Meeting of the Central Valley Flood Protection Board
March 8, 2013

Staff Report – Transmittal of Reclamation District 1000's Letter of Intent for a System-Wide Improvement Framework to the U.S. Army Corps of Engineers

Sacramento and Sutter Counties

1.0 – ITEM

Consider authorizing the Executive Officer to send a letter to the U.S. Army Corps of Engineers (USACE) transmitting a Letter of Intent (LOI) for a System-Wide Improvement Framework (SWIF) prepared by Reclamation District 1000 (RD 1000) for the RD 1000 Natomas Levee System as defined by the USACE's Periodic Inspection dated January 2010.

2.0 – LOCATION

The RD1000 Natomas Levee System is located in Sacramento and Sutter Counties and partly within the City of Sacramento. The levee system is bounded in the north by the Natomas Cross Canal and the Pleasant Grove Creek Canal, in the east by the Natomas East Main Drainage Canal (NEMDC), in the south by the American River, and in the west by the Sacramento River.

3.0 – AGENCY

RD 1000 is the regional flood control agency of the levee system. The agency has responsibility for the maintenance of the levee system, and plays a key role in planning, coordinating, and implementing flood risk reduction activities within the levee system. RD 1000, as a member agency of the Sacramento Area Flood Control Agency (SAFCA) and in partnership with DWR, has undertaken significant levee improvements to the Natomas levee system as part of the Natomas Levee Improvement Program (NLIP). RD 1000 will be taking the lead in developing a SWIF plan with the support and assistance of SAFCA, DWR, and CVFPB, as well as collaboration with the USACE, environmental and historical resource agencies, the City of Sacramento, and Sutter and Sacramento Counties.

4.0 – USACE PERIODIC INSPECTION

In January 2010 the USACE performed a Periodic Inspection (PI) of the RD 1000 Natomas Levee System. PIs are conducted to verify proper operation and maintenance, evaluate operational adequacy and structural stability, identify features to monitor over time, and improve the ability to communicate the overall condition. The Periodic Inspection Report produced by the USACE for RD 1000 Natomas determined that the levee system was "Unacceptable," which, upon the expiration of the California's Central Valley Flood System Improvement Framework, resulted in "Inactive" status for USACE Public Law 84-99 Rehabilitation and Inspection Program (RIP) assistance.

5.0 – PURPOSE OF THE LOI AND SWIF

USACE approval of this LOI will allow RD 1000 to move forward with the preparation of a SWIF, while implementing the approved vegetation variance (see Attachment 4) concurrent with making improvements that address system-wide issues and correct unacceptable inspection items in a prioritized manner to optimize flood risk reduction. RD 1000 is requesting a two-year period to develop a SWIF.

If the SWIF is accepted by the USACE, the RD 1000 Natomas levee system will retain eligibility for RIP while the local levee maintainers perform the work described in the SWIF.

6.0 – STAFF RECOMMENDATION

As agreed to in the initial operations and maintenance assurances to the USACE, the CVFPB serves as the non-federal sponsor for all of the State-federal project levees within the jurisdiction of the Sacramento-San Joaquin Drainage District, including the RD 1000 Natomas levee system. In this capacity, it is the CVFPB's responsibility to transmit the LOI and subsequent SWIF to the USACE on behalf of the local maintaining agency.

Staff has reviewed the LOI (see Attachment 2) submitted by RD 1000 and finds that it adequately addresses the six requirements for submitting a LOI for a SWIF as described in the USACE's November 29, 2011 Policy for Development and Implementation of System-Wide Improvement Frameworks (SWIFs) (see Attachment 3).

RD 1000 has obtained final approval from its Board to submit the LOI. In order to submit the LOI as soon as possible, RD 1000 has requested that the CVFPB authorize the Executive Officer to transmit the finalized and signed LOI, included in this staff report. Staff agrees with this request and is recommending that the CVFPB authorize the Executive Officer to finalize a letter of transmittal to the USACE and forward it with the signed LOI to the USACE.

7.0 – ATTACHMENTS

1. Draft Letter of Transmittal to USACE
2. Letter of Intent Prepared by RD 1000
3. Excerpt from USACE Policy for Development and Implementation of System-Wide Improvement Frameworks
4. RD 1000 Vegetation Variance

STATE OF CALIFORNIA – CALIFORNIA NATURAL RESOURCES AGENCY **EDMUND G. BROWN JR.,** GOVERNOR

CENTRAL VALLEY FLOOD PROTECTION BOARD
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March 7, 2013

Colonel William J. Leady
District Commander
U.S. Army Corps of Engineers
1325 J Street
Sacramento, California 95814

Subject: Reclamation District 1000 Natomas Levee System - Letter of Intent (LOI) for Developing and Implementing a System-Wide Improvement Framework (SWIF) Plan

Colonel Leady:

The Central Valley Flood Protection Board (CVFPB) wishes to notify USACE by this letter that the Reclamation District 1000 (RD 1000) intends to develop and implement a System-Wide Improvement Framework (SWIF) plan in order for their levee system to retain eligibility for rehabilitation assistance authorized under Public Law 84-99.

The system's levees were originally constructed by RD 1000 and the Natomas Company and maintained by RD 1000. Several improvements and remedial measures to bring the levees up to Federal standards were implemented over the course of the levee's existence, but due to the less rigorous encroachment permitting standards of the past, some areas of the levee system received unacceptable ratings in USACE's recent periodic inspection reports.

USACE approval of this LOI will allow RD 1000 to move forward with the preparation of a SWIF, while implementing the approved vegetation variance concurrent with making improvements that address system-wide issues and correct unacceptable inspection items in a prioritized manner to optimize flood risk reduction. RD 1000 is requesting a two-year period to develop a SWIF. The attached information supports this notification.

We respectfully submit this Letter of Intent on behalf of RD 1000 in accordance with the USACE's *Policy for Development and Implementation of System-Wide Improvement Frameworks* and request a two-year extension of eligibility for P.L. 84-99 rehabilitation assistance for the RD 1000 Natomas levee system while RD 1000 develops and implements a SWIF. Following approval of this Letter of Intent, RD 1000 will commence efforts to develop a SWIF for USACE approval.

Sincerely,

Jay S. Punia
Executive Officer

RD1000

RECLAMATION
DISTRICT 1000

February 21, 2013

Bill Edgar, President
Central Valley Flood Protection Board
3310 El Camino Avenue
Room 151
Sacramento, California 95821

Subject: Reclamation District No. 1000--Letter of Intent for System-Wide Improvement Framework

Dear Mr. Edgar,

As the local maintaining agency, Reclamation District (RD) 1000 is submitting this System-Wide Improvement Framework (SWIF) Letter of Intent (LOI) for the RD1000 - Natomas levee system. We request you forward our LOI to the U.S. Army Corps of Engineers (USACE) Sacramento District as the non-Federal sponsor.

The RD 1000 SWIF will address system-wide issues, including correction of unacceptable inspection items, in a prioritized way to optimize flood risk reduction. The attached supplemental information includes the required information to support this request.

Sincerely,

Paul T. Devereux
General Manager/District Engineer

Enclosures

cc Rick Johnson (SAFCA)
Colonel Leady (Corps of Engineers—Sacramento District)

1633 GARDEN HIGHWAY
SACRAMENTO, CA 95833
916-922-1449

SUPPLEMENTAL INFORMATION SUPPORTING RD 1000 SWIF LETTER OF INTENT

Introduction

The Central Valley Flood Protection Board (CVFPB) is submitting this System-wide Improvement Framework (SWIF) Letter of Intent (LOI) on behalf of Reclamation District (RD) 1000 for reinstatement of the RD 1000 - Natomas levee system (Natomas levee system) in the P.L. 84-99 Rehabilitation and Inspection Program (RIP) while developing a SWIF. This attachment describes levee system deficiencies and system-wide issues that will be addressed under the SWIF. The RD 1000 Natomas levee system is currently inactive in the RIP; however RD 1000 and the CVFPB have requested a reinspection which would change the systems status in the RIP to active.

The U.S. Army Corps of Engineers (USACE) Sacramento District issued a Periodic Inspection report in September 2010. Under terms of the California Central Valley Flood System Improvement Framework, while unacceptable items (i.e., encroachments, erosion/bank caving, and vegetation) were identified during the periodic inspection, the system remained eligible for PL 84-99 RIP assistance. Upon the Central Valley Flood System Improvement Framework (Framework) expiration with the CVFPB's adoption of the Central Valley Flood Protection Plan, the system's eligibility was changed from active to inactive in August 2012.

