Ventura County
Watershed Protection District

FEMA Levee Certification

Ventura County, California

Sespe Creek Levee (SC-1)
Old Telegraph Road to Goodenough Road

Evaluation Report

February 13, 2009

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

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Prepared for:

Ventura County
Watershed Protection District

Prepared by:

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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 Sespe Creek Levee (SC-1) 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 SC-1 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.

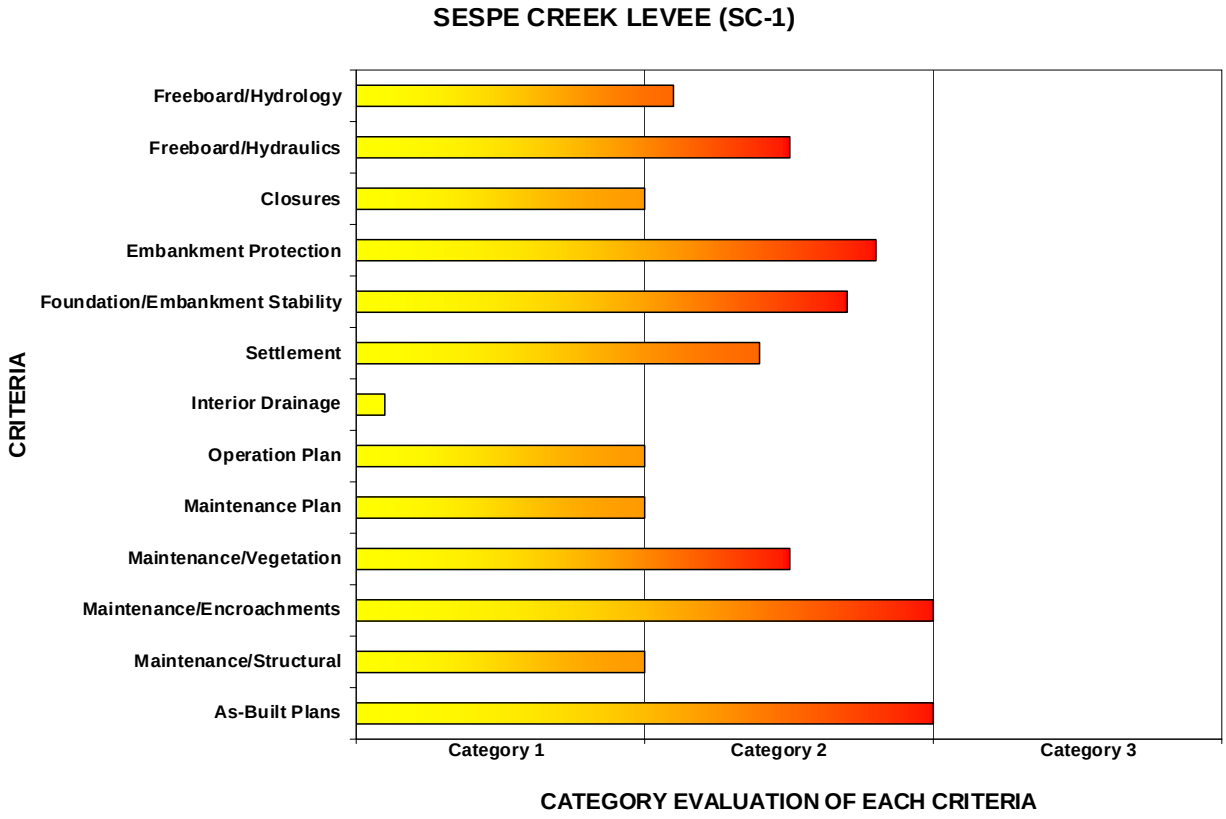
Data collection efforts have been performed to determine what information is available in support of levee certification. Existing information collected and reviewed at the time of preparation of this report includes the following:

- 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 SC-1 levee system be classified as a Category 2 Levee. The suggested critical path to achieve levee certification for the SC-1 levee system is outlined in Section F Recommendation.

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Old Telegraph Road to Goodenough Road

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A) Introduction

The Sespe Creek Levee (VCWPD ID No: SC-1) is located in the City of Fillmore in Ventura County. The location of the levee system is from Old Telegraph Road to Goodenough Road and is shown on Figure 1. The SC-1 levee system is located along the left bank of Sespe Creek. The levee system consists of embankment levees, side drainage penetrations, and a stop-log structure where Fillmore and Western Railroad track crosses the levee. The protective works of the Sespe 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, recreational, and potentially developable property in low lying areas within the base flood floodplain of the Sespe Creek Watershed.

The levee system begins at the Old Telegraph Road and continues upstream to Goodenough Road. The length of the levee along the Sespe Creek is approximately 1 mile, with an embankment height of 10 to 15 feet above natural ground on the landward side. The levee's earthen berm is protected by loose riprap and grouted riprap. An approximately 14.5 feet wide access road 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 river 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.

The discharge frequency values presented in the December 2006 Ventura County Watershed Protection District report (VCWPD) entitled "Santa Clara River 2006 Hydrology Update, Phase I, From Ocean to County Line" are directly usable for Santa Clara River and Sespe Creek levee certification purposes. This report was developed through a collaborative effort

Figure 1 – Location Map

among hydrologic engineering staff at VCWPD, Corps of Engineers, Los Angeles District (Corps), and Los Angeles County Department of Public Works. The study results are current in that flow data through water year 2005 was used in the hydrologic analysis, and there have been no flood events in the interim that are large enough to significantly alter the discharge frequency values in the report. Water Resource Council Bulletin #17B discharge frequency procedures were applied as prescribed by FEMA guidelines as the basis for the hydrologic analysis.

There will be a need to generate baseflood hydrographs for geotechnical evaluation of levee stability considering seepage therefore a volume duration frequency analysis will need to be performed. Baseflood hydrographs would be generated using a "balanced hydrograph" approach in which the baseflood hydrograph would be consistent with respect to volume duration frequency relationships for the Sespe Creek levee. A pattern hydrograph based on either a hypothetical flood event such as Standard Project Flood or a large historical flood event would be used to shape the baseflood hydrographs.

The current FEMA FIS hydraulic model for Sespe Creek is available. The current FEMA FIS hydraulic model will be useful as a base model to develop the freeboard analysis. In addition, the existing topographic information may need to be verified with a survey due to vegetation that may have created inaccuracies in the LiDAR data.

In addition sedimentation and scour analyses will need to be performed to support the freeboard analysis and embankment stability analysis.

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 includes a stop log system that acts as a closure. The stop log structure includes 32 aluminum beams located at the site for installation during flooding conditions.

Documentation of this structure is required as part of the certification.

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 river 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. The existing rock revetment is of a couple

different types of rock and some of it is desiccated and broken down into smaller pieces along the levee. The Corps has sent two of their geologists out to observe the rock. Their findings are that only 5% of the rock is breaking down and they do not anticipate the break down to continue at a significant rate. The Corps geologist also noted at the site and in the construction inspection notes that, at several locations along the levee, the rock was undersized when it was placed during construction. The undersized rock was noted and discussed during construction and it was decided by the Corps that no action would be taken at that time. The Corps report is attached as Exhibit 5. The ability of this rock revetment to provide the appropriate level of protection will be determined in this analysis.

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.

A total of 17 test trench logs and a single hand auger log from the original levee design are available for review. The test pits and hand auger boring were shallow in depth and laboratory testing was limited to in-situ moisture tests and some gradation analyses. A geology report dated March 1980 was made available for review. The report provides test boring logs, laboratory test results, engineering analyses, and geotechnical design recommendations. However, the original design was based on assumed seepage conditions and did not provide a detailed seepage analysis and resulting potential effects on the stability of the embankment.

A significant portion of the rip-rap material present on the riverside embankment did not appear to meet project specifications with regard to weight and soundness. In addition, from about Station 63+00 to 74+80 the toe of the landside portion of the levee has been undercut.

Further analysis and evaluations would include the following:

- Geotechnical borings for determining existing geologic conditions, obtaining geologic samples, and performing in-situ permeability testing.
- Test pits for evaluation of rip-rap conditions.
- Laboratory testing consisting of soil classification, shear strength and permeability.
- Seepage analyses.
- Slope stability analyses.

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.

The referenced geologic report did not address settlement of the levee. As of January 22, 2009, no geotechnical design or construction information regarding settlement potential 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 testing to evaluate consolidation potential.
- Analyses 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 indentifies the sources, extent, and depth of interior flooding.

Interior drainage analyses will be required at all storm drain penetrations. Based on the field investigation and review of the as-built plans, there are no storm drain penetrations through the levee.

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 stop log structure as well as 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 and undercutting of the landward side levee toe near Old telegraph Road.

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.

