



**Ventura County
Watershed Protection District**

**FEMA Levee Certification
Ventura County, California**

**Calleguas Creek Levee (CC-3)
Pleasant Valley Road to Highway 101**

**Evaluation Report
February 27, 2009**



TETRA TECH, INC.
17770 Cartwright Road, Suite 500
Irvine, California 92614

FEMA Levee Certification

Ventura County, California

Calleguas Creek Levee (CC-3)

Pleasant Valley Road to Highway 101

Evaluation Report

February 2009

Prepared for:

Ventura County
Watershed Protection District

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Executive Summary

As nation-wide efforts to certify all the existing flood control levees, FEMA has identified existing levee facilities within Ventura County. As part of this effort FEMA has requested the Ventura County Watershed Protection District (District) to evaluate the Calleguas Creek Levee (CC-3) and prepare documents for the certification process based on FEMA's regulatory requirements as identified in Title 44 of the Code of Federal Regulations (CFR), Section 65.10 (44 CFR 65.10).

Certification Criteria are as follows:

- Design criteria (freeboard, closures, embankment protection, embankment and foundation stability, settlement, and interior drainage)
- Operation plans and criteria (for closures and interior drainage)
- Maintenance plans and criteria
- Actual certification requirements (i.e. as-builts, forms, documentation, and data)

As part of the Phase 1 process, Tetra Tech was contracted by the District to evaluate the CC-3 levee system and to recommend a levee categorization to facilitate the levee certification.

Levee Categorizations are as follows:

- Category 1 – Levees meet 44 CFR 65.10 requirements and all data or complete documentation is available
- Category 2 – Levees may meet 44 CFR 65.10, but additional data or documentation is needed
- Category 3 – Levees do not currently meet 44 CFR 65.10
- Not a Levee – Based on physical conditions, low WSEL, no SFHA, and/or not providing flood protection

A levee that is assigned a Category 1 or 2 ratings will be further evaluated in the Phase 2 or 3 processes, respectively, in order to finalize its certification status. A levee that is assigned a Category 3 rating will require a Pre-Design Study in the Phase 4 process and implementation of the required improvements to achieve certification status.

Data collection efforts have been performed to determine what information is available in support of levee certification. Existing information collected and reviewed at the time of preparation of this report includes the following:

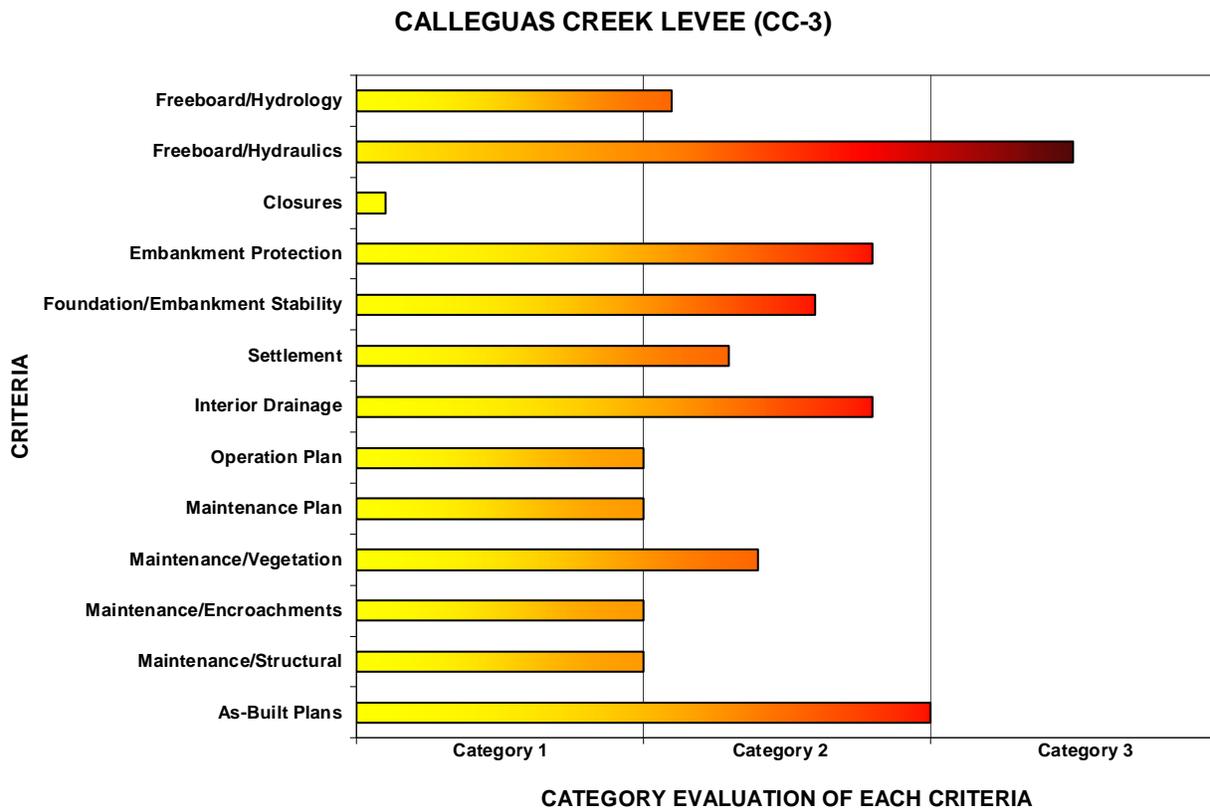
- Hydrologic Analysis
- LiDAR Topographic data
- As-built Plans
- Operation and Maintenance Manual
- Inspection/Maintenance Records

A field investigation conducted in early December identified several maintenance issues that will need to be addressed prior to levee certification. Additional field investigations to obtain



geotechnical data and additional engineering analyses to support certification requirements will be required to complete levee certification. The specifics of the work required are discussed in this report.

The graphic presented below identifies the extent of work to be accomplished related to each criterion for levee certification. The longer the task bar the more work required to complete certification. This is a subjective analysis that can be best used to compare the relative amount of work required for all the levees being considered as part of the Levee Certification program within Ventura County. The extent of work required can also be used to categorize the levee. The longest task bar determines the recommended categorization of the levee.



Based on the review of existing data and observations from the field investigation, it is recommended that the CC-3 levee system be classified as a Category 3 Levee.



FEMA Levee Certification

Calleguas Creek Levee (CC-3) Pleasant Valley Road to Highway 101

Evaluation Report

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EXHIBITS

- Exhibit 1 – Field Investigation Report
- Exhibit 2 – Preliminary Evaluation of Levee System Profiles
- Exhibit 3 – As-Built Plans Status List
- Exhibit 4 – Responses to Comments on Draft Evaluation Report



A) Introduction

The Calleguas Creek Levee (VCWPD ID No: CC-3) is located in the City of Camarillo, Ventura County. The location of the levee system is from the Pleasant Valley Road to Highway 101 and is shown on Figure 1. The CC-3 levee system is located along the left side of the Calleguas Creek. The levee system consists of embankment levees, side drainage penetrations, and drop structures. The protective works of the Calleguas Creek Levee were designed to provide protection from the 1-percent-annual-chance discharge (base flood) in conformance with FEMA required freeboard and other regulations. The levee system is intended to protect existing residential, and potentially developable property in low lying areas within the base flood floodplain of the Calleguas Creek Watershed.

The levee system begins at Pleasant Valley Road and continues upstream to Highway 101. The length of the levee along the Calleguas Creek is approximately 0.78 miles, with an embankment height up to 2 feet above natural ground on the landward side. The levee's earthen berm is protected by loose riprap and grouted riprap with an approximately 15 feet wide service road that runs along the top.

For purposes of the NFIP, FEMA will only recognize in its flood hazard and risk mapping effort those levee systems that meet, and continue to meet, minimum design, operation, and maintenance standards that are consistent with the level of protection sought through the comprehensive floodplain management criteria established by Section 60.3 of the NFIP regulations. Section 65.10 of the NFIP regulations describes the types of information FEMA needs to recognize, on NFIP maps, that a levee system provides protection from the flood that has a 1-percent chance of being equaled or exceeded in any given year (base flood). This information must be supplied to FEMA by the community or other party seeking recognition of a levee system at the time a study or restudy is conducted, when a map revision under the provisions of Part 65 of the NFIP regulations is sought based on a levee system, and upon request by the Administrator during the review of previously recognized structures. The FEMA review is for the sole purpose of establishing appropriate risk zone determinations for NFIP maps and does not constitute a determination by FEMA as to how a structure or system will perform in a flood event. (FEMA, 2007a)

B) Design Criteria

For the purposes of the NFIP, FEMA has established levee design criteria for freeboard, closures, embankment protection, embankment and foundation stability, settlement, interior drainage, and other design criteria. These criteria are summarized in subsections below.

B.1) Freeboard

Section 65.10(b)(1) of the NFIP regulations identifies a minimum freeboard requirement of 3 feet along riverine levees with an additional 0.5 feet required at the upstream limit of the levee and an additional 1.0 foot on both sides of structures (such as bridges). Freeboard is determined by comparing the 100-year water surface elevation with the top of levee elevation. The water surface elevation is derived from hydrologic and hydraulic analyses.

Review of prior hydrology studies for Calleguas Creek yielded discharge frequency information and methodology developed by the Corps of Engineers and Ventura County Watershed Protection District (VCWPD), which are suitable for levee certification purposes.



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Figure 1 – Location Map



The U.S. Army Corps of Engineers, Los Angeles District, Calleguas Creek Watershed Feasibility Study, Hydrology Appendix dated February 2003 provides discharge frequency values appropriate for levee certification for the CC-3 levee system.

The Corps HEC-HMS rainfall-runoff model generates 100-year hydrographs that can be used for baseflood hydrographs. Some additional volume-frequency analysis will be required to meet geotechnical analysis needs for levee long duration seepage and stability evaluation.

The current FEMA FIS hydraulic model for the Calleguas Creek Watershed is available. The current FEMA FIS mapping shows that downstream half of the CC-3 levee system is overtopped by flows. The current hydraulic model was reviewed to determine if the levee system could be segmented or if the upstream half could be considered a channel.

Based on an evaluation of the current hydraulic model, generating more detailed cross sections from Hwy 101 to Pleasant Valley Road and using the fully contained flow from the City of Camarillo Appeal, it does not appear that the left bank levee can be certified as a levee or be segmented to show channel containment for any reach.

B.2) Closures

Section 65.10(b)(2) of the NFIP regulations requires that all openings be provided with closure devices that are structural parts of the system.

Review of the as-built plans and results from the field investigation (Field Investigation Report included as Exhibit 1) indicate that the system does not include any closure devices such as a stop log system.

B.3) Embankment Protection

Section 65.10(b)(3) of the NFIP regulations requires that engineering analyses be submitted that demonstrate that no appreciable erosion of the levee embankment can be expected during the 100-year flood.

Data needed to perform this analysis includes results from the hydraulic analysis, scour analysis, as-built plans, and field verification of the existing embankment protection. The hydraulic analysis and scour analysis would be developed as part of the freeboard assessment. As-built plans are available and field verification has been completed.

A preliminary evaluation of the levee system's current top, toe, toedown and creek thalweg has been prepared and is presented in Exhibit 2.

Field investigations have identified several locations where the levee embankment has been impacted and requires restoration/mitigation.

B.4) Embankment and Foundation Stability

Section 65.10(b)(4) of the NFIP regulations requires that engineering analyses be submitted that evaluate the levee embankment stability. Borings of the levee are required to support this analysis.