Since 2010, RD 1000, actively working with the CVFPB and in coordination with the USACE Sacramento District, has taken actions to address unacceptable items identified in the 2010 Periodic Inspection report including addressing all items that were likely to prevent the system from performing in the next flood event. Despite these efforts, there a number of unacceptable items which need to be addressed over a longer period due to financial constraints, as well as property rights and encroachment permit issues.

Additionally, since 2007, the Sacramento Area Flood Control Agency (SAFCA), (which RD 1000 is a member agency), the CVFPB, and the State of California Department of Water Resources (DWR) have undertaken significant levee improvements to the Natomas levee system as part of the Natomas Levee Improvement Program. Collectively, these agencies have funded over $410 million for improvements to 18 miles of levee in an effort to reduce risk while waiting for Federal participation under the American River Common Features project.

Lastly, USACE, in partnership with CVFPB, DWR, and SAFCA have proposed improvements (herein referred to as Federal project) to the Natomas levee system as described in the *Post Authorization Change and Interim General Reevaluation Report for the American River Common Features Project, Natomas Basin, Sutter and Sacramento Counties California, June 2010* (Natomas PACR) which USACE has transmitted to Congress for authorization.

1.0 Levee System and Segment Identification and Description

1.1 Levee System and Segment Identification

The levee system covered by this LOI, and which will be included in the SWIF, is the Natomas levee system (NLD System ID: 5205000923). It is comprised of five segments as described in the

table below. The CVFPB is the non-Federal sponsor for this system; RD 1000 is the local maintaining agency. Figure 1 presents the location of the segments and the system.

Table 1.1 Levee System and Segment Identification

Levee System Name and ID Number	NLD Segment Name	NLD Segment ID Number	Latest Inspection Date and Type	Rating*
RD 1000 – Natomas Levee System NLD System ID: 5205000923	RD 1000 – Natomas – Unit 1, Sacramento River	5205000911	Periodic, January 2010	U
	RD 1000 – Natomas – Unit 2, American River	5205000912	Periodic, January 2010	MA
	RD 1000 – Natomas – Unit 3 South, Natomas East Main Drainage Canal	5205000913	Periodic, January 2010	U
	RD 1000 – Natomas – Unit 3 North, Cross Canal Inflow	5205000914	Periodic, January 2010	MA
	RD 1000 – Natomas – Unit 4, Natomas Cross Canal	5205000915	Periodic, January 2010	U

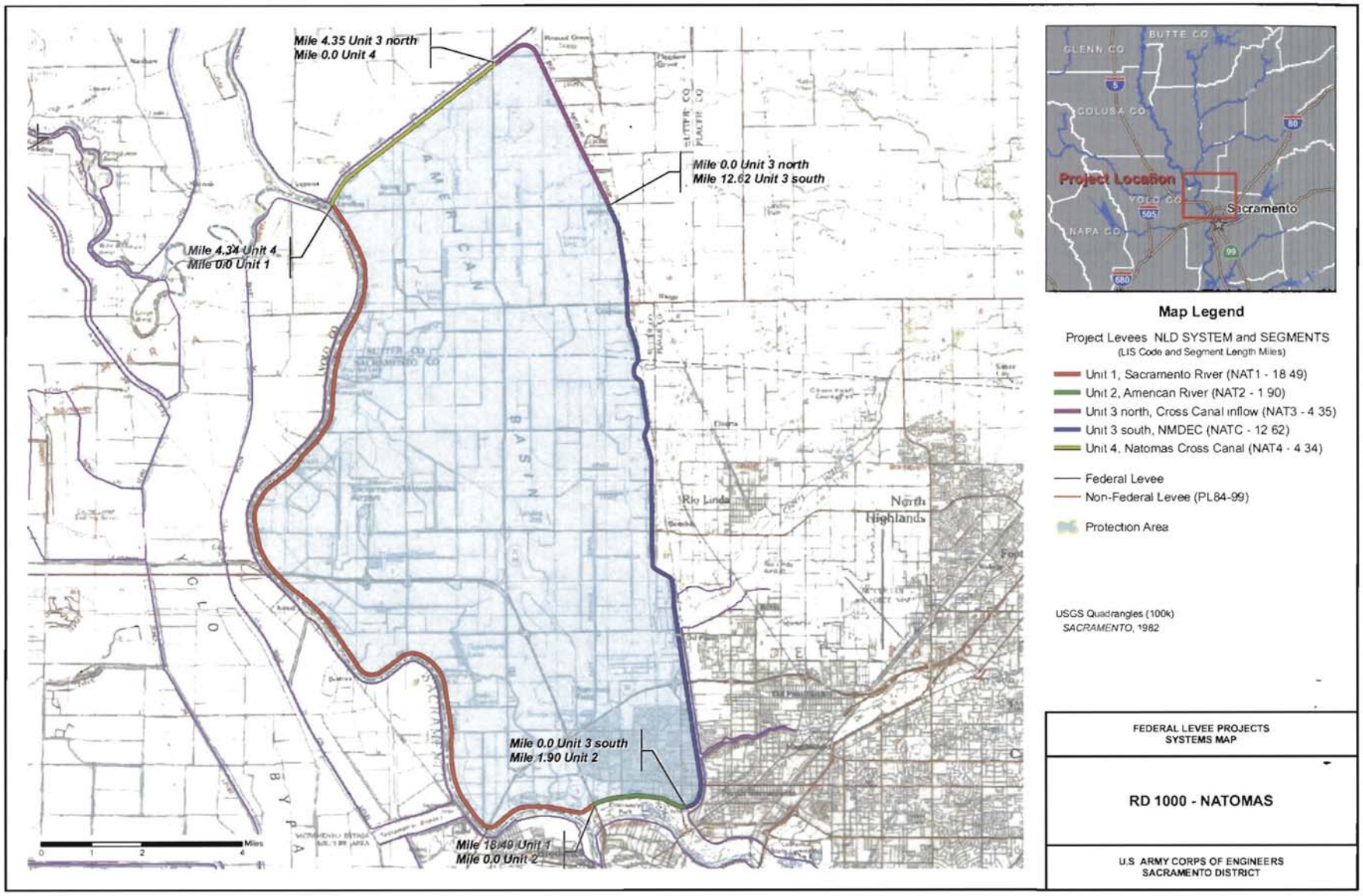
* U – Unacceptable; MA – Minimally Acceptable

1.2 System and Segment Description

The RD 1000 Natomas system of levees consists of four Units, made up of five segments (Unit 1, Unit 2, Unit 3 South, Unit 3 North, and Unit 4). It is located within Sacramento and Sutter Counties, and partly within the City of Sacramento, California.

Table 1.2 Description of Segments in the RD 1000 – Natomas Levee System

Segment	River/ Channel	Levee Length (Miles)	Description	Location (Levee Miles)
Unit 1	Sacramento	18.28	Located on the east (left) bank of the Sacramento River, beginning at the Natomas Cross Canal and extending south to the confluence of the American River	0.00 to 18.49
Unit 2	American	2.31	Located on the north (right) bank of the American River	0.00 to 1.90
Unit 3, South	NEMDC	12.61	Located on the west (right) bank of Natomas East Main Drainage Canal	0.00 to 12.62
Unit 3, North	Cross Canal	4.35	Located on the west (left) bank of Pleasant Grove Creek Canal	0.00 to 4.35
Unit 4	Natomas Cross Canal	4.34	Located on the south (left) bank of the Natomas Cross Canal	0.00 to 4.34


Mile 4.35 Unit 3 north
Mile 0.0 Unit 4
Mile 0.0 Unit 3 north
Mile 12.62 Unit 3 south
Mile 4.34 Unit 4
Mile 0.0 Unit 1
Mile 0.0 Unit 3 south
Mile 1.90 Unit 2
Mile 18.49 Unit 1
Mile 0.0 Unit 2
Rio Linda
North Highlands
Miles
BUTTE CO
GLENN CO
COLUSA CO
Project Location
Sacramento
NAPA CO
Map Legend
Project Levees NLD SYSTEM and SEGMENTS
(LIS Code and Segment Length Miles)
Unit 1, Sacramento River (NAT1 - 18 49)
Unit 2, American River (NAT2 - 1 90)
Unit 3 north, Cross Canal inflow (NAT3 - 4 35)
Unit 3 south, NMDEC (NATC - 12 62)
Unit 4, Natomas Cross Canal (NAT4 - 4 34)
Federal Levee
Non-Federal Levee (PL84-99)
Protection Area
USGS Quadrangles (100k)
SACRAMENTO, 1982
FEDERAL LEVEE PROJECTS
SYSTEMS MAP
RD 1000 - NATOMAS
U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT

1.3 Construction History

Construction of the Natomas levee system began in 1911 by RD 1000 working with the Natomas Company and was largely completed by 1915. During the late 1950's, portions of the system were improved to bring the levees up to Federal standards prior to being turned over to the State of California (State) in 1958. Several improvements and remedial measures were implemented between 1958 and 2007, but none as comprehensive as those proposed under the Natomas Levee Improvement Program being implemented now by SAFCA and the State.