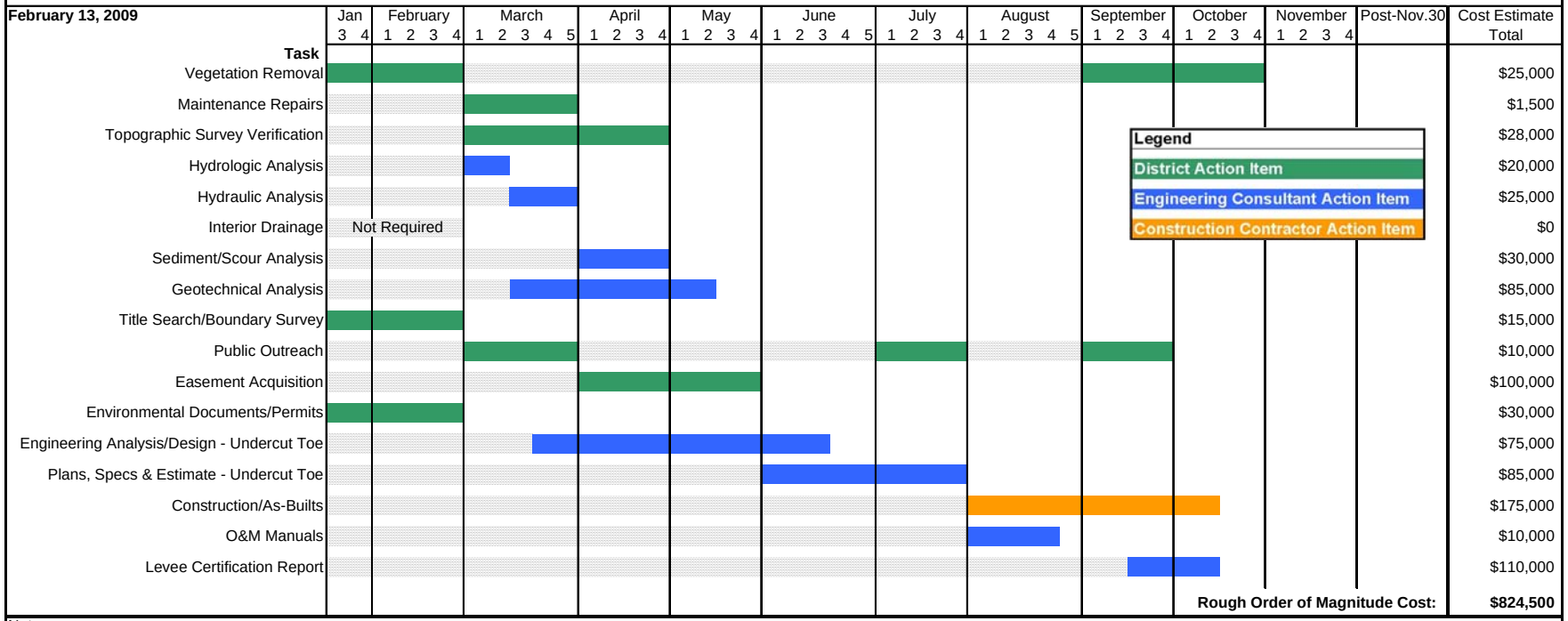
F) Recommendation

The field investigation identified several critical issues that must be resolved prior to certification. The most significant issues are undercutting of landward side levee toe near Old Telegraph Road and vegetation removal. Engineering analyses will also need to be performed to verify that this levee meets the NFIP Section 65.10 requirements. Based on the review of existing data and observations from the field investigation, it is recommended that the SC-1 levee system be classified as a Category 2 Levee.

The suggested critical path to achieve levee certification for the SC-1 levee system is outlined below and a tentative schedule of actions is shown on Figure 2.

- Vegetation Removal
- Maintenance Repairs
- Topographic Survey
- H&H Analyses/Interior Drainage
- Sediment/Scour Analyses
- Geotechnical Field Investigation and Analyses
- Title Search and Boundary Survey
- Public Outreach/Workshop
- Easement Acquisition (if needed)
- Environmental Documents/Permits
- Engineering Analysis and Design
- Plans, Specifications and Estimate
- Construction/As-builts
- Operation and Maintenance Manuals
- Levee Certification Report

LEVEE CERTIFICATION ACTION PLAN TASK TIMELINE AND COST ESTIMATES FOR SC-1



Notes:
1) Costs in this table are Rough Order of Magnitude and are based on the best available information as of the date listed in the upper left.
2) Costs for major rehabilitation requirements due to deficiencies found in future work are not included in this table.

Figure 2 – Tentative Schedule of Actions

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.

Tetra Tech. 2008. *Sespe Creek Levee (SC-1) Old Telegraph Road to Goodenough Road, Field Investigation Report.* Prepared for the Ventura County Watershed Protection District, Ventura, California.

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. 2006. *Santa Clara River 2006 Hydrology Update, Phase I, From Ocean to County Line.*

Ventura County Watershed Protection District. 2007. *Sespe Creek Levee, Old Telegraph Road to Goodenough Road, Operation and Maintenance Manual*.

Exhibit 1

Field Investigation Report

Ventura County
Watershed Protection District

FEMA Levee Certification

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Introduction

Sespe Creek Levee (VCWPD ID No: (SC-1) is located between Old Telegraph Road and Goodenough Road in the City of Fillmore in Ventura County. The location of the levee system is from Old Telegraph Road to Goodenough Road and is shown on Figure 1.

As part of the FEMA levee certification process, field investigations of the Sespe Creek Levee (SC-1) 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.

Figure 1 – Location Map

General Descriptions

- The levee system is located along the left side of Sespe Creek and consists of embankment levees and a stop log structure immediately upstream of the Old Telegraph Road crossing where Fillmore and Western Railroad track crosses the levee.
- The protective works of the Sespe Creek Levee at Fillmore 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 begins at Old Telegraph Road and ends in the vicinity of Goodenough Road.
- The length of the levee along Sespe Creek is approximately 1 mile.
- The FIRM dated October 31, 1985 shows containment of Zone A.
- The levee system is intended to protect existing residential, recreational, and potentially developable property in low lying areas within the base flood floodplain of the Ventura River Watershed.
- The levee's earthen berm is protected by loose riprap on the riverward side and smaller size stone and gravel on the landward side. The access road that runs along the top is approximately 14.5 feet wide.

General Field Observations

a) Riverward side of Levee:

1. Removal of vegetation (trees and shrubs) within 15 feet of levee toe is required at downstream end near RR stop log structure (approximately 400 lf).
2. Rock revetment is a sandstone type rock and a lot of it has desiccated and broken down into smaller pieces along entire length of the levee. The ability of this rock revetment to provide the appropriate level of protection is questionable.

b) Landward side of Levee:

1. Removal of vegetation (trees and shrubs) on levee embankment and within 15 feet of levee toe is required at upstream end along border with private home owners (approximately 370 lf).
2. Restoration of the levee toe to a 2:1 slope is required near the downstream end near the access road. Currently the toe is undercut exposing a concrete curb that parallels the adjacent home owners' fences. This will require the toe to be right up to the fence leaving no room for maintenance access.

Levee Penetrations

Levee closure of the Sespe Creek Levee (SC-1) system during storm events must consider the existing stop log structure. The stop log structure includes 32 aluminum beams at the site for installation during flooding conditions. A summary of levee system penetrations is presented in Table 1.

Table 1 – Summary of Levee Penetrations

River Station	GPS		*Photo No.	Description
	Lat	Long		
Sespe Creek Levee (SC-1)				
62+51	N34.40546	W118.93022	P1-P4	32 beam stop log system at railroad crossing upstream of Old Telegraph Road

* 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 improvements at the locations identified in Table 2 are complete, the field inspection of the levee system indicates that the Sespe Creek Levee (SC-1) 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			
Sespe Creek Levee (SC-1)				
N34.40562	W118.93091	M1	Vegetation within 15' of Toe (Riverward Side)	Remove vegetation and root ball, fill voids with impervious material and firmly compact.
N34.40549	W118.93033	M2, M3	Vegetation within 15' of Toe (Riverward Side)	Remove vegetation and root ball, fill voids with impervious material and firmly compact.
N34.40569	W118.93022	M4	Vegetation within 15' of Toe & minor debris (Riverward Side)	Remove vegetation and root ball, fill voids with impervious material and firmly compact.
N34.40576	W118.93021	M5	Vegetation within 15' of Toe & minor debris (Riverward Side)	Remove vegetation and root ball, fill voids with impervious material and firmly compact.
N34.40584	W118.93013	M6	Vegetation within 15' of Toe & minor debris (Riverward Side)	Remove vegetation and root ball, fill voids with impervious material and firmly compact.
N34.40593	W118.93011	M7	Vegetation within 15' of Toe & minor debris (Riverward Side)	Remove vegetation and root ball, fill voids with impervious material and firmly compact.
N34.40603	W118.93003	M8	Vegetation within 15' of Toe & minor debris (Riverward Side)	Remove vegetation and root ball, fill voids with impervious material and firmly compact.
N34.40619	W118.92995	M9	Vegetation within 15' of Toe & minor debris (Riverward Side)	Remove vegetation and root ball, fill voids with impervious material and firmly compact.
N34.40626	W118.92994	M10	Vegetation within 15' of Toe & minor debris (Riverward Side)	Remove vegetation and root ball, fill voids with impervious material and firmly compact.
N34.40646	W118.92980	M11	Vegetation within 15' of Toe & minor debris (Riverward Side)	Remove vegetation and root ball, fill voids with impervious material and firmly compact.
N34.41797	W118.92314	M12	Vegetation on Levee embankment (Landward Side)	Remove vegetation and root ball, fill voids with impervious material and firmly compact.