As of February 27, 2009, no geotechnical design or construction information has been made available for review.



During field inspections, erosion associated with animal burrows and surface erosion created surficial instabilities. Evaluation of the surficial stability should be conducted.

Further analysis and evaluations would include the following:

- Geotechnical borings for determining existing geologic conditions, obtaining geologic samples, and performing in-situ permeability testing.
- Laboratory analysis to determine soil properties and strength parameters.
- Seepage and stability analysis for static and flood conditions.

B.5) Settlement

Section 65.10(b)(5) of the NFIP regulations requires that engineering analyses be submitted that assess the potential and magnitude of future losses of freeboard as a result of levee settlement.

As of February 27, 2009, no geotechnical design or construction information has been made available for review.

During field inspections, no obvious evidence of adverse settlement was observed.

Further analysis and evaluations would include the following:

- Geotechnical borings for determining existing geologic conditions, obtaining geologic samples, and performing in-situ permeability testing.
- Laboratory analysis to determine soil properties and consolidation potential.
- Analysis of potential long term settlement and seismic deformation.

B.6) Interior Drainage

Section 65.10(b)(6) of the NFIP regulations requires that an analysis be submitted that identifies the sources, extent, and depth of interior flooding.

Interior drainage analyses would be required at all storm drain penetrations. Based on the field investigation and review of the as-built plans, there are 7 storm drain penetrations through the levee. None of the storm drains have flap gates. GPS locations and descriptions for each are included in Table 1 of the field investigation report included as Exhibit 1. Photographs of the outlets are also included in the report. For storm drains that continue under ground into the City of Camarillo, additional documents will be required including the master plan of drainage to develop the interior drainage analyses.

C) Operation Plans and Criteria

Section 65.10(c) of the NFIP regulations requires submittal of appropriate documentation of the operation of the system.

An operation plan exists that is in use for this levee. For certification this operation plan will need to be updated to meet the NFIP requirements including the attachment of the County's Flood Warning System and Emergency Response Plan. The operation plan will need to include the procedures for operating the entire system including the interior drainage system.



D) Maintenance Plans and Criteria

Section 65.10(d) of the NFIP regulations requires submittal of appropriate documentation for the maintenance of the system.

A maintenance plan exists that is in use for this levee. For certification this maintenance plan will need to be updated to meet the NFIP requirements.

The field investigation report included as Exhibit 1 documents maintenance issues that were identified during the field investigation. Those issues are summarized in Table 2 of that report. The District has been unable to implement certain maintenance improvements due to permitting and environmental constraints. However, these locations need to be repaired or remediated in order for the levee system to meet the levee certification criteria set by USACE and FEMA and to be fully operational. Table 2 also provides possible repair or remediation actions for the locations along with the GPS points. Photos taken at the maintenance required locations are included in Appendix C of the report. Major maintenance issues are related to vegetation removal, animal burrows, erosion of the riprap along certain portions of the levee's toe and penetrations missing closure devices (flap gates).

E) Certification Requirements

Section 65.10(e) of the NFIP regulations requires that in addition to the above-described analyses, certified as-built plans of the levee must be submitted.

Most as-built plans obtained through data collection efforts have appropriate approvals to be used for certification; however, there are some outstanding as-built documents that still need to be obtained to complete the analysis and certification process. A list of the as-built plans and their status for this project is presented in Exhibit 3.

A complete system and structural evaluation should be performed as part of the certification.

Additional work to complete this task includes preparation of a Levee Certification Report that includes all analyses to meet the Section 65.10 NFIP requirements as well as the FEMA MT-2 application package.

F) Recommendation

The field investigation identified several critical issues that must be resolved prior to certification. These issues include the erosion of the riprap along certain portions of the levee's toe, the need for vegetation removal and remediation due to animal burrows.

Based on an evaluation of the current hydraulic model, generating more detailed cross sections from Hwy 101 to Pleasant Valley Road and using the fully contained flow from the City of Camarillo Appeal, it does not appear that the left bank levee can be certified as a levee or be segmented to show channel containment for any reach.

It is recommended that FEMA be notified that the CC-3 levee system cannot be certified and should be removed the PAL list. The Zone X along the left bank would then revert to Zone A or AE.

Also with this updated hydraulic information it is also questionable whether the right bank contains the base-flood. Separately the District should pursue the impacts of containing the breakout in the channel downstream of Hwy 101 – particularly with respect to the right bank.



CALLEGUAS CREEK LEVEE (CC-3) EVALUATION REPORT

Based on the review of existing data and observations from the field investigation, it is recommended that the CC-3 levee system be classified as a Category 3 Levee.



G) References

- FEMA. 2005a. *Title 44 of the Code of Federal Regulations (CFR), Section 65.10 (44 CFR 65.10)*, Federal Emergency Management Agency.
- FEMA. 2005b. *Procedural Memorandum 34 – Interim Guidance for Studies Including Levees*, Federal Emergency Management Agency.
- FEMA. 2007a. *Fact Sheet Requirements of 44 CFR, Section 65.10 Mapping of Areas Protected by Levee Systems*, Federal Emergency Management Agency.
- FEMA. 2007b. *Revised Procedural Memorandum 43 – Guidelines for Identifying Provisionally Accredited Levees*, Federal Emergency Management Agency.
- Howard H. Chang Consultants. 2004. *Sediment Studies for Channel Improvements of Calleguas Creek, Conejo Creek and Revlon Slough*. Prepared for the Ventura County Watershed Protection District, Ventura, California.
- Tetra Tech. 2008. *Calleguas Creek Levee (CC-3) Pleasant Valley Road to Highway 101, Field Investigation Report*. Prepared for the Ventura County Watershed Protection District, Ventura, California.
- U.S. Army Corps of Engineers, Los Angeles District. 2003. *Calleguas Creek Watershed Feasibility Study, Hydrology Appendix*.
- U.S. Army Corps of Engineers. 2006. *Levee Owner's Manual for Non-Federal Flood Control Works*. Prepared for the Rehabilitation and Inspection Program, Public Law 84-99.
- U.S. Army Corps of Engineers. 2008. *EC 1110-2-6067 - Certification of Levee Systems for the National Flood Insurance Program (NFIP)*.
- Ventura County Watershed Protection District. 2007. *Calleguas Creek Levee, Pleasant Valley Road to U.S. Highway 101, Operation and Maintenance Manual*.



Exhibit 1

Field Investigation Report



**Ventura County
Watershed Protection District**

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- Appendix B – Photos of Penetrations and Typical Levee Features
- Appendix C – Photos of Maintenance Required Sites



FEMA Levee Certification

Calleguas Creek Levee (CC-3) Pleasant Valley Road to Highway 101

Field Investigation Report

Introduction

Calleguas Creek Levee (VCWPD ID No: CC-3) is located between Pleasant Valley Road and Highway 101 in the City of Camarillo in Ventura County. The location of the levee system is shown on Figure 1.

As part of the FEMA levee certification process, field investigations of the Calleguas Creek Levee (CC-3) were conducted on December 8, 2008. The team included representatives from the Ventura County Watershed Protection District (District), Tetra Tech, and AMEC. The investigation was conducted by walking the entire length of the levee system while visually assessing the existing conditions of the flood protection elements. The visual assessment included thirteen (13) different evaluation items such as unwanted vegetation growth, signs of depression/rutting and erosion/bank caving, slope stabilities, penetration, etc. The description of these 13 items can be found in the Levee Inspection Log (Appendix A). Separate inspection logs were completed by Tetra Tech and AMEC at the end of the field visit. The log in Appendix A is a team log that comprises the assessments from the individual inspection logs.

Any notable findings and existing conditions of the levee during the walk were documented with photos and their geo-referenced locations were recorded with a GPS unit. Photos taken during the field investigation along with maps showing their location are presented in Appendix B and Appendix C.



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Figure 1 – Location Map



General Descriptions

- The levee system is located along the left bank of Calleguas Creek. The levee system consists of a trapezoidal embankment levee. The leveed reach forming the line of protection is continuous.
- The protective works of the Calleguas Creek Levee were designed to provide protection from the 1-percent-annual-chance discharge (100-year flood event) in conformance with FEMA required freeboard and other regulations.
- The levee system begins at the Highway 101 Bridge and continues downstream until it reaches the Pleasant Valley Road Bridge.
- The length of the Calleguas Creek Levee is approximately 0.78-miles (3,780-feet).
- The FIRM dated September 29, 1986 shows containment of Zone A.
- The levee system is intended to protect existing residential, and potentially developable property in low lying areas within the base flood floodplain of the Calleguas Creek Watershed.
- The levee's earthen berm is protected by riprap and the access road that runs along the top is approximately 15-feet wide.

General Field Observations

a) Riverward side of Levee:

1. Seven (7) storm drain outlets with various opening sizes from 18 inch to 60 inch in diameter were observed on the levee side slope. These culvert openings do not have any closure devices (flap gates) in place. Closure devices are necessary to avoid flooding behind the levee caused by the backup of the channel flow.
2. Multiple animal burrows were observed in the field. They are located near the top of the slope and along the interface between the revetment and dirt embankment. A few burrow holes were located on the asphalt-paved top of the levee. They do not affect the structural integrity of the levee but need to be repaired during maintenance.
3. A 5- to 6-ft high rock bench was constructed by the County along the toe of the ungrouted riprap section of the levee after the 1998 El Nino flood up to the observed high water mark. However, currently a 55-ft section of the rock bench has possibly washed away exposing the ungrouted toe of the levee and needs to be repaired to achieve the continuity of the bench and avoid a weak spot. The County personnel confirmed that as-built plans were available for the rock bench and should be provided for review.
4. Several areas with bank erosion were observed on the side slope of soil embankment above the rock bench near HWY 101 Bridge.



b) Landward side of Levee:

1. Nothing of significance noted.

Levee Penetrations

Levee closure of the Calleguas Creek Levee (CC-3) system during storm events must consider the existing storm drain outlets. The storm drain outlets should include closure devices at the end of each storm drain penetration. The need for closure devices for each penetration should be verified with additional engineering analysis. A summary of levee system penetrations is presented in Table 1.

Table 1 – Summary of Levee Penetration

River Station	GPS		*Photo No.	Description
	Lat	Long		
<i>Calleguas Creek Levee (CC-3) (Left Bank Only)</i>				
478+95	N34.20550	W119.01700	P1	60” RCP SD w/o a closure device. An active trickle of water was observed.
479+45	N34.20560	W119.01700	P2	18” RCP SD w/o a closure device.
482+00	N34.20628	W119.01662	P3	18” RCP SD w/o a closure device. A drop inlet for the RCP was located on the dry-side of the levee.
488+00	N34.20776	W119.01591	P4	18” RCP w/o a closure device. A drop inlet for the RCP was located on the dry-side of the levee.
495+00	N34.20961	W119.01508	P5	18” RCP w/o a closure device. A drop inlet for the RCP was located on the dry-side of the levee.
499+12	N34.21078	W119.01500	P6	42” RCP w/o a closure device. An active trickle of water was observed.
X	N34.21552	W119.01492	P7	24” CMP w/o a closure device immediately downstream of HWY 101. (No as-built plan available)

* Photos can be found in Appendix B.

