

**Meeting of the Central Valley Flood Protection Board  
November 22, 2013**

**Staff Report – 33 U.S.C., Section 408 Request  
to the U.S. Army Corps of Engineers, Sacramento District**

**Knights Landing Ridge Drainage District  
Knights Landing Ridge Cut Levee Repair Project, Yolo County**

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### **1.0 – REQUESTED ITEM**

Consider approval to send a letter (Attachment A) to the U.S. Army Corps of Engineers (USACE), Sacramento District requesting permission to alter a portion of the Sacramento River Flood Control Project (SRFCP) based on Application No. 18905 and pursuant to 33 U.S.C., Section 408 (Section 408).

The letter states that based on the information that the Central Valley Flood Protection Board (Board) has received and reviewed to date, that "...the Board supports the proposed Knights Landing Ridge Cut Levee Repair Project and believes the alterations will not be injurious to the public interest, and will not impair the usefulness of the SRFCP." The letter also indicates that, "If upon completion the USACE formally incorporates the Knights Landing Ridge Cut Levee Repair Project into the SRFCP the State of California, acting through the Board, will accept the altered project for operation and maintenance and hold and save the United States free from damage due to the constructed works."

This is not a flood system improvement project hearing, and no construction permit is being considered for issuance at this time. Board staff is requesting that the draft attached letter be finalized and sent to USACE Sacramento District to initiate the Section 408 review process for the proposed repair project.

### **2.0 – APPLICANT**

Knights Landing Ridge Drainage District (KLRDD)

### **3.0 – PROJECT LOCATION**

The project area is located downstream of the town of Knights Landing approximately 26 miles northwest of Sacramento, in eastern Yolo County. The site is surrounded by

Sacramento River Flood Control Project (SRFCP) facilities on all sides: the Sacramento River to the north and east, the Knights Landing Ridge Cut (KLRC) to the west, and the Yolo Bypass to the south (Attachment B – Project Maps).

#### **4.0 – PROJECT DESCRIPTION**

The KLRC levee repair project proposes levee improvements for approximately 3.5 miles of levee along the left (east) bank of the KLRC including (Attachment C and D):

- levee crown and landside slope remediation
- construction of a patrol road
- relocation of a drainage ditch parallel to the levee
- access ramps and ditch crossings for private use to adjacent landowners
- demolition of three existing drainage discharge pipes through the levee and installation of three new pipes
- construction of an access road on the spoil berm parallel to the levee

Two of the existing pump stations are in conflict with the proposed spoils berm and are proposed to be removed and replaced at the same location but outside the spoils berm. A third pump station is not in conflict with the spoils berm and can remain. Discharge pipes do not meet current USACE design criteria and are shown on the plans to be reconstructed above the channel design water surface elevation.

#### **5.0 – AUTHORITY OF THE BOARD**

- California Code of Regulations, Title 23 (CCR 23), § 6, Need for a Permit
- CCR 23, § 106, Existing Encroachments within an Adopted Plan of Flood Control
- CCR 23, § 116, Borrow and Excavation Activities – Land and Channel
- CCR 23, § 120, Levees
- CCR 23, § 121, Erosion Control
- CCR 23, § 123, Pipelines, Conduits and Utility Lines
- CCR 23, § 124, Abandonment of Pipelines
- CCR 23, § 130, Patrol roads and Access Ramps
- CCR 23, § 131, Vegetation

- Rivers and Harbors Act of 1899, Title 33 United States Code, § 408, hereafter referred to as Section 408

## **6.0 – PROJECT ANALYSIS**

The proposed KLRC levee repair project includes remediation at three Sites 12, 12A, and 13, as part of the Mid-Valley Area, Phase III. The project extends from project Stations 0+00 to 182+00. A summary of project background, design review, hydraulic review, geotechnical review, environmental review is presented below along with project benefits and issues related to easements and minor 408 actions.

### **6.1 – Project Background**

The Mid-Valley Area, Phase III is a component of the authorized Sacramento River Flood Control Project (SRFCP). The storms of February 1986 severely affected northern California with record or near record flow in many rivers and streams. After the flood of 1986 the USACE conducted a system-wide analysis (System Evaluation) of the SRFCP to bring it up to current design standards.

In 1996 the USACE authorized a Design Memorandum (1996 DM) for conducting a comprehensive analysis of the long-term integrity of the levee system for the SRFCP. Studies indicated that sections of the project levees are susceptible to seepage and stability problems and do not provide the design level flood protection. The 1996 DM provided for the preparation of Plans and Specifications (P&S) for the Mid-Valley Area Levee Reconstruction project of the SRFCP. The 1996 DM recommended 30 levee reconstruction sites in four construction areas. The four areas are Area 1 (Reclamation District 1500), Area 2 (Reclamation District 1001), Area 3 (Knights Landing), and Area 4 (Elkhorn). Area 3 is bounded by the right (west) bank levee of the Yolo Bypass, the right (west) bank levee of the Sacramento River, and the left (east) bank of the KLRC.

Within Area 3 several repair sites were identified using the best available information based on knowledge gained during flood fighting activities. These repair sites are locations that have exhibited poor performance and / or have required flood fighting activities during the past.

USACE approved the SRFCP, California, Mid-Valley Area, Phase III Design Memorandum/EA-IS, June 1996 (DM/EA-IS 1996) on August 16, 1996. After Northern California experienced widespread and destructive flooding in December 1997 through

January 1998, Congress directed the USACE to re-evaluate the Mid-Valley sites and additional sites for reconstruction. Minor design modifications were made to the approved DM/EA-IS 1996 along with more detailed plans and specifications.

## **6.2 – Project Design Review**

Board staff has reviewed the following technical documents, provided by the applicant, in preparation of this staff report:

- Design Documentation Report
- Draft 408 Project Summary Report (Attachment E)
- Submittal (plans, specifications, and supporting documents)
- Final Environmental Assessment / Initial Study, Sacramento River Flood Control System Evaluation, Phase III, Mid-Valley, Area 3.

## **6.3 – Hydraulic Review**

The existing levee crown elevation varies significantly along the project length with some areas having freeboard in excess of seven feet above the authorized 1957 water surface elevation while other areas have less than three feet of freeboard. The applicant is proposing to maintain the existing levee crown elevations except in those areas that have less than three feet of freeboard, where the applicant proposes to restore the levee crown to an elevation that provides three feet of freeboard above the 1957 water surface profile.

The proposed repairs to by KLRDD will occur on the landside of the levee and will have no impact on the existing KLRC channel hydraulics.

## **6.4 – Geotechnical Review**

The scope of KLRDD's geotechnical analyses included performing steady-state seepage analyses to evaluate underseepage, performing steady-state stability analyses to evaluate landside stability, and performing rapid drawdown stability analyses to evaluate waterside stability conditions.

Based on the results of geotechnical analyses submitted by the applicant, the landside slope will be reconstructed with a slope inclined at 3 horizontal to 1 vertical (H:V) and

covered with a minimum five-foot thickness perpendicular to the landside face. Furthermore, the existing landside drainage ditch will be relocated a minimum of 15 feet landward of the new landside toe. Board staff's review of the geotechnical analyses concluded that the proposed project is anticipated to comply with CCR 23 standards, and no adverse geotechnical impacts are anticipated.

## **6.5 – Environmental Review**

The USACE has prepared for the Mid Valley Area 3 project an Environmental Assessment/Initial Study (EA/IS) to comply with the National Environmental Protection Act (NEPA) and the California Environmental Quality Act (CEQA). The EA/IS analyzed the potential impacts (including cumulative impacts) of the proposed project on all relevant resource areas, including aesthetics, agriculture and land use, air quality, sensitive species and wetlands, cultural resources, hazardous waste, hydrology and water quality, noise, recreation, and transportation. Based on the EA/IS analysis the USACE deemed the proposed project to be a logical and desirable alternative. Furthermore, the USACE determined that the project would have no significant effects on the environment. Based on the results of the environmental evaluation and completion of interagency coordination the USACE issued a Finding of No Significant Impact (FONSI) on April 18, 2013. To avoid and minimize construction-related effects, KLRDD will implement environmental commitments to reduce or offset short-term, construction-related effects as described in the Phase III, Mid-Valley, Contract Area 3 Final Environmental Assessment/Initial Study, dated April 2013.

## **6.6 – Project Benefits**

The proposed KLRC levee repairs are consistent with the adopted 2012 Central Valley Flood Protection Plan (CVFPP) and would:

- reduce the risk of flooding and its impacts to human health, safety, and welfare
- improve the existing, authorized flood management infrastructure
- further protect farmland, agricultural commodities, and agricultural infrastructure for this crucial agricultural region
- restore the original level of flood protection as authorized by the USACE (1953, Supplement to Standard Operation and Maintenance Manual, SRFCP, Unit No. 127)

## **6.7 – Easements**

KLRDD holds easements and fee rights to the land beneath and adjacent to the KLRC left bank levee throughout the project length. KLRDD will acquire additional area adjacent to the levee to accommodate the proposed slope flattening and ditch relocation. Permanent acquisition, relocation, and compensation services will be conducted in compliance with federal and State relocation laws, which are the Uniform Act of 1970 (42 USC 4601 et seq.) and implementing regulation, 49 CFR Part 24; and California Government Code Section 7267 et seq. These laws require that appropriate compensation be provided to displaced landowners and tenants.

## **6.8 – Minor 408 Actions**

The proposed KLRC repair project does not include major 408 actions such as levee realignment, change in hydraulic conditions, levee raise, or crediting/reimbursement requests, as described in the USACE February 6, 2012 “Sacramento District Policy on Classifications of Actions Subject to 33 USC 408”. Accordingly, Board staff believes that the proposed KLRC repairs are “minor 408” modifications to the system and can therefore be reviewed and approved at the USACE Sacramento District without the need for USACE headquarters review.

## **6.9 – Adjacent Landowners**

Board staff has mailed adjacent landowner letters to property owners adjacent to the proposed project. No objection or protest letters have been received to date.

## **7.0 – STAFF RECOMMENDATION**

Staff recommends that the Board approve finalizing the attached draft letter, (Attachment A), authorize the Executive Officer to sign, and send it to the U. S. Army Corps of Engineers, Sacramento District. The letter requests permission pursuant to 33 U.S.C. § 408 to alter a portion of State Plan of Flood Control project levee along the Knights Landing Ridge Cut left (east) levee in Yolo County as proposed in Application No. 18905 submitted by the Knights Landing Ridge Drainage District.

