



**Ventura County
Watershed Protection District**

**FEMA Levee Certification
Ventura County, California**

**Arroyo Simi Levee (AS-6)
First Street to Erringer Road**

**Evaluation Report
February 13, 2009**



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

FEMA Levee Certification

Ventura County, California

Arroyo Simi Levee (AS-6)

First Street to Erringer Road

Evaluation Report

February 2009

Prepared for:

Ventura County
Watershed Protection District

Prepared by:

Tetra Tech, Inc.
17770 Cartwright Road, Suite 500
Irvine, California 92614
(949) 250-6788

and

AMEC
1290 North Hancock Street, Suite 102
Anaheim, California 92807
(714) 779-2591



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 Arroyo Simi Levee (AS-6) 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 AS-6 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:

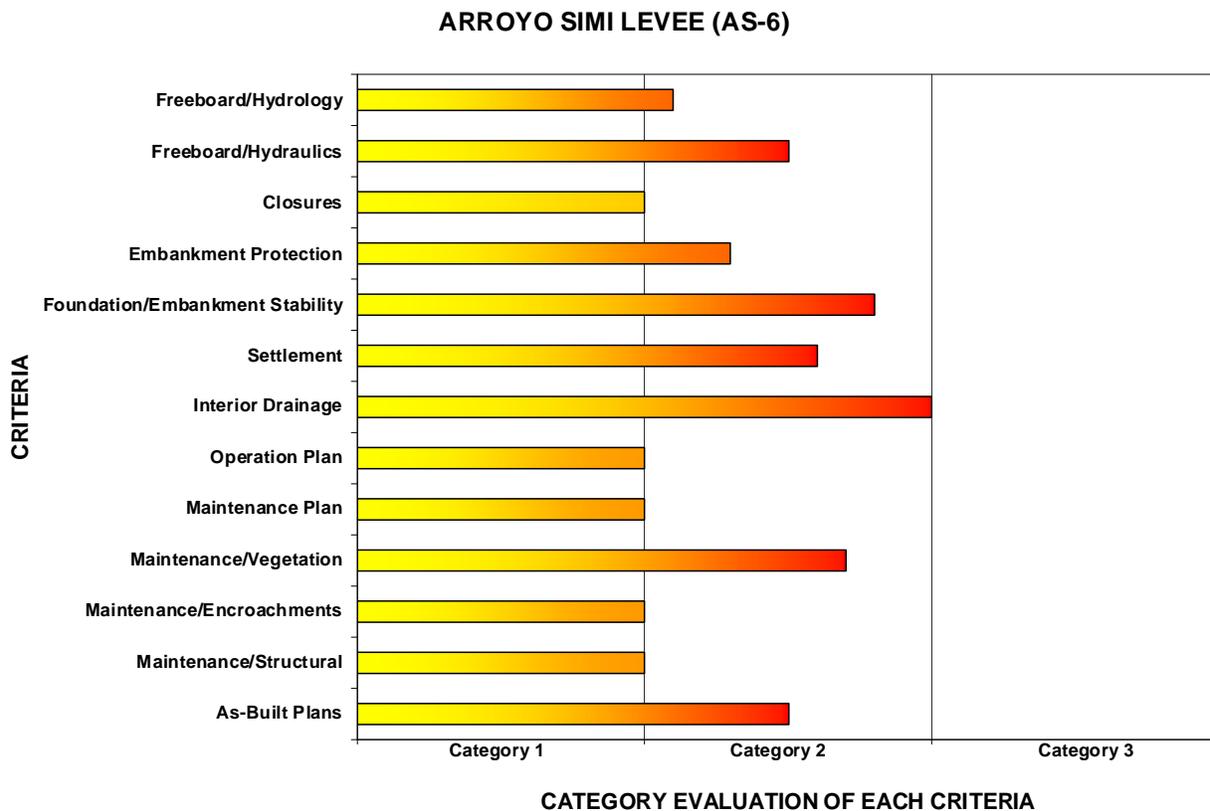
- Hydrologic Analysis
- LiDAR Topographic data
- As-built Plans
- Operation and Maintenance Manual
- Inspection/Maintenance Records

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 AS-6 levee system be classified as a Category 2 Levee. The suggested critical path to achieve levee certification for the AS-6 levee system is outlined in Section F Recommendation.



FEMA Levee Certification

Arroyo Simi Levee (AS-6) First Street to Erringer Road

Evaluation Report

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EXHIBITS

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



A) Introduction

The Arroyo Simi Levee (VCWPD ID No: AS-6) is located in the City of Simi Valley, Ventura County. The location of the levee system is from the First Street to Erringer Road and is shown on Figure 1. The AS-6 levee system is located along the left and right sides of Arroyo Simi. The levee system consists of embankment levees, side drainage penetrations, and a stop-log structure. The protective works of the Arroyo Simi Levee were designed to provide protection from the 1-percent-annual-chance discharge (base flood) in conformance with FEMA required freeboard and other regulations. The levee system is intended to protect existing residential, and recreational property in low lying areas within the base flood floodplain of the Arroyo Simi Watershed.

The levee system begins at the First Street and continues upstream to Erringer Road. The length of the levee system is approximately 1 mile, with an embankment height up to 5 feet above natural ground on the landward side. The levee's earthen berm is protected by loose and grouted riprap. A 10 feet and 15 feet wide access road runs along the top of the left and right banks, respectively.

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

B) Design Criteria

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

B.1) Freeboard

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

Review of prior hydrology studies for Calleguas Creek yielded discharge frequency information and methodology developed by the Corps of Engineers and Ventura County Watershed Protection District (VCWPD), which are suitable for levee certification purposes. The U.S. Army Corps of Engineers, Los Angeles District, Calleguas Creek Watershed Feasibility Study, Hydrology Appendix dated February 2003 provides discharge frequency



Figure 1 – Location Map



values appropriate for levee certification for the AS-6 levee system.

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

The current FEMA FIS hydraulic model for the Calleguas Creek Watershed is available. The current FEMA FIS 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.

The existing sediment study prepared by Howard H. Chang Consultants, Sediment Studies for Channel Improvements of Calleguas Creek, Conejo Creek and Revlon Slough, dated February 2004 will be useful as a reference, however, additional 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. It is located along the left bank just downstream of Erringer Road. It includes 6 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 creek thalweg has been prepared and is presented in Exhibit 2.

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

B.4) Embankment and Foundation Stability

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

As of January 22, 2009, no geotechnical design or construction information has been made available for review.



During field inspections, active seepage was observed in several locations along the river side slope. A retention pond and local irrigation may be the source of this seepage. This seepage may impact stability of the levee and should be evaluated. In addition, erosion in the form of a gully approximately 6 feet wide and up to approximately 4 feet deep was observed at one location along the landside slope on the right bank of the levee.

Further analysis and evaluations would include the following:

- Geotechnical borings for determining existing geologic conditions, obtaining geologic samples, and performing in-situ permeability testing.
- Laboratory analysis to determine soil properties and strength parameters.
- Seepage and stability analysis considering both the active seepage and flood conditions.
- Evaluation of erosion impacts.

B.5) Settlement

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

As of January 22, 2009, no geotechnical design or construction information has been made available for review.

During field inspections, a sinkhole was observed adjacent to a drop structure wall on the left bank. No additional evidence of settlement was observed.

Further analysis and evaluations would include the following:

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

B.6) Interior Drainage

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

Interior drainage analyses would be required at all storm drain penetrations. Based on the field investigation and review of the as-built plans, there are 11 storm drain penetrations through the left bank levee, and 18 storm drain penetrations through the right bank levee. Three of the left bank penetrations and three of the right bank penetrations have flap gates. GPS locations and descriptions for each are included in Table 1 of the field investigation report included as Exhibit 1. Photographs of the outlets are also included in the report. For storm drains that continue under ground into the City of Simi Valley, additional documents will be required including the master plan of drainage to develop the interior drainage analyses.



C) Operation Plans and Criteria

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

An operation plan exists that is in use for this levee. For certification this operation plan will need to be updated to meet the NFIP requirements including the attachment of the County's Flood Warning System and Emergency Response Plan. The operation plan will need to include the procedures for operating the entire system including the 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, seepage, and penetrations missing closure devices (flap gates).

E) Certification Requirements

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

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

A complete system and structural evaluation should be performed as part of the certification. This analysis will address some concerns identified in the field investigation including structural integrity of the grouted stone bank revetment in areas of seepage.

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 issue is the vegetation encroaching into the landward side embankments. Other issues that require attention are seepage through the left bank revetment immediately downstream of the drop structures and restoration of the levee embankment at the sinkhole and gully. The



evaluation of the seepage issue may determine a complex solution is necessary which could delay certification. 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 AS-6 levee system be classified as a Category 2 Levee.