Maintenance Required Locations

During the field inspection, locations where maintenance is required were documented and are summarized in Table 2. The District has been unable to implement certain maintenance improvements due to permitting and environmental constraints. However, these locations need to be repaired or remediated in order for the levee system to meet the levee certification criteria set by USACE and FEMA and to be fully operational. Table 2 also provides possible repair or remediation actions for the locations along with the GPS points. Photos taken at the maintenance required locations are included in Appendix C.



Inspection Conclusion

Once maintenance at the locations identified in Table 2 are complete, the field inspection of the levee system indicates that the Calleguas Creek Levee (CC-3) system may be certified as providing base flood protection if all other criteria are satisfied. Some maintenance improvements may require additional engineering analyses, design, construction and preparation of as-constructed documents.



Table 2 – Summary of Maintenance Required Locations

GPS		*Photo No.	Description	Action Required
Lat	Long			
<i>Calleguas Creek Levee (CC-3)</i>				
N34.20550	W119.01700	M1	60" RCP SD w/o a closure device (Sta.478+95)	Install a closure device, if appropriate.
N34.20560	W119.01700	M2	18" RCP SD w/o a closure device (Sta.479+45)	Install a closure device, if appropriate.
N34.20570	W119.01686	M3	Vegetation within 15' of Toe (Riverward side)	Remove vegetation and root ball, fill voids with impervious material and firmly compact.
N34.20595 to N34.21490	W119.01670 to W119.01482	M4	Multiple animal burrows on top of slope for an entire length of CC-3 (Riverward side)	Fill voids with impervious material and firmly compact.
N34.20628	W119.01662	M5	18" RCP SD w/o a closure device (Sta.482+00)	Install a closure device, if appropriate.
N34.20665	W119.01655	M6	Undercut at bottom of grouted revetment caused by toe erosion	Verify current toedown depth and condition of revetment. Repair revetment. Additional engineering analysis recommended.
N34.20776	W119.01591	M7	18" RCP w/o a closure device (Sta.488+00)	Install a closure device, if appropriate.
N34.20858	W119.01528	M8	Animal burrow through paved top of levee (Riverward side)	Fill voids with impervious material and firmly compact. Patch hole with asphalt.
N34.20887	W119.01520	M9	Animal burrow through paved top of levee (Riverward side)	Fill voids with impervious material and firmly compact. Patch hole with asphalt.
N34.20961	W119.01508	M10	18" RCP w/o a closure device (Sta.495+00)	Install a closure device, if appropriate.
N34.20970	W119.01505	M11	Animal burrow through paved top of levee (Riverward side)	Fill voids with impervious material and firmly compact. Patch hole with asphalt.
N34.21078	W119.01500	M12	42" RCP w/o a closure device (Sta.499+12)	Install a closure device, if appropriate.
N34.21157	W119.01484	M13	Bank erosion on earthen embankment above rock bench placed at toe (Riverward side)	Fill voids with impervious material and firmly compact and restore design slope.



**CALLEGUAS CREEK LEVEE (CC-3)
FIELD INVESTIGATION REPORT**

GPS		*Photo No.	Description	Action Required
Lat	Long			
N34.21174	W119.01483	M14	Erosion at toe of levee. A 55-ft long section of rock bench is washed away. An earthen embankment behind the bench is also eroded.	Restore earthen embankment and rock bench at toe to design condition. Additional engineering analysis recommended.
N34.21227	W119.01475	M15	Bank erosion on earthen embankment for approximately 10 ft long above rock bench placed at toe (Riverward side)	Fill voids with impervious material and firmly compact and restore design slope.
N34.21250	W119.01472	M16	Bank erosion on earthen embankment for approximately 10 ft long above rock bench placed at toe (Riverward side)	Fill voids with impervious material and firmly compact and restore design slope.
N34.21402 to N34.21490	W119.01471 to W119.01482	M17	Vegetation within 15' of Toe & minor debris (Riverward Side)	Remove vegetation and root ball, fill voids with impervious material and firmly compact.
N34.21470 to N34.21485	W119.01478 to W119.01480	M18	A series of bank erosion areas on earthen embankment above rock bench placed at toe (Riverward side)	Fill voids with impervious material and firmly compact and restore design slope.
N34.21552	W119.01492	M19	24" CMP w/o a closure device immediately downstream of HWY 101. (No as-built plan available)	Install a closure device, if appropriate.

* Photos can be found in Appendix C.



Appendix A

Levee Inspection Log



**CALLEGUAS CREEK LEVEE (CC-3)
FIELD INVESTIGATION REPORT**

Levee Inspection Log

Facility Name/ID:	<u>Calleguas Creek Levee (CC-3)</u>	Date:	<u>12/8/2008</u>
Watercourse:	<u>Calleguas Creek</u>	By:	<u>Jung Suh, Nathan Schreiner (Tetra Tech), Daniel Costamagna, Chris Spitzer (AMEC), and Jim (Ventura Co. O&M personnel)</u>
Reach:	<u>Pleasant Valley Road to Highway 101</u>		

RATED ITEM	A	M	U	N/A	EVALUATION	LOCATIONS / REMARKS / RECOMMENDATIONS
1. Unwanted Vegetation Growth					A The levee has a good grass cover with little or no unwanted vegetation (trees, bushes, or undesirable weeds) and has been recently mowed. Except in those cases where a vegetation variance has been granted by the Corps, a 15' zone, free from all woody vegetation, is maintained adjacent to the landward/riverside toe of the FCW for maintenance and flood-fighting activities. Additionally, a 3' root free zone is maintained to protect the external limits of the levee cross section. Reference EM 110-2-301 and/or local Corps policy.	- Vegetation was observed along the toe of the levee on riverward side near the upstream and downstream ends of the levee system.
		X			M Minimal number of trees (2" diameter or smaller) and /or brush present on the levee or within the 15' zone, that will not threaten the integrity of the project but which need to be removed.	
					U Tree, weed, and brush cover exists in the FCW requiring removal to reestablish or ascertain FCW integrity. (Note: if significant growth on levees exists, prohibiting the inspection of animal burrows or other inspection items, then the levee inspection should be ended until this item is corrected.)	
2. Depressions /Rutting	X				A There are no ruts, pot holes, or other depressions on the levee. No evidence of levee settlement. The levee crown, embankments, and access road crowns are well established and drain properly without any ponded water.	
					M Some minor depressions in the levee crown, embankment, or access roads that will not pond water and do not threaten the integrity of the levee.	
					U There are depressions greater than 6 inches deep that will pond water, endangering the integrity of the levee.	
3. Erosion / Bank Caving					A No active erosion, undermining, or bank caving due to riverbed degradation or flow impingement, observed on the landward or on the riverward side of the levee.	- Approximately between stations 498+15 and 498+70, a rock bench placed along the toe of the levee (riverward side) was washed away, and the earthen embankment behind it was experiencing erosion along the toe.
					M There are areas where active erosion is occurring or has occurred on or near the levee embankment, but levee integrity is not threatened.	
			X		U Erosion, undermining, or caving is occurring or has occurred along the toes that threatens the stability and integrity of the levee. The erosion or caving has progressed into the levee section or into the extended footprint of the levee foundation and has compromised the levee foundation stability.	
4. Surficial Slope Stability					A No slides present.	- The erosion activity noted in Item No.3 has led to surficial instability of the riverward side slope of the levee.
					M Minor superficial sliding that with deferred repairs will not pose an immediate threat to FCW integrity.	
			X		U Surficial instabilities that will require more than typical or periodic repair and that threatens FCW integrity. Repairs are required to reestablish FCW integrity.	
5. Deep Seated Slope Stability					A No slides present.	
		X			M Signs of deep seated instability can not be determined from site assessment or evidence may or may not be an indicator of deep seated stability. .	
					U Evidence of deep seated sliding that threatens FCW integrity. Repairs are required to reestablish FCW integrity.	
6. Cracking	X				A No cracking observed on the levee greater than 6 inches deep.	- Minor cracking was observed on the pavements and grouted stone revetment.
					M Longitudinal and/or transverse cracking greater than 6 inches deep. No evidence of vertical movement along the crack.	
					U Longitudinal and/or transverse cracking present and exhibits signs of vertical movement.	
7. Animal Burrows					A No animal burrows present on the levees.	- A number of animal burrows were observed throughout the entire length of the levee at the top of slope. A few burrows
					M Several animal burrows present which may lead to seepage or slope stability problems, and they require immediate attention.	
			X		U Significant maintenance is required to fill existing burrows, and the	



CALLEGUAS CREEK LEVEE (CC-3) FIELD INVESTIGATION REPORT

RATED ITEM	A	M	U	N/A	EVALUATION	LOCATIONS / REMARKS / RECOMMENDATIONS
					levee will not provide reliable flood protection until this maintenance is complete.	created holes through pavement on top of the levee.
8. Encroachments	X				A No trash, debris, excavations, structures, adverse sediment accumulation, or other obstructions present within the project easement area.	
					M Trash, debris, excavations, structures, adverse sediment accumulation, or other obstructions present, or inappropriate activities that will not inhibit project operations and maintenance or emergency operations.	
					U Trash, debris, excavations, structures, adverse sediment accumulation, or other obstructions present, or inappropriate activities that will inhibit project operations and maintenance or emergency operations.	
9. Revetments & Banks					A Existing revetment protection is properly maintained and is undamaged. Revetment protection clearly visible and revetment materials are of sound quality.	- As described in Item No.3, a segment of the rock bench along the toe was washed away.
					M No revetment displacement or scouring activity that could undercut banks, erode embankments, or restrict desired flow. Unwanted vegetation must be cleared and sprayed with an appropriate herbicide.	
			X		U Dense brush, trees, or grasses hide the revetment protection or meandering and/or scour activity is undercutting banks, eroding embankments, or impairing channel flows by causing turbulence or shoaling.	
					N/A There is no revetment protecting the levee.	
10. Closure Structures (Stop Log, Earthen Closures, or Gates)					A Closure structure in good repair. Placing equipment, stoplogs, and other materials are readily available at all times. Components of closure clearly marked and installation instructions/procedures readily available.	- Side drains did not have any closure devices. Additional engineering analysis is required to determine the need for closure devices for each penetration.
			X		U Closure structure in poor condition. Parts missing or corroded. Placing equipment may not be available within normal warning time.	
					N/A There are no closure structures along the levee.	
11. Underseepage Relief Wells / Toe Drainage Systems					A Toe drainage systems and pressure relief wells necessary for maintaining FCW stability during flood events functioned properly during the last flood event and no sediment is observed in horizontal system (if applicable). No signs of adverse seepage conditions adjacent to or within the levees. Nothing is observed which would indicate that the system won't function properly during the next flood.	
					M Toe drainage systems or pressure relief wells are damaged and may become clogged if they are not repaired. Signs of adverse seepage such as sand boils, spring lines, vegetation change or other seepage indicators are present but do not directly affect the stability of the levee.	
					U Toe drainage systems or pressure relief wells necessary for maintaining FCW stability during flood events have fallen into disrepair or have become clogged. Signs of adverse seepage such as sand boils, spring lines, vegetation change or other seepage indicators are present and directly affect the stability of the levee.	
				X	N/A There are no relief wells/toe drainage systems along the levee.	
12. Maintenance and Emergency Access	X				A Maintenance/emergency accesses are clear of obstructions and in good condition.	
					M Minor obstructions and/or damages to the maintenance/emergency access are present, but would not directly affect the accessibility of the levee..	
					U Numerous obstructions and/or damages to the maintenance/emergency access are present that would directly affect the accessibility of the levee.	
13. Deviation from As-Built Plans					A There are no deviations from the as-built plans.	- A rock bench was placed in front of the toe of levee up to the high flow mark along the upstream half of the levee. (Riverward side)
		X			M There are minor deviations from the as-built plans that would not affect the functionality of the levee.	
					U There are major deviations from the as-built plans that could affect the functionality of the levee. Additional engineering analyses are recommended.	