Since 2007, approximately 18 miles of levee along the Natomas Cross Canal and Sacramento River have been remediated for structural deficiencies while also addressing most of the encroachment, real estate, access and vegetation issues along those levees. The completed work addressed the areas of highest risk based on the geotechnical data and historical performance of the levees consistent with the SWIF philosophy of addressing the worst first. Specifically, this construction work consisted of cutoff walls, seepage berms, and construction of an adjacent levee.

Concurrently with the Natomas Levee Improvement Program, USACE completed a Chief's Report for the Natomas portion of the PACR in December 2010, and is awaiting Congressional authorization. This authorization and subsequent appropriation would result in major construction to the remainder of the levees in the system.

1.4 Population and Industry at Risk

The RD 1000 – Natomas levee system encompasses 53,484 acres. The area is comprised of both extensive residential development, primarily occupying the southern one-third of the basin and agricultural lands. The Natomas Basin is occupied by more than 100,000 residents, numerous schools, businesses and Sacramento International Airport and contains $8.2 billion in damageable property.

2.0 Description of Deficiencies and Justification of SWIF approach

2.1 Description of Deficiencies

The Sacramento District identified three unacceptable deficiency categories in its periodic inspection: vegetation, encroachments, and erosion/bank caving. Table 2.1 summarizes the unacceptable ratings from the original Periodic Inspection by levee unit. While vegetation was rated unacceptable, it was not considered likely to prevent the system from performing in the next flood event, and therefore did not contribute to a system rating of unacceptable. Encroachments in Unit 1, and erosion/bank caving in Units 1, 3 North and 4, considered to prevent the system from performing in the next flood event, lead to the unacceptable and inactive system rating.

RD 1000 addressed the areas of erosion and bank caving identified by the Sacramento District as part of their routine operations and maintenance. Further, RD 1000 and the CVFPB have worked with the landowner in Unit 1 to remove the encroachment (container box cut into the levee prism). Thus, all unacceptable items likely to prevent the system from performing in the next flood event were corrected. Documentation of the remediation done by RD 1000 was provided to the CVFPB and USACE Sacramento District. RD 1000 and the CVFPB staff anticipate the Sacramento

District will reflect these corrections in their records once it follows up on our January 8, 2013 re-inspection request.

Vegetation was rated as unacceptable in all five segments. During the time of the periodic inspection report development, SAFCA sought a vegetation variance for most of the Natomas Basin waterside vegetation. Subsequent to finalization of the report, USACE Headquarters approved a variance for much of the Natomas levee system. Unit 1, Unit 2, a portion of Unit 3 South (LM 0.0 to 0.3), and Unit 4 were included in this variance approval. Unit 3 North and Unit 3 South above LM 4.4 have no waterside vegetation and did not require a variance. LM 0.3 – 4.4 of Unit 3 South was not approved for a variance, but the removal of problem vegetation (23 trees) and mitigation has been included in the federal project or alternatively could be handled through the SWIF.

Notwithstanding the variance and corrections made by RD 1000, some unacceptable vegetation will remain in a portion of Unit 3 South as noted above and some unacceptable encroachments will remain in all five segments. However, these conditions are not likely to prevent the system from performing in the next flood event. As part of the SWIF, RD 1000 and SAFCA in coordination with the CVFPB will present a plan for addressing the vegetation in light of complex environmental issues related to endangered species and permitting and compliance requirements for encroachments because of complex property rights issues.

Lastly, although not impacting status in the RIP, USACE, DWR, and SAFCA have undertaken studies to compare the existing condition and design of the levee to current standard. These studies indicate that reaches of the levees do not meet current standards for through- and under-seepage, slope stability, and levee height. As mentioned previously, SAFCA has led a capital improvements program (i.e., the Natomas Levee Improvement Program) to address these deficiencies and has been successful in upgrading 18 miles of levee since 2007. However, upgrades remain necessary in other reaches, and these upgrades are likely to be implemented by the Federal project which is currently awaiting Congressional authorization and appropriations.

Table 2.1 Periodic Inspection Segment Ratings* by

Deficiency	RD 1000 - Natomas Levee System				
	Unit 1	Unit 2	Unit 3 South	Unit 3 North	Unit 4
Item 1, Vegetation Growth	U	U	U	U	U
Item 3, Encroachments	U	U	U	U	U
Item 6, Erosion/Bank Caving	U	M	M	U	U

* The table does not include deficiencies where there were no unacceptable ratings reported.
U – Unacceptable; MA – Minimally Acceptable

2.2 Justification of SWIF Approach

Given the complexity of resolving the encroachment deficiencies due to property rights and permitting issues, and the complexities in resolving vegetation issues due to endangered species

habitats and permitting, such efforts would be best completed through a SWIF process. RD 1000, SAFCA, in coordination with the CVFPB will take a worst-first prioritized approach with the overall goal of correcting outstanding deficiencies to bring the system into compliance with the project Operations and Maintenance Manual in accordance with the assurances the CVFPB has provided. The Operations and Maintenance Manual for the SRFCP includes the following language due to conditions peculiar to this area:

> "Brush and small trees may be retained on the waterward 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 growths on areas riverward of the levees."

Further, and as mentioned above, USACE Headquarters approved a vegetation variance for much of the Natomas levee system in 2010. The November 29, 2011, SWIF policy states that one purpose of a SWIF is to assist levee sponsors in attaining compliance with USACE standards. Under the assurances provided for the SRFCP, the sponsor will maintain to the standard that USACE has directed in the Operations and Maintenance Manual and approved vegetation variance.

The first priority, and the most comprehensive, is implementation of the Federal project. Construction of the Federal project will address the Natomas levee system's remaining structural deficiencies and most of the system's vegetation and encroachment issues. Waterside vegetation issues would be addressed largely by a landward expansion of the levee system in areas where such vegetation is in conflict with USACE policy. USACE has concluded that this design will result in sufficiently large (or "overbuilt") levee sections to warrant a variance from the requirement to remove existing waterside vegetation as part of the structural improvement program. The design will also result in the removal of trees currently located along the landside of the affected levee sections in order to accommodate landward expansions. Lastly, the design calls for removing, or acceptably modifying, all major encroachments within the footprint of the improved levee system. In preparation for the Federal project, RD 1000 and SAFCA are coordinating with Sacramento District and CVFPB staff to review many of the unacceptable encroachments and determine reasonable steps RD 1000 can now take to address the encroachments, given legal and financial constraints.

Thus, the deficiencies remaining would include a relatively small number of encroachments and establishing a unique, system-specific approach to dealing with future encroachments and vegetation to improve access and operations and maintenance activities. RD 1000, SAFCA, and the CVFPB do not intend to wait for the Federal project to begin development of such an approach, and have in fact already begun its development.

We understand implementation of the Federal project is contingent upon Congressional authorization of the Natomas PACR and future Federal appropriations. The Chief's Report recommending authorization is currently awaiting action. Congress has initiated a Water Resources Development Act (WRDA) in 2013. In addition, legislation has been introduced in both the House and Senate which would authorize the Natomas PACR and is actively supported by RD 1000 and SAFCA. Given the flood risk and potential damages in Natomas, the work done to date by the State and SAFCA, and community support demonstrated for the project we believe it reasonable to assume the Federal project will be authorized and implemented over time. However, should Congress fail to authorize the project, it is the intent of RD 1000 and SAFCA in coordination with the CVFPB to develop a modified approach over the next two years as part of the SWIF process with USACE.