The suggested critical path to achieve levee certification for the AS-6 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



G) References

- FEMA. 2005a. *Title 44 of the Code of Federal Regulations (CFR), Section 65.10 (44 CFR 65.10)*, Federal Emergency Management Agency.
- FEMA. 2005b. *Procedural Memorandum 34 – Interim Guidance for Studies Including Levees*, Federal Emergency Management Agency.
- FEMA. 2007a. *Fact Sheet Requirements of 44 CFR, Section 65.10 Mapping of Areas Protected by Levee Systems*, Federal Emergency Management Agency.
- FEMA. 2007b. *Revised Procedural Memorandum 43 – Guidelines for Identifying Provisionally Accredited Levees*, Federal Emergency Management Agency.
- Howard H. Chang Consultants. 2004. *Sediment Studies for Channel Improvements of Calleguas Creek, Conejo Creek and Revlon Slough*. Prepared for the Ventura County Watershed Protection District, Ventura, California.
- Tetra Tech. 2008. *Arroyo Simi Levee (AS-6) 1st Street to Erringer Road, Field Investigation Report*. Prepared for the Ventura County Watershed Protection District, Ventura, California.
- U.S. Army Corps of Engineers, Los Angeles District. 2003. *Calleguas Creek Watershed Feasibility Study, Hydrology Appendix*.
- U.S. Army Corps of Engineers. 2006. *Levee Owner's Manual for Non-Federal Flood Control Works*. Prepared for the Rehabilitation and Inspection Program, Public Law 84-99.
- U.S. Army Corps of Engineers. 2008. *EC 1110-2-6067 - Certification of Levee Systems for the National Flood Insurance Program (NFIP)*.
- Ventura County Watershed Protection District. 2007. *Arroyo Simi Levee, First Street to Erringer Road, Operation and Maintenance Manual*.



Exhibit 1

Field Investigation Report



**Ventura County
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APPENDIX

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



FEMA Levee Certification

Arroyo Simi Levee (AS-6) 1st Street to Erringer Road

Field Investigation Report

Introduction

Arroyo Simi Levee (VCWPD ID No: AS-6) is located between 1st Street and Erringer Road in the City of Simi Valley in Ventura County. The location of the levee system is shown on Figure 1.

As part of the FEMA levee certification process, field investigations of the Arroyo Simi Levee (AS-6) were conducted on December 9 through 10, 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 and right banks of Arroyo Simi between the Erringer Road and First Street Bridges. The levee system consists of left and right bank rock faced trapezoidal levees. Small portions of the rock facing are grouted, but the majority is un-grouted. An access road that runs along the top is approximately 17-feet wide. A floodwall, completed in 2001, protects an area along the left bank of the Arroyo Simi upstream of 1st Street.
- The protective works of the Arroyo Simi 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 length of the levee along Arroyo Simi is approximately 1-mile.
- The FIRM dated September 3, 1997 shows intermittent non-containment of Zones AE and AO.
- The levee system is intended to protect existing residential, and recreational properties in low lying areas within the base flood floodplain of the Arroyo Simi Watershed.

General Field Observations

a) Riverward side of Levee:

1. Many storm drain outlets located on the levee side slopes do not have any closure devices in place (flap gates). Closure devices are necessary to avoid flooding behind the levee caused by the backup of the channel flow.
2. Multiple animal burrows were observed in the field. They are located near the top of the slope and along the interface between the revetment and dirt embankment. A few burrow holes were located on the asphalt-paved top of the levee. They do not affect the structural integrity of the levee, however, they need to be repaired during maintenance.
3. Seepage through the transitional grouted riprap revetment near the vertical walls of the drop structure was observed. At the time of the field investigation, an active trickle of water through slurry and subsequent growth of vegetation were observed. A source of the seepage is a recreational lake behind the levee. Impact to the integrity of the levee needs to be evaluated.
4. A sink hole was observed at the top of the levee. The hole may be created by the breakage of PVC pipe underneath with piping of material into the broken pipe and removed during periods of flow. County personnel stated that the hole is filled every year, however, a permanent repair needs to be applied.
5. A concrete outlet structure for a 10-inch PVC pipe on the right side levee has a 12-inch diameter hole at the invert of the structure and needs to be repaired.
6. Two concrete outlet structures which were located near the upper half of the levee height do not have concrete aprons downstream of the structures.



Currently, active streams of outflow are allowed to flow through un-grouted riprap and into the channel bottom. Although it could not be verified on the field visit due to large rocks, erosion of dirt underneath the revetment may be taking place.

b) Landward side of Levee:

1. Many large diameter trees have been planted by the City or private property owners along the landward side of the levees within 15 feet of the top of the slopes. These trees need to be removed.

Levee Penetrations

Levee closure of the Arroyo Simi Levee (AS-6) system during storm events shall consider the existing storm drain outlets. The storm drain outlets shall include closure devices at the end of each storm drain penetration. The need for closure devices for each penetration should be verified with additional engineering analysis. A summary of levee system penetrations is presented in Table 1.



Table 1 – Summary of Levee Penetration

River Station	GPS		*Photo No.	Description
	Lat	Long		
<i>Arroyo Simi Levee (AS-6) – Left Levee</i>				
63+35	N34.27018	W118.77863	P1L	18" RCP w/o a closure device
64+42	N34.27000	W118.77844	P2L	18" RCP with a Flap Gate and concrete outlet structure
70+70	N34.26948	W118.77635	P3L	18" CMP w/o a closure device. (not shown on the as-built plan)
71+90	N34.26938	W118.77596	P4L	6" PVC subdrain on the side wall of a drop structure with an active stream of flow
74+94	N34.26918	W118.77500	P5L	24" CMP with a Flap Gate. A catch basin is located on the cul-de-sac on the landward side of the levee.
76+53	N34.26905	W118.77448	P6L	24" RCP with a Flap Gate and concrete outlet structure
80+42	N34.26883	W118.77345	P7L	27" CMP with a concrete outlet structure but w/o a closure device (not shown on the as-built plan)
80+50	N34.26883	W118.77345	P7L	18" CMP with a concrete outlet structure but w/o a closure device
84+50	N34.26843	W118.77192	P8L	24" RCP w/o a closure device. Angled towards downstream
90+58	N34.26770	W118.77024	P9L	2-36" CMP w/o a closure device on the side wall of a drop structure
90+75	N34.26770	W118.77024	P9L	36" RCP w/o a closure device on the side wall of a drop structure. An active stream was observed.
90+95	N34.26770	W118.77024	P9L	42" RCP w/o a closure device on the side wall of a drop structure. An active stream was observed.
97+10	N34.26732	W118.76803	P10L	16" CMP w/o a closure device, draining areas behind the levee
105+90	N34.26735	W118.76524	P11L	36" CMP w/o a closure device, draining areas behind the levee
117+00	N34.26657	W118.76170	P12L, P13L	Opening for 6-beam stop log system near at the top of channel access ramp near Erringer Road bridge (Not shown on as-built plan)

* Photos can be found in Appendix B.



**ARROYO SIMI LEVEE (AS-6)
FIELD INVESTIGATION REPORT**

River Station	GPS		*Photo No.	Description
	Lat	Long		
<i>Arroyo Simi Levee (AS-6) – Right Levee</i>				
62+95	N34.27037	W118.77862	P1R	12" CMP w/o a closure device
66+50	N34.27003	W118.77754	P2R	18" CMP w/o a closure device. A drop inlet is located on the landward side of levee.
69+38	N34.26981	W118.77668	P3R	24" RCP with a concrete outlet structure but w/o a closure device. A drop inlet is located inside a housing complex behind the levee.
70+90	N34.26969	W118.77613	P4R	18" CMP w/o a closure device. A drop inlet is located inside a property parking lot behind the levee.
74+80	N34.26939	W118.77494	P5R	18" CMP w/o a closure device. Currently, one third of opening is blocked by debris and rusted.
77+90	N34.26920	W118.77402	P6R	36" CMP w/o a closure device. An active stream was observed.
86+34	N34.26855	W118.77132	P7R	10" PVC with a concrete outlet structure but w/o a closure device. An active stream was observed.
87+92	N34.26834	W118.77088	P8R	18" RCP with a concrete outlet structure but w/o a closure device.
89+91	N34.26804	W118.77035	P9R	18" RCP with a concrete outlet structure but w/o a closure device.
90+09	N34.26793	W118.77018	P10R	24" CMP w/o a closure device
101+93	N34.26784	W118.76654	P11R	60" RCP with a concrete outlet structure but w/o a closure device. An active stream was observed.
104+14	N34.26780	W118.76581	P12R	18" RCP with a Flap Gate and concrete outlet structure
106+06	N34.26771	W118.76518	P13R	24" RCP with a Flap Gate and concrete outlet structure
108+00	N34.26754	W118.76457	P14R	12" RCP with a Flap Gate and concrete outlet structure
110+80	N34.26740	W118.76355	P15R	16" CMP w/o a closure device
113+85	N34.26715	W118.76264	P16R	24" CMP w/o a closure device
115+40	N34.26701	W118.76209	P17R	12" CMP w/o a closure device
117+15	N34.26683	W118.76159	P18R	24" CMP w/o a closure device through a concrete abutment just downstream of Erringer Road bridge

* Photos can be found in Appendix B.



Maintenance Required Locations

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

Inspection Conclusion

Once maintenance at the locations identified in Table 2 are complete, the field inspection of the levee system indicates that the Arroyo Simi Levee (AS-6) system may be certified as providing base flood protection if all other criteria are satisfied. Some maintenance improvements may require additional engineering analyses, design, construction and preparation of as-constructed documents.