Key: A = Acceptable. M = Minimally Acceptable; Maintenance is required. U = Unacceptable. N/A = Not Applicable. RODI =Requires Operation during Inspection.



Appendix B

Photos of Penetrations and Typical Levee Features



Appendix B – Penetration and Site Feature Photograph Locations along Calleguas Creek Levee (CC-3)



Calleguas Creek Levee (CC-3) (Photo No. P1) – 60” RCP SD w/o a closure device. An active trickle of water was observed.



Calleguas Creek Levee (CC-3) (Photo No. P3) – 18” RCP SD w/o a closure device.



Calleguas Creek Levee (CC-3) (Photo No. P2) – 18” RCP SD w/o a closure device.



Calleguas Creek Levee (CC-3) (Photo No. P4) – 18” RCP w/o a closure device. A drop inlet for the RCP was located on the dry-side of the levee.



Calleguas Creek Levee (CC-3) (Photo No. P5) – 18” RCP w/o a closure device. A drop inlet for the RCP was located on the dry-side of the levee.



Calleguas Creek Levee (CC-3) (Photo No. P7) – 24” CMP w/o a closure device immediately downstream of HWY 101. No as-built plan available.



Calleguas Creek Levee (CC-3) (Photo No. P6) – 42” RCP w/o a closure device. An active trickle of water was observed.



Calleguas Creek Levee (CC-3) (Photo No. F1) – Looking at a typical drop inlet structure collecting water along toe of landward side of the levee.



Appendix C

Photos of Maintenance Required Locations



Appendix C – Photograph Locations of Maintenance Required Areas along Calleguas Creek Levee (CC-3)



Calleguas Creek Levee (CC-3) (Photo No. M1) – 60” RCP SD w/o a closure device (Sta.478+95.)



Calleguas Creek Levee (CC-3) (Photo No. M3) – Vegetation within 15’ of Toe (Riverward side).



Calleguas Creek Levee (CC-3) (Photo No. M2) – 18” RCP SD w/o a closure device (Sta.479+45).



Calleguas Creek Levee (CC-3) (Photo No. M4) – Multiple animal burrows on top of slope for an entire length of CC-3 (Riverward side).



CALLEGUAS CREEK LEVEE (CC-3) FIELD INVESTIGATION REPORT



Calleguas Creek Levee (CC-3) (Photo No. M5) – 18" RCP SD w/o a closure device (Sta.482+00).



Calleguas Creek Levee (CC-3) (Photo No. M7) – 18" RCP w/o a closure device (Sta.488+00).



Calleguas Creek Levee (CC-3) (Photo No. M6) – Undercut at bottom of grouted revetment caused by toe erosion.



Calleguas Creek Levee (CC-3) (Photo No. M8) – Animal burrow through paved top of levee (Riverward side).



Calleguas Creek Levee (CC-3) (Photo No. M9) – Animal burrow through paved top of levee (Riverward side).



Calleguas Creek Levee (CC-3) (Photo No. M11) – Animal burrow through paved top of levee (Riverward side).



Calleguas Creek Levee (CC-3) (Photo No. M10) – 18” RCP w/o a closure device (Sta.495+00).



Calleguas Creek Levee (CC-3) (Photo No. M12) – 42” RCP w/o a closure device (Sta.499+12).



CALLEGUAS CREEK LEVEE (CC-3) FIELD INVESTIGATION REPORT



Calleguas Creek Levee (CC-3) (Photo No. M13) – Erosion on earthen embankment above rock bench placed at toe (Riverward side).



Calleguas Creek Levee (CC-3) (Photo No. M15) –Erosion on earthen embankment above rock bench placed at toe for 10-ft (Riverward side).



Calleguas Creek Levee (CC-3) (Photo No. M14) – Erosion at toe of levee. A 55-ft long section of rock bench is washed away.



Calleguas Creek Levee (CC-3) (Photo No. M16) –Erosion on earthen embankment for 10 ft long above rock bench placed at toe (Riverward side).



Calleguas Creek Levee (CC-3) (Photo No. M17) – Vegetation within 15' of Toe & minor debris (Riverward Side).



Calleguas Creek Levee (CC-3) (Photo No. M19) – 24" CMP w/o a closure device immediately downstream of HWY 101. No as-built plan available.



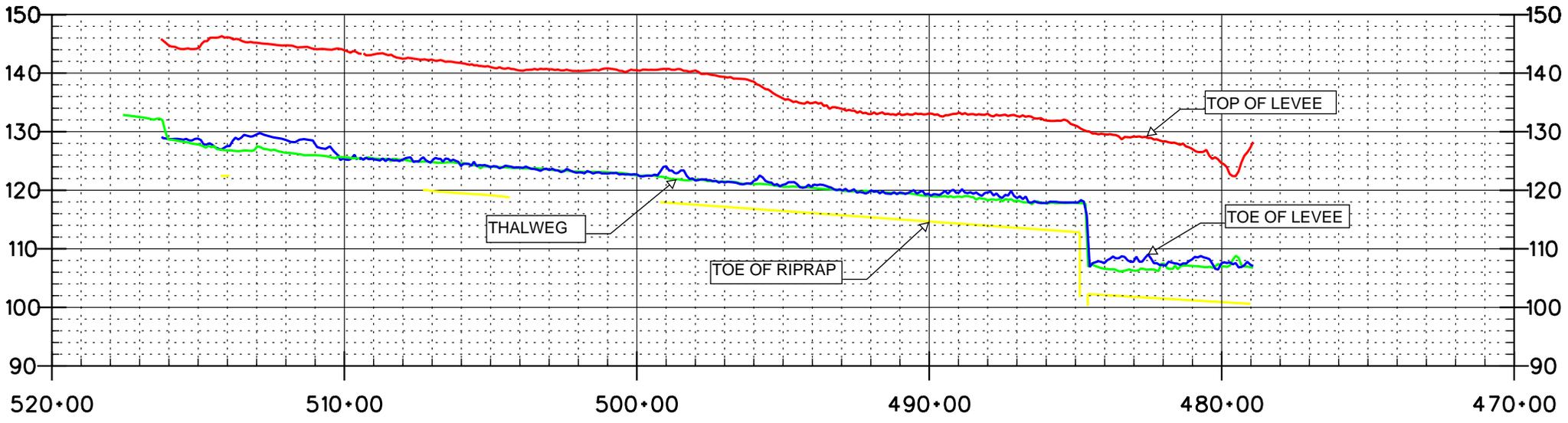
Calleguas Creek Levee (CC-3) (Photo No. M18) – Series of erosion areas on earthen embankment above rock bench placed at toe (Riverward side).



Exhibit 2

Preliminary Evaluation of Levee System Profiles

CALLEGUAS CREEK (CC-3)
STATION 470+00 TO 520+00



- LEGEND:
- TOP OF LEVEE
 - TOE OF LEVEE
 - THALWEG
 - TOE OF RIPRAP

SCALE:
HORIZONTAL: 1" = 500'
VERTICAL: 1" = 25'



Exhibit 3

As-Built Plans Status List

Calleguas Creek Levee (CC-3) - Pleasant Valley Road to Hwy 101

Bridge Crossings (U/S to D/S)	As-Builts Provided to Consultant by County	County or City Dwg. No.	Date*	Sta. (relative to individual plan set)	Action
Hwy 101	No				Request from Caltrans.
Pleasant Valley Rd	No		Pre 1979		Request from County.
Levee System (U/S to D/S)					
Levee System Bank Restoration	No	Y-3-3271 to 3273	1992	0+76 to 16+00	We have dwgs, but they're not stamped as "Record Dwgs." Request from County.
Levee System	Partial	Y-3-1928 to 1936	1979	478+90 to 499+20 & 504+34 to 504+31 & 513+93 to 514+23	Missing as-builts for levee from STA. 499+20 to 504+34 & STA 507+31 to 518+00. Request from County.
County FCD Drop Structure	No	Y-3-85 to 87	Pre 1979	484+85	Request from County.
Penetrations (U/S to D/S)					
24" CMP	No				Request from County.
42" RCP	Yes	Y-3-1930	1979	499+10	
18" RCP	Yes	Y-3-1930	1979	495+00	
18" RCP	Yes	Y-3-1929	1979	488+00	
18" RCP	Yes	Y-3-1929	1979	482+00	
18" RCP	No	C-2445		479+50	Request from County or City of Camarillo.
60" RCP	No	C-2442		(+/-) 479+00	Request from County or City of Camarillo.

*Date indicates as-built date. Design plan dates were used if the plans were available, but were not stamped and/or signed as-built.



Exhibit 4

Responses to Comments on Draft Evaluation Report

FEMA Levee Certification -VCWPD
Project Team Comments on Tetra Tech's Draft Evaluation Reports
January 2009

