wild;" and (v) any other measures required by the consulting agency pursuant the HCP requirements will be met.[181]

HCPs can be useful in situations where there is no federal nexus, but the project applicant could potentially take a listed species or adversely modify its critical habitat. For levee project applicants, there is potential to develop creative HCPs to conserve critical riparian habitat in part of the river, and allow for limited modification in the action area. In other words, if the applicant finds that in one portion of the river, obtaining a variance is impractical, but the applicant still needs to undergo levee updates, the applicant could develop an HCP to protect critical habitat in another area. Note that for the action area, the applicant would still need to minimize impacts to habitat to the greatest extent practicable, so mass removal of woody vegetation is unlikely to conform to these regulations. However, if an action will result in the removal of relatively small amounts of woody vegetation as critical habitat, then the applicant could work with the appropriate consulting agency (or both, depending on impacted species) to develop an HCP and protect critical habitat elsewhere. This has been a solution explored by the State, described above, for the Feather River Region area.

9. Compliance with WRRDA 2014

USACE could develop new vegetation management policies, including an updated variance policy, per the requirements of WRRDA 2014, section 3013. WRRDA 2014, section 3013 directed USACE to review current guidelines in a way that takes into account regional variation. The legislation also directs USACE to consider factors such as varied interests, environmental impacts, benefits woody vegetation can provide to levee safety, impacts to levee safety of vast vegetation removal, Native American rights, recent science suggesting little evidence that woody

[180] 16 U.S.C. §1539(a)(2)(A).
[181] 16 U.S.C. § 1539(a)(2)(B).

vegetation causes increased flood risk, and economic costs. The legislation further directs USACE to do so with the advice of officials from State and federal government agencies, local and tribal government officials, leaders from NGOs and independent experts. WRRDA 2014, section 3013 directs USACE to do this within eighteen months of the law's passage. This deadline passed last year.

If USACE were to revisit the vegetation guidelines using best available science, with the advice of experts in the field, and taking into account regional variations, it is likely they would come to a conclusion that in California's Central Valley, woody vegetation could be retained in most instances. This is based on recent studies and models demonstrating that in California, woody vegetation generally does not pose a significant safety risk to levees. If USACE were to voluntarily comply with the terms of WRRDA 2014, section 3013 and implement new vegetation management policies in California that allow for woody vegetation retention, then essentially all of the problems and conflicts presented in *Part II: Problems Associated with Vegetation Removal Requirements* would be resolved, including potential conflicts between State and federal law, and conflicts between USACE policy and the ESA.

Rather than redoing their vegetation management policy nationwide, another option for USACE could be to implement levee vegetation regulations specific to California. This could take into account the State's region-specific needs and unique levee system, which overlaps with the last remaining critical habitat for endangered salmon. USACE could release engineering guidelines specific to California levees, in light of these regional differences. These guidelines could borrow from State planning guidelines, including LCM, which allows for retention of woody vegetation on the lower waterside slope (the part that provides the most critical habitat to endangered fish), but that over time phases out vegetation on all other parts of the levee.

Finally, USACE could rework the vegetation management guidelines focusing on a workable variance procedure. If USACE deems that the nationwide policy is necessary, they could make a feasible variance process to allow for regional considerations. As of now, the variance process and procedure is lengthy, expensive and confusing, and has been described by local maintainers as generally impracticable. If, however, USACE released clear guidelines that allowed for woody vegetation retention in Central Valley levees, and these guidelines were workable and

feasible for local maintainers, then this could also solve the above issues and problems articulated in *Part II: Problems Associated with Vegetation Removal Requirements*.

In should also be noted that in revisiting and reissuing their vegetation management policies, and/or their variance policies, USACE must abide by all applicable environmental laws, including NEPA and ESA. The complaints described in detail in *Appendix 3: Case Law*, contain arguments that USACE violated NEPA and ESA in promulgating the ETL and PGL without the necessary environmental review. Pursuant to NEPA, when a federal agency undergoes any action that significantly affects the human environment, the agency must prepare an environmental assessment (EA). If the EA raises a substantial question as to whether the action may significantly affect the human environment, the agency must prepare an EIS. Given the above discussion and potential for large woody vegetation removal to remove the little remaining critical salmon habitat in California, it is quite likely that in promulgating any woody vegetation regulation, USACE will be required to undergo preparation of an EIS, and would be violating NEPA if they fail to do so.

Similarly, under ESA, any federal action agency must consult with the appropriate consulting agency (NMFS and/or FWS) for any action to ensure it is not likely to jeopardize the continued existence of any listed species. In promulgating new vegetation regulations, USACE is required to consult with NMFS and FWS to ensure that the regulations are not likely to jeopardize the continued existence of any listed species or result in the adverse modification of critical habitat. If USACE fails to do so, they would be in violation of ESA Section 7 consultation requirements. Thus, the ESA as well as NEPA and all other applicable environmental laws should be followed if and when USACE complies with WRRDA 2014, section 3013 mandates and reissues their vegetation management policies.

10. Update O&M Regulations

USACE could update their O&M regulations, consisting of 33 CFR 208.10 and two manuals specific to the Central Valley: the Sacramento River Levee Operation and Maintenance Manual and Lower San Joaquin River Levee Operations and Maintenance Manual. These regulations were originally developed in the 1950s, and are now incredibly outdated. Because of this,

problems exist regarding confusion over requirements, difficulties for LMAs to meet O&M manual requirements, and inconsistencies between manual requirements and environmental laws, which were passed after the O&M manuals. Also, because these manuals and regulations are so old, they predate the ESA and as such, USACE never underwent the ESA Section 7 consultation process during their promulgation. (These problems are discussed in greater detail in *Part II: Problems Associated with Vegetation Removal Requirements*).

If USACE were to update the regulations set forth in 33 CFR 208.10, the manuals based off of these regulations would need to be updated as well. In doing so, USACE would need to undergo the required consultation with NMFS and FWS per ESA Section 7, ensuring that the updated regulations are not likely to jeopardize the continued existence of listed species or adverse modification of critical habitat. This could result in creative solutions during the consultation process to retain woody vegetation as critical habitat on levees, while providing clearer, more up-to-date O&M guidelines for LMAs.

CONCLUSION

Ultimately this issue comes down to the need to address regional differences for levee maintenance with respect to vegetation management. Right now, that is difficult to accomplish. George Qualley characterized it best in a Vegetation Policy Guidance White paper by stating that we need a policy that,

> "facilitates risk-prioritized management of legacy levee vegetation that promotes efficient use of public resources in meeting public safety goals while protecting and enhancing important and sensitive habitat within riparian corridors."[182]

This paper has attempted to compile the most current federal policies, State policies, case law and science on California levee vegetation issues. The author recognizes that this is an area where ongoing research will grow and develop, and the most recent science will continue to evolve. Ideally, laws should be informed by science, so that as our understanding of the world evolves, our laws and policies reflect the best available information. Therefore, as the science progresses relative to levee vegetation issues, so should our policies. This is particularly germane to the federal vegetation management policies and USACE guidelines that prescribe a vegetation free zone on levees. Recently compiled levee vegetation research demonstrates that in most instances woody vegetation on levees does not pose a serious threat to levee integrity. USACE policies should be updated to reflect our scientific understanding.

This report also offers arguments for why the current state of affairs is inadequate. This includes conflicting laws, both in terms of potentially conflicting State and federal law and conflicting USACE policy with the ESA; the dire need for levee repair, but levee maintainer's hesitation to do so in the face of confusing and conflicting policies; critical conditions of endangered salmonids and other endangered species in the Central Valley, and the fact that the last remaining three to five percent of riparian habitat is located on levee systems; confusion over O&M responsibilities, and outdated O&M guidelines that conflict with environmental laws as well as with USACE vegetation policies; confusing and costly variance requirements; confusion with current USACE standards in the face of WRRDA 2014, and implications for PL 84-99 eligibility; and the high cost of conforming with USACE vegetation-free requirements. Overall, the current state of affairs is unworkable and must be changed.

Finally, this report offers proposed solutions moving forward. It should be noted that this is far from an exhaustive list, and other creative solutions may provide answers preferable to those presented here. This list of proposed solutions was developed in coordination with members of

[182] George Qualley, Post WRRDA Vegetation Policy Guidance White Paper (Oct 8, 2014).

State and federal agencies, local agencies, and experts in the field of levee vegetation science and policy. These proposed solutions include engineering and designing levees that retain woody vegetation but are also acceptable to governing agencies, including USACE, in terms of safety; using peer-reviewed newly developed methods to uniformly and impartially determine when vegetation may pose a risk to levee integrity; encouraging multi-benefit, regionally based projects which can act as test sites for State or federal policies; re-forming a levee vegetation interagency working group such as the Roundtable; developing a SWIF or multiple SWIFs in conjunction with variance/s for the Central Valley; passing legislation that would improve the regulatory framework; using existing tools in the ESA to encourage vegetation retention on levees, including strong RPAs and developing HCPs; re-initiation of litigation; or USACE could simply comply with WRRDA 2014 and revisit and reissue vegetation management guidelines and associated variance guidelines.

Regardless of the method, this issue will ultimately come down collaboration and cooperation between leaders in the field. True, litigation or new legislation could attempt to compel USACE to issue new vegetation guidelines to resolve conflicts between those guidelines and the ESA as well as with State law. However, it is much more productive and effective for USACE officials to work with California officials, leaders from natural resource agencies, NGOs, and other experts in the field in addressing this problem. This is because passing legislation is quite expensive and takes significant time and resources, as does litigation. Moreover, legislation and court orders compelling an agency to act creates an adversarial relationship between actors and feeds into an argumentative mindset, making future compromise even less likely. If true collaboration could occur, where leaders from their respective organizations with the power to effect change gathered and discussed policy issues using data and conclusions from the best available science, new policies could be born that could address all of the worst issues faced by levee vegetation maintainers.

APPENDIX 1: Federal Laws and Policies

1. *FEMA*

USACE and the Federal Emergency Management Agency (FEMA) are the two federal agencies with direct roles and responsibilities related to flood risk management. Flood risk management generally refers to measures taken to reduce the risk of current and future flooding in a community. Such measures can include a variety of actions such as building or zoning requirements, insurance incentive programs, and requirements for constructing and maintaining levees. USACE and FEMA have distinct, but complimentary roles in levee development and maintenance.

FEMA has a variety of fundamental roles related to flood risk management. FEMA provides guidelines for communities to help reduce the risk of flooding, and damage due to flooding, to the maximum extent possible. One of the greatest tools FEMA uses to encourage implementation of these guidelines is the National Flood Insurance Program (NFIP). The NFIP uses insurance to incentivize communities to adopt and enforce flood management regulations.

Local communities at high risk from flood events are referred to as "Special Flood Hazard Areas" (SFHA), and are eligible for federal programs that will financially protect the community against losses due to floods, if the community adopts and enforces FEMA-endorsed floodplain management actions. In order to identify SFHAs and other high-risk areas, FEMA has created a Flood Risk Insurance Rate Map. FEMA's Flood Risk Insurance Rate Map identifies areas of flood control systems with less than 100-year level of flood protection. "100-year flood" means there is a 1 in 100 chance of a flood being exceeded in any given year (also referred to as "1% annual chance flood"). Similarly, a 200-year flood has a 1 in 200 (or 0.5%) chance of being exceeded in any given year.[183]

Areas that exceed the 100-year flood standard are considered "high-risk-areas" and as such have greater development restrictions than other communities.[184] Development in these areas must

[183] 2012 Central Valley Flood Protection Plan at 6.
[184] Federal Emergency Management Agency, Introduction to the NFIP (August, 2011) at 2. <https://www.fema.gov/media-library-data/20130726-1438-20490-1905/f084_atq_11aug11.pdf>

comply with federal requirements for floodplain management. Additionally, insurable structures in these areas must purchase flood insurance.[185] Flood insurance premiums can be quite costly, and as such FEMA has an incentive based system in place to reward communities that have taken extra steps to reduce risks due to flood damage with a discount on flood insurance premiums. This program is the NFIP's Community Rating System (CRS).[186] Communities that join the CRS can obtain flood insurance premiums ranging from 5% to 45%, based on: (1) the community's additional efforts to reduce flood damage risk, (2) the community's efforts to strengthen insurance aspects of the NFIP, and (3) any other efforts to improve comprehensive floodplain management.[187]

By identifying areas that do not meet the 100-year flood standard, FEMA's Flood Risk Map provides the basis for NFIP regulations and flood insurance requirements.[188] Areas identified as high-risk are more expensive to develop, difficult to insure, and subject to flood-proofing or elevation requirements.[189] This could benefit the natural floodplain by discouraging development in naturally flooded areas, and decrease the population at risk from flooding.

For areas already developed in floodplains, this can have the practical effect of adding costly flood insurance premiums to communities at risk.[190] For such communities, this creates a huge incentive to undertake substantial flood risk management and maintenance projects in order to qualify for the CRS, and thereby avoid expensive insurance premiums.[191]

Communities attempting to qualify for CRS must take significant steps to reduce the risk of damage due to flooding. This almost certainly involves updates and improvements to levees, the first line of defense protecting communities from flooding waters. However, such levee improvement projects place communities trying to qualify for CRS subject to all levee development and improvement laws, policies and regulations. There are a host of federal and

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[185] *Id*.
[186] *Id*. at 6.
[187] *Id*. at 6.
[188] Federal Emergency Management Agency, National Flood Insurance Program: Flood Hazard Mapping < http://www.fema.gov/national-flood-insurance-program-flood-hazard-mapping > (last visited August 17, 2016).
[189] 2012 Central Valley Flood Protection Plan at 6.
[190] 2012 Central Valley Flood Protection Plan at 1-19.
[191] Federal Emergency Management Agency, National Flood Insurance Program: Flood Hazard Mapping < http://www.fema.gov/national-flood-insurance-program-flood-hazard-mapping > (last visited August 17, 2016).

State laws, policies and regulations regarding levee development and improvement projects, including USACE's vegetation requirements, which will be discussed at length below.

Communities are thus financially incentivized through flood insurance programs to undertake substantial levee improvement projects to minimize potential risks due to flood events. In so doing, they become subject to federal and State levee improvement regulations, including USACE vegetation requirements. This can be problematic for communities, as USACE vegetation requirements may conflict with other State and federal laws, including the Endangered Species Act (ESA). Ramifications of conflicting laws and policies on local communities attempting to retrofit levees are discussed at length in *Part II: Issues Associated with Vegetation Removal Requirements*.

2. *USACE - National Levee Safety Program*

The USACE National Levee Safety Program "addresses a range of operation and maintenance, risk communication, risk management, and risk reduction issues." [192] The USACE program aims to better understand, manage, and reduce flood risks associated with levees through partnering with State and local maintainers to inspect, maintain and upgrade levees, as appropriate.

The USACE National Levee Safety Program keeps and maintains a national inventory of levee systems in the National Levee Database.[193] The program also annually inspects and assesses about 2,500 levee systems nationwide, using data gathered from the inspections and assessments to inform and prioritize future flood control actions.[194] Finally, the program works to communicate all risk-related concerns to communities in order to further reduce the risk from flood events.

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[192] U.S. Army Corps of Engineers Website. USACE/FEMA/Community Partners <http://www.usace.army.mil/Missions/Civil-Works/Levee-Safety-Program/USACE-FEMA-Community-Partnership/ > (last visited August 17, 2016).
[193] U.S. Army Corps of Engineers Website. Levee Safety Program < http://www.usace.army.mil/Missions/Civil-Works/Levee-Safety-Program/ > (For National Levee Database, *see*: http://nld.usace.army.mil/egis/f?p=471:1:) (last visited October 4, 2016).
[194] *Id*.

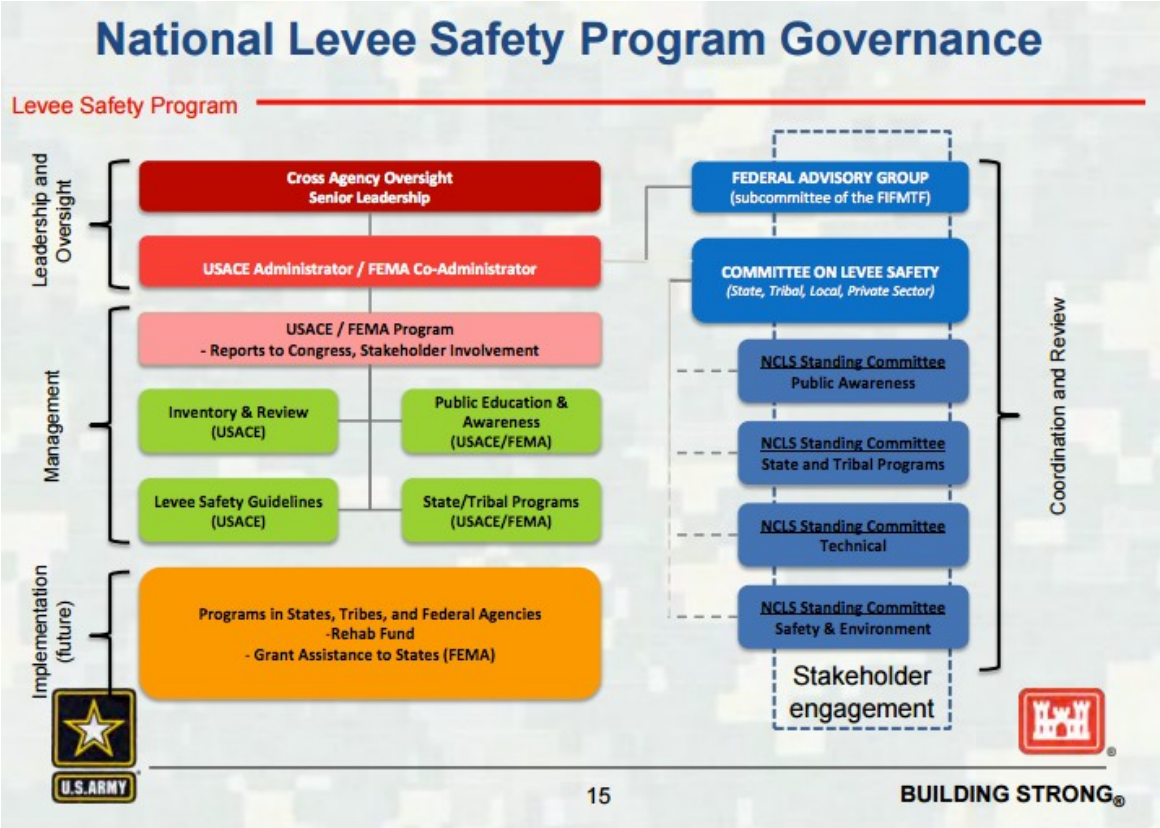

Figure 16: National Levee Safety Program Overview[195]

The National Committee on Levee Safety is comprised of a FEMA official; eight representatives from USACE; and experts from the private sector, local agencies, and Indian tribes. The committee also includes the Secretary (or designee) and Administrator (or designee) as nonvoting members.[196] The Committee is charged with developing ongoing recommendations for the USACE National Levee Safety Program, including a plan for the program's implementation.[197]

As part of its overarching responsibilities to reduce flood risks associated with levees, USACE has developed specific policies regarding the maintenance of vegetation on levees. Although the USACE authority over levee maintenance is quite broad, these levee vegetation policies are

[195] Eric Halpin, US Army Corps of Engineers, National Levee Safety Program (September, 2015).
[196] Recommendations for a National Levee Safety Program From the National Committee on Levee Safety: About the Committee <http://www.leveesafety.org/aboutthecommittee.cfm> (last visited August 17, 2016).
[197] *Id*.

among the most crucial issues facing California's Central Valley, and will be the focus of the remainder of this discussion.

3. *USACE White Paper: Treatment of Vegetation with local Flood-Damage-Reduction Systems*

In 2007, USACE released a White Paper, "Treatment of Vegetation with local Flood-Damage-Reduction Systems." This paper was notably significant because it signaled a change of course in the USACE levee vegetation management policies.

The White Paper clarified the USACE nationwide policy regarding the removal of vegetation, including wild growth, trees, and other encroachments, as prerequisite for Public Law (PL) 84-99 eligibility. This marked a departure from what had previously been USACE policy, embodied in the USACE "Vegetation variance letter" (August 3, 1949). Prior to the release of the White Paper, the USACE variance policy was described in the letter as follows:

> "Brush and small trees may be retained on the waterside slope where desirable for the prevention of erosion and wave wash. Where practicable, measures shall be taken to retard bank erosion by the planting of willows or other suitable growth on areas riverward of the levees."[198]

Similarly, 33 CFR 208.10, last updated by the Flood Control Act of 1944, remains the most current guidance document for levee Operation and Maintenance. 33 CFR 208.10 reinforces the USACE policy regarding vegetation prior to the white paper by containing identical phrasing as the 1949 variance letter:

> "Where practicable, measures shall be taken to retard bank erosion by planting of willows or other suitable growth on areas riverward of the levees."[199]

[198] 2012 Central Valley Flood Protection Plan at 3-25 (§ 3.10.1) (Referencing USACE vegetation variance letter, August 3, 1949).
[199] 33 C.F.R. § 208.10(b)(1) (1944).

Therefore, USACE policies prior to 2007 (and indeed, still embodied in current Operation and Maintenance guidelines) encouraged the planting of certain woody vegetation on levees to promote levee safety and reduce risk of erosion.

Contrastingly, the 2007 White Paper identified two "prevalent deficiencies" in numerous levees, which place the levees at risk for losing PL 84-99 eligibility, and loss of NFIP certification. These deficiencies are described as: (1) the presence of vegetation, and (2) insufficient widths of vegetation-free zones.[200]

The 2007 White Paper continues to describe the risks associated with levee vegetation, noting, "[a]ny debate about vegetation will demonstrate both detrimental and beneficial effects on local flood-damage-reduction systems."[201] Although the White Paper describes potential benefits of vegetation on levees (including protecting slopes from rain-induced surface erosion and essential fish and wildlife habitat), the paper concludes that a conservative approach to vegetation management is needed, and recommends updating policies to enforce a vegetation-free zone. The scientific basis for this conclusion is uncertain, but it seems to stem from a precautionary principle-based approach, where in the face of uncertainty or potential danger, one employs the most conservative or cautionary method. Therefore, even though USACE acknowledges that woody vegetation can, in certain situations, promote levee stability, they conclude that a precautionary approach to levee vegetation management is preferable, adopting a uniform, nation-wide policy of vegetation prohibition on levees.

The promulgation of this uniform anti-vegetation approach prompted uproar from many in the flood management and environmental communities. Some flood managers and levee maintainers see certain types of vegetation as beneficial to levee stability. They feared these requirements would lead to mandated removal of massive amounts of vegetation on levees. Such actions would be expensive and could risk levee stability and overall levee integrity. Many environmentalists pointed to potential Endangered Species Act violations and ramifications this uniform policy would have on endangered fish species. Woody vegetation on levees, particularly

[200] CECW-CE, Draft Final White Paper: Treatment of Vegetation within Local Flood-Damage Reduction Systems (U.S. Army Corps of Engineers, April 20, 2007) at 2.
[201] *Id*. at 7.

on the lower waterside slopes of levees, provides shade and water temperature benefits, as well as spawning and rearing habitat for endangered fish. As such it is designated critical habitat under the federal Endangered Species Act, and must be protected to promote the recovery of endangered fish.

The White Paper notably states that, "this guidance is not in agreement with 33 CFR 208.10, a policy that encourages the planting of willows or other suitable growth on areas riverward of the levees."[202] In other words, the new vegetation policy directly conflicts with the existing USACE operations and maintenance procedures, set forth in 33 CFR 208.10. This inconsistency led to additional concerns from local levee maintainers over the new USACE policy as articulated in the White Paper. Implications from this inconsistency are discussed in *Part II: Problems Associated with Vegetation Removal Requirements*.

In the 2012 Central Valley Flood Protection Plan (2012 CVFPP), a statewide planning document for levees in the California flood system, the State described the release of the 2007 White Paper as, "[in]consistent with the long-standing USACE practice of protecting trees while performing levee repairs on Central Valley levees, and requiring new tree planting in its levee designs, where feasible."[203] Therefore, inconsistencies in the new vegetation policy quickly became apparent to State policymakers.

In effect, the USACE 2007 White Paper marked a major policy shift for maintenance of levees nationwide. The prohibition of vegetation on levees has unique implications California's Central Valley, as noted in the 2012 CVFPP, and which will be discussed in greater detail in *Appendix 2: California State Laws and Policies*.

4. *USACE - ETL 1110-2-571 and ETL 1110-2-583*

While the aforementioned White Paper announced the USACE intention to change course in terms of its vegetation policy, the release of Engineering Technical Letter 1110-2-571 (ETL 1110-2-571) marked the actual implementation of new vegetation management guidelines. ETL

[202] *Id*. at 13.
[203] 2012 CVFPP 3.10.1.

1110-2-571 established a nationwide vegetation policy, including uniform vegetation-free and root-free zones for levees throughout the United States. This policy prohibits all vegetation, except for grass, on the entirety of the levee prism and within fifteen feet on either side of the levee toe.[204]

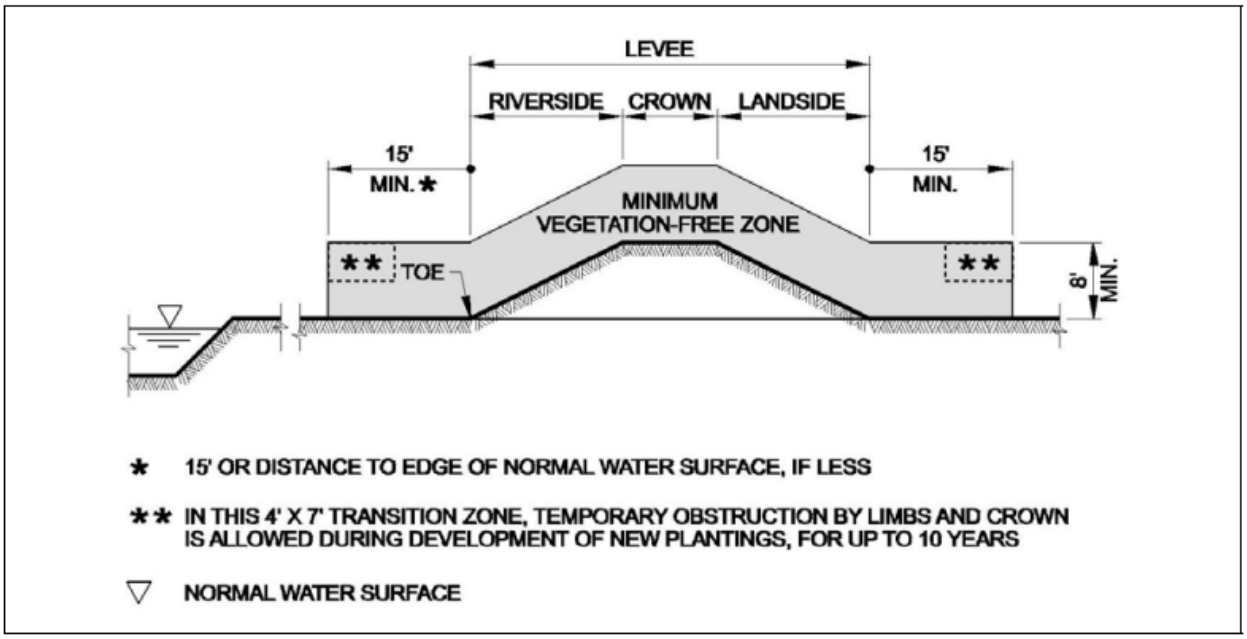

Figure 17: Basic Vegetation-Free Zone Requirements[205]

The ETL applied to all levee systems under direct USACE control and any levees maintained by the State or Local Maintaining Agencies (LMAs) who needed to comply with certain USACE-issued approvals or permits, or wished to maintain eligibility under Public Law (PL) 84-99.[206] According to USACE, PL 84-99,

> "is the discretionary authority given to [USACE] by Congress to act and react to emergencies caused by floods, contaminated water sources, drought, or dam failures.

[204] ETL 1110-2-583 (April, 2014). *See* generally chapter 6.
[205] *Id*. at 6-1; U.S. Army Corps of Engineers, Engineering Technical Letter 1110-2-581 (April, 2014) at A-2.
[206] ETL 1110-2-583 (April, 2014) at 1.

> This authority allows [USACE] to repair and/or rehabilitate any qualified flood control project (Levee) whether it is federally constructed or privately owned."[207]

In other words, PL 84-99 provides federal funding for emergency repair and rehabilitation activities. In a Fact Sheet distributed by USACE to clarify PL 84-99, USACE characterizes the program as authorizing USACE

> "to undertake activities including disaster preparedness, Advance Measures, emergency operations (Flood Response and Post Flood Response), rehabilitation of flood control works threatened or destroyed by flood, protection or repair of federally authorized shore protective works threatened or damaged by coastal storm, and provisions of emergency water due to drought or contaminated source."[208]

Thus, following the release of ETL 1110-2-571, if the State and LMAs wished to maintain eligibility for emergency rehabilitation relief, they had to comply with the ETL vegetation-free zone requirements.

A second Engineering Technical Letter , "ETL 1110-2-583, Guidelines for Landscape Planting and Vegetation Management at Levees, Floodwalls, Embankment Dams, and Appurtenant Structures," was released a few years after ETL 1110-2-571, and maintained almost identical requirements regarding the vegetation-free zone[209] The only apparent distinction between the two policies is with respect to compliance in order to obtain PL 84-99 eligibility. While ETL 1110-2-571 clearly stated that conformance with vegetation-free zone was mandatory for PL 84-99 eligibility, ETL 1110-2-583 backtracked slightly. ETL 1110-2-581 instead states, "This ETL is not applicable to determinations for eligibility in the Rehabilitation Program under . . . [PL 84-99]." This suggests that conformance with vegetation-free requirements will no longer be included in any part of determinations for eligibility in the PL 84-99 program. However, the ETL later describes detailed vegetation-free requirements for levees, including limited instances

[207] U.S. Army Corps of Engineers, Rehabilitation Assistance for Non-Federal Flood Control Projects, Pub. Law 84-99 (October 2009) at 3.
[208] U.S. Army Corps of Engineers Disaster Operations, Public Law 84-99
[209] ETL 1110-2-583 (April, 2014).

where a variance could be issued when "shown to be necessary."[210] This suggests that vegetation-free requirements remain mandatory in the eyes of USACE. The inconsistent messages from ETL 1110-2-581 has resulted in a general consensus that if a levee maintainer is deficient in terms of levee vegetation requirements, but in nothing else, they will not lose eligibility in the PL 84-99 program. However, conformance with vegetation requirements is still technically required, and is included in the overall analysis for PL 84-99 eligibility. This can be a fine, gray line for local levee maintainers to walk and has resulted in recent confusion as to the extent of vegetation-free conformance necessary for PL 84-99 eligibility.

USACE planning documents describe ETL 1110-2-571 and ETL 1110-2-583 (ETL) as a "clarification," of previous guidelines with no change in the vegetation-free zone, which was originally established in an Engineering Manual (EM) 1110-2-301 (January, 2000).[211] Presumably, this description was articulated to alleviate concerns regarding the change in USACE levee vegetation policy. However, the ETL clarified the previous guidance in a way which limited vegetation growth on levees, and in doing so, essentially changed the terms of the previous guidance, which was much more flexible in allowing for levee vegetation.