Table 2 – Summary of Maintenance Required Locations

GPS		*Photo No.	Description	Action Required
Lat	Long			
<i>Arroyo Simi Levee (AS-6) – Left Levee</i>				
N34.27018	W118.77863	M1L	18" RCP w/o a closure device (Sta.63+35)	Install a closure device, if appropriate.
N34.26948	W118.77635	M2L	18" CMP w/o a closure device (Sta.70+70)	Install a closure device, if appropriate.
N34.26943	W118.77617	M3L	Seepage through revetment (Riverward side)	Additional engineering analysis recommended
N34.26938	W118.77596	M4L	6" PVC w/o a closure device (Sta.73+90)	Install a closure device, if appropriate
N34.26938	W118.77596	M5L	Sink hole on top levee directly over 6" PVC	Repair a possibly broken 6" PVC line and fill the void with impervious material and firmly compact.
N34.26883	W118.77345	M6L	27" CMP w/o a closure device (Sta.80+42)	Install a closure device, if appropriate
N34.26883	W118.77345	M6L	18" CMP w/o a closure device (Sta.80+50)	Install a closure device, if appropriate
N34.26843	W118.77192	M7L	24" RCP w/o a closure device (Sta.84+50)	Install a closure device, if appropriate
N34.26770	W118.77024	M8L	36" CMP w/o a closure device (Sta.90+58)	Install a closure device, if appropriate
N34.26770	W118.77024	M8L	36" RCP w/o a closure device (Sta.90+75)	Install a closure device, if appropriate
N34.26770	W118.77024	M8L	42" RCP w/o a closure device (Sta.90+95)	Install a closure device, if appropriate
N34.26770	W118.77030	M9L	Animal burrow on top of levee (Riverward side)	Fill voids with impervious material and firmly compact.
N34.26732	W118.76803	M10L	16" CMP w/o a closure device (Sta.97+10)	Install a closure device, if appropriate
N34.26735	W118.76524	M11L	36" CMP w/o a closure device (Sta.105+90)	Install a closure device, if appropriate



**ARROYO SIMI LEVEE (AS-6)
FIELD INVESTIGATION REPORT**

GPS		*Photo No.	Description	Action Required
Lat	Long			
N34.26742	W118.76515	M12L	Seepage through revetment (Riverward side)	Additional engineering analysis recommended
N34.27018 to N34.26652	W118.77863 to W118.76153	M13L	Vegetation within 15' of Toe (Landward side)	Remove vegetation and root ball, fill voids with impervious material and firmly compact.
<i>Arroyo Simi Levee (AS-6) – Right Levee</i>				
N34.27037	W118.77862	M1R	12" CMP w/o a closure device (Sta.62+95)	Install a closure device, if appropriate.
N34.27003	W118.77754	M2R	18" CMP w/o a closure device (Sta.66+50)	Install a closure device, if appropriate
N34.26981	W118.77668	M3R	24" RCP w/o a closure device (Sta.69+38)	Install a closure device, if appropriate
N34.26969	W118.77613	M4R	18" CMP w/o a closure device (Sta.70+90)	Install a closure device, if appropriate
N34.26953	W118.77491	M5R	Surface erosion exposing an utility line (Landward side)	Fill voids with impervious material and firmly compact
N34.26953	W118.77491	M6R	A stock pile of debris and trash at toe (Landward side)	Remove debris and trash.
N34.26939	W118.77494	M7R	18" CMP w/o a closure device (Sta.74+80)	Install a closure device, if appropriate
N34.26920	W118.77402	M8R	36" CMP w/o a closure device (Sta.77+90)	Install a closure device, if appropriate
N34.26855	W118.77132	M9R	10" PVC w/o a closure device (Sta.86+34)	Install a closure device, if appropriate
N34.26855	W118.77132	M10R	A hole at the bottom of outlet structure for 10" PVC	Remove debris and repair the concrete slab portion of outlet structure.
N34.26834	W118.77088	M11R	18" RCP w/o a closure device (Sta.87+92)	Install a closure device, if appropriate
N34.26804	W118.77035	M12R	18" RCP w/o a closure device (Sta.89+91)	Install a closure device, if appropriate
N34.26793	W118.77018	M13R	24" CMP w/o a closure device (Sta.90+09)	Install a closure device, if appropriate



**ARROYO SIMI LEVEE (AS-6)
FIELD INVESTIGATION REPORT**

GPS		*Photo No.	Description	Action Required
Lat	Long			
N34.26768	W118.76773	M14R	A small palm tree through revetment (Riverward side)	Remove vegetation and root ball, fill voids with impervious material and firmly compact.
N34.26784	W118.76654	M15R	60" RCP w/o a closure device (Sta.101+93)	Install a closure device, if appropriate
N34.26769	W118.76510	M16R	Seepage through revetment (Riverward side)	Additional engineering analysis recommended
N34.26754	W118.76457	M17R	Debris inside a outlet structure for 12" RCP with a flap gate (Riverward side)	Remove debris and establish a clear passage from pipe to the channel
N34.26740	W118.76355	M18R	16" CMP w/o a closure device (Sta.110+80)	Install a closure device, if appropriate
N34.26715	W118.76264	M19R	24" CMP w/o a closure device (Sta.113+85)	Install a closure device, if appropriate
N34.26701	W118.76209	M20R	12" CMP w/o a closure device (Sta.115+40)	Install a closure device, if appropriate
N34.26683	W118.76159	M21R	24" CMP w/o a closure device (Sta.117+15)	Install a closure device, if appropriate
N34.26691	W118.76180	M22R	Animal burrow on top of levee (Riverward side)	Fill voids with impervious material and firmly compact.
N34.27053 to N34.26683	W118.77875 to W118.76159	M23R	Vegetation within 15' of Toe (Landward side)	Vegetation and root ball may need to be removed. Then, 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:	<u>Arroyo Simi Levee (AS-6)</u>	Date:	<u>12/9/2008 through 12/10/2008</u>
Watercourse:	<u>Arroyo Simi</u>	By:	<u>Jung Suh, Nathan Schreiner (Tetra Tech), Daniel Costamagna, Chris Spitzer (AMEC), and Jim (Ventura Co. O&M personnel)</u>
Reach:	<u>1st Street crossing to Erringer Road crossing</u>		

RATED ITEM	A	M	U	N/A	EVALUATION	LOCATIONS / REMARKS / RECOMMENDATIONS
1. Unwanted Vegetation Growth					A The levee has a good grass cover with little or no unwanted vegetation (trees, bushes, or undesirable weeds) and has been recently mowed. Except in those cases where a vegetation variance has been granted by the Corps, a 15' zone, free from all woody vegetation, is maintained adjacent to the landward/riverside toe of the FCW for maintenance and flood-fighting activities. Additionally, a 3' root free zone is maintained to protect the external limits of the levee cross section. Reference EM 110-2-301 and/or local Corps policy.	Trees were observed on the landward side of the levees on both right and left levees of the channel. Many of these trees were located within 15 feet of the levee and may need to be removed.
		X			M Minimal number of trees (2" diameter or smaller) and /or brush present on the levee or within the 15' zone, that will not threaten the integrity of the project but which need to be removed.	
					U Tree, weed, and brush cover exists in the FCW requiring removal to reestablish or ascertain FCW integrity. (Note: if significant growth on levees exists, prohibiting the inspection of animal burrows or other inspection items, then the levee inspection should be ended until this item is corrected.)	
2. Depressions /Rutting					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.	
		X			M Some minor depressions in the levee crown, embankment, or access roads that will not pond water and do not threaten the integrity of the levee.	
					U There are depressions greater than 6 inches deep that will pond water, endangering the integrity of the levee.	
3. Erosion / Bank Caving					A No active erosion, undermining, or bank caving due to riverbed degradation or flow impingement, observed on the landward or on the riverward side of the levee.	- A large sink hole, which is probably caused by fractured 6" PVC pipe directly underneath was observed on the left levee. - Erosion was noted on the landward side approximately at station 74+75 on the right levee which was caused by surface flow from top 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	X				A No slides present.	
					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.	
		X			M Signs of deep seated instability can not be determined from site assessment or evidence may or may not be an indicator of deep seated stability. .	
					U Evidence of deep seated sliding that threatens FCW integrity. Repairs are required to reestablish FCW integrity.	
6. Cracking	X				A No cracking observed on the levee greater than 6 inches deep.	- Some cracking along drop structures, grouted stone revetments, and access roads were noted but do not impact the levee.
					M Longitudinal and/or transverse cracking greater than 6 inches deep. No evidence of vertical movement along the crack.	
					U Longitudinal and/or transverse cracking present and exhibits signs of vertical movement.	
7. Animal Burrows					A No animal burrows present on the levees.	- Several animal burrows were present at the top of revetment and need to be repaired.
		X			M Several animal burrows present which may lead to seepage or slope stability problems, and they require immediate attention.	
					U Significant maintenance is required to fill existing burrows, and the	