Maint. Defect	Description	Recommended Action by Tetra-Tech	Recommended Response by O&M Division	Environ. Permit Codes	Environmental Services Section Comments	R.O.W. Issue*	Levee Certification Project Team's Comments to Draft Evaluation Reports	Tetra Tech's Response
Calleguas Creek Levee (CC-3) Category 2								
M1	60" RCP SD w/o a closure device (Sta.478+95)	Install a closure device, if appropriate.	C5 - Survey needed for drain elevation, Maybe City of Camarillo	E2	Install of headwall =excav/concrete in levee	X	Is this flap gate required? Who will determine ownership?	Determination of the need for a flap gate will require a channel hydraulic analysis and an interior drainage analysis. These analyses will be performed during the next phase of work. If as-builts are not available to determine ownership a survey will be required to establish elevations of the storm drain inverts and tops of outlet, inlets, manholes..etc.
M2	18" RCP SD w/o a closure device (Sta.479+45)	Install a closure device, if appropriate.	C5 - Survey needed for drain elevation, Maybe City of Camarillo	E2	Install of headwall =excav/concrete in levee	X	Is this flap gate required? Who will determine ownership?	Determination of the need for a flap gate will require a channel hydraulic analysis and an interior drainage analysis. These analyses will be performed during the next phase of work. If as-builts are not available to determine ownership a survey will be required to establish elevations of the storm drain inverts and tops of outlet, inlets, manholes..etc.
M3	Vegetation within 15' of Toe (Riverward side)	Remove vegetation and root ball, fill voids with impervious material and firmly compact.	C2	E1	Minor veg removal needed, no root ball extraction			
M4	Multiple animal borrows on top of slope for an entire length of CC-3 (Riverward side)	Fill voids with impervious material and firmly compact.	C1, Pam to assist	E2	Excavate & recompact existing levee, add IPM			
M5	18" RCP SD w/o a closure device (Sta.482+00)	Install a closure device, if appropriate.	C5 - Survey needed for drain elevation, Maybe City of Camarillo	E2	Install of headwall =excav/concrete in levee	X	Is this flap gate required? Who will determine ownership?	Determination of the need for a flap gate will require a channel hydraulic analysis and an interior drainage analysis. These analyses will be performed during the next phase of work. If as-builts are not available to determine ownership a survey will be required to establish elevations of the storm drain inverts and tops of outlet, inlets, manholes..etc.
M6	Undercut at bottom of grouted revetment caused by toe erosion	Verify current toedown depth and condition of revetment. Repair revetment. Additional engineering analysis recommended.	C3/C4	E2	Excavate and repair in kind			
M7	18" RCP w/o a closure device (Sta.488+00)	Install a closure device, if appropriate.	C5 - Survey needed for drain elevation, Maybe City of Camarillo	E2	Install of headwall =excav/concrete in levee	X	Is this flap gate required? Who will determine ownership?	Determination of the need for a flap gate will require a channel hydraulic analysis and an interior drainage analysis. These analyses will be performed during the next phase of work. If as-builts are not available to determine ownership a survey will be required to establish elevations of the storm drain inverts and tops of outlet, inlets, manholes..etc.
M8	Animal borrow through paved top of levee (Riverward side)	Fill voids with impervious material and firmly compact. Patch hole with asphalt.	C1, Pam to assist	E2	Excavate & recompact levee, continue IPM			
M9	Animal borrow through paved top of levee (Riverward side)	Fill voids with impervious material and firmly compact. Patch hole with asphalt.	C1, Pam to assist	E2	Excavate & recompact levee, continue IPM			
M10	18" RCP w/o a closure device (Sta.495+00)	Install a closure device, if appropriate.	C5 - Survey needed for drain elevation, Maybe City of Camarillo	E2	Install of headwall =excav/concrete in levee	X	Is this flap gate required? Who will determine ownership?	Determination of the need for a flap gate will require a channel hydraulic analysis and an interior drainage analysis. These analyses will be performed during the next phase of work. If as-builts are not available to determine ownership a survey will be required to establish elevations of the storm drain inverts and tops of outlet, inlets, manholes..etc.
M11	Animal borrow through paved top of levee (Riverward side)	Fill voids with impervious material and firmly compact. Patch hole with asphalt.	C1, Pam to assist	E2	Excavate & recompact levee, continue IPM			
M12	42" RCP w/o a closure device (Sta.499+12)	Install a closure device, if appropriate.	C5 - Survey needed for drain elevation, Maybe City of Camarillo	E2	Install of headwall =excav/concrete in levee	X	Is this flap gate required? Who will determine ownership?	Determination of the need for a flap gate will require a channel hydraulic analysis and an interior drainage analysis. These analyses will be performed during the next phase of work. If as-builts are not available to determine ownership a survey will be required to establish elevations of the storm drain inverts and tops of outlet, inlets, manholes..etc.
M13	Bank erosion on earthen embankment above rock bench placed at toe (Riverward side)	Fill voids with impervious material and firmly compact and restore design slope.	C3/C4	E2	Excavate and repair in kind			
M14	Erosion at toe of levee. A 55-ft long section of rock bench is washed away. An earthen embankment behind the bench is also eroded.	Restore earthen embankment and rock bench at toe to design condition. Additional engineering analysis recommended.	C3/C4	E2	Excavate and repair in kind			
M15	Bank erosion on earthen embankment for approximately 10 ft long above rock bench placed at toe (Riverward side)	Fill voids with impervious material and firmly compact and restore design slope.	C3/C4	E2	Excavate and repair in kind			
M16	Bank erosion on earthen embankment for approximately 10 ft long above rock bench placed at toe (Riverward side)	Fill voids with impervious material and firmly compact and restore design slope.	C3/C4	E2	Excavate and repair in kind			

*Right of Way column reflects the Operation and Maintenance Division's preliminary opinion based on their field inspections. That opinion will be vetted through the Real Estate Services Division of the Public Works Agency.

FEMA Levee Certification -VCWPD
Project Team Comments on Tetra Tech's Draft Evaluation Reports
January 2009

Maint. Defect	Description	Recommended Action by Tetra-Tech	Recommended Response by O&M Division	Environ. Permit Codes	Environmental Services Section Comments	R.O.W. Issue*	Levee Certification Project Team's Comments to Draft Evaluation Reports	Tetra Tech's Response
Calleguas Creek Levee (CC-3) Category 2								
M17	Vegetation within 15' of Toe & minor debris (Riverward Side)	Remove vegetation and root ball, fill voids with impervious material and firmly compact.	C3/C4	E1	Minor veg removal needed, no root ball extraction			
M18	A series of bank erosion areas on earthen embankment above rock bench placed at toe (Riverward side)	Fill voids with impervious material and firmly compact and restore design slope.	C3/C4	E2	Excavate and repair in kind		Should the rock be replaced and the slope regraded? What is the recommended repair?	Erosion should be repaired as indicated with in-kind material and documented. Documentation of the removal and replacement/re-compaction of the impacted material shall be conducted by a certified testing and materials lab that the District is familiar with. The documentation shall include a report provided by the testing and materials lab. AMEC will periodically observe these locations and will require a copy of the report for documentation and review. In-kind backfill would be materials free of organic or deleterious debris that has similar or lower permeability than the levee material. These materials could consist of excavated soil, imported soil, concrete, or slurry, and shall be evaluated by the testing and materials lab. compaction requirements are detailed on the attached Figure 1. Major repair examples include any erosion feature that is deeper than 1 foot or that is greater than 2 feet wide. Additionally, revetment protection evaluation including rock sizing analysis should be incorporated in repair of revetment material.
M19	24" CMP w/o a closure device immediately downstream of HWY 101. (No as-built plan available)	Install a closure device, if appropriate.	C5 - Who owns this? Is it CalTrans or the City?	E2	Install of headwall =excav/concrete in levee	X	Is this flap gate required? Who will determine ownership?	Determination of the need for a flap gate will require a channel hydraulic analysis and an interior drainage analysis. These analyses will be performed during the next phase of work. If as-builts are not available to determine ownership a survey will be required to establish elevations of the storm drain inverts and tops of outlet, inlets, manholes, etc.

*Right of Way column reflects the Operation and Maintenance Division's preliminary opinion based on their field inspections. That opinion will be vetted through the Real Estate Services Division of the Public Works Agency.

Draft Evaluation Report
January 2009
Reviewer Comments

Levee ID	Author	Page Number	Revision Requested	Tetra Tech's Annotations
VR-3	Zia	i	Change 'for' to 'in'. Data collection efforts have been performed to determine what information is available for support of levee certification.	Change made.
		i	Under LiDAR Topographic data, reviewer requests addition of 1. Compare the river bed vertical elevation and cross section changes by topo & survey. 2. There are some areas always need repair by records. Point out the areas need re-study.	This entire levee was severely damaged in the 2005 flood. This levee is being re-designed by the Corps of Engineers from Santa Ana Blvd to the Live Oaks Diversion. Tetra Tech would need to review the Corps design to see if new topographic data was used.
		1	Change 'give year' to 'given year'. "... or exceeded in any give year (base flood).	Change made.
		3*	Change 'addition' to 'additional'. "...however addition sedimentation and scour analyses..."	Change made.
		3	Change 'the' to 'that'. "...NFIP regulations requires the engineering analyses..."	Change made.
		4	Question: Are interior flooding and interior drainage the same? Please clarify the use of these terms. Are they to be used interchangeably?	Interior flooding is caused from impeded interior drainage.
		4	To the Levee Penetration portion, add: 1. Is the flap gate work fine? 2. Sediment deposition in the gate area? 3. Describe existing condition and pictures.	The flap gate is in working order unless it is listed in Table 2 where its condition is described and associated photos are referenced in Appendix C.
	Jaques	General Comment	The middle section of this reach is not a levee. Does it make sense to split this into two separate levees? 1. Near Santa Ana Blvd and 2. Live Oak Creek Diversion to where the levee terminates?	A determination of segmenting this levee system would have to be made during the hydraulic analysis which is the next phase of work.
		ii	Why is as-built plan show as Category 3?	The construction of the Corps' proposed design is not expected to happen with in the PAL time schedule (Nov.30,2009) therefore as-builts would not be prepared.
		3	Why is a hydrograph needed for levee certification?	For geotechnical seepage analyses which requires the baseflood stage duration.
		3	See the Bureau of Reclamation report "Hydrology, Hydraulics, and Sediment Studies for the Meiners Oaks and Live Oak Levees-Draft Report (July 2007) for the information on scour analysis, toe down and rock size requirements.	Noted, Tetra Tech has obtained this document and will be used during the next phase of work.
		4	Check with Corps of Engineers on geotechnical available for the levees.	Noted, all available Corps of Engineers' design work will be obtained for use in the next phase of work.
		6	Since the levee and floodwall up to Live Oak Creek Diversion will be improved by the Corps with the Matilija project, should we pursue improvements required on the Diversion portion in anticipation of the Corps certifying this entire levee once their work is complete?	This work needs to be done to certify the entire system however the schedule of this Category 3 levee is to be determined.
		6	Should we ask Tetra Tech to review Corps construction documents as part of their contract?	Yes we will need to review design for certification.
		4	Check with the Corps of Engineers on geotechnical information available for the levees.	Noted, all available Corps of Engineers' design work will be obtained for use in the next phase of work.
		6	Table 2-Summary of Maintenance Required, add the River Stations to the table.	There are many different as-built drawings with different stationing. It was determined the best way to convey the location of the required maintenance was with a Lat. Long. GPS point.

*Indicates comment made by more than one reviewer.

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Reviewer Comments

Levee ID	Author	Page Number	Revision Requested	Tetra Tech's Annotations
VR-1	Jaques	3*	Change 'addition' to 'additional'. "...however addition sedimentation and scour analyses..."	Change made.
		field investigation report, page 3	Remove "Show desktop.scf"	Change made.
		Appendix B, photos of penetrations	P6 (Stanley Drain) missing from map. Please include.	P6 is shown on pages B-1 and B-2.
		B-4	per Sec. 2.16 USACE levee Owner Manual, Aluminum stop logs should be supported along entire length where stored.	Noted this will be evaluated in the structural analysis.
		Exhibit 2, Preliminary Evaluation of levee system profiles	Station 90+00 to 140+00, is there an additional toe down for green and yellow lines between 140+ and 130+?	We do not have any additional available information showing additional toe down.
SC-1	Jaques	3	Add 'to' between 'used' and 'shape'. "...flood even would be used shape the base flood..."	Change made.
		4	Remove 'it'. Their findings are that only 5% of the rock is breaking down and they do not anticipate it the break down to continue at ..."	Change made.
		field investigation report, page 1	Insert 'County' between Ventura and Watershed. "The team included representatives from the Ventura Watershed Protection District..."	Change made.
		B-2	per Sec. 2.16 USACE levee Owner Manual, Aluminum stop logs should be supported along entire length where stored.	Noted, this will be evaluated in the structural analysis.
AS-6	Jaques	3	Insert commas as follows: "reference, however, additional sedimentation and scour..." "...dated February 2004 will be useful as a reference however addition sedimentation and scour analyses..."	Change made.
		Field investigation report page 3	Change "borrows" to "burrows" throughout.	Change made.
		Levee Inspection Log, A-1	Change "borrows" to "burrows" throughout.	Change made.
		B-5	per Sec. 2.16 USACE levee Owner Manual, Aluminum stop logs should be supported along entire length where stored.	Noted, this will be evaluated in the structural analysis.
		Appendix C, Photos of Maintenance Required Locations	M22R Photo Caption, revise borrow to read "burrow"	Change made.
	Joe Lampara	General Comment	Similar to AS-7, this levee system is identified as extending along Arroyo Simi from f ^l . Street to Erringer Road. In actuality this reach is a combination of a series of levees, including a floodwall located immediately upstream of f ^l Street, and levees located in the immediately vicinity of the channel drop structures, and along one reach of low land at the upstream end adjacent to the channel. Between these locations there are reaches of incised channel which do not meet the definition of a levee or levee system.	Determination of the levee situation on certain lengths of the levee system will require a hydraulic analysis. This analysis will be performed during the next phase of work.