**8.0 – LIST OF ATTACHMENTS**

- A. Draft 408 Request Letter to the USACE
- B. Project Maps
  - B1 – Vicinity Map
  - B2 – Location Map
- C. KLRC levee profile
- D. Typical cross section of the proposed levee repair
- E. KLRDD Project Summary Report

Technical Review:           Ali Porbaha, Senior Engineer  
Document Review:         Eric Butler, PE, Projects and Environmental Branch Chief  
                                      Len Marino, PE, Chief Engineer

# Attachment A: 408 Request Letter to the USACE

STATE OF CALIFORNIA – CALIFORNIA NATURAL RESOURCES AGENCY

EDMUND G. BROWN JR., GOVERNOR

## **CENTRAL VALLEY FLOOD PROTECTION BOARD**

3310 El Camino Ave., Rm. 151  
SACRAMENTO, CA 95821  
(916) 574-0609 FAX: (916) 574-0682  
PERMITS: (916) 574-2380 FAX: (916) 574-0682



November 22, 2013

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

Subject: Knights Landing Ridge Cut Levee Repair Project, Knights Landing Ridge Drainage District, 33 U.S.C. Section 408 Request

Dear Colonel Farrell:

The Central Valley Flood Protection Board (Board) is requesting permission from the U.S. Army Corps of Engineers (USACE) to alter approximately 3.4 miles (18,200 linear feet) of Sacramento River Flood Control Project (SRFCP), Knights Landing Ridge Cut (KLRC) left (east) levee in Yolo County. This request is based on the Policy and Procedural Guidance for the Approval of Modification and Alteration of Corps of Engineers Projects dated October 23, 2006, and the Clarification Guidance dated November 17, 2008, and on behalf of the Knights Landing Ridge Drainage District (KLRDD). The project consists of Sites 12, 12A, and 13 of the Mid-Valley Area Phase III project. The Board is making this request pursuant to 33 U.S.C. Section 408.

USACE approved the Sacramento River Flood Control Project, California, Mid-Valley Area, Phase III Design Memorandum/EA-IS, June 1996 (DM/EA-IS 1996) on August 16, 1996. After Northern California experienced widespread and destructive flooding in December 1997 through January 1998, the U.S. Congress directed the USACE to re-evaluate the Mid-Valley sites; and to evaluate additional sites for reconstruction. Minor design modifications were made to the approved DM/EA-IS 1996 along with more detailed plans and specifications.

In June 2012, the Board adopted the Central Valley Flood Protection Plan (CVFPP) which represented the first comprehensive update of the State Plan of Flood Control in the Central Valley in more than five decades. The proposed KLRC levee repair project is one of many proposed incremental improvements consistent with implementation of the CVFPP.

The proposed KLRC levee repair project consists of replacing a portion of the landside slope with lean clay, constructing a toe berm at the landside toe, and relocating the drain ditch further from the levee. The Board has reviewed the Design Documentation Report, specifications, plans and drawings, geotechnical analyses, and other relevant documents submitted by KLRDD. These documents indicate that the proposed repairs would reduce the risk of flood loss and minimize the effect of floods on human health, safety, and welfare by improving existing, authorized flood management infrastructure, and would increase protection for the existing population. Importantly, the KLRC levee repairs would help further protect farmland, agricultural commodities, and agricultural infrastructure for this crucial agricultural region. The



## Attachment A: 408 Request Letter to the USACE

Colonel Michael Farrell, Commander

November 22, 2013

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KLRC levee repairs would restore the level of flood protection, not increase it beyond that which was originally authorized by the USACE (1953, Supplement to Standard Operation and Maintenance Manual, SRFCP, Unit No. 127).

Strengthening portions of the federal project levee system protecting the basin as proposed by KLRDD would not result in any significant, adverse hydraulic impacts or induce flooding to other sub-basins protected by the SRFCP. Indeed, the work proposed will restore the KLRC left bank levee to the authorized level of protection. The KLRC levee repair work will occur on the landside of the levee and will have no impact on the existing channel hydraulics.

The USACE has prepared for the Mid Valley Area 3 project an Environmental Assessment/Initial Study (EA/IS) for the purposes of complying with the National Environmental Protection Act (NEPA) and the California Environmental Quality Act (CEQA). The EA/IS analyzed the potential impacts (including cumulative) of the proposed project on all relevant resource areas, including aesthetics, agriculture and land use, air quality, sensitive species and wetlands, cultural resources, hazardous waste, hydrology and water quality, noise, recreation, and transportation. Based on the EA/IS analysis, the USACE deemed the proposed project to be a logical and desirable alternative. Furthermore, the USACE determined that the project would have no significant effects on the environment and the USACE issued a Finding of No Significant Impact on April 18, 2013.

Based on the information provided by KLRDD to date, the Board supports the proposed KLRC levee repair project and believes the alterations will not be injurious to the public interest, and will not impair the usefulness of the SRFCP. Supplemental information in the form of a Project Summary Report as required by the October 26, 2006 and November 17, 2008 policies and procedural guidance is enclosed as part of this request.

If, upon completion, the USACE formally incorporates the KLRC levee repair project into the SRFCP, the State of California, acting through the Board, will accept the altered project for operation and maintenance and will hold and save the United States free from damage due to the constructed works.

If you have any questions regarding this request, please contact me at (916) 574-0609, or your staff may contact Mr. Ali Porbaha, Senior Engineer, Projects and Environmental Branch at (916) 574-2378 or by email at [mohammad.porbaha@water.ca.gov](mailto:mohammad.porbaha@water.ca.gov).

Sincerely,

Jay S. Punia  
Executive Officer

Enclosure: Project Summary Report

Attachment A: 408 Request Letter to the USACE

Colonel Michael Farrell, Commander

November 22, 2013

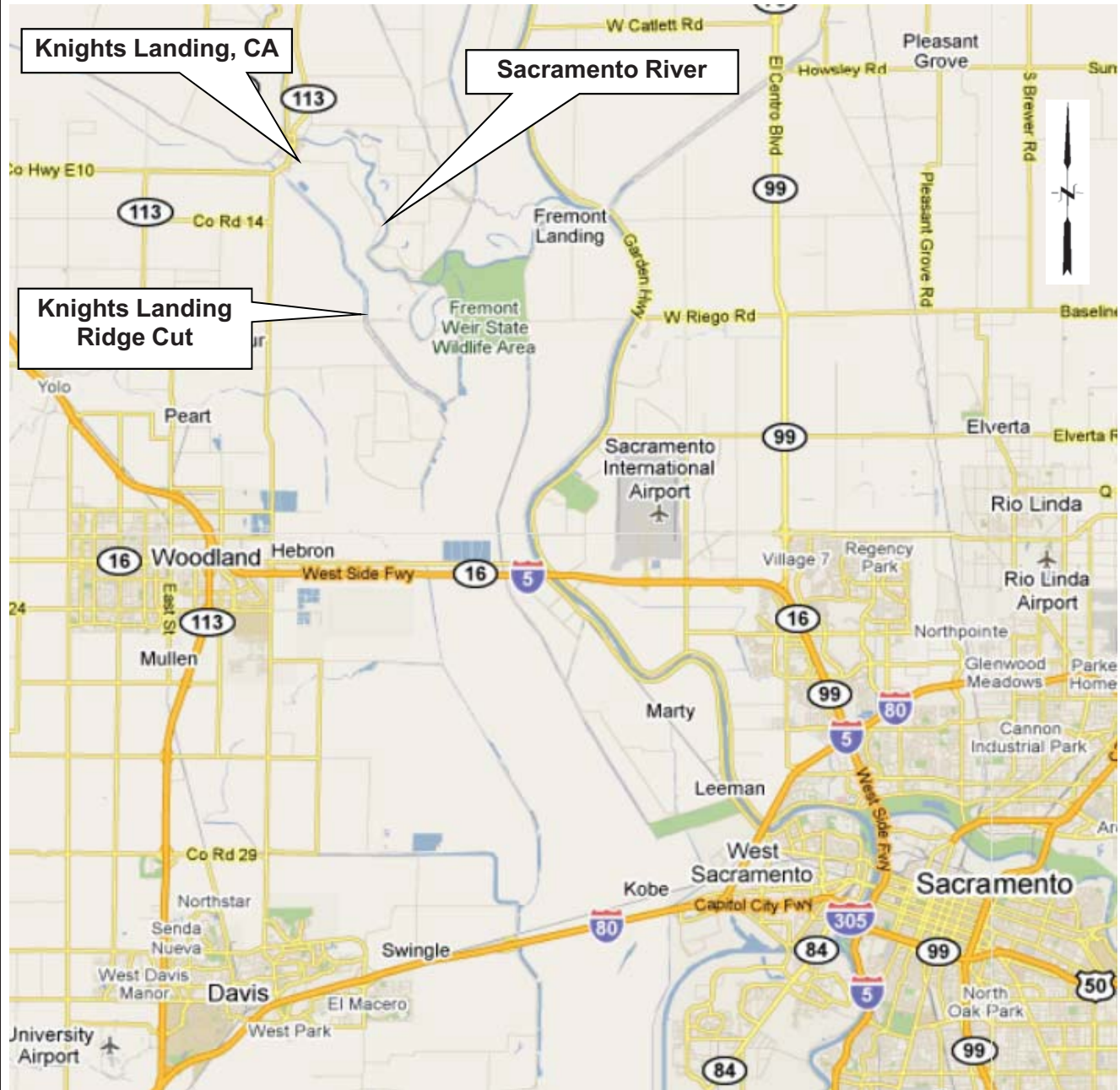
Page 3/3

cc: Mr. Lewis Bair, General Manager  
Knights Landing Ridge Drainage District  
P.O. Box 50  
Grimes, CA 95950-0050

Mr. Barry O'Regan  
Peterson Brustad, Inc.  
119 E. Weber Avenue  
Stockton, CA 95202

DRAFT

Attachment B1\_Vicinity Map



NO SCALE

Map Reference: [www.google.com/maps](http://www.google.com/maps)



GENTERRA/Hultgren-Tillis/TABER  
 3911 West Capitol Avenue  
 West Sacramento, California 95691  
 (916) 371-1690  
 Fax (916) 371-7265