ARROYO SIMI LEVEE (AS-6) FIELD INVESTIGATION REPORT

RATED ITEM	A	M	U	N/A	EVALUATION	LOCATIONS / REMARKS / RECOMMENDATIONS
					levee will not provide reliable flood protection until this maintenance is complete.	
8. Encroachments				A	No trash, debris, excavations, structures, adverse sediment accumulation, or other obstructions present within the project easement area.	- Some debris was present in the channel.
		X		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.	
		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)				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.	- Multiple storm drains pipes did not have any closure devices. Additional engineering analysis is required to determine the need for closure devices for each penetration.
			X	U	Closure structure in poor condition. Parts missing or corroded. Placing equipment may not be available within normal warning time.	
				N/A	There are no closure structures along the levee.	
11. Underseepage Relief Wells / Toe Drainage Systems				A	Toe drainage systems and pressure relief wells necessary for maintaining FCW stability during flood events functioned properly during the last flood event and no sediment is observed in horizontal system (if applicable). No signs of adverse seepage conditions adjacent to or within the levees. Nothing is observed which would indicate that the system won't function properly during the next flood.	- Seepage was noted around the drop structure at approximately station 106+57. This seepage was indicated by active moisture percolating out of the revetment, vegetation, and algal growth. The seepage in this area appears to not be controlled by or directed to outlets and likely impacts the levee integrity.
				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.	
			X	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	X			A	Maintenance/emergency accesses are clear of obstructions and in good condition.	
				M	Minor obstructions and/or damages to the maintenance/emergency access are present, but would not directly affect the accessibility of the levee..	
				U	Numerous obstructions and/or damages to the maintenance/emergency access are present that would directly affect the accessibility of the levee.	
13. Deviation from As-Built Plans				A	There are no deviations from the as-built plans.	Several additional drains were observed during the site visit.
		X		M	There are minor deviations from the as-built plans that would not affect the functionality of the levee.	
				U	There are major deviations from the as-built plans that could affect the functionality of the levee. Additional engineering analyses are recommended.	

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



Appendix B

Photos of Penetrations and Typical Levee Features



Appendix B – Penetration and Site Feature Photograph Locations along Arroyo Simi Levee (AS-6)



Arroyo Simi AS-6 (Photo No. P1L) – 18" RCP w/o a closure device



Arroyo Simi AS-6 (Photo No. P3L) – 18" CMP w/o a closure device. (not shown on the as-built plan)



Arroyo Simi AS-6 (Photo No. P2L) – 18" RCP with a Flap Gate and concrete outlet structure



Arroyo Simi AS-6 (Photo No. P4L) – 6" PVC subdrain on the side wall of a drop structure with an active stream of flow



Arroyo Simi AS-6 (Photo No. P5L) – 24" CMP with a Flap Gate. A catch basin is located on the cul-de-sac on the landward side of the levee



Arroyo Simi AS-6 (Photo No. P7L) – A concrete outlet structure with 27" RCP and 18" CMP w/o a closure device



Arroyo Simi AS-6 (Photo No. P6L) – 24" RCP with a Flap Gate and concrete outlet structure



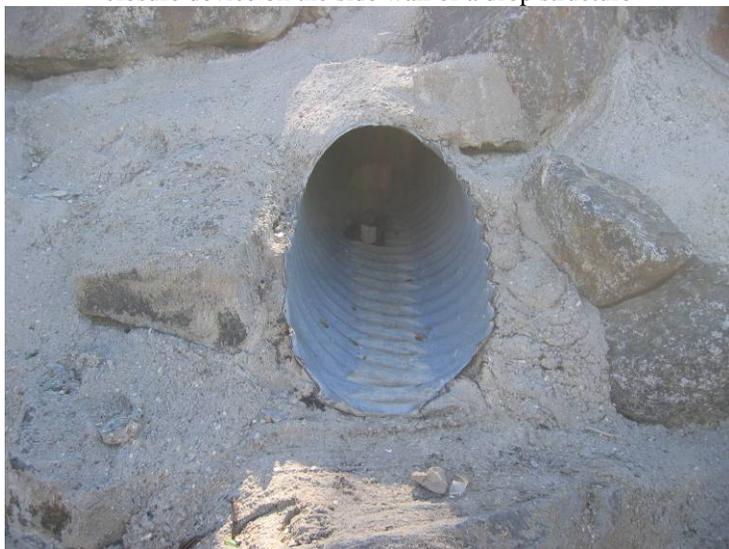
Arroyo Simi AS-6 (Photo No. P8L) – 24" RCP w/o a closure device. Angled towards downstream



Arroyo Simi AS-6 (Photo No. P9L) – 2-36" CMPs and 42" RCP w/o closure device on the side wall of a drop structure



Arroyo Simi AS-6 (Photo No. P11L) – 36" CMP w/o a closure device, draining areas behind the levee



Arroyo Simi AS-6 (Photo No. P10L) – 16" CMP w/o a closure device, draining areas behind the levee



Arroyo Simi AS-6 (Photo No. P12L) – 6-beam sloop log system for access ramp near Erringer Road Bridge.



Arroyo Simi AS-6 (Photo No. P13L) – A stockpile of 6 beams for slop log system for access ramp near Erringer Road Bridge



Arroyo Simi AS-6 (Photo No. F2L) – Looking upstream at a typical drop structure along Arroyo Simi from the left side levee



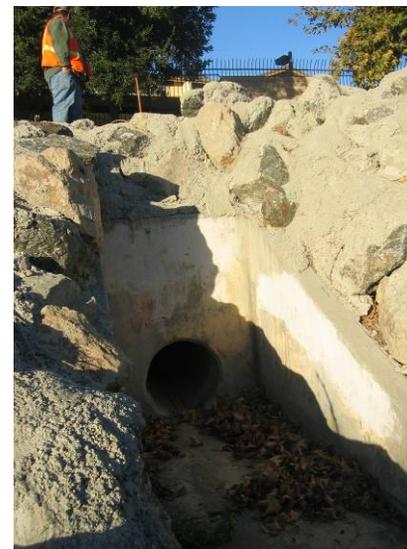
Arroyo Simi AS-6 (Photo No. F1L) – Looking downstream along Arroyo Simi from Erringer Road Bridge



Arroyo Simi AS-6 (Photo No. F3L) – Looking downstream along a floodwall on top of the levee upstream of 1st Street Bridge



Arroyo Simi AS-6 (Photo No. P1R) – 12" CMP w/o a closure device



Arroyo Simi AS-6 (Photo No. P3R) – 24" RCP with a concrete outlet structure but w/o a closure device.



Arroyo Simi AS-6 (Photo No. P2R) – 18" CMP w/o a closure device. A drop inlet is located on the landward side of levee



Arroyo Simi AS-6 (Photo No. P4R) – 18" CMP w/o a closure device. A drop inlet is located inside a property parking lot behind the levee



Arroyo Simi AS-6 (Photo No. P5R) – 18" CMP w/o a closure device.
Currently, one third of opening is blocked by debris and rusted



Arroyo Simi AS-6 (Photo No. P7R) – 10" PVC with a concrete outlet structure but w/o a closure device. An active stream was observed



Arroyo Simi AS-6 (Photo No. P6R) – 36" CMP w/o a closure device. An active stream was observed



Arroyo Simi AS-6 (Photo No. P8R) – 18" RCP with a concrete outlet structure but w/o a closure device



Arroyo Simi AS-6 (Photo No. P9R) – 18" RCP with a concrete outlet structure but w/o a closure device



Arroyo Simi AS-6 (Photo No. P11R) – 60" RCP with a concrete outlet structure but w/o a closure device. An active stream was observed



Arroyo Simi AS-6 (Photo No. P10R) – 24" CMP w/o a closure device



Arroyo Simi AS-6 (Photo No. P12R) – 18" RCP with a Flap Gate and concrete outlet structure



Arroyo Simi AS-6 (Photo No. P13R) – 24" RCP with a Flap Gate and concrete outlet structure



Arroyo Simi AS-6 (Photo No. P15R) – 16" CMP w/o a closure device



Arroyo Simi AS-6 (Photo No. P14R) – 12" RCP with a Flap Gate and concrete outlet structure



Arroyo Simi AS-6 (Photo No. P16R) – 24" CMP w/o a closure device



Arroyo Simi AS-6 (Photo No. P17R) – 12" CMP w/o a closure device



Arroyo Simi AS-6 (Photo No. P18R) – 24" CMP w/o a closure device
through a concrete abutment just downstream of Erringer Road bridge



Appendix C

Photos of Maintenance Required Locations



Appendix C – Photograph Locations of Maintenance Required Areas along Arroyo Simi Levee (AS-6)



**Arroyo Simi (AS-6), (Photo No. M1L) – 18" RCP w/o a closure device
(Sta.63+35)**



**Arroyo Simi (AS-6), (Photo No. M3L) – Seepage through revetment
(Riverward side)**



**Arroyo Simi (AS-6), (Photo No. M2L) – 18" CMP w/o a closure device
(Sta.70+70)**



**Arroyo Simi (AS-6), (Photo No. M4L) – 6" PVC w/o a closure device
(Sta.73+90)**



Arroyo Simi (AS-6), (Photo No. M5L) – Sink hole on top levee directly over 6" PVC



Arroyo Simi (AS-6), (Photo No. M7L) – 24" RCP w/o a closure device (Sta.84+50)