*Indicates comment made by more than one reviewer.

Draft Evaluation Report
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Reviewer Comments

Levee ID	Author	Page Number	Revision Requested	Tetra Tech's Annotations
AS-7	Jaques	General Comment	A LOMR was accepted FEMA on March 4, 2003.	All Current LOMRs have been requested from FEMA, if the County has a copy Tetra Tech would like to obtain a copy.
		6	Application of 44 CFR65.10 criteria should be applied only to the reaches of the channel between 1 st and Erringer that meet the definition of a levee.	Determination of the levee situation on certain lengths of the levee system will require a hydraulic analysis. This analysis will be performed during the next phase of work.
		field investigation report, page 1	Insert 'County' between Ventura and Watershed. "The team included representatives from the Ventura Watershed Protection District..."	Change made.
		field investigation report, page 4	Table 1-Summary of Penetrations. River Station 120+72 and 125+66.1, reviewer indicates the WSL is below the existing ground.	Noted
CC-3	Jaques	General Comment	If this levee is 2' above adjacent ground (page 1) and FEMA requires 3' minimum levee height above the 100 yr flood, how is this a levee? It looks like this should be re-categorized as Not a Levee.	The 2' height is based on a visual inspection. Determination of the levee situation will require a hydraulic analysis to compare the 100-yr WS to adjacent ground. This analysis will be performed during the next phase of work. If the analysis shows the 100-yr WS is below adjacent ground then de-listing this stretch of channel as a levee will be pursued.
		Field Investigation Report, 1	Has the Kasraie Report and Draft D-Firm maps been reviewed? I believe that they show breakout to the east in this reach of Calleguas Creek.	They have not been reviewed. Tetra Tech has requested all current D-Firm analyses and Appeals from FEMA. If the County has a copy Tetra Tech would like a copy.
	Joe Lampara	General Comment	The efforts under Phase 1 involve the categorization of the nine Provisionally Accredited Levees in Ventura County. Levee categories include: Category 1 – levee meets 44CFR65.10 requirements and all data or complete documentation is available, Category 2 – levee may meet 44CFR65.10 criteria , but additional data or documentation is needed, Category 3 – levee does not currently meet 44CFR65.10 criteria, Not a levee – Based on physical conditions, low WSEL, no SFHA, and/or not providing flood protection. This levee system, which extends along Calleguas Creek from Pleasant Valley Road to Hwy 101, may not be a levee in the sense as a levee is defined. Phase 1 efforts must include this determination prior to the final categorizing of this "levee system." Determination under Phase 3 efforts that Phase 1 efforts were incomplete.	The 2' height is based on a visual inspection. Determination of the levee situation will require a hydraulic analysis to compare the 100-yr WS to adjacent ground. This analysis will be performed during the next phase of work. If the analysis shows the 100-yr WS is below adjacent ground then de-listing this stretch of channel as a levee will be pursued.
CC-2	Joe Lampara	General Comment The reach between Mission Oaks and this point no longer meet the definition of a levee.	This levee system is identified as extending along Calleguas Creek from Mission Oaks Blvd. upstream to Adolfo Road. It includes the reach of Somis Drain from Calleguas Creek up to The reach upstream of Somis Drain along Calleguas Creek to Adolfo Road is not a levee in that the surface of the ground landward of the Calleguas Creek Channel is higher than the streambank protection placed along the channel bank. As originally constructed the levee did extend from Mission Oaks Blvd to Somis Drain. Subsequent to the completion of construction of this levee developers were granted permits to fill in portions of the land behind the levee to allow for industrial development. As a result there is a reach of the original levee extending from Mission Oaks Blvd. upstream for approximately 1500 feet that no longer meets the definition of a levee. The surface of the ground landward of the levee now exceeds base flood elevation in the channel, or is at or above the top of levee elevation. Suggest revising the downstream terminus of CC-2 from Mission Oaks Blvd. to the point upstream where the permitted fill placed behind the original levee alignment ends.	Determination of the levee situation on certain lengths of the levee system will require a hydraulic analysis and verification of the higher adjacent ground due to recent improvements. This analysis will be performed during the next phase of work.

*Indicates comment made by more than one reviewer.

Draft Evaluation Report
January 2009
Reviewer Comments

Levee ID	Author	Page Number	Revision Requested	Tetra Tech's Annotations
ASR-2	Jaques	Field investigation report, A-2	Number 8, Encroachments, remarks are included, but no rating is given. Please add an A, M or a U.	Change made to reflect a U.
		B-2	per Sec. 2.16 USACE levee Owner Manual, Aluminum stop logs should be supported along entire length where stored.	Noted, this will be evaluated in the structural analysis.
		Exhibit 2, Preliminary Evaluation of levee system profiles	Station 120+00 and 130+00, is there an additional toe down for green and yellow lines between 129+ and 128+?	We do not have any additional available information showing additional toe down.
All Levee Reports	Tony Chen	General Comment		
			Please extend the tree removal to a flexible limit. For some trees, the 15' buffer belt is not enough. We need to remove the vegetation and trees within 15' buffer belt. As I learned from FMA classes. I understand some of the special kinds of the tree roots can extend and penetrate the levee. These trees shall be cleaned within a certain distance. I suggest to ask the Environmental Section set up a list of trees need to install an underground buffer wall or remove the special trees within a defined distance.	The Corps guidelines in EM 1110-2-301 are the current standard for vegetation on levees.
			There are power poles in the defined levee area. Do we need to relocate them?	Utility poles within the embankment prism (only 1 on SCR-1) must be relocated.
			A new aero-photo map is necessary to get for study, planning, design and construction purposes. Please put some budget for survey purposes.	Noted
			How to get rid of small animals like gofers.	According to O&M the WPD currently has a plan to control burrowing animals
			A levee Certification Work Team is necessary. It could be consisted by Advanced Planning, O&M, Design and Construction, Environmental Section, and Real Estate Section.	Noted
			There are many small lateral storm drain pipes, how to prevent the backup water?	An interior drainage analysis will be performed on each drain to determine if a flap gate is required.
			There are some developed areas behind the levee. How to get the required land from the land owners?	This is a County Real Estate issue.
			The flood control annually budget is limited. How to get the required money to finish the work?	This is a County Budget issue.

*Indicates comment made by more than one reviewer.

Draft Evaluation Report
January 2009
Reviewer Comments

Levee ID	Author	Page Number	Revision Requested	Tetra Tech's Annotations
All Levee Reports	Joe Lampara	General Comment		
		All levees categorized as Category 2	Include in the work to be done as noted in Figure 2 for each levee a Right of Way survey to establish in the field the actual limits of County owned property and easements.	This is part of the Title Search/Boundary Survey task.
		CC-2, AS-6, SCR 1, VR-1, ASR-2, CC-3	Figure 2 of each report contains a list of work that needs to be completed for levee certification to be done for each levee. One of the items is Topographic Survey Verification. For selected levees, VR-1 being one, there is a time interval indicated for this work. For the majority of the remaining levees no verification is required. Recommend that topographic survey verification being included the levees noted with this comment. The reasoning for including it with VR-1 can be applied to the others, i.e. ASR-1 – concerns exists regarding the elevation of the channel, including the stabilizer, relative to the footing of the floodwall. Without a survey it may not be possible to discern the relationship of these two items. For CC 3, if this levee is not categorized as "not-a-levee" in Phase 1, verification of the topography is required under Phase 3 in order to finalize whether or not CC-3 is a levee.	Tetra Tech will provide the District with a standard specification sheet and survey topo exhibit describing minimum survey requirements for levee certification requirements for all levees, and additional levee-specific survey requirements and locations of additional topo required.
All Levee Reports	Zia	General Comment	What is the plan for soil testing?	A scope of work detailing the subsurface exploration, laboratory testing and geotechnical assessment is being prepared for the next Phase of work.
			Why is the consultant requesting consolidation tests?	The purpose for the consolidation testing is three-fold. The first reason is to determine the existing conditions of the alluvium and levee material and evaluate if any material may experience consolidation with future loads that could be detrimental to the levee. The second, and in this case more critical, is to determine if any consolidation as a result of the original levee construction is anticipated. Secondary compression or consolidation in fine grained soils is dependant on the time needed for the excess pore pressures created by imposed loads to dissipate allowing the soil to consolidate. Typically the finer grained a soil and the thicker the soil deposit, the longer amount of time is needed for consolidation to take place. By running time based consolidation tests on samples collected, we can anticipate the amount of settlement that is to occur, as well as the time needed, as a result of implied loads on the soil. If we have a condition, say, that just meets the 3 feet of freeboard and we are anticipating another 6 inches of settlement in the foreseeable future, something will need to be done to ensure that the levee can maintain that 3 feet of freeboard. The third reason is to evaluate the potential for hydro-collapse. If soils are rapidly deposited and are buried quickly by subsequent depositional events, the soil structure may develop such that they have not been allowed to consolidate fully. Additionally, mineral accumulation, such as salts or caliche, may also develop giving the soil added strength. When these soils are subsequently saturated during a future event, the potential for consolidation of the loose soils or dissolution of the mineral content, collectively know as hydro-collapse, exists. In some cases this collapse can be significant and has caused failure of structures built over the collapsible soils. The testing for this potential is similar to consolidation testing, although slightly less time consuming, and will be conducted if the field investigation reveals the potential.
			Could the consultant please be more specific when commenting on areas of concern? Please quantify problems, instead of making general comments.	Tetra Tech would be happy to answer any specific questions, however for most items specific data is not required and with the accelerated schedule detailing and quantifying each problem is not feasible.

*Indicates comment made by more than one reviewer.