GPS		*Photo No.	Description	Action Required
Lat	Long			
Sespe Creek Levee (SC-1)				
N34.41784	W118.92353	M13, M14, M15	Vegetation & Spigot on Levee embankment (Landward Side)	Remove vegetation and root ball, fill voids with impervious material and firmly compact.
N34.40667	W118.92945	M16, M17	Undercut of Levee toe (Landward side)	Re-establish 2:1 toe of levee embankment. Additional engineering analyses are recommended.
N/A	N/A	M18-M27	Broken stone revetment throughout levee embankment (Riverward side)	Additional engineering analyses are recommended.
N/A	N/A	M28	Sinkhole at edge of bike path exposing buried groin	Repair sinkholes and fill voids with impervious material and firmly compact.

* Photos can be found in Appendix C.

Appendix A

Levee Inspection Log

Levee Inspection Log

Facility Name/ID:	SC-1	Date:	December 8, 2008
Watercourse:	Sespe Creek	By:	Ike Pace, Michael Chung (Tt),
Reach:	Old Telegraph Road to Goodenough Road		Doug Dahncke, Bijan
			Farahani (AMEC), & Bill
			DuFrain (VCWPD)

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.	Removal of vegetation (trees and shrubs) on levee embankment and within 15 feet of the toes is required in various locations. Remove vegetation and root ball, fill voids with impervious material and firmly compact.
					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.	
			X		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					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.	Repair of a sink hole located along the bike path is required. Fill voids with impervious material and firmly compact.
					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.	
			X		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.	
		X			M	There are areas where active erosion is occurring or has occurred on or near the levee embankment, but levee integrity is not threatened.	
					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.	
		X			M	Minor superficial sliding that with deferred repairs will not pose an immediate threat to FCW integrity.	
					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.	Restoration of the landward side levee toe to a 2:1 slope is required near the downstream end near the access road. Additional engineering analyses are recommended.
					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. .	
			X		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.	
					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	X				A	No animal burrows present on the levees.	
					M	Several animal burrows present which may lead to seepage or slope stability problems, and they require immediate attention.	

RATED ITEM	A	M	U	N/A		EVALUATION	LOCATIONS / REMARKS / RECOMMENDATIONS
					U	Significant maintenance is required to fill existing burrows, and the levee will not provide reliable flood protection until this maintenance is complete.	
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.	Rock revetment is broken down into smaller pieces along entire length of the levee. Additional engineering analyses are recommended.
		X			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.	
					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)	X				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.	
					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	X				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.	
					N/A	There are no relief wells/toe drainage systems along the levee.	
12 Maintenance and Emergency Access					A	Maintenance/emergency accesses are clear of obstructions and in good condition.	Once the toe is re-established as stated in item 5, there will not be access along the landward side toe for maintenance vehicles.
		X			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.	See Item 5.
					M	There are minor deviations from the as-built plans that would not affect the functionality of the levee.	
			X		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 Sespe Creek Levee (SC-1)

Sespe Creek Levee (Photo No. P1) –Railroad crossing immediately upstream of Old Telegraph Road

Sespe Creek Levee (Photo No. P3) – Stop log slot looking downstream of levee

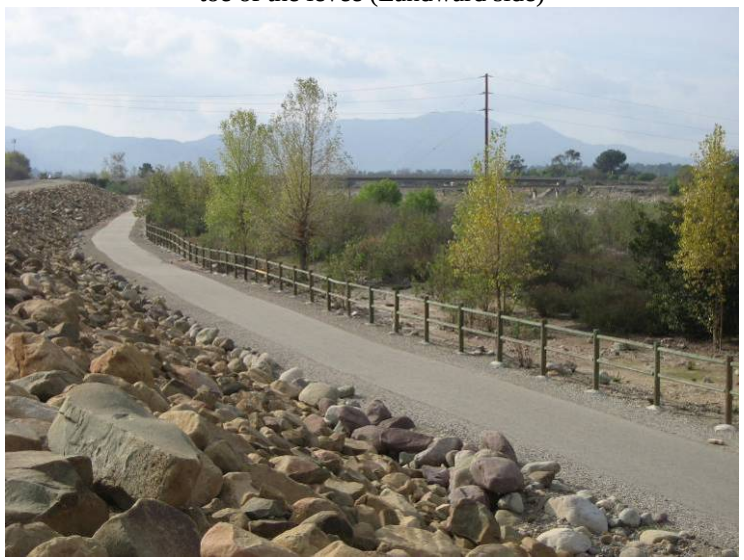
Sespe Creek Levee (Photo No. P2) – Located on top of levee looking down on stop log slot

Sespe Creek Levee (Photo No. P4) – 32 aluminum beams for stop log structure, looking downstream

Sespe Creek Levee (Photo No. F1) – Paved pedestrian trail at the toe of the levee (Riverward side)

Sespe Creek Levee (Photo No. F3) – Maintenance road access ramp at the toe of the levee (Landward side)

Sespe Creek Levee (Photo No. F2) – Unpaved maintenance road on the top of the levee (Photo taken looking toward the landward side)



Sespe Creek Levee (Photo No. F4) – Typical Levee embankment and paved pedestrian trail at the toe of the levee (Riverward Side)

Appendix C

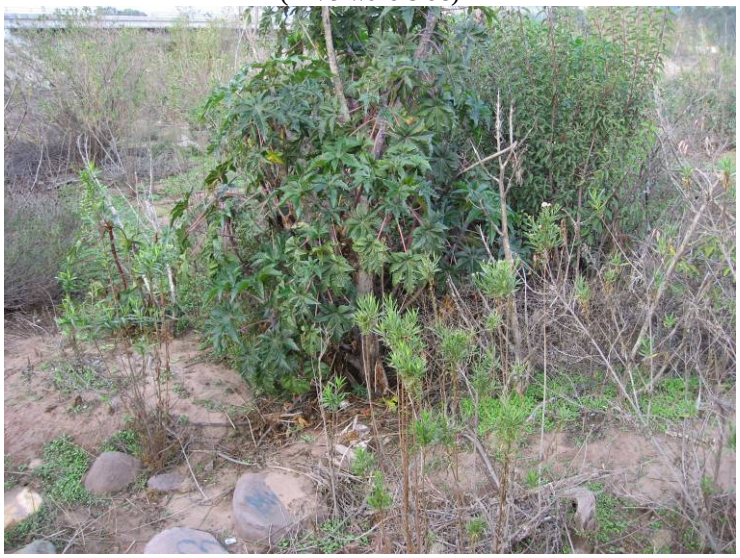
Photos of Maintenance Required Locations

Appendix C – Photograph Locations of Maintenance Required Areas along Sespe Creek Levee (SC-1)

Sespe Creek Levee (Photo No. M1) – Vegetation within 15' of levee toe (Riverward side)

Sespe Creek Levee (Photo No. M3) – Vegetation within 15' of levee toe (Riverward side)

Sespe Creek Levee (Photo No. M2) – Vegetation within 15' of levee toe (Riverward side)



Sespe Creek Levee (Photo No. M4) – Vegetation within 15' of levee toe (Riverward side)

Sespe Creek Levee (Photo No. M5) – Vegetation & minor debris within 15' of levee toe (Riverward side)

Sespe Creek Levee (Photo No. M7) – Vegetation & minor debris within 15' of levee toe (Riverward side)

Sespe Creek Levee (Photo No. M6) – Vegetation & minor debris within 15' of levee toe (Riverward side)

Sespe Creek Levee (Photo No. M8) – Vegetation & minor debris within 15' of levee toe (Riverward side)

Sespe Creek Levee (Photo No. M9) – Vegetation & minor debris within 15’ of levee toe (Riverward side)

Sespe Creek Levee (Photo No. M11) – Vegetation within 15’ of levee toe (Riverward side)

Sespe Creek Levee (Photo No. M10) – Vegetation & minor debris within 15’ of levee toe (Riverward side)

Sespe Creek Levee (Photo No. M12) – Vegetation on levee embankment (Landward side)

Sespe Creek Levee (Photo No. M13) – Vegetation & irrigation spigot within 15' of levee toe (Landward side)

Sespe Creek Levee (Photo No. M15) – Vegetation on levee embankment (Landward side)

Sespe Creek Levee (Photo No. M14) – Vegetation on levee embankment & toe (Landward side)

Sespe Creek Levee (Photo No. M16) – Undercut of Levee toe (Landward side)

Sespe Creek Levee (Photo No. M17) – Undercut of Levee toe (Landward side)

Sespe Creek Levee (Photo No. M19) – Broken stone revetment (Riverward side)

Sespe Creek Levee (Photo No. M18) – Broken stone revetment (Riverward side)

Sespe Creek Levee (Photo No. M20) – Broken stone revetment (Riverward side)

Sespe Creek Levee (Photo No. M21) – Broken stone revetment (Riverward side)