United States Army Corps of Engineers

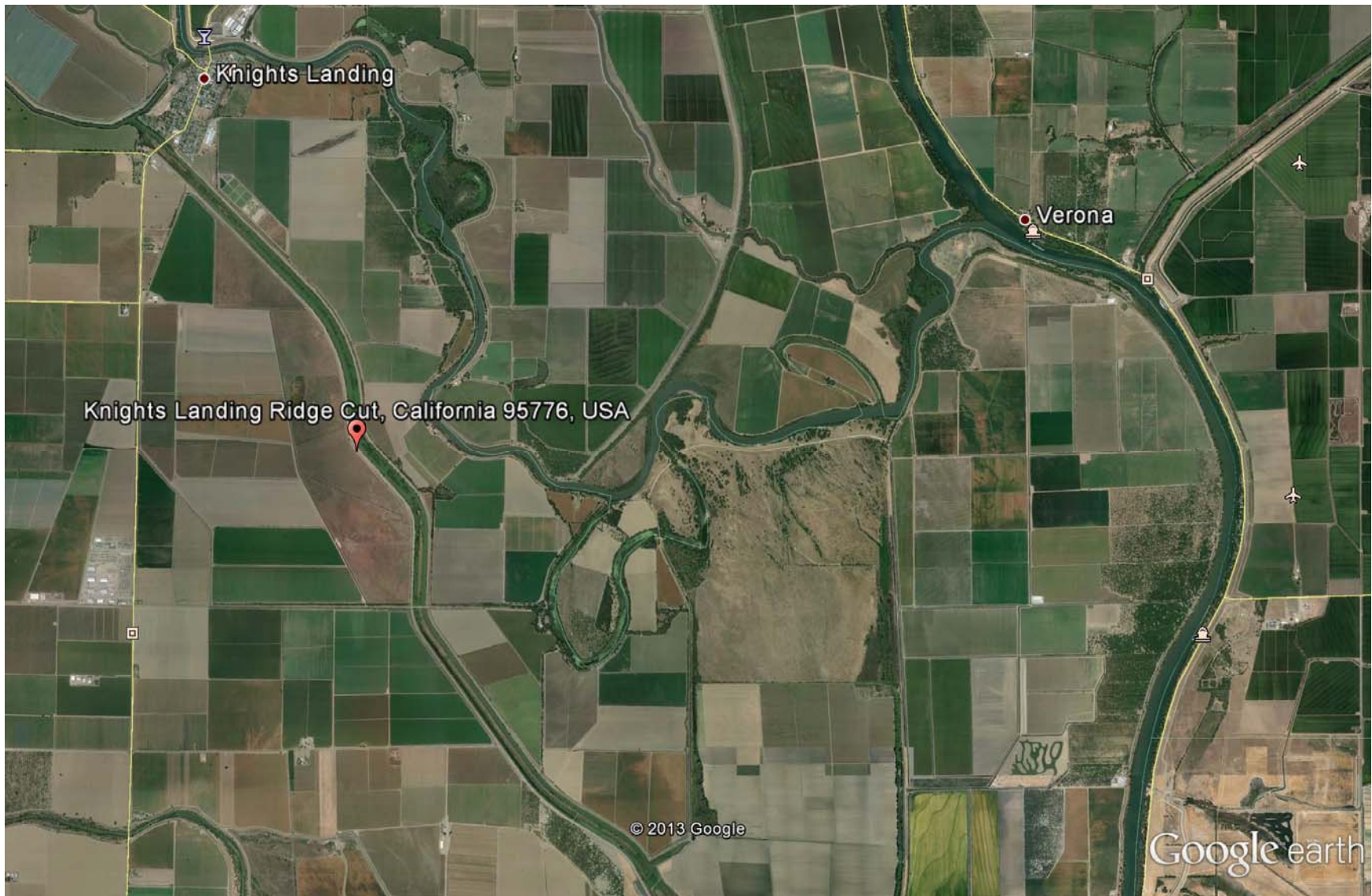
Mid-Valley Area Phase III Area 3  
 Left Bank Knights Landing Ridge Cut, Sites 12, 12A, and 13  
 Yolo County, California

Vicinity Map

Figure 1



## Attachment B2\_Location Map



Location map ( Google Earth)

# Attachment C Levee Profile

Knights Landing Ridge Cut Levee Repair Project – Section 408 Summary Report – October 2013

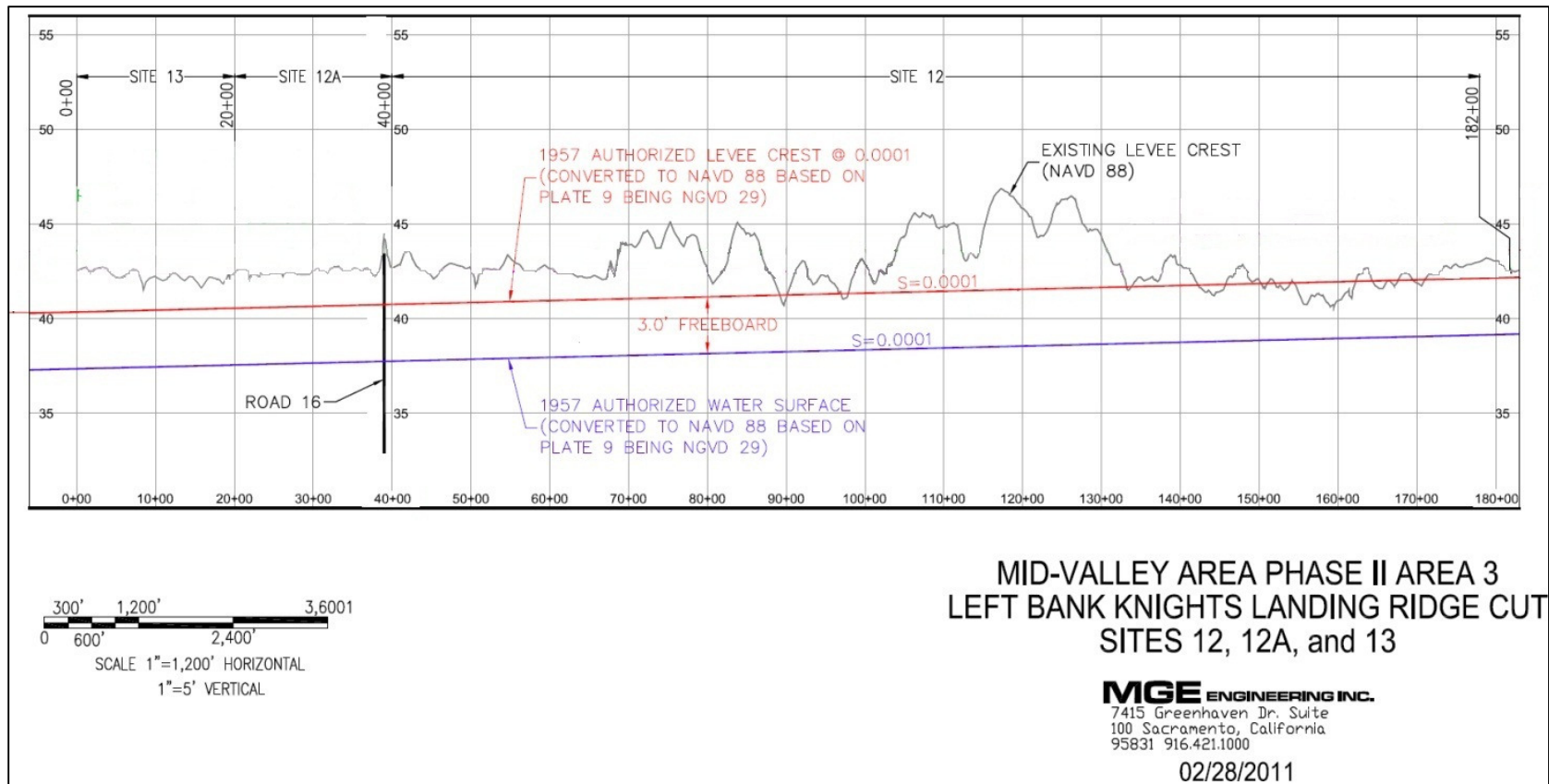
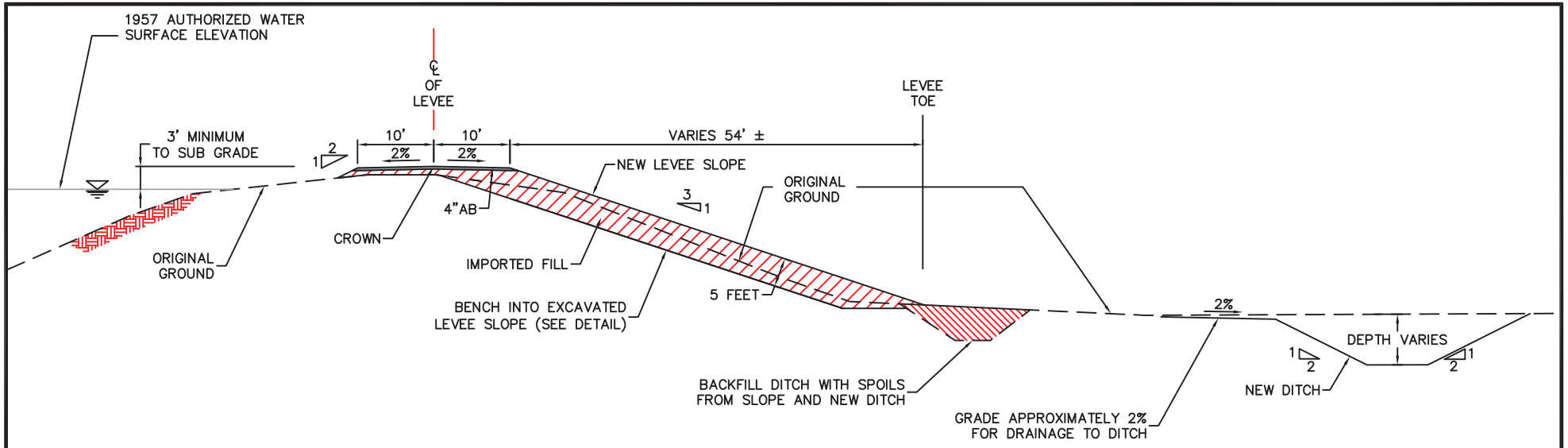