Arroyo Simi (AS-6), (Photo No. M6L) – A concrete outlet structure with 27" RCP and 18" CMP w/o a closure device



Arroyo Simi (AS-6), (Photo No. M8L) – 2-36" CMPs and 42" RCP w/o closure device on the side wall of a drop structure



**Arroyo Simi (AS-6), (Photo No. M9L) – Animal burrow on top of levee
(Riverward side)**



**Arroyo Simi (AS-6), (Photo No. M11L) – 36" CMP w/o a closure device
(Sta.105+90)**



**Arroyo Simi (AS-6), (Photo No. M10L) – 16" CMP w/o a closure device
(Sta.97+10)**



**Arroyo Simi (AS-6), (Photo No. M12L) – Seepage through revetment
(Riverward side)**



Arroyo Simi (AS-6), (Photo No. M13L) – Vegetation within 15' of Toe
(Landward Side)



**Arroyo Simi (AS-6), (Photo No. M1R) – 12" CMP w/o a closure device
(Sta.62+95)**



**Arroyo Simi (AS-6), (Photo No. M3R) – 24" RCP w/o a closure device
(Sta.69+38)**



**Arroyo Simi (AS-6), (Photo No. M2R) – 18" CMP w/o a closure device
(Sta.66+50)**



**Arroyo Simi (AS-6), (Photo No. M4R) – 18" CMP w/o a closure device
(Sta.70+90)**



Arroyo Simi (AS-6), (Photo No. M5R) – Surface erosion exposing an utility line (Landward side)



Arroyo Simi (AS-6), (Photo No. M7R) – 18” CMP w/o a closure device (Sta.74+80)



Arroyo Simi (AS-6), (Photo No. M6R) – A stock pile of debris and trash at toe (Landward side)



Arroyo Simi (AS-6), (Photo No. M8R) – 36” CMP w/o a closure device (Sta.77+90)



**Arroyo Simi (AS-6), (Photo No. M9R) – 10” PVC w/o a closure device
(Sta.86+34)**



**Arroyo Simi (AS-6), (Photo No. M11R) – 18” RCP w/o a closure device
(Sta.87+92)**



**Arroyo Simi (AS-6), (Photo No. M10R) – A hole at the bottom of outlet
structure for 10” PVC**



**Arroyo Simi (AS-6), (Photo No. M12R) – 18” RCP w/o a closure device
(Sta.89+91)**



**Arroyo Simi (AS-6), (Photo No. M13R) – 24" CMP w/o a closure device
(Sta.90+09)**



**Arroyo Simi (AS-6), (Photo No. M15R) – 60" RCP w/o a closure device
(Sta.101+93)**



**Arroyo Simi (AS-6), (Photo No. M14R) – A small palm tree through
revetment (Riverward side)**



**Arroyo Simi (AS-6), (Photo No. M16R) – Seepage through revetment
(Riverward side)**



Arroyo Simi (AS-6), (Photo No. M17R) – Debris inside an outlet structure for 12" RCP with a flap gate (Riverward side)



Arroyo Simi (AS-6), (Photo No. M19R) – 24" CMP w/o a closure device (Sta.113+85)



Arroyo Simi (AS-6), (Photo No. M18R) – 16" CMP w/o a closure device (Sta.110+80)



Arroyo Simi (AS-6), (Photo No. M20R) – 12" CMP w/o a closure device (Sta.115+40)



**Arroyo Simi (AS-6), (Photo No. M21R) – 24" CMP w/o a closure device
(Sta.117+15)**



**Arroyo Simi (AS-6), (Photo No. M23R) – Vegetation within 15' of Toe
(Landward Side)**



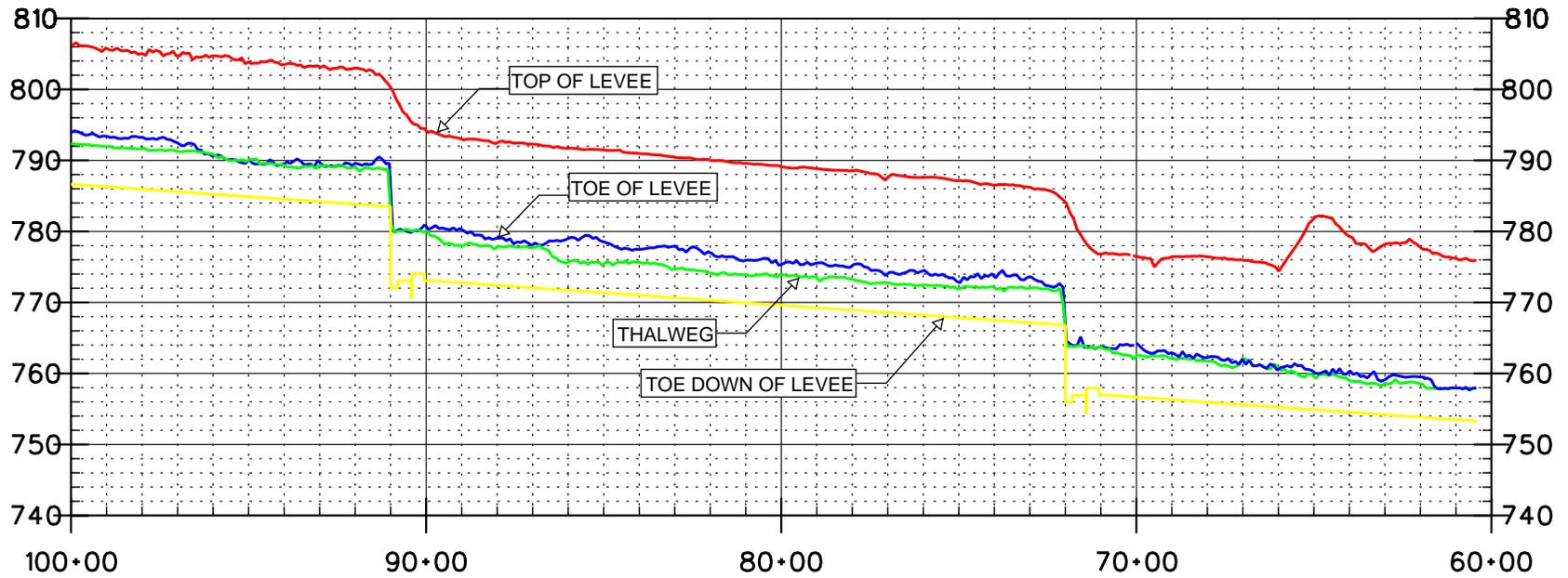
**Arroyo Simi (AS-6), (Photo No. M22R) – Animal burrow on top of levee
(Riverward side)**



Exhibit 2

Preliminary Evaluation of Levee System Profiles

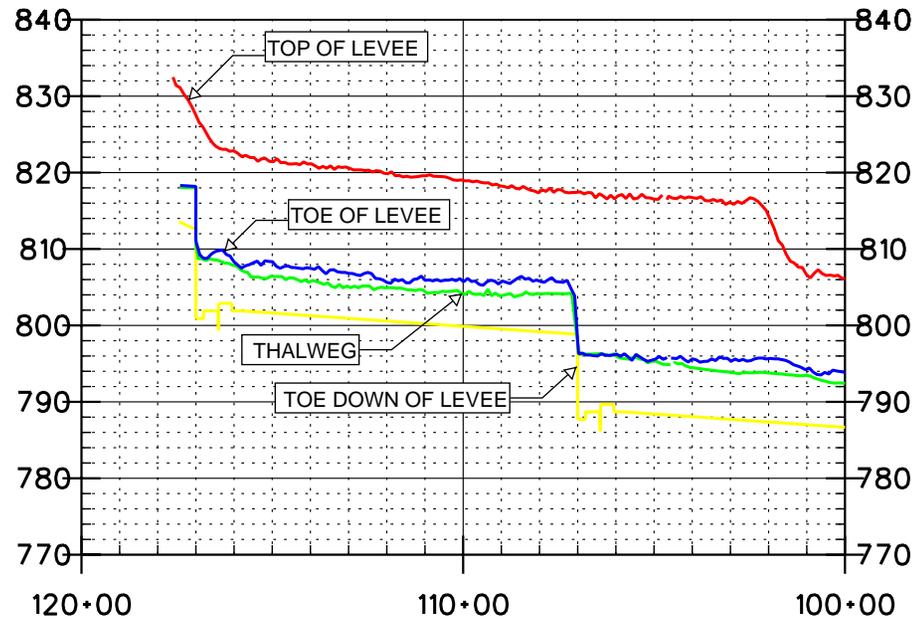
ARROYO SIMI (AS-6)
STATION 60+00 TO 100+00



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

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

ARROYO SIMI (AS-6)
STATION 100+00 TO 120+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