VCWPD OPERATION & MAINTENANCE DIVISION RFI

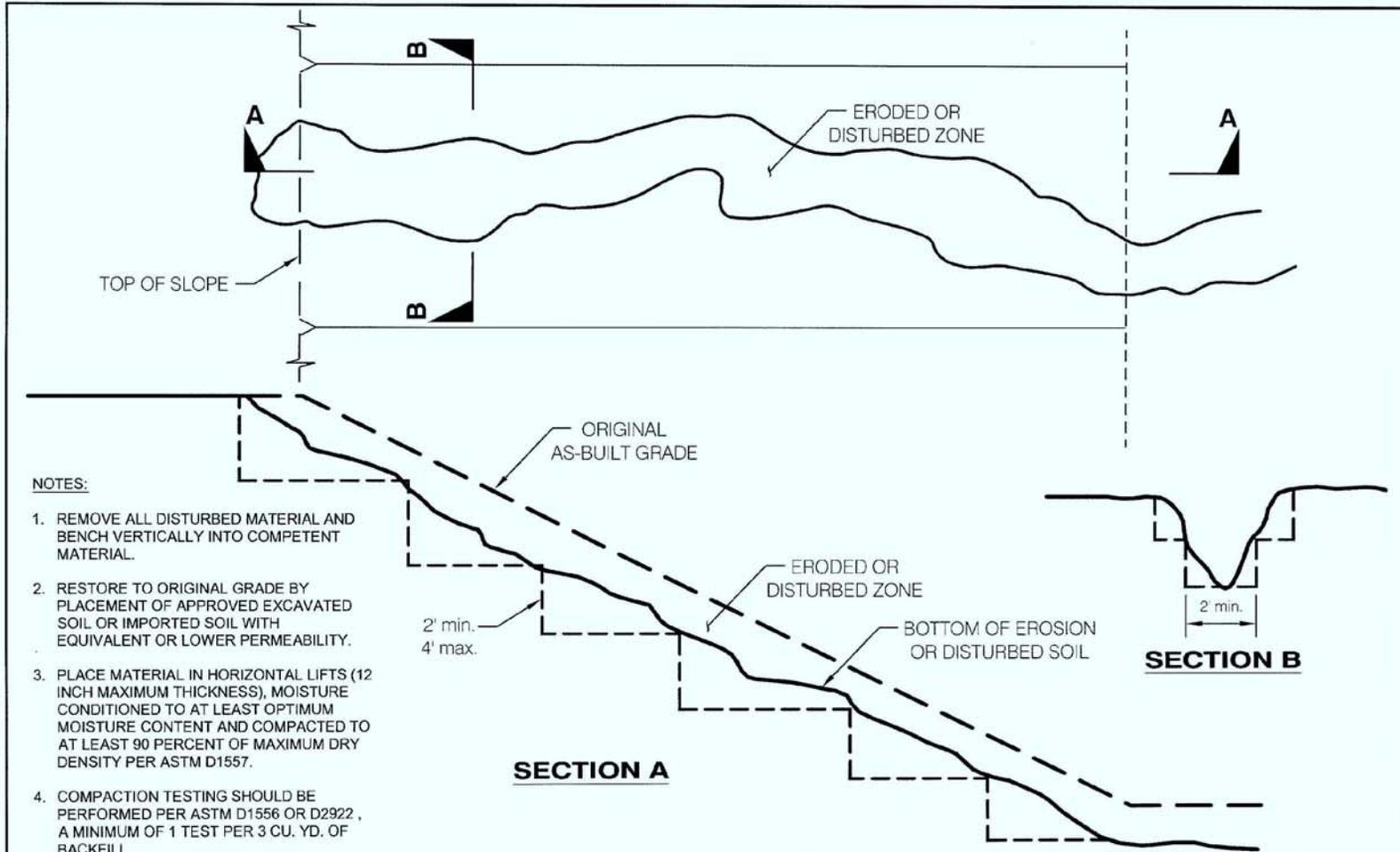
VCWPD O&M QUESTION	TETRA TECH/AMEC RESPONSE
<p>1. Animal burrow/hole repair procedures. Please confirm acceptable methods. Also confirm acceptable documentation method.</p>	<p>For small isolated burrows, infilling of the burrow with grout is sufficient. The grout should be relatively free flowing to permeate the burrows. A typical grout specification would be similar to CalTrans Specifications Section 41-1. A copy of this section is attached but should be modified to suit the conditions.</p> <p>For areas where a large number of interconnected burrows exist or the amount of burrows present has caused surficial instability, removal and replacement/re-compaction of the impacted material is needed. The attached Figure 1 presents a typical detail and backfilling requirements.</p> <p>Documentation for the singular burrows shall consist of a documentation of the location, size, volume of grout placed, and other pertinent details. Documentation of the removal and replacement/re-compaction of the impacted material shall be conducted by a certified testing and materials lab that the District is familiar with. The documentation shall include a report provided by the testing and materials lab. AMEC will periodically observe these locations and will require a copy of the report for documentation and review.</p>
<p>2. Please describe methods for vegetation and rootball removal.</p>	<p>4" DIAMETER TRUNK OR GREATER: Cut the woody vegetation approximately two (2) feet above ground level leaving a prominent stump for use in the rootball extraction process. Remove the stump and rootball by pulling or extracting with a backhoe or similar equipment. Clean the rootball cavity of all loose soil and remaining root system (roots greater than 1/2" diameter). Prepare the cavity by excavating per FIGURE 2. Backfill with excavated soil or imported soil with equivalent or lower permeability. Place material in horizontal lifts no greater than twelve (12) inches. Moisture conditioned to at least optimum moisture content and compacted to at least ninety (90) percent of the maximum dry density of the fill soil per ASTM D1557. Compaction typically requires the use of manually operated compaction equipment or compaction attachment to a backhoe. Compaction testing should be performed per ASTM D1556 or D2922. A minimum of one (1) test per three (3) cubic yards of backfill.</p> <p>2"-4" DIAMETER TRUNK: Cut the woody vegetation stump flush with the ground. Treat the stump with a protective coating similar to polyurethane to prolong the decay process.</p>

VCWPD O&M QUESTION	TETRA TECH/AMEC RESPONSE
	<p>2" DIAMETER TRUNK OR LESS: Cut the woody vegetation to twelve (12) inches of height above the ground level.</p> <p>For all vegetation removal under 4" trunk diameter, no documentation is necessary. For larger rootball removal in which excavation and compaction is required, documentation of the impacted material shall be conducted by a certified testing and materials lab that the District is familiar with. The documentation shall include a report provided by the testing and materials lab. AMEC will periodically observe these locations and will require a copy of the report for documentation and review.</p>
<p>3. Where is 15' buffer from toe measured from (buried portion or at ground level)?</p>	<p>The fifteen (15) foot vegetation line is measured from the visual toe of slope to the center line of the trunk (tree), the closest trunk to the toe (multiple trunk trees/plants) or the stock/stem protruding through the soil (large plant connected to a root system)</p>
<p>4. Can Tetra Tech provide specs for compaction and grading requirements? Discuss major and minor repair examples.</p>	<p>Compaction requirements are detailed on the attached Figures 1 and 2. Major repair examples include any erosion feature that is deeper than 1 foot or that is greater than 2 feet wide. Major and minor animal burrows are discussed in item 1.</p>
<p>5. Can in-kind materials be used for backfill?</p>	<p>In-kind backfill would be materials free of organic or deleterious debris that has similar or lower permeability than the levee material. These materials could consist of excavated soil, imported soil, concrete, or slurry, and shall be evaluated by the testing and materials lab.</p>
<p>6. Discuss documentation/inspection requirements for verification of grading.</p>	<p>The requirements for verification of grading are discussed above.</p>

VCWPD O&M QUESTION	TETRA TECH/AMEC RESPONSE
7. Can Tetra Tech provide weekly inspection of work completed to date?	Future work can be observed by AMEC. It is suggested that scheduling field time be conducted to maximize the efficiencies of the site visits. AMEC will provide a site visit to each levee during repair work preferably before backfill commences. Additional site visits would likely incur additional costs.
8. Please provide a procedure for concrete patching.	<p>All repairs should extend at least three (3) inches beyond the area of delaminated or broken concrete and should be chipped out to at least 3/4 inch below any exposed reinforcing. Concrete patch edges should be sawcut without damaging embedded reinforcing bars. Sandblast clean all exposed concrete and steel surfaces in repair opening and paint any exposed reinforcing bars and tensioning posts with a protective anti-corrosive coating. After coating cure, recast the repair opening using concrete patching material.</p> <p>In the case of minor chipping of concrete surface – no deep concrete cracks or steel exposure – a high performance urethane polymer or industrial bonding epoxy may be used to restore the concrete surface.</p> <p>The documentation shall include a report documenting the statement of work, list of materials used and photos. Tetra Tech will make a final inspection of the completed work.</p>
9. Is a headwall needed for flap gate attachment?	<p>No. Different styles of heavy-duty flap gates can be attached directly to an exposed corrugated pipe. If the pipe already ends directly at a headwall or culvert, then it is recommended the flap gate be attached to the concrete surface. In either application the flap gate needs to remain operational and achieve the goal of backflow prevention.</p> <p>The documentation shall include a report documenting the statement of work, list of materials used and photos. Tetra Tech will make a final inspection of the completed work.</p>
10. Are rock or soil piles (or ramps) a problem for certification?	Any trash, debris or other obstructions that inhibit operations and maintenance performance and visual inspection of a levee will affect the completion of certification. Unauthorized levee debris that causes obstruction from routine levee inspection and management, obstruction to flood-fighting zones, and debris flow/breeching during storm events must be removed.

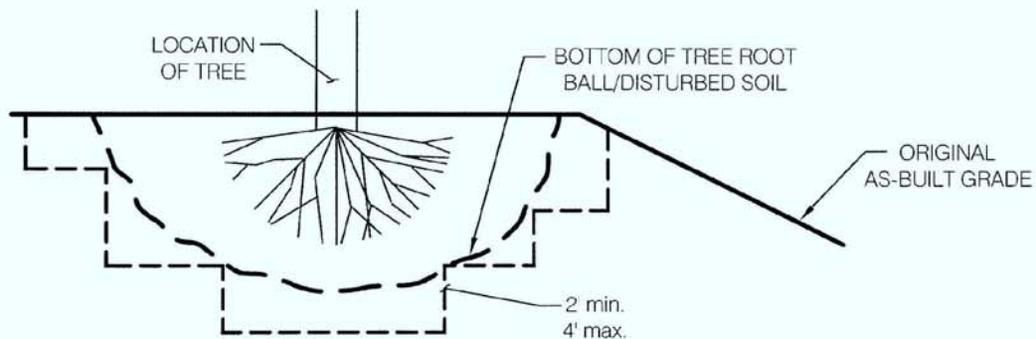
VCWPD O&M QUESTION	TETRA TECH/AMEC RESPONSE
11. AS-7, M4R: Is this a levee? Is veg removal required within only 8' of the foundation of the wall?	Determination of the levee situation on certain lengths of the levee system will require a hydraulic analysis. This analysis will be performed during the next phase of work. A levee is an earthen embankment, floodwall, or structure along a water course whose purpose is flood risk reduction or water conveyance. In the case of a floodwall, the root-free zone is the greater of either eight (8) feet from toe of the floodwall foundation or fifteen (15) feet from face of floodwall. If there is a drainage system at the toe, then the eight (8) feet is measured from the outside of the drainage system. All vegetation growing over the floodwall's foundation heel/toe as well as the eight (8) feet root-free zone must be removed.
12. AS-7, M4L: Is seepage a problem for certification?	Further analysis is required to make that determination. Provided that the wall and channel bottom have been designed to accommodate this condition and that existing and anticipated future groundwater conditions are within the anticipated ranges utilized in design, certification may proceed.
13. AS-7, M8L: What is considered the top of the levee? Is there a floodwall?	Determination of the levee situation on certain lengths of the levee system will require a hydraulic analysis. This analysis will be performed during the next phase of work.
14. AS-6, M13L: Does not appear to be a levee.	Determination of the levee situation on certain lengths of the levee system will require a hydraulic analysis. This analysis will be performed during the next phase of work.
15. AS-6, M23R: Does not appear to be a levee.	Determination of the levee situation on certain lengths of the levee system will require a hydraulic analysis. This analysis will be performed during the next phase of work.