Figure 4 - Knights Landing Ridge Cut Profile

# Attachment D\_Typical Cross Section of Levee Repair

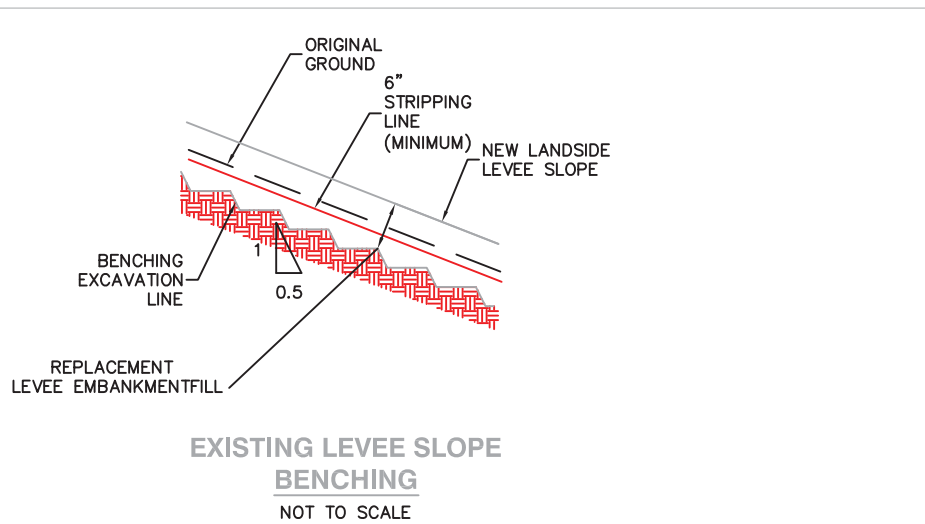


**NOTES:**

1. CLEAR AND GRUB TO DEPTH OF 6" WITHIN PROPOSED GRADED AREA.
2. THE EXISTING CROWN IS ABOVE THE 1957 AUTHORIZED LEVEL OF PROTECTION FOR APPROXIMATELY 1,300' WITHIN SITE 12 AND 12A. THOSE AREAS ARE TO BE LOWERED TO AUTHORIZED LEVEL AND DAYLIGHTED AND SLOPED AT 2% TO THE RIVERSIDE OF THE LEVEE.

**CROSS SECTION SITES 12, 12A, & 13**

NOT TO SCALE



**EXISTING LEVEE SLOPE  
BENCHING**  
NOT TO SCALE



GENTERRA/Hultgren-Tillis/TABER  
3911 West Capital Avenue  
West Sacramento, CA 95691-2116  
(916) 371-1690 Fax (916) 371-7265

US Army Corps of Engineers

Mid-Valley Phase III Area 3  
Sites 12, 12A and 13  
Yolo County, California

Typical Improved Cross-Section

Figure 12

**Knights Landing Ridge Cut Levee Repair Project**  
**Section 408 Application**  
**Project Summary Report**

*Prepared for:*

**U.S. Army Corps of Engineers**  
**1325 J Street**  
**Sacramento, CA 95814**

*Prepared by:*

**Knights Landing Ridge Drainage District**  
**975 Wilson Bend Road**  
**Grimes, CA**

**October 2013**

# Attachment E Project Summary Report

Knights Landing Ridge Cut Levee Repair Project – Section 408 Summary Report – October 2013

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## Attachment E Project Summary Report

Knights Landing Ridge Cut Levee Repair Project – Section 408 Summary Report – October 2013

### 1.0 Non-Federal Request for Alteration

The Knights Landing basin is located in eastern Yolo County, approximately 26 miles northwest of Sacramento. The basin is surrounded by Sacramento River Flood Control Project (SRFCP) facilities on all sides: the Sacramento River to the north and east, the Knights Landing Ridge Cut to the west, and the Yolo Bypass to the south. The SRFCP was authorized by the Flood Control Act of 1917 and received subsequent authorizations under the Flood Control Acts of 1928, 1936, and 1941 as well as the Rivers and Harbors Act of 1937. The Flood Control Acts of 1944 and 1950 authorized additional modifications.

After the 1986 flood, which caused significant stress on the SRFCP levees throughout the Valley, the Corps conducted a system-wide analysis of the Sacramento River Flood Control Project (System Evaluation) in five phases.

- Phase I – Sacramento Urban Area.
- Phase II – Marysville/Yuba City Area.
- Phase III – Mid-Valley Area.
- Phase IV – Lower Sacramento Area.
- Phase V – Upper Sacramento Area.

The Knight Landing basin levees which protect the small community of Knights Landing (population 995) were included in the Phase III- Mid-Valley Area of the System Evaluation. The Mid Valley Project was further subdivided in Contract Areas 1, 2, 3, and 4 (see figure 1). The Local Maintaining Agencies (LMAs) signed agreements supporting the State's project commitments under a Project Cooperative Agreement (PCA) with the Corps to implement the Phase III- Mid-Valley Area project. To date, only Contract Area 1, RD 1500 area, has been completed (in 1998 under a separate PCA).

Mid-Valley Project Contract Area 3 is comprised of repairs to levees along the right bank of the Sacramento River and along the left bank of the Knights Landing Ridge Cut (KLRC), (see figure 2). The Knights Landing Ridge Drainage District (KLRDD) is the LMA for the KLRC levees. Due to lack of progress with the Mid Valley phase of the System Evaluation KLRDD wishes to use local funds to construct the repairs to the KLRC levees already developed and designed by the Corps as part of the Mid-Valley project. KLRDD initially attempted to construct the Corps designed KLRC levee repairs under their existing PCA with the Corps. However that PCA does not contain the language which would allow in-kind credit for construction work. Efforts by the Corps to amend the PCA to insert language which would allow construction to proceed under the existing PCA have stalled. Therefore KLRDD is requesting a Section 408 permit to allow the KLRC levee repairs to be constructed in 2014.

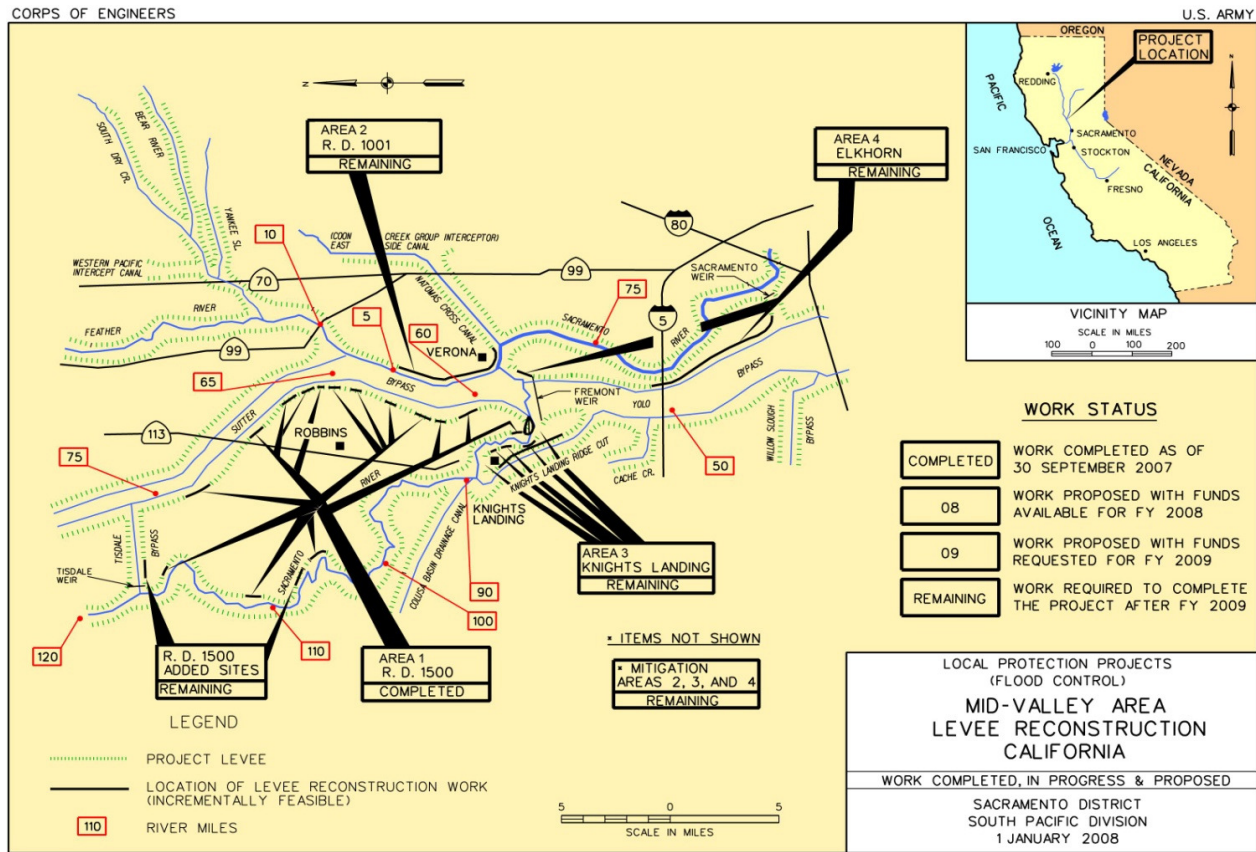
# Attachment E Project Summary Report

Knights Landing Ridge Cut Levee Repair Project – Section 408 Summary Report – October 2013

This Section 408 request includes the construction of the following features along the left levee of the Knights Landing Ridge Cut:

1. 18,035 feet of levee crown and landside slope remediation
2. 18,085 feet of patrol road
3. Relocation of an interior drainage ditch.
4. Access ramps and ditch crossings for private use to adjacent landowners.
5. Demolition and replacement of three drainage discharge lines through the levee