EM 1110-2-301, distributed by USACE in January, 2000, provides that,

> "Where the safety of the structure is not compromised and effective flood-fighting and maintenance of the facility is not seriously affected, appropriate landscape planting (trees, shrubs, vines, and grasses) can be incorporated into the design of floodwalls, levees, and dam embankments."[212]

In other words, while EM 1110-2-301 promoted vegetation-free zones on levees where woody vegetation posed a threat to levee safety, it also encouraged woody vegetation on levees where the levee structure would not be compromised. This national policy allowed for regional

[210] *Id*. at 1-1.
[211] *See* presentation on guidelines from U.S. Army Corps of Engineers Manager, June 2009: <http://www.safca.org/protection/NR_Documents/LARTF_2009_Jun_ETL.1110.2.57LARTFBriefingJune2009.pdf >
[212] U.S. Army Corps of Engineers, Guidelines for Landscape Planting and Vegetation Management at Floodwalls, Levees, and Embankment Dams, Engineering Manual (EM) No. 1110-2-301 (January 1, 2000) at 1-1.

flexibility, especially in locations where woody vegetation has demonstrable benefits to flood risk reduction and critical habitat.

Contrastingly, the ETL established uniform vegetation-free zones on all levees. Specifically, the ETL mandates that all flood reduction systems, including levees, maintain a vegetation-free and root-free corridor on the width of the levee prism, plus an additional fifteen feet on each side, with a height of eight feet.[213] These dimensions are described as "minimum" requirements, where the project design team may require even larger vegetation-free zones beyond that of the minimum.[214]

Thus, the ETL codifies the USACE policy shift in levee vegetation management. It brings the federal government's treatment of levee vegetation from one of regional variation based on site-specific data, to a uniform precautionary policy prohibiting woody vegetation on levees. The vegetation-free zone applies to all levees under USACE control, and all levees where State and local maintainers wish to maintain eligibility for emergency disaster relief. While not determinative for PL 83-99 eligibility, confusion still exists as to the extent of enforceability of the ETL's vegetation-free requirements.

5. *Variance Procedures: Policy Guidance Letter (PGL) and Revised PGL*

In order to obtain a "variance," or exemption, from the USACE's ETL requirements, a levee maintainer must meet the basic requirements established in the document, "Variance Policy: Policy Guidance Letter (PGL)—Process for Requesting a Variance from Vegetation Standards for Levees and Floodwalls."(Dec. 7, 2012).[215] The 2012 PGL replaced earlier guidelines released in the PGL from February, 2010.[216] The 2012 PGL is quite similar to the 2010 PGL in terms of qualifying for a variance from the ETL, but with additional clarifications and requirements for submitted scientific information. This includes that any scientific information regarding levee

[213] ETL 1110-2-583 (April, 2014) at 2-1 (§2-2).
[214] "Due to specific site conditions and project requirements, many levees, floodwalls, embankment dams, and appurtenant structures will be determined, by the project design team, to require a vegetation-free zone larger than the minimum described here." ETL 1110-2-583 §2-2(d).
[215] 77 Fed. Reg. 9637 (February, 2012).
[216] *See* 75 Fed. Reg. 26 (February 2010).

vegetation included in the submission materials be peer-reviewed and submitted to USACE's Engineer Research and Development Center (ERDC).

The variance program was likely developed in response to public outcry following the release of the USACE vegetation policy, embodied in the White Paper and codified in the ETL. After USACE announced and released the vegetation-free levee requirements, regulators from natural resource agencies and flood maintaining agencies voiced strenuous opposition. Vocal opponents to USACE policies ranged across a spectrum of interests, from those advocating for critical species habitat to LMAs voicing their inability to comply with such requirements. USACE likely released the PGL as a way for levee maintainers to obtain an exemption from vegetation requirements and address stakeholder concerns. The theory behind the variance process is that levee sponsors who meet certain standards can still "comply" with federal requirements, and thus be covered under federal assistance programs like PL 84-99, while being exempted from the ETL vegetation-free requirement. However, in practice, levee sponsors have expressed opinions that complying with the PGL is overly burdensome, and as such, does not actually relieve them from the vegetation removal requirements of the ETL.[217]

a. Basic requirements and exceptions for obtaining a variance

The basic requirements for obtaining a variance, pursuant to the PGL, are situation-specific and differ depending on whether the applicant is the USACE District itself, or another local levee sponsor. The basic requirements may also differ if the levee prism meets certain size requirements, or if a "special consideration" applies.

For consideration of a vegetation variance, the requester must demonstrate that a variance is the *only* reasonable means to achieve the following: (1) comply with applicable law concerning environmental, cultural, or historic preservation; (2) protect the rights of Tribal nations; or (3) address a unique environmental consideration. These are also known as 6.a requirements.[218]

[217] Cal. Dept. of Fish and Game *(note – today agency is the Dept. of Fish and Wildlife)* v. United States Army Corps of Engineers (E.D. Cal. 2012), Case 2:12-at-00745 Dept. of Fish and Game Complaint at 2, paragraph 4.
[218] 77 Fed. Reg. 9637 (February, 2012) at § 6.a.

In addition to the 6.a requirements, all vegetation variance requests must demonstrate that the structural integrity and functionality of the levee system are retained. The applicant must also demonstrate retention of accessibility for operations, maintenance, repair, inspection, monitoring, and floodfighting of the levee system.[219]

Separate requirements and some exceptions apply to levees with an existing variance (before December, 2012), and for a vegetation variance requested for a planting berm.[220] The variance policy does not apply to embankment dams and their appurtenant structures; channels; or shoreline riverbank protection systems such as revetments, sand dunes, and barrier islands.[221]

In the case of a USACE District attempting to obtain a vegetation variance, they must first obtain a concurrence from the local levee sponsor, but need not meet the 6.a requirements listed above. Instead, the USACE District may obtain a variance in the following situations: (1) federally authorized levees already under construction prior to December, 2012, but where USACE has not provided a notice of O&M duties; (2) existing federally authorized levees, "in which it can be demonstrated that vegetation was previously part of the original design prior to [December 7, 2012]"; (3) existing federally authorized levees with O&M manuals that allow vegetation within the vegetation-free zone; (4) levee systems where USACE is responsible for O&M; and (5) areas with endangered species Act (ESA) considerations, or where rights of Tribal Nations may be impacted, in which case, USACE District may submit repairs for PL 84-99 consideration that include vegetation for a specific portion of the levee system (where the submittal contains additional requirements).[222]

Regional variances, or variances covering all levees within a geographic area, will not be issued.[223] Further, there is a presumption against approving a vegetation variance request for any portion of the levee in the upper third of the waterside slope, the levee crown, the landside slope,

[219] *Id.* at § 6.d.
[220] *Id.* at § 6.b.
[221] *Id.* at § 9.1.
[222] *Id.* at § 6.c.
[223] *Id.* at § 9.c.

or within fifteen feet of the landside toe.[224] Additionally, approvals for vegetation variances near floodwalls may be limited.[225]

The levee sponsor must also ensure compliance with all applicable environmental laws and requirements before USACE will make a decision on a vegetation variance request. This includes the National Environmental Policy Act (NEPA) and Endangered Species Act (ESA).[226]

The PGL also contains lists of documents and descriptions required for a vegetation variance request to be considered, including engineering analyses, USACE reports, summaries of the levee system performance history, detailed vegetation management plans, NEPA and ESA compliance documents, and other submission requirements.[227] Submittal requirements also include specifications for submission of a cross-sectional analysis, which must demonstrate that, among other things, "no significant roots (those greater than 0.5 in. in diameter) will enter the levee prism or approach 8 feet of structures critical to performance, such as drains or seepage-cutoff walls."[228] Although not included in the "requirements" section of the PGL, this is a notable requirement, and demonstrates that in order for a variance request to be successful, the levee prism must remain a root-free zone. NMFS officials have reported encountering variance requests denied unless the applicant can demonstrate a root-free zone in the levee prism, indicating that this requirement is strongly enforced.

Although the author has attempted to summarize the basic requirements and exceptions for obtaining a variance above, it should be noted that among these requirements the PGL specifies that in order to obtain a variance the levee structure must, at a minimum, meet the standards as described in all USACE Engineer Manuals (EMs), Engineer Technical Letters (ETLs), and Engineer Circulars (ECs). This imposes a number of requirements in addition to those set forth above. It is unclear which EMs, ETLs and ECs pertain to the variance process. This exemplifies

[224] *Id.* at § 6.d. (The following will be "carefully evaluated to ensure the requirements in Paragraph 6 are met.")
[225] *Id.* at § 9.e.
[226] *Id.* at Paragraph 11.
[227] *Id*. See, Enclosure 1; Enclosure 3.
[228] *Id*. at Enclosure 3, Submittal Requirements § 10(5)(a)(1).

the uncertainty levee sponsors may face with when attempting to obtain a variance, and the need for USACE involvement for a variance request to be successful.

Another element of the PGL that reportedly causes confusion for LMAs is the requirement that levee sponsors submit a variance request within one year of the distribution of the PGL (December 7, 2012). However, shortly after the PGL's release, two major lawsuits were filed against the USACE and WRRDA 2014 was passed. Both WRRDA 2014 and the Courts directed USACE to revisit the terms of the PGL, and resubmit guidance for vegetation on levees. To date, the USACE has failed to do so, and absent other guidelines, levee sponsors still seek variances from the ETL's requirements through the PGL (despite the deadline for doing so having passed in 2013). It seems that in practice, the USACE is not enforcing the one-year requirement, as variances have been sought and granted after December of 2013.

6. *"Section 408"*

"Section 408" is a shorthand referral to 33 U.S.C. 408, passed March 3, 1899, more popularly known as the "Rivers and Harbors Appropriation Act of 1899."

Until very recently, Section 408 was reportedly not widely utilized by USACE. The law made a resurgence in July 21, 2014, when the USACE issued the Engineering Circular (EC) 1165-2-216. EC 1165-2-216 essentially breathed life back into 33 U.S.C. 408, stated that the law was still applicable, and provided guidelines on how the USACE would be applying it. Another EC, of the same name, issued by the USACE in 2015 supersedes the 2014 EC, and provides detailed standards, policies and procedures for enforcing Section 408.

Components of Section 408 are quite brief. Generally, Section 408 provides that one may not alter a USACE civil works project (including levees), unless one first obtains permission from USACE. USACE should generally grant permission to alter the civil works project if two criteria are met: (1) the alteration does not impair the usefulness of the project, and (2) the alteration is not injurious to the public interest.

EC 1165-2-216 was issued to allow USACE to grant permission to alter civil works projects. This includes levees, and so with the issuance of EC 1165-2-216, the USACE clarified that any levee sponsor must obtain 408 permission prior to altering a levee.

Pursuant to the overarching terms of Section 408, generally USACE has the authority to grant permission for an "alteration" if USACE determines that the activity will not be injurious to the public interest nor impair the usefulness of the project.[229] For these purposes, an "alteration" includes "occupation," "use," action approved as an "encroachment" pursuant to 33 C.F.R. 208.10, or "any action by any entity other than USACE that builds upon, alters, improves, moves, occupies, or otherwise affects the usefulness, or the structural or ecological integrity, of a USACE project."[230] In practice, 408 permission is generally required for any proposed encroachment or major modification to a levee system.

In addition to the two-pronged analysis set forth in Section 408, the EC imposes design and construction standards for any alteration affecting a civil works project. Pursuant to these standards, the proposed alteration must meet "current USACE design and construction standards."[231] However, a requester is not required to bring any portions of the project not impacted by the alteration up to current USACE design standards.

In other words, any portion of an existing USACE project that is impacted by the alteration must be brought up to date and meet all USACE design and construction standards. This presumably includes vegetation standards as well. Therefore, any portion of a levee construction project required to obtain 408 permission must likely also meet USACE vegetation removal requirements, or obtain a vegetation variance.

[229] EC No. 1165-2-216 (B) (2015).
[230] *Id.*
[231] *Id*.

7. *Operations and Maintenance Policies*

a. 33 C.F.R. 208.10

While Section 408 governs major modifications to levees and other flood control systems, 33 C.F.R. 208.10 covers maintenance and operations procedures. It specifies the requirements for local project sponsors to preserve and protect federally authorized flood control project.

33 CFR 208.10 was last updated by the Flood Control Act of 1944, and so dates back to over 70 years ago.[232] It sets rigorous standards for operations and maintenance (O&M) of levees and greater flood control systems, but these standards are quite dated.

Among other things, 33 CFR 208.10 O&M guidelines require local levee sponsors to appoint a permanent committee responsible for O&M of flood control structures "and for continuous inspection and maintenance of the project works during periods of low water, all without cost to the United States."[233] Thus, USACE requires that local levee sponsors maintain and operate the levee, or other flood control system, to standards specified in 33 CFR 208.10, and that the local sponsor provide funds to do so. USACE maintains the strict policy that once they have certified a levee, USACE has handed off all O&M duties to the local sponsor. The levee then becomes the sole responsibility of that local sponsor, but the sponsor must meet all O&M requirements established in 33 CFR 208.10.

33 CFR 208.10 prohibits any "encroachments or trespass" on "rights-of-way" that would inhibit the facility's efficient operation. Moreover, the regulations require a reserve supply of materials for a flood emergency. The USACE District Engineer must also retain access at all times to all portions of the facility, and the local sponsor must submit a semiannual report to the District Engineer "covering inspection, maintenance, and operation of the protective works."[234]

The regulations also mandate "prior determination," or authorization, by USACE for any "improvement, excavation, construction, or alteration" of the project, or for "any change . . . in

[232] 33 CFR § 208.10 (1944); as amended 33 U.S.C. 701c.
[233] 33 CFR § 208.10 (a)(2).
[234] 33 CFR § 208.10 (a)(6).

any feature of the works." USACE must first review the proposed change, improvement, excavation, construction or alteration to ensure that it will "not adversely affect the functioning of the protective facilities."[235] Further, the USACE will only authorize proposed changes that are "in accordance with standard engineering practice."[236] This suggests that local levee sponsors may be required to meet standards set forth in other USACE EMs, ECs, and ETLs, which could include vegetation guidelines.

The regulations also require periodic inspections (immediately before and following the flood season, and not to exceed 90 days) to be certain that: (i) no "sloughing" or loss of grade on the levee cross section has occurred; (ii) no caving has occurred that might affect levee stability; (iii) no seepage, saturated areas, or sand boils have occurred; (iv) toe drainage systems and pressure relief wells are working effectively; (v) drains are in good working condition; (vi) no riprap or revetment work has been displaced; (vii) no actions "such as burning grass and weeds during inappropriate seasons" are being undertaken, "which will retard or destroy the growth of sod;" (viii) access roads are properly maintained; (ix) cattle guards and gates are working effectively; (x) levee crown and roadway are well shaped and maintained; (xi) there is no unauthorized grazing or vehicular traffic; and (xii) there are no encroachments that might affect levee functioning during an emergency.[237]

Further, levee operation requirements specify that during flood periods, the levee shall "be patrolled continuously to locate possible sand boils or unusual wetness of the landward slope" to ensure there has been no sloughing, wave wash or scouring, no levee sections have been overtopped, and no other conditions exist that might endanger the levee.[238]

Thus, the regulations set out in 33 CFR 208.10 establish strong safety standards that local sponsors must meet in operating and maintaining flood management systems. USACE technically relinquishes all O&M duties to the local sponsor, but as demonstrated by USACE involvement in approving local sponsor O&M methodology, regular USACE inspections, and

[235] 33 CFR § 208.10(a)(5).
[236] 33 CFR § 208.10(a)(5).
[237] 33 CFR § 208.10(b)(1)(i) - (b)(1)(xii).
[238] 33 CFF § 208.10(b)(2).

rules that sponsors must meet, USACE retains some O&M decision-making authority after they have handed off the majority of O&M authority to local sponsors.

For levee maintenance specifically, the regulations require regular maintenance at a level that will "insure serviceability of structures in time of flood."[239] The levee maintenance regulations also state,

> "Measures shall be taken to promote the growth of sod, exterminate burrowing animals, and to provide for routine mowing of grass and weeds, removal of wild growth and drift deposits, and repair of damage caused by erosion or other forces. Where practicable, measures shall be taken to retard bank erosion by planting of willows or other suitable growth on areas riverward of the levees."[240]

On August 2, 1949 the O&M regulations were updated with the inclusion of a "Vegetation variance letter." This allowed, "brush and small trees may be retained on the waterward slope where desirable for the prevention of erosion and wave wash."[241]

The O&M regulations encourage the planting of certain types of woody vegetation (willows and other suitable growth) to promote levee safety. However, these same regulations also require local sponsors to maintain levees in accordance with standard engineering practices, which suggests required compliance with the ETL, prohibiting woody vegetation on levees. This seems contradictory and can place conflicting mandates on local levee sponsors.

b. Sacramento River Levee Operation and Maintenance Manual

While 33 CFR 208.10 provides regulations on the operations and maintenance (O&M) for levees nationwide, two manuals specific to the Central Valley provide O&M guidance for California levees. The manual for the Sacramento River Flood Control Project is entitled, "Standard

[239] 33 CFR § 208.10 (b)(1).
[240] 33 CFR § 208.10 (b)(1).
[241] 2012 Central Valley Flood Protection Plan at 3-25.

Operation and Maintenance Manual for the Sacramento River Flood Control Project" and was released by the USACE in May, 1955.[242]

The manual covers areas on the Sacramento River "and the lower reaches of its principal tributaries in north-central California."[243] This includes areas "from Ord Bend downstream to Collinsville near the mouth of the river, a distance of 184 miles."[244]

The Sacramento River Flood Control Project provides for general improvements to flood control works and levees in the above area. More specifically, the Project:

> "provides for the enlargement of the Sacramento River channel below the mouth of Cache Slough (about 20 river miles upstream from Suisun Bay); for making two cutoffs between the mouth of the Feather River and Colusa; for the construction of four bypass weirs and the reconstruction of Tisdale Weir; for construction of outfall gates at the mouth of Butte Slough and at Knights Landing; for levees along certain reaches of the main river and tributaries; for drainage pumping plants on the east side of the Sutter Bypass; for bank protection work and levee set-backs on the main river and tributaries from Ord Bend to Collinsville; for maintenance of the enlarged river channel below Cache Slough during construction, including revetment of the banks of the cut; and for maintenance and operation of gaging stations on navigable rivers and streams during the construction period. The project also includes channel clearing, rectification, snagging, and bank protection along the Sacramento River and tributaries in Tehama County and from Red Bluth southerly."[245]

The Maintenance Manual covers the general rules and procedures for O&M of flood control works that are part of the Sacramento River Flood Control Project. It establishes the State of

[242] Standard Operation and Maintenance Manual for the Sacramento River Flood Control Project (USACE, revised May, 1955) (1955 manual found on PDF here: file:///C:/Users/annalisa.batanides/Downloads/SRFCP%20-%20O&M%20Manual%20(1955_05_00).pdf)
[243] U.S. Army Corps of Engineers, Standard Operation and Maintenance Manual Sacramento River Flood Control Project (May 1955), paragraph 1-03.
[244] *Id*. at paragraph 1-03.
[245] *Id*. at paragraph 1-03.

California as the "responsible local agency" for operating and maintaining flood control works in the Project.

Much of the manual is duplicative of 33 CFR 208.10 requirements, but also contains suggestions for complying with 33 CFR 208.10 requirements. These suggestions include how the head of the designated committee charged with operating and maintaining the system ("Superintendent") should train personnel. The manual also includes suggestions for submitting proposals to USACE for proposed improvements or alterations, submitting the semi-annual report, coordinating with private facilities, safety requirements for patrolling levees, stream flow stage requirements, specific timeframes that periodic inspections must be completed by, inspection checklists, and diagram specification suggestions.

The manual also provides specific methods to be used to repair or reconstruct portions of the levee that have been damaged. In addition, it provides methods for filling dens and runways from burrowing animals, and maintenance for access roads.

In addition to providing specific suggestions on how the State of California can meet requirements established in 33 CFR 208.10, the Manual provides specific information on levee vegetation. 4-05(b), "Care of Vegetation on Levee" provides regulations for the Sacramento River Flood Control Project, and in the case of contradictory information, supersedes the 33 CFR 208.10 regulations.[246]

The manual states that due to site-specific conditions on the Sacramento River Flood Control Project, the growth of sod on levee slopes is not practicable. Further, "brush, trees, and other wild growth" shall be cleared from the levee crown and slopes, but "brush and small trees may be retained on the waterward slope where desirable for the prevention of erosion and wave wash."[247] The manual also encourages burning of "weeds, grasses, and debris" on the levee "during appropriate seasons" to detect "cracks, holes, burrows, slips, and other damage" and to

[246] *Id*. at paragraph 4-05(b). ". . . the following special instructions are furnished in lieu of paragraph 4-02(b)(vii) of the prescribed general regulations"
[247] *Id*. at paragraph 4-05(b)(1).

detect and kill burrowing animals. Finally, the manual encourages mowing of grass and weeds on levee slopes where burning is "dangerous or impracticable" or would "constitute a hazard."[248]

Hence, the manual governing O&M of levees on the Sacramento River Flood Control Project discourages the use of sod, but encourages planting brush and small trees on the waterside slope of the levee to increase the safety and functionality of the levee. The manual also encourages burning "weeds, grasses, and debris" during appropriate seasons and clearing of "brush, trees and other wild growth." This suggests the acknowledged distinction between woody vegetation that either increases levee safety, or decreases levee safety. It seems that in 1955, there was a recognition that woody vegetation in the Sacramento River Flood Control Project area should be treated on a case-by-case basis.

c. Lower San Joaquin River Levee Operations and Maintenance Manual

The manual for the San Joaquin River is entitled, "Standard Operation and Maintenance Manual for the Lower San Joaquin River Levees Lower San Joaquin River and Tributaries Project, California" and was released by the USACE in April 1959.[249]

The Lower San Joaquin River Levees Project includes areas about 80 miles upstream from the junction of the San Joaquin River with the Stockton Deep Water Channel near Stockton, to the mouth of the Merced River in Merced County, and includes "distributaries of the San Joaquin River in the Upper Delta, i.e., lower reaches of the Stanislaus and Tuolomne River within backwater limits of the San Joaquin River."[250] In general, the Project includes, "construction or reconstruction of levees, channel improvement and the provision for bank protection along the Lower San Joaquin River from the mouth of the Merced River to the Delta."[251]

Like the O&M manual for the Sacramento River Flood Control Project, the manual for the Lower San Joaquin River Levees Project, Lower San Joaquin River and Tributaries Project builds off of the requirements for 33 CFR 208.10 and provides specific suggestions relative to

[248] *Id*. at paragraph 4-05(b)(2).
[249] *Id*. at paragraph 4-05(b)(1).
[250] U.S. Army Corps of Engineers, Standard Operation and Maintenance Manual for the Lower San Joaquin River Levees, Lower San Joaquin River and Tributaries Project, California (April 1959) at 1-03.
[251] *Id*.

the San Joaquin River. This also includes supplemental guidelines and suggestions for the "Superintendent," hiring and training personnel, submission requirements for proposed improvements or alterations, submission requirements for a semi-annual report, coordination suggestions with private entities, safety requirements, stream flow stage requirements, timeframes specific to San Joaquin for periodic inspections, inspection checklists, and suggestions for O&M diagrams.[252]

For levee maintenance specifically, the manual reinforces the terms of 33 CFR 208.10, and provides a suggested checklist for reporting inspections of the levee.[253] The manual provides specific instructions regarding revetment work for the San Joaquin River system, due to the fact that much of the levee system in this area was constructed "with stone protection work consisting of quarry stone or cobbles."[254] This includes filling portions of damaged levees with earth, and stone placed on top of the earth.[255]

The manual also provides specific regulations regarding vegetation, in Section 4-05(b), "Care of Vegetation on Levees." These are identical to those found in the Sacramento River Flood Control System manual, and as such reflect a site-by-site approach to vegetation management. Certain types of woody vegetation are encouraged on waterside levee slopes in the San Joaquin River system in order to protect levee stability, while other types are discouraged in order to increase the effectiveness of visual inspections and exterminate rodents and other burrowing animals. This also reflects a case-specific, flexible approach to levee vegetation management in the Central Valley.

8. *System-Wide Improvement Framework (SWIF)*

The System-Wide Improvement Framework policy was released by USACE in 2011 and is intended to provide a way for local levee sponsors to maintain eligibility for federal programs, even though the local sponsor may not be in conformity with all USACE levee requirements. The theory behind the SWIF policy is that local levee sponsors may submit a plan for how they

[252] *Id*. at 3-01 –3-11.
[253] *Id*. at 4-02 -4-03.
[254] *Id*. at 4 -05(a).
[255] *Id*. at 4-05(a)(1).

will eventually come into compliance with all USACE regulations. If USACE accepts the plan, the local sponsor will maintain eligibility for federal programs in the interim period, during the time it takes to bring the levee system into full compliance. It follows a "worst first" approach, and establishes guidelines for local sponsors to fix the most dangerous threats to the levee's integrity first, followed later by less immediate threats.

A Memorandum released by the USACE on November 29, 2011, establishes the policy for development and implementation of a SWIF. The guidelines establish that the SWIF should be used to address major deficiencies that cannot be accomplished through routine corrective actions.[256] Examples provided include: engineering deficiencies, improvements involving multiple levee systems, Tribal considerations, and "complex natural resource considerations that require additional time and coordination to ensure that the imperatives of both levee safety and environmental requirements are adequately served."[257] Complex natural resource considerations include issues related to woody vegetation on levees. As such, the SWIF process is set forth as a possible avenue for local levee sponsors to maintain compliance with federal permits and permissions, such as Section 408, 33 CFR 208.10 and PL 84-99, while deferring levee vegetation compliance issues.

The SWIF guidelines require compliance with environmental laws and hold USACE responsible for "assuring compliance with all applicable environmental requirements before it makes any decisions that would affect the environment or other resources."[258]

Under the PL 84-99 program, federally-authorized, locally-operated and maintained levee systems are automatically placed in "Active" status upon construction completion, making the system eligible for rehabilitation assistance. Nonfederal levee systems constructed, operated and maintained by local entities may be placed on "Active" status after an initial USACE eligibility inspection, where USACE determines the levee system meets the minimum eligibility

[256] U.S. Army Corps of Engineers, Memorandum for Commanders, Major Subordinate Commands and Districts: Policy for Development and Implementation of System-Wide Improvement Frameworks (SWIFs) (November 29, 2011) at 3 § (3)(e).
[257] *Id.* at 3 § (3)(e) (1) – (4).
[258] *Id.* at 3 § (3)(d)

requirements and technical criteria.[259] Levees are continuously inspected "against nationally consistent standards that USACE determined are essential for the reliable performance of the levee system."[260]

Following inspections, levee systems are rated as "Acceptable," "Minimally Acceptable," or "Unacceptable." Levee systems that receive "Acceptable" or "Minimally Acceptable" inspection ratings maintain an "Active" status under the PL 84-99 program, and thus are eligible for rehabilitation assistance. Levee systems that receive an "Unacceptable" inspection rating are immediately placed in "Inactive" status, and are not eligible for rehabilitation assistance.

Levee sponsors with an existing vegetation variance (through the PGL), and with a current "Active" status in the PL 84-99 program can use the SWIF process "to transition to a new vegetation inspection standard," while maintaining PL 84-99 "Active" status.[261] The sponsors must meet the milestones set forth in the applicable SWIF to maintain their "Active" status.

Levee sponsors with a current "Unacceptable" rating, or that have "Inactive" status in the PL 84-99 program may use the SWIF process to regain PL 84-99 eligibility. Levee sponsors who have never been eligible for PL 84-99 assistance cannot gain eligibility through the SWIF process.[262]

Development of a SWIF comprises first of submittal of a "Letter of Intent" from the sponsor, describing levee deficiencies and a plan for how the SWIF approach will reduce flood risk. USACE must approve of the sponsor's letter. Once the Letter of Intent has been approved by the USACE, the levee sponsor has up to two years to develop the actual SWIF plan for addressing deficiencies and reducing flood risk. After that, continued eligibility is determined by milestones set forth in the SWIF. The SWIF plan itself includes specific milestones for the sponsor to meet so as to guide the sponsor's overall progress in reducing flood risk.[263]

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[259] *Id.* at 4 § (6)(a).
[260] *Id.* at 4 § (6)(b)(1).
[261] *Id.* at 5 §(6)(c).
[262] *Id.* at 5 §(6)(d).
[263] *Id.* at 5 § (7).

The 2011 USACE Memo also establishes detailed submittal requirements for the Letter of Intent and the SWIF itself, the process for USACE approval, and the process for reporting and continued eligibility under PL 84-99.

The SWIF process may be used in conjunction with a vegetation variance, obtained pursuant to the PGL. According to the 2011 USACE Memo,

> "The SWIF offers an interagency approach to identify regional solutions and tools that may be useful in development of a vegetation variance request. The end result of a SWIF process will be levees that meet the USACE inspection standards, which may also include an approved vegetation variance."[264]

In other words, the SWIF does not in itself create an exemption from the ETL's vegetation-free zone requirement. However, the SWIF can be used in conjunction with a vegetation variance obtained via PGL requirements, if the levee sponsor already has a vegetation variance. Overall, the SWIF does not impose less stringent guidelines on the local levee sponsor, and the sponsor must still meet all USACE requirements, including those from the ETL. However, the SWIF does provide the levee sponsor with more time to comply with these requirements, and do so in such a way that tackles the most pressing problems (non-vegetation related) first.

Finally, a SWIF can be used to obtain a "federal nexus" for a nonfederal levee sponsor. If a State or local levee sponsor has successfully developed a SWIF and that SWIF has been approved by USACE, then USACE has engaged in a "federal action," triggering Section 7 of the Endangered Species Act (ESA). This can be beneficial for local sponsors, because Section 7 consultation can provide coverage for incidental "take" under the ESA, safeguarding the levee sponsor from liability. This is the primary impetus for preliminary discussions for SWIF development in California being undertaken by FWS. More on how a SWIF can be used to provide a "federal nexus" is discussed above in *Part IV: Solutions*.

[264] *Id.* at 8 § (10).

9. *WRRDA 2014*

The Water Resources Reform and Development Act of 2014 (WRRDA 2014) is an extensive law governing many aspects of waterway and floodplain maintenance. Section 3013 of WRRDA 2014, "Vegetation Management Policy," directs USACE to "carry out a comprehensive review of guidelines in order to determine whether current federal policy relating to levee vegetation is appropriate for all regions in the United States."[265] In reviewing the guidelines to determine whether their current vegetation policy is appropriate uniformly throughout the United States, USACE is specifically directed to review the ETL and PGL.[266]

In carrying out the review, USACE is directed by WRRDA 2014 to consider specific factors. These factors include: varied interests and responsibilities in managing flood risk, including public safety and environmental impacts; the levee safety benefits that can be provided by woody vegetation; preservation of natural resources, including habitat benefits provided by woody vegetation on levees and impacts of removing large amounts of woody vegetation; rights of Indian tribes; determining vegetation impacts on a levee system during a storm or flood event; available science and the historical record of levee vegetation and flood risk; avoiding actions that add significant economic or environmental cost; and other factors that may be deemed appropriate.[267]

Therefore, Section 3013 of WRRDA 2014 directs USACE to review the ETL's vegetation policy in a way which takes into account regional variation, the potential benefits vegetation may offer in terms of levee safety, the environmental benefits that woody vegetation provides to critical habitat, and potential dangers and costs associated with removing woody vegetation on levee systems.