Sespe Creek Levee (Photo No. M23) – Broken stone revetment (Riverward side)

Sespe Creek Levee (Photo No. M22) – Broken stone revetment (Riverward side)

Sespe Creek Levee (Photo No. M24) – Broken stone revetment (Riverward side)

Sespe Creek Levee (Photo No. M25) – Broken stone revetment (Riverward side)

Sespe Creek Levee (Photo No. M27) – Broken stone revetment (Riverward side)

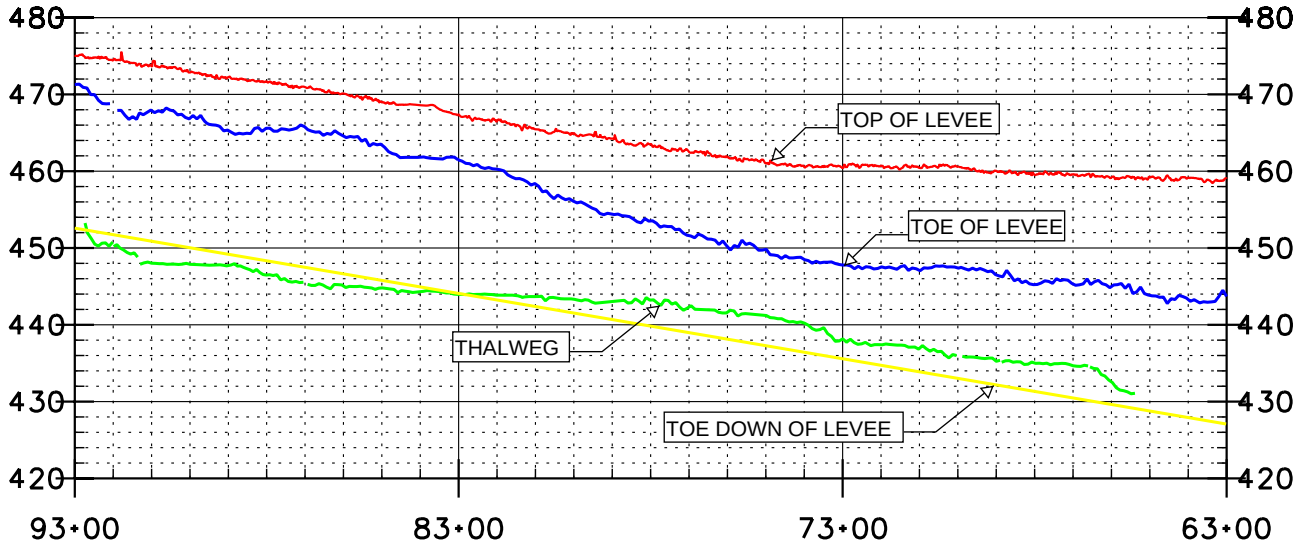
Sespe Creek Levee (Photo No. M26) – Broken stone revetment (Riverward side)

Sespe Creek Levee (Photo No. M28) –Sink hole at edge of bike path over buried groin

Exhibit 2

Preliminary Evaluation of Levee System Profiles

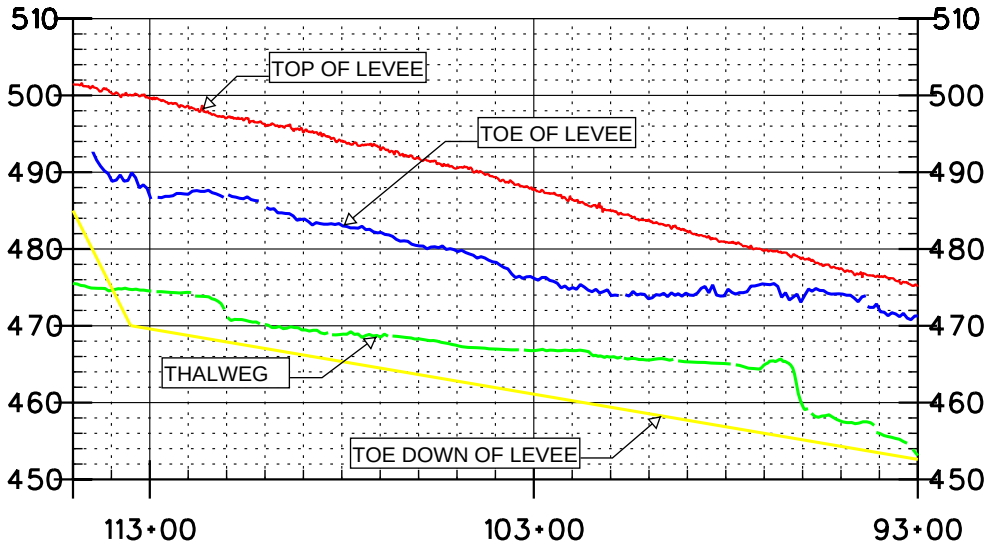
SESPE CREEK (SC-1)
STATION 63+00 TO 93+00



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

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

SESPE CREEK (SC-1)
STATION 93+00 TO 115+00



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

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

Exhibit 3

As-Built Plans Status List

Sespe Creek Levee at Fillmore (SC-1) - Old Telegraph Road to Goodenough Road

Bridge Crossings (U/S to D/S)	**As-Builts Provided to Consultant by County**	**County or USACE Dwg. No.**	**Date***	**Action**
Railroad (~70' U/S of Old Telegraph Rd.)	No			Request from SPRR.
Old Telegraph Rd	Yes	Y-2-1515 to 1531	1984	
Ventura Street	No			Request from County.
Levee System (U/S to D/S)				
Sespe Creek Levee at Fillmore	Yes	460/224 to 253	1984	
Sespe Creek Bank Restoration	Yes	Y-2-1303 to 1318	1979	
Sespe Levee Rock Groin Restoration	Yes	Y-2-2666 to 2675	1999	
Stop log system @ RR X-ing U/S of Old Telegraph Rd.	Yes	460/224 to 253	1984	
Sespe Creek Levee (Under Old Telegraph Rd. Bridge)	Yes	Y-2-1506 to 1514	1982	
Future Repairs				
Encroachment repair			Fall 2009	To be constructed.
Vegetation removal repair			Fall 2009	To be constructed.

*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
Sespe Creek Levee (SC-1), Category 2								
M1	Vegetation within 15' of Toe (Riverward Side)	Remove vegetation and root ball, fill voids with impervious material and firmly compact.	**C1**	E1	Clearing sparse/ exotic veg	**X**	Definition of impervious material	For all vegetation removal under 4" trunk diameter, no documentation is necessary. For larger rootball removal where excavation & compaction is required, documentation of the impacted material shall be conducted by a certified testing & materials lab familiar to the District. The documentation shall include a report provided by the lab. AMEC will periodically observe these locations & will require a copy of the report for documentation & review. Figure 2 attached outlines the excavation & compaction details. Documentation of the removal & replacement/re-compaction of the impacted material shall be conducted by a certified testing & materials lab familiar to the District. The documentation shall include a report provided by the lab. AMEC will periodically observe these locations & will require a copy of the report for documentation & 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, & shall be evaluated by the lab.
M2, M3	Vegetation within 15' of Toe (Riverward Side)	Remove vegetation and root ball, fill voids with impervious material and firmly compact.	**C1**	E1	Veg outside creek, clearing	**X**	Definition of impervious material	For all vegetation removal under 4" trunk diameter, no documentation is necessary. For larger rootball removal where excavation & compaction is required, documentation of the impacted material shall be conducted by a certified testing & materials lab familiar to the District. The documentation shall include a report provided by the lab. AMEC will periodically observe these locations & will require a copy of the report for documentation & review. Figure 2 attached outlines the excavation & compaction details. Documentation of the removal & replacement/re-compaction of the impacted material shall be conducted by a certified testing & materials lab familiar to the District. The documentation shall include a report provided by the lab. AMEC will periodically observe these locations & will require a copy of the report for documentation & 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, & shall be evaluated by the lab.
M4	Vegetation within 15' of Toe & minor debris (Riverward Side)	Remove vegetation and root ball, fill voids with impervious material and firmly compact.	**C1**	E1	Clearing sparse/ exotic veg	**X**	Definition of impervious material	For all vegetation removal under 4" trunk diameter, no documentation is necessary. For larger rootball removal where excavation & compaction is required, documentation of the impacted material shall be conducted by a certified testing & materials lab familiar to the District. The documentation shall include a report provided by the lab. AMEC will periodically observe these locations & will require a copy of the report for documentation & review. Figure 2 attached outlines the excavation & compaction details. Documentation of the removal & replacement/re-compaction of the impacted material shall be conducted by a certified testing & materials lab familiar to the District. The documentation shall include a report provided by the lab. AMEC will periodically observe these locations & will require a copy of the report for documentation & 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, & shall be evaluated by the lab.
M5	Vegetation within 15' of Toe & minor debris (Riverward Side)	Remove vegetation and root ball, fill voids with impervious material and firmly compact.	**C1**	E1	Veg outside creek, clearing	**X**	Definition of impervious material	For all vegetation removal under 4" trunk diameter, no documentation is necessary. For larger rootball removal where excavation & compaction is required, documentation of the impacted material shall be conducted by a certified testing & materials lab familiar to the District. The documentation shall include a report provided by the lab. AMEC will periodically observe these locations & will require a copy of the report for documentation & review. Figure 2 attached outlines the excavation & compaction details. Documentation of the removal & replacement/re-compaction of the impacted material shall be conducted by a certified testing & materials lab familiar to the District. The documentation shall include a report provided by the lab. AMEC will periodically observe these locations & will require a copy of the report for documentation & 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, & shall be evaluated by the lab.
M6	Vegetation within 15' of Toe & minor debris (Riverward Side)	Remove vegetation and root ball, fill voids with impervious material and firmly compact.	**C1**	E1	Veg outside creek, clearing	**X**	Definition of impervious material	For all vegetation removal under 4" trunk diameter, no documentation is necessary. For larger rootball removal where excavation & compaction is required, documentation of the impacted material shall be conducted by a certified testing & materials lab familiar to the District. The documentation shall include a report provided by the lab. AMEC will periodically observe these locations & will require a copy of the report for documentation & review. Figure 2 attached outlines the excavation & compaction details. Documentation of the removal & replacement/re-compaction of the impacted material shall be conducted by a certified testing & materials lab familiar to the District. The documentation shall include a report provided by the lab. AMEC will periodically observe these locations & will require a copy of the report for documentation & 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, & shall be evaluated by the lab.