**Figure 1 – Mid Valley Area**



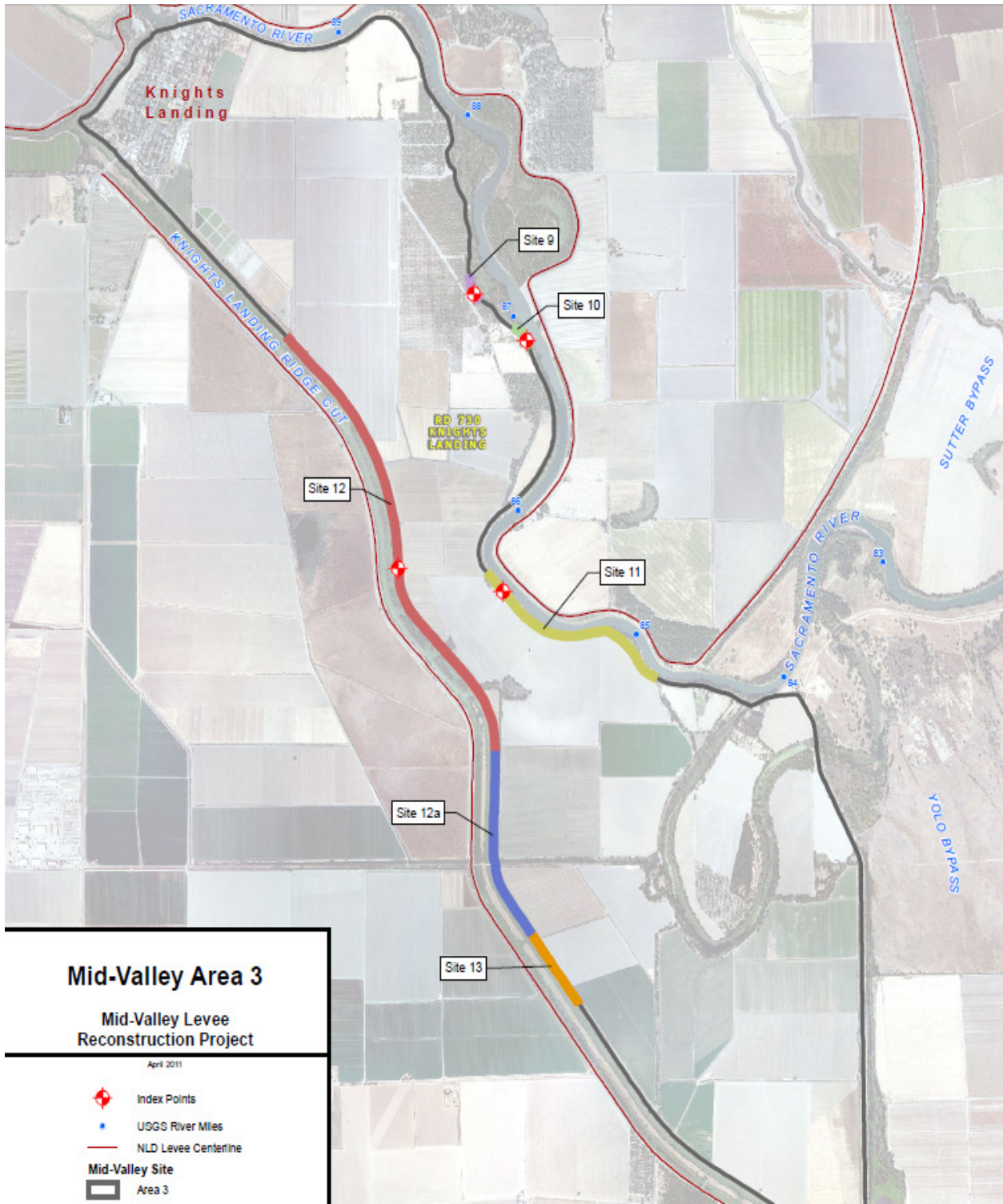
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4 February 2008

# Attachment E Project Summary Report

Knights Landing Ridge Cut Levee Repair Project – Section 408 Summary Report – October 2013

**Figure 2 - Knights Landing Basin**



## 2.0 Description of the Existing Project

### 2.1 Project History & Authorization

The Sacramento River Flood Control Project (SRFCP) was authorized by the Flood Control Act of 1917 and received subsequent authorizations under the Flood Control Acts of 1928, 1936, and 1941 as well as the Rivers and Harbors Act of 1937. The Flood Control Acts of 1944 and 1950 authorized additional modifications. The Knight Landing Ridge Cut (KLRC) levees are part of the SRFCP and protect the small community of Knights Landing (population 995). The KLRC levees were constructed by the Corps of Engineers (Corps) and completed in 1955.

After the 1986 flood, which caused significant stress on the SRFCP levees throughout the Valley, the Corps conducted a system-wide analysis of the Sacramento River Flood Control Project (System Evaluation) in five phases.

- **Phase I – Sacramento Urban Area.** Repair deficient levees in the Sacramento area and a floodwall on the Sacramento River. Construction was completed in 1997.
- **Phase II – Marysville/Yuba City Area.** Repair levees along Feather and Yuba Rivers and tributaries; Sutter Bypass; cities of Marysville and Yuba City; and the communities of Linda, Gridley, Live Oak and Olivehurst. First contract was completed in 1996.
- **Phase III – Mid-Valley Area.** Restore levees on the Feather and Sacramento Rivers and tributaries just north of Sacramento to design standards. Phase III was divided into four construction contract areas. Construction of the first contract area (Reclamation District (RD) 1500) was completed in 1998. The other three construction contract areas have completed plans and specifications in project specific design memoranda recommending minor changes based on seepage observed during 1997 and 1998 floods.
- **Phase IV – Lower Sacramento Area.** Restore levees south of Sacramento along the Sacramento River and tributaries, distributaries, sloughs, and the Yolo Bypass to design standards. Four sites were identified. Plans and specifications are completed.
- **Phase V – Upper Sacramento Area.** Restore levees along the Sacramento River and Colusa Basin Drain. Plans and specifications are completed.

The System Evaluation led to the Corps preparing the *Sacramento Flood Control Project, California, Mid-Valley Area, Phase III, Design Memorandum* which was completed in June 1996 (1996 DM). The 1996 DM proposed remediation work along various levee locations in the Phase III area and separated the designs for the Mid-Valley Phase III remediation work into four construction contract areas (see figure 1). The repairs included in the 1996 DM included portions of the Sacramento River (RM 70 to 118), Feather River (RM 0 to 3), KLRC,

## Attachment E Project Summary Report

Knights Landing Ridge Cut Levee Repair Project – Section 408 Summary Report – October 2013

Sutter Bypass (Tisdale Bypass to the Feather River), and Yolo Bypass (Fremont Weir to the Sacramento Bypass). To date only Contract Area 1 (the RD 1500 area), has been completed.

Mid-Valley Project Contract Area 3 is comprised of repairs to levees along the right bank levee of the Sacramento River and along the left bank levee of the KLRC (see figure 2). This Section 408 request is confined to the KLRC left bank levee repairs to sites 12, 12a, and 13 for which the Corps has completed environmental review, geotechnical design, and civil engineering plans and specifications. Construction of the Sacramento River levee repairs (Sites 9, 10 & 11) will continue to be pursued through completion of the Mid Valley Project.

### **2.2 Failure Mechanisms Warranting Remediation**

According to the 1996 DM, the KLRC levees have a long history of stability problems. Records dating to 1951 have described levee deformation, slippage, and partial collapse. Many of the failures have been on the landside slope and are often shallow, involving approximately the upper 5 feet of the levee. Deeper slides, sometimes resulting in significant slumping of the crown, have also occurred. Past repairs have included removal and recompaction of the failed material with flatter slopes and inclusion of a stabilizing berm to counterbalance the tendency for rotational failures of the levee fill. A total of 67 levee repair and reconstruction sites have been noted in the Corps documents since 1956. The Corps has previously evaluated the levees and developed a rehabilitation scheme that consists of replacing a portion of the landside slope with lean clay, constructing a toe berm at the landside toe, and relocating the drain ditch further from the levee.

## **3.0 Purpose and Need for the Modification**

The primary purpose of the KLRC levee repairs are to reduce flood risk for the Knights Landing basin by addressing known levee deficiencies identified in the 1996 DM. The deficiencies could cause portions of the existing levee system to fail, triggering flooding and damage to the planning area's existing residential, commercial, and agricultural uses and the potential loss of life.

# Attachment E Project Summary Report

Knights Landing Ridge Cut Levee Repair Project – Section 408 Summary Report – October 2013

## 4.0 Description of the Proposed Alteration

### 4.1 Physical Description of the Alteration

The objective of the KLRC project is to eliminate the cause of landside levee slope failures by replacing the landside levee face with lean clay, constructing a spoils berm, replacing pump station discharge lines, and relocating the portion of the drainage ditches affected by the construction away from the levee slope. The recommended levee repair work is on the landside at Sites 12, 12A, and 13 located on the left bank levee of the KLRC south of Knights Landing (see figure 2) at the following locations:

- Site 12 starts approximately 0.75 mile south of the town of Knights Landing at channel mile (CM) 5.0 and extends 14,100 feet downstream to CM 2.3.
- Site 12A is contiguous with the south end of Site 12 and extends 2,100 feet downstream to CM 1.9.
- Site 13 is contiguous with the south end of Site 12A and extends 2,000 feet downstream to CM 1.5.

The levee repair work is detailed in the Corps' *Knights Landing Ridge Cut Sites 12, 12A & 13, July 2011 Design Documentation Report*, and in the accompanying *Knights Landing Ridge Cut, Sites 12, 12A & 13, Design Plans and Specifications, August 2011*. Table 1 below lists the proposed work.

**Table 1 – Proposed Work**

Site 12	Flatten 3H to 1V, and stabilize landside slope by importing embankment fill material of lean clay on landside slope for 5 ft. depth (perpendicular to landside face). Relocate the irrigation ditch a minimum of 15 ft. landside from the new toe.	Station 41+00 to Station 182+00
Site 12 A	Flatten 3H to 1V, and stabilize landside slope by importing embankment fill material of lean clay on landside slope for 5 ft. depth (perpendicular to landside face).	Station 20+00 to Station 41+00
Site 13	Flatten 3H to 1V, and stabilize landside slope by importing embankment fill material of lean clay on landside slope for 5 ft. depth (perpendicular to landside face). Relocate the irrigation ditch a minimum of 15 ft. landside from the new toe.	Station 0+00 to Station 20+00

A typical cross section of the proposed repair is shown in figure 3 below.