Section 3013 of WRRDA 2014 also provides factors for USACE to consider in reviewing the vegetation variance policy set out in the PGL. These include consideration of regional or watershed conditions, hydrologic factors, vegetation patterns and characteristics, environmental

[265] H.R. 3080, 113th Cong. (2014), § 3013(b).
[266] H.R. 3080, 113th Cong. (2014), § 3013 (a)(1) – (2).
[267] H.R. 3080, 113th Cong. (2014), § 3013(c)(1)(A) – (H).

resources (including endangered and threatened species habitat); levee performance history; effects on water supply; scientific evidence on the link between levee vegetation and levee safety; institutional considerations (including conflicts with State and federal laws); availability of limited funds for levee construction and rehabilitation; economic and environmental cost of removing vegetation on levees; and other relevant factors that may be deemed appropriate.[268]

Thus, WRRDA 2014 requires USACE to revisit their variance policy in a flexible manner. In doing so, USACE must consider site-specific conditions, benefits vegetation can provide to levee safety and environmental resources, potential conflicts with State law and other federal laws, and the associated environmental and financial cost of removing existing vegetation.

Section 3013 of WRRDA 2014 also directs USACE to consult with appropriate representatives from State and federal agencies, local and tribal governments, nongovernmental organizations, and the general public in developing the new regulations.[269] Additionally, USACE is directed to consult with independent experts on engineering, environmental, and institutional considerations, and to make the views of independent experts available to the public.[270]

WRRDA 2014 gave USACE an eighteen-month deadline to revise the ETL and PGL, followed by a thirty-day public comment period and then submittal to Congress.[271] The revised guidelines must also include recommendations received as part of the public participation and consultation requirements.[272]

The revised ETL and PGL are directed by WRRDA 2014 to "provide a practical, flexible process for approving statewide, tribal, regional, or watershed variances from the guidelines" that incorporate regional considerations and "State, tribal, and regional vegetation management guidelines."[273] Hence, USACE must provide a more flexible process for obtaining a vegetation

[268] H.R. 3080, 113th Cong. (2014), § 3013 (c)(2)(A)(i) – (xi).
[269] H.R. 3080, 113th Cong. (2014), § 3013 (d)(1) – (2).
[270] H.R. 3080, 113th Cong. (2014), § 3013 (3)(1) – (2).
[271] H.R. 3080, 113th Cong. (2014), § 3013 (f)(1)(A) – (B).
[272] H.R. 3080, 113th Cong. (2014), § 3013 (f)(1)(A)(ii).
[273] H.R. 3080, 113th Cong. (2014), § 3013 (f)(2)(A).

variance on levees, and must also consider State policies on levee vegetation in reissuing the PGL and ETL, pursuant to Section 3013 of WRRDA 2014.

Section 3013 of WRRDA 2014 further provides interim actions and consequences if USACE fails to meet the eighteen-month deadline. Note that at the time of this paper, the deadline has passed and USACE has failed to revisit the ETL and PGL guidelines, as mandated by WRRDA 2014.

Section 3013 provides that if the USACE fails to submit a report by the required deadline, they should instead submit a report to Congress that includes why the deadline was missed, solutions needed to meet the deadline, and a projected date for the submission of the report.[274] Recent inquiries indicate that this report has not been submitted, to date. Furthermore, in the "interim," or until such date as USACE revises their guidelines, USACE,

> " . . . shall not require the removal of existing vegetation as a condition or requirement for any approval or funding of a project, or any other action, unless the specific vegetation has been demonstrated to present an unacceptable safety risk."[275]

Therefore, pursuant to congressionally authorized law, USACE is precluded from enforcing the vegetation-free policy presented in the ETL. USACE may not require vegetation removal by any levee sponsor in order to obtain other federal approvals or funding, including eligibility under the PL 84-99 program. USACE may only require vegetation removal from a levee sponsor if they can demonstrate that the vegetation in question poses an unacceptable safety risk to the levee.

The legislative history of the provisions in WRRDA 2014, Section 3013 is also germane to this discussion. The congressional record demonstrates that Section 3013 of WRRDA 2014 was not included in the legislation lightly, but after significant thought and consideration and concern over vegetation-removal mandates.

For example, Congresswoman Napolitano voiced strong support for WRRDA 2014, section 3013, stating, "It changes levee vegetation policy [by considering factors] not previously taken

[274] H.R. 3080, 113th Cong. (2014), § 3013 (f)(3).
[275] H.R. 3080, 113th Cong. (2014), § 3013 (g)(1).

into account, [including] local characteristics, habitats, [and] safety."[276] Congresswoman Napolitano further clarified her support of the law, stating, "I ask unanimous consent to revise and extend my remarks in clarifying that section 3013 of WRRDA will require the corps to perform a new review and revision of levee vegetation policy engineering technical letters."[277] This stresses the congressional intent at the time of WRRDA 2014 passage for USACE to revisit and reissue the ETL's vegetation-free policy.

Congresswoman Napolitano described a brief history of the ETL and how most DWR and local flood control districts strongly agree with the ETL's vegetation-free requirements, "as not taking into account local characteristics and good science."[278] Congresswoman Napolitano further described the ways that strict conformance with the ETL would damage California, including that it would (1) lead to overall weaker levee systems, (2) displace ESA habitat, (3) fail to include local geologic characteristics, (4) unnecessarily divert limited funds.[279] Congresswoman Napolitano held up Section 3013 of WRRDA 2014 as a tool to solve these problems by requiring USACE to reissue levee vegetation policies "and incorporate regional characteristics, habitat for species of concern, and levee performance."[280] Congressman Matsui echoed the Congresswoman's support of WRRDA 2014, Section 3013, encouraging the condition that "[USACE] shift . . . its one-size-fits-all approach to now consider regional variances to the national levee vegetation policy."[281]

The congressional record further clarifies that ETL 1110-2-583, released shortly after ETL 1110-2-571, does not satisfy the requirements of WRRDA 2014, Section 3013. As described below by Congresswoman Napolitano,

> "I would like to clarify for the record the intent of Congress that the Corps' new ETL 1110-2-583 does not satisfy the requirement of Section 3013. Section 3013 requires the

[276] Congressional Record, 113th Congress, 2nd Session, Vol. 160, No. 76, Water Resources Reform and Development Act of 2014 House of Representatives (May 20, 2014) at H4491. (Found at: https://www.congress.gov/congressional-record/2014/05/20/house-section/article/H4487-4).
[277] *Id*.
[278] *Id*.
[279] *Id*.
[280] *Id*.
[281] *Id*.

> Corps to revise its levee vegetation guidelines after performing a comprehensive review taking into account all regions of the United States and their unique habitats and levee structures."[282]

Therefore, the congressional record clearly states Section 3013 was strategically placed in WRRDA 2014 to combat the perceived dangers of the USACE vegetation-free policy, and ETL 1110-2-583 had not yet satisfied Section 3013's strong requirements.

On March 21, 2014, in order to come into compliance with interim requirements from WRRDA 2014, USACE issued a guidance to local levee districts in the Memorandum: Interim Policy for Determining Eligibility Status of Flood Risk Management Projects for Rehabilitation Program Pursuant to Public Law (PL) 84-99. The new interim guidance contains language that does not automatically disqualify a levee district from PL 84-99 eligibility for simply having levee vegetation present. Instead, the guidance described "interim eligibility criteria" to be used to determine eligibility for rehabilitation assistance under PL 84-99 "until final policy is issued."[283] Rating criteria still evaluate levees as safer when they contain "little or no unwanted vegetation" on the "mandatory" root-free zone in the levee profile.[284] However, the policy also states that, "vegetation management will not be considered in making an eligibility determination."[285] In other words, vegetation is still assessed in the eligibility assessment process, but compliance with vegetation removal requirements will not dictate the final determination as to whether or not the levee is eligible for the PL 84-99 program.

The interim guidance specifically states:

> "Eligibility for rehabilitation assistance will be determined pursuant to paragraphs 5 and 6 of this interim policy, which specifies that only a subset of the criteria previously used to determine eligibility will continue to be used to make eligibility determinations during the interim period. Note: vegetation management will not be considered in making an

[282] *Id*.
[283] USACE Memorandum For Commanders, Major Subordinate Commands and Districts: Interim Policy for Determining Eligibility Status of Flood Risk Management Projects for the Rehabilitation Program Pursuant to Public Law (P.L.) 84-99, (March 21 2014) at 2.
[284] *Id.* at Enclosure 2.
[285] *Id.* at 2.

eligibility determination. A final policy will be established through notice and comment rulemaking. Any eligibility criteria eliminated by this interim policy will be restored, if at all, only through a public rulemaking process."[286]

Although the language in WRRDA 2014 is quite clear, its implementation has been anything but. Local levee sponsors in California still feel as though vegetation removal is the current policy and vegetation-free zones are the status quo, despite the above guidance clarifying that vegetation compliance may not be used as a determining factor for PL 84-99 eligibility. This may be because vegetation removal is still articulated as a "mandatory" under the guidance. Further, when levee sponsors push back on the USACE requirements to remove vegetation, they are often confronted with the assertion that all levee vegetation poses an "unacceptable threat" by the nature of its existence and location on the levee prism. More on unintended consequences of WRRDA 2014, Section 3013's "unacceptable threat" provision are discussed in *Part II: Problems Associated with Vegetation Removal Requirements*.

10. *Endangered Species Act (ESA) Considerations*

The Endangered Species Act (ESA) protects plant and animal species from extinction by designating species as "endangered" or "threatened," (taken together, endangered and threatened species are also referred to as "listed" species), establishing critical habitat for listed species, and prohibiting "take," or adverse modification of designated critical habitat. To "take" for ESA purposes means "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct."[287]

For purposes of levee vegetation, the most pertinent section of the ESA is Section 7, which governs actions of federal agencies. Three other sections may also be applicable to levee vegetation issues, including Section 2, Section 9 and Section 10. Section 2 establishes Congressional findings and ethical justifications for the ESA. Section 9 prohibits against take

[286] *Id*.
[287] 16 U.S.C. § 1532(19).

from all individuals, including private individuals and public entities. Section 10 provides exceptions to the ESA.

Section 2 of the ESA establishes the purpose of the act, which is to preserve ecosystems of endangered and threatened species, to provide listed species with conservation programs, and to engage in international acts and agreements to facilitate conservation. Section 2 also includes the provision:

> "It is further declared to be the policy of Congress that all Federal departments and agencies shall seek to conserve endangered species and threatened species and shall utilize their authorities in furtherance of the purposes of this chapter. . . It is further declared to be the policy of Congress that Federal agencies shall cooperate with State and local agencies to resolve water resource issues in concert with conservation of endangered species."[288]

This exemplifies how federal agencies are held to a higher standard in terms of conserving species. It also shows how federal directives are not limited to Section 7 of the ESA. Rather, in every action a federal agency takes it must use its authority to further the conservation of listed species. Finally, Congress foresaw potential conflict in terms of conserving endangered species and allocating limited water resources. As such, Congress included the provision that federal agencies should cooperate to resolve these water resource issues with ESA conservation goals in mind. Levee maintenance is closely linked to water allocation, as levees contain and channel the State's water. However, for the purposes of vegetation management, water resource allocation will not be discussed here. Even though Congress could not foresee every possible conflict, they established a precedent by stating that the most controversial of topics must still be handled with the conservation of listed species as a topmost priority. Levee vegetation is very similar to water resource allocation issues in that it is controversial and polarizing. Thus, in the context of levee vegetation, the spirit and terms of ESA similarly direct all federal agencies to handle levee vegetation with conservation of listed species as a priority.

[288] 16 U.S.C. § 1531(c).

Section 7 of the ESA describes duties specific to federal agencies. Of these duties, all federal agencies are directed to utilize their authorities to conserve listed threatened and endangered species.[289] Federal agencies are also directed to engage in interagency cooperation when the federal agency undertakes any action that might take a listed species or adversely modify its critical habitat. In this situation, the federal agency must consult with the appropriate consultation agency. The consultation agency is either the United States Fish and Wildlife Service (FWS), or National Oceanic and Atmospheric Administration (NOAA) Fisheries National Marine Fisheries Service (NMFS). NMFS' jurisdiction extends to anadromous fish species, whose critical habitat in California overlaps almost completely with California's levee system. Therefore, this paper will focus on NMFS jurisdiction, as it is the most pertinent to the levee vegetation discussion.

California's levee system contains approximately the last three to five percent of riparian forest that was once prevalent along Central Valley river corridors.[290] Riparian forest containing woody vegetation on levees is now designated critical habitat for listed species, and essential for their continued existence. Due to the existing location and close alignment of Central Valley levees, the levees essentially form the riverbank and provide hundreds of miles of fish habitat. Therefore, California's Central Valley levees serve two purposes: public safety, and designated critical habitat for listed threatened and endangered species. Any federal guidelines that promote or require the removal of such critical habitat is problematic and may violate the terms of the ESA. As such, NMFS has historically supported and continues to support policies that encourage USACE to reexamine vegetation-free requirements.

The consultation requirement of ESA Section 7 obliges any federal action agency to consult with NMFS and/or FWS prior to taking an action that may result in the take of a listed species or in the adverse modification of its remaining critical habitat. This means that whenever a federal agency wishes to modify a levee that also acts as designated critical habitat, they must first consult with NMFS and/or FWS to ensure the action does not jeopardize the continued existence

[289] 16 U.S.C. § 1536(a)(1).

[290] Edwin F. Katihab, A Brief History of Riparian Forests in the Central Valley of California, Paper presented at the California Riparian Systems Conference (University of California, Davis, September 17–19, 1981); Whipple et. al., Sacramento-San Joaquin Delta Historical Ecology Investigation: Exploring Pattern and Process (SFEI, 2012).

of the listed species. If the action may jeopardize the continued existence of a listed species or adversely modify its critical habitat, the acting agency must undergo "formal" consultation with NMFS and/or FWS.

As FWS and/or NMFS undergoes a formal consultation with the action agency per Section 7 of the ESA, the consulting agency and action agency must agree on a determination as to whether or not the action results in jeopardy. If the action is likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of critical habitat, then the formal consultation is characterized as a "jeopardy biological opinion."[291] In a formal consultation, if the action is not likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of critical habitat, the result is a "no jeopardy" biological opinion.[292] In the case of a "jeopardy" biological opinion, the biological opinion (BiOp) must include reasonable and prudent alternatives (RPAs).[293] If the consulting agency is unable to develop RPAs, "it will indicate that to the best of its knowledge there are no [RPAs]."[294]

RPAs are identified during a formal consultation, and offer alternative actions consistent with the action's original purpose, that will avoid the likelihood of jeopardizing the continued existence of listed species or the destruction or adverse modification of designated critical habitat.[295] RPAs must also be economically and technologically feasible.[296] In formulating RPAs, the consulting agency must use the "best scientific and commercial data available" and "give appropriate consideration to any beneficial actions taken by the federal agency or applicant, including any actions taken prior to the initiation of consultation."[297]

For levees, RPAs could include modifications such as retaining or planting riparian woody vegetation, including shaded riverine aquatic (SRA) habitat, which is critical for endangered fish survival. Conflicts emerge when these ESA recommendations violate USACE engineering

[291] 50 C.F.R. §402.14(h)(3).
[292] 50 C.F.R. §402.14(h)(3).
[293] 50 C.F.R. §402.14(h)(3).
[294] 50 C.F.R. §402.14(h)(3).
[295] 50 C.F.R. §402.02.
[296] 50 C.F.R. §402.02.
[297] 50 C.F.R. § 402.14(g)(8).

specifications, and this are discussed in greater detail in *Part II: Problems Associated with Vegetation Removal Requirements*.

In addition to ensuring that individual federal actions will not jeopardize listed species or their habitat, NMFS also issued a Recovery Plan for endangered and threatened species in the Central Valley.[298] This Recovery Plan is meant to guide actions to lead towards the recovery of endangered Sacramento River winter-run Chinook salmon Evolutionary Significant Unit (ESU), the threatened Central Valley spring-run Chinook salmon ESU, and the threatened California Central Valley steelhead Distinct Population Segment (DPS). Recovery refers to a state where listed species and their ecosystems are restored and their future is safeguarded to a point where ESA protections are no longer needed.[299] The Recovery Strategy focuses on two main conservation principles: the need for providing sufficient habitat; and the need for adequate spatial structure, diversity, productivity, and abundance.[300] The Recovery Plan notes that habitat degradation has occurred due to many forces, including "construction of levees and barriers to migration, modification of natural hydrologic regimes by dams and water diversions, elevated water temperatures, and water pollution from agriculture and industry."[301]

Chapter 5 of the Recovery Plan identifies high priority threats and recovery actions to bring about the recovery of endangered and threatened fish in the Central Valley. The recovery actions were scored 1-3 based on priority, with a score of 1 connoting an action of the highest priority. One action priority receiving a score of 1 includes the action to "[d]evelop and implement State and National levee vegetation policies to maintain and restore riparian corridors."[302] Another priority action with a score of 1 includes the action to, "[i]ncorporate ecosystem restoration including breaching and setting back levees into Central Valley flood control plans (i.e., FloodSAFE Strategic Plan and the Central Valley Flood Protection Plan)."[303] This is

[298] National Oceanic and Atmospheric Administration, National Marine Fisheries Service West Coast Region, Recovery Plan: For the Evolutionary Significant Units of Sacramento River Winter-Run Chinook Salmon and Central Valley Spring-Run Chinook Salmon and the Distinct Population Segment of California Central Valley Steelhead (July, 2014).
[299] *Id*. at i.
[300] *Id*. at ii.
[301] *Id*. at i-ii.
[302] *Id*. at 113 (Action ID No. CEV-1.8).
[303] *Id*. at 113 (Action ID No. CEV-1.9).

demonstrative of NMFS commitment to restoring vegetation and habitat on Central Valley levee systems as an agency priority. Further, pursuing policies to maintain and restore vegetation and riparian habitat on levees has been identified by NMFS biologists as a high priority action necessary to bring about the recovery of listed endangered and threatened fish.

Section 9 of the ESA describes prohibited acts, and is applicable to all individuals and organizations, including private individuals. It generally prohibits take, transfer or sale of listed species.[304] As described above, the definition of take covers many actions, including the term "harm." Courts have expanded the definition of harm to include any "significant habitat modification or degradation that actually kills or injures wildlife."[305] Thus, private individuals are precluded from directly harming or killing a listed species, or from adversely modifying listed species habitat in a way that results in harm to the species. In the context of levee vegetation, this is significant because levee maintainers may be violating ESA Section 9 unknowingly when trying to comply with USACE vegetation-free requirements. If a maintaining agency removes riparian vegetation on a levee that provides critical habitat to listed salmon (as much of the riparian vegetation on levees does), then they may be significantly degrading critical species habitat. This would put them in violation of Section 9. Associated problems faced by LMAs with respect to Section 9 are covered in greater detail in *Part II: Problems Associated with Vegetation Removal Requirements*.

Section 10 of the ESA describes exceptions to the ESA, including requirements for Habitat Conservation Plans (HCPs). An actor, including a private actor, may carry out an otherwise lawful activity that results in incidental take to the species if they obtain an "incidental take permit." A private actor can only acquire an incidental take permit through an HCP. In developing an HCP, the applicant must submit the plan to USFWS or NMFS for approval, depending on the species in question. The HCP must specify the impact from the taking, plans for mitigation, possible alternative actions considered, and any other important factors.[306] USFWS and NMFS may approve the HCP if they agree that the taking is incidental, the applicant is minimizing and mitigating all impacts of the take, the applicant is providing

[304] 16 U.S.C. § 1538(a)(1).
[305] *Babbitt v. Sweet Home Chapter of Communities for a Great Oregon*, 515 U.S. 687, 708 (1995).
[306] 16 U.S.C. § 1539(a)(2)(A)-(B).

adequate funding, and the take will not reduce the likelihood of survival for the listed species.[307] HCPs are useful for private actors who, absent an HCP, would be barred from developing a project that could potentially negatively impact a listed species or its habitat. This is important in terms of levee vegetation, because levee maintainers have the option to pursue an HCP to cover incidental take associated with riparian habitat removal. This option is discussed in greater detail in *Part IV: Solutions*.

[307] 16 U.S.C. § 1539(a)(2)(A)-(B).

APPENDIX 2: California State Laws and Policies

1. California Endangered Species Act

The California Endangered Species Act (CESA) largely mirrors its federal counterpart.[308] CESA contains a consultation requirement similar to the federal ESA, which the applicant may undertake in conjunction with a federal consultation (if the action may also affect federally-listed species).[309] Similarly to the federal ESA, CESA also authorizes the consulting agency (California Department of Fish and Wildlife or "CDFW") to issue incidental take permits if an action may result in the take of a CESA-listed species. CESA also contains a similar provision to ESA Section 9, whereby privately acting individuals are prohibited from any act that will result with "take" a state-listed species. CESA defines "take" similarly to the federal ESA, although it does not include the terms to "harm" or "harass," which has led to interpretations that CESA does not prevent adverse habitat modification in the definition of "take," as ESA does.[310] It also differs from the federal ESA in that it allows more public comment in the petition listing process.[311] CESA is considered stronger than the federal law in a few ways, as well. For example, it protects candidate species (those species in consideration for being listed as threatened or endangered) and plants on private lands. Overall, however, the federal ESA is considered by many to be the stronger mandate, in large part due to its interpretation and practice.[312]

The CESA counterpart to ESA Section 7 is similar to the federal consultation process. Under CESA, when a State agency takes an action to authorize, fund, or carry out an action that may jeopardize the continued existence of a CESA-listed species, result in the take of a listed species, or that may result in the adverse modification of essential habitat, the agency must consult with CDFW.[313] Similar to the federal ESA, CESA consultations may be informal or formal. Formal consultations with jeopardy conclusions must also include reasonable and prudent alternatives

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[308] *See* Cal. Fish and Game Code § 2050 et. seq.
[309] Cal. Fish and Game Code § 2081.
[310] Lynn E Dwyer and Dennis D. Murphy, Natural Resources Journal Vol. 35, Fulfilling the Promise: Reconsidering and Reforming the California Endangered Species Act (Fall 1995), at 740.
[311] *Id*. at 740.
[312] *Id*. at 742-743.
[313] *Id*. at 746-747.

(RPAs) to the action.[314] The RPAs must be incorporated into the project, unless economic or other conditions make implementation of RPAs infeasible. The action agency can still proceed with the action, absent the RPAs, if the project includes reasonable mitigation measures to minimize the project's adverse impacts, or if cost-benefit analysis demonstrates that the project's benefits without the RPAs outweighs the RPAs.[315]

CESA also presents opportunities for public and private individuals to obtain incidental take permits, when take may occur but is incidental to the project purpose. Similarly to the federal ESA, the consulting agency, CDFW, can issue such a permit following the consultation process. Under CESA, permits can also be issued to individuals or institutions that demonstrate the proposed take is for "scientific, educational or management purposes."[316]

2. *Responsibilities of DWR and CVFPB – Creation of 2012 CVFPP and description of SPFC*

State responsibilities regarding flood management rest principally within the Central Valley Flood Protection Board (CVFPB) and California Department of Water Resources (DWR). Formed in 1911, the CVFPB (formerly known as The State Reclamation Board) is the California State agency charged with reducing flood risk to people and property within the California Central Valley.[317] In 1967 the legislature placed all Board activities under DWR, and the Board was left with essentially no staff. Then in 2007-2008, with the passage of the Central Valley Flood Protection Act of 2008 (commonly referred to as "SB 5"), the Board was, in a sense, created again, as the legislature provided funds for the CVFPB to hire a permanent staff.[318] The Central Valley Flood Protection Act of 2008 also legally designated the CVFPB as the official nonfederal sponsor for all California levees within the State Plan of Flood Control (SPFC).[319] Finally, the Central Valley Flood Protection Act of 2008 directed DWR to prepare the 2012

[314] *Id*. at 747.
[315] *Id*. at 747.
[316] *Id*. at 747; Cal. Fish & Game Code § 2081.
[317] Central Valley Flood Protection Board, < http://cvfpb.ca.gov/about-us/board/ > (last visited August 18, 2016) ("The Board at all times shall enforce on behalf of the State the erection, maintenance and protection of such levees, embankments and channel rectification as will, in its judgment, best serve the interests of the state."); Cal. Water Code § 8534.
[318] Cal. Water Code § 9600 et. seq.
[319] *Id.*

Central Valley Flood Protection Plan (CVFPP) for CVFPB adoption. DWR did so and released the 2012 CVFPP in December 2011, which was adopted by the CVFPB in June 2012.

CVFPB and DWR have special responsibilities for areas protected by the SPFC. The SPFC includes the portion of the Central Valley flood management system where the CVFPB or DWR has "provided assurances of nonfederal cooperation to the United States, and those facilities identified in [California Water Code] Section 8361."[320] The California Water Code specifies areas under the SPFC as: Sacramento River Flood Control Project areas;[321] Sacramento River and San Joaquin River Watershed Flood Control Project areas;[322] specific facilities identified in California Water Code Section 8361; and other areas "for which the board [CVFPB] and department [DWR] has provided the assurances of nonfederal cooperation to the United States."[323] Thus, by definition, levees and other flood control projects in the Central Valley, for which the CVFPB and DWR are designated nonfederal sponsors, are included in the SPFC. A visual representation of SPFC levees is included in Figure 1-7 of the 2012 Central Valley Flood Protection Plan (CVFPP), and included below as a reference.

[320] Cal. Water Code § 9110(f).
[321] Cal. Water Code § 8450.
[322] Cal. Water Code Article 2, §12648 et seq.
[323] Cal. Water Code § 9110(f).

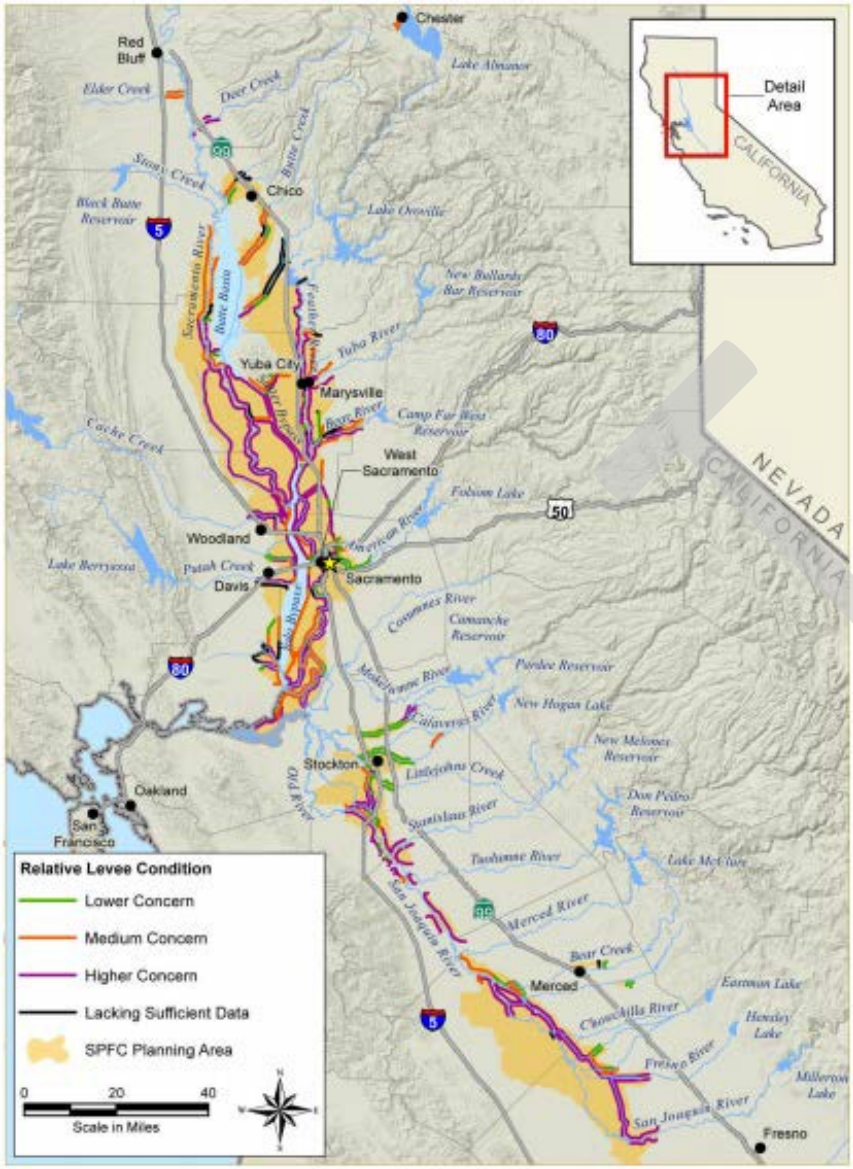

Figure 18: Summary of Physical Levee Conditions in SPFC[324]

[324] 2012 Central Valley Flood Protection Plan at 1-13.

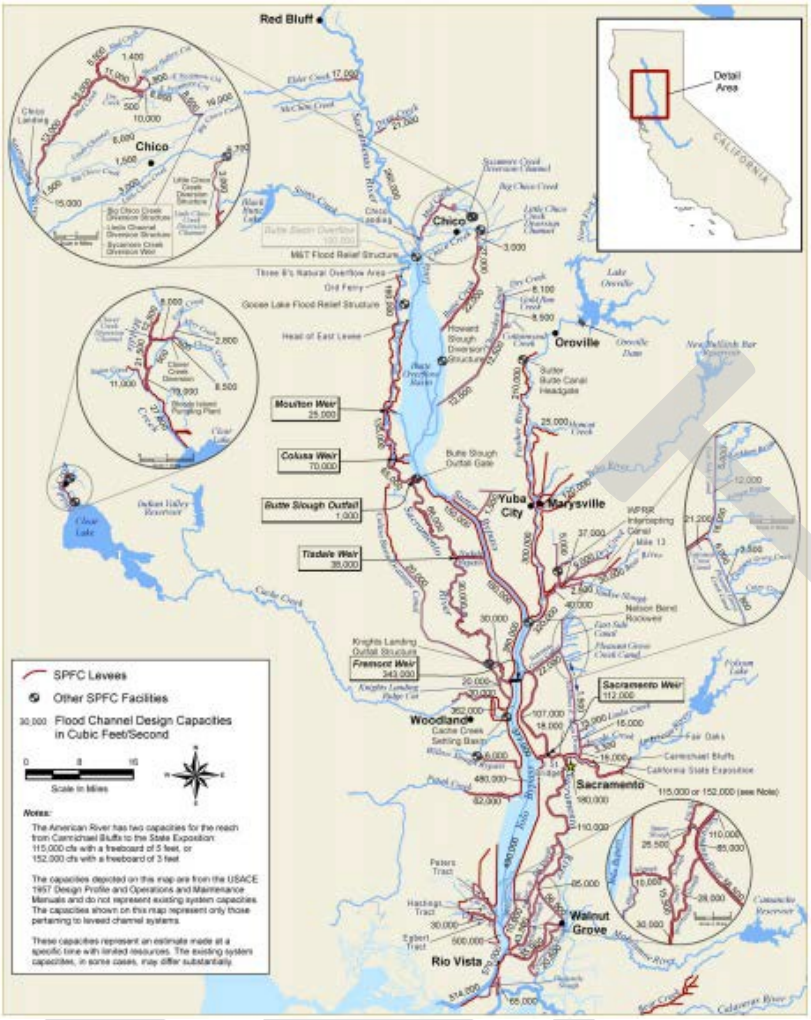

Figure 19: SPFC Facilities – Sacramento River Basin[325]

325 *Id*. at 1-8.