Arroyo Simi Levee (AS-6) - 1st Street to Erringer Road

Bridge Crossings (U/S to D/S)	As-Builts Provided to Consultant by County	County Dwg. No.	Date*	Sta. (relative to 1986 Dwgs)	Action
Erringer Road	No				Request from County
1st Street	No				Request from County
E Los Angeles Ave	No				Request from County
Levee System (U/S to D/S)					
Levee System	Yes	Y-3-2676 to 2696	1986		
Floodwall	Yes	Y-3-3857 to 3860	1999		
Future Repairs					
Seepage Repair			TBD		To be constructed.
Penetrations (U/S to D/S)					
24" CMP, along Right Bank (RB)	Yes	Y-3-2681	1986	117+15	
12" CMP (RB)	Yes	Y-3-2681	1986	115+40	
24" CMP (RB)	Yes	Y-3-2681	1986	113+85	
15" CMP (RB)	Yes	Y-3-2680	1986	110+80	
12" RCP w/ Flap Gate (RB)	No			108+00	Request from County
36" CMP, along Left Bank (LB)	Yes	Y-3-2680	1986	105+90	
24" RCP w/ Flap Gate (RB)	No			106+06	Request from County.
18" RCP w/ Flap Gate (RB)	No			104+14	Request from County.
60" RCP (RB)	No			101+93	Request from County.
18" CMP (LB)	Yes	Y-3-2679	1986	97+10	
24" CMP (RB)	Yes	Y-3-2679	1986	95+25	
42" RCP (LB)	Yes	Y-3-2679	1986	90+95	
36" RCP (LB)	Yes	Y-3-2679	1986	90+75	
36" CMP (LB)	Yes	Y-3-2679	1986	90+58	
24" CMP (RB)	Yes	Y-3-2679	1986	90+09	
18" RCP (RB)	No			89+91	Request from County.
18" RCP (RB)	No			87+92	Request from County.
10" PVC (RB)	No			86+34	Request from County.
24" CMP (LB)	Yes	Y-3-2679	1986	84+50	
18" CMP (LB)	Yes	Y-3-2678	1986	80+50	
27" CMP (LB)	No			80+48	Request from County.
36" CMP (RB)	Yes	Y-3-2678	1986	77+90	
24" RCP w/ Flap Gate (LB)	No			76+53	Request from County.
24" CMP w/ Flap Gate (LB)	No			74+94	Request from County.
18" CMP (RB)	Yes	Y-3-2678	1986	74+80	
18" CMP (RB)	Yes	Y-3-2678	1986	70+90	
18" CMP (LB)	Yes	Y-3-2678	1986	70+45	
24" RCP (RB)	No			69+38	Request from County.
18" CMP (RB)	Yes	Y-3-2677	1986	66+50	
18" RCP w/ Flap Gate (LB)	Yes	Y-3-2677	1986	64+42	
18" RCP (LB)	Yes	Y-3-2677	1986	63+35	
12" CMP (RB)	Yes	Y-3-2677	1986	62+95	

*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
Arroyo Simi Levee (AS-6) – Right Levee Category 2								
M1R	12" CMP w/o a closure device (Sta.62+95)	Install a closure device, if appropriate.	C5 - Survey needed for drain elevation, Maybe City of Simi Valley	E2	Install of headwall =excav/concrete in levee	X	Is this flap gate required? Who will determine ownership?	Determination of the need for a flap gate will require a channel hydraulic analysis and an interior drainage analysis. These analyses will be performed during the next phase of work. If as-builts are not available to determine ownership a survey will be required to establish elevations of the storm drain inverts and tops of outlet, inlets, manholes..etc.
M2R	18" CMP w/o a closure device (Sta.66+50)	Install a closure device, if appropriate	C5 - Survey needed for drain elevation, Maybe City of Simi Valley	E2	Install of headwall =excav/concrete in levee	X	Is this flap gate required? Who will determine ownership?	Determination of the need for a flap gate will require a channel hydraulic analysis and an interior drainage analysis. These analyses will be performed during the next phase of work. If as-builts are not available to determine ownership a survey will be required to establish elevations of the storm drain inverts and tops of outlet, inlets, manholes..etc.
M3R	24" RCP w/o a closure device (Sta.69+38)	Install a closure device, if appropriate	C5 - Survey needed for drain elevation, Maybe City of Simi Valley	E2	Install of headwall =excav/concrete in levee	X	Is this flap gate required? Who will determine ownership?	Determination of the need for a flap gate will require a channel hydraulic analysis and an interior drainage analysis. These analyses will be performed during the next phase of work. If as-builts are not available to determine ownership a survey will be required to establish elevations of the storm drain inverts and tops of outlet, inlets, manholes..etc.
M4R	18" CMP w/o a closure device (Sta.70+90)	Install a closure device, if appropriate	C5 - Survey needed for drain elevation, Maybe City of Simi Valley	E2	Install of headwall =excav/concrete in levee	X	Is this flap gate required? Who will determine ownership?	Determination of the need for a flap gate will require a channel hydraulic analysis and an interior drainage analysis. These analyses will be performed during the next phase of work. If as-builts are not available to determine ownership a survey will be required to establish elevations of the storm drain inverts and tops of outlet, inlets, manholes..etc.
M5R	Surface erosion exposing a utility line (Landward side)	Fill voids with impervious material and firmly compact	C2	E1	Landward repair not regulated	X	Definition of impervious material	Erosion should be repaired as indicated with in-kind material and documented. Documentation of the removal and replacement/re-compaction of the impacted material shall be conducted by a certified testing and materials lab that the District is familiar with. The documentation shall include a report provided by the testing and materials lab. AMEC will periodically observe these locations and will require a copy of the report for documentation and review. In-kind backfill would be materials free of organic or deleterious debris that has similar or lower permeability than the levee material. These materials could consist of excavated soil, imported soil, concrete, or slurry, and shall be evaluated by the testing and materials lab. compaction requirements are detailed on the attached Figure 1. Major repair examples include any erosion feature that is deeper than 1 foot or that is greater than 2 feet wide.
M6R	A stock pile of debris and trash at toe (Landward side)	Remove debris and trash.	C1	E1	Trash removal not regulated			
M7R	18" CMP w/o a closure device (Sta.74+80)	Install a closure device, if appropriate	C5 - Survey needed for drain elevation, Maybe City of Simi Valley	E2	Install of headwall =excav/concrete in levee	X	Is this flap gate required? Who will determine ownership?	Determination of the need for a flap gate will require a channel hydraulic analysis and an interior drainage analysis. These analyses will be performed during the next phase of work. If as-builts are not available to determine ownership a survey will be required to establish elevations of the storm drain inverts and tops of outlet, inlets, manholes..etc.
M8R	36" CMP w/o a closure device (Sta.77+90)	Install a closure device, if appropriate	C5 - Survey needed for drain elevation, Maybe City of Simi Valley	E2	Install of headwall =excav/concrete in levee	X	Is this flap gate required? Who will determine ownership?	Determination of the need for a flap gate will require a channel hydraulic analysis and an interior drainage analysis. These analyses will be performed during the next phase of work. If as-builts are not available to determine ownership a survey will be required to establish elevations of the storm drain inverts and tops of outlet, inlets, manholes..etc.
M9R	10" PVC w/o a closure device (Sta.86+34)	Install a closure device, if appropriate	C5 - Survey needed for drain elevation, Maybe City of Simi Valley	E2	Install of headwall =excav/concrete in levee	X	Is this flap gate required? Who will determine ownership?	Determination of the need for a flap gate will require a channel hydraulic analysis and an interior drainage analysis. These analyses will be performed during the next phase of work. If as-builts are not available to determine ownership a survey will be required to establish elevations of the storm drain inverts and tops of outlet, inlets, manholes..etc.
M10R	A hole at the bottom of outlet structure for 10" PVC	Remove debris and repair the concrete slab portion of outlet structure.	C1	E1	Routine concrete repair: use BMPs			
M11R	18" RCP w/o a closure device (Sta.87+92)	Install a closure device, if appropriate	C5 - Survey needed for drain elevation, Maybe City of Simi Valley	E2	Install of headwall =excav/concrete in levee	X	Is this flap gate required? Who will determine ownership?	Determination of the need for a flap gate will require a channel hydraulic analysis and an interior drainage analysis. These analyses will be performed during the next phase of work. If as-builts are not available to determine ownership a survey will be required to establish elevations of the storm drain inverts and tops of outlet, inlets, manholes..etc.
M12R	18" RCP w/o a closure device (Sta.89+91)	Install a closure device, if appropriate	C5 - Survey needed for drain elevation, Maybe City of Simi Valley	E2	Install of headwall =excav/concrete in levee	X	Is this flap gate required? Who will determine ownership?	Determination of the need for a flap gate will require a channel hydraulic analysis and an interior drainage analysis. These analyses will be performed during the next phase of work. If as-builts are not available to determine ownership a survey will be required to establish elevations of the storm drain inverts and tops of outlet, inlets, manholes..etc.
M13R	24" CMP w/o a closure device (Sta.90+09)	Install a closure device, if appropriate	C5 - Survey needed for drain elevation, Maybe City of Simi Valley	E2	Install of headwall =excav/concrete in levee	X	Is this flap gate required? Who will determine ownership?	Determination of the need for a flap gate will require a channel hydraulic analysis and an interior drainage analysis. These analyses will be performed during the next phase of work. If as-builts are not available to determine ownership a survey will be required to establish elevations of the storm drain inverts and tops of outlet, inlets, manholes..etc.