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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
Sespe Creek Levee (SC-1), Category 2								
M7	Vegetation within 15' of Toe & minor debris (Riverward Side)	Remove vegetation and root ball, fill voids with impervious material and firmly compact.	C1	E1	Veg outside creek, clearing	X	Definition of impervious material	For all vegetation removal under 4" trunk diameter, no documentation is necessary. For larger rootball removal where excavation & compaction is required, documentation of the impacted material shall be conducted by a certified testing & materials lab familiar to the District. The documentation shall include a report provided by the lab. AMEC will periodically observe these locations & will require a copy of the report for documentation & review. Figure 2 attached outlines the excavation & compaction details. Documentation of the removal & replacement/re-compaction of the impacted material shall be conducted by a certified testing & materials lab familiar to the District. The documentation shall include a report provided by the lab. AMEC will periodically observe these locations & will require a copy of the report for documentation & 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, & shall be evaluated by the lab.
M8	Vegetation within 15' of Toe & minor debris (Riverward Side)	Remove vegetation and root ball, fill voids with impervious material and firmly compact.	C1	E1	Veg outside creek, clearing	X	Definition of impervious material	For all vegetation removal under 4" trunk diameter, no documentation is necessary. For larger rootball removal where excavation & compaction is required, documentation of the impacted material shall be conducted by a certified testing & materials lab familiar to the District. The documentation shall include a report provided by the lab. AMEC will periodically observe these locations & will require a copy of the report for documentation & review. Figure 2 attached outlines the excavation & compaction details. Documentation of the removal & replacement/re-compaction of the impacted material shall be conducted by a certified testing & materials lab familiar to the District. The documentation shall include a report provided by the lab. AMEC will periodically observe these locations & will require a copy of the report for documentation & 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, & shall be evaluated by the lab.
M9	Vegetation within 15' of Toe & minor debris (Riverward Side)	Remove vegetation and root ball, fill voids with impervious material and firmly compact.	C1	E1	Veg outside creek, clearing	X	Definition of impervious material	For all vegetation removal under 4" trunk diameter, no documentation is necessary. For larger rootball removal where excavation & compaction is required, documentation of the impacted material shall be conducted by a certified testing & materials lab familiar to the District. The documentation shall include a report provided by the lab. AMEC will periodically observe these locations & will require a copy of the report for documentation & review. Figure 2 attached outlines the excavation & compaction details. Documentation of the removal & replacement/re-compaction of the impacted material shall be conducted by a certified testing & materials lab familiar to the District. The documentation shall include a report provided by the lab. AMEC will periodically observe these locations & will require a copy of the report for documentation & 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, & shall be evaluated by the lab.
M10	Vegetation within 15' of Toe & minor debris (Riverward Side)	Remove vegetation and root ball, fill voids with impervious material and firmly compact.	C1	E1	Veg outside creek, clearing	X	Definition of impervious material	For all vegetation removal under 4" trunk diameter, no documentation is necessary. For larger rootball removal where excavation & compaction is required, documentation of the impacted material shall be conducted by a certified testing & materials lab familiar to the District. The documentation shall include a report provided by the lab. AMEC will periodically observe these locations & will require a copy of the report for documentation & review. Figure 2 attached outlines the excavation & compaction details. Documentation of the removal & replacement/re-compaction of the impacted material shall be conducted by a certified testing & materials lab familiar to the District. The documentation shall include a report provided by the lab. AMEC will periodically observe these locations & will require a copy of the report for documentation & 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, & shall be evaluated by the lab.
M11	Vegetation within 15' of Toe & minor debris (Riverward Side)	Remove vegetation and root ball, fill voids with impervious material and firmly compact.	C1	E1	Veg outside creek, clearing	X	Definition of impervious material	For all vegetation removal under 4" trunk diameter, no documentation is necessary. For larger rootball removal where excavation & compaction is required, documentation of the impacted material shall be conducted by a certified testing & materials lab familiar to the District. The documentation shall include a report provided by the lab. AMEC will periodically observe these locations & will require a copy of the report for documentation & review. Figure 2 attached outlines the excavation & compaction details. Documentation of the removal & replacement/re-compaction of the impacted material shall be conducted by a certified testing & materials lab familiar to the District. The documentation shall include a report provided by the lab. AMEC will periodically observe these locations & will require a copy of the report for documentation & 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, & shall be evaluated by the lab.

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Sespe Creek Levee (SC-1), Category 2								
M12	Vegetation on Levee embankment (Landward Side)	Remove vegetation and root ball, fill voids with impervious material and firmly compact.	**C5 -** PR issue with landowner (permitted)	E1	Landward veg removal not regulated	X	Definition of impervious material	For all vegetation removal under 4" trunk diameter, no documentation is necessary. For larger rootball removal where excavation & compaction is required, documentation of the impacted material shall be conducted by a certified testing & materials lab familiar to the District. The documentation shall include a report provided by the lab. AMEC will periodically observe these locations & will require a copy of the report for documentation & review. Figure 2 attached outlines the excavation & compaction details. Documentation of the removal & replacement/re-compaction of the impacted material shall be conducted by a certified testing & materials lab familiar to the District. The documentation shall include a report provided by the lab. AMEC will periodically observe these locations & will require a copy of the report for documentation & 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, & shall be evaluated by the lab.
M13, M14, M15	Vegetation & Spigot on Levee embankment (Landward Side)	Remove vegetation and root ball, fill voids with impervious material and firmly compact.	**C5 -** PR issue with landowner (permitted)	E1	Landward veg removal not regulated	X	Spigot is from landowner and does not cross levee	Any irrigation, water or similar line located on or near a levee embankment that has the potential to cause erosion and failure of the embankment must be removed.
M16, M17	Undercut of Levee toe (Landward side)	Re-establish 2:1 toe of levee embankment. Additional engineering analyses are recommended.	**C5** - Griffin Homes issue	E1	Landward repair not regulated	X	Can the dirt level be raised to the toe and regraded?	This repair will likely require design and engineering to cut, bench compact and possibly a retaining wall based on outcome of developer negotiations. Certified As-builts drawings need to be prepared.
M18-M27	Broken stone revetment throughout levee embankment (Riverward side)	Additional engineering analyses are recommended.	**C2**	E2	In kind repair, exc. & place new rock	X	Are the broken rocks still an issue?	Determination of the revetment protection will require hydraulic and rock sizing analyses. These analyses will be performed during the next phase of work.
M28	Sinkhole at edge of bike path exposing buried groin	Repair sinkholes and fill voids with impervious material and firmly compact.	**C5** - Planning, City of Filmore	E2	Exc. & recomp. In existing footprint	X		

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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.

Draft Evaluation Report
January 2009
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 1st. Street to Erringer Road. In actuality this reach is a combination of a series of levees, including a floodwall located immediately upstream of 1st 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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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 1st 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.

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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.

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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.