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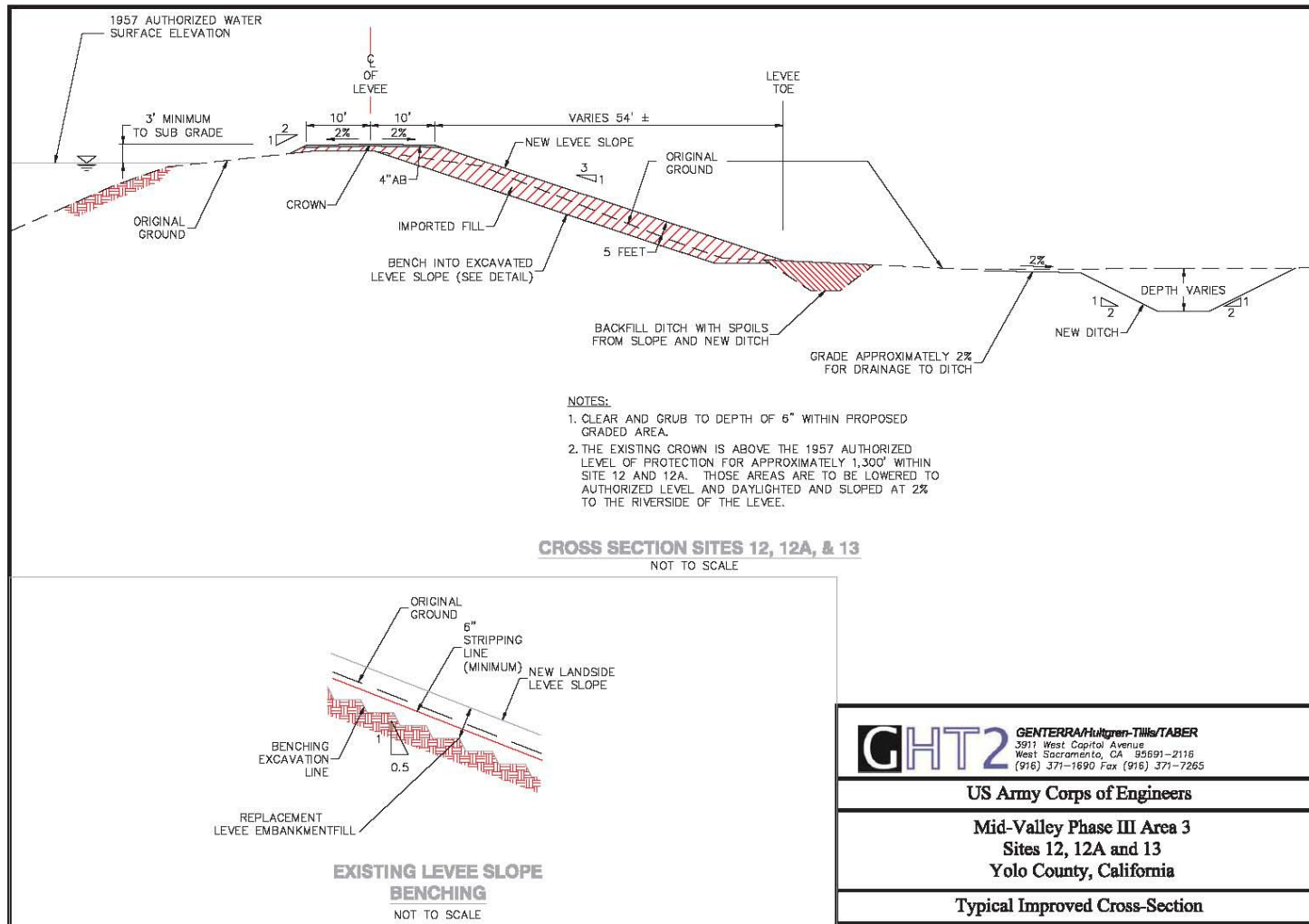


Figure 3 – Typical Cross Section of Proposed Levee Repair

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The existing levee crown elevation varies significantly along the project length with some areas having freeboard in excess of 7-feet above the authorized 1957 water surface elevation and other areas having less than 3-feet of freeboard. The Corps' design, detailed in the *Knights Landing Ridge Cut, Sites 12, 12A & 13, Design Plans and Specifications*, proposes reconstructing the levee crown to a consistent elevation of 42.5 feet (NAVD 88) to best match the existing crown elevation. Reconstructing the levee crown at 42.5 feet would in some locations, 'raise' the levee crown and provide more than 3 feet of freeboard above the authorized 1957 water surface elevation. The Central Valley Flood Protection Board is concerned that this may be construed as a 'levee raising' requiring a Section 408 'Major' review which could result in delays to project implementation. Therefore the KLRDD is proposing to modify the Corps' design to limit restoring of the levee crown to 3-feet above the authorized 1957 water surface elevation in those areas with currently less than 3-feet of freeboard.

### **4.2 O&M Considerations**

The KLRC is part of the SRFCP as previously discussed and its O&M is covered in the current SRFCP O&M Manual. The proposed alterations will not change the existing typical maintenance activities which include vegetation control through mowing, herbicide application, and/or slope dragging; rodent control; patrol road maintenance; and erosion control and repair. Vegetation control typically is performed twice a year. Erosion control and slope repair activities include re-sloping and compacting; fill and repair of damage from rodent burrows is treated similarly.

### **4.3 Mitigation Commitments**

Environmental commitments are measures incorporated as part of the project description, meaning they are proposed as elements of the proposed action. To avoid and minimize construction-related effects, KLRDD will implement environmental commitments to reduce or offset short-term, construction-related effects as described in the *Phase III, Mid-Valley, Contract Area 3 Final Environmental Assessment/Initial Study, dated April 2013*.

### **4.4 Real Estate Analysis**

Throughout the project length, KLRDD holds easements and fee rights to the land beneath and adjacent to the KLRC left bank levee. No easements or fee rights to the land are held by the Corps. KLRDD will acquire additional area adjacent to the levee to accommodate the slope flattening and ditch relocation. Permanent acquisition, relocation, and compensation services will be conducted in compliance with Federal and state relocation laws, which are the Uniform Act of 1970 (42 USC 4601 et seq.) and implementing regulation, 49 CFR Part 24;



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and California Government Code Section 7267 et seq. These laws require that appropriate compensation be provided to displaced landowners and tenants.

### 4.5 Encroachments

Table 2 below lists the existing encroachments in and adjacent to the levee and the proposed project action for each encroachment.

**Table 2 - Encroachments**

<b>Encroachment</b>	<b>Proposed Action</b>	<b>Beginning Sta.</b>	<b>End Sta.</b>
Irrigation ditch at landside levee toe.	Relocate outside of project right of way	00+43	18+19
Irrigation ditch at landside levee toe.	Relocate outside of project right of way	52+19	66+00
Irrigation ditch at landside levee toe.	Relocate outside of project right of way	80+91	91+00
Irrigation ditch at landside levee toe.	Relocate outside of project right of way	94+86	176+50
PG&E overhead powerline at landside levee toe.	Relocate outside of project right of way	18+50	68+00
PG&E underground gas line	Relocate outside of project right of way	39+00	67+50
Pump Station Discharge 18" Pipe	Replace in kind	18+45	
Gravity 24" drainage pipe through the levee	Replace in kind	18+50	
Pump Station Discharge 18" Pipe	Replace in kind	42+47	
Pump Station Discharge 18" Pipe	Replace in kind	126+32	
Pump Station Discharge 24" Pipe	Replace in kind	126+38	

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### **4.6 Vegetation**

Existing vegetation on the landside levee slope, and directly adjacent to the landside levee toe will be removed by the project to facilitate construction, and to allow relocation of directly adjacent landside irrigation districts. The project will not remove any waterside vegetation. The Knights Landing Drainage District has submitted to the Central Valley Flood Project Board a Letter of Intent (LOI) to prepare a System Wide Improvement Framework (SWIF) Plan to address any remaining vegetation considered non-compliant with ETL 1110-2-571 “Guidelines For Landscape Planting and Vegetation Management at Levees, Floodwalls, Embankment Dams, and Appurtenant Structures”.

## 5.0 Related Actions, Programs, and Planning Efforts

This section provides an overview of other flood management activities that comprise the regional planning context.

### 5.1 Sacramento River Flood Control System Evaluation

As discussed in Section 2 of this document, following the flood of 1986, the Corps and the State of California, along with local partners, completed a comprehensive evaluation of the Sacramento River Flood Control System and initiated a flood risk management program aimed at repairing, raising, and strengthening urban levees, among other activities. This effort, known as the Sacramento River Flood Control System Evaluation (commonly referred to as System Evaluation) resulted in the repair of more than 70 miles of deficient levees by the Corps. The KLRC is part of the SRFCP and is included in Phase III of the System Evaluation.

### 5.2 Central Valley Flood Protection Act

The Central Valley Flood Protection Act (CVFPA), enacted in California in 2009, called for DWR to prepare the Central Valley Flood Protection Plan (CVFPP), which was adopted by the Central Valley Flood Protection Board (CVFPB) in June 2012. The CVFPP provides a comprehensive framework for system-wide flood management and flood risk reduction in the Central Valley. The CVFPA also establishes a new standard of 200-year flood protection for urban areas in the Central Valley and requires this standard to be achieved by 2025.

The CVFPP presents three preliminary approaches for addressing current challenges and affordably meeting the CVFPP goals. The State has assembled what it views as the most promising, affordable, and timely elements of the three preliminary approaches into the State Systemwide Investment Approach (SSIA), which provides guidance for future State participation in projects and programs for integrated flood management in the Central Valley. The FRWLP is consistent with the SSIA.

The people of California passed two bond measures (Propositions 84 and 1E) that provide approximately \$5 billion toward flood improvements to reduce flood risk, particularly to state-Federal levees protecting urban areas in the Central Valley. These levee improvements are expected to occur over the 10-years since authorization of the bonds in 2006 with much of the bond money spent after the year 2012. However, there were urgent needs to improve inadequate flood protection in advance of the overall comprehensive effort. These advance efforts are termed early implementation projects (EIPs). EIPs can be implemented ahead of and in parallel with the comprehensive effort as long as they are

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designed to ensure that they do not eliminate opportunity or prejudice future flood risk-management alternatives that would provide regional or system-wide benefits. Local agencies and the State are identifying and planning EIPs in a parallel process to be compatible with comprehensive, system-wide studies. Several EIPs have been implemented, such as those under the programs of SAFCA, SBFCA, and WSAFCA. KLRDD will implement the KLRC levee repairs as an EIP.

### **5.3 Sutter Basin Project**

The Sutter Basin Project is undergoing a feasibility study by the Corps, Sacramento District, to determine Federal interest in implementing a flood-risk management project. The Sutter Butte Flood Control Agency (SBFCA) and the State of California are the non-Federal sponsors of the feasibility study. The feasibility study will evaluate structural and nonstructural flood risk management measures, including improvements to existing levees. The draft integrated study report and EIS for the feasibility study was released in the summer of 2013.

An outgrowth of this feasibility study is the Feather River West Levee Project which proposes to repair-in-place approximately 41 miles of levee as an EIP and Section 408 action. An FEIS/FEIR has been prepared with the Corps as the Federal lead agency for NEPA based on the Corps' responsibilities under Section 408, and Section 404. The first phase of this project is presently under construction.