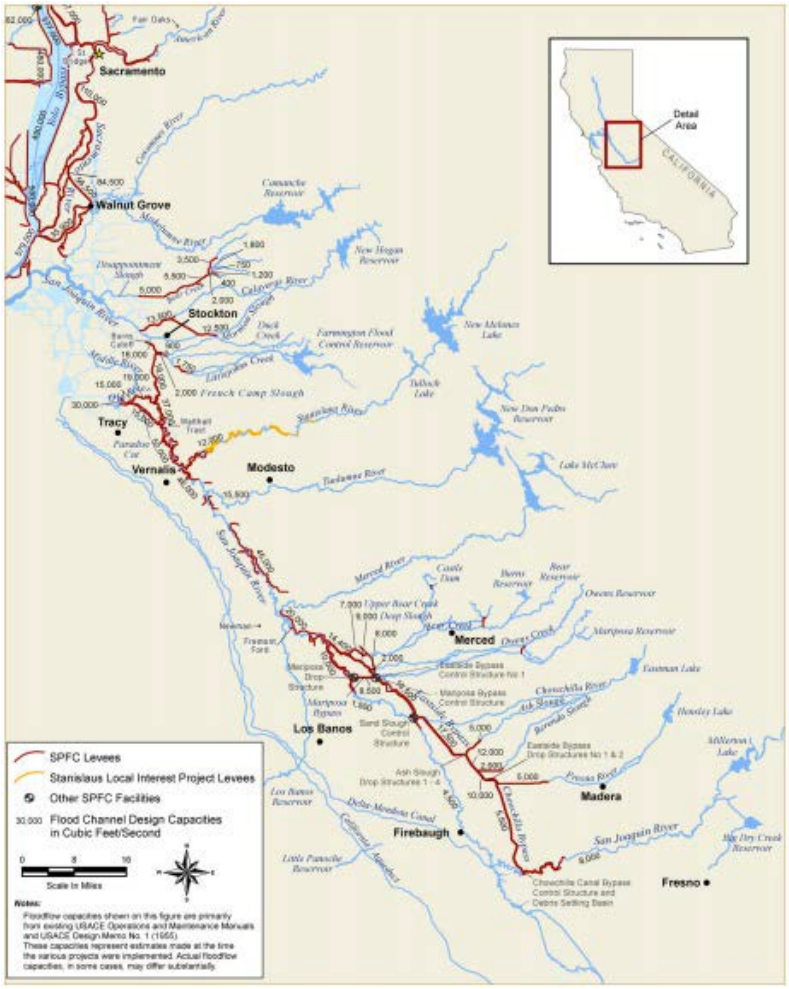

Figure 20: SPFC Facilities – San Joaquin River Basin[326]

326 *Id*. at 1-9.

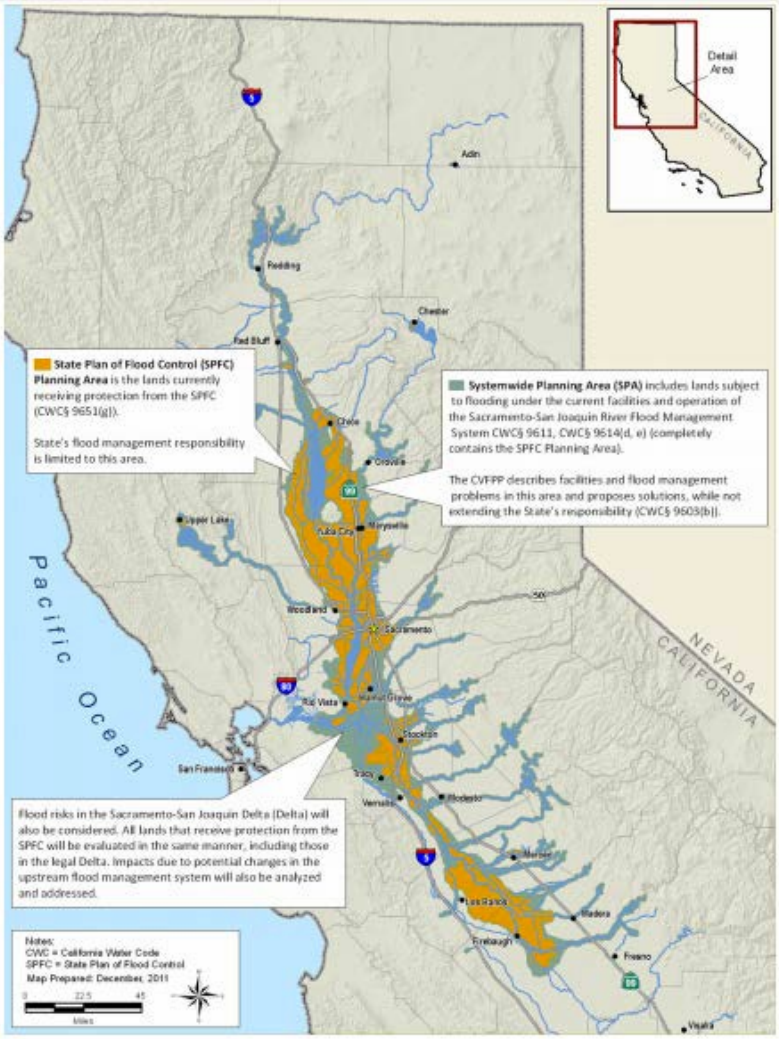

Figure 21: SPFC and SPA[327]

The Sacramento-San Joaquin River Flood Management System comprises all facilities of the SPFC, as well as any levee or other flood management facility that, "does one or more of the following: (1) provides significant systemwide benefits for managing flood risks within the Sacramento-San Joaquin Valley; (2) Protects urban areas within the Sacramento-San Joaquin Valley."[328] DWR may identify and propose facilities from the Sacramento-San Joaquin Flood Management System to be added to the SPFC. Following the DWR proposal, the CVFPB may

[327] *Id*. at 1-23

[328] Cal. Water Resources Code § 9611(b).

add these facilities to the SPFC if they agree that the facilities accomplish the purposes identified above.[329]

Following a proposal from DWR, the CVFPB can adopt a system into the SPFC. Moreover, any flood management project for which DWR or the CVFPB is the nonfederal sponsor is included in the SPFC.

3. 2012 CVFPP

The 2012 CVFPP "is the most comprehensive flood management planning effort ever undertaken in California, addressing flood risks in an integrated manner while concurrently improving ecosystems, operations and maintenance practices, and institutional support for flood management."[330]

The 2012 CVFPP as a comprehensive statewide planning tool is highly influential due to a variety of factors. First, as described above, the document was written by DWR, adopted by CVFPB, and outlines flood management risk strategy for areas of the SPFC. Although the 2012 CVFPP focuses on areas protected by SPFC facilities, flood emergency response and operations and management of facilities in tributary watersheds that influence SPFC-protected areas are also considered in the 2012 CVFPP.[331] Because the SPFC contains such a large physical area of flood management systems, and indeed all systems for which DWR and CVFPB are nonfederal sponsors, the 2012 CVFPP is intended to guide management for most of the flood control system in California. (See Figure 21 above for areas included in the SPFC).

Additionally, DWR and CVFPB follow the plan's guidelines in carrying out their own duties as nonfederal levee sponsors. Finally, although the 2012 CVFPP is not "legally binding" in the sense that federal sponsors and LMAs have no direct obligation to carry out the specific terms of the 2012 CVFPP, the Central Valley Flood Protection Act of 2008 requires cities and counties in the Sacramento and San Joaquin Valley to incorporate information from the CVFPP into local

[329] Cal. Water Resources Code § 9611(c).
[330] 2012 Central Valley Flood Protection Plan at III.
[331] 2012 Central Valley Flood Protection Plan at 1-22.

land use plans and projects, memorializing its provisions into local planning documents.[332] DWR and CVFPB also encourage LMAs to follow the terms of 2012 CVFPP while carrying out their own flood risk management duties. Therefore, the 2012 CVFPP is one of the most prominent State planning documents for flood management in California.

The 2012 CVFPP was released as a public draft in December 2011 and adopted by the CVFPB in a unanimous vote on June 29, 2012. The same legislation that prompted DWR to draft the 2012 CVFPP also directs DWR to draft an updated plan every five years. At the time of this paper, the 2017 CVFPP is in the process of being drafted and a public draft will likely be released at the beginning of 2017.

The 2012 CVFPP has one primary goal and several supporting goals. The primary goal of the CVFPP is to reduce the chance of flooding, and once flooding occurs, to improve public safety, preparedness, and emergency response through, (1) identifying, recommending, and implementing structural and nonstructural projects and actions that benefit lands currently receiving protection from facilities of the SPFC; and (2) formulating standards, criteria and guidelines to facilitate the implementation of structural and nonstructural actions for protecting urban areas and other lands of the Sacramento and San Joaquin river basins and the Delta.

The supporting goals include: improving operations and maintenance, promoting ecosystem functions, improving institutional support and promoting multi-benefit projects. In order to improve O&M, the plan supports reducing systemwide maintenance and repair requirements by modifying systems to make them more compatible with natural processes, and to coordinate and streamline regulatory O&M practices. To promote ecosystem functions, the plan supports integrating recovery and restoration of ecological functions, native habitats and species into flood system improvements. To improve institutional support, the plan advocates developing stable institutional frameworks and protocols that enable effective adaptive and integrated flood management. Finally, in order to promote multi-benefit projects, the plan supports integration of broader water management objectives.

[332] 2012 Central Valley Flood Protection Plan; Cal. Water Code § 9600-9603.

In order to best achieve these goals, the plan outlines three basic strategies, and compares each strategy based on its ability to meet the established goals, as well as economic cost, time of implementation, and other relevant criteria. Ultimately, the plan advocates for one approach above the other two. This approach is called, "State Systemwide Investment Approach" (SSIA). The SSIA promotes projects to achieve regional flood control benefits for urban areas, small communities, and rural-agricultural areas. Additionally, the SSIA proposes larger system improvements to the SPFC that provide cross-regional benefits and improve the overall function and performance of the SPFC.[333]

a. Levee Vegetation Management Strategy and Lifecycle Management

The 2012 CVFPP was revolutionary in terms of levee vegetation management, because it proposed and defined an approach known as, "Lifecycle Management" (LCM) as part of the State's larger Levee Vegetation Management Strategy (LVMS). The LVMS generally includes a strategy of complying with the USACE vegetation-free zone requirements for newly constructed levees, but largely protecting existing vegetation on existing levees.

Under the LCM approach, existing levees would gradually move towards meeting the USACE policy goal of eventually eliminating woody vegetation from the vegetation management zone, which includes the landside slope, crown, and upper waterside slope of levees. According to the 2012 CVFPP this would be accomplished "over many decades." This is because LCM advocates that "legacy levee vegetation," or vegetation already in place on most portions of the levee, be allowed to live out the remainder of their normal life cycles, while any new growth is swiftly identified and removed.

The 2012 CVFPP also states that the LVMS will protect and improve riparian habitat, by largely preserving existing vegetation, in the "near-term." Additionally, the policies set forth in the CVFPP's description of LCM promote development of additional habitat to offset the gradual

[333] 2012 Central Valley Flood Protection Plan at 3-1.

die-off of existing trees and removal of others. LCM also acknowledges the need to revisit the policy in the long term, in order to better protect riparian habitat.[334]

The LVMS policy categorizes vegetation on levees, and applies different management rules depending on which category the vegetation falls under. Newly constructed levees will be free of vegetation, and any growth will be removed, pursuant to USACE vegetation-free zone requirements.

Vegetation existing on the lower waterside slope of existing levees would only be removed when it poses an unacceptable threat to levee integrity. Additional vegetation would be allowed to grow on the lower waterside slope. This is the only area where additional vegetation retention is allowed. This is because the lower waterside slope provides critical habitat to the some of the few remaining endangered fish species in the Central Valley, and vegetation on this part of levee slopes rarely presents threats to levee integrity. In fact, vegetation on the lower waterside slope can provide beneficial functions for levee integrity, such as slowing near shore water velocities, and holding soil in place to reduce erosion. Riparian brush and larger woody vegetation can also provide the greatest erosion protection and stabilize levees through extensive root systems.[335]

Vegetation on the levee system that does not exist on the lower waterside slope is to be trimmed to provide for visibility and access, but will not be removed unless it is demonstrated to pose an unacceptable threat, or creates visibility problems within the vegetation management zone. Through routine O&M, this vegetation is to be evaluated and monitored to identify any changed conditions that could pose an unacceptable threat to levee integrity, based on accepted engineering practice.

LCM advocates an "adaptive vegetation management strategy," by allowing existing trees and other woody vegetation in the vegetation management zone (areas on the levee other than the lower waterside slope) to live out the rest of their normal life cycles, but eliminate new tree and

[334] 2012 Central Valley Flood Protection Plan at 4-14. ("For the long-term, it is anticipated that continued scientific research, potential system modifications, and evolving vegetation policy will support preservation and restoration of sustainable riparian habitat within the levee system.")

[335] 2012 Central Valley Flood Protection Plan at 4-13 – 4-14.

woody vegetation growth. This would be accomplished by removing "immature" trees and woody vegetation, or any new growth less than four inches.

The LVMS policy further promotes routine inspections, multiple times a year, which would seek to identify a wide variety of potential problems, including trees that may pose an unacceptable threat to levee integrity, or which could create a visibility problem. Any such threats would be removed.

The LVMS seems to be a productive compromise in the short term for problems faced by levee sponsors and maintainers. However, in the long term, LCM could result in the loss of vast amounts of critical riparian habitat, as new trees are consistently removed, and existing trees and other woody vegetation dies off. In order to attempt to deal with this problem, the LVMS includes the establishment of riparian forest corridors, which will result in net gain of riparian habitat.[336] The Conservation Framework, included as an attachment to the 2012 CVFPP, also contains a tree planting program and monitoring plan, to ensure that the "quality and quantity of riparian corridors of the Central Valley are maintained and enhanced over time."[337] Finally, DWR promotes research on risks and benefits of trees on levee performance, and encourages its own agency and others to "incorporate new information into evolving policies and practices."[338] Therefore, the LVMS presents a compromise-type approach, which would effectively deal with levee vegetation management in the short-term, but DWR recognizes the need to revisit the policy in the long-term, as it is unlikely to sustain adequate vegetation growth over decades of implementation.

b. Conservation Framework

Another significant inclusion in the 2012 CVFPP is the Conservation Framework (CF). Overall, the 2012 CVFPP can be thought of as a framework to guide future State investment in flood risk reduction projects, and as a guide on how to prioritize resources and funding to reduce as much risk as possible. The CF, included as "Attachment 2" to the 2012 CVFPP, describes how environmental stewardship is integrated into flood risk management activities, references

[336] 2012 Central Valley Flood Protection Plan at 4-15.
[337] 2012 Central Valley Flood Protection Plan at 4-15.
[338] 2012 Central Valley Flood Protection Plan at 4-16.

environmental elements in the 2012 CVFPP, and provides additional detail on environmental planning.[339]

The Conservation Framework (CF) contains the following ecological goals:

(1) To improve ecosystem process overall. This includes improving the dynamic hydrologic (flow) and geomorphic processes in the SPFC. The CF identifies these ecosystem processes as critical for maintaining species and habitats. Furthermore, the CF recognizes that sustainable fisheries and riverine habitats require a diversity of flows, suitable sources of sediment, and a sufficiently broad river corridor to allow for stream meandering.
(2) To improve and increase the quantity, diversity, quality, and connectivity of riverine and floodplain habitats, including aquatic, riparian, wetland, shaded riverine aquatic (SRA) cover, and other floodplain habitats, as well as agricultural lands that can provide wildlife values.
(3) To contribute to the recovery and sustainability of native species populations and overall biotic community diversity. Particular attention is given to native species associated with riverine habitats at risk of extinction. This goal also emphasizes the need to avoid and minimize adverse effects on sensitive species, to develop compensatory habitat for adversely affected sites, and to contribute to species recovery in addition to mitigating for impacts.
(4) To reduce the stressors related to the development and operation of the SPFC that negatively affect at-risk species. These stressors include invasive plant species, constraints on sediment sources and channel meander migration, isolation of floodplains from rivers by levees, and fish passage barriers, all of which contribute to loss and degradation of ecosystem functions and habitats.
(5) To increase support and collaboration among regulatory agencies, flood managers, local planners, environmental nongovernmental organizations (NGOs) and agricultural interests for multi-benefit flood projects.

[339] 2012 Central Valley Flood Protection Plan at 1-30.

(6) To increase the quality of environmental information and tools for informing flood management and conservation activities.[340]

Overall, the CF and articulated goals provided direction for conservation planning in the context of flood risk management. The CF was included as the "first phase" of a more comprehensive and integrated Central Valley Flood System Conservation Strategy (Conservation Strategy, or CS).[341] In a sense, the CF was a first draft of the CS.

c. Conservation Strategy

The CF goals listed above also serve as the same basic goals for the Draft Central Valley Flood System Conservation Strategy (CS). Generally, the overall goals of the CS are to promote natural dynamic hydrologic and geomorphic processes; increase and improve the quantity, diversity and connectivity of habitats; and to promote the recovery and stability of native species populations and the overall biotic community diversity.[342]

The CS was developed to provide a comprehensive approach for the State, consistent with the CF, to achieve the environmental goals and objectives set forth in the Central Valley Flood Protection Act, FloodSAFE, and 2012 CVFPP. The CS was also developed to implement the DWR environmental stewardship policy within the flood management system.[343]

The CS seeks to provide a comprehensive, long-term approach for improving riverine and floodplain ecosystems through multi-benefit projects that provide ecological benefits while protecting public safety. The CS utilizes a regional, programmatic framework in order to increase the predictability and cost-effectiveness of permitting, resulting in less costly and more effective conservation outcomes.[344]

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[340] Central Valley Flood Management Planning Program, FloodSAFE Cal., 2012 Central Valley Flood Protection Plan Attachment 2: Conservation Framework (January 2012) at 3-1 – 3-2.
[341] *Id*. at 1-1.
[342] Cal. Dept. of Water Resources, Draft Central Valley Flood System Conservation Strategy (November 2016) at 3-2 – 3-3.
[343] 2012 Central Valley Flood Protection Plan Attachment 2: Conservation Framework at 1-8.
[344] Cal. Dept. of Water Resources, Draft Central Valley Flood System Conservation Strategy (November 2016 at 4-1.

The development of the CS was first proposed in the 2009 California Levees Roundtable framework document, "California Central Valley Flood System Improvement Framework" (2009). The framework addressed levee vegetation issues and advocated for the development of a Conservation Strategy for the Central Valley flood system.

The CS describes how planners can achieve the environmental goals and objectives set forth in the 2012 CVFPP. The CS promotes actions that support multiple goals and objectives, also referred to as "multi-benefit" projects. For example, in order to support the goals of improving flood risk management and habitat restoration, the CS promotes structural improvements that increase the size of the floodway, including bypass expansions, new transient storage areas, and setback levees, which would improve flood risk management by increasing system flexibility and reliability.[345] The CS supports the CVFPP goal of improving O&M practices through promoting multi-benefit projects that reduce the amount of vegetation and sediment that needs to be removed from channels, and more generally locating habitat where conflicts are minimized. The CS also supports the CVFPP O&M goal by promoting the relocation of certain facilities to reduce the physical forces acting on them, thus reducing maintenance needs. The CS promotes regional and programmatic permits, advance mitigation, long-term maintenance, and incorporation of multi-benefit features, all of which could increase the reliability and cost-efficiency of the permitting process and result in more efficient O&M.

In order to support the 2012 CVFPP goal of improving institutional support, the CS suggests that projects that advance conservation goals could attract funding from outside sources interested in promoting conservation. The CS also predicts that flood risk reduction projects that improve environmental quality will help build public support for funding and implementing such projects. Finally, the CS directly supports the 2012 CVFPP goals of promoting ecosystem functions in every almost aspect of the strategy.

Given the programmatic nature of the CS goals, the strategy was developed in close coordination with two Basinwide Feasibility Studies (BWFS) for the Sacramento and San Joaquin River, and

[345] *Id*. at 6-5.

six Regional Flood Management Plans (RFMPs) for subdivisions of those basins. These programmatic planning documents will likely be included in the 2017 CVFPP.

The CS addresses the importance of incorporating environmental improvements directly into flood risk management activities, rather than project proponents paying for conservation in a physically remote location to try to mitigate impacts. It provides approaches for integrating ecosystem restoration into multi-benefit flood risk management projects.

To achieve the goals enumerated in the CS, the CS takes a targeted approach to habitats, processes, species and stressors. It "targets," or focuses on habitats and species with the most potential to benefit from conservation integrated with flood management. Then, the CS sets "measurable objectives" for these targets, which include floodplain inundation, riparian habitat and fish passage barriers.

The inclusion of measurable objectives may be the most noteworthy aspect of the CS. The measurable objectives provide a framework for measuring, monitoring and evaluating progress in implementing conservation measures. This in turn informs the CVFPB and DWR funding program, which can look to current and projected levels of compliance with the objectives. The objectives are intended to be attainable, relevant to the SPFC, and include a time frame for achievement.[346] The CS also recognizes the uncertainty associated at the intersection of flood management and ecosystem restoration, and establishes reevaluation criteria to revise and review the objectives during early implementation.[347]

The objectives themselves are not obligatory, and the CS does not establish any performance obligations on DWR or other LMAs with respect to the conservation objectives. Rather, the measureable objectives are intended to "begin the process of developing a scientifically supportable and stable framework for evaluating progress over time rather than setting absolute performance criteria for DWR to meet."[348] The objectives take into account realistic

[346] *Id*. at 5-1.
[347] *Id*. at 5-1.
[348] *Id*. at 1-3.

opportunities to contribute to conservation based on flood system management, and attempt to set realistic measurable objectives based on existing opportunities.[349]

The measures themselves are articulated in Section 5.0 of the CS. In this section of the CS, areas in the Systemwide Planning Area (SPA)[350] are divided into five Conservation Planning Areas (CPAs). These CPAs include: (1) The Sacramento River CPA, which includes the Sacramento River and tributaries from Red Bluff to the Fremont Weir (Upper and Mid-Sacramento River CVFPP RFMP regions); (2) The Feather River CPA, which includes the Feather River, as well as the Yuba and Bear Rivers and other tributaries (Feather River CVFPP RFMP region); (3) The Lower Sacramento River CPA, which includes the Sacramento River and tributaries from the Fremont Weir to Isleton (Lower Sacramento River and Delta-North CVFPP RFMP regions); (4) The Upper San Joaquin River CPA, which includes the San Joaquin River and tributaries from Friant Dam to the Merced River (Upper San Joaquin River CVFPP RFMP region); and (5) The Lower San Joaquin River CPA, which includes the San Joaquin River and tributaries from the Merced River to Stockton (Lower and Mid-San Joaquin River and Delta-South CVFPP RFMP regions).[351]

Within each CPA, each measurable objective addresses a targeted ecosystem process, habitat, or stressor. The objectives themselves consist of one or more specific metrics (for example, the acreage of riparian vegetation).

The CS itself will likely be included as part of the 2017 CVFPP, just as the CF was included as an Attachment 2 in the 2012 CVFPP. As of the time of the writing of this paper, discussions continue as to the utilization of the CS in the 2017 CVFPP, and possible incorporation elsewhere.

Appendix D of the CS includes details on the State's Levee Vegetation Management Strategy (LVMS), an integral part of the CS. This strategy differs from the federal vegetation management strategy in many ways, including the presumption that levee vegetation necessarily

[349] *Id*. at 5-7.
[350] *Id.* at 1-3. (Systemwide Planning Area "consists of lands currently receiving protection from the SPFC and additional areas where management actions may be implemented as part of the CVFPP").
[351] *Id*. at 1-4 – 1-6.

poses a threat to levee integrity. Rather, vegetation management is considered important to maintain visibility and accessibility for inspections and floodfighting, and "in some limited cases," may pose an unacceptable threat to levee integrity.[352] The LVMS also seeks to eliminate invasive plants, which can be harmful to endangered species and flood system capabilities. As part of the LVMS, newly constructed levees are to be free of vegetation, per USACE requirements, but in order to minimize impacts on SRA, the LVMS promotes designing new levees to include a waterside planting berm "that accommodates trees and other woody vegetation to sustain continuous SRA habitat."[353] The planting berm is included not only for improving habitat, but also to minimize erosion on the waterside. DWR also requires that the planting berm on newly constructed levees conform to USACE engineering standards.[354] The LVMS also supports the implementation of setback levees, where practical.[355]

The State's LVMS further clarifies the definition of "legacy vegetation," to include,

> "trees and other woody vegetation that was inspected by USACE and for which there is no documentation stating that the nonfederal sponsor was notified before 2007 that the vegetation needed to be removed. This includes vegetation present on State/federal project levees at the time the project was turned over by USACE in the 1950s, vegetation that was planted for mitigation as part of a cost-shared USACE project, and vegetation that has been allowed by USACE to remain to meet federal [ESA] or other requirements."[356]

The LVMS discusses the treatment of this legacy vegetation in terms of vegetation posing a "potential risk," rather than through an assumption that all existing woody vegetation necessarily poses a risk. This is based off of recent studies, including USACE's ERDC report (July 2011), which shows that woody vegetation can increase or decrease levee safety, depending on a variety of factors (the ERDC report is discussed in greater detail in *Appendix 4: Science and Research*).

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[352] Cal. Dept. of Water Resources, Draft Appendix D. Vegetation Management Strategy (July 2016) at D-1. <http://www.water.ca.gov/conservationstrategy/docs/app_d.pdf >
[353] *Id*. at D-3.
[354] *Id*. at D-3.
[355] *Id*. at D-3.
[356] *Id*. at at D-4.

Management of legacy vegetation includes a Vegetation Management Zone (VMZ) in which vegetation is managed (trimmed and thinned) for visibility and accessibility and new vegetation growth is removed. Vegetation outside of this zone, in the lower waterside slope of the levee would largely remain unmanaged and in place, given its low threat to levee safety and high ecosystem value, especially for endangered fish. As part of the State's vegetation management strategy, trees that have been identified to pose an unacceptable threat to levee integrity shall be identified and removed, or managed to reduce their threat to an acceptable level.[357]

The CS also references assessment tools currently under development, which could help identify which trees pose such a threat. These tools will be discussed in greater detail in *Appendix 4: Science and Research*. The state approach also encourages the establishment of riparian forest corridors in the vicinity of existing levees, on the waterside if feasible.[358] Finally, the LVMS establishes protocols for vegetation management as part of levee repair or improvement projects. This includes directives to replant vegetation where appropriate and include root or seepage barriers in the levee crown.[359]

In addition to clarifications made to previous DWR strategy, the State's LVMS also offers new strategies to manage channel vegetation and invasive plants. This includes utilization of new models to determine channel conveyance along with habitat needs.[360] The LVMS also emphasizes the DWR goal of removing invasive plant species along levees through increased institutional support, development of coordinated approaches within Channel Maintenance Areas, and development of partnerships to optimize limited resource use.[361] The State also plans on continuing implementation of ongoing strategies to combat invasive species, including prioritizing species for control, implementing best management practices (BMPs) and continuing to use models to track and prioritize treatment of invasive plants.[362]

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[357] *Id*. at D-8.
[358] *Id*. at D-9.
[359] *Id*. at D-11.
[360] *Id*. at D-13.
[361] *Id*. at D-13 – 14.
[362] *Id*. at D-14.

In summation, the State approach to dealing with levee vegetation differs from that of the federal approach. The State's vegetation management approach, embodied in the LVMS, presumes vegetation retention in most cases, and addresses site-specific characteristics.

APPENDIX 3: Case Law

Two prominent lawsuits quickly followed the release of the USACE vegetation-free policy. One was brought by a group of environmental non-governmental organizations (NGOs), and another by the California Department of Fish and Wildlife (CDFW). Both alleged that in promulgating their new rule, USACE violated the Endangered Species Act (ESA), National Environmental Policy Act (NEPA) and the Administrative Procedure Act (APA). It is unclear whether either of these cases would have won on the merits, because while the lawsuits were being litigated WRRDA 2014 was released. WRRDA 2014, Section 3013 directed USACE to revisit and reissue the vegetation-free policy. In each case the court decided that if USACE was already compelled by the legislature to re-write the vegetation policies at issue, the court would abstain from issuing a ruling. However, in both cases the court maintained the authority to hear the case again in the future if USACE failed to comply with the directives of WRRDA 2014, Section 3013.

The case details are summarized below, with additional background on claims brought by the plaintiffs. The specific allegations remain significant today, and thus are discussed in detail below, because these cases could potentially be brought against USACE again in the future.

1. *Friends of the River v. United States Army Corps of Engineers*

In Friends of the River v. United States Army Corps of Engineers, the plaintiffs[363] filed suit in the United States District Court, Eastern District of California in June 2011. Plaintiffs, including Friends of the River, or "FOR," filed for Declaratory and Injunctive Relief[364] under First Amendment and Administrative Procedure Act (APA) claims for violation of the National Environmental Protection Act (NEPA); APA claim for violation of ESA; and APA claim for failure to follow rulemaking procedures.

[363] Plaintiffs include Friends of the River (FOR), Center for Biological Diversity, & Defenders of Wildlife. Referred to collectively as "Plaintiffs" or FOR.

[364] Declaratory relief refers to a judge's determination of the parties' rights under contract or statute. In other words, in this case, the plaintiffs sought a court declaration of the meaning of the statute. Injunctive relief refers to any court order for an action, rather than money damages. In this case, the plaintiffs sought an injunction that would compel the defendants to follow certain statutory mandates.

The above issues alleged by FOR arose from USACE issuance of levee vegetation policies. More specifically, the claims are related to ETL 1110-2-571 (2009), the PGL variance policy, and USACE reliance on "Final Draft White Paper: Treatment of Vegetation within Local Flood-Damage-Reduction Systems" (2007). FOR alleged that USACE violated NEPA by failing to prepare an Environmental Impact Statement (EIS), violated ESA by failing to consult with NMFS and FWS in issuing the aforementioned policies, and violated APA rulemaking in adopting policies that prohibit vegetation on levees.

The FOR complaint begins by describing how vegetation on and near California levees contain virtually all that remains of the riparian forests in the Central Valley and certain other parts of the State of California. The plaintiffs allege that, if USACE policies were to stay in place,

> "it would require the destruction of much of the last 5% of once thriving riparian forests in California's Central Valley that provides essential habitat for the survival of several endangered species, scenic beauty and shade for aesthetic and recreational enjoyment of the rivers by people."[365]

The plaintiffs allege that the USACE policies require removal of all vegetation from levees without environmental review, consideration of regional differences, and without scientific support. FOR argues that in issuing the vegetation removal policies, in essence, USACE is requiring the clear-cutting of the surviving remnant of riparian forests in the Central Valley and in turn violating NEPA, ESA and APA.