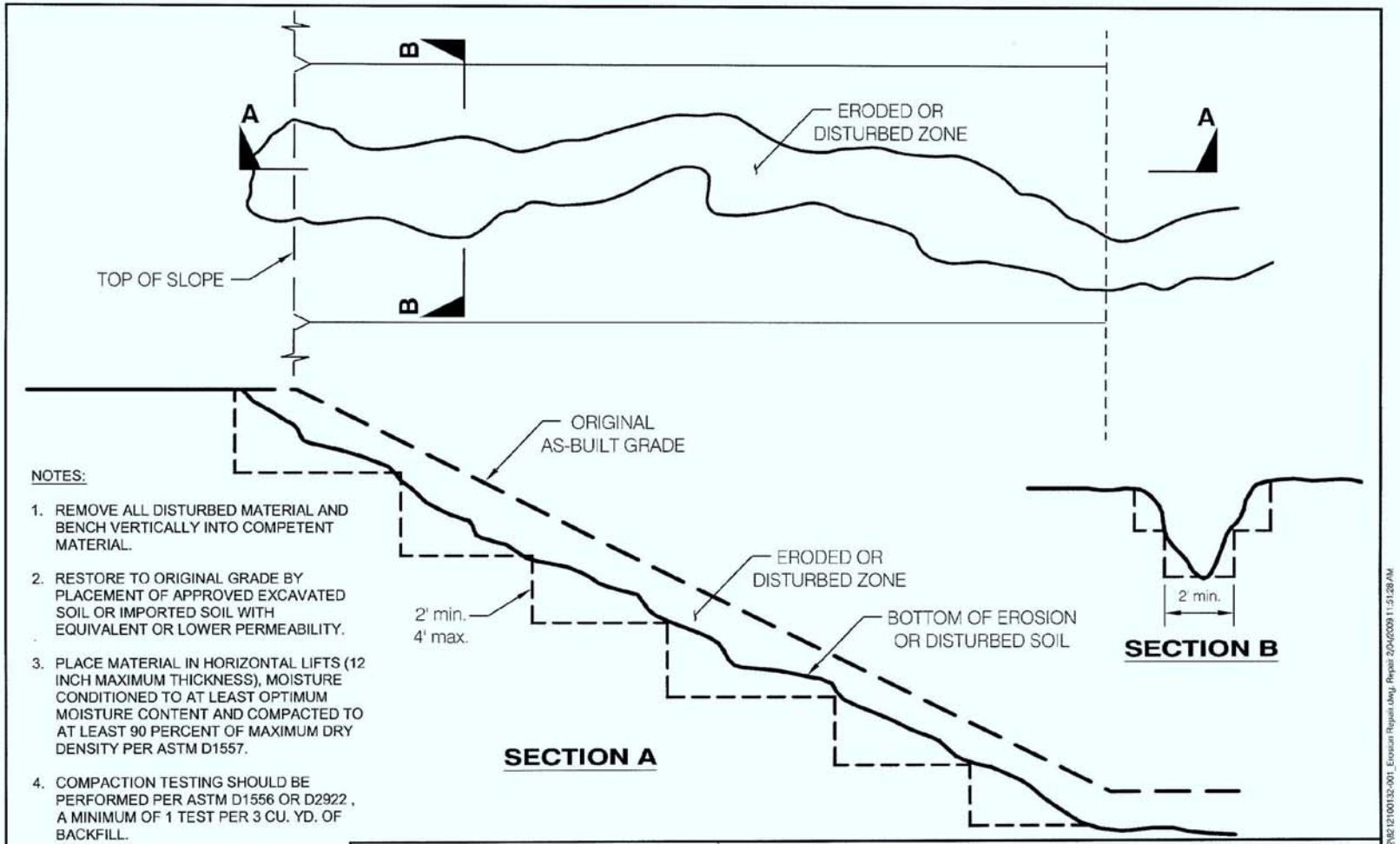
VCWPD OPERATION & MAINTENANCE DIVISION RFI

VCWPD O&M QUESTION	TETRA TECH/AMEC RESPONSE
1. Animal burrow/hole repair procedures. Please confirm acceptable methods. Also confirm acceptable documentation method.	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. 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. 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.
2. Please describe methods for vegetation and rootball removal.	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. 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.

VCWPD O&M QUESTION	TETRA TECH/AMEC RESPONSE
	2" DIAMETER TRUNK OR LESS: Cut the woody vegetation to twelve (12) inches of height above the ground level. 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.
3. Where is 15’ buffer from toe measured from (buried portion or at ground level)?	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)
4. Can Tetra Tech provide specs for compaction and grading requirements? Discuss major and minor repair examples.	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.
5. Can in-kind materials be used for backfill?	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.
6. Discuss documentation/inspection requirements for verification of grading.	The requirements for verification of grading are discussed above.

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.	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. 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. 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.
9. Is a headwall needed for flap gate attachment?	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. 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.
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.



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 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:
JBD	February 2009	8212100132
CHK'D BY:	SCALE:	FIGURE No.
DRB	Not To Scale	FIGURE 1

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

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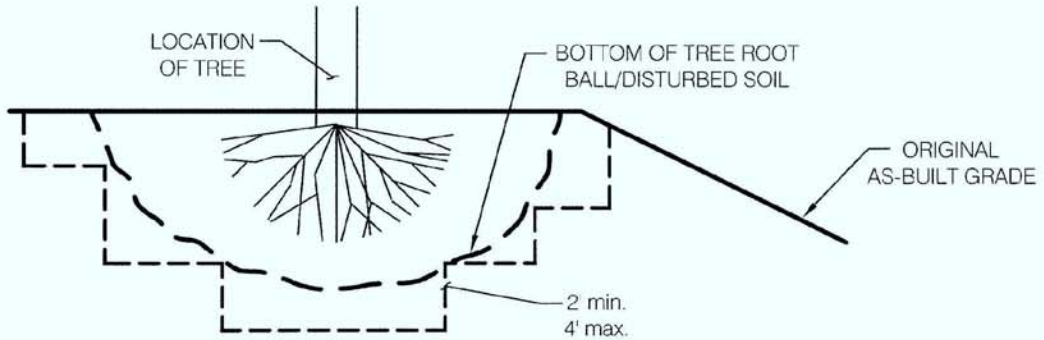
FILE: 8212100132-001_EROSION REPAIR PLOT DATE: 2/4/2009



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/earthandenvironmental

DWN BY:	DATE:	PROJECT NO:
JBD	February 2009	8212100132
CHK'D BY:	SCALE:	FIGURE No.
DRB	Not To Scale	FIGURE 2

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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.

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.

. 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

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.

Exhibit 5

Corps of Engineers Inspection of Stone Protection on Sespe Creek Levee

CESPL-ED-GG (1110) 15 January 2009

MEMORANDUM FOR RECORD

SUBJECT: Inspection of Stone Protection on Sespe Creek levee, Fillmore, CA.

1. Objective. To examine the condition and gradation of slope protection stone on the Sespe Creek levee, Fillmore, CA. This inspection was carried out on Tuesday morning, 6 January 2009, by:

a. David Lukesh (E.G., U.S. Army Corps of Engineers Geotechnical Branch, Los Angeles District Office, CESPL-ED-GG);

b. Mark Chatman (P.G., U.S. Army Corps of Engineers Geotechnical Branch, Los Angeles District Office, CESPL-ED-GG).

c. The purpose of this inspection was to follow up on a Tetra Tech report from the field that yellow sandstone slope protection stone on the levee upstream of Old Telegraph Rd. was breaking down (cracking, crumbling, disintegrating to soil-like material in extreme instances) and that the overall ungrouted slope protection stone mix was undersized, relative to project specifications. Tetra Tech has been retained by Ventura County to obtain certification for the Sespe Creek levee segment that is upstream of the Old Telegraph Rd. crossing of the levee, and, in the future, will be tasked with the same objective for the levee segment downstream of Old Telegraph Rd. Mr. Robert Koplin, Chief, Engineering Division, was notified on or about 10 December 2008 by Tetra Tech of this perceived stone problem and the field assignment fell to Chatman and Lukesh, who in turn examined ungrouted slope protection stone both upstream and downstream of Old Telegraph Rd. to determine and document any problems that may exist with stone protection. See **fig. 1** for the plan and typical levee section, and **fig. 2** for a view of the typical stone revetment used on the levee.

d. To carry out the inspection, the geologists walked along the downstream toe of the levee, observing the protection stone, from sta. 112+75, downstream to the Old Telegraph Rd. abutments, and then downstream of Old Telegraph Rd. for the first 500 ft of ungrouted stone. The stone quality is so good in that area downstream of Old Telegraph Rd. that it was determined to be non-productive to continue the inspection process farther downstream. Photographic documentation of the condition and general gradation of the ungrouted slope protection stone was collected every 250 ft for the area upstream of Old Telegraph Rd., beginning at sta. 112+75. In all, 4,500 ft of the overall 5,300 ft of levee upstream of Old Telegraph Rd. was inspected and photo-documented in this manner (see **figs. 3-22**). The photographic documentation was started at the upstream end of the ungrouted slope protection stone blanket that is downstream of Old Telegraph Rd. and continued for 500 ft only (see **figs. 23-25**), for reasons discussed above.

2. Background.

a. The Corps built the levee structure in 1982-1983 and this slope protection stone layer was an original feature of the levee. Slope protection stone is ungrouted from sta. 25+00 upstream to the Old Telegraph Rd. crossing (except around ramps down the creek-side levee face and at

bridge abutments on the levee), and is ungrouted upstream of the Old Telegraph Rd. crossing (except around ramps down the creek-side levee face).

b. Prior to this Corps field examination, an extensive review was made of Corps documents prepared during construction that indicate the nature and source of stone protection used.

c. In the field, the stone was observed with regard to size, gradation, presence of any cracks and crumbling, appearance of potentially incipient or expanding cracks. The concern was that broken slope protection stone might be smaller, after breaking, than the specified gradation, and thus might be unable to resist flow to the degree intended by the design. Similar insufficient resistance to flow could exist if undersized stone had been used originally in construction (i.e., stone that had not deteriorated since construction). Potential for future deterioration also was an issue.