### **5.4 Natomas Levee Improvements Program**

As part of its long-term program to improve the Natomas Basin levee system, the Sacramento Area Flood Control Agency (SAFCA) proposes to continue waterside and landside levee-strengthening efforts, including levee raises, seepage remediation, increased bank protection, levee stabilization, and flattening of landside levee slopes under the Natomas Levee Improvement Program (NLIP), EIP and Section 408 action.

The ultimate goal of the NLIP is to provide the Natomas Basin with a 200-year level of flood protection by improving conditions along approximately 26 miles of levees surrounding the Natomas Basin. These levees include the Natomas Cross Canal South Levee, Sacramento River East Levee, American River North Levee, Natomas East Main Drainage Canal West Levee, and the Pleasant Grove Creek Canal West Levee. The NLIP is a four-phase construction program: Phase 1 occurred in 2008, Phase 2 in 2009 and 2010, Phase 3 in 2010 and 2011, and a majority of Phase 4a work was completed in 2011 with the remainder scheduled for 2012 and 2013. Phases 1 through 4a focus on the Natomas Cross Canal South Levee and a large portion of the Sacramento River East Levee.

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Phase 4b includes a portion of the Sacramento River East Levee, the American River North Levee, the Natomas East Main Drainage Canal West Levee, the Pleasant Grove Creek Canal West Levee, any water supply and drainage pump station improvements which are needed but have been deferred from SAFCA's construction program, and other improvements needed to provide 200-year level of flood protection to the Natomas Basin. SAFCA staff is currently working with the Corps on an evolving plan for completing the Phase 4b work using a combination of the Corps and SAFCA resources.

### **5.5 West Sacramento Levee Improvements Program**

The West Sacramento Area Flood Control Agency (WSAFCA) proposes to implement the Southport project along the left bank of the urbanized reach of the Sacramento River as an EIP and Section 408 action. The study reach is approximately 6 miles connecting the Sacramento River to the Sacramento River Deep Water Ship Channel and extending downstream to West Sacramento city limit at the southern cross levee. The project would most immediately protect the part of the city known as Southport and is targeted at addressing under-seepage, through-seepage, erosion, and slope instability. This project is presently undergoing design development and an EIS/EIR is being prepared with the Corps as the Federal lead agency for NEPA based on the Corps' responsibilities under Section 408, Section 404, and Section 10.

## 6.0 Environmental Considerations

The Corps has prepared for the Mid Valley Area 3 project an Environmental Assessment/Initial Study (EA/IS) for the purposes of complying with the National Environmental Protection Act (NEPA) and the California Environmental Quality Act (CEQA). The EA/IS analyzed the potential impacts (including cumulative) of the proposed project on all relevant resource areas, including aesthetics, agriculture and land use, air quality, sensitive species and wetlands, cultural resources, hazardous waste, hydrology and water quality, noise, recreation, and transportation. The EA/IS tiered off the Programmatic Environmental Impact Statement/Environmental Impact Report for the System Evaluation completed by the Corps in May 1992. The EA/IS determined that potential adverse effects would be avoided, minimized, or reduced to less than significant by implementing best management practices and mitigation measures as discussed in the EA/IS. The loss of riparian vegetation will be compensated onsite by planting similar vegetation, and potential take of the federally listed valley elderberry longhorn beetle and giant garter snake would be avoided by complying with all terms and conditions in the U.S. Fish and Wildlife Service's (USFWS) Biological Opinion issued for the project. USFWS also prepared a Coordination Act Report (CAR) for the project.

Based on the EA/IS analysis the Corps deemed the proposed project to be a logical and desirable alternative. Furthermore, the Corps determined that the project would have no significant effects on the environment. Based on the results of the environmental evaluation and completion of interagency coordination the Corps issued a Finding of No Significant Impact on April 18, 2013.

## 7.0 Public Interest Determination

Proposed Federal projects are to be reviewed to determine a project's probable impacts (including cumulative impacts) on the public interest (33 CFR §320.4). The public interest review is described as a balancing of the benefits which reasonably may be expected to accrue from the proposal against its reasonably foreseeable detriments, with consideration of the national concern for both protection and utilization of important resources (33 CFR §320.4). In the case of the proposed Project, this review was conducted in an EA/IS prepared and completed by the Corps for the purposes of complying with NEPA (40 CFR §1508.9). The EA/IS analyzed the potential impacts (including cumulative) of the proposed project on all relevant resource areas, including aesthetics, agriculture and land use, air quality, sensitive species and wetlands, cultural resources, hazardous waste, hydrology and water quality, noise, recreation, and transportation.

## 8.0 Executive Order 11988

Executive Order 11988 (May 24, 1977) requires a Federal agency, when taking an action, to avoid short- and long-term adverse effects associated with the occupancy and the modification of a floodplain. In February 1978, the Water Resources Council issued Floodplain Management Guidelines for Implementing Executive Order 11988. These guidelines provide analysis of the Executive Order, definitions of key terms, and an eight-step decision-making process for carrying out the Executive Order's directives.

In February 1978, the Water Resources Council issued Floodplain Management Guidelines for Implementing Executive Order 11988. These guidelines provide analysis of the Executive Order, definitions of key terms, and an eight-step decision-making process for carrying out the Executive Order's directives. The process contained in the Water Resources Council guidelines incorporates the basic requirements of the Executive Order. Briefly, the eight-step process is outlined below, followed by discussion of the KLRC levee repair project application of the process to demonstrate compliance.

**Step 1: Determine if a proposed action is in the base floodplain** (100-year floodplain or 1% chance flood or 500-year or 0.2% if the action falls under the definition of critical, discussed separately below). The KLRC levee is located within the Knights Landing basin which has been designated by the Federal Emergency Management Agency (FEMA) as being within a 100-Year floodplain.

The Water Resources Council Floodplain Management Guidelines presented the concept of a critical action. While there is no precise definition of critical action, the guidelines (under Part II, Decision-Making Process, Step 1C) outline the parameters of critical actions. To summarize, as noted in the guidelines, a critical action is "any activity for which even a slight chance of flooding is too great." This definition is intended to apply to Federal actions where that action would involve facilities or infrastructure that are sensitive to flooding, where the consequences of flooding would be severe in terms of ability to provide essential community services or to protect life and welfare. For the KLRC levee repair project, it is the levee project itself that would reduce the chance of flooding, rather than being sensitive to or compromised by flooding; i.e., the project purpose is to manage flood risk. Therefore, the KLRC levee repair project is not considered a critical action because it is intended to withstand flood conditions, reduce flood risk, and increase flood protection.

**Step 2: Provide public review.** The NEPA/CEQA process provides for public disclosure and an Environment Assessment/Initial Study was prepared by the Corps for the project.



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**Step 3: Identify and evaluate reasonable and feasible alternatives to locating in the base floodplain.** Since this is an in-place levee repair project, the project cannot be located elsewhere.

**Step 4: Identify the effects of the proposed action.** The Environment Assessment/Initial Study prepared for the project analyzed the environmental effects potentially resulting from the project per NEPA/CEQA requirements. Review under the Endangered Species Act was also completed and a Biological Opinion was issued by the U.S. Wildlife Service. The Environment Assessment/Initial Study determined the project would have no significance effects on the environment.

**Step 5: Minimize threats to life and property and to natural and beneficial floodplain values.** The KLRC levee repairs would reduce flood risk for the Knights Landing Basin and increase protection for life and property within the affected area. The existing levee system was originally designed and constructed to provide a minimum level of protection. The KLRC levee repairs are designed to restore that minimum level of protection.

**Step 6: Reevaluate alternatives.** The Corps System Reevaluation discussed in Section 2 of this document and the subsequent 1996 DM evaluated repairs alternatives and demonstrated that the proposed remediation actions are the most practicable alternatives.

**Step 7: Issue findings and a public explanation.** To conclude the NEPA process, a Finding of No Significant Impact was issued by the Corps on April 18, 2013. To conclude the CEQA process, the Central Valley Flood Project Board adopted a Mitigated Negative Declaration at their regularly scheduled Board meeting on July 26, 2013.

**Step 8: Implement the action.** KLRDD intends to construct the KLRC levee repairs in 2014 following conclusion of the project approval processes.

The KLRC levee repairs would reduce the risk of flood loss and minimize the effect of floods on human health, safety, and welfare by improving existing, authorized flood management infrastructure, and would increase protection for the existing population. Importantly, the KLRC levee repairs would help further protect farmland, agricultural commodities, and agricultural infrastructure for this crucial agricultural region. The KLRC levee repairs would restore the level of flood protection, not increase it beyond that envisioned with the SRFCP. Therefore, the KLRC levee repairs are not in conflict with Executive Order 11988 because the project would restore flood protection and because there is no reasonable and feasible alternative.

## 9.0 Residual Risk and Transfer of Risk Effects of the Proposed Modification

### 9.1 Residual Risk

Construction of the KLRC levee repairs would lessen the probability of flooding in the Knights Landing basin. However, the Knights Landing basin would remain subject to risk from flooding from failure of the Sacramento River levees, and from larger storm events larger that could overwhelm the system. Construction of the KLRC levee repairs will not remove the Knights Landing basin from the FEMA 100-Year floodplain, therefore National Flood Insurance Program (NFIP) restrictions preventing new development from occurring within a FEMA designated 100-Year floodplain will remain in place. These restrictions will prevent increases in residual risk after project implementation, and the project will not result in additional development within the basin.

### 9.2 Transfer of Risk

Strengthening portions of the federal project levee system protecting the basin as proposed by KLRDD would not result in any significant, adverse hydraulic impacts or induce flooding to other sub-basins protected as part of the SRFCP. Indeed, the work proposed will bring the KLRC left bank levee closer to the authorized level of protection. Furthermore, these improvements would be consistent with the principles that have guided the management of the SRFCP over the past century. The KLRC levee repair work will occur on the landside of the levee and will have no impact on the existing channel hydraulics of the KLRC.

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### 10.0 Technical Analysis and Adequacy of Design

The KLRC levee repair designs completed by the Corps in accordance with Corps guidance (see Table 2). The Corps *Design Documentation Report for the Knights Landing Ridge Cut Sites 12, 12A & 13, July 2011*, provides the technical basis of design for the KLRC levee repairs.