The FOR complaint also discusses the history of levee vegetation maintenance in California, and how USACE historically allowed, encouraged, and even required the maintenance and planting of trees and shrubs on California levees. FOR describes how USACE reversed course in 2007, in issuing the Final Draft White Paper, "Treatment of Vegetation within Local Flood-Damage-Reduction Systems." This paper established new policy guidance for a vegetation-free-zone for

[365] Friends of the River v. United States Army Corps of Engineers (E.D. Cal. 2011), First Amended Complaint for Declaratory and Injunctive Relief, Case 2:11—cv-01650-JAM-JFM (2014) paragraph 1.

all levees for which USACE has responsibility for design, operation, maintenance, inspection or certification.[366]

FOR describes the pushback that USACE received from other State and local agencies, as well as from NGOs and individuals upon the release of the 2007 White Paper. This includes a DWR letter, which described the long-standing agreement amongst regulatory agencies that trees and other vegetation on levees in the Central Valley can co-exist with their public safety function, but that this agreement was now set aside by USACE in favor of a new, nationwide policy.

The FOR complaint continues to describe how, despite multiple objections, USACE issued ETL 1110-2-571 in 2009, requiring a vegetation-free zone, or corridor, along levees, including the span of the actual levee and 15 feet on each side. The ETL requires that all vegetation except for grass be removed. This includes existing riparian forest on and alongside California levees. The ETL further places the burden of seeking a variance from the vegetation-free zone requirements on the levee operators. The ETL applies broadly to all USACE Commands having Civil Works responsibilities and to all flood damage reduction projects for which USACE has responsibility for design, operation, maintenance, inspection, or certification. For nonfederal projects, the ETL is applicable under the Rehabilitation and Inspection Program (RIP), where USACE performs inspections of nonfederal projects under ER 500-1-1 and PL 84-99.[367]

The complaint further discusses the USACE issuance of the PGL in February 2010, which adopted a new policy for requesting a variance from USACE vegetation requirements. USACE issued a public notice for the new PGL in 2010. The notice acknowledged the mandatory vegetation-management standards for levees established in ETL 1110-2-571. The notice also stated that the PGL would serve as an interim guidance until the process is incorporated into a USACE engineer publication, and provided a deadline of September 30, 2010 for all variance applications (including new and existing variances). Thus, on its face, the PGL and notice

[366] *Id*. at paragraph 24.
[367] *Id*. at paragraph 26; U.S. Army Corps of Engineers ER 5-100-1 (September 2001), prescribes policies for the Civil Emergency Management (CEM) Program of USACE. <http://www.publications.usace.army.mil/Portals/76/Publications/EngineerRegulations/ER_500-1-1.pdf?ver=2013-09-08-233252-360 >

appeared to invalidate any existing variances prior to September 30, 2010, unless a new application was filed.

FOR further disputed USACE claims that the ETL did not establish new standards, but clarified standards presented in EM 1110-2-301. FOR argued that the ETL did establish new standards for the following reasons. First, the ETL declares "on its face" that it supersedes EM 1110-2-301. Second, EM 1110-2-301 defines a limited vegetation-free zone, different from the larger one described in the ETL. Further, EM 1110-2-301 provided for plantings on urban levees for aesthetic reasons, and rural levees to restore environmental values, while the ETL specifies that the vegetation-free zone must be maintained in all areas except those with a formal variance. FOR also argues that the ETL standard is in direct conflict with 33 CFR 208.10, which encourages certain types of tree growth on levees. Finally, FOR argues that in even if the ETL had not substantially changed USACE policy regarding vegetation on levees, the PGL did because the PGL states that existing variances are no longer valid. In issuing the PGL and effectively invalidating existing variances, FOR argues that USACE took an agency action that had direct, indirect and cumulative impacts on the environment, including listed species and critical habitats.[368]

FOR continues by enumerating the many objections from federal, State, and local agencies, as well as NGOs and individuals regarding the issuance of the USACE vegetation removal policy.

For example, the FWS voiced the following complaints in comments regarding the USACE policy:

> "The woody vegetation found on Central Valley Levees is a significant portion of the remaining riparian habitat that provides nesting, foraging and cover habitat for migratory birds (including neo-tropical migrants, raptors, and others), overhead cover and shade that moderates water temperatures and energy input to river productivity at all trophic levels. This residual vegetation serves an important ecological role essential to the survival of numerous terrestrial and aquatic animals, and plant species throughout the

[368]Friends of the River v. United States Army Corps of Engineers (E.D. Cal. 2011), First Amended Complaint for Declaratory and Injunctive Relief, Case 2:11—cv-01650-JAM-JFM (2014) paragraph 49.

Central Valley, including those in the Sacramento-San Joaquin Bay-Delta region significant to the economy of the State of California. Included are federally listed threatened and endangered species whose survival as well as recovery is directly or indirectly dependent on riparian habitat. Only about 5 percent of historic riparian habitat remains in the Central Valley, much of which exists on man-made levees."[369]

CDFW and DWR voiced similar complaints in comments submitted to USACE:

> "Federal or state-listed endangered or threatened species that could be affected by removal of the levee vegetation include salmonids such as winter-run and spring-run Chinook and Central Valley steelhead, delta smelt, Valley elderberry longhorn beetle, late fall-run Chinook salmon, southern [distinct] population segment of the North American green sturgeon, long-fin smelt, giant garter snake, riparian brush rabbit, Swainson's hawk, and burrowing owl."[370]

The State Water Resources Control Board (SWRCB) issued the following comments in response to the USACE vegetation-removal policy:

> "The ecological benefits of riparian vegetation are well documented. Riparian vegetation slows surface velocities and increases infiltration. Riparian vegetation filters pollutants and reduces bank erosion and sedimentation. Sediment-laden waters impact municipal water supplies, recreational uses, and conditions for anadromous fish and other aquatic organisms. Riparian vegetation provides cover and shade for aquatic species. Shade reduces water temperatures which is critical for many aquatic species including salmonids."[371]

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[369] *Id*. at paragraph 44; Comments from U.S. Fish and Wildlife Service Regional Director, Pacific Southwest Region, April 22, 2010 at 4.

[370] Friends of the River v. United States Army Corps of Engineers (E.D. Cal. 2011), First Amended Complaint for Declaratory and Injunctive Relief, Case 2:11—cv-01650-JAM-JFM (2014) paragraph 45;
Comments of Cal. Dept. of Water Resources and Cal. Dept. of Fish and Wildlife on the Process for Requesting a Variance from Vegetation Standards for Levees and Floodwalls and Associated Draft EA/FONSI, Docket Number COE-2010-000, April 15, 2010.

[371] Friends of the River v. United States Army Corps of Engineers (E.D. Cal. 2011), First Amended Complaint for Declaratory and Injunctive Relief, Case 2:11—cv-01650-JAM-JFM (2014) paragraph 46; Comments from Cal. State Water Resources Control Board Executive Director, Dorothy Rice, April 23, 1010 at 1-2.

The complaint further describes the ongoing substantial public controversy over the issue of whether vegetation has an adverse, beneficial, or no effect on levee performance. FOR explains that, despite this controversy, most of the studies surrounding this issue have concluded that vegetation on levees is compatible with the flood function of levees, or that vegetation actually improves levee safety by reducing the potential for levee erosion. In concluding this, FOR references USACE's own two studies. One study, "The Effects of Vegetation on the Structural Integrity of Sandy Levees" (1991), concluded that trees generally improve, rather than degrade levee safety. The other, conducted by ERDC and issued in 2007 after the White Paper concluded that "no documented evidence exists to prove trees negatively influence levee integrity; however, research is very limited that specifically addresses woody vegetation on levees."[372]

In summarizing the ongoing controversy, FOR also describes USACE's admission of the issues associated with vast requirements for vegetation removal. FOR cites the July 26, 2011 USACE Literature Review, prepared by ERDC, which found that "clear-cutting on natural slopes and stream banks generally leads to an increase in slope failures."[373] The Literature Review further concedes that the benefits and risks of converting wooded levees to grass-covered levees, as well as the engineering feasibility and economic costs, have yet to be fully investigated.[374] The Literature Review made such recommendations as addressing levees in terms of ecosystem habitat diversity, and establishing specific guidance for each individual ecosystem as a separate environmental community.[375]

Continuing with their description of the public controversy over woody vegetation on levees, FOR describes the paper released by USACE on September 8, 2011, entitled, "Initial Research into the Effects of Woody Vegetation on Levees," prepared by ERDC. ERDC conducted site visits, field studies, laboratory testing, modeling and simulations, and conducted analyses for

[372] Friends of the River v. United States Army Corps of Engineers (E.D. Cal. 2011) at paragraph 47(a); U.S. Army Corps of Engineers (2007).
[373] Friends of the River v. United States Army Corps of Engineers (E.D. Cal. 2011) at paragraph 47(b); Maureen K. Corcoran, et. al., U.S. Army Corps of Engineers, Engineer Research and Development Center, Literature Review – Vegetation on Levees (December 2010) at 10.
[374] Friends of the River v. United States Army Corps of Engineers (E.D. Cal. 2011) at paragraph 47(b); Maureen K. Corcoran, et. al., U.S., Literature Review – Vegetation on Levees (December 2010) at 16.
[375] Friends of the River v. United States Army Corps of Engineers (E.D. Cal. 2011) at paragraph 47(b); Maureen K. Corcoran, et. al., U.S., Literature Review – Vegetation on Levees (December 2010) at 16.

eight locations around the Central Valley as well as other parts of the county. FOR points to specific conclusions found in report, including, "Trees near the toe increased the factor of safety because of the reinforcing effects of the roots and the increased counterweight effect of the tree to slope movement."[376] The report further found that tree presence on levees "can increase or decrease the factor of safety with respect to slope stability depending on the location of the tree on the levee" and that, "because of the extreme variability in geology, tree species, climate, and soils, the impact of trees on levees must be analyzed on a case-by-case basis."[377]

FOR concludes the description of the development of the levee vegetation policy by describing USACE announcements in a press releases, made in September 2011, that seemingly disregarded the results of the aforementioned studies. The Press Releases stated that the initial research did not warrant a change to the USACE national vegetation management standard. Rather, the results would be used to inform USACE decisions for trees on levees in the USACE levee safety program, including programs such as prioritizing deficiencies.[378]

The FOR complaint points out the economic cost of complying with USACE vegetation removal policies. The complaint references CDFW and DWR comments, where the agencies estimated that the cost of complying with the ETL for the 1600 miles of non-compliant project levees would be $7.5 billion.[379] CDFW and DWR noted that if all of the entire remaining levee bond funds were redirected to address vegetation management, this cost could potentially be paid. However, that would be at the risk of redirecting funds from far more significant levee deficiency repairs, such as deficiencies from seepage and erosion.

[376] Friends of the River v. United States Army Corps of Engineers (E.D. Cal. 2011) at paragraph 47(c); Maureen K. Corcoran, et. al., U.S. Army Corps of Engineers, Engineer Research and Development Center, Initial Research into the Effects of Woody Vegetation on Levees (July 2011), Vol. IV, Summary pp. v, 25;).
[377] Friends of the River v. United States Army Corps of Engineers (E.D. Cal. 2011) at paragraph 47(c); Maureen K. Corcoran, et. al., Initial Research into the Effects of Woody Vegetation on Levees (July 2011) Vol. IV, Summary, pp. vi, 29.
[378] Friends of the River v. United States Army Corps of Engineers (E.D. Cal. 2011) at paragraph 47(d).
[379] Friends of the River v. United States Army Corps of Engineers (E.D. Cal. 2011) at paragraph 48; Cal. Dept. of Water Resources and Cal. Det. of Fish and Game Comments (April 15, 2010), Attachment at 11.

The FOR complaint also discusses the burdensome nature of the PGL's variance requirements, and the fact that an approved variance will "likely prove unattainable for many agencies."[380] Because of the expensive and burdensome process, they predict that at least some of the levee maintaining agencies will choose to remove vegetation rather than seeking a variance from USACE. Therefore, even though USACE underwent limited environmental review for the PGL, the full environmental effects of USACE vegetation removal policies will never be evaluated under NEPA.[381]

The FOR complaint also discusses the process of how the Sacramento Area Flood Control Agency (SAFCA) applied for a variance for the Natomas Levee Improvement project. In 2006, SAFCA proposed a "fix in place" alternative for the 42-mile levee system, where little vegetation would have been removed. Upon the release of the new USACE vegetation standard, SAFCA instead proposed an Adjacent Set-back levee alternative in 2007, which would have reduced the need to remove waterside vegetation while complying with the USACE guidance. However, this did result in the removal of several landside woodland groves and individual trees on the landside of the levee. The Natomas Levee Improvement project ultimately cost SAFCA about $180 million more than originally projected.[382]

Plaintiffs additionally argued that USACE violated NEPA procedures. NEPA, 42 U.S.C. 4321-4370, directs federal agencies to address the environmental consequences of proposed actions. Prior to undertaking any major federal action significantly affecting the environment, the federal agency taking the action must prepare and circulate for public review and comment a detailed Environmental Impact Statement (EIS).[383] Further, if, after preparing an EIS, the agency makes substantial changes to the proposed action, the agency must prepare a supplemental EIS analyzing the environmental implications of the changes.[384]

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[380] Friends of the River v. United States Army Corps of Engineers (E.D. Cal. 2011) at paragraph 49; Cal. Dept. of Water Resources and Cal. Det. of Fish and Game Comments (April 15, 2010) Attachment at 38.
[381] Friends of the River v. United States Army Corps of Engineers (E.D. Cal. 2011) at paragraph 49; Cal. Dept. of Water Resources and Cal. Det. of Fish and Game Comments (April 15, 2010) Attachment at 38.
[382] Friends of the River v. United States Army Corps of Engineers (E.D. Cal. 2011) at paragraph 51.
[383] 42 U.S.C. § 4332(2)(C).
[384] 40 C.F.R. § 1502.9(c).

In determining whether the proposed action will have significant environmental impacts (and thus necessitating the development of an EIS), the agency may prepare an Environmental Assessment (EA). However if the agency may also skip this step and prepare a full EIS from the outset. If the agency concludes that the action will not have significant impacts on the environment based off of the EA, the agency must document its decision and explain the reasons why the project's impacts are insignificant in a "finding of no significant impact" (FONSI). Unless the environmental consequences of a proposed action are so minor that the action can be categorically excluded from consideration in an EIS, the agency must at least prepare an EA, and if the project's impacts are not so insignificant as to lead to development of a FONSI, the agency must prepare a full EIS.

The complaint describes how USACE did not prepare an EIS or EA under NEPA before issuing the 2007 White Paper, the 2009 ETL, the 2010 PGL, or the notice for the PGL in the Federal Register.

FOR alleges that the USACE vegetation removal policies as set forth in the ETL and PGL were major federal actions "significantly affecting the environment," and thus USACE violated NEPA in failing to prepare an EIS, or at the very least an EA. FOR describes the environmental impacts of the ETL and PGL in terms of context and intensity, including direct, indirect, and cumulative ecological, aesthetic, historic and cultural effects in concluding that USACE policy significantly affects the environment. FOR specifically points to examples of the policy's environmental effects, including the nationwide context of the ETL and PGL and the long term effects on riparian areas; the intensity of the scientific controversy over removing trees from levees; the cumulative nature of the impacts of removing trees from 1600 miles of levees in California; the destruction of the last remaining significant scientific, cultural, and historical resources made up by the surviving remnant of riparian habitat; removal of riparian habitat adversely affecting endangered and threatened species; and violation of environmental laws.[385]

Further, FOR alleges that USACE vegetation removal policies as set forth in the ETL and PGL were "major federal actions," and thus subject to NEPA's EIS requirement. NEPA regulations

[385] Friends of the River v. United States Army Corps of Engineers (E.D. Cal. 2011) at paragraph 60.

require EIS preparation at the earliest possible time, so that planning decisions reflect environmental values.[386] FOR alleges that USACE violated NEPA by failing to prepare an EIS, or even an EA, on the ETL, PGL and vegetation removal program. FOR maintains that the USACE vegetation removal program is a final agency action and decision, and was arbitrary and capricious because it was not based upon, guided by, or even accompanied by adequate environmental review in an EA or EIS.[387]

Although USACE did release a draft EA/FONSI for the PGL, FOR contends that the EA/FONSI is wholly inadequate, containing no environmental analysis whatsoever. Further, FOR alleges that USACE "belatedly and tacitly conceded that applicability of NEPA" in issuing the EA/FONSI about 10 months after issuing the ETL[388]. FOR argues that in doing so, USACE was essentially admitting that they were taking an action that requires USACE to comply with NEPA, but did so in a post hoc way that still violated the full NEPA requirements.

Finally, FOR alleges that USACE violated NEPA by improperly segmenting or truncating the project description, avoiding the preparation of a programmatic EIS. In doing so, FOR argues that USACE failed to consider basic environmental issues, such as the effect of vast vegetation removal from levees on flood control effectiveness, whether a "no action" alternative could accomplish the same goals, the environmental impact of vast vegetation removal, program alternatives, cumulative impacts of levee vegetation removal, and the cost of vegetation removal.[389]

Plaintiffs also argued that USACE violated ESA procedures. The ESA requires that,

> "each Federal agency shall, in consultation with and with the assistance of the Secretary [of Commerce or the Interior], insure that any action authorized, funded, or carried out by such agency . . . is not likely to jeopardize the continued existence of an endangered species or threatened species or result in the destruction or adverse modification of

[386] Friends of the River v. United States Army Corps of Engineers (E.D. Cal. 2011) at paragraph 62; 40 C.F.R. §§ 1501.2, 1502.5.
[387] Friends of the River v. United States Army Corps of Engineers (E.D. Cal. 2011) at paragraph 64.
[388] *Id*. at paragraph 43.
[389] *Id*. at paragraph 65.

> habitat of such species which is determined by the Secretary, after consultation as appropriate with affected states, to be critical . . . "[390]

To fulfill this mandate, the federal agency taking the action ("action agency") must consult with the appropriate wildlife agency ("consultation agency") whenever an action may affect a listed species.

Under the ESA Section 7 requirements, the action agency (federal agency taking the action) must decide whether or not that action may impact a listed species or its critical habitat. The action agency then determines the effect the action may have on the species or its critical habitat. If the action will have no effect on the species or its critical habitat, the agency makes a "no effect" determination, and no consultation is needed. If the action may affect, but is not likely to adversely affect the species or its critical habitat, the action agency may submit a Biological Assessment (BA) assessing the effects of the project, to the consultation agency, but is not required to do so. This is the process of informal consultation, and if the consultation agency agrees that the action is not likely to adversely affect the species and critical habitat, the consultation agency concurs with the action agency. If the consultation agency disagrees, and finds that the action will adversely affect the species or its habitat, the action agency must initiate formal consultation. If the action is likely to adversely affect a listed species or its critical habitat, the action agency is required to prepare and submit a BA to the appropriate consultation agency. This is the process of formal consultation.

Under the ESA requirements, "action" refers to

> "all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies in the United States or upon the high seas. Examples include, but are not limited to: (b) the promulgations of regulations; . . . (d) actions directly or indirectly causing modifications to the land, water, or air."

(50 CFR 402.02(b), (d)). The appropriate consultation agency is either the U.S. Fish and Wildlife Service (FWS) or NOAA Fisheries/National Marine Fisheries Service (NMFS), depending on

[390] *Id*. at paragraph 69; 16 U.S.C. § 1536(a)(2).

the affected species. To summarize, whenever an action may affect a listed species or critical habitat, the action agency must undergo informal or formal consultation with the appropriate consultation agency. The action agency must undergo formal consultation with the consultation agency when the action agency determines that the action may adversely affect a listed species or critical habitat. In undergoing a formal consultation, the action agency must provide the best scientific and commercial data that is available or which can be obtained. (50 CFR 402.14(a), (c), (d)).

FOR alleges that USACE violated the ESA by failing to consult with either consultation agency prior to releasing the vegetation removal policy, as set forth in the ETL, White Paper and PGL. FOR contends that the release of this policy is subject to the ESA Section 7 requirements, because it is an activity or program, carried out in whole or in part by USACE that directly or indirectly causes modification to land, water, or air, and thus is an agency action that may affect ESA-listed species and/or their critical habitat within the meaning of the statute and implementing regulations. USACE did not initiate and complete consultation with FWS or NMFS in order to ensure against jeopardy or adverse modification to listed species and/or their critical habitat.

FOR further argues that USACE violated ESA by making an "irretrievable commitment of resources" in promulgating and enforcing the vegetation-removal policies prior to consultation with FWS or NMFS to address impacts to listed species and critical habitat.

FOR's third and final claim for relief in the complaint centers on APA violations for failure to complete a formal rulemaking before the USACE adoption of new rules. Pursuant to the APA, a reviewing court may hold unlawful and set aside an agency action, findings, or conclusions found to be, "(A) arbitrary, capricious, an abuse of discretion, or otherwise no tin accordance with law; . . . (C) in excess of statutory jurisdiction, authority, or limitations, or short of statutory right; . . . (D) without observance of procedure required by law."[391]

FOR contends that USACE has promulgated new mandatory vegetation "rules," in releasing the ETL and PGL, subjecting USACE to the notice and comment requirements of the APA. A "rule"

[391] 5 U.S.C. § 706(2).

is defined as "the whole or a part of an agency statement of general or particular applicability and future effect designated to implement, interpret, or prescribe law or policy or describing the organization, procedure, or practice requirements of an agency."[392] FOR argues that the ETL and PGL fall under this definition of a rule, and therefore USACE violated the APA in failing to offer adequate public notice and opportunity for comment, prior to releasing these policies.

Further, FOR alleges that USACE violated APA because adopting the new vegetation policies without proper analysis under NEPA and without consultation under ESA was not in accordance with the law and must be set aside pursuant to APA Section 706(2).

The parties ultimately agreed to dismiss the case in September 2014 due to the passage of WRRDA 2014. Specifically, Section 3013 of WRRDA 2014 resolved the Plaintiff's claims because it requires the USACE to comprehensively review their vegetative management guidelines for levees, and to determine whether their current policy regarding levee vegetation is appropriate for all regions of the United States.[393] The court further emphasizes 3013(g), prohibiting the USACE from requiring any vegetation removal "as a condition or requirement for any approval or funding of a project, or any other action, unless the specific vegetation has been demonstrated to present an unacceptable safety risk."[394]

In addition to the legislative mandate of WRRDA 2014, Section 3013, the Court itself stressed the importance that USACE not require vegetation removal until they have revisited their vegetation removal guidelines. The Court held that,

> "In accordance with [Section] 3013(g) until the date on which revisions to the guidelines are adopted, the Corps [USACE] will not require the removal of existing vegetation as a condition or requirement for any approval or funding of a project, or any other action,

[392] Friends of the River v. United States Army Corps of Engineers (E.D. Cal. 2011) at paragraph 79; 5 U.S.C. § 551(4).
[393] Friends of the River v. United States Army Corps of Engineers (E.D. Cal. 2011); H.R. 3080, 113th Cong. (2014), § 3013.
[394] H.R. 3080, 113th Cong. (2014), § 3013 (g).

unless the specific vegetation has been demonstrated to present an unacceptable safety risk."[395]

Thus, FOR alleged numerous and detailed violations of environmental and administrative laws by USACE. However, both parties recognized that the case should be put on hold as USACE undergoes the requirements set forth in WRRDA 2014, Section 3013. To date USACE has failed to comply with WRRDA 2014, Section 3013. Therefore, FOR's allegations remain relevant as the plaintiffs may choose to reinitiate the lawsuit in the future.

2. California Department of Fish and Game v. United States Army Corps of Engineers

Shortly after FOR filed their lawsuit against USACE, California Department of Fish and Game (now the California Department of Fish and Wildlife, or "CDFW") filed a similar suit in the Eastern District of California.

The Plaintiff's complaint gives an overview of USACE levee vegetation policies, including ETL 1110-2-571 (2009), the SWIF policy, PGL (2010), and the "Revised" PGL (2012). The complaint continues to describe the State-federal flood protection system in California's Central Valley, consisting of 1,600 miles of federal project levees, 1,200 miles of 148,000 acres of designated floodways, 26 project channels covering several thousand acres, and 56 other major flood protection works along the Sacramento and San Joaquin rivers and tributaries.[396] CDFW also describes the system of "levee sponsors" in California, and how the State or local entities work with the federal or State government for funding of flood control projects.

In the complaint, CDFW describes how USACE has partnered with the state of California for flood control since 1917, and previously had policies encouraging vegetation growth and retention on levees. CDFW also points to studies conducted by DWR from 1967, 1999 and 2008 that show the benefits woody vegetation can pose to levees. Riparian vegetation on levees

[395] Leagle.com, Friends of the River v. U.S. Army Corps of Engineers: Stipulation and order of Voluntary Dismissal Without Prejudice (September 11, 2014) Case No. 2:11-cv-01650-JAM-JFM < http://www.leagle.com/decision/In%20FDCO%2020140915336/Friends%20of%20the%20River%20v.%20U.S.%20Army%20Corps%20of%20Engineers >
[396] *Id.*

provides stability and prevents soil erosion. It is compatible with flood control, and there have not been any documented cases in California of woody vegetation causing levee failure. Finally, removing vast amounts of woody vegetation on levees would be dangerous and costly.

The complaint further describes the importance of woody vegetation on levees to the ecological system in California. California's Central Valley levee system has approximately the last five percent of riparian forest that it once had. The remaining riparian habitat we've been able to maintain contains habitat for species including Swainson's hawk, the Giant garter snake, Riparian brush rabbit and burrowing owl. This remaining riparian habitat also contains critical habitat for the following listed species: Valley elderberry long-horn beetle, Green Sturgeon, Winter-run Chinook salmon, Spring-run Chinook Salmon and Central Valley Steelhead.

The CDFW complaint further describes the USACE levee vegetation policy at the time the complaint was filed. This includes the 2007 USACE White Paper, which first proposed the USACE levee vegetation removal policy, to which DWR objected. The complaint also describes the California Levees Roundtable with various stakeholders including DFG, DWR, the CVFPB and federal and local agencies, to address vegetation and other issues affecting levees in California's Central Valley. As a result of the Roundtable process, USACE signed the Roundtable Framework, released in April 2008. The Roundtable Framework memorialized the group intent to work collaboratively to develop a plan to address levee integrity, public safety, flood control and vegetation issues in the Central Valley. The Roundtable Framework called for a measured approach to vegetation management so that potential damage to levees from wholesale vegetation removal could be avoided, and that all levee risk factors be considered together, along with good science. However, in 2009, USACE instituted a policy that largely diverted from the temporary policy set forth in the Roundtable Framework.

The complaint describes the details of ETL 1110-2-571, issued in April 2009, which established the current USACE vegetation removal policy. ETL 1110-2-571 marked a change in USACE policy, superseding the previous policy set forth in EM 1110-2-301, which promoted vegetation-free zones on levees where woody vegetation posed a threat to levee safety and encouraged levee vegetation on levees where the levee structure would not be compromised. EM 1110-2-301 allowed for regional flexibility where ETL 1110-2-571 established a strict national policy. ETL

1110-2-571 essentially mandated that all flood reduction systems, including levees, have a vegetation free corridor the width of the levee, plus fifteen feet on each side, and a height of eight feet. All vegetation that does not conform to the policy must be removed. CDFW stresses that USACE did not prepare an Environmental Assessment (EA), an Environmental Impact Statement (EIS), nor consult with wildlife agencies prior to issuing the ETL.

CDFW also describes the "PGL" and "Revised PGL" in the complaint. The PGL is USACE policy that sets forth procedures to obtain a variance from vegetation standards. In 2010, USACE released the draft PGL and took public comments. At that time USACE also announced that all previously-granted variances were revoked and if the applicant required a variance from the new ETL, the applicant would need to submit a variance application with the PGL. The PGL guidelines require the submitting agency to comply with all applicable environmental laws, including the National Environmental Policy Act (NEPA) and Endangered Species Act (ESA) before submitting a variance request.

Further, as per the terms of the PGL, USACE will only grant a variance to sections of levee systems, not levee systems on a watershed scale. This differed from the previous policy, which allowed variances on a watershed scale. The PGL also differed from previous USACE policy in that waterside planting berms will now only be allowed after a variance is granted. Additionally, previous USACE policy had allowed for variances on a case-by-case basis for any portion of the levee. With the issuance of the PGL, that policy changed, and now certain portions of levees never qualify for a variance. This includes the upper third of the riverside slope, crown, landside, and the area within fifteen feet of the landside levee toe. The PGL also diverges from previous USACE policy in that it no longer allows for trees less than five inches in diameter to be placed on the levee.

CDFW further notes that in issuing the PGL, USACE published an EA and a Finding of No Significant Impact (FONSI), pursuant to NEPA. These environmental review documents found that changing the variance process did not affect the environment, and that the PGL would not have a significant effect on the quality of the human environment. Thus, USACE did not conduct a more extensive review under NEPA, which would have consisted of an EIS.

The CDFW complaint also describes the "Revised PGL," which is a subsequent variance policy issued by USACE of the same name as the PGL, published as a final rule in February 2012 (33 Fed. Reg. 9637). The complaint describes the Revised PGL as a final rule of general application. It establishes the current process for applying for and receiving a variance from the ETL. This policy gives levee sponsors one year from the date of its issuance to develop a letter indicating intent to apply for a variance from the ETL, or to develop a SWIF. The Revised PGL is very similar to the 2010 draft PGL, in that the sponsor must still comply with the ETL, it is still the sponsor's duty to comply with ESA and NEPA mandates, and there is no administrative means to contest an adverse decision. It differs from the draft PGL in that it requires any scientific information regarding levee vegetation be peer-reviewed and submitted to the USACE's Engineering Research and Development Center (ERDC) for first level of evaluation. In other words, if a levee sponsor wishes to submit new science or technology to justify keeping vegetation on levees, the submitter must first submit new science to USACE's ERDC for review, before including the science or technology in the variance request. In issuing the Revised PGL, USACE similarly issued an EA and FONSI under NEPA. There was no environmental review or consultation conducted under the ESA.

The complaint also describes the USACE Policy for System-Wide Improvement Frameworks (SWIF), issued November 29, 2011. The SWIF promotes a "worst first policy" and describes a process for levee sponsors to bring levees into compliance with USACE requirements in a prioritized way while maintaining eligibility for assistance under PL 84-99. Under the SWIF, levee sponsors must still comply with the ETL, and remove vegetation. However, the SWIF allows sponsors to delay removal and use limited funds to first address higher priority safety issues to levee integrity, rather than focusing on vegetation on levees, which is less of a threat to levee integrity.

CDFW alleges that the above policies violate NEPA, ESA and APA. NEPA applies to all federal actions that significantly affect the human environment. (42 U.S.C. 4332(C)). The federal actor must prepare an Environmental Assessment (EA), to determine whether an action might have any significant environmental effects. If the EA raises substantial questions that the action may have a significant effect upon the human environment, an EIS is required. (40 CFR 1501.4). Alternatively, if the federal acting agency suspects or knows that the action may have significant

environmental effects, they can jump straight to preparing an EIS and skip the development of an EA. If the agency determines, through the EA, that the proposed action will not have a significant effect on the environment, the agency must document and explain its decision and prepare a FONSI. (40 CFR 1508.13).