3. Observations with regard to stone quality.

a. The overall ungrouted stone protection blanket is well interlocked and is a good mix of larger and smaller stones, as was intended by the design. This is both upstream and downstream of Old Telegraph Rd.

b. The vast majority of the ungrouted slope protection stone is a drab, dark, medium- to fine-grained yellow / slightly greenish sandstone (**fig. 2**). This matches with the documented description of the construction-era accepted stone source. Intermixed is some harder, grey-white-buff sandstone that is more rounded and may be some of the sub-angular river-run stone that was used on the levee. Also present is an insignificantly small volume of hard, well-rounded, reddish brown sandstone, at times conglomeratic, which is found at the creek-side slope toe only, and likely was a pre-paved-bike-path aesthetic enhancement placed after the structure was completed. Downstream of Old Telegraph Rd., the yellow sandstone still is a very common component of this protection stone layer, but somewhat less pervasive than it is upstream of Old Telegraph Rd.; it has been supplanted in the mix by a larger proportion of the harder, grey-white-buff, semi-rounded sandstone.

c. Upstream of Old Telegraph Rd., by visual estimation, no more than 5% of the total mass of slope protection stone has cracked or deteriorated (see **fig. 26**). Stone that has not broken down to date does not appear to be imminently ready to do so in the future. The stone protection blanket still is expected to function, with this level of stone deterioration, because the level of deterioration has not significantly altered the gradation of the stone from that which was originally placed and accepted. Only three (3) individual slope protection stones were observed that had deteriorated so badly that they had crumbled to a gravel-like mass; most individual stones with “deterioration” were no more than halved or quartered by large, through-going cracks, most with wide separation along the cracks. Downstream of Old Telegraph Rd., by visual estimation, no more than 1% of the total mass of that slope protection stone has cracked or deteriorated in the manner described above.

d. All deterioration is within the yellow sandstone. In general, it is the coarser-grained sandstone that appears more inclined to crack.

e. There is no nesting of deteriorated stones anywhere on the levee and no concentration of deteriorated stones that exceeds a few square yards in maximum extent.

f. No stones have deteriorated into a soil-like mass. Post-construction recreational and functional enhancements (a paved, hiking/biking trail along the creek-side toe and a resurfaced, paved, levee crest access/maintenance road) are responsible for the "soil-like" material seen scattered into the slope protection blanket at the levee crest and along the creek-side toe. Some road base material from those construction activities was pushed too far from the "road" edges during construction of these post-levee features and became intermixed with the levee's slope protection stone. The material is not the same as the slope protection stone and could not have been formed by protection stone break down.

g. Grouted stone was observed around access road ramps down to the creek-side levee toe in two places upstream of Old Telegraph Rd., and at the Old Telegraph Rd. abutments at the levee. No deterioration of the grouted slope protection stone was observed in those places. The stone used there appears to be the same as the ungrouted stone: dominantly the yellow sandstone.

4. Observations with regard to gradation. The design gradations for stone protection are as follows.

a. "Type I stone". Ungrouted slope protection stone, upstream of Old Telegraph Rd. is to be a 36-inch-thick layer of this gradation:

% lighter by weight	limits of stone weight in pounds
100	2363 - 933
50	691 - 467
15	346 - 146
(ref. (*1*), table. D-1).	

b. "Type II stone". Ungrouted slope protection stone, upstream of sta. 25+00 to the downstream side of Old Telegraph Rd. (excepting access ramps) is to be a 21-inch-thick layer of this gradation:

% lighter by weight	limits of stone weight in pounds
100	643 - 185
50	137 - 93
15	69 - 29
(ref. (*1*), table. D-1).	

c. "Type III stone". Grouted slope protection stone (downstream of sta. 25+00) is to be 4 to 12 in. diameter stone, in an 18-inch-thick layer. This choice was made because of the proximity of the creek to the levee; if ungrouted, this section would have needed a 5-ft thick layer of slope protection stone (ref. (*1*), pg. D-4). By grouting, a considerably less-thick layer could be used.

d. Converting stone weights listed above to diameter, in inches, using a specific gravity value of 2.45, minimum ("bulk s.s.d." specific gravity), the weight limits for Type I and Type II stone listed in the two charts above are converted below to inches:

"Type I stone":

% smaller in diameter	limits of stone diameter approximated in inches
100	33 - 24
50	22 - 19
15	17 - 13.

"Type II stone":

% smaller in diameter	limits of stone diameter, approximated in inches
100	21 - 14
50	12.7 - 11.1
15	10.1 - 7.5.

e. From this perspective, very few, if any, reaches of ungrouted stone on the Sespe Creek levee upstream from Old Telegraph Rd. would fail a gradation test, based on visual assessments made in the field on 6 January 2009.

f. The specified and the actual gradation of the slope protection stone layer downstream of Old Telegraph Rd. is smaller than the stone protection blanket upstream of Old Telegraph Rd. By visual assessment, the stone layer downstream of Old Telegraph Rd. appears to be within gradation.

g. Verification testing of protection stone gradation in certain areas upstream of Old Telegraph Rd. possibly could demonstrate that there are segments with smaller than the specified gradation, but this is not due to stone breakdown. The project record documents that during construction, under-gradation-sized slope protection stone was encountered during inspections at sta. 94+00 (see **figs. 10, 11**). No fix was prescribed and the material was left in place on the grounds that the stone

was about 10% undersized and that suitably large and angular protection had been placed on all other segments of the levee that had been protected by stone at that point in time in the construction process. But the Contractor was instructed to increase the size of the slope protection stone on all future stone placement (ref. (*2*)). Levee sections adjoining the general sta. 94+00 area have larger stone, which is evidence that the problem of undersized stone placement was not allowed to continue. The segment with this "small" gradation was observed in the current inspection to be about 200 ft long (a short levee length overall) and the levee here was observed to be very short in height here (less than 6 ft tall). Much of that zone, therefore, is protecting levee freeboard so it would be less likely that this area would experience flows. With all these facts considered, the Geology and Investigations Section does not see a need to replace this area with larger stone.

5. Recommendations. If stakeholders determine that verification testing of gradation of slope protection stone should be done, the Geology & Investigations Section recommends ***against*** removing any of the slope protection stone layer. The layer is well interlocked. Such an invasive examination would needlessly weaken a part of the protection stone blanket and probably would break stone that could not be broken by creek-flow forces, Therefore, the gradation measured would not be representative of in-situ conditions, because of the extra stone breakage anticipated to be imparted onto the sample. Recommended instead of excavation is laying out a grid on the slope protection surface at some mutually agreed upon areas, perhaps three or four in number, and perhaps 20- to 50-ft wide and running toe to crest, and measuring the stone widths, in place, that fall beneath the grid.

6. Conclusions. The quality of slope protection stone on the Sespe Creek levee is suitable. The amount of breakdown of the stone estimated from visual observation (5% of the stone pieces, or less) is not sufficiently pervasive to represent a problem or require a fix. Based on visual observations at the time of this inspection, in some areas upstream of Old Telegraph Rd. verification testing of gradation may show some undersized sections; at the largest, they would be no more than about 200 ft long. This condition has existed since the levee was constructed and is not caused by stone breakdown. Some undersized stone was placed during construction and a decision was made to leave it in place without a fix, as documented above. This stone size is not anticipated to detract from the functioning of the stone protection layer.

7. References cited.

(*1*) US Army Engineer District, Los Angeles, 1980, Appendix D, engineering design and cost estimates, in: Detailed project report for flood control and environmental assessment, Sespe Creek at Fillmore, Ventura County, California, main report and appendices: US Army Corps of Engineers, Los Angeles District.

(2) Ferguson, J. S., Jr., 1982, Sespe Creek levee at Fillmore: US Army Engineer District, Los Angeles, CESPL-ED-GG, Memorandum for Record, 15 Sept. 1982, unpubl., 1 pg.