FILE: 8212100132-001 EROSION REPAIR - PLOT DATE: 2/4/2009



TYPICAL EROSION OR SURFICIAL SLOPE INSTABILITY REPAIR				
LEVEE CERTIFICATION PROJECT VENTURA COUNTY, CALIFORNIA				
AMEC Earth & Environmental 1290 N. HANCOCK STREET, SUITE 102 ANAHEIM, CA 92807-1924 www.amec.com/earthandenvironmental		DWN BY:	DATE:	PROJECT NO:
		CHKD BY:	SCALE:	FIGURE No.
		JBD	February 2009	8212100132
		DRB	Not To Scale	FIGURE 1

ANAHEIM, R:\C:\www\p2008\08\16\12100132\001 Erosion Repair.dwg, Repair 2/04/2009 11:51:28 AM



NOTES:

1. REMOVE ALL DISTURBED MATERIAL AND BENCH VERTICALLY INTO COMPETENT MATERIAL.
2. RESTORE TO ORIGINAL GRADE BY PLACEMENT OF APPROVED EXCAVATED SOIL OR IMPORTED SOIL WITH EQUIVALENT OR LOWER PERMEABILITY.
3. PLACE MATERIAL IN HORIZONTAL LIFTS (12 INCH MAXIMUM THICKNESS), MOISTURE CONDITIONED TO AT LEAST OPTIMUM MOISTURE CONTENT AND COMPACTED TO AT LEAST 90 PERCENT OF MAXIMUM DRY DENSITY PER ASTM D1557.
4. COMPACTION TESTING SHOULD BE PERFORMED PER ASTM D1556 OR D2922, A MINIMUM OF 1 TEST PER 3 CU. YD. OF BACKFILL.

		TYPICAL VEGETATION REMOVAL REPAIR		
		LEVEE CERTIFICATION PROJECT VENTURA COUNTY, CALIFORNIA		
AMEC Earth & Environmental 1290 N. HANCOCK STREET, SUITE 102 ANAHEIM, CA 92807-1924 www.amec.com/earthandenvrmental		DWN BY:	DATE:	PROJECT NO:
		CHK'D BY:	SCALE:	FIGURE No.
		JBD	February 2009	8212100132
		DRB	Not To Scale	FIGURE 2

SECTION 41: PAVEMENT SUBSEALING AND JACKING

41-1 PAVEMENT SUBSEALING

41-1.01 DESCRIPTION

This work shall consist of filling voids beneath existing portland cement concrete pavement, at the locations shown on the plans, by drilling holes through the existing pavement, injecting grout through the holes and filling the drilled holes with mortar or concrete.

41-1.02 MATERIALS

- Grout for filling the voids beneath the existing pavement shall be composed of portland cement, fly ash and water. Portland cement and fly ash shall be proportioned by weight at the rate of one part portland cement to 2.4 to 2.7 parts fly ash. Water shall be added in an amount to provide a grout efflux time of 10 to 16 seconds as determined by California Test 541, Part D.
- Portland cement for the grout shall be Type II Modified conforming to the provisions in Section 90-2.01, "Cement."
- Fly ash shall conform to the requirements in ASTM Designation: C 618 for either Class C or Class F fly ash, except that the loss on ignition shall not exceed 4 percent. The brand of fly ash used in the work shall conform to the provisions for approval of admixture brands in Section 90-4.03, "Admixture Approval."
- When fly ash, cement, or fly ash and cement are delivered in packages, each package shall be marked plainly with the class, type, name and brand of producer, and the weight of material contained therein. Similar information shall be provided in the shipping invoices accompanying the shipment of packaged or bulk fly ash and cement.
- Chemical admixtures and calcium chloride conforming to the provisions in Section 90-4, "Admixtures," may be used in the grout mixture, subject to the Engineer's written approval.
- In advance of grouting operations, the Contractor shall submit a proposal for the materials to be used in the work accompanied with independent laboratory test data that indicates the initial set time and the one-day, 3-day, and 7-day compressive strengths of the grout at 10-second, 12-second and 14-second efflux times using specimen molds and curing conditions specified in ASTM Designation: C 109.
- Grout having a 7-day compressive strength of less than 750 psi at a 12-second efflux time as determined by the independent laboratory tests will not be acceptable.
- No change in the grout materials shall be made unless a resubmittal of the above information and requirements is furnished to the Engineer.
- Mortar for filling the holes in the concrete pavement shall be composed of one part portland cement to 3 parts fine aggregate, by volume, and only enough water to permit placing and packing of the mortar in the holes. A commercial quality premixed rapid set mortar or concrete may be used to fill the holes.

SECTION 41

PAVEMENT SUBSEALING AND JACKING

41-1.03 CONSTRUCTION

- Holes shall be drilled through the pavement and underlying base to a depth of 15 inches to 18 inches below the pavement surface. The holes shall be drilled to the diameter necessary to accommodate the equipment used for injecting the grout. Care shall be taken to protect the pavement surrounding each hole from damage.
- The location of the holes shall conform to the configuration shown on the plans unless otherwise directed or permitted by the Engineer. Before beginning grouting operations, and continuing thereafter to the end of each run or work shift, the holes in at least 2 consecutive slabs requiring subsealing shall be drilled ahead of the grouting operations.
- Open drilled holes shall not remain ungrouted for more than 2 working days.
- The side of the injection hole shall be washed with a minimum water gage pressure of 40 psi just prior to grout injection. The washing device shall be constructed such that a minimum of 4 jets shall direct water horizontally at the slab-base interface.
- The grout plant shall consist of a positive displacement cement injection pump and a high-speed colloidal mixer. The colloidal mixer shall operate between a minimum speed of 800 RPM and a maximum speed of 2,000 RPM. The injection pump shall be capable of sustaining a gage pressure of 150 psi when pumping a grout mixed to a 12-second flow time. A pressure gage shall be located immediately adjacent to the grout hose supply valve and shall be positioned so it can be easily monitored by the Engineer.
- Dry cement and fly ash shall be accurately measured by weight, if in bulk, or shall be packaged in containers of uniform weight.
- Water shall be introduced into the mixing process through a meter or scale.
- Grout not used in the work within one hour after mixing shall be disposed of as directed by the Engineer.
- Grout shall be pressure injected through the holes until all voids under the pavement slab are filled. No portion of the slab shall be moved or raised more than 0.050-inch as a result of pressure grouting. The Engineer will furnish and utilize suitable devices to monitor slab movement during pressure grouting.
- The injection nozzle shall prevent leakage during injection and shall not protrude below the concrete slab. Grout shall be injected into only one hole at a time on any slab. When grout appears at any longitudinal or transverse joint, crack, or adjacent hole, or when monitoring devices indicate slab movement in excess of 0.050-inch, pressure injection of grout shall cease at that hole.
- In the event that grout flow does not occur after 7 seconds of sustained 150 psi injection pump gage pressure and if there is no indication of slab movement, continued injection at that hole shall cease.
- Immediately after the nozzle is removed, the hole shall be temporarily plugged with a round, tapered wooden plug. The plug shall remain in place until pressure grouting at adjacent holes progresses to the point where grout will not be forced up through previously grouted holes.
- In the event the Engineer determines that continued grouting at a location is no longer advantageous, the Engineer may direct the Contractor to cease subsealing operations at that location.

SECTION 41**PAVEMENT SUBSEALING AND JACKING**

- Grouting shall not be performed when the atmospheric or subgrade temperature is below 40° F, or during inclement weather. When standing rainwater is present in the holes, grouting shall not be performed unless permitted by the Engineer.
- The Contractor shall take necessary precautions to prevent grout from being injected into any drainage facility or other open structure.
- Cracks in the pavement which occur during the injection of grout will be considered as damage to the pavement due to the Contractor's operations. The damage shall be repaired by the Contractor at the Contractor's expense and as directed by the Engineer.
- Upon completion of the grouting operation, grout shall be removed from the drilled holes to a depth of not less than 4 inches below the pavement surface. The holes shall be cleaned and then filled with mortar or premixed, rapid set concrete and finished flush with the concrete pavement surface.
- At the end of each work shift, the work area shall be left in a clean, swept and neat condition.

41-1.04 MEASUREMENT

- The quantity of drilled holes will be measured as units determined by actual count. Any hole drilled that is not shown on the plans or ordered by the Engineer will not be measured nor paid for.
- The quantities of dry cement and fly ash used in the grout mix will be measured by the ton and will be paid for as grout (subsealing). Quantities of grout not used in the work and grout that is wasted by leaking through to the pavement surface because of not taking preventative measures to avoid wasting of grout, will not be paid for. The quantity of grout wasted or disposed of will be determined by the Engineer. Quantities of grout, cement or fly ash remaining on hand after completion of the work will not be paid for.

41-1.05 PAYMENT

- Items of work, measured as specified in Section 41-1.04, "Measurement," will be paid for at the contract unit price for drill hole (subsealing) and the contract price per ton for grout (subsealing).
- The above prices and payments shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals, and for doing all the work involved in subsealing existing portland cement concrete pavement as shown on the plans, as specified in these specifications and the special provisions, and as directed by the Engineer.
- Full compensation for furnishing and placing mortar or concrete for filling the drilled holes shall be considered as included in the contract unit price paid for drill hole (subsealing) and no additional compensation will be allowed therefor.

41-2 PAVEMENT JACKING**41-2.01 DESCRIPTION**

- This work shall consist of raising existing portland cement concrete pavement to grade, at the locations shown on the plans, by drilling holes through the existing

SECTION 41**PAVEMENT SUBSEALING AND JACKING**

pavement, injecting grout through the holes to fill voids beneath the pavement and raise the pavement to grade, and filling the drilled holes with mortar or concrete.

41-2.02 MATERIALS

- The grout for pavement jacking and mortar or concrete for filling the drilled holes shall conform to the provisions for grout and mortar or concrete for pavement subsealing in Section 41-1.02, "Materials," except that the grout for pavement jacking shall contain water in an amount to provide a grout efflux time of 16 seconds to 26 seconds. Additional water may be added to reduce the grout efflux time to not less than 10 seconds to initiate the pressure injection of the grout.

41-2.03 CONSTRUCTION

- Pavement jacking shall conform to the provisions for pavement subsealing in Section 41-1.03, "Construction," except for the following:

The positive displacement grout injection pump shall be capable of providing a sustained gage pressure of 200 psi. Gage pressures exceeding 200 psi, but not exceeding 600 psi, may be used for brief periods of time to start the movement of the slab.

Slabs shall be raised uniformly to grade. The Contractor shall furnish and utilize stringlines to monitor the movement of the pavement.

The final elevation of the surface of the concrete pavement shall not vary at any point more than 0.01-foot above or below the grade established by the Engineer. If the surface of the pavement at any point is higher than 0.01-foot above the grade established by the Engineer, the surface shall be ground to meet the above specified tolerance; however, the entire slab shall be removed and replaced with new concrete pavement if the surface at any point is higher than 0.10-foot above the grade established by the Engineer. Grinding of the concrete pavement or removal and replacement of the pavement, if necessary, shall conform to the provisions in Section 42-2, "Grinding," except for payment.

Adjacent slabs, not requiring adjustment in grade, shall not be moved. Corrections to grade of adjacent slabs, if necessary, and as determined by the Engineer, shall be made in the same manner that is required for pavement that is raised to grade.

41-2.04 MEASUREMENT

- The quantity of drilled holes will be measured as units determined by actual count. Any hole drilled that is not shown on the plans or ordered by the Engineer will not be measured nor paid for.
- The quantities of dry cement and fly ash used in the grout mix will be measured by the ton and will be paid for as grout (jacking). Quantities of grout not used in the work and grout that is wasted by leaking through to the pavement surface because of not taking preventative measures to avoid wasting of grout, will not be paid for. The quantity of grout wasted or disposed of will be determined by the Engineer. Quantities of grout, cement or fly ash remaining on hand after completion of the work will not be paid for.



TETRA TECH