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Arroyo Simi Levee (AS-6) – Right Levee Category 2								
M14R	A small palm tree through revetment (Riverward side)	Remove vegetation and root ball, fill voids with impervious material and firmly compact.	C1	E1	Cut at base, needs no herbicide, fibrous roots		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.
M15R	60" RCP w/o a closure device (Sta.101+93)	Install a closure device, if appropriate	C5 - Survey needed for drain elevation, Maybe City of Simi Valley	E2	Install of headwall =excav/concrete in levee	X	Is this flap gate required? Who will determine ownership?	Determination of the need for a flap gate will require a channel hydraulic analysis and an interior drainage analysis. These analyses will be performed during the next phase of work. If as-builts are not available to determine ownership a survey will be required to establish elevations of the storm drain inverts and tops of outlet, inlets, manholes..etc.
M16R	Seepage through revetment (Riverward side)	Additional engineering analysis recommended	C3/C4Replace damaged toe?	Depends on corrective action	E2 if need to excavate and recompact, install new drain		Should the toe be replaced?	Determination of the impact of the seepage noted will require additional investigation and analysis. Items to be determine include the following: the source of seepage, impact on the levee caused by seepage, and possible remediation strategies for remediation of the seepage if a negative impact is determined.
M17R	Debris inside a outlet structure for 12" RCP with a flap gate (Riverward side)	Remove debris and establish a clear passage from pipe to the channel	C1	E1	Do not discharge debris into creek.			
M18R	16" CMP w/o a closure device (Sta.110+80)	Install a closure device, if appropriate	C5 - Survey needed for drain elevation, Maybe City of Simi Valley	E2	Install of headwall =excav/concrete in levee	X	Is this flap gate required? Who will determine ownership?	Determination of the need for a flap gate will require a channel hydraulic analysis and an interior drainage analysis. These analyses will be performed during the next phase of work. If as-builts are not available to determine ownership a survey will be required to establish elevations of the storm drain inverts and tops of outlet, inlets, manholes..etc.
M19R	24" CMP w/o a closure device (Sta.113+85)	Install a closure device, if appropriate	C5 - Survey needed for drain elevation, Maybe City of Simi Valley	E2	Install of headwall =excav/concrete in levee	X	Is this flap gate required? Who will determine ownership?	Determination of the need for a flap gate will require a channel hydraulic analysis and an interior drainage analysis. These analyses will be performed during the next phase of work. If as-builts are not available to determine ownership a survey will be required to establish elevations of the storm drain inverts and tops of outlet, inlets, manholes..etc.
M20R	12" CMP w/o a closure device (Sta.115+40)	Install a closure device, if appropriate	C5 - Survey needed for drain elevation, Maybe City of Simi Valley	E2	Install of headwall =excav/concrete in levee	X	Is this flap gate required? Who will determine ownership?	Determination of the need for a flap gate will require a channel hydraulic analysis and an interior drainage analysis. These analyses will be performed during the next phase of work. If as-builts are not available to determine ownership a survey will be required to establish elevations of the storm drain inverts and tops of outlet, inlets, manholes..etc.
M21R	24" CMP w/o a closure device (Sta.117+15)	Install a closure device, if appropriate	C5 - Survey needed for drain elevation, Maybe City of Simi Valley	E2	Install of headwall =excav/concrete in levee	X	Is this flap gate required? Who will determine ownership?	Determination of the need for a flap gate will require a channel hydraulic analysis and an interior drainage analysis. These analyses will be performed during the next phase of work. If as-builts are not available to determine ownership a survey will be required to establish elevations of the storm drain inverts and tops of outlet, inlets, manholes..etc.

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Arroyo Simi Levee (AS-6) – Right Levee Category 2								
M22R	Animal borrow on top of levee (Riverward side)	Fill voids with impervious material and firmly compact.	C1, Pam to assist	E2	Excavate & recompact existing levee, add IPM		Definition of impervious material	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 with in-kind materials. 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 discussed below. 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 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.
M23R	Vegetation within 15' of Toe (Landward side)	Vegetation and root ball may need to be removed. Then, fill voids with impervious material and firmly compact.	Is this a levee? If so, what are the levee's limits? What is to be removed? The trees? Please explain.	E1	Landward veg removal not regulated	X	Is this a levee? If so, what are the levee's limits? What is to be removed? The trees? Please explain.	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.

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Arroyo Simi Levee (AS-6) – Left Levee Category 2								
M1L	18" RCP w/o a closure device (Sta.63+35)	Install a closure device, if appropriate.	C5 - Survey needed for drain elevation, Maybe City of Simi Valley	E2	Install of headwall =excav/concrete in levee	X	Is this flap gate required? Who will determine ownership?	Determination of the need for a flap gate will require a channel hydraulic analysis and an interior drainage analysis. These analyses will be performed during the next phase of work. If as-builts are not available to determine ownership a survey will be required to establish elevations of the storm drain inverts and tops of outlet, inlets, manholes..etc.
M2L	18" CMP w/o a closure device (Sta.70+70)	Install a closure device, if appropriate.	C5 - Survey needed for drain elevation, Maybe City of Simi Valley	E2	Install of headwall =excav/concrete in levee	X	Is this flap gate required? Who will determine ownership?	Determination of the need for a flap gate will require a channel hydraulic analysis and an interior drainage analysis. These analyses will be performed during the next phase of work. If as-builts are not available to determine ownership a survey will be required to establish elevations of the storm drain inverts and tops of outlet, inlets, manholes..etc.
M3L	Seepage through revetment (Riverward side)	Additional engineering analysis recommended	C5 - Design & Construction Division.	Depends on corrective action	E2 if need to excavate and recompact, install new drain		Seepage is a normal occurrence, is this a problem?	Further analysis will need to be conducted to determine the source, cause, and impact of this seepage.
M4L	6" PVC w/o a closure device (Sta.73+90)	Install a closure device, if appropriate	C5 - Survey needed for drain elevation, Maybe City of Simi Valley	E2	Install of headwall =excav/concrete in levee	X	Is this flap gate required? Who will determine ownership?	Determination of the need for a flap gate will require a channel hydraulic analysis and an interior drainage analysis. These analyses will be performed during the next phase of work. If as-builts are not available to determine ownership a survey will be required to establish elevations of the storm drain inverts and tops of outlet, inlets, manholes..etc.
M5L	Sink hole on top levee directly over 6" PVC	Repair a possibly broken 6" PVC line and fill the void with impervious material and firmly compact.	C1	E2	Excavate & recompact existing levee		Definition of impervious material	The sinkhole that was observed may be a result of material that is being piped out of a damaged PVC drain pipe. Repair and replacement of any drainage systems must be conducted to restore the original design conditions before repair of the sinkhole is to be performed. Removal and replacement/re-compaction of the impacted material is needed. The attached Figure 1 presents a typical detail and backfilling requirements with in-kind materials. 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 discussed below. 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.
M6L	27" CMP w/o a closure device (Sta.80+42)	Install a closure device, if appropriate	C5 - Survey needed for drain elevation, Maybe City of Simi Valley	E2	Install of headwall =excav/concrete in levee	X	Is this flap gate required? Who will determine ownership?	Determination of the need for a flap gate will require a channel hydraulic analysis and an interior drainage analysis. These analyses will be performed during the next phase of work. If as-builts are not available to determine ownership a survey will be required to establish elevations of the storm drain inverts and tops of outlet, inlets, manholes..etc.
M6L	18" CMP w/o a closure device (Sta.80+50)	Install a closure device, if appropriate	C5 - Survey needed for drain elevation, Maybe City of Simi Valley	E2	Install of headwall =excav/concrete in levee	X	Is this flap gate required? Who will determine ownership?	Determination of the need for a flap gate will require a channel hydraulic analysis and an interior drainage analysis. These analyses will be performed during the next phase of work. If as-builts are not available to determine ownership a survey will be required to establish elevations of the storm drain inverts and tops of outlet, inlets, manholes..etc.
M7L	24" RCP w/o a closure device (Sta.84+50)	Install a closure device, if appropriate	C5 - Survey needed for drain elevation, Maybe City of Simi Valley	E2	Install of headwall =excav/concrete in levee	X	Is this flap gate required? Who will determine ownership?	Determination of the need for a flap gate will require a channel hydraulic analysis and an interior drainage analysis. These analyses will be performed during the next phase of work. If as-builts are not available to determine ownership a survey will be required to establish elevations of the storm drain inverts and tops of outlet, inlets, manholes..etc.
M8L	36" CMP w/o a closure device (Sta.90+58)	Install a closure device, if appropriate	C5 - Survey needed for drain elevation, Maybe City of Simi Valley	E2	Install of headwall =excav/concrete in levee	X	Is this flap gate required? Who will determine ownership?	Determination of the need for a flap gate will require a channel hydraulic analysis and an interior drainage analysis. These analyses will be performed during the next phase of work. If as-builts are not available to determine ownership a survey will be required to establish elevations of the storm drain inverts and tops of outlet, inlets, manholes..etc.
M8L	36" RCP w/o a closure device (Sta.90+75)	Install a closure device, if appropriate	C5 - Survey needed for drain elevation, Maybe City of Simi Valley	E2	Install of headwall =excav/concrete in levee	X	Is this flap gate required? Who will determine ownership?	Determination of the need for a flap gate will require a channel hydraulic analysis and an interior drainage analysis. These analyses will be performed during the next phase of work. If as-builts are not available to determine ownership a survey will be required to establish elevations of the storm drain inverts and tops of outlet, inlets, manholes..etc.
M8L	42" RCP w/o a closure device (Sta.90+95)	Install a closure device, if appropriate	C5 - Survey needed for drain elevation, Maybe City of Simi Valley	E2	Install of headwall =excav/concrete in levee	X	Is this flap gate required? Who will determine ownership?	Determination of the need for a flap gate will require a channel hydraulic analysis and an interior drainage analysis. These analyses will be performed during the next phase of work. If as-builts are not available to determine ownership a survey will be required to establish elevations of the storm drain inverts and tops of outlet, inlets, manholes..etc.