3.0 Demonstration of Funding Commitments

Since 2007, SAFCA, of which RD 1000 is a member agency, and the State have spent over $410 million to provide levee upgrades to 18 miles of levee in the Natomas Basin under the Natomas Levee Improvement Program clearly demonstrating a history of commitment to funding necessary levee improvements. This funding was provided by the State through Proposition 1E State Flood Control Bond funds and locally matched with funds from SAFCA obtained through voter-approved assessments. As presented in Table 5-7 of the Natomas PACR, the adjusted non-Federal cost share for the remaining work, considering credit for work completed to date, is approximately $4.3M. SAFCA and the CVFPB would use, and currently have in place, funding to meet this share.

In addition to the capital improvements for the Natomas Levee Improvement Program, RD 1000 has an annual operations and maintenance budget of over $3.0 million raised by a special benefit assessment on properties in Natomas. This annual budget is used to address many of the on-going items associated with operation and maintenance of the levee system including erosion, bank caving, burrowing animals, visibility, access, and vegetation management. A portion of the annual budget could also be used to correct any remaining encroachment and vegetation issues following implementation of the Federal project.

4.0 Interim Risk Reduction Measures

RD 1000 is currently implementing interim risk reduction measures and will be preparing an Interim Risk Reduction Measures Plan (IRRMP) as part of the SWIF. The IRRMP will include a combination of emergency response plans, communication and coordination with the property owners and evacuation planners (City and Counties), as well as capital improvements to reduce the flood risk in specific areas of concern.

RD 1000 has an adopted Flood Emergency Response Plan that was previously submitted to the CVFPB. As part of implementing the Natomas Levee Improvement Program, they have been working closely with SAFCA and their geotechnical consultants to identify areas of special concern based on geotechnical analysis combined with historical observations of levee performance during high water events. Based on this information, RD 1000 has modified their levee patrol criteria and frequency in areas of concern as part of the Flood Emergency Response Plan.

RD 1000 has also been coordinating with City and County emergency managers to improve communication and evacuation planning. They are signatories to the Sacramento County Public Works Mutual Aid Agreement, and have executed a similar agreement with the City of Sacramento to ensure adequate resources to monitor the system and respond to a flood emergency. There have been community meetings and events in Natomas hosted by the City and County which included participation by RD 1000 representatives to provide information to the public about emergency planning and evacuation procedures. RD 1000 has also recently initiated a comprehensive public outreach campaign to make the community aware of its flood control responsibility and to provide contact information and locations for the public to get pertinent information before and during a flood event.

In recent years, RD 1000 along with the CVFPB have increased focused communication with property owners adjacent to the levees, particularly the waterside property owners along the Sacramento River, which is the area of greatest concern for encroachments. RD 1000 recently

targeted properties with vegetation encroaching onto the Garden Highway (levee crown) impacting visibility of the levee slope and adjacent area. In recent years, there has been significant improvement in this area in response to the notices and communications. RD 1000's efforts to address this area of concern will continue in combination with the CVFPB's enhanced enforcement efforts as further part of our collective interim risk reduction measures.

In addition to these non-structural measures, a number of efforts have been completed, or are underway, to reduce the flood risk on an interim basis through structural improvements. Besides the Natomas Levee Improvement Program work described above, SAFCA, CVFPB, and USACE are constructing improvements at Folsom Dam which, when completed, will reduce peak flows in the American River during large flood events. In addition, USACE recently completed jet grouting work as part of the American River Common Features Project at Site R1 which was a "window" left in the previous slurry wall construction along the Garden Highway adjacent to the RD 1000 office and pump station.

5.0 Interagency Collaboration

There are a number of past and current collaborative efforts relative to the Natomas levee system:

- Current effort by USACE as part of the American River Common Features GRR and previous parallel efforts by USACE on the Natomas features leading to the 2010 Chief's Report.
- Implementation of the NLIP by SAFCA, including environmental compliance, design and permitting which included close coordination with the DWR, CVFPB, USACE, and the Resource Agencies (U.S. Fish and Wildlife Service [FWS], National Marine Fisheries Service [NMFS], State Historic Preservation Office [SHPO], and California Department of Fish and Game [CDFG]).
- Post Periodic Inspection Report coordination with USACE, CVFPB and RD 1000.
- Until recently, the Levee Vegetation Roundtable efforts coordinated through the State to address vegetation and encroachments on Central Valley levees which included the USACE, State, local flood control interests, and Resource Agencies.

Completing the remaining elements of the Natomas Levee Improvement Program, which would resolve the remaining structural deficiencies and most of the system's vegetation and encroachment issues, as part of the Federal project, with local sponsorship, will require a collaborative effort among many agencies and stakeholders, including the same parties described above for the initial levee work constructed by SAFCA with State assistance.

Those encroachment, access, right of way, or vegetation items which are not addressed through implementation of the Federal project will be addressed by RD 1000 and SAFCA in coordination with the CVFPB, and identified in the SWIF. RD 1000 has been working with SAFCA to develop a tailored approach for addressing outstanding encroachment and vegetation issues focusing on access, visibility and structural integrity. This tailored approach will set standards for new, future encroachments and vegetation for the system. RD 1000 and SAFCA have been working with the CVFPB and USACE staff on this approach which would be incorporated into the SWIF.

Implementation of the SWIF will require collaborative planning with some or all of the following;

- RD 1000 (encroachment remediation, operations and maintenance, emergency response)
- SAFCA (levee certification, construction, encroachment remediation, right of way)
- USACE (levee standards)
- CVFPB (real property issues, permitting, compliance)
- Federal Emergency Management Agency (levee certification)
- FWS, NMFS, DFG, SHPO (environmental and historical resources)
- California DWR (funding, levee standards, coordination with State Plan of Flood Control)
- City of Sacramento, Sutter and Sacramento Counties (land use planning and regulations, emergency planning)

6.0 Anticipated Permit and Consultation Requirements

Significant consultation and subsequent permitting related to the Federal project was and will be conducted by the USACE. Compliance with these permits and agreements would be required as part of implementing the Federal project. Updates to completed consultation and permitting may be required due to design refinements and would be conducted by the USACE. Additional permitting and consultation would be required for any additional, significant projects proposed as part of the SWIF, although none are identified at this time.

For those actions remaining following implementation of the Federal project, including a relatively small number of encroachments and vegetation removal, consultation with and subsequent permits from several State and Federal agencies would be largely focused on impacts to State and federally listed species and impacts to landowners.

The California Central Valley is home to hundreds of species of wildlife and plant life including several State and federally threatened and endangered species.

Valley Elderberry Longhorn Beetle (*Desmocerus californicus dimorphus*),
Delta Green Ground Beetle (*Elaphrus viridis*),
Delta Smelt (*Hypomesus transpacificus*),
Green Sturgeon (*Acipenser medirostris*),
Central Valley Steelhead (*Oncorhynchus mykiss*),
Central Valley Spring, Late-Summer, Fall, and Winter-Run Chinook Salmon (*Oncorhynchus tshawytscha*),
California Red-Legged Frog (*Rana aurora*),
California Tiger Salamander (*Ambystoma californiense*),
Giant Garter Snake (*Thamnophis gigas*),
Fairy Shrimp (*Branchinecta lynchi*),
Swainson's Hawk (*Buteo swainsoni*),
Bank Swallow (*Riparia riparia*)

Removal of vegetation, particularly if it is riparian vegetation, and removal or modification of encroachments may impact one or more of the above listed species as well as other non-listed species. Consultation with USFWS, NMFS, and CADFG would be required in any instance where the action could impact these listed species. Vegetation removal and encroachment removal or modification may also involve actions such as alterations in the streambed or disturbance to waters of the United States and as such could require consultation and permits with CADFG and USACE.

In addition to consultation under fish and wildlife protection authorities and other environmental regulations, encroachment permitting, removal, or modification will require significant consultation between RD 1000 and CVFPB as well as individual encroachment owners and landowners. The CVFPB is responsible for enforcing encroachment permit terms and conditions and has a process in place for such enforcement. It includes research of permit and as-built records, informal coordination with easement- and land-owners, noticing, and potentially public hearings. This process can take a significant amount of time and can become litigious. Further, in some cases, encroachments pre-date the establishment of operations and maintenance regulations and/or are found in project as-builts.