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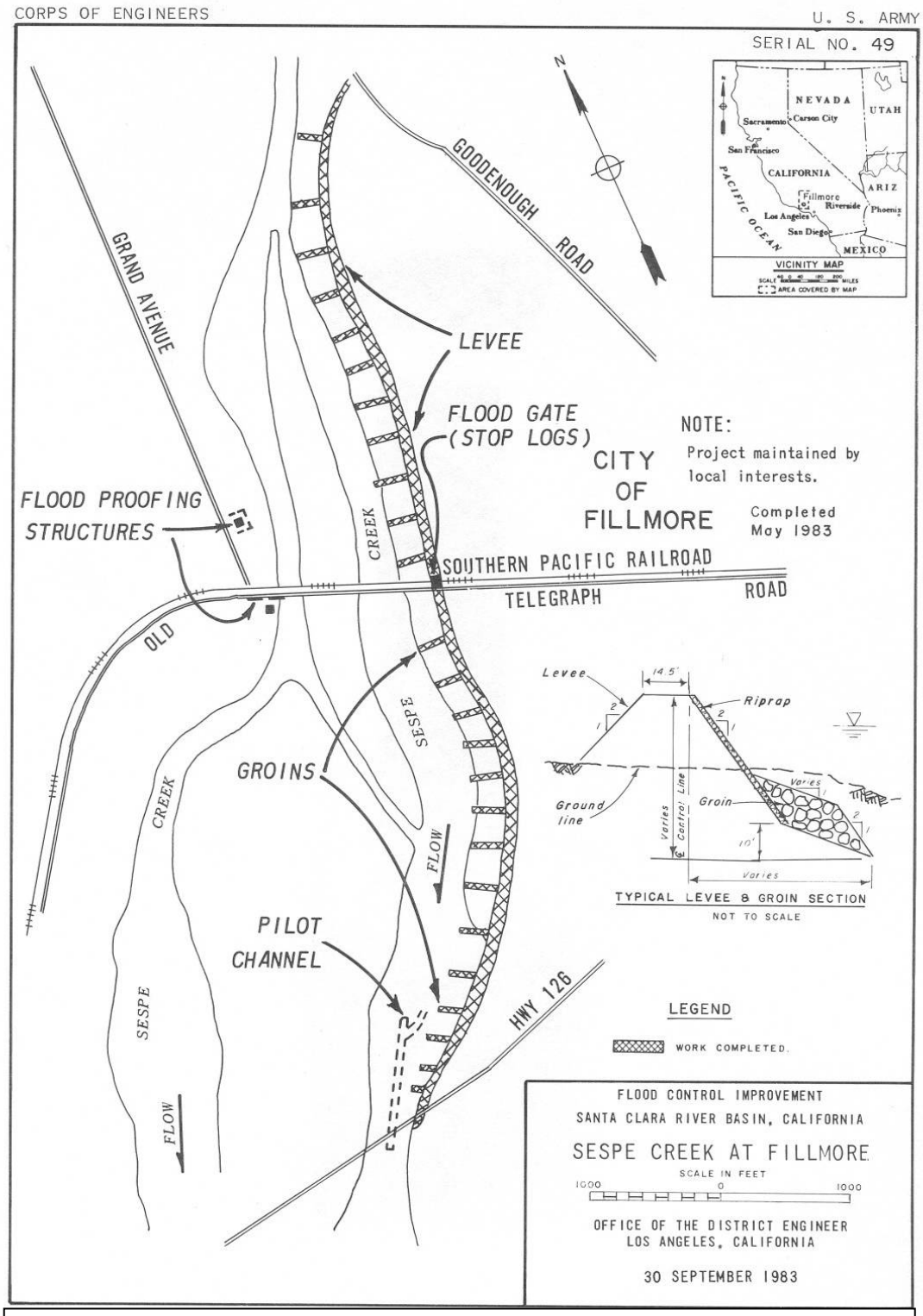

Fig. 1.—Plan and typical section, Sespe Creek levee.

Fig. 2.—Typical slope protection stone mix, upstream of Old Telegraph Rd. View is upstream. Photograph by US Army Corps of Engineers, 6 Jan. 2009.

Fig. 3.—Slope protection stone, showing gradation and stone quality, levee sta. 112+75; this is upstream of Old Telegraph Rd. View is to the east. This is the upstreammost photograph taken. Photograph by US Army Corps of Engineers, 6 Jan. 2009.

Fig. 4.—Slope protection stone, showing gradation and stone quality, levee sta. 110+30; this is upstream of Old Telegraph Rd. View is to the east. Photograph by US Army Corps of Engineers, 6 Jan. 2009.

Fig. 5.—Slope protection stone, showing gradation and stone quality, levee sta. 107+30; this is upstream of Old Telegraph Rd. View is to the east. Photograph by US Army Corps of Engineers, 6 Jan. 2009.

Fig. 6.—Slope protection stone, showing gradation and stone quality, levee sta. 105+40; this is upstream of Old Telegraph Rd. View is to the east. Photograph by US Army Corps of Engineers, 6 Jan. 2009.

Fig. 7.—Slope protection stone, showing gradation and stone quality, levee sta. 102+90; this is upstream of Old Telegraph Rd. View is to the east. Photograph by US Army Corps of Engineers, 6 Jan. 2009.

Fig. 8.—Slope protection stone, showing gradation and stone quality, levee sta. 100+40; this is upstream of Old Telegraph Rd. View is to the east. Photograph by US Army Corps of Engineers, 6 Jan. 2009.

Fig. 9.—Slope protection stone, showing gradation and stone quality, levee sta. 98+00; this is upstream of Old Telegraph Rd. View is to the east. Photograph by US Army Corps of Engineers, 6 Jan. 2009.

Fig. 10.—Slope protection stone, showing gradation and stone quality, levee sta. 95+50; this is upstream of Old Telegraph Rd. View is to the east. Photograph by US Army Corps of Engineers, 6 Jan. 2009.

Fig. 11.—Slope protection stone, showing gradation and stone quality, levee sta. 93+10; this is upstream of Old Telegraph Rd. View is to the east. Photograph by US Army Corps of Engineers, 6 Jan. 2009.

Fig. 12.—Slope protection stone, showing gradation and stone quality, levee sta. 90+60; this is upstream of Old Telegraph Rd. View is to the east. Photograph by US Army Corps of Engineers, 6 Jan. 2009.

Fig. 13.—Slope protection stone, showing gradation and stone quality, levee sta. 88+10; this is upstream of Old Telegraph Rd. View is to the east. Photograph by US Army Corps of Engineers, 6 Jan. 2009.

Fig. 14.—Slope protection stone, showing gradation and stone quality, levee sta. 85+70; this is upstream of Old Telegraph Rd. View is to the east. Photograph by US Army Corps of Engineers, 6 Jan. 2009.

Fig. 15.—Slope protection stone, showing gradation and stone quality, levee sta. 84+35; this is upstream of Old Telegraph Rd. It also shows the upstream end of a grouted stone segment, which is grouted because an access ramp has been built near here down to the creek-side levee toe, from the levee crest. View is to the east. Photograph by US Army Corps of Engineers, 6 Jan. 2009.

Fig. 16.—Slope protection stone, showing gradation and stone quality, levee sta. 80+80; this is upstream of Old Telegraph Rd. It also shows the downstream end of a grouted stone segment, which is grouted because an access ramp has been built near here down to the creek-side levee toe, from the levee crest. View is to the east. Photograph by US Army Corps of Engineers, 6 Jan. 2009.

Fig. 17.—Slope protection stone, showing gradation and stone quality, levee sta. 78+30; this is upstream of Old Telegraph Rd. View is to the east. Photograph by US Army Corps of Engineers, 6 Jan. 2009.

Fig. 18.—Slope protection stone, showing gradation, levee sta. 75+80; this is upstream of Old Telegraph Rd. View is to the east. Photograph by US Army Corps of Engineers, 6 Jan. 2009. No in-focus pictures are available for this location. Nevertheless, a general idea of the gradation can be had from viewing this, after comparing it to adjoining photographs (figs. 17 and 19).

Fig. 19.—Slope protection stone, showing gradation and stone quality, levee sta. 73+40; this is upstream of Old Telegraph Rd. View is to the east. Photograph by US Army Corps of Engineers, 6 Jan. 2009.

Fig. 20.—Slope protection stone, showing gradation and stone quality, levee sta. 70+90; this is upstream of Old Telegraph Rd. View is to the east. Photograph by US Army Corps of Engineers, 6 Jan. 2009.

Fig. 21.—Slope protection stone, showing gradation and stone quality, levee sta. 68+50; this is upstream of Old Telegraph Rd. View is to the east. Photograph by US Army Corps of Engineers, 6 Jan. 2009.

Fig. 22.—Slope protection stone, showing gradation and stone quality, levee sta. 66+00; this is upstream of Old Telegraph Rd. This is the downstreammost point photographed that is still UPSTREAM of Old Telegraph Rd. View is to the east. Photograph by US Army Corps of Engineers, 6 Jan. 2009.

Fig. 23.—Slope protection stone, showing gradation and stone quality, levee sta. 56+33; this is downstream of Old Telegraph Rd. The area immediately adjacent the Old Telegraph Rd. abutment has been grouted. This is the upstream end of the ungrouted stone that also is downstream of Old Telegraph Rd. View is to the east. Photograph by US Army Corps of Engineers, 6 Jan. 2009.

Fig. 24.—Slope protection stone, showing gradation and stone quality, levee sta. 53+90; this is downstream of Old Telegraph Rd. View is to the east. Photograph by US Army Corps of Engineers, 6 Jan. 2009.

Fig. 25.—Slope protection stone, showing gradation and stone quality, levee sta. 51+40; this is downstream of Old Telegraph Rd. View is to the east. This is the downstreammost point that was photographed. Ungrouted slope protection stone continues downstream to sta. 25+00. Photograph by US Army Corps of Engineers, 6 Jan. 2009.

Fig. 26.—Typical deterioration (cracking) of yellow sandstone (inside red oval), upstream of Old Telegraph Rd. View is downstream. Photograph by US Army Corps of Engineers, 6 Jan. 2009.

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