An EIS is a lengthy and substantial environmental review document, intended to guide federal agency actions and encourage the acting agency to take into account the environmental effects of their actions. An EIS must include (1) environmental impacts of a proposed action, (2) any adverse environmental effects that cannot be avoided, and (3) alternatives to the proposed action and mitigation measures to lessen any adverse impacts. This is a public process where the acting agency solicits public comments. In determining the "significance" of environmental effects, the agency must take into account listed species and critical habitat that may be affected. (40 CFR 1508.27(b)(9)).

CDFW alleges that the ETL, SWIF and PGLs violate NEPA, because the release of these policies are final agency actions that would otherwise necessitate full NEPA review. Further, the ETL, SWIF and PGLs are all likely to affect the quality of the human environment, and as such, USACE should have at the very least prepared an EA for each policy. USACE prepared an EA for the PGL, followed by a FONSI. However, USACE did not prepare an EA for the ETL or SWIF policies.

Additionally, CDFW alleges that the above actions have unambiguous significant environmental effects, and as such, USACE should have prepared an EIS (as opposed to a FONSI) for each policy. In determining whether something has a "significant effect," the acting agency must include any take or harm of California fish and wildlife resources, including any listed species, destruction of habitat for any listed species, and harm to fish and wildlife resources from unstable levees that fail and could cause flooding. CDFW alleges that the ETL specifically causes direct, indirect and cumulative adverse effects on California fish and wildlife resources through habitat destruction. Similarly, CDFW alleges that the SWIF and PGLs have direct, indirect and cumulative adverse effects on California fish and wildlife resources. Ultimately, CDFW argues that USACE should have prepared an EIS for the new levee vegetation management policies, and violated NEPA by failing to do so.

Under the ESA, CDFW alleges that USACE violated the ESA for failing to consult with applicable wildlife agencies, pursuant to 16 USC 1536(a)(2). Under ESA Section 7, any federal agency carrying out an "agency action" (any action authorized, funded, or carried out by a federal agency), must ensure it is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of the habitat of any listed species. (16 USC 1536(a)(2); CFR 402.10).

CDFW alleges that the USACE levee vegetation removal policies, codified in the ETL, SWIF and PGLs, constitute agency actions within the meaning of the ESA. This is because the above policies are all the result of promulgated regulations, and directly and indirectly modify the land and water. Thus, CDFW alleges that USACE clearly violated ESA policy in failing to prepare a BA or consult with USFWS and NMFS in promulgating the ETL, PGL and SWIF vegetation policies.

The APA governs general rules that federal agencies must follow in enacting and enforcing agency policies. Under the APA, when a federal agency enacts and adopts substantive rules of general applicability, the federal agency must comply with APA regulations. (5 USC 552 et. seq.). CDFW alleges that the USACE violated the APA in issuing its vegetation removal policies, because the ETL, SWIF and PGLs all constitute new rules of general application, adopted without adequate public notice and opportunity to comment, do not comply with NEPA and ESA, and thus are not in accordance with the law. CDFW alleges that the USACE vegetation removal policy is arbitrary, capricious, and an abuse of discretion not in accordance with the law (5 USC 702).

Finally, for the purposes of NEPA and the ESA, CDFW describes how the USACE vegetation removal policies are "final agency actions." The significance of whether or not the ETL, SWIF and PGL constitute "final agency actions" rests on the definition and legal implication of the term. If considered "final agency actions," the regulations would be subject to the requirements the aforementioned federal laws, including NEPA. For example, if considered a "final agency action," USACE would have violated NEPA and the APA by failing to prepare an EIS prior to releasing the policies. CDFW alleges that the ETL is a final agency action for a few reasons. First, they provide numerous examples of LMAs submitting requests for variances from the

ETL, instances of USACE officials notifying local maintainers that the projects do not conform to ETL requirements, the USACE own statement that the ETL takes precedence over the guidelines of its O&M manual, and numerous local maintainers admissions that they are required to comply with the ETL policy.

CDFW also points to policy arguments for the ETL constituting a "final agency action." This includes that the ETL changes the financial rights and obligations of levee sponsors. Levee sponsors must now remove vegetation from levees in order to remain eligible for PL 84-99 funding. In order to remove vegetation, levee sponsors must spend large amounts of money and time on environmental review and authorizations under ESA. Further, as a direct result of the ETL vegetation removal policy, levee sponsors' legal rights and obligations have changed. Levee sponsors are now either in noncompliance with the ETL and must forfeit assistance under PL 84-99, or remove riparian habitat and likely violate terms of the ESA. Or, if the levee sponsor successfully obtains a variance, it could cost the sponsor approximately $300,000 per levee mile, without any assurance that the sponsor would successfully obtain the actual variance requested. Further, CDFW alleges that implementing the variance policy to comply with PGL standards would cost $1,100,000 per levee mile.

CDFW requested declaratory relief in the form of a court order stating that the ETL, SWIF and Revised PGL violate NEPA, ESA and APA. They also sought declaratory relief in the form of a court order requiring the USACE to comply with NEPA, ESA, APA and vacating (setting aside) the ETL, SWIF and PGL polices until such time as the USACE comes into compliance with NEPA and ESA. Finally, CDFW sought an injunction, preventing the USACE from any further implementation of levee vegetation removal policies until the ETL, SWIF and PGLs comply with NEPA, ESA and APA.

The CDFW case was ultimately dismissed on similar grounds to the FOR case. The development of WRRDA 2014, of which Section 3013 required USACE to revisit and reissue the ETL, PGL and SWIF policies, essentially targeted the exact arguments set forth by CDFW. Thus, the case was dismissed without prejudice, which in a sense placed the case on hold until such time as the USACE complies with WRRDA 2014, Section 3013 requirements. It should be noted once more that at the time of this paper, USACE has failed to comply with Section 3013, and has not

revisited or reissued its vegetation guidelines, nor has it reached out to the applicable resource agencies for input in any part of this process. It is therefore unclear if FOR or CDFW will reinitiate their lawsuits with USACE.

APPENDIX 4 Science and Research

The issuance of USACE vegetation removal policies prompted efforts to justify both the presence and removal of vegetation on levees from various stakeholders. Proponents from each side of the debate attempted to leverage scientific studies to reinforce their arguments. Initially, this led to the realization on both sides that more research needed to be done, and eventually prompted the development of innovative and cutting-edge levee vegetation research.

1. *2007 Research symposium*

In 2007, stakeholders met in Sacramento, California, for the Levee Vegetation Research Symposium. The Symposium addressed what was referred to as "The Vegetation Challenge." In order to do so, the Symposium's description and purpose included "a scientific and engineering examination of managing vegetation along California's Central Valley levees that protect urban and rural areas from devastating floods."[397]

The symposium was sponsored by USACE, the CVFPB, DWR and SAFCA. These sponsors came together to explore science, real-world experience, challenges, and policy solutions related to levee vegetation. Registration numbers revealed over 511 people from 21 states nationwide registered for the symposium, representing over 151 agencies from federal, state and local flood management, resource agencies, academic institutions and consulting engineering and environmental firms.[398]

[397] Sacramento Area Flood Control Agency, 2007 Levee Vegetation Research Symposium <http://www.safca.org/protection/Environmental_2007_Symposium.html > (last visited August 18, 2016).
[398] *Id.*

The Symposium began with a keynote speech given by the Mayor of Sacramento, Heather Fargo, who commended the symposium and called for greater collaboration and science to allow for vegetation variations, especially in places like Sacramento, known as the City of Trees. The Symposium continued by establishing "the issue" of levee vegetation, and its timeliness and importance to the Central Valley. Proceedings began with perspectives from USACE, State and local agencies, researchers and engineers, and biologists. The speaker from USACE gave a presentation entitled, "Corps Perspective," followed by a speaker from DWR who gave a presentation entitled, "California Perspective," and finally the speaker from SAFCA presented on, "Local Perspective." Each of these presenters outlined the basic policies of USACE, DWR and local agencies, respectively, noting the importance of balancing safety and environmental concerns, and doing so in the face of limited resources. Next, USACE presented on the recently released "Draft Final White Paper, Treatment of Vegetation within Local Flood-Damage-Reduction Systems" (April 20, 2007). The paper is described as a 34-page "thinking paper" that examines the levee vegetation issue at a policy level. (This paper is described in more detail in *Appendix 1: Federal Laws and Policies*). Following the overview of the White Paper, a presenter from DWR gave a talk that stressed the compliance issues with the USACE White Paper. The DWR presenter spoke to the shortcomings of the USACE policy laid out in the White Paper and discussed DWR's view that fixating on vegetation issues would divert attention from more important levee safety issues. The presenter called for collaborative discussions and greater scientific input in moving forward with levee vegetation policies.

Presentations also included an overview of a report from a UC Davis plant scientist, Dr. Alison Berry, who focused on issues that tree roots pose as potential risk factors to levees. Dr. Berry gave an overview of studies conducted on tree roots in levees, focusing on the potential for roots to cause increased seepage, or surface erosion from windthrow. Results indicated that tree roots generally avoided "well-compacted fill," and the toe region of the levee, suggesting that mitigation measures such as keyhole trenches or slurry walls may be effective with coping with potential tree root concerns. Dr. Berry also suggested numerous areas where more research was

needed to better explore the issue, including more information combining trench excavation and other methods to determine "the real picture of roots and levees."[399]

Dr. Donald Gray, a Professor of Civil and Environmental Engineering from the University of Michigan also spoke to the general factors, including vegetation, which affect the structural stability and integrity of earthen levees. The three major failure mechanisms affecting earthen levees include: mass stability failures, surficial erosion, and hydraulic forces. Dr. Gray noted that most woody vegetation appears to have a beneficial influence on the structural integrity and stability of levees, because roots can reinforce soil and increase the resistance to shallow sloughing failures. Vegetation can also improve resistance to scour and erosion that can occur during overtopping. However, Dr. Gray also mentioned potential adverse effects vegetation on levees can pose, the foremost of which included instances of isolated, tall trees growing on levees prone to windthrow or that promote turbulence and erosion around their base. Lastly, Dr. Gray argued that seepage erosion and piping problems attributed to tree root presence had been "greatly exaggerated," and that seepage occurs in many ways irrespective of tree roots.[400]

Researchers from USACE's Engineer Research and Development Center (ERDC) also provided an overview of their (at the time) soon-to-be-released literature review, which will be discussed in greater detail below.

A UC Davis Professor of Wildlife Biology, Dr. Dirk Van Vuren, gave a presentation on mammals on Sacramento levees, focusing on those with a potential for significant soil displacement through digging and burrowing. Dr. Van Vuren found that removing woody vegetation on levees would have differing effects on burrowing animals, depending on the animal. For instance, converting woody vegetation to open grassland could increase the abundance of voles, gophers, ground squirrels, and possibly badgers, likely have no effect on

[399] Dr. Alison M. Berry, Professor, Department of Plant Sciences, University of California, Davis (2007); Presentation Transcript found here: < http://www.safca.org/protection/NR_Documents/2007_Symposium_Berry_Transcript.pdf> (last visited August 2016).

[400] Dr. Donald Gray (2007) Presentation transcript found here: <http://www.safca.org/protection/NR_Documents/2007_Symposium_Gray_Transcript.pdf> (last visited August 2016).

muskrats, and have uncertain effects on beavers. Dr. Van Vuren concluded that removing woody vegetation from levees would likely increase the most impactful soil-excavating mammals.[401]

Dr. Douglas Shields, a research hydraulic engineer at the National Sedimentation Laboratory of the USDA Agricultural Research Service gave a presentation on the effects of vegetation on levee slope stability and revetment durability. Dr. Shields summarized a study conducted in 1987, which looked at six sites on the riverside of the Sacramento River levee supporting various types of vegetation. Dr. Shields revisited that study recently, taking information found from the original study and incorporating it into a computer model for slope stability. The model analyzed vegetation correlations with surface permeability of the soil, as well as slope stability. Results indicated that roots generally reinforced the levee soil and increased factors of safety, and roots generally posed no seepage problems, except in extreme and unlikely conditions. Results further indicated that roots generally did not create any void in the soil, although voids were associated with animal activity. Dr. Shields concluded by offering numerous areas where additional studies were needed, including woody vegetation impacts on maintenance and inspection activities.[402]

A forest ecologist in the Department of Plant Biology at the University of Georgia, Dr. Chris Peterson, gave a presentation on risks that trees pose to uprooting due to high winds. Dr. Peterson noted that at the time of the symposium, there had been no published studies documenting the effects of high winds leading to tree uprootings on levees. Therefore, he spoke to the research that had been conducted for tree uprootings in forest settings. Major factors in uprootings include high winds, which are generally not an issue in California's Central Valley. Larger, taller trees are more likely to be wind thrown than smaller trees, and windthrow properties differ by species. Larger trees are also more likely to create large "root pits" or holes in the ground as the tree uproots, but this is also influenced by tree species. Additionally, lower-density (or trees spaced further apart from each other) are more vulnerable to windthrow than

[401] Dr. Dirk Van Vuren, Professor of Wildlife Biology, Dept of Wildlife, Fish and Conservation Biology, UC Davis (2007); presentation transcript found here: <http://www.safca.org/protection/NR_Documents/2007_Symposium_VanVuren_Transcript.pdf> (last visited August 2016).

[402] Dr. F. Douglas Shields, P.E., Research Hydraulic Engineer, USDA Agricultural Research Service National Sedimentation Laboratory (2007); Presentation transcript found here: <http://www.safca.org/protection/NR_Documents/2007_Symposium_Shields_Transcript.pdf> (last visited August 2016).

higher-density trees. Shallow roots in saturated soils are also more likely to uproot due to windthrow than deeper roots in less saturated soils. Dr. Peterson concluded by offering several areas where additional research is needed, particularly in the Central Valley, including merging models with site-specific features like soil conditions and topography to get predictions for particular stretches of levee in the Central Valley.[403]

Dr. Johannes DeVries, an internationally recognized expert in hydrology and hydraulic engineering gave a presentation on vegetation effects on river hydraulics and floodway conveyance, or the capacity of the river to carry flow. Dr. DeVries applied models for flow to the specific dimensions of the Sacramento River, looking at areas with and without vegetation on levees. He found that reducing vegetation or dense vegetation next to levees generally increased the velocity of water, which in turn increased the potential for scour. Dr. DeVries also analyzed erosion from high wind waves and boat wakes on levees, and found that grass levees acted basically like smooth or concrete surfaces, and were the most prone to erosion from high waves. Shrubs and trees however, seemed to provide erosion protection from waves, and rock and riprap provided the greatest degree of protection. The ability of woody vegetation to protect levees from erosion due to high waves also differed depending on branch location, with maximum protection provided by trees with stems and branches in the water.[404]

Dr. Douglas Sherman, a Professor and Department Head at Texas A&M University's Department of Geography gave an overview of a decadal research project designed to assess the impacts of boat wakes on delta levees, with an emphasis on the influence of vegetation. Dr. Sherman had been monitoring 40 sites, four times per year, and the sites represented a cross section of environments in the Sacramento-San Joaquin Delta. The study recorded horizontal and vertical erosion at all sites, and monitored boat traffic, including boat speed, length, wake characteristics, and cumulative bank effects. The conclusion of the study indicated that levee

[403] Dr. Chris J. Peterson, Associate Professor, Department of Plant Biology, University of Georgia (2007); presentation transcript found here: <http://www.safca.org/protection/NR_Documents/2007_Symposium_Peterson_Transcript.pdf> (last visited August 2016).

[404] Dr. Johannes DeVries, Ph.D., P.E., P.H., D.WRE, David Ford Consulting Engineers (2007); presentation transcript found here: < http://www.safca.org/protection/NR_Documents/2007_Symposium_DeVries_Transcript.pdf > (last visited August 2016).

erosion from boat wakes in the Delta is slowed by the presence of vegetation, particularly from tule stands and brush bundles.[405]

At the time of the symposium, little direct vegetation research had been conducted on California levees, so presentations focused on levee vegetation research and policies in New Orleans, the Missouri River, the Netherlands, and Germany. The presentation from New Orleans entitled, "New Orleans; Current vegetation removal activities, driving factors & technical basis" discussed how, in the wake of Hurricane Katrina, the New Orleans District of USACE established a tree removal project team to remove trees and other woody vegetation on and near levees and floodwalls. The presenter, Michael Stout, spoke to problems posed by trees to levee stability and seepage, as well as maintenance, inspection and flood-fighting, as well as the process of removing trees from the levee system, highlighting challenges and issues. Stout, a Project Manager for Tree Removal with USACE, worked to remove trees, fences and other encroachments within 15 feet of levees. Stout described how, in the course of his work, he encountered tree roots posing problems to levee safety by providing pathways for seepage. He also described how, during storms when trees blow over and root balls create voids, large trees can worsen seepage and weaken levee stability. Further, he contended that the shading of trees could result in erosion of the levee embankment and poor grass turf establishment. Finally, Stout argued that trees too close to levees impair maintenance, inspections and flood fighting activities on levees.[406]

The Dutch presentation, "The Dutch Experience: Scientific basis for Dutch levee vegetation policy," was given by a Dutch Geotechnical Specialist, Clara Spoorenberg. She described how, in the Netherlands, national legislation states that no trees on levees are permitted, but that despite these regulations, trees occur on much of the Dutch levee system. In practice, the Dutch approach to levee vegetation management is characterized by flexibility and site specific needs,

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[405] Dr. Douglas J. Sherman, Professor and Department Head, Texas A&M University, Department of Geography (2007) ; transcript found here: <http://www.safca.org/protection/NR_Documents/2007_Symposium_Sherman_Transcript.pdf> (last visited August 2016).

[406] Michael Stout (2007); presentation transcript, found here: <http://www.safca.org/protection/NR_Documents/2007_Symposium_Stout_Transcript.pdf > (last visited August 2016).

and Spoorenberg argued that the required safety level could be guaranteed without removing vast amounts of trees from levees. Two-thirds of the Netherlands is below mean sea level, with some parts of the country as low as seven meters below sea level. The country is at risk of flooding due to high water levels from the North Sea, large rivers overflowing from Germany and Belgium, and several large lakes within the country's borders. It is secured against flooding by more than 3,500 kilometers of levees, dikes and dams, some of which are over 1,000 years old. In addition to the primary levees, the Dutch maintain 14,000 kilometers of secondary levees along canals, small streams, brooks, creeks and smaller lakes. Maintainers, consisting of Dutch water boards, are required to perform a safety review on the primary levees every five years. Dutch water boards have various approaches regarding policies towards trees on levees, generally grouped into "toleration policies" or "extinction policies," where toleration policies allow trees on levees and extinction policies require removal and replanting. Spoorenberg pointed to levee stability problems that may have been related to the presence of trees. Following those events, the Dutch Levee Advisory Board published new legislation in 2000 and 2001. This policy required the removal of many trees in the name of safety, but prompted public backlash.[407]

Spoorenberg continued by arguing that trees influence levee stability in either a positive or negative manner, depending on the location within the levee profile, the weight of the tree, and other factors. Trees may cause damage during a storm by retaining the water source they are a part of, and due to the dynamic tree motions during storm conditions. Trees can also increase soil stability, depending on local conditions. The largest threat that trees posed to levee stability, according to the Spoorenberg, was of trees uprooting. However, she discussed possible solutions to this problem, including planting new trees near old, decaying trees, so that the new roots would replace the hollow spaces left from decaying roots and reduce the chance of uprooting. Spoorenberg also presented the demonstrated public support for maintaining trees in the Netherlands, and pointed to situations where action groups successfully blocked planned tree removals via litigation. In these situations, the court ordered that only necessary trees be taken down. Overall, despite strict anti-vegetation policies, the Dutch experience is practically

[407] Clara Spoorenberg, MSC, Geotechnical Specialist, DHV Consultancy BV (2007); Presentation transcript found here: <http://www.safca.org/protection/NR_Documents/2007_Symposium_Spoorenberg_Transcript.pdf> (last visited August 2016).

characterized by a flexible system that takes into account the possible negative and positive effects woody vegetation on levees provides.[408]

The German presentation, "German Experience: Role of woody vegetation on dykes in Bavaria," was given by a German Project Engineer for the State Department of Water Resources and Institute of Hydraulic and Water Resources Engineering of the University of Technology in Munich, Dr. Ronald Haselsteiner. He spoke to safety issues facing levees and dykes in Bavaria, Germany, and compared German technical specifications with international standards. Dr. Haselsteiner spoke to the positive and negative effects woody vegetation can have on dykes and levees. As for the positive effects, he spoke to the ability of woody vegetation to provide natural reinforcement and drainage, protecting against surface erosion and acting as shoreline protection. The negative effects included the hindrance woody vegetation poses to properly conduct flood fighting and inspections. Negative effects also included dyke breaches, although it was not clear whether reported breaches were caused by trees, or other factors. Negative effects also include wind throw, where trees fall over, which can damage levees and dykes as roots are ripped from the earth. Dr. Haselsteiner spoke to the issue of rotting roots causing erosion, but concluded that there is still an unanswered question as to whether rotting roots cause erosion or not, and mentioned ongoing studies that sought to shed light on that issue.[409]

The presenter from the Missouri River, Dr. John Dwyer, an associate professor and forest management specialist with the Department of Forestry at the University of Missouri, gave a presentation entitled, "Role of Woody Corridor in Levee Protection along the Missouri River in 1993." Dr. Dwyer described results from a 2003 study, in which a 353-segment along the Missouri River was investigated to determine the relationship between woody vegetation corridors and levee damage during the flood of 1993. The study demonstrated the protective values of woody corridors in the floodplains of the Missouri River. The study showed that, with a woody corridor width of 300 feet or more, the chance of levee failure was reduced by 75% or

[408] *Id.*
[409] Ronald Haselsteiner (2007); presentation transcript, found here: <http://www.safca.org/protection/NR_Documents/2007_Symposium_Haselsteiner_Transcript.pdf> (last visited August 2016).

more.[410] Further, the median failure length for levees that did not have a woody corridor was significantly longer than failure lengths for levees where a woody corridor was present. The study also demonstrated that there was an inverse relationship between the width of the woody corridor and length of levee failure. In other words, as the width of the woody corridor increased, the length of the levee failure generally decreased.

The study also evaluated whether eligibility under USACE PL 84-99 program correlated with levees that were less likely to fail. The PL 84-99 program is one of federal rehabilitation relief after an emergency flood event, and is described in greater detail in *Appendix 1: Federal Laws and Policies*. In order to maintain eligibility in the PL 84-99 program, levee maintainers must meet USACE structural and engineering requirements. Dr. Dwyer found that levees were equally likely to fail regardless of their status in the PL 84-99 program. He also found a highly significant difference in length of levee failure depending on whether or not a woody corridor was present upstream of the levee. When a woody corridor was present upstream of a levee, the median levee failure length was about 341 feet. Absent the presence of a woody corridor upstream of a levee, median failure length was about 787 feet. For levees that did not fail, the median woody corridor length was 4,882 feet, but for levees that did fail, the median woody corridor length was 2,946 feet. Having a long woody corridor upstream from a levee was highly significant in whether or not the levee failed.

Dr. Dwyer also pointed out that the study did not look at bank stability, but mentioned other studies that found that vegetation played a more significant role than soil type in reducing bank stability. The Dr. Dwyer spoke to complex issues posed by roots in levees. On one hand, roots that die off create channels in the soil, which can negatively affect levee stability. On the other hand, he pointed to examples of tree roots in levees that kept the levees functioning and stable during flood events. He finished by offering numerous ideas for future research, stressing the importance of studying effects of woody vegetation on levees as a comprehensive, integrative

[410] John Dwyer (2007); presentation transcript, found here: <http://www.safca.org/protection/NR_Documents/2007_Symposium_Dwyer_Transcript.pdf> (last visited August 2016).

practice, looking at as many risk factors as possible together, rather than studying the effects woody vegetation to levees in a vacuum.[411]

The second day of the Symposium began with presentations from local maintainers who provided, "Regional perspective on levee conditions, risk factors, & consequences of implementing Corps' certification standards." The president of MBK Engineers provided the history and description of the Sacramento River Flood Control Project (SRFCP).[412] Steve Chainey, a senior ecologist and watershed restoration expert also provided an overview of the natural history and current state of Central Valley river systems.[413] This included an overview of the functions of river vegetation, which includes: shading and cooling the aquatic zone; providing nutrients and food exchange between terrestrial and aquatic habitats; proving a migration corridor for bird populations; providing cover and rearing habitat for fish, including juvenile salmon and steelhead; a source of instream woody material vital for juvenile fish survival; and as energy dissipation for waves, flows and sediment.[414]

Chainey also spoke to the importance of floodplains with frequent (two to five year) flooding events. California has a few remnant floodplains left, but for the majority of the state, natural floodplains remain cutoff from the river by levee systems. Today, the Sacramento and San Joaquin rivers are contained narrowly on each side by levee walls that are higher than the natural floodplain surface. Some riparian habitat remains at the waterside toe of levees, which Chainey described as "substitute floodplain habitat." The remaining forest, even that on the landside of levees, is not regenerating because the floodplains are isolated, so seed is not delivered in the spring as it naturally would. This riparian habitat is especially important to the survival of salmonids, particularly steelhead, which depend on the riparian system for spawning, migration

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[411] Dr. John P. Dwyer, Associate Professor, University of Missouri, Department of Forestry (2007); presentation transcript found here: < http://www.safca.org/protection/NR_Documents/2007_Symposium_Dwyer_Transcript.pdf> (last visited August 2016).

[412] Joseph D. Countryman, P.E., D.WRE, President, MBK Engineers (2007); presentation transcript found here: <http://www.safca.org/protection/NR_Documents/2007_Symposium_Countryman_Transcript.pdf> (last visited August, 2016)

[413] Steve P. Chainey, Senior Ecologist, EDAW (2007); presentation transcript found here: <http://www.safca.org/protection/NR_Documents/2007_Symposium_Chainey_Transcript.pdf> (last visited August 2016).

[414] *Id*.

and rearing habitat. In the case of steelhead, dams now block 80 percent of their historic reproductive habitat, and 37 of the 50 tributaries of the Sacramento River are now completely blocked. Today, out-migrating juvenile salmon are predominantly forced to use the remaining shoreline, shallow vegetation and woody debris as cover from predators and heat, and to feed. However, much of the remaining vegetation on the waterside of levees has also been removed in favor of "rip-rap" or rocks covering the entire waterside of the levee, devoid of any vegetation. In the upper Sacramento River, three quarters has been armored with rip-rap, and out of the entire Sacramento River system, nearly 200 miles, or nearly half, is covered with rip-rap. Finally, Chainey offered innovative engineer design solutions for safe levees designed by engineers and informed by biologists. (For more details on these innovative designs see *Part VII: Solutions*).

A water Resources Engineering Associate and Flood Fight Specialist with DWR, Rick Burnett, spoke to the experience of flood fighting and levee inspection in the Central Valley.[415] Levee vegetation can pose issues for patrolling in advance of a flood event, and during the actual act of floodfighting. Vegetation presents a problem for regular patrollers, as it can hamper their view of any possible defects in the levee, and make patrolling much more difficult. Vegetation can also impede the ability of floodfighting by obstructing responders, and making it difficult for crews to deploy equipment. Burnett expressed the view that vegetation was more of an issue for regular maintenance and inspections, but for during floodfighting, levee vegetation is "not so bad. If vegetation is in the way, it's usually cleared quickly by the same flood fighters that are responding."[416]

The USACE Sacramento District also provided results from the Lower American River levee section pilot study. USACE and DWR conducted the study to test out USACE consistent national inspection ratings and standards checklists for both federal and nonfederal projects. USACE also wanted to be sure that local sponsors and state sponsors were applying the USACE inspection rating and checklists in a uniform manner. Inspection items were categorized into "acceptable," "minimally acceptable," and "unacceptable." Upon inspection, each district was

[415] Rick Burnett, Water Resources Engineering Associate, Flood Fight Specialist, Department of Water Resources, Division of Flood Management (2007); presentation transcript found here: <http://www.safca.org/protection/NR_Documents/2007_Symposium_Burnett_Transcript.pdf > (last visited August 2016)
[416] *Id*.

expected to have a current O&M manual and to be prepared with emergency supplies. Levees themselves were also examined for slope stability and slope cracking. There were some problems found with levee erosion and bank caving. There were three items on the checklist that were rated under the "unacceptable category," including: unwanted vegetation growth, animal control, and encroachments.[417] Unwanted vegetation included trees within the levee prism or within a 10-15 foot area from the landside or waterside toe.[418] Corrective actions following the inspection included "about 1.5 miles of tree and wild growth removal."[419] The biggest challenges in ensuring uniform inspections included the length of time to conduct thorough inspections, coordination with property owners, enforcement of encroachment permits (or lack thereof), and compliance with environmental laws. Since the study, inspection checklists were updated to be a bit more lenient in terms of not rating an area "unacceptable" based on one unacceptable item and revising the 15-foot vegetation free zone to an "easement area."[420]

SAFCA gave an overview of a Sacramento-region levee vegetation and levee condition survey, as well as risk factors and issues encountered from attempting to implement the USACE vegetation guidance. Results indicated that there would likely be about 3,800 trees in the 20 miles surveyed that would need to be removed in order to comply with USACE guidelines. The average number of trees in the vegetation free zone is about 37 trees per 1,000 feet, and assuming about a 20-foot circle around those trees in order to remove them, there would be about 12,000 square feet of levee disturbance involved in tree removal. This presents problems in terms of significant levee reconstruction cost and labor in order to comply with the vegetation removal guidelines.[421]

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[417] Meegan G. Nagy, P.E., Emergency Manager US Army Corps of Engineers, Sacramento District (2007); presentation transcript found here: <http://www.safca.org/protection/NR_Documents/2007_Symposium_Nagy_Transcript.pdf> (last visited August 2016).
[418] *Id.*
[419] *Id.*
[420] *Id.*
[421] Ken Rood, Principal, Northwest Hydraulic Consultants (2007); presentation transcript found here: <http://www.safca.org/protection/NR_Documents/2007_Symposium_Rood_Transcript.pdf > and Ed Wallace, Principal, Northwest Hydraulic Consultants (2007); presentation transcript found here: <http://www.safca.org/protection/NR_Documents/2007_Symposium_Wallace_Transcript.pdf >

The symposium concluded with presentations on, "Policy solutions based on applied engineering and science – a practical vision for the future and those living behind the levee. Costs vs. benefits, multi-use values, & appropriate standards for vegetation removal along river levees." The first of these panels focused on applying engineering and science to solutions, with nine panelists representing a diverse set of disciplines. The second focused on risk and uncertainty, and costs and benefits of implementing USACE vegetation removal policies. The final panel focused on critical needs for the future, and opportunities for flexibility in policy implementation.[422] Themes from all panels included benefits versus risks of woody vegetation on levees; cost and labor required in vegetation removal; and full compliance with USACE guidelines versus regional flexibility.

The 2007 Levee Vegetation Research Symposium was groundbreaking in that it brought leading scientists and researchers together with policymakers to discuss contemporary levee vegetation research and policies. One key conclusion from the symposium was that there is a lack of scientific research on interactions of woody vegetation on California levees. Thus, the 2007 Levee Vegetation Research Symposium prompted tremendous strides in levee vegetation research over the next few years.