7.0 Conclusion

RD 1000 and the CVFPB will continue efforts to modify and/or remove the unacceptable encroachments over time, dealing with the difficult property right and permitting issues. In addition, SAFCA and the CVFPB have indicated their intent to be non-Federal sponsors and cost-sharing partners for the remaining Natomas levee improvements when authorized by Congress. Most of the encroachment and vegetation issues to be addressed through the SWIF will be mitigated by construction of the levee improvements. Any remaining items will be addressed by RD 1000 (with assistance from SAFCA) in coordination with the CVFPB as part of the SWIF.

Although RD 1000 and the CVFPB anticipate the USACE will reinstate the RD 1000 Natomas System in the RIP as unacceptable items likely to prevent performance have been corrected or their designation amended, the CVFPB, on behalf of RD 1000, respectfully requests that the *RD 1000 – Natomas* levee system remain in active status in the P.L. 84-99 Program while a SWIF is being developed for the more complex unacceptable items which do not pose an immediate threat to performance. The CVFPB, on behalf of RD 1000, asks that this initial request be granted for two years to allow adequate time to develop a successful SWIF.

CECW-HS
SUBJECT: Policy for Development and Implementation of System-Wide Improvement Frameworks (SWIFs)

c. Transitioning "Acceptable" or "Minimally Acceptable" Levees. Levees sponsors with levees that are "Active" in the rehabilitation assistance program under an existing vegetation variance or deviation from the standard that want to use the SWIF process to transition to a new vegetation inspection standard through the vegetation variance request process, or that would like to systematically improve the condition of participating levees, may maintain their P.L. 84-99 rehabilitation assistance eligibility as long as they continue to meet the milestones set forth in their applicable SWIF.

d. Reinstating Eligibility While Developing and Implementing a SWIF. Levee sponsors that receive an overall levee system inspection rating of "Unacceptable" or have been "Inactive" in the rehabilitation program may regain eligibility for P.L. 84-99 rehabilitation assistance through the SWIF process. Upon approval by USACE of the letter of intent, requirements described below, the levee sponsor will receive an initial of up to two-year reinstatement of eligibility for P.L. 84-99 rehabilitation assistance. Continued eligibility will be determined annually based on milestones described in the subsequent SWIF. Levee sponsors who have never been eligible for rehabilitation assistance under P.L. 84-99 cannot gain P.L. 84-99 rehabilitation assistance eligibility through the SWIF process.

7. Requirements for Development and Submittal of a SWIF. The development of a SWIF is a two-step process consisting of (1) a Letter of Intent from the sponsor briefly describing levee system deficiencies and justification for how a system-wide approach will optimize flood risk reduction, and (2) development of a SWIF for addressing deficiencies and reducing flood risk. Once a Letter of Intent has been approved by USACE, a levee sponsor has up to two years to develop a SWIF plan. Eligibility after this two-year period will be dependent on the levee sponsor's progress in achieving the milestones defined in the SWIF. The SWIF plan is intended to be a specific document that guides sponsor activities, including anticipated milestones, but may also be adaptable and should be revised if conditions or needs change during implementation. The requirements for the Letter of Intent and SWIF are described as follows:

a. Requirements for Submitting a Letter of Intent for a SWIF. A Letter of Intent must be signed by all associated levee sponsors for each levee system involved in developing the SWIF and must include the following:

(1) Identification of levee system or systems to be covered by the SWIF, including system name and system identification number as listed in the National Levee Database;

(2) Brief description of deficiencies or issues that will be included in the SWIF and discussion of how a system-wide approach will improve and optimize overall flood risk reduction. This includes identifying any conditions not within the control of the levee sponsor(s) that prevents them from correcting "Unacceptable" inspection items in a timely manner;

(3) Demonstration that significant non-federal resources have been, or will be, committed for developing and/or implementing the SWIF (e.g., state legislative action, bond financing);

(4) Anticipated interim risk reduction measures that will be implemented throughout the SWIF process, including overall risk communication approach that addresses the risk to life increased by system-wide deficiencies;

(5) Brief description of existing or planned interagency collaborative efforts that will contribute positively to SWIF development, implementation and oversight; and

(6) List of anticipated state and federal permits and consultation requirements, needed to implement the SWIF.

b. Requirements for Submittal of a SWIF. SWIFs are developed and implemented by levee sponsor(s), reviewed and accepted by USACE, and monitored by a USACE district to address system-wide issues in a prioritized way to optimize system-wide risk reduction. As a minimum for acceptance by USACE, the levee sponsor's SWIF must include the following:

(1) Identification of levee system or systems covered by the system-wide improvement framework, including system name and identification number as listed in the National Levee Database;

(2) Description of proposed levee improvement and justification on how the SWIF optimizes flood risk reduction;

(3) A plan and schedule for interagency collaboration, including environmental and/or Tribal consultation if applicable, in the implementation of the SWIF;

(4) Documentation of specific agreements, such as project specific agreements, between levee sponsors and USACE or other agencies/organizations related to implementation of levee modifications, under Section 408 or other overlapping USACE policies and studies, applicable to the levee systems identified in the system-wide improvement framework;

(5) Documentation of any regional considerations, approaches, and tools to be used during implementation of the system-wide improvement framework;

(6) Description of interim maintenance standards that will be implemented during the SWIF to mitigate conditions of uncorrected "Unacceptable" inspection items;

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS
441 G STREET, NW
WASHINGTON, DC 20314-1000

REPLY TO
ATTENTION OF

JUN 17 2010

CEMP-SPD

MEMORANDUM FOR Commander, South Pacific Division (CESPD-PDC)

SUBJECT: Central Valley Flood Protection Board, Vegetation Variance Request for the American River Watershed, California, Common Features (Natomas Basin) Project, Post-Authorization Change Report

1. Reference: Memorandum, CECW-CE, subject as above, dated 16 June 2010, attached.

2. As indicated in the referenced memorandum, the vegetation variance requested by the Central Valley Flood Protection Board and Sacramento Area Flood Control Agency, and recommended by the Sacramento District (SPK) and South Pacific Division, has been approved for all reaches except for the reach on Plate 22. The enclosed memorandum provides a detailed explanation for this decision.

3. It is understood that SPK has already initiated consultation with NMFS to develop conservation measures for the Plate 22 reach to ensure no net loss of habitat or species, while meeting levee safety standards. Appropriate changes reflecting this variance approval decision and conditions will be included in the draft Natomas Post-Authorization Change Report (NPACR) and draft Environmental Impact Statement (EIS) and further evaluation will be performed such that a selected option with a Biological Opinion can be included in the final NPACR and EIS.

4. The collaborative solutions associated with this vegetation variance request demonstrate consistent and successful implementation of the partnerships and agreements of the California's Central Valley Flood System Improvement Framework. We recognize the complexities of the situation and look forward to further collaboration at all levels as we work through the Framework and beyond.

5. Please direct questions about this memorandum to Ms. Ada Benavides, Deputy Chief for Civil Works, South Pacific Division Regional Integration Team, 202-761-0415.

Encl

SCOTT L. WHITEFORD
Chief, SPD-Regional Integration Team
Directorate of Military Programs

DEPARTMENT OF THE ARMY
U.S. Army Corps of Engineers
441 G Street N.W.
WASHINGTON, D.C. 20314-1000

REPLY TO
ATTENTION OF:
CECW-CE

JUN 16 2010

MEMORANDUM FOR Commander, US Army Corps of Engineers, ATTN: CEMP-SPD (Mr. Scott L. Whiteford, Chief, SPD-Regional Integration Team), 411 G Street, NW, Washington, DC 20314-1000

SUBJECT: Central Valley Flood Protection Board (CVFPB), Vegetation Variance Request for the American River Watershed, Common Features Project, Natomas Basin, Post-Authorization Change Report (NPACR)

1. References:

   a. California's Central Valley Flood System Improvement Framework, March 2009.

   b. Memorandum, SPK-DE, Subject: CENTRAL VALLEY FLOOD PROTECTION BOARD (CVFPB), Vegetation Variance Request for the American River Common Features Project, Natomas Post Authorization Change Report, 28 May 2010.

   c. Memorandum, CESPD-DE, Subject: Vegetation Variance Request for American River Watershed, Common Features Project, Natomas Basin, Post-Authorization Change Report, 7 June 2010.

   d. Memorandum, CEMVR-EC-DG, Subject: Vegetation Variance Request for American River Watershed, Common Features Project, Natomas Basin, Post-Authorization Change Report, 8 June 2010.