**Table 3- Standards and Design Guidance References**

Design Component	Manual	Reference
<b>Datum</b>		The referenced vertical datum for the FRWLP is the North American Vertical Datum of 1988 (NAVD88). The referenced horizontal projection for the FRWLP is NAD 1983 State Plane, California Zone II.
<b>Levee</b>		
Guidance	EM 1110-2-1913 (30 April 00)	Design and Construction of Levees
Misc. Guidance	SOP03 (11 April 2008)	Sacramento Geotechnical Levee Practice
Vegetation	ETL 1110-2-571 (10 April 09)	Engineering and Design: Guidelines for Landscape Planting and Vegetation Management at Levees, Floodwalls, Embankment Dams, and Appurtenant Structures
Misc. Guidance	CA Title 23	California Code of Regulations Title 23 “Water”
<b>Hydraulic</b>		
Design Water Surface Elevation	EM 1110-2-1619 (01 Aug 96)	Risk Based Analysis for Flood Damage Reduction Studies
<b>Geotechnical</b>		
Bearing	EM 1110-1-1905 (30 Oct 92)	Engineering and Design - Bearing Capacity of Soils
Earthquake loading	ER 1110-2-1806 (31 Jul 95)	Earthquake Design & Evaluation for Civil Works Projects
Drainage	EM 1110-2-2007 (30 Apr 95)	Structural Design of Concrete Lined Flood Control Channels
Slope Stability	EM 1110-2-1902 (31 Oct 03)	Slope Stability
Underseepage	ETL 1110-2-569 (01 May 05)	Design Guidance for Levee Underseepage

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### **10.1 Geotechnical Analysis**

A geotechnical analysis was prepared by GENTERRA/Hultgren – Tillis/TABER, LLC (GHT2) for the Corps as part of their work under contract *W91238-09-D-0064, Task Order 2, for Mid-Valley Area Phase III Area 3, Left Bank Knights Landing Ridge Cut, Sites 12, 12A, and 13, Yolo County, California*. This contract included collection of data from 19 borings, 28 CPTs, and geotechnical laboratory testing. Borings and CPTs were advanced from the levee crest, the landside levee toe, and landside of the toe. Laboratory tests included 120 moisture content tests, 40 sieve analysis tests, 4 unconsolidated-undrained (UU) triaxial shear tests, 4 consolidated-undrained (CU) triaxial shear tests, and 4 consolidation tests. Boring logs, CPT logs and laboratory data were published by GHT2 in a report titled Geotechnical Data Report - FINAL on November 2, 2010.

GHT2 found that the KLRC levee area is generally blanketed by clay and materials encountered at the site were broadly categorized into four types: levee fill, foundation clay, silt, and sand. At most locations below the levee a layer of sand with occasional gravel was found below the native clay. At some locations there are layers of silt between the native clay and the sand. At most exploration locations below the levee, the sand layer extended to the depths explored.

The geotechnical analysis included evaluation of the existing levee configuration for the two separate water levels for seepage and stability. Steady state seepage analysis was performed using the computer program SEEP/W 2007 (version 7.17). Limit equilibrium slope stability analysis was performed using the computer program SLOPE/W 2007 (version 7.17). For stability, the long-term and rapid drawdown cases were also evaluated. For seepage, the long-term case was also evaluated.

Slope stability analyses were performed using Spencer's method and computer program SLOPE/W. Phreatic surfaces and steady state pore pressures obtained from the SEEP/W steady-state seepage analyses imported into SLOPE/W and were used for the analysis. Factors of safety for landside slope stability were evaluated for two cases: existing configuration with steady state seepage (existing case), and improved conditions with steady state seepage (long-term case). Factors of safety for waterside slope stability were evaluated for a rapid drawdown case.

As described in EM 1110-2-569 (2005), current USACE criteria require seepage remediation if there is a history of severe seepage or if computed vertical exit gradients exceed 0.5 at the landside toe. Historical documents do not describe problematic seepage at the site and computed vertical exit gradients do not exceed 0.5, therefore remedial measures to reduce underseepage are not required.

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Based on the results of the analysis and consideration of historic slope performance, GHT2 found that the landside slope should be rehabilitated to improve performance. GHT2 recommended that the landside slope should be reconstructed with a slope inclined at 3H:1V and should be covered with a minimum 5-foot thickness (perpendicular to landside face) of soil meeting the USACE fill guidelines. GHT2 recommended that the existing landside drainage ditch should be relocated a minimum of 15 feet landside of the new landside toe.

### **10.2 Hydraulic Analysis**

Per the 1996 DM, project design flows and water surface profiles were developed based on available hydrologic information, detailed hydraulic studies, and as various segments of the SRFCP were constructed. The water surface elevations have been agreed upon by the Reclamation Board, State of California, and the Corps and published as "Levee and Channel Profiles, Sacramento River Flood Control Project," dated 15 March 1957. The agreed upon water surface profiles can be found in Plates 4 through 15 of the 1996 DM. Plate 9 of the 1996 DM presents design water surface elevations and February 1986 floodwater surface elevations along the KLRC. According to the 1996 DM, the February 1986 flood was estimated as a 60-year flood for Knights Landing at Sacramento River Channel Mile 89.7. Along the KLRC, the design water surface ranges between about 0.4 feet below the 1986 flood level at KLRC Channel Mile 0, to about 1.6 feet above the 1986 flood level at KLRC Channel Mile 6.

Figure 4 (on the following page) shows the 1957 design water surface elevations for both the NGVD 29 and NAVD 88 datums. The elevations were taken from Plate 9 of the 1996 DM.

### **10.3 Risk and Uncertainty Analysis**

The KLRC levee repairs are all located on the landside of the levee and do not impact channel hydraulics, therefore a risk analysis was not performed for this 408 application.

### **10.4 Safety Assurance Review**

The KLRC levee repair designs have been developed by the Corps and have been extensively reviewed as part of the System Evaluation and the Mid Valley Area 3 project therefore a Safety Assurance Review (SAR) will not be prepared for this project.

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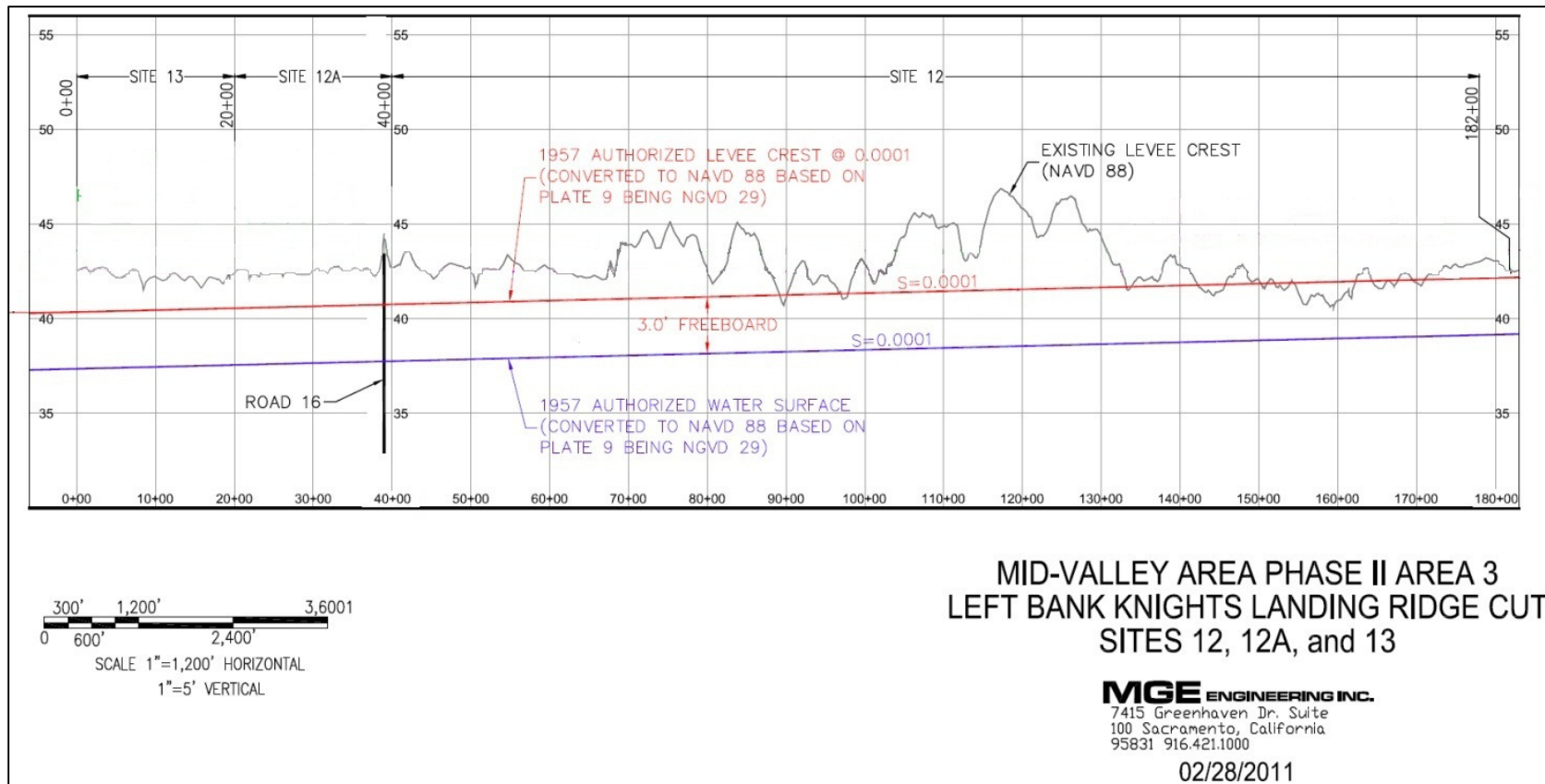


Figure 4 - Knights Landing Ridge Cut Profile

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### 11.0 Technical Support Documents

*Design topographic survey "Mid-Valley Area, Phase III, Knights Landing" prepared by Andregg Geomatics, 11/20/2009*

*Evaluations of Results and Remediation Method Development Report (Project Geotechnical Report) prepared by GHT2, 12/22/2010*

*Knights Landing Ridge Cut Sites 12, 12A & 13, Design Documentation Report, July 2011*

*Knights Landing Ridge Cut, Sites 12, 12A & 13, Design Plans and Specifications, August 2011.*

*Sacramento Flood Control Project, California, Mid-Valley Area, Phase III, Design Memorandum completed, June 1996*

*Final Environmental Assessment/Initial Study, Sacramento River Flood Control System Evaluation Phase III, Mid-Valley, Contract Area 3, April 2013*