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Arroyo Simi Levee (AS-6) – Left Levee Category 2								
M9L	Animal borrow on top of levee (Riverward side)	Fill voids with impervious material and firmly compact.	C1, Pam to assist	E2	Excavate & recompact existing levee, add IPM		Definition of impervious material	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 with in-kind materials. 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 discussed below. 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.
M10L	16" CMP w/o a closure device (Sta.97+10)	Install a closure device, if appropriate	C5 - Survey needed for drain elevation, Maybe City of Simi Valley	E2	Install of headwall =excav/concrete in levee	X	Is this flap gate required? Who will determine ownership?	Determination of the need for a flap gate will require a channel hydraulic analysis and an interior drainage analysis. These analyses will be performed during the next phase of work. If as-builts are not available to determine ownership a survey will be required to establish elevations of the storm drain inverts and tops of outlet, inlets, manholes..etc.
M11L	36" CMP w/o a closure device (Sta.105+90)	Install a closure device, if appropriate	C5 - Survey needed for drain elevation, Maybe City of Simi Valley	E2	Install of headwall =excav/concrete in levee	X	Is this flap gate required? Who will determine ownership?	Determination of the need for a flap gate will require a channel hydraulic analysis and an interior drainage analysis. These analyses will be performed during the next phase of work. If as-builts are not available to determine ownership a survey will be required to establish elevations of the storm drain inverts and tops of outlet, inlets, manholes..etc.
M12L	Seepage through revetment (Riverward side)	Additional engineering analysis recommended	C3/C4 - Replace damaged toe?	Depends on corrective action	E2 if need to excavate and recompact, install new drain		Should the toe be replaced?	The seepage observed is located on the riverside toe adjacent to a pond on the landside of the levee. Further exploration is needed to determine if this seepage is a result of the pond or a result of a drainage system malfunction behind the drop structure and at the riverside toe.
M13L	Vegetation within 15' of Toe (Landward side)	Remove vegetation and root ball, fill voids with impervious material and firmly compact.	C5 - Survey needed for drain elevation, Maybe City of Simi Valley	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.

Specific question for AS-6: Below the bridge, the river is 2' to 3' below the toe at First Street leaving the toe exposed. What needs to be done here?

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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.

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

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

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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.

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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

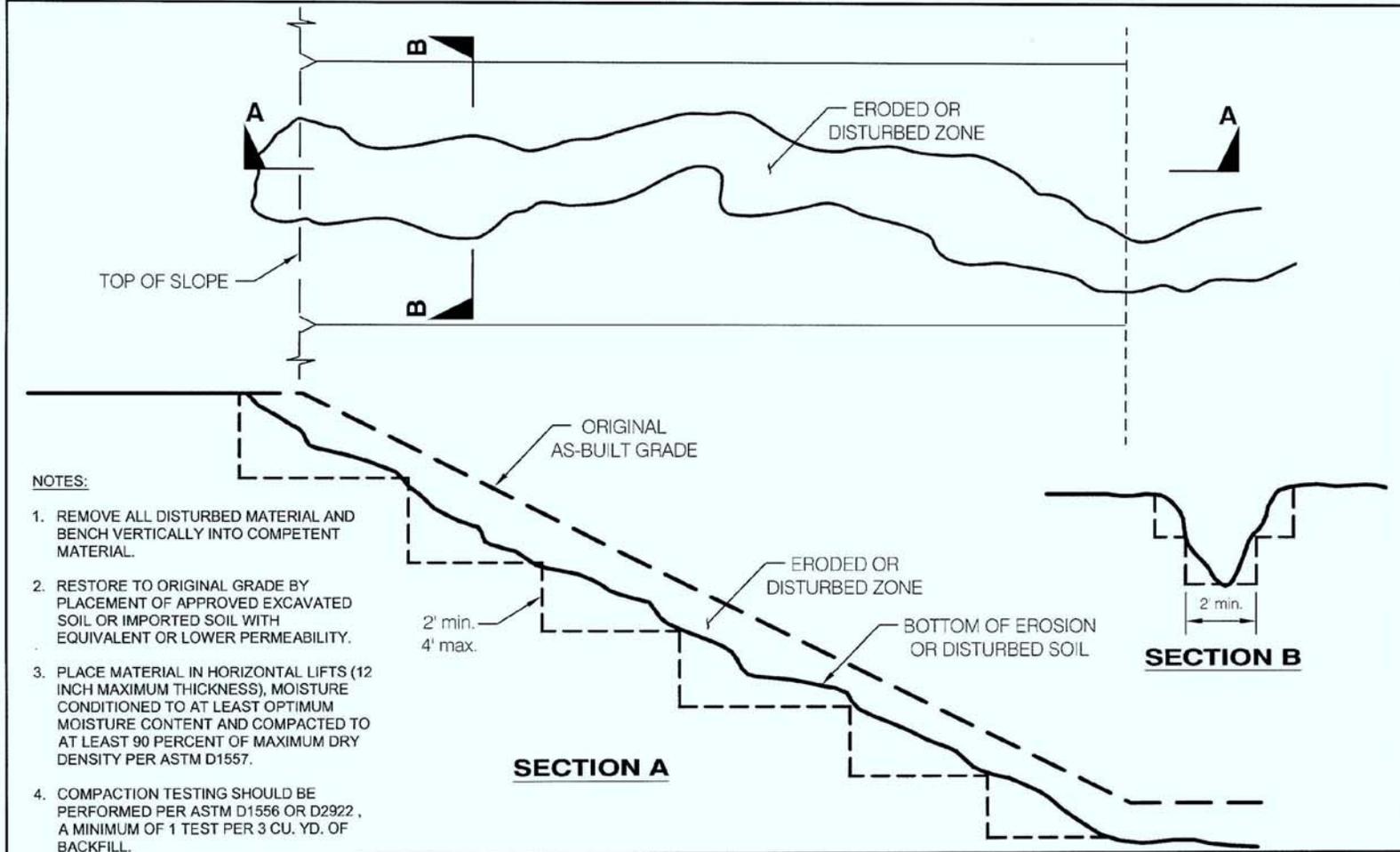
VCWPD O&M QUESTION	TETRA TECH/AMEC RESPONSE
<p>1. Animal burrow/hole repair procedures. Please confirm acceptable methods. Also confirm acceptable documentation method.</p>	<p>For small isolated burrows, infilling of the burrow with grout is sufficient. The grout should be relatively free flowing to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

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

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

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

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

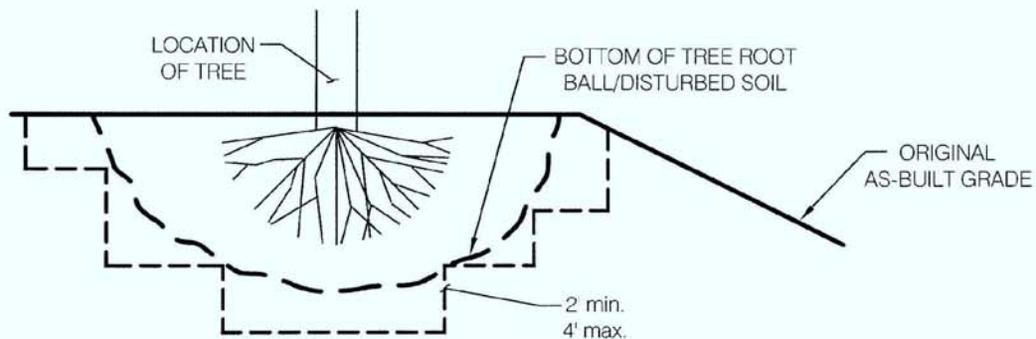


NOTES:

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:
		CHKD BY:	SCALE:	FIGURE No.
		JBD	February 2009	8212100132
		DRB	Not To Scale	FIGURE 1

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

SECTION 41: PAVEMENT SUBSEALING AND JACKING

41-1 PAVEMENT SUBSEALING

41-1.01 DESCRIPTION

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

41-1.02 MATERIALS

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

SECTION 41

PAVEMENT SUBSEALING AND JACKING

41-1.03 CONSTRUCTION

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

SECTION 41**PAVEMENT SUBSEALING AND JACKING**

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

41-1.04 MEASUREMENT

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

41-1.05 PAYMENT

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

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

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

SECTION 41**PAVEMENT SUBSEALING AND JACKING**

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

41-2.02 MATERIALS

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

41-2.03 CONSTRUCTION

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

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

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

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

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

41-2.04 MEASUREMENT

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