2. Upon review and consideration of the vegetation variance request package submitted by the Central Valley Flood Protection Board (CVFPB) and Sacramento Area Flood Control Agency (SAFCA) and recommendations provided by the Sacramento District (SPK), South Pacific Division (SPD), and Agency Technical Review (ATR) team, a vegetation variance is approved for all reaches, except for the reach on Plate 22 shown in the enclosure.

3. For all approved reaches, sufficient information has been provided by SAFCA that demonstrates that the vegetation permitted to remain on the proposed levee cross-sections, does not diminish system reliability, levee integrity, and public safety. The acceptable conditions include,

   a. For 21.23 miles (example shown in Plate 5, enclosure), a riverside planting berm is provided, preventing impact to the critical levee template.

b. For 3.5 miles (Plate 25, enclosure), a variance is requested only from the riverside toe to the river. The nearest vegetation would be 80 feet from the levee crown with minimal potential for impact to the critical levee template.
c. For 0.88 miles (Plate 28, enclosure), a variance is requested riverward of the lower ½ of the riverside slope. The nearest vegetation would be 50 feet from the levee crown with minimal potential for impact to critical levee template.

4. Vegetation on approved reaches will be permitted to remain in-place permanently, provided final constructed levee cross-sections correspond with the proposed levee cross-sections in this vegetation variance request package and as long as the vegetation is maintained in accordance to the associated vegetation management plan, project operation and maintenance manual, and final project partnership agreement. If, at any time, the US Army Corps of Engineers (USACE) determines that conditions within a variance area threaten system reliability and public safety, USACE will collaborate with the sponsor and resource agencies to revise to the approved vegetation variance as needed.

5. Plate 22 includes a portion of the Natomas East Main Drainage Canal (NEMDC) and it is requested that trees be permitted to remain on the lower 1/3 of slope and riverward for this segment. This area has been designated as critical habitat by the National Marine Fisheries Service (NMFS). For the trees remaining on the lower 1/3 slope, it has been proposed and endorsed by SPD and SPK that a "launchable riprap" blanket be installed around the base of each tree to reduce risks against tree overturning. SPD's endorsement recommends approval based on minimal environmental impacts while addressing public safety; minimal levee reconstruction; and no schedule slippage. SPD recognizes that in the event of overturning, there is a chance that the riprap will not fill in the divot created by the root ball as intended. SPD also notes that consultation with the resource agencies on removing these trees will be initiated on a parallel track.

6. For Plate 22, vegetation riverward from the toe is acceptable; however, allowing trees to remain on the lower 1/3 slope is not approved for the following reasons:

a. Due to substantial uncertainties with the Natomas levee system, including underseepage issues, erosive nature of the soil composition, performance history, and the minimum levee cross-section for the Plate 22 reach, allowing the trees to remain on the levee slope in this reach introduces an unacceptable uncertainty to the reliability of the system.
b. The potential impacts of tree roots on cutoff walls are not well documented.
c. The nearest vegetation (large trees) would be only 35 feet from the levee crown with significant potential for impact to the critical levee template.
d. Roots will occupy the riverside levee slope to a general depth of 2 to 4 feet, with potentially significant root intrusion to greater depths, and well into the critical section, as defined by the 1 vertical on 1.7 horizontal slope line.

CECW-CE
SUBJECT: Central Valley Flood Protection Board (CVFPB), Vegetation Variance Request for the American River Watershed, Common Features Project, Natomas Basin, Post-Authorization Change Report (NPACR)

7. There are two alternatives available for the Plate 22 reach that can address both environmental considerations and public safety. The first one is to work with the resource agencies on a conservation plan involving removal of the trees from the levee slope and mitigating in areas that would be more advantageous to the environment. The second alternative includes widening the levee section to provide a planting berm similar to other portions of the levee system.

8. It is understood that SPK will work with NMFS to develop conservation measures for this reach to ensure no net loss of habitat or species, while meeting levee safety standards. Alternatives and options for this reach will be included in the draft Environmental Impact Statement (EIS) and further evaluated leading to publication of a selected option with a Biological Opinion and the final EIS for the NPACR. The NPACR will continue as scheduled.

9. The collaborative solutions associated with this vegetation variance request demonstrate consistent and successful implementation of the partnerships and agreements of the California's Central Valley Flood System Improvement Framework. We recognize the complexities of the situation and look forward to further collaboration at all levels as we work through the Framework and beyond.

10. Please direct questions about this memorandum to Ms. Tammy Conforti, HQUSACE Levee Safety Program Manager, at (202) 761-4649.

Encl

JAMES C. DALTON, P.E.
Levee Safety Officer
Chief, Engineering and Construction
Directorate of Civil Works

SAFCA and CVFPB

Source: MBK 2010

Vegetation Variance Request Base Map

VEGETATION VARIANCE REQUEST BASE MAP

Natomas Levee Improvement Program

March 11, 2010

PLATE 3

NCC LM 0.7

NCC LM3.6

SREL LM 5.8

SREL LM 15.2

SREL LM 17.0

ARNL LM 1.1

NEMDC LM 0.3

NEMDC LM 0.0

NATOMAS CROSS CANAL SOUTH LEVEE

PLEASANT GROVE CROSS CANAL WEST LEVEE

SACRAMENTO RIVER EAST LEVEE

AMERICAN RIVER NORTH LEVEE

NATOMAS EAST MAIN DRAINAGE CANAL WEST LEVEE

NEMDC STORMWATER PUMPING STATION

Howsley Road
Sankey Road
Powerline Rd
Riego Road
Elverta Road
Elkhorn Blvd
Del Paso Rd
San Juan Rd
El Centro Rd
Truxel Rd
Northgate Blvd

SACRAMENTO RIVER

SAFCA

MBK ENGINEERS

Legend

Levee Segments Covered by Variance Request

- Sacramento River East Levee (SREL)
- American River North Levee (ARNL)
- Natomas Cross Canal (NCC)
- Natomas East Main Drainage Canal (between NEMDC Pumping Plant and Northgate Blvd)
- PGCC, NEMDC North **(Variance Request Not Required)**

Vegetation Variance Cross-Section Locations

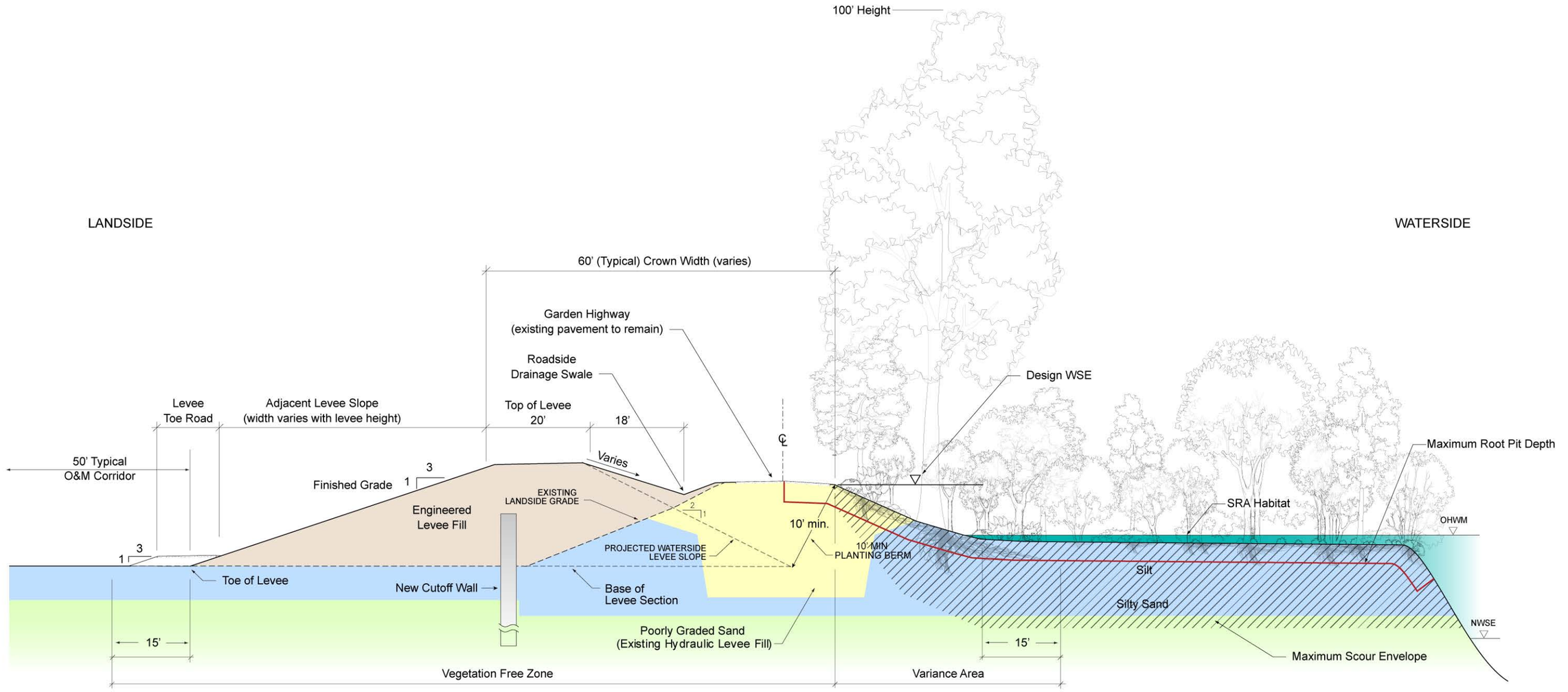
Reclamation District No 1000 Levee Mile Marker