2. *ERDC: 2010 Literature Review & 2011 White Paper*

a. *Literature Review*

USACE's Engineer Research and Development Center (ERDC) conducted a literature review of topics related to vegetation on levees, to gain a better understanding of whether vegetation on levees compromises levee integrity.[423] ERDC reviewed 200 documents in this process, including policy documents from the State, federal, local, and international levels; Journal articles; proceedings and transactions; newspaper articles; grey literature (including documents not published in an accessible format) and personal communications. Of the 200 reviewed, 140 documents were included in the literature review, and from that, 18 were considered "pertinent"

[422] 2007 California Levee Research Symposium, Audio found here: < http://www.safca.org/protection/Environmental_2007_Symposium.html> (last visited August 2016).
[423] Maureen K. Corcoran, et. al., U.S. Army Corps of Engineers, Engineer Research and Development Center, Literature Review – Vegetation on Levees (December 2010). < http://www.nws.usace.army.mil/Portals/27/docs/Levees/ERDC%20Literature_Review-Vegetation.pdf >

literature documents that dealt with vegetation on levees. Of those 18 documents, multiple documents may have stemmed from the same initial research or data, so a central message of the effort was that, at the time, there was not considerable existing research on this subject.[424]

The report highlighted many areas where additional research is needed, including: the influence of woody vegetation on burrowing animal habitat; the effect of woody vegetation on maintenance, inspection and floodfighting; a system-wide approach to future research to better understand the interaction of woody vegetation with different components of the levee system, environment, and river community; the effect of tree root decay and tree throw-down (the hole remaining after a tree has been uprooted) on seepage and levee stability; the effect of woody vegetation on slurry cutoff walls; and the benefits and risks of converting wooded levees to grass-covered levees, including the engineering feasibility and economic cost of such a conversion.[425]

The review summarized the most prevalent issues found in existing literature. This includes the suggestion that levees be addressed in terms of ecosystem habitat diversity (as separate environmental communities), and that specific guidance be established for those ecosystems.[426] The review recommended that scientific and engineering principles support guidance addressing woody vegetation on levees.[427] Thus, based on a review of existing literature regarding levee vegetation, ERDC ultimately recommended that levee maintainers address levee vegetation on an ecosystem/regional scale and utilize the best available science in doing so.

b. 2011 Report

In September of 2011, ERDC conducted research on the impacts of trees on levees, releasing results of the research into a report, "Initial Research into the Effects of Woody Vegetation on

[424] Dr. Maureen K. Corcaran, Research Geologist, USACE ERDC, author of Literature Review, presentation at 2007 Levee Vegetation Symposium (2007); transcript found here: <http://www.safca.org/protection/NR_Documents/2007_Symposium_Corcoran_Transcript.pdf > (last visited August 2016).
[425] Maureen K. Corcoran, et. al., Literature Review – Vegetation on Levees (December 2010). at 16.
[426] *Id*., at 16.
[427] *Id*., at 16.

Levees" (report).[428] This was a two-year, $1.34 million research effort that included a global literature review; site characterizations and assessments; field data collection, including root mapping, root strength assessment, and soil properties collections; and numerical model development.[429]

The report was unique in that no other program of this magnitude had ever been attempted on this topic. It involved a range of disciplines and employed several cutting-edge technologies. The report was presented in four volumes: (I) Project overview, (II) Field data, (III) Numerical modeling, and (IV) Summary of results and conclusions.

The report made clear that the research was not intended to weigh positive versus negative effects of woody vegetation on levees, but suggested that future efforts aim to do so. The analysis was limited to sandy or silty levees (those found in the Central Valley), and was further limited to living, isolated trees.

Volume I provided an explanation of the purpose of the report, which is to examine the positive and negative impacts of vegetation on the two primary levee failure mechanisms the USACE determined could be caused by levee vegetation: internal erosion or seepage, and slope stability.

Volume II provided an overview of field tests conducted by ERDC, much of which was used in modeling efforts. Because of time constraints, much of the field data collected was not used in modeling, although models did include field data regarding root strength in slope stability. Other parameters, including levee geometry, soil characteristics, river hydrology and site geology were obtained from existing studies and reports.

Field tests included site assessments at six field sites east of, or within Dallas, Texas, as well as four western sites. These western sites include: Albuquerque, New Mexico; Burlington, Washington; Portland, Oregon; and Sacramento, California. The field studies included non-invasive and invasive techniques to collect root characterization data. The research team

[428] Maureen K. Corcoran, et. al., U.S. Army Corps of Engineers, Engineer Research and Development Center, Initial Research into the Effects of Woody Vegetation on Levees (July 2011), Vol. I-IV; <http://wri.usace.army.mil/woody_vegetation_research.html>

[429] U.S. Army Corps of Engineers, Engineer Resource and Development Center Public Affairs Office, Vegetation on Levees (September 7, 2011); < http://wri.usace.army.mil/woody_vegetation_research.html >

modified a root pull-out method, using an apparatus to measure root strength and applied non-intrusive methods to map tree roots.[430] Data was also collected on soil properties around nine trees at eight locations. Findings from field studies indicate little to no evidence that tree roots influence the average hydraulic conductivity[431] of soil.[432] Field studies testing root strength indicated no difference in strength due to species, but location and root diameter were important determining factors for root strength.[433]

Volume III summarized the numerical models and parameters used in simulating tree effects. Two-dimensional (2-D) models considered critical conditions for slope stability and seepage at the four western sites and within four levee cross sections (on both riverside and landside). These conditions were then used to assess levee performance at differing locations for single trees. Results showed that root zones generally affect the flow field (flow of groundwater through the soil) within their immediate vicinity but have no influence in the overall flow field. The most likely impact of tree roots to flow occurred when the tree was located at the landside toe of the levee. Changes in hydraulic conductivity on the riverside did not appear to affect landside flow conditions.

Three western sites were chosen to assess the affects of woody vegetation on erosion. The probability of woody vegetation causing internal erosion was concluded to be "negligible" at the toe of the levee for the Burlington and Portland sites.[434] The probability of internal erosion occurring at the Albuquerque site was concluded to be, "negligible to 0.25."[435]

Three-dimensional (3-D) models analyzed "worst case" scenarios for flow field around root zones, but found no apparent change to flow field or seepage associated with these zones.[436] In

[430] *Id*.
[431] Hydraulic conductivity is defined by this study as " a measure of the ability of a soil to transmit water." For more information *see* Maureen K. Corcoran, et. al., Initial Research into the Effects of Woody Vegetation on Levees (July 2011), Vol. II at 378-379.
[432] *Id*., Vol. I at iii
[433] *Id.*
[434] *Id* ., Vol. II at v.
[435] *Id* ., Vol. II at v.
[436] *Id* ., Vol. II at vi.

general, the effect of a single tree on levee performance is smaller in the 3-D model than in the 2-D model.[437]

2-D models were also used to determine the importance of tree location on slope stability. In general, the study found that trees on the upper part of the levee slope made levees less safe, because they add weight to the upper slope, but trees near the toe made levees safer by adding stability. Trees at midslope generally had a neutral effect on levee safety.[438] Slope stability was also analyzed relative to wind loads. The models found that wind speeds are greater than 40 miles per hour, the factor of safety decreases for all tree locations evaluated.[439]

Volume IV summarized the results and conclusions of the report. It stressed the many limitations of these models, and the need for additional research. It also discussed how tree roots can increase or decrease the factor of safety with respect to slope stability, depending on the location of the tree on the levee. When wind speeds greater than 40 miles per hour are considered, the factor of safety decreases for all locations evaluated. The research team further concluded that "because of the extreme variability in geology, tree species, climate, and soils, the impact of trees on levees must be analyzed on a case-by-case basis" that takes into account tree weight, tree location, root system and wind loads.[440] The team also identified areas that required further study, including: impacts of dead or decaying root systems causing "piping," or seepage due to preferential flow paths; seepage generally and the progression of piping; general study on impacts from dead or decaying roots; windthrow and animal burrows in relation to seepage; the impact of woody vegetation on the hydraulic conveyance of a river; biological impacts; woody vegetation in relation to scour and erosion; and woody vegetation in relation to O&M activities.[441]

USACE publicized the following results in a release through the public affairs office:

[437] *Id* ., Vol. IV. at 22.
[438] *Id* ., Vol. II at v.
[439] *Id* ., Vol. II at vi.
[440] *Id*., Vol. I at vi.
[441] *Id* ., Vol. I at vi.

- "Initial research has advanced our knowledge and understanding of some aspects of this complex issue.
- The presence of trees on a levee increases the uncertainty associated with levee integrity and performance.
- ERDC researches considered the effects of trees at various locations on levees and found that a tree may either increase or decrease the factor of safety; at some locations where a tree was found to increase the factor of safety under one set of conditions, that same tree was found to decrease the factor of safety when other likely conditions were considered.
- ERDC researchers have determined that because of the many variables, including climate, moisture, soil types, three species and levee designs, the full impacts of trees on levees may never be fully quantifiable."[442]

The public release concludes that the impacts of vegetation on levees remains "extremely complex, highly variable, and unquantifiable."[443] USACE suggests that in the face of uncertainty, "USACE remains confident that a well-constructed levee with well-maintained grass cover represents the optimal goal for reducing the uncertainty of the performance of levee systems." It is likely that in the face of complex results, USACE chose what they viewed as the safest policy choice, which is to refrain from updating their vegetation removal policy until more conclusive science is presented.

3. *2011 DWR Memo*

On March 23, 2011, the URS Corporation prepared for DWR's Division of Flood Management a Memorandum on, "The Influence of Vegetation on Levee Past Performance—a Review of Historic Data Based on the Levee Evaluation Program Database." (DWR Memo). This memo was developed as part of the Levee Evaluation Program (LEP), which evaluates the safety of both urban and non-urban levees in the Central Valley. At the time of the DWR Memo's release, DWR was beginning an effort to evaluate 470 miles of urban levees and 1,620 miles of non-

[442] U.S. Army Corps of Engineers, Engineer Resource and Development Center Public Affairs Office, Vegetation on Levees (September 7, 2011); < http://wri.usace.army.mil/woody_vegetation_research.html >
[443] *Id*.

urban levees in the LEP, determining where levees did not meet geotechnical criteria, and identifying remedial measures to bring levees into compliance.

The research team collected information on levees in the Central Valley from reports, interviews, historic data and field observations. The team cataloged the documents, reviewing each for points of interest (POIs) related to levee performance. POIs included: (1) locations with reported instances of past levee performance issues such as erosion, underseepage (boils), through-seepage, breaches, slides and overtopping; (2) locations with reported implemented mitigation measures, such as slurry cutoff walls or levee raises; and (3) locations with levee engineering structures such as pipe penetrations, pump stations, or weirs.[444] Significant events related to levee performance were categorized by those related to seepage, stability, erosion, overtopping and levee breach. This included a database of more than 10,000 records and additional evaluation of over 350 miles of urban levees.[445]

The review of performance data indicated that primary factors that play a key role in levee performance are: levee foundation characteristics, levee material, levee geometry, and hydraulic head. Secondary and external factors that may influence levee performance are animal burrows and the presence of utility penetrations.[446]

Levee performance records were also evaluated to determine how vegetation affects levee performance. These records were categorized into the following: (1) performance records identifying vegetation as a factor that adversely or positively influenced levee performance; (2) performance records identifying vegetation as a factor that influenced levee operations and maintenance (O&M) activities; (3) performance records with an incidental description of vegetation, but no indication that vegetation influenced levee O&M or levee performance; and (4) performance records identifying the occurrence of vegetation in association with performance data but with no clear cause-effect relationship between levee performance and vegetation.[447]

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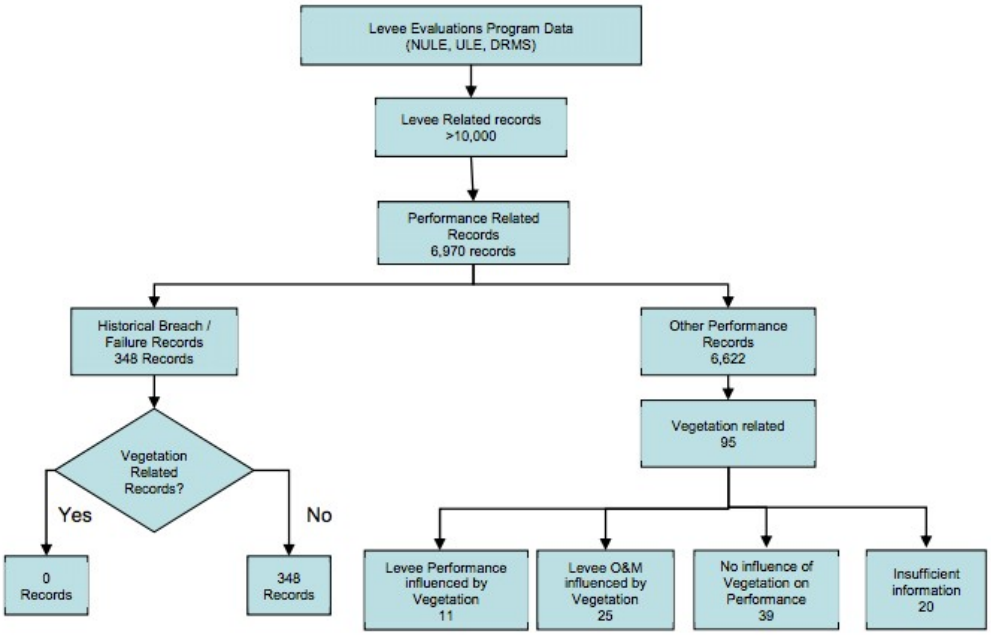
[444] Nadira Kabir and Fran Bean, URS Corporation (March 2011) at 2. < http://www.safca.org/protection/NR_Documents/CLVRP_Influence_of_Vegetation_on_Levee_Past_Performance.pdf >
[445] *Id.*, at 3.
[446] *Id.*, at 3.
[447] *Id.*, at 4.

Of the over 10,000 records reviewed, 6,970 were identified in the four categories above. Of these categorized records, 348 described levee breaches that resulted in floodwater flowing to the landside of the levee. None of the records identified vegetation as an influence on the breach.[448]

Of the remaining 6,622 performance records, 95 indicated the presence of vegetation in the vicinity of an identified levee performance issue.[449] These included: 11 records indicating that vegetation was a factor that influenced levee performance; 25 records indicating that vegetation had an influence on levee O&M; 39 records referencing vegetation in a way that was irrelevant to levee performance or O&M; and 20 records discussing the presences of vegetation in the vicinity of a levee performance issue, but with insufficient information about the role of vegetation on levee performance.[450]

The memo concludes that records indicating vegetation had an influence on levee performance is very small, at 1.4% of total records, and of these, only 12% indicate that vegetation played a role in levee performance.



[448] *Id.*, at 4.
[449] *Id.*, at 4.
[450] *Id.*, at 4-5.

Figure 22: Levee Performance Records[451]

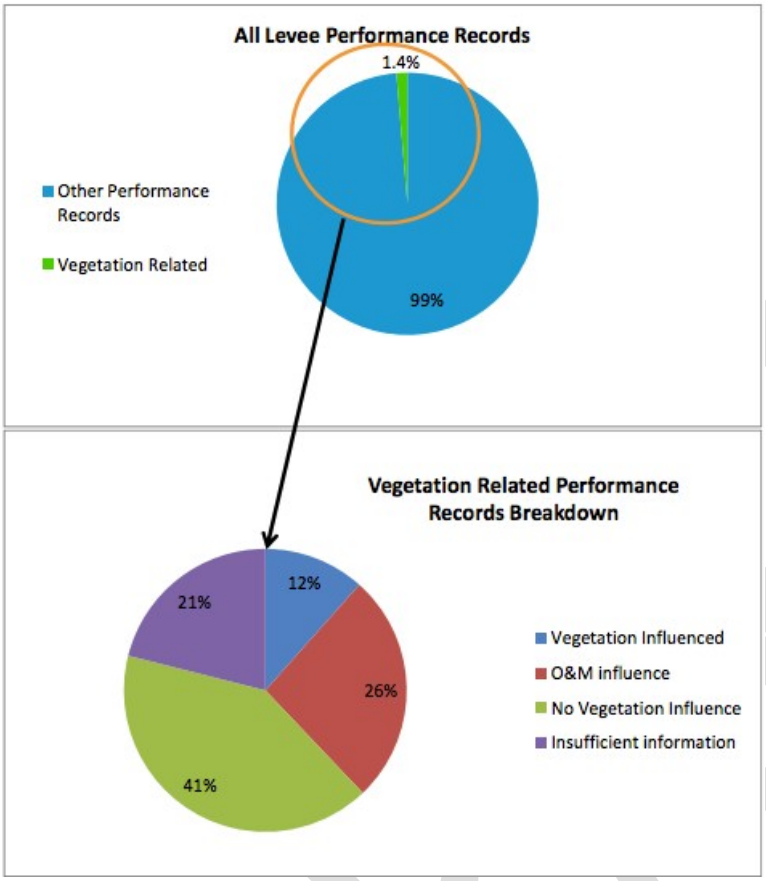


Figure 23: Distribution of Levee Performance[452]

Of the records that did indicate vegetation played a role in levee performance, the majority related to O&M activities. Of these, records generally indicated the inability to visually determine levee performance during high water events due to the presence of vegetation on levees.

4. *2012 Symposium*

The 2007 Levee Vegetation Research Symposium started an important discussion amongst stakeholders and prompted additional research from ERDC (discussed above) and the California

[451] *Id*. at 6.
[452] *Id*. at 7.

Levee Vegetation Research Program (discussed below), and other relevant national and international studies regarding the effects of vegetation on levee integrity. The 2012 Symposium, "Levee Vegetation Research Symposium 2012, Scientific Progress Informing a Path Forward" was held in August in Sacramento, and built off of the 2007 Symposium and the research that had been conducted in the interim. The symposium brought stakeholders and researchers together to discuss topics including:

- Tree root architecture in levees
- Slurry cut-off walls and roots
- Slope stability and tree roots
- Effects of roots on soil cohesion
- Tree windthrow and levees
- Effects of burrowing mammals
- International perspectives of vegetation and levees
- High-resolution 3D tree root and mammal burrow imaging
- Modeling/simulation for levee trees
- Levee seepage analysis
- Engineered or design solutions
- How science is incorporated into policy decision making
- Forensics of California levee failures

The symposium began with a welcome address by the past President of the Central Valley Flood Protection Board, Benjamin Carter, followed by a welcome address from Congresswoman Doris O. Matsui. The Congresswoman voiced the need for secure levees, and raised her own concerns with the USACE approach to levee vegetation, and "their [USACE] so-called 'variance policy.'"[453] The Congresswoman stated her concerns with the USACE vegetation removal policy as follows:

[453] Congresswoman Doris O. Matsui, Fifth Congressional District of CA, US House of Representatives, Welcome Address (August 28, 2012); Transcript found here: <http://www.safca.org/symposium_2012_documents/2012_Symposium_Matsui_Transcript.pdf> (last visited August 2016).

> "[USACE's vegetation removal policy] could force thousands of trees to be pulled out and the levees to be rebuilt. This would result in the loss of shaded habitat for both aquatic and terrestrial species. But most importantly to me, in a time of shrinking federal, state, and local budgets, it could lead us down a path that makes levee improvements too costly to implement. It very likely could divert our attention away from necessary levee fixes to secondary issues that, while important, are not nearly as pressing."[454]

Congresswoman Matsui was followed by William Stelle, Regional Administrator for the Northwest Region of NOAA Fisheries, who framed the issue of levee vegetation from a natural resource agency perspective. Mr. Stelle suggested that the issue not as one between public safety or aquatic function, but "as an issue of both."[455] He also expressed fundamental issues with USACE policy, including whether the ETL satisfies the "best available science" obligation under the federal Endangered Species Act, and whether the PGL and SWIF policy properly reflect USACE nondiscretionary obligations to conserve listed salmonids under the Endangered Species Act.[456] These issues are explored in greater detail in *Part II: Problems Associated with Vegetation Removal Requirements* and *Part IV: Solutions*.

The research and findings presented in the 2012 Levee Vegetation Research Symposium are included in the report, Synthesis of Levee Vegetation Research Results, which is discussed in detail below.

5. *California Levee Vegetation Research Program*

The California Levee Vegetation Research Program (CLVRP) was established following the 2007 Levee Vegetation Research Symposium, prompted by the recognized need for additional research on issues regarding levee vegetation. In 2009 DWR and SAFCA partnered with policy makers, levee managers, and researchers from local, State and federal agencies, including

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[454] *Id*.

[455] William Stelle, Regional Administrator – Northwest Region, National Oceanic and Atmospheric Administration Fisheries Service, Framing the Issue & Role of Science – A Natural Resource Agency Perspective (August 28, 2012), Transcript found here: <http://www.safca.org/symposium_2012_documents/2012_Symposium_Stelle_Transcript.pdf> (last visited August 2016).

[456] *Id.*

CVFPB, USFWS, NMFS, CDFW and Central Valley reclamation districts to form the CLVRP. The purpose of the CLVRP is to support original scientific research about vegetation and its impacts on levees, and provide a science-based foundation to develop levee vegetation management policies and maintenance procedures.

The research produced by CLVRP is distinguished between two phases. Phase I of the CLVRP focused upon expanding the body of knowledge regarding the impacts of vegetation and burrowing mammals on levee performance. In Phase I, CLVRP published numerous reports on associations between vegetation and burrowing animals on levees; levee tree root architecture; seepage through levees with live trees, dead stumps, and herbaceous cover; effects of tree roots on levee slope stability; computer modeling to simulate levee seepage and slope stability; forces required to overturn trees (windthrow); and spatial distributions of roots around levee slurry cutoff walls.[457] Much of the information gathered and published as part of Phase I was included in the "CLVRP Synthesis Report" and will be described in greater detail below.

Phase II of the CLVRP is focused on integrating the research results developed in Phase I into practical guidance for DWR in their levee Operations and Management (O&M) practices. This phase includes (i) the CLVRP Synthesis Report, (ii) a study being conducted at UC Berkeley to evaluate incremental risk associated with levee vegetation, entitled "Evaluation of the Incremental Probability of Levee Failure Due to the Effects of Woody Vegetation; and (iii) the Vegetation Assessment Working Group (VAWG). The VAWG is currently focused on two efforts: the Levee Tree Assessment (LTA) Guidance, which is an attempt to produce guidelines for determining when woody vegetation poses an unacceptable threat; and Levee Vegetation Data Collection Procedures, which is an attempt to produce standardized procedures for collecting data on woody vegetation on levees.

The VAWG's LTA Guidance could provide an objective methodology for determining if woody vegetation poses an "unacceptable threat" to levee integrity. If utilized by permitting agencies, this could help enormously with problems faced by State and local levee sponsors. Since the

[457] F. Douglas Shields, Synthesis of Levee Vegetation Research Results, prepared for Cal. Levee Vegetation Research Program (January 2016) at 1-2. < http://www.water.ca.gov/floodsafe/leveeveg/levee_documents/2016-0127-Levee-Veg-Synthesis-Report-FINAL.pdf >

passage of WRRDA 2014 (See *Appendix 1: Federal Laws and Policies*) and court orders (See *Appendix 3: Case Law*), USACE is precluded from enforcing the strict terms of the ETL and PGL, and may only require levee maintainers to remove vegetation if the vegetation is proven to pose an "unacceptable threat" to levee integrity. However, the current methods of deciding which vegetation poses an unacceptable threat vary widely depending on who is conducting the analysis, because levee maintainers in general do not have a standard to go by. There are no uniform standards based on best available science in existence that levee maintainers can use to ascertain whether or not vegetation poses an objective threat. The LTA could provide those standards.

The VAWG is also working to develop standardized levee vegetation data collection procedures. This is an attempt to produce standardized procedures for collecting data on woody vegetation on levees. Similarly to the LTA, this could help enormously in terms of providing uniform, objective standards, based on sound science, for collecting data on levee vegetation. This will help State and local levee sponsors in their inspection and O&M duties by providing clear guidelines, and ensuring data collection accurately reflects real world threats and conditions on the levees. VAWG is also working on the "Tree-fall Data Rapid Response," which will guide the development of a mobile research team who will deploy soon after trees fall on levees to collect real-time data. This procedure will similarly use the best available science to establish uniform standards to collect real-time data, including root pit measurements, soil compaction, soil saturation, tree species, and condition. Data collected will be used in future analyses and research.

The CLVRP is also conducting a risk-based study through UC Berkeley, to evaluate the incremental probability of levee failure due to the effects of woody vegetation. The study is currently underway, and will use peer-informed risk assessment methodology to evaluate the probability of levee failure in certain segments of Central Valley levees. Similarly to the LTA, this study seeks to quantify when vegetation poses a risk to levee integrity. However, this study differs in that it will quantify the incremental probability of levee failure due to vegetation, including incremental risks posed by other factors, using selected case study levees from the Central Valley. The results could help policymakers from all agencies in terms of permitting safer levee designs, by quantifying the risks posed to levees from vegetation versus other levee

risks. In other words, this will provide clarity on the relative probability of levee failure due to woody vegetation, as compared to general failure modes (e.g., encroachments, penetrations, animal burrows), and how these different risk factors influence each other.

6. *Synthesis Report*

As discussed above, Phase II of the CLVRP includes of the development and release of, "Synthesis of Levee Vegetation Research Results" (Synthesis Report). Following the 2007 Levee Vegetation Research Symposium, considerable research on levee vegetation was conducted by CLVRP, ERDC, and European scientists, much of which was reported in the 2012 Levee Vegetation Research Symposium. In order to better understand the big picture messages from so many nuanced and specialized research findings, a contractor for CLVRP underwent an exercise of compiling the most recent findings on levee vegetation, with emphasis on findings from 2007 to 2014. The report compiles findings based on discipline and geography, and identifies where consensus has emerged as well as remaining data gaps and controversial or unresolved issues. The Synthesis Report was prepared by F. Douglas Shields, Jr., Ph.D., P.E., D.WRE, of cbec eco engineering, and was released in January, 2016. Funding for the report was provided by DWR.

The CLVRP Synthesis Report starts by describing the purpose and context of the document, which was to objectively report results of vegetation management research, adding the author's own interpretation of the implications of research results in a separate section. The introduction also emphasizes that little research on levee vegetation had been conducted prior to the research described in the report. The author describes our current situation, where past and present regulations have sought to limit or prohibit woody vegetation on levees, based in part on precaution in the face of uncertainty. However, despite those regulations, woody vegetation has been allowed to grow and mature, and is now in conflict with those standards.[458] In particular, California levees support the final remnants of riparian woodlands in the entire State, and levee vegetation provides habitat for threatened and endangered species. Woody vegetation on levees also provides aesthetic enjoyment and could help contribute to levee stability and durability.

[458] F. Douglas Shields, Synthesis of Levee Vegetation Research Results, prepared for Cal. Levee Vegetation Research Program (January 2016) at 1-2. < http://www.water.ca.gov/floodsafe/leveeveg/levee_documents/2016-0127-Levee-Veg-Synthesis-Report-FINAL.pdf >

However, concern for levee safety in the wake of Hurricane Katrina triggered national debate and caused USACE to take a more conservative approach to levee risk management. This prompted levee vegetation removal guidelines embodied in the ETL, and guidelines for obtaining a variance, codified in the PGL. The author offers hope that this report will be considered as USACE undergoes its WRRDA 2014 directive to consider and incorporate current science into the new levee vegetation policy.

The Synthesis Report describes the controversy over levee vegetation by listing the most common objections to woody vegetation, based on the following concerns: that woody vegetation can obscure visual inspections and obstruct access for maintenance and floodfighting activities; living or dead roots from woody vegetation could facilitate through-seepage by creating macropores (holes or cavities larger than about 0.08 millimeter); wind action on vegetation and possible enhanced seepage and infiltration could negatively affect slope stability; trees subject to windthrow could create voids or pits in the levee prism; trees and shrubs could attract burrowing animals, making them more difficult to control and leading to seepage within the levee; erect or fallen trees could produce scour, causing erosion during high flows; tree roots could uplift hardscapes such as paved or interlocking revetments, drainages, or gates; and trees could negatively impact desirable vegetation such as grass through shading or changing the chemical nature of the soil.[459]

Additionally, scientists in Europe, primarily from France and Germany, have conducted extensive research on levee vegetation following the 2007 Symposium. France conducted a research program dealing with the effects of trees on dikes, focusing on large tree root architecture. Tree roots were mechanically uprooted from levees with coarse, gravelly soils using noninvasive techniques to map roots and measure root decay. A university in Austria also conducted prototype-scale experiments, where the researchers constructed a test levee enclosed in a basin and stimulated flooding. They tested a variety of vegetation treatments on the effects of seepage, soil properties, and development of above and below ground plant components.

[459] *Id*. at 1-8.

The Synthesis Report summarizes and synthesizes the findings by the aforementioned researchers and any others relevant to levee vegetation.[460] The report categorizes all results in terms of: (1) root architecture, (2) noninvasive detection of roots, (3) root strength, (4) root decay, (5) water erosion, (6) treefall, (7) burrowing animals, (8) seepage and piping, (9) slope stability, (10) risk analysis, (11) flood fighting, (12) inspection, and (13) levee design.

a. Root Architecture

Before determining the potential for trees roots to cause seepage or treefall on levees, researchers must first determine the size and spatial distribution of tree roots, or root architecture. Many regulations (including the ETL) make assumptions about tree root dimensions, so summarizing results from root architecture studies can help clarify and improve these assumptions.

Studies that analyzed root architecture included five where the excavation of pits or trenches revealed portions of tree root structures on levees, two that involved exhumation of the entire root system on selected levee trees, and one exhumation study that involved the entire root structure of a tree not growing on a levee.

Results indicated that root numbers and biomass tend to decline exponentially with width and depth from the tree. Most roots are confined to the top one-meter of soil, at a consistent depth, regardless of their direction from the tree, and are within the dripline[461] of the tree. Tree roots also grow within a zone surrounding the trunk that is smaller in horizontal extent than the canopy. However, some exceptional tree roots, including those of cottonwoods, grow at greater depths and distances.

Results further indicated that trees growing on levee slopes differ from those on hillslopes, in that root number, extent, and biomass tend to be higher toward the bottom of levee slopes, which is the opposite case for roots on hillslopes. Roots tend to grow more downhill on levee slopes as they grow outwards horizontally.

[460] *Id*. at 1-3.
[461] Dripline refers to the area under the tree, defined by the outermost circumference of the tree canopy.

Key influences on root architecture include tree species and the environment. For instance, cottonwood roots extend further than valley oaks, and root length is greater in coarse/gravelly soil than in sandy/silty soil. In fine/sandy soils, root density per stem is high and roots tend to grow in bundled or oblique angles, whereas in gravelly soils, root density is lower with fewer roots of larger diameter. In porous material, roots tend to be near the surface when the primary source of water is rainfall, but are more likely to have a tap root when there is groundwater access.