N E S W

0 0.5 1 1.5 Miles

Plate 3

Vegetation Variance Request Plates



NOTES:

a. Scour depths were computed using the Melville and Colman Bridge Pier Scour Equation (Appendix F) with hydraulics provided by the USACE Sacramento Basin HEC-RAS model.

b. The Maximum Scour Envelope encompasses the potential maximum scour extents if a large tree were to topple anywhere within the vegetation variance zone. Scour dimensions around a single toppled tree are discussed in Appendix F.

c. Due to the dependence of scour on both depth and velocity, scour may be maximized during events with a more frequent occurrence than the 200-year water level. The event which maximizes scour at any elevation at a given levee cross-section may also vary. The Maximum Scour Envelope shown is the composite results of the maximum scour extents for tree toppling on various elevations on the levee cross-section for events which occur at or more frequently than the 200-year event. The ranges of hydraulic conditions are discussed in Appendix F.

d. Velocities were computed as a function of depth assuming a Manning's relationship: $V=(1.49/n)(y^{2/3})(S_f)^{1/2}$ where the Manning's n value and Friction Slope, S_f, were taken directly from the USACE Sacramento Basin HEC-RAS model, and the depth, y, was computed from WSEL and local ground elevation. For this site, the Manning's n was assumed to be 0.035 and the friction slope was assumed to be 0.0001 during the 200-year water level. This approximates a velocity of 2.0 ft/s at the levee toe concurrent with the 200-year water level.

e. 100 foot tall trees depicted represent potential maximum Valley Oak tree height and are not representative of actual field conditions.

f. 8' tap root depicted is representative of the worst case scenario and is unlikely to occur in these site conditions.

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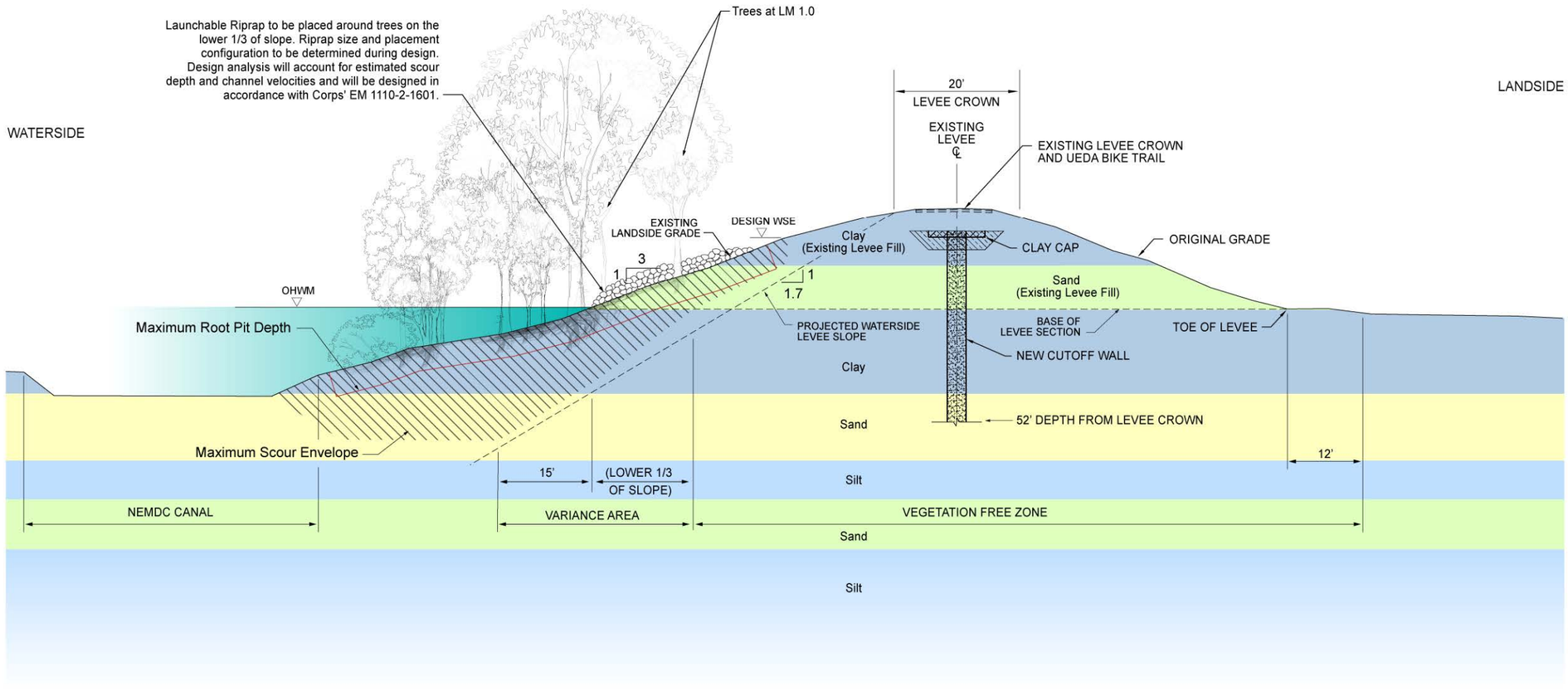
G 06110058.01 255

Source: Data provided by HDR, NHC, and Kleinfelder; adapted by AECOM in 2010

SREL LM 5.8 Levee Section with Cutoff Wall (LM 0 to LM 13.2)

Plate 5 (May 17, 2010)



NOTES:

a. Scour depths were computed using the Melville and Colman Bridge Pier Scour Equation (Appendix F) with hydraulics provided by the USACE Sacramento Basin HEC-RAS model.

b. The Maximum Scour Envelope encompasses the potential maximum scour extents if a large tree were to topple anywhere within the vegetation variance zone. Scour dimensions around a single toppled tree are discussed in Appendix F.

c. Due to the dependence of scour on both depth and velocity, scour may be maximized during events with a more frequent occurrence than the 200-year water level. The event which maximizes scour at any elevation at a given levee cross-section may also vary. The Maximum Scour Envelope shown is the composite results of the maximum scour extents for tree toppling on various elevations on the levee cross-section for events which occur at or more frequently than the 200-year event. The ranges of hydraulic conditions are discussed in Appendix F.

d. Velocities were computed as a function of depth assuming a Manning's relationship: $V=(1.49/n)(y^{2/3})(S_f)^{1/2}$ where the Manning's n value and Friction Slope, S_f, were taken directly from the USACE Sacramento Basin HEC-RAS model, and the depth, y, was computed from WSEL and local ground elevation. For this site, the Manning's n was assumed to be 0.040 and the friction slope was assumed to be 0.00007 during the 200-year water level. This approximates a velocity of 1.9 ft/s at the levee toe concurrent with the 200-year water level.