Root morphologies include plate, heart, and tap root. Root patterns include conical, disk-shaped, or cylindrical. One study showed that root pattern and morphology does not depend on species as much as environmental conditions, like soil, access to water, and local constraints. In other words, the study indicated that within the same soils and environment, different species have the same root architecture. However, another study showed stronger variation by species rather than environmental conditions.

b. Noninvasive Detection of Roots

Noninvasive detection of roots is important for many of the same reasons as determining root architecture. Studies attempt to similarly map root architecture, but without destroying vegetation and the levee embankment, which could potentially provide faster, cheaper answers to questions of root distribution than other methods.

The Synthesis Report presented three studies of root detection in levee embankments using noninvasive techniques. The first used ground-penetrating radar, electrical resistivity and electromagnetic induction at levee sites, and was not effective in all sites. The second used ground-penetrating radar but reported it unsuccessful, and suitable for certain soil textures only. The third used electrical resistivity to detect roots buried in containers of soil in the laboratory, but showed poor overall performance, especially in finer soils.

Results indicated that it is currently uncertain how valuable these techniques are, especially lacking field validation. Right now there does not seem to be a proven reliable technology to detect roots using noninvasive methods, although this remains a ripe opportunity for future research.

c. *Root Strength*

Root strength, including tensile and bending strength, is important to ascertain in order to figure out how trees influence levee stability. Sometimes levee failures occurs when a large block of material slumps off, and vegetation could contribute to this by adding weight and wind loads. However, roots could also make slopes more stable by reducing moisture in soil and through direct reinforcement. Analyzing root strength is relevant to both of these issues.

Research results generally indicate that tree root strength declines with root diameter. Most studies showed that root strength for any given tree root of the same diameter and in the same environment is more or less the same, regardless of species. Small roots are much more numerous than large, and make much more significant contribution to soil strength. All but one study showed that larger roots are more likely to pull out of the ground but also offer resistance to bending, whereas fine roots cannot resist bending forces as well.

Root contribution to soil strength also varies with the size and distribution of roots, and with their tensile strength. Because root density declines exponentially with depth, root contribution to soil strength also declines sharply with depth.

d. *Root Decay*

Root decay is important to study because some argue that voids left by decaying roots induce "piping," or water seepage into levee soil, which could lead to levee failure. Other things that can cause these voids include: shrinkage cracks, hydraulic fractures, contact surfaces, animal tunnels, relict root holes, soil pipes, manmade activities, encroachments, and other penetrations.

The Synthesis Report analyzed studies that showed much of the evidence of old decaying roots leading to piping, and therefore levee failure, is anecdotal. In other words, people may see trees upturned on failed levees and assume that tree roots are the cause. However, it is impossible to prove causation in many of these anecdotal cases. Fears around root decay also include the fear of removing dead, decaying roots, because that too is thought to potentially exacerbate seepage.

The Synthesis Report presented both applied and theoretical studies. One conducted in California involved the excavation into actual levees, revealing living, dead and decaying roots. This study

found no voids left by decaying roots. Another was conducted in France, where researchers buried root samples in levees, then underwent exhumation after two and four years to allow for decay. Decay rates were closely related to tree species, as opposed to root diameter, although root diameter did affect decay rate in that smaller roots tend to decay faster.

Whether decaying roots leave voids depends largely on soil type. Voids from decaying roots were only found in cohesive soils.[462] There were no reports of decaying roots creating tubular voids in sandy soils. This is important information for California policymakers because Central Valley levees are characterized by sandy soils.

Studies further showed that root decay interactions with surrounding soil differ depending on the number of tree roots. The death of a single tree creates different effects to the soil than the death of many trees. This is because, when one tree dies the living roots of surrounding trees rapidly colonize zones around the decaying roots. This does not happen when a group of trees die, as there may not be sufficient living roots in the vicinity of the dead tree to fill the voids.

The combined studies and reports demonstrate that decayed roots generally have not been implicated in pipe formation, other than by anecdote.

e. Roots and Erosion

During flood events, river currents and waves can erode levees. Differing views exist as to whether tree-root-penetrated levees impact levee performance in this situation. One theory is that trees can reduce erosional threats to the levee. A differing theory is that trees can exacerbate erosion by concentrating flows between tree trunks or by shading turf/grass development. This segment of the Synthesis Report looked at studies that aimed to better understand if and how trees on levees influence levee erosion.

Compiled research included three published studies, which observed levee failure rates in relation to the width of waterside forest stands. One study was conducted in a lab and quantified the effects of woody riparian species on floodplain soil erosion rates. This study found that trees

[462] Cohesive soil is hard and compacted, and includes soil types such as clay or silt. Noncohesive soil moves more easily and includes soil types like gravel or sandy soil.

counteracted but did not eliminate fluvial erosion. Other studies included in the Synthesis Report assessed 41 tree-root-penetrated levees in the Midwest after a 2008 flood. That effort produced no evidence that tree roots had an impact on levee performance. Another study analyzed the Missouri River flood of 1993, and found that woody vegetation may have saved levees from failure in multiple cases. Observations also indicated that strips of herbaceous vegetation and small trees protected levees during hurricane events.

The Synthesis Report included findings from recent and ongoing lab tests aimed at quantifying the capacity of grasses/herbaceous plants to provide protection to levee slopes from waves and overtopping. The study noted that additional studies are needed to fully assess these potential beneficial benefits.[463] There is also a lack of information on vegetation leading to scour, and additional studies are needed to further analyze this issue.

Results of the compiled research indicate that vegetation on or riverward of the waterside levee toe helps significantly in saving levees from the impacts from wave wash and reducing erosion during high water. Further, the presence of a floodplain forest protects levees against direct attack from water currents. However, there is still a need for a guidance or standard approach for assessing the beneficial effects woody vegetation on erosion from river currents and erosion from waves, as well as scour.

f. Treefall

When trees fall or are uprooted, roots leave spaces or pits in the ground. There is a common fear that these pits can in turn lead to levee failure, and this is often used as justification for prohibiting woody vegetation on levees. The research compiled in this section focused on the force required to pull over trees, to better ascertain when trees on levees pose a hazard to levee stability due to treefall.

Of the studies analyzed, one included winching tests of valley oaks and cottonwoods. This study found that the force required to topple trees is directly proportional to tree size. Pits left by overturned trees are also directly proportional to tree size. Two other studies provided

[463] *Id.* at 6-1.

compilations of data on root pit size for overturned trees. These studies produced regressions for pit size in terms of tree diameter at breast height. Studies also analyzed the potential for remaining root pits to lead to seepage. Results indicated that pits on the landside levee toe of a large enough size increased the risk of erosion and piping. However, on the waterside slope, pits as large as five feet deep and 60 feet wide had essentially no effect on seepage.

Results indicate that large trees have the greatest potential to cause large root pits, and thus cause the greatest potential threat. However, wind forces required to topple healthy trees are extremely rare in the Central Valley. Small trees could overturn in high wind events, but produce smaller pits, which are unlikely to endanger a levee. Where large, isolated trees grow at the top or landside toe of a small levee embankment, and fail by overturning rather than breaking, these tress could pose risks to levee integrity. However, removing existing large trees from levees could also increase the risk of overtopping, seepage, and slope instability, so more information and research is needed to manage potentially hazardous trees in these situations.

g. Burrowing Animals

Burrowing animals, especially ground squirrels and Botta's pocket gophers, frequently utilize Central Valley levees. Other mammals and reptiles can also impact California levees, as well as worms, insects and reptiles. The relationship between burrowing animals and woody vegetation on levees is important to understand, because some feel that woody vegetation may attract more burrowing animals. Burrowing animals pose a threat to levee failure, because while burrowing they create voids that can collapse or weaken the levee, cause seepage, or disturb soil at a burrow entrance, promoting erosion.

Several studies in the report implicated rodent burrows as the cause, or probable causing factor, in levee failure. A literature review documented the range, depths and lengths of ground squirrel burrows, and field studies mapped burrows in two California levees. Numerous other experiments and studies showed burrows were the dominant cause of seepage through levee embankments, even when large trees or stumps are present. One study conducted in Sacramento found squirrel burrows in 98% of levee segments examined and gopher burrows in 95%. Landside densities of burrowing animals averaged three times greater than waterside densities.

Studies showed that, in general, burrows are less frequent in areas with tree cover and leaf litter, but more frequent when landsides of grassed levees were adjacent to fruit or nut crops. Pocket gophers and ground squirrels both generally prefer barren areas devoid of trees, leaf litter, riprap, gravel and pavement. Pocket gophers also generally avoid leaf litter, tree boles and gravel.

More information is needed regarding whether the presence or absence of trees on levees has much impact on burrowing mammal abundance when the levees are adjacent to crop fields. This is especially pertinent because results indicate that levees close to fruit and nut crops are much likelier to contain burrowing animals. A debate remains as to habitat associations among animal populations. Most studies suggest that converting woody vegetation to grassland will increase the probability of the occurrence of burrowing animals, but anecdotal reports suggest a positive relationship with beavers and woody vegetation.

h. Seepage and Piping

During floods, concentrated seepage can lead to piping, and one theory is that living or dead trees can create paths to facilitate this piping. Roots can also change seepage patterns and alter soil moisture within the levee embankment, either degrading or improving overall slope stability. Plant cover generally increases permeability of soils, but in some situations, can reduce permeability, and the seriousness of seepage caused by changes in soil permeability is controversial. The studies presented in this section aim to shed light on the effects trees can have on seepage and piping in levees.

Studies analyzed include three field experiments, which reviewed and examined the effects of trees on water movement through levee embankments. One of these field experiments examined downslope water movement from a longitudinal trench excavated near the levee crown for a segment with no woody vegetation. This was compared with a similar trench containing a dead/decaying stump. Water flowed more easily through the region with the stump, but in both segments, change to water flow was dominated by animal burrows. The second of these experiments examined downslope water movements from a trench excavated along a levee crest. Trees were present on both water and landside levee slopes. The experiment showed that water movement was only governed by animal burrows and soil stratigraphy, and did not change depending on root presence. The third experiment examined flow from an experimental basin

surrounded by levees, with segments of shrubby willows. Flow patterns on embankments with willows versus those with only grass had identical responses.

Models, including 2-D and 3-D models, examining the effects of woody vegetation on seepage were also included in the Synthesis Report. The models decreased or increased hydraulic loads to evaluate results in seepage discharge on the levee slope. The results showed that flow was affected within the immediate vicinity of the root zone, but nowhere else. Another study analyzed "vertical defect," (the effects of a root that creates a small-diameter vertical void through the soil surface) and found that although the presence of voids destabilized wetting patterns, overall effects were slight because the permeability of the surrounding soil controlled flow into and between voids.

Results from the above as well as other studies presented in this section indicate that roots have little effect on soil permeability, and it is essentially impossible to establish a pattern of hydraulic conductivity relative to vegetation cover on levees. Results also indicated the importance of macropores, rather than voids. Macropores occur from shrinkage cracks, hydraulic fractures, contact surfaces, rodent burrows, soil pipes or root growth and root death. The worst seepage scenarios in terms of levee stability occur when a zone of elevated hydraulic conductivity occurs at the landside levee toe, which is usually caused by animal burrows.

i. Slope Stability

Levee slopes can collapse or slide, causing levee failure. This usually happens when driving forces, like soil weight, exceed resisting forces. Additional driving forces can include earthquakes, vehicle traffic, and possibly woody vegetation. There are conflicting perspectives on how woody vegetation impacts soil strength and levee stability. Woody vegetation is thought to affect slope stability in four main ways: (1) mechanical reinforcement by woody vegetation roots; (2) soil arching between trees (vegetation creates soil masses between trees, which has stabilization effects); (3) enhanced filtration/evapotranspiration associated with vegetation (woody vegetation dries soils, which are, up to a certain point, stronger than wetter soils); and (4) additional loading from the weight of trees and from wind forces on aboveground portions of trees transferred through roots to the soil. The Synthesis Report analyzed the most recent science

with respect to each of these arguments to gain a clearer understanding of how trees on levees actually affect slope stability.

The Synthesis Report analyzed simulations, 2-D numerical simulations including early work in the 1990s, follow-up work and application of the fiber bundle model, streambank stability analyses, an ERDC model, a simulation conducted at UC Berkeley, and European models. The report also analyzed two 3-D numerical simulations, including one from ERDC. These geotechnical models can be used to assess slope stability and can be modified to include the effects of vegetation.

Results varied widely with site conditions, however "there is a strong consensus that woody vegetation significantly improves levee slope stability with respect to shallow failure planes."[464]

Trees generally increase slope stability, "except under the most unusual conditions," such as "very high winds acting on a tree at the top of a levee slope." Further, large-scale tree removal or clear-cutting on levees could lead to massive slope failures. Therefore, any large-scale removal of trees from levees should be done with caution.[465]

j. Risk Analysis

Risk is defined as the total probability of failure within a given interval of time, multiplied by expected consequence. In this context, we typically describe levee "failure" as functional, meaning that the levees have admitted enough water to the protected area to produce damage. Risk analyses are important to determine the probability of levee failure. For the purposes of levee vegetation, risk analyses are important in determining the relative risk woody vegetation poses to levees.

The Synthesis Report includes a German study, which predicted frequencies from levees overtopping and incorporated the effect of failure due to vegetation. Another study evaluated

[464] *Id*. at 10-13 – 10-14.
[465] *Id*. At 10-14.

levee failure probability for several Sacramento area levees. This study found that vegetation effects on total composite failure ranged from less than 1% to 3%.

The Synthesis Report also included a review of a large database of CA levee performance records. The review indicated no documented influence of levee vegetation on any known breaches. The review also found that vegetation had either a documented or perceived influence on levee performance in only 16 out of 7,424 records. The Synthesis Report also includes the Delta Risk Management Strategy (DRMS), which computed probabilities of failure of Delta levees. DRMS demonstrated that the probability of levee failure due to seismic events is far greater than for failures caused by vegetation-related processes.

Results indicated that the probability of vegetation affecting levees and leading to failure is small compared to that of other sources. However, more work is required to accurately quantify these effects in a comparative risk analysis.

k. Flood Fighting

Flood-fighting requires levee embankments to be intensively monitored for signs of leakage, overtopping, erosion, or other forms of distress. If imminent problems arise, personnel, material, and equipment must be rapidly deployed for temporary erosion protection, to control seepage, to raise levees, or to build temporary flood protection structures. USACE policies state that vegetation restricts levee access and visibility during floodfighting activities. The Synthesis Report analyzes data to ascertain whether and to what extent vegetation impedes floodfighting activities.

The author notes that, "there is almost no literature dealing with the effects on flood-fighting activities of trees and shrubs growing on or near levees."[466] Thus, much of the information used in this section of the Synthesis Report came from transcripts from the 2007 and 2012 Levee Vegetation Research Symposia.

Woody vegetation can act as a visual barrier, or can complicate emergency activities by requiring additional vegetation removal during floodfighting activities. However, at least 3

[466] *Id*. at 12-4.

engineers with floodfighting records noted they never personally witnessed significant adverse impacts from woody vegetation on floodfighting. Trees near levees can aid floodfighting by serving as source of brush for temporary structures or making soft, moist soils more trafficable. Waterside trees protruding above water help show conditions below the surface that flood-fighters might not otherwise see.

Participants of the 2007 and 2012 Symposia generally felt that woody vegetation did not adversely impact floodfighting activities. However, the Synthesis Report noted that there is still a need for additional studies and surveys on the subject of vegetation influencing floodfighting activities.

l. Inspection

Federal regulations require regular inspection of levees to detect flaws, such as erosion, slumping, or other signs of distress. One major rationale for prohibiting woody vegetation on or immediately adjacent to levees is its impact on visibility and accessibility for inspections. The Synthesis Report aimed to ascertain whether and to what extent woody vegetation impedes levee inspections.

No scientific research exists regarding vegetation effects on routine levee inspections. Maintenance guidance documents suggest that walking inspections may be preferable to driving in areas of dense wooded vegetation, which may be more labor intensive and have a higher associated cost. Other approaches to inspections could include a cleared viewing corridor, cluster methods of vegetation placement, selecting of appropriate vegetation, and pruning strategies. The State of California's vegetation management guidelines for levees in 2007 provided DWR's interim levee vegetation inspection criteria. These criteria prescribed pruning and thinning of vegetation to maintain visibility corridors.

The author presented the above creative solutions to deal with problems posed by woody vegetation on levee inspections, but acknowledged the lack of data or surveys to provide empirical evidence of these issues. Therefore, there is a recognized need for additional research on this subject.

m. Levee Design

There have been experimental designs to attempt to counter key concerns that woody vegetation can pose to levees. Among other things, these experimental designs include planting berms, the inclusion of metal or plastic materials in the levee embankment, overbuilt sections, and root barriers. Each of these levee designs are analyzed in more detail in *Part IV: Solutions*.

n. Summary and Conclusions

The Synthesis Report presented the most current, best available science on the issues of levee vegetation. The science presented in the report generally demonstrated that seismic activity and burrowing animals are significantly more detrimental to levee reliability than any other risk factor studied, and California burrowing animals tend to be associated with habitat types other than woody vegetation. Further, the risk of tree overturn due to windthrow is small in California, due to California wind conditions. There was also little evidence of decaying roots causing piping in Central Valley levees due to Central Valley soil types, and the fact that voids tend to quickly be filled by live tree roots. However, piping could result following mass clear cutting of trees.

Vegetation can mitigate the effects of water erosion from overtopped waves or a flood surge, but woody vegetation can also promote local scour, depending on many environmental factors. Existing data shows that woody vegetation does not necessarily affect hydraulic conductivity on levee slopes. Modeling can help predict the influence of vegetation on slope stability, but current models are not able to accurately predict real-world effects. Research so far indicates that woody vegetation generally helps slope stability in almost all conditions.

A better risk analysis methodology is needed to fully quantify risks posed by levee vegetation relative to other risks. However, existing risk analysis methods indicate small risks from the effects of woody vegetation on California levees as compared to other risk factors.

Currently, inspecting officials usually drive along levee tops in order to inspect the levees. Some of the inspectors voiced concerns with levee vegetation, in that it impairs their ability to visually inspect the levee. Suggestions to combat this include walking inspections or trimming trees to

allow for views under the canopy. Woody vegetation also poses potential risks to floodfighting activities, although this differs based on opinion and evidence is anecdotal. More research is needed on woody vegetation effects relative to inspections and floodfighting activities on levees.

In conclusion, levee vegetation research has made enormous strides in the past few years, stemming from the recognized need for additional research following the 2007 Levee Research Symposium. Since then, researchers in California, nationwide, and abroad have conducted field tests, modeling, and reports to better analyze the effects of woody vegetation on levees. There are still many areas where further research is needed, but California policymakers have never been more equipped to utilize state of the art scientific research in decision-making.

Attachment 1: Timeline of Federal and State Policies Regarding Vegetation Management on California Levees

- **May 1955:** United States Army Corps of Engineers ("Corps", or USACE) releases Standard Operation and Maintenance Manual for the Sacramento River Flood Control Project (USACE, revised May, 1955).
- **1958:** State of California accepts responsibility for Sacramento River Flood Control System.
- **April 1959:** USACE releases Standard Operation and Maintenance Manual for the Lower San Joaquin River Levees, Lower San Joaquin River and Tributaries Project, California (USACE, April 1959).
- **October 1996:** Water Resources Development Act (WRDA) Section 202(9) directs USACE to review vegetation management guidelines to "address regional variations in levee management and resource needs."
- **September 2001:** USACE issues Engineering Regulation 500-1-1 (ER 500-1-1).
- **August 2005:** Hurricane Katrina and levee failures in New Orleans trigger national response and attention to flood control systems nationwide.
- **February 2006:** California Governor declares state of emergency for California levee system.
- **May 2006:** California Governor signs AB 140, providing $4 Billion in bonds for levee repair and flood control; and AB 142, which appropriates $500 million from the general fund to DWR for levee evaluation and repair.
- **November 2006:** Propositions 84 and 1E pass, establishing FloodSAFE California.
- **2007:** "California Levees Roundtable" is established, creating a collaborative, group process that includes the United States Corps of Engineers, as well as State and local policy-makers.
- **2007:** National Levee Safety Act passes (WRDA 2007, Title IX—National Levee Safety Program).
- **February 2007:** United States Army Corps of Engineers conducts Nationwide levee inspection.

- **April 20, 2007:** USACE releases Final Draft White Paper: Treatment of Vegetation with Local Flood-Damage-Reduction Systems.
- **August 2007**: First research symposium on levee vegetation issues is held in Sacramento.
- **December 2007:** USACE releases Literature Review, synthesizing existing literature on levee vegetation issues.
- **2008:** Central Valley Flood Protection Act (CVFPA) passes.
- **March 2009:** California's Central Valley Flood System Improvement Framework is released.
- **April 2009**: USACE Issued Engineering Technical Letter (ETL) 1110-2-571, establishing a nationwide vegetation policy.
- **October 2009:** Public Law (PL) 84-99 **is** updated and released, establishing guidelines for federal emergency relief funding eligibility.
- **January 2010:** California Levee Vegetation Research Program (CLVRP) releases Circular No. 1: Summary of CLVRP.
- **February 2010**: USACE issues draft Policy Guidance Letter (PGL), which adopts a new variance process**:** Process for Requesting a Variance from Vegetation Standards for Levees and Floodwalls -- 75 Fed. Reg. 6364-68.
- **April 2010:** California Department of Water Resources (DWR) and California Department of Fish and Wildlife (DFW) submit extensive comments on ETL and PGL.
- **December 2010:** USACE issues: Literature Review -- Vegetation on Levees.
- **March 2011**: DWR (prepared by URS) distributes Memo on the Influence of Vegetation on Levee Past Performance, finding no instances in California of woody vegetation contributing to levee failure.
- **June 2011:** Plaintiffs file lawsuit in *Friends of the River v. United States Army Corps of Engineers,* 870 F. Supp. 2d 966 (E.D. Cal. 2012).
- **September 2011:** USACE releases the report: Initial Research into the Effects of Woody Vegetation on Levees.
- **November 2011:** USACE proposes System-Wide Improvement Framework Policy (SWIF).

- **December 2011:** CLVRP releases paper: California Levee Vegetation Research Needs/Priorities and CLVRP Circular No. 2: Summary of Research Completed to Date.
- **December 2011:** Research and Development Workshop held in Sacramento.
- **February 2012**: Draft Policy Guidance Letter: Process for Requesting a Variance from Vegetation Standards for Levees and Floodwalls (77 Fed. Reg. 9637) (PGL) is released.
- **March 2012:** 2012 Central Valley Flood Protection Plan (CVFPP) is released, establishing California's Levee Vegetation Management Strategy.
- **May 2012:** Plaintiffs file complaint in *California Department of Fish and Game v. United States Army Corps of Engineers,* 2:12-at-00745 (E.D. Cal. Filed May 22, 2012).
- **August 2012**: Second symposium on levee vegetation issues is held in Sacramento: Levee Vegetation Research Symposium 2012.
- **January 2014:** CLVRP Studies are released - Vol 1: Review of Literature and Case Histories; Vol. 2 & 3: descriptions and data from two field seepage experiments; Vol. 4: results of study of burrowing mammal activity; Vol. 5: geometries of openings caused by roots or animal burrows on piping or seepage-induced slope failure; Vol. 6: results of analyses of influence of tree roots on levee embankment stability.
- **April 2014**: USACE issues new ETL, clarifying and updating previous ETL (ETL 1110-2-583 Guidelines for Landscape Planting and Vegetation Management at Levees, Floodwalls, Embankment Dams, and Appurtenant Structures).
- **June 2014**: Congress enacts and signs into law Water Resources Reform and Development Act of 2014 (WRRDA).
- **July 2014:** USACE issues Engineer Circular (EC) 1165-2-216, clarifying use of Rivers and Harbors Act/Section 408.
- **August 2014:** CLVRP releases Circular No. 3: New Research and Steps.
- **March 2016:** CLVRP issues Synthesis of Levee Vegetation Research Results, a report synthesizing the most current global research, models and studies on levee vegetation issues.

Attachment 2: Defining Levee Terminology

A levee is a manmade structure that helps contain or control the flow of water during a flood.[467] Levees usually lie parallel to and on either side of a channel, or they encircle a protected area.[468] Levees help to protect against rising floodwaters, or temporary high waters, by confining water in a deeper floodway, preventing the water from flooding lands and properties on the landside of the levee. Levees are generally constructed from material obtained by the riverside, and the land between the levees is called the "floodway," "batture," or "foreshore."[469] Levees are typically designed to hold hydraulic loading for less than a few weeks per year. In California, levees are very narrowly situated, generally built directly on the edge of the riverbank.

A typical levee cross section consists of the embankment crown, slopes, and toes, described by their location on the landside or riverside of the levee.

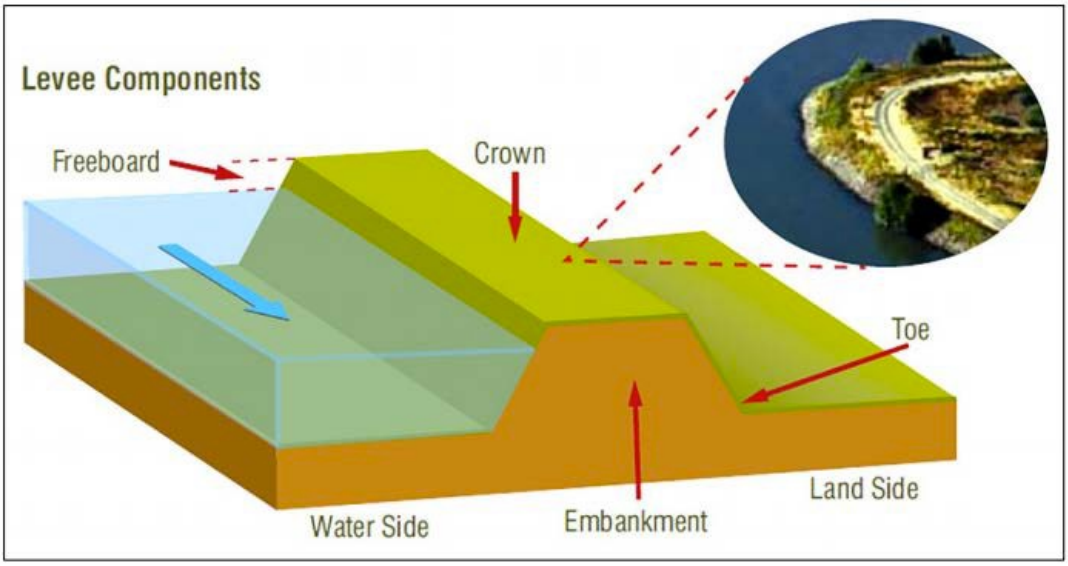

Figure 24: Basic Levee Components[470]

[467] FEMA Factsheet: What is a Levee? Last updated May 18, 2016. < https://www.fema.gov/media-library/assets/documents/22951 >
[468] F. Douglas Shields, Synthesis of Levee Vegetation Research Results, prepared for CLVRP, January 2016 at 1-4. < http://www.water.ca.gov/floodsafe/leveeveg/levee_documents/2016-0127-Levee-Veg-Synthesis-Report-FINAL.pdf >
[469] Shields, 2016, 1-4.
[470] *Id*. at 1-5.

Levees tend to deteriorate over time if not properly maintained. Maintenance usually includes the removal of vegetation via mowing or burning, replanting and managing desirable vegetation, controlling unwanted animals, filling animal burrows, and repairing damaged areas.[471] Damaged areas could be caused by erosion from wave wash or currents, underseepage, through-seepage, animal burrows, ruts, foot traffic by animals or humans, and slips or slides.[472] Maintenance can also involve upkeep of access through roads and ramps, upkeep of appurtenant structures, and stockpiles of emergency construction materials.[473]

Levees tend to fail during high-water periods. Failure mechanisms include overtopping, breaching, seepage, and slumping.[474] A breach usually refers to a situation where part of the levee itself breaks, creating a hole in a segment of the levee and allowing water to flow freely to the landside. Overtopping refers to a situation where water passes over the top of the levee, often causing erosion that eventually leads to a levee breach. Through-seepage can also lead to levee failure by triggering subsurface internal erosion, and can even form continuous voids or pipes within the levee, which progressively enlarge until a segment of levee washes out completely.[475] Through-seepage is usually initiated with cracks or macropores[476], although existing cracks or macropores are not necessary to trigger seepage failures.[477]

Underseepage is the passage of water below the levee, often manifested by localized upwellings or sand boils on the landside. Sand boils occur when groundwater has welled up through a bed of sand to the other side. In situations like this, the soils under the levee can become fluid and levee failure can be very rapid.[478]

Slope instability is characterized by the slope surface of the levee slumping or collapsing, and is often characterized by seepage patterns causing embankment pressure.[479]

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[471] Shields, 2016, 1-4.
[472] Shields, 2016, 1-4.
[473] Shields, 2016, 1-4.
[474] Shields, 2016, 1-4; American Society of Civil Engineers, 2010, Figure 1-2.
[475] Shields, 2016, 1-5.
[476] Holes or cavities larger than about 0.08 millimeter
[477] Shields, 2016, 1-5.
[478] Shields, 2016, 1-6.
[479] Shields, 2016, 1-6.

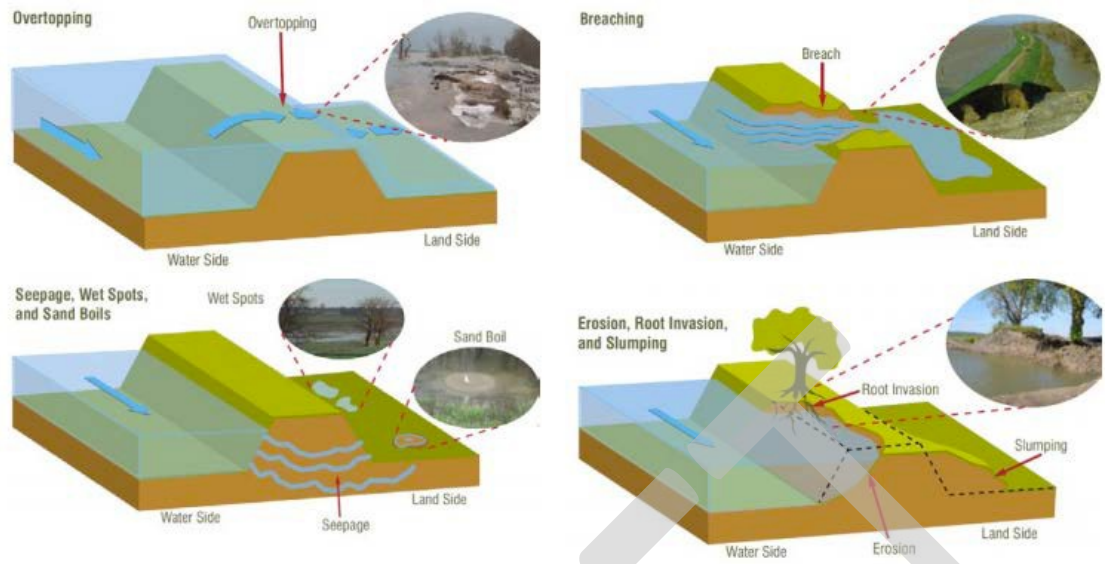

Figure 25: Levee Failure Modes[480]

Levee failures are usually caused by a combination of the aforementioned forces, with one form of failure causing or contributing to another.[481]

[480] *Id*. at 1-6.
[481] Shields, 2016, 1-6.