0 10 20
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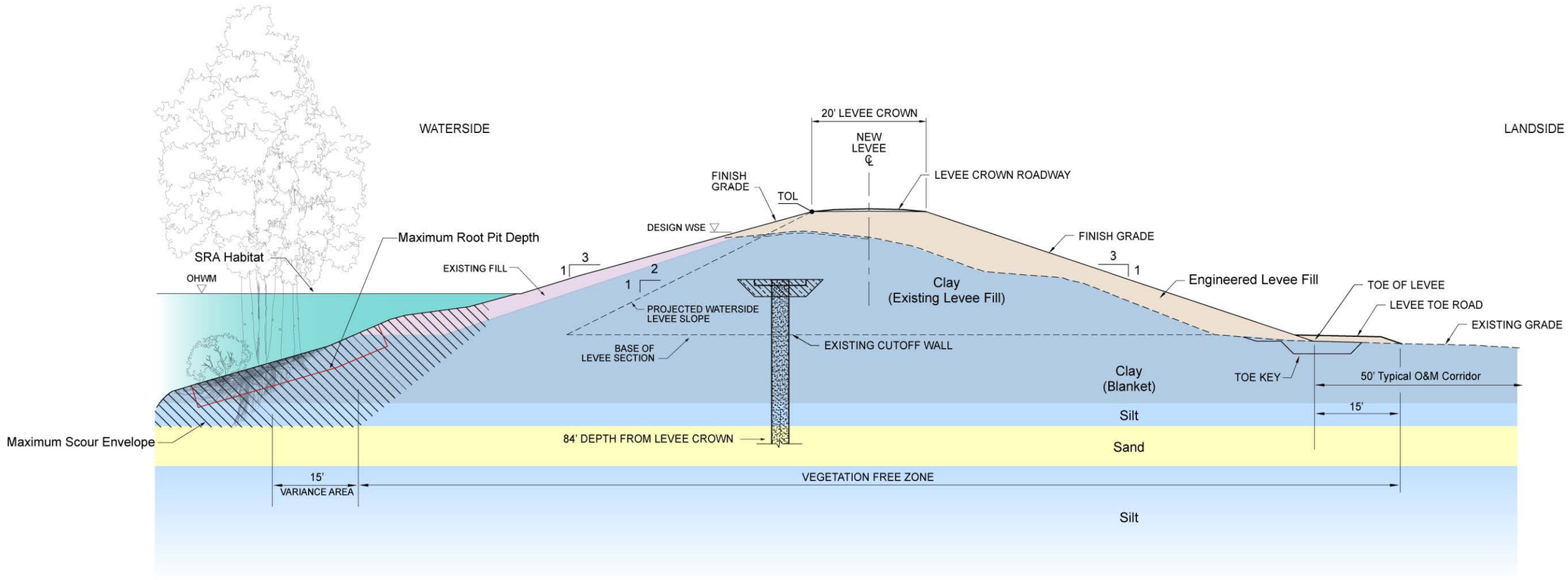
Source: Wood Rodgers, NHC, and Kleinfelder 2010; Adapted by AECOM 2010

NEMDC LM 0.3 Typical Levee Cross Section (LM 0.3 to LM 1.1)

Plate 22 (May 27, 2010)



NOTES:

a. Scour depths were computed using the Melville and Colman Bridge Pier Scour Equation (Appendix F) with hydraulics provided by the USACE Sacramento Basin HEC-RAS model.

b. The Maximum Scour Envelope encompasses the potential maximum scour extents if a large tree were to topple anywhere within the vegetation variance zone. Scour dimensions around a single toppled tree are discussed in Appendix F.

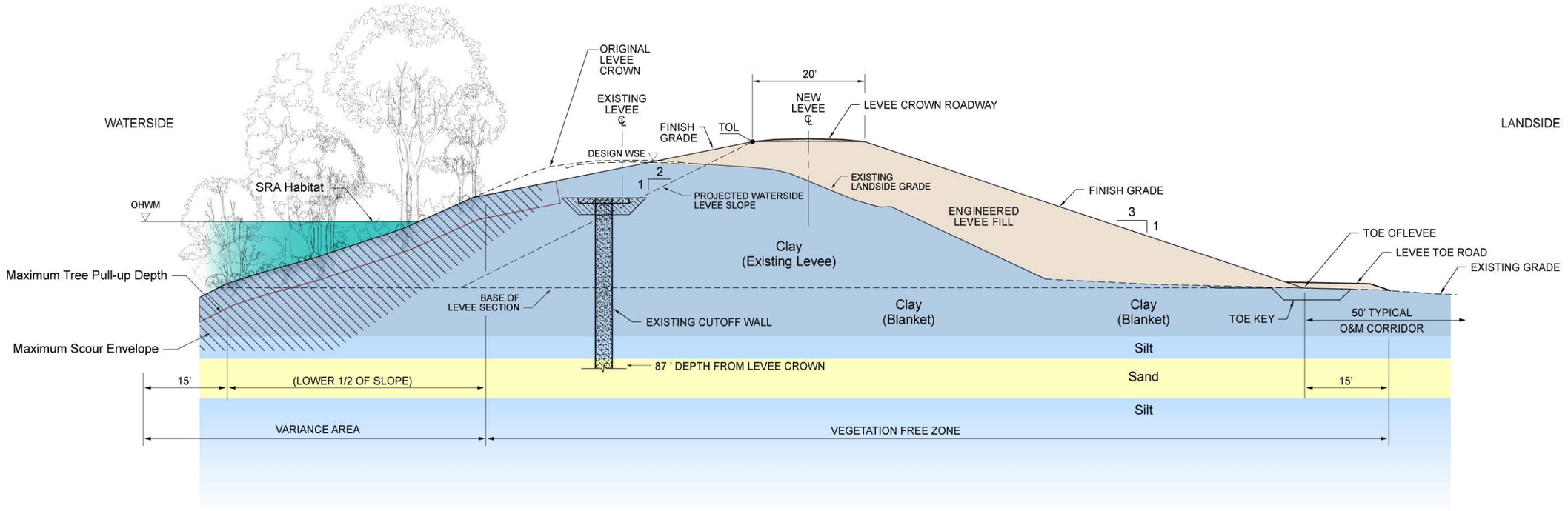
c. Due to the dependence of scour on both depth and velocity, scour may be maximized during events with a more frequent occurrence than the 200-year water level. The event which maximizes scour at any elevation at a given levee cross-section may also vary. The Maximum Scour Envelope shown is the composite results of the maximum scour extents for tree toppling on various elevations on the levee cross-section for events which occur at or more frequently than the 200-year event. The ranges of hydraulic conditions are discussed in Appendix F.

d. Velocities were computed as a function of depth assuming a Manning's relationship: $V=(1.49/n)(y^{2/3})(S_f)^{1/2}$ where the Manning's n value and Friction Slope, S_f, were taken directly from the USACE Sacramento Basin HEC-RAS model, and the depth, y, was computed from WSEL and local ground elevation. For this site, the Manning's n was assumed to be 0.035 and the friction slope was assumed to be 0.00005 during the 200-year water level. This approximates a velocity of 2.4 ft/s at the levee toe concurrent with the 200-year water level.

Source: Wood Rodgers, NHC, and Kleinfelder 2010; Adapted by AECOM 2010

NCC LM 0.7 Typical Levee Cross Section (LM 0 to LM 3.5)

Plate 25 (May 18, 2010)



NOTES:

a. Scour depths were computed using the Melville and Colman Bridge Pier Scour Equation (Appendix F) with hydraulics provided by the USACE Sacramento Basin HEC-RAS model.

b. The Maximum Scour Envelope encompasses the potential maximum scour extents if a large tree were to topple anywhere within the vegetation variance zone. Scour dimensions around a single toppled tree are discussed in Appendix F.

c. Due to the dependence of scour on both depth and velocity, scour may be maximized during events with a more frequent occurrence than the 200-year water level. The event which maximizes scour at any elevation at a given levee cross-section may also vary. The Maximum Scour Envelope shown is the composite results of the maximum scour extents for tree toppling on various elevations on the levee cross-section for events which occur at or more frequently than the 200-year event. The ranges of hydraulic conditions are discussed in Appendix F.

d. Velocities were computed as a function of depth assuming a Manning's relationship: $V=(1.49/n)(y^{2/3})(S_f)^{1/2}$ where the Manning's n value and Friction Slope, S_f, were taken directly from the USACE Sacramento Basin HEC-RAS model, and the depth, y, was computed from WSEL and local ground elevation. For this site, the Manning's n was assumed to be 0.035 and the friction slope was assumed to be 0.00005 during the 200-year water level. This approximates a velocity of 2.4 ft/s at the levee toe concurrent with the 200-year water level.

0 10 20
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G 06110058.01 264

Source: Wood Rodgers, NHC, and Kleinfelder 2010; Adapted by AECOM 2010

NCC LM 3.6 Typical Levee Cross Section (LM 3.5 to LM 4.38)

Plate 28 (May 18